Cross-border electricity trade in Southeast Asia

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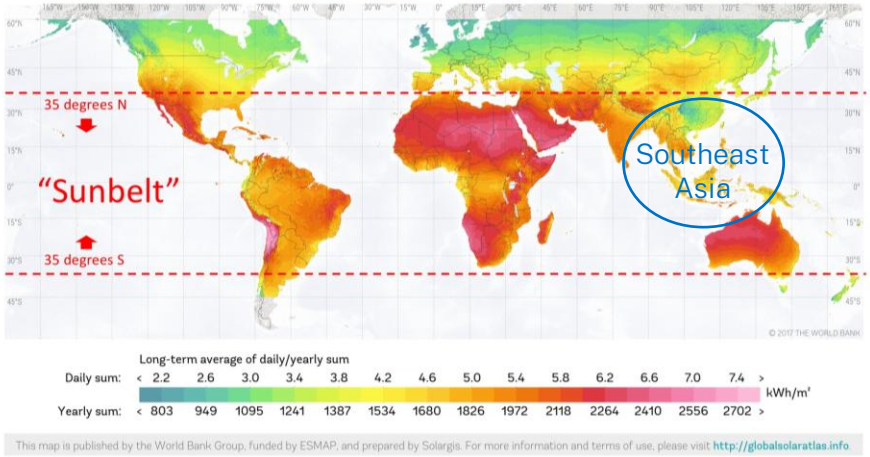
Outline

1. Benefits of cross-border electricity trade
2. Cross-border electricity trade models
3. ASEAN cross border electricity trade status
4. Barriers
5. Ways forward

1. Benefits of cross-border electricity trade

- Save costs: could reduce the overall electricity supply costs by around 20% compared to individual electricity systems
- Contribute to addressing climate change, if based on renewables
- Increase renewable power uptake
- Enable electricity access for remote areas

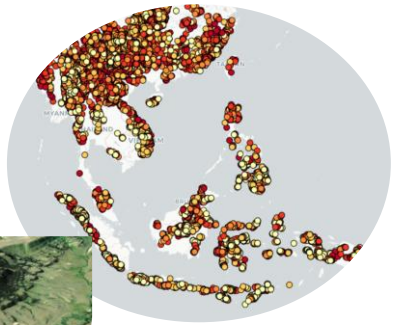
100% renewable electricity is possible for ASEAN



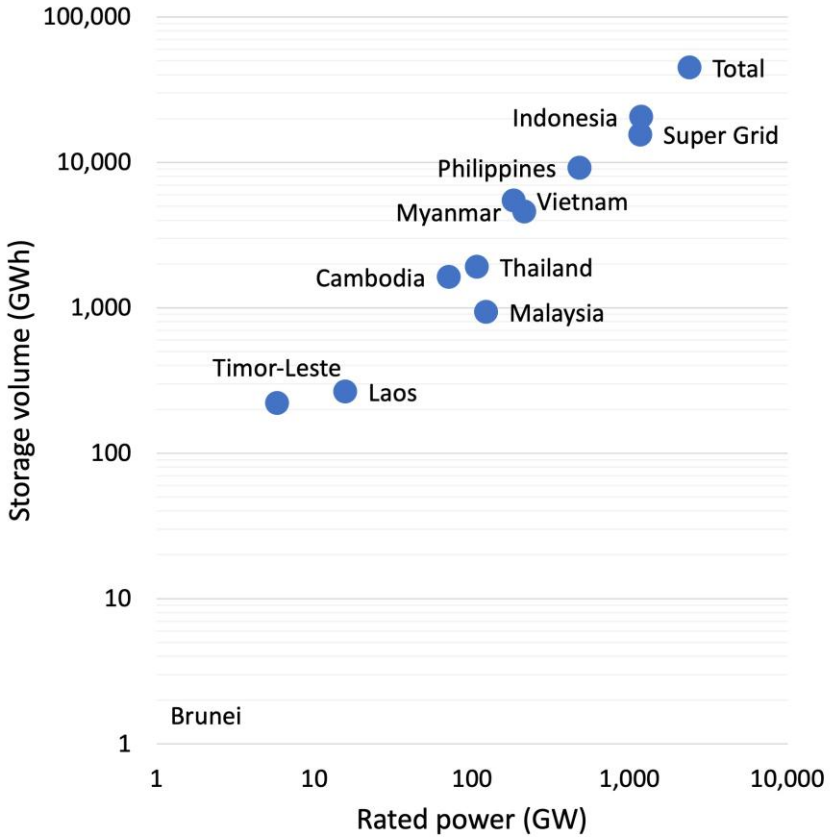
Capacity requirements to support 100% RE in Southeast Asia

- Solar PV: 6,606 GW (3% of the land)
- Wind: 420 GW (3% of the land)
- Pumped hydro storage: 44,707 GWh (2% of the resource potential)

