

# Exploring the Prospect: Indonesia's Green Energy Export to Power Singapore

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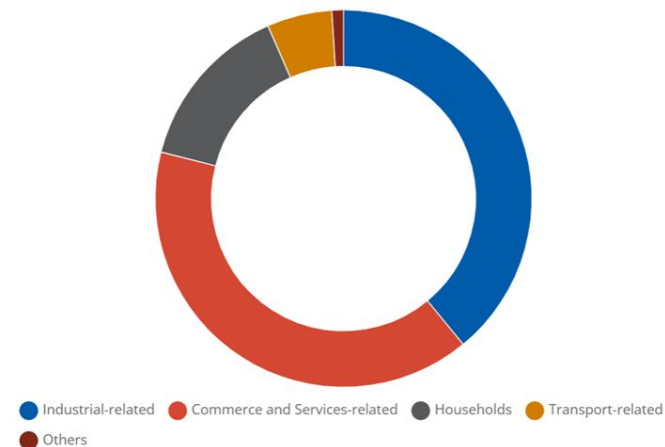
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# Singapore's Energy Transition Background

As of today, approximately 95% of Singapore's 28.5 TWh electricity demand is fulfilled by natural gas power generation, a source that contributes heavily to the carbon footprint of the power sector, responsible for nearly 40% of the country's total carbon emissions. While Singapore has identified solar energy as a viable renewable resource, spatial limitations and other geographic constraints mean solar could meet only about 10% of the nation's electricity demand by 2050, even under the most favorable circumstances.

Recognizing the need for substantial decarbonization, Singapore is actively collaborating with private sector entities to construct advanced technology in low-emission electricity. One of them is a Combined Cycle Gas Turbine (CCGT) plants that boast enhanced efficiency and are adaptable to hydrogen usage. These kinds of hydrogen technologies, preferably green hydrogen, align with Singapore's strategic approach to a more resilient and low-carbon energy grid while maintaining reliability and meeting future demand growth as the country gradually shifts to cleaner energy that works towards its net-zero emissions target.

28.5 TWh in 1H 2024



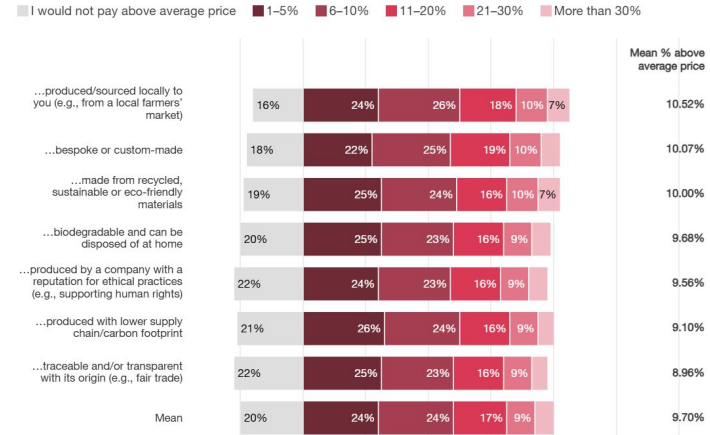
Singapore's Overall Electricity Consumption by Sector at 1H 2024\*

# Sentiment on Green Product

In recognizing the global urgency of climate action, former Prime Minister Lee Hsien Loong emphasized that while Singapore alone cannot halt climate change, the nation must contribute its fair share toward viable solutions.

This sentiment resonates strongly within the Singaporean community: a survey found that 95% of respondents support a transition to a low-carbon economy, with 78% willing to bear some additional costs or inconvenience to achieve this goal. This willingness aligns with broader global trends, where consumers across various industries from 31 countries expressed a readiness to pay an average of 9.7% premium for green products if these deliver similar performance to conventional options (PwC, 2024).

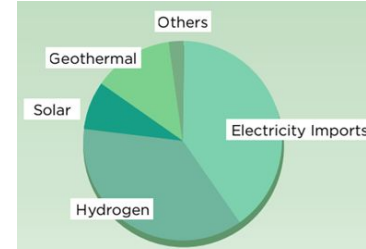
The support for sustainable choices, both globally and locally, underscores Singapore’s growing commitment to environmentally responsible consumption as part of the wider push toward a carbon-neutral future via clean energy sources such as hydrogen, geothermal, and solar.



How much above average price would a consumer be willing to pay for a product

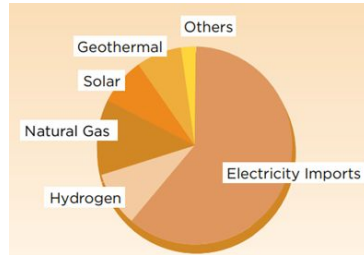
# Electricity Import Scenarios: An Integral Part of Singapore Energy Mix

Singapore's path to a net-zero power sector by 2050 could unfold through various energy mix scenarios, each shaped by different global conditions. In the ideal situation of the Clean Energy Renaissance, rapid advancements in both energy and digital technologies are matched by strong international cooperation over the coming decades.



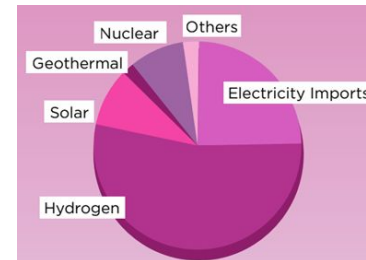
**Scenario 1: Clean Energy Renaissance**

**Scenario 2: Climate Action Bloc**



In a Climate Action Bloc scenario, a supportive geopolitical climate encourages collaboration on global climate initiatives, yet technological advancements proceed at a slower pace.

Conversely, the Emergent Technology Trailblazer scenario envisions a fragmented geopolitical landscape with limited cooperation. Yet, technological innovation accelerates, enabling Singapore to adopt breakthroughs like low-carbon hydrogen and digital solutions to power its grid.



**Scenario 3: Emergent Technology Trailblazer**

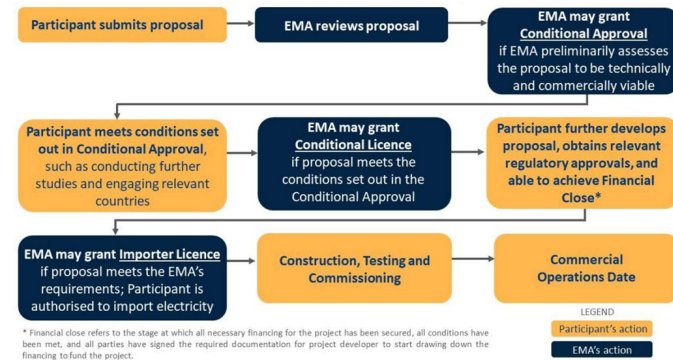
# What It Takes to Sell Low-Carbon Electricity to Singapore

## Conditional Approvals

- The project is technically and commercially viable after preliminary assessment from EMA
- Facilitates in obtaining necessary Singapore regulatory clearances
- Eligible to obtain Conditional Licenses
- Need to commence various marine surveys and feasibility studies, as well as demonstrates ability to meet both countries requirements and/or regulations

## Conditional Licenses

- Has been awarded Conditional Approvals in the past
- The project is in advanced developmental stage
- If the obligations in the license are fulfilled, Singapore will grant Electricity Importer License to start construction and commercial operation



Process from Conditional Approval to Importer License

# Singapore's Path to 6 GW of Low-Carbon Electricity

Singapore has set ambitious targets to integrate low-carbon electricity imports into its energy mix, initially aiming for 4 GW by 2035 and recently raising this target to 6 GW. This increase reflects Singapore's commitment to sourcing clean energy from the region, where abundant solar, wind, geothermal, and hydropower resources are well-suited to support its energy transition.

Following that ambitious target, Singapore granted approval licenses to neighboring countries to import 3.4 GW from Indonesia, 1.75 GW from Australia, 1 GW from Cambodia, and 1.2 GW from Vietnam.

Alongside these imports, Singapore is advancing domestic capabilities in technologies such as hydrogen, geothermal drilling, and carbon capture, utilization, and storage (CCUS). These innovations are poised to play a crucial role in Singapore's decarbonization strategy, offering pathways to create a resilient, low-emission power sector. The concurrent focus on regional low-carbon imports and technological advancement highlights Singapore's dual approach to a greener, more sustainable energy future.



Conditional Approval and Licenses on electricity import granted to neighbouring countries

# Indonesia: 3.4 GW Potential Export

List of Companies Granted Conditional Licenses / Approvals to Export Electricity from Indonesia to Singapore.