Renewable energy (mainly solar) supported by off-river pumped hydro



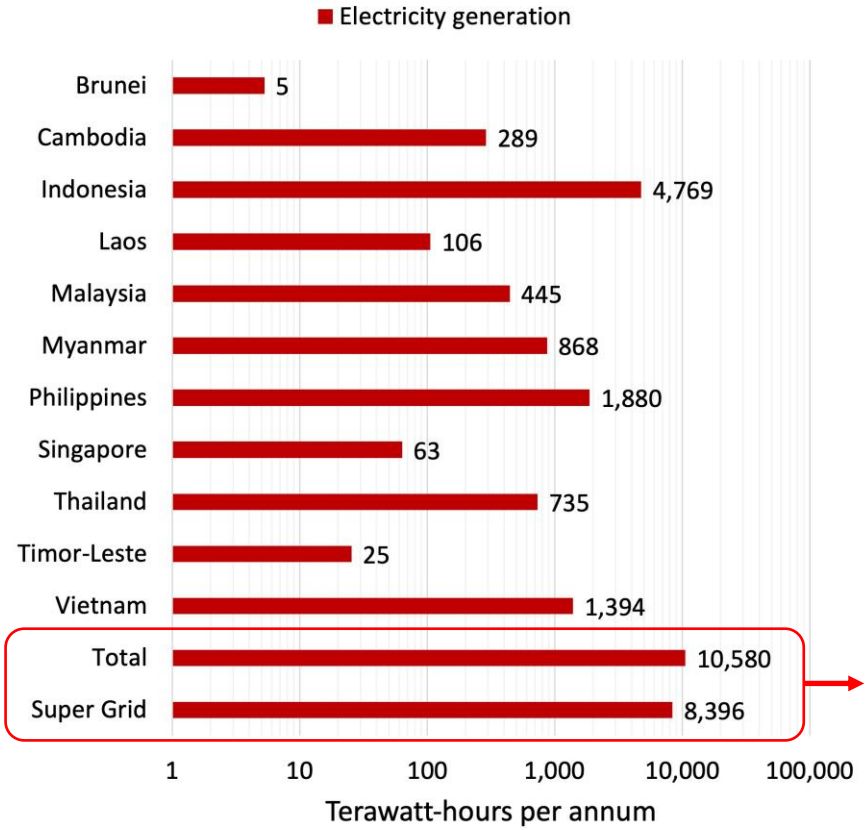
Off-river pumped hydro resource potential
(2 million GWh)



Benefits of interconnection

Reduced energy storage requirement:

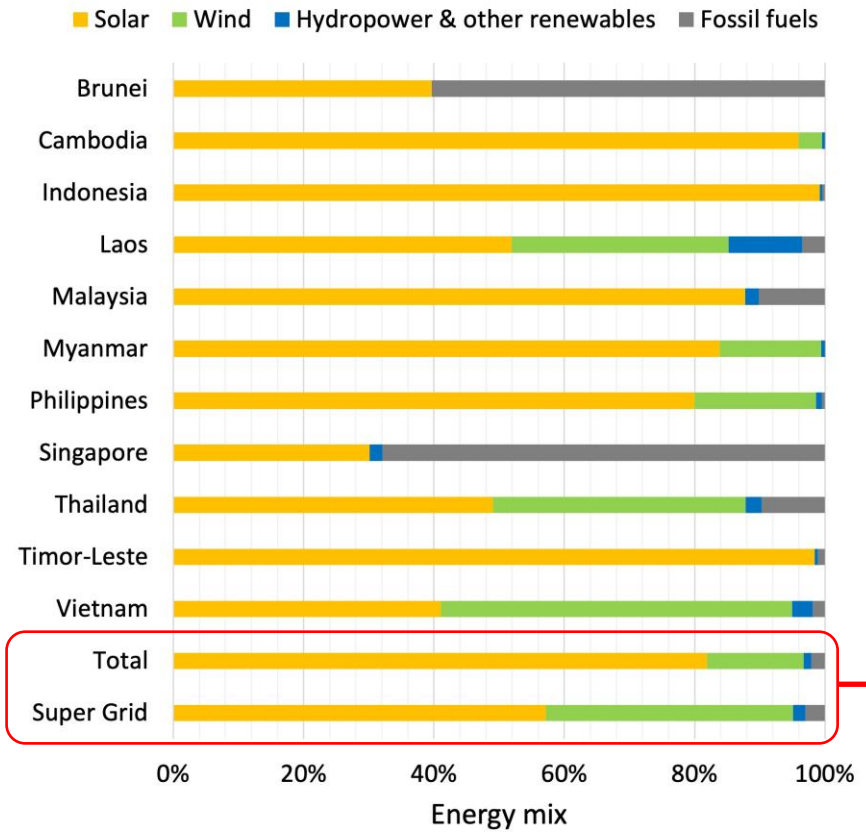
- The storage requirements are more than halved in the Super Grid scenario, due to the sharing of renewable energy resources.