Company	Import Capacity (GW)	Status	Grant Date
Pacific Medco Solar Energy Pte Ltd.	0.6	Conditional License	5 Sep 2024
Adaro Solar International Pte Ltd.	0.4	Conditional License	5 Sep 2024
EDP Renewables APAC	0.4	Conditional License	5 Sep 2024
Vanda RE Pte Ltd.	0.3	Conditional License	5 Sep 2024
Keppel Energy Pte Ltd	0.3	Conditional License	5 Sep 2024
Singa Renewables Pte Ltd.	1	Conditional Approval	5 Sep 2024
Shell Eastern Trading (Pte.) Ltd.	0.4	Conditional Approval	5 Sep 2024

# Company Overview: Pacific Medco Solar Energy Pte Ltd

Pacific Medco Solar Energy Pte Ltd is a company formed by Pacific, Medco, and Gallant. Medco Power is an Independent Power Producer under MedcoEnergi, a leading Southeast Asian energy and natural resources company listed on the Indonesia Stock Exchange. MedcoEnergi has three key business segments, Oil & Gas, Power, and Mining. While PacificLight Renewables Pte Ltd is a renewable energy company, focused on achieving a greener future for Singapore through innovative renewable energy solutions, including the Bulan Solar Project. Gallant Venture Ltd is a public-listed company in Singapore focusing on commercial development and growth opportunities in the Riau Archipelago of Indonesia. Since its establishment in the 1990s, Gallant Venture has been an important innovator in key business segments, namely utilities, industrial parks, resort operations, property development, and automotive.

The company plans to build the Bulan Solar Project, featuring over 2,000 MWp of solar PV and 500 MWh of battery storage on Bulan Island. First announced in September 2023, the project is expected to be completed by 2028.





# Company Overview: Adaro Solar International

- Adaro Solar International is a subsidiary of PT Adaro Energy Indonesia Tbk (AEI), a core part of its green pillar focusing on solar power.
- Undisclosed project
  - In 2023, the plan is to build 1 GWp solar PV and Battery Energy Storage System (BESS) with at least 3 GW capacity at Batam island.



# Company Overview: EDP Renewables APAC

- Formerly known as Sunseap is the fourth largest renewable energy producer worldwide with presence in 28 markets across Europe, North America, South America and Asia/Pacific, based in Madrid and with main regional offices in Houston, São Paulo and Singapore.
- Combol and Citlim Island Project
  - Combol island: 1,380 MWp solar PV and 3,000 MWh ESS.
  - Citlim island: 1,682 MWp solar PV and 3,500 MWh ESS.
  - MOU signed with Riau government for 3,000 hectares of land for Sunseap to build solar energy plants and energy storage systems at Apr 2022.
- Duriangkang Island Project
  - Generation of 2.2 GWp and 6,300MWh ESS.
  - Located in Batam island where Sunseap has signed an MoU with BP Batam to build floating photovoltaic and energy storage systems with US\$ 2 billion cost.



# Company Overview: Vanda RE Pte Ltd

- A joint venture company led by Gurin Energy, headquartered in Singapore, with a focus on solar, wind, and battery storage projects.
- Undisclosed Project
  - Integrate 2,000 MW of solar PV and 4,400 MWh of battery storage at Riau islands.
  - Expected to be completed by 2027.
  - Signed supply agreement framework with Trinasolar (Chinese-based) to supply its latest solar panel technology Vertex N n-type i-TOPCon.



# Company Overview: Keppel Energy Pte Ltd

- Keppel Energy Pte Ltd is a Singapore-based company that generates power, distributes gas, and retails electricity. Through its infrastructure department, Keppel focuses on the development and implementation of low-carbon energy value chain.
- Undisclosed Project
  - At least 2,000 MW of solar PV at Riau islands.



# Company Overview: Singa Renewables Pte Ltd

- A joint venture between TotalEnergies and Royal Golden Eagle (RGE), based in Singapore.
- TotalEnergies is a globally integrated energy company that produces and markets energies: oil and biofuels, natural gas and green gases, renewables, and electricity.
- RGE, formerly known as Raja Garuda Emas, was founded by Indonesian entrepreneur and philanthropist, Sukanto Tanoto. The company's green energy segment produces bio-based materials to replace plastics and lowers carbon emissions by producing cleaner and alternative sources of energy such as Sustainable Aviation Fuel (SAF).
- Undisclosed Project



# Company Overview: Shell Eastern Trading Pte Ltd

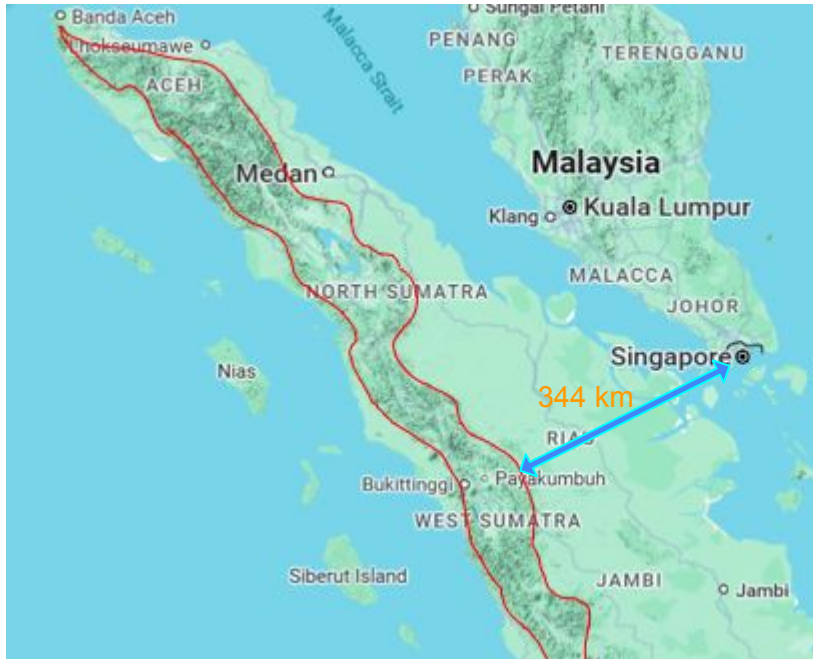
- In partnership with Vena Energy in the business of importing low-carbon electricity from Indonesia's solar power farm.
- Vena Energy Indonesia, formerly Equis Energy, is known for its presence as Independent Power Producer (IPP) with solar power plant at Lombok.
- Undisclosed Project
  - The feasibility study is said to produce 2 GW of solar power and include 8 GWh of utility-scale battery storage, generating over 2.6 TWh of green energy annually.



# Alternative Option to Solar PV: Hydropower

Alongside solar PV, which is actively being explored as a source for power export to Singapore, hydropower stands out as a promising candidate as well. With its capacity for consistent and large-scale electricity generation, hydropower offers a renewable alternative that could complement solar energy's potential.

Legend:  
Red lines: Hydropower potential



Hydropower in West Sumatra, supported by the Bukit Barisan mountains, stands as an ideal alternative to Solar PV for exporting electricity to Singapore. The mountains provide a natural setting for high-capacity dam projects, utilizing abundant water resources to deliver steady, round-the-clock power. While long transmission lines require significant investment, hydropower offers reliability that solar PV—dependent on weather and daylight—cannot match.

The map beside shows the shortest direct route from Singapore to the mountainous regions of West Sumatra, approximately 345 kilometers away.

# Economic Viability of Electricity Export from Sumatra's Hydropower

## 1. Average Cost per MW for Hydropower Projects in Sumatra

Historical data indicates that the investment cost for hydropower projects in Sumatra varies depending on the project's scale and complexity. For instance:

- **Kerinci Merangin Hydroelectric Power Plant:** This 420 MW project in Jambi Province has an estimated investment of \$861.8 million, resulting in a cost of approximately \$2.05 million per MW.\*
- **Batang Toru Hydropower Project:** Located in North Sumatra, this 510 MW project has an estimated cost of \$1.6 billion, equating to about \$3.14 million per MW.\*

## 2. Transmission Infrastructure Cost

- **Subsea Cable Costs:** The cost of submarine power cables can exceed \$2.5 million per kilometer.\*
- **Distance to Singapore:** The distance between Sumatra and Singapore is approximately 50 kilometers, implying a minimum subsea cable cost of around \$125 million, excluding installation and ancillary expenses.