Benefits of interconnection

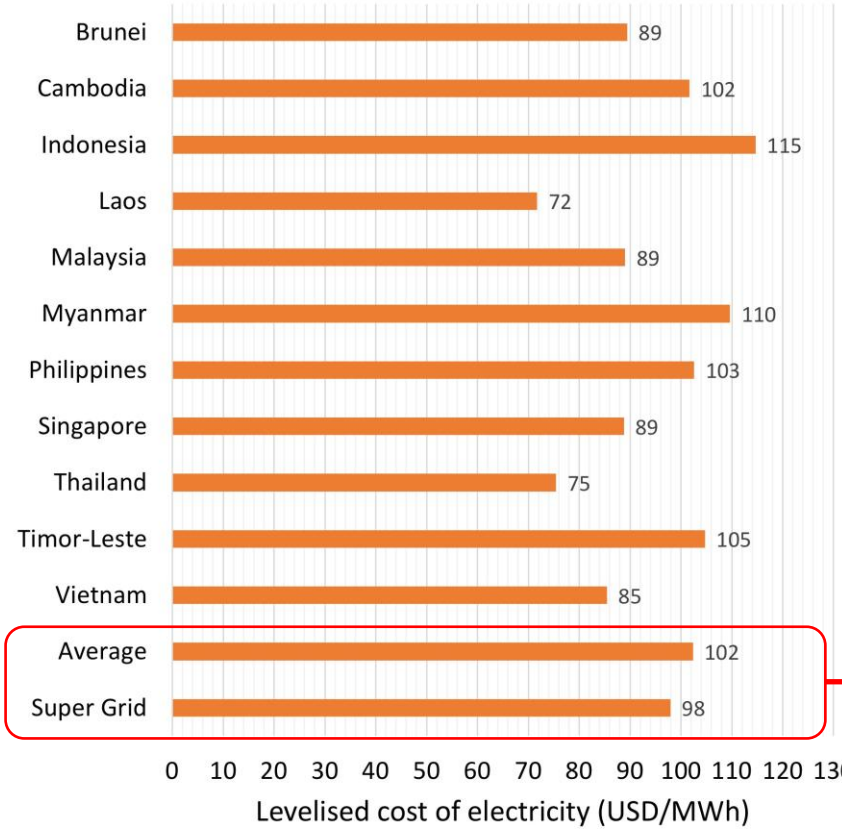
Reduced generation requirement

Renewable energy supply can be effectively smoothed out through the Super Grid, so the energy spillage is minimal.



Benefits of interconnection

The Super Grid allows moving of wind energy from north to south, and therefore it can promote wind energy integration.

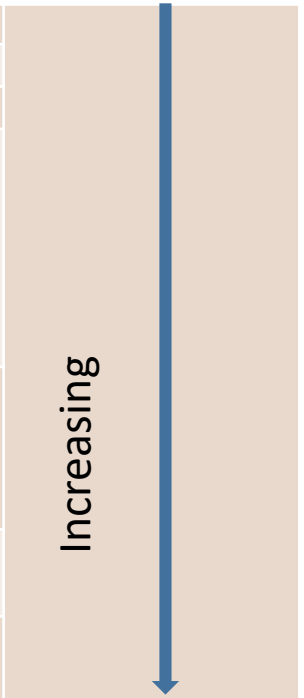


Benefits of interconnection

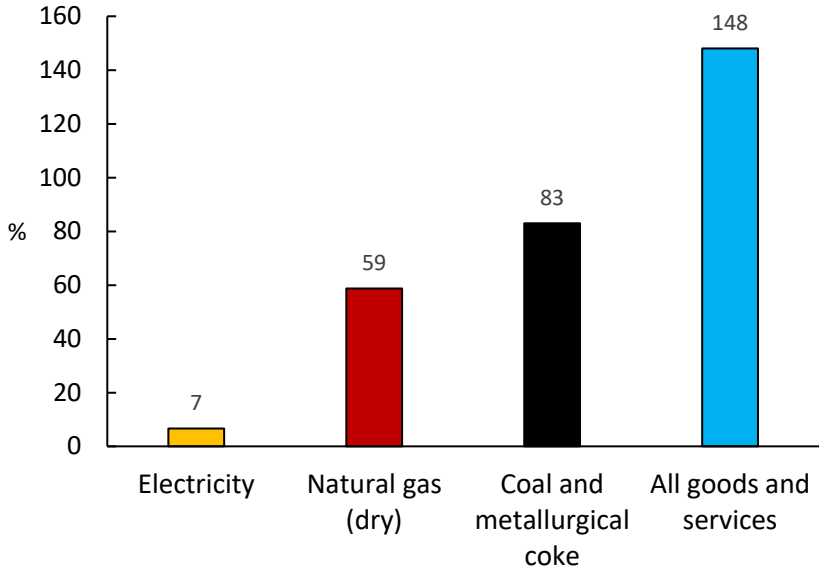
Lower levelized cost of electricity

Despite a large investment on the transmission infrastructure, the cost figure decreases in the Super Grid scenario.