# Economic Viability of Electricity Export from Sumatra's Hydropower (cont'd)

## 3. Economic Viability Assessment

- **Levelized Cost of Electricity (LCOE):** Hydropower projects in Indonesia have LCOEs ranging from \$0.02 to \$0.10 per kWh, indicating competitive generation costs.\*
- **Singapore's Electricity Tariffs:** As of October to December 2024, Singapore's regulated electricity tariff is 31.72 cents per kWh (inclusive of GST).\*

## 4. Assuming electricity sold to Singapore is S\$0.25 per kWh, estimating the IRR for exporting electricity at this rate requires consideration of several factors:

- **Capital Expenditure (CapEx):** Assuming an average cost of \$2.5 million per MW for a 100 MW hydropower plant, the total CapEx would be \$250 million.
- **Operational Expenditure (OpEx):** Hydropower plants typically have low operational costs, often estimated at 1-2% of CapEx annually.
- **Annual Energy Production:** Assuming a capacity factor of 50%, a 100 MW plant would generate approximately 438,000 MWh per year.
- **Revenue:** At a selling price of 25 cents per kWh, annual revenue would be approximately \$109.5 million.
- **Net Cash Flow:** Subtracting annual OpEx (estimated at \$2.5 million), the net annual cash flow would be around \$107 million.

Using these assumptions, the IRR can be calculated over the project's lifespan (typically 30 years). Preliminary estimates suggest an IRR in the range of 15-20%, indicating a potentially attractive investment.



# Indonesian export electricity to Singapore hinges on several critical factors:

We anticipate that exporting electricity from Indonesia to Singapore will be highly dependent on the involvement and approval of PT Perusahaan Listrik Negara (PLN). As the state-owned enterprise overseeing electricity transmission across Indonesia, PLN is essential to ensuring that any export initiative aligns with national energy priorities. This requirement for PLN's engagement arises from multiple regulatory and operational considerations:



1. **Domestic Supply Assurance:** Indonesia's regulatory framework mandates that domestic electricity needs must be fully met before any surplus can be considered for export. This requirement aligns with **Law No. 30 of 2009 on Electricity** and **Minister of Energy and Mineral Resources Regulation No. 5 of 2021**, which explicitly prioritize local energy security. PLN, as the primary provider and distributor of electricity within Indonesia, is responsible for assessing and guaranteeing that domestic demand is sufficiently covered.



2. **PLN's Control Over Transmission Infrastructure:** PLN is the primary authority overseeing the transmission network across Indonesia, including the complex logistics of any cross-border energy transfer. Exporting electricity to Singapore would require access to and integration with PLN's transmission systems, which are crucial for the stability and reliability of power exports. Without PLN's operational support, any cross-border infrastructure would face challenges in coordinating and maintaining consistent electricity flow.



3. **PLN as a Stakeholder and Regulator:** Beyond its operational role, PLN's position in the electricity market grants it a significant regulatory influence over power distribution and export policies. Given that cross-border energy agreements impact national energy resources, it is vital to engage PLN as a central stakeholder. Without PLN's cooperation, there is a substantial risk that energy export plans could conflict with domestic supply obligations or lead to infrastructural bottlenecks.



# Indonesia Revenue Estimation from Electricity Import by Singapore

Melvin Chen, Wood Mackenzie's head of power and renewables consulting for the Asia-Pacific, said he expects a solar import project from Indonesia could cost upwards of \$300 per megawatt hour (MWh) of electricity (The Strait Times, Sep 2024).

At current electricity import approval and licenses by Singapore that has been granted of 3.4 GW, it means an annual gross revenue of US\$ 8.9 billion can be expected. With solar electricity production cost at Indonesia local of about one-fifth of that gross revenue (at US\$60 per MWh), this electricity import business can become a major source of income for Indonesia.



Singapore and Indonesia's Riau islands (Google, 2024)

## Singapore's Import Strategy Beyond Indonesia: ASEAN Cross-border Electricity Import

Singapore is expanding its renewable energy imports through strategic cross-border initiatives aimed at harnessing clean energy from regional partners. Currently, Singapore imports up to 100 MW of hydropower from Laos as part of the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP), a trial that exemplifies regional collaboration for sustainable energy. Plans are in place to double this capacity to 200 MW by incorporating additional hydropower from Malaysia, strengthening Singapore's access to low-carbon electricity within ASEAN.




- Two-year PPA signed between Keppel Electric and Électricité du Laos in 2021
- 100 MW of electricity import commenced on 23 June 2022

LTMS-PIP Project (Beatrice Riingen, 2022)

# ASEAN Countries Potential Export to Singapore

## Vietnam: 1.2 GW

Company	Import Capacity (GW)	Status	Grant Date	
<p>Sembcorp Utilities Pte Ltd.</p> <ul style="list-style-type: none"> <li>• A Singapore-based energy and urban solutions provider.</li> <li>• Undisclosed Project               <ul style="list-style-type: none"> <li>◦ Plan to develop offshore wind farms in South Vietnam</li> <li>◦ Sembcorp renewables capacity in Vietnam will reach 455MW after recent acquisition of 196 MW of solar and wind assets.</li> <li>◦ The deals were valued at S\$218 million (US\$160.3 million).</li> </ul> </li> </ul>		1.2	Conditional Approval	24 Oct 2023

## Cambodia: 1 GW

Company	Import Capacity (GW)	Status	Grant Date	
<p>Keppel Energy Pte. Ltd</p> <ul style="list-style-type: none"> <li>• Keppel Energy Pte Ltd is a Singapore-based company that generates power, distributes gas, and retails electricity. Through its infrastructure department, Keppel focuses on the development and implementation of low-carbon energy value chain.</li> <li>• Undisclosed Project               <ul style="list-style-type: none"> <li>◦ The project will harness solar energy, hydropower, and potentially wind power, supported by battery energy storage systems or pumped storage hydropower.</li> <li>◦ A long-term Power Purchase and Export Agreement with Cambodia's Royal Group Power (RGP) has been signed March 2023.</li> </ul> </li> </ul>		1.0	Conditional Approval	16 Mar 2023



## Singapore's Import Strategy Beyond ASEAN: Australia

Singapore's energy import strategy has evolved to prioritize diversification beyond traditional sources, including plans to source renewable electricity from countries outside ASEAN, such as Australia.


One of the key motivations behind this diversification is risk management. Relying primarily on ASEAN countries could make Singapore vulnerable to regional political shifts, policy changes, and supply disruptions. By expanding partnerships outside of ASEAN, Singapore reduces these risks, creating a more resilient energy supply network that is less dependent on regional dynamics. For instance, importing electricity from Australia's Northern Territory, where vast solar farms are in development.

Furthermore, the physical scale and renewable resources available in countries like Australia provide Singapore with the opportunity to import larger, more consistent flows of energy. Australia's expansive land area and strong sunlight exposure allow for substantial solar power production, which could be transmitted to Singapore via undersea cables.



AAPowerLink Project by Sun Cables

# Australia: 1.75 GW

Company	Import Capacity (GW)	Status	Grant Date
<p data-bbox="79 314 625 347">Sun Cable (Singapore) Assets Pte Ltd</p>  <ul data-bbox="112 430 1159 888" style="list-style-type: none"> <li>• Sun Cable is a renewable energy company that known as the one behind a A\$30 billion (S\$27.5 billion) project known as the Australia-Asia PowerLink, a flagship project that aims to transmit renewable energy from Australia's Northern Territory to Darwin and Singapore.</li> <li>• AAPowerlink Project <ul style="list-style-type: none"> <li>○ Set to deploy between 17 GW and 20 GW of solar capacity and between 36.42 GWh and 42 GWh via 4,300km of subsea cable.</li> <li>○ Estimated AU\$20 billion in economic value.</li> <li>○ Project is planned in two stages with 900MW will be provided in stage one and approximately 3GW in stage two.</li> </ul> </li> </ul>	1.75	Conditional Approval	24 Oct 2023

# Key Takeaways



1. **Singapore's Energy Transition:** Singapore is targeting significant decarbonization to meet its net-zero goals, constrained by limited solar capacity due to spatial limitations. Importing low-carbon electricity, especially from neighboring regions, is a practical solution to enhance its clean energy supply.



2. **Low-Hanging Fruit for Indonesia's Renewable Sector:** Exporting renewable energy to Singapore presents an accessible, high-impact opportunity for Indonesia. By tapping into the growing demand for clean energy imports, Indonesia can leverage its abundant solar, hydro, and geothermal resources, capitalizing on Singapore's commitment to a 6 GW low-carbon import target by 2035.



3. **Hydropower as a Competitive Option:** West Sumatra's hydropower resources offer a strategic, low-cost advantage due to proximity, reducing infrastructure costs and energy losses associated with subsea cables, positioning Indonesia as a viable, efficient energy supplier to Singapore.



4. **Project Viability and Conditional Approvals:** Renewable export projects from Indonesia to Singapore must prove technical and commercial feasibility, secure conditional licenses, and meet regulatory standards from both countries, underscoring Indonesia's position as a critical supplier in Singapore's energy future.



Thank You