2. Cross-border electricity trade models

Trade model	Trade mode	Example	Degree of integration and complexity
Bilateral	Unidirectional	Cambodia imports from Vietnam	
	Bidirectional	Lao PDR ↔ Vietnam	
Multilateral	Unidirectional involving a transit country	Lao PDR exports to Malaysia via Thailand	
	Multidirectional among differentiated markets	Southern African Power Pool	
	Multidirectional among harmonized markets	European Union Internal Energy Market	
Unified	Unified market structure, differentiated operations	Nord Pool	
	Unified market and operations	Australian National Electricity Market	

3. However, cross border electricity trade has been limited



Openness index by product for ASEAN, 2022

Cross-border electricity trade is minimal compared to trade in natural gas, coal, or the overall economy in ASEAN

ASEAN Power Grid (APG) progress

- Initiated in 1997
- Limited to Mekong countries
- Majority of power trade has been bilateral between neighbours
- Far from full multilateral, multidirectional trading

4. Barriers

Desire for self sufficiency

Associated with sovereignty and nationalism

Example: Indonesia's regulations allow for the possibility of electricity imports, but prioritise national generation capacity

Limited willingness to rely on foreign electricity sources: national security concerns

Example: Singapore opts to rely on imported natural gas including LNG to power 95% electricity generation rather than importing electricity

The trust required for cross-border trade remains underdeveloped

Technical and institutional barriers

- Geographic dispersion
- High diversity in standards, specifications, and protocols for electricity transmission and distribution
- Reluctance to share information
- Resistance from incumbent utilities: risks of losing monopoly power, bankrupt when prices converge

Singapore:

- Competitive wholesale market for electricity
- Reluctant to enter into a contract for a fixed quantity of supply when joining the Lao PDR-Thailand-Malaysia project

Economic barriers

Transaction costs

- Upgrading existing institutions or establishing a new single centralised entity
- Dispute resolution

Cost sharing

- Hard to employ “benefits pay” principle
- Not attractive to private investors due to high risks

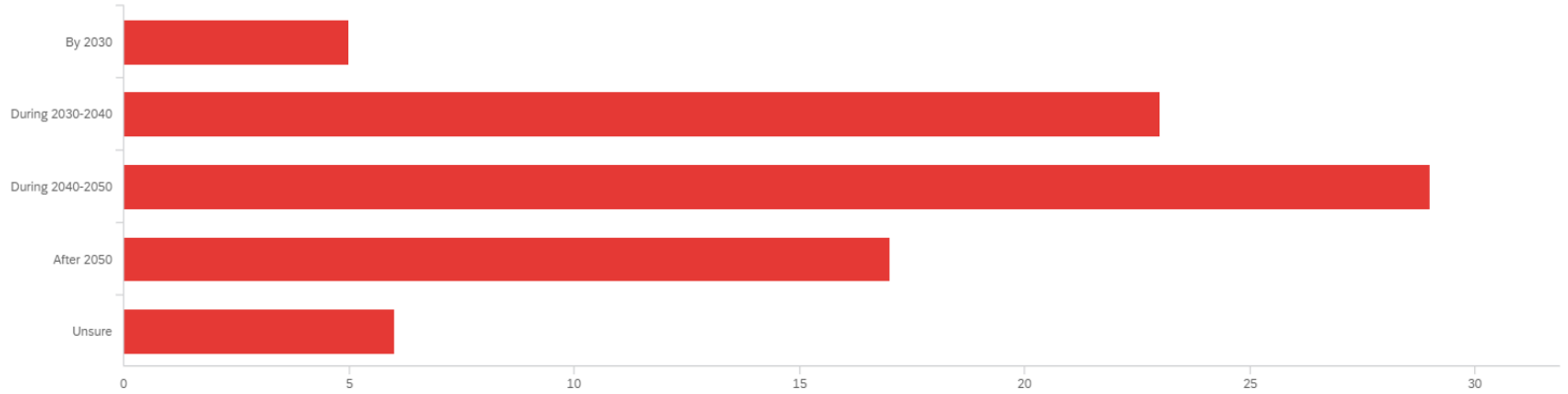
Environmental and social costs of traded hydropower

- Estimated US$ 18 billion by 41 planned hydropower dams in Lower Mekong Basin
- Downstream countries unlikely to support cross-border electricity trade that would incentivize more dams being built upstream

Expert survey: ASEAN Power Grid will unlikely complete by 2040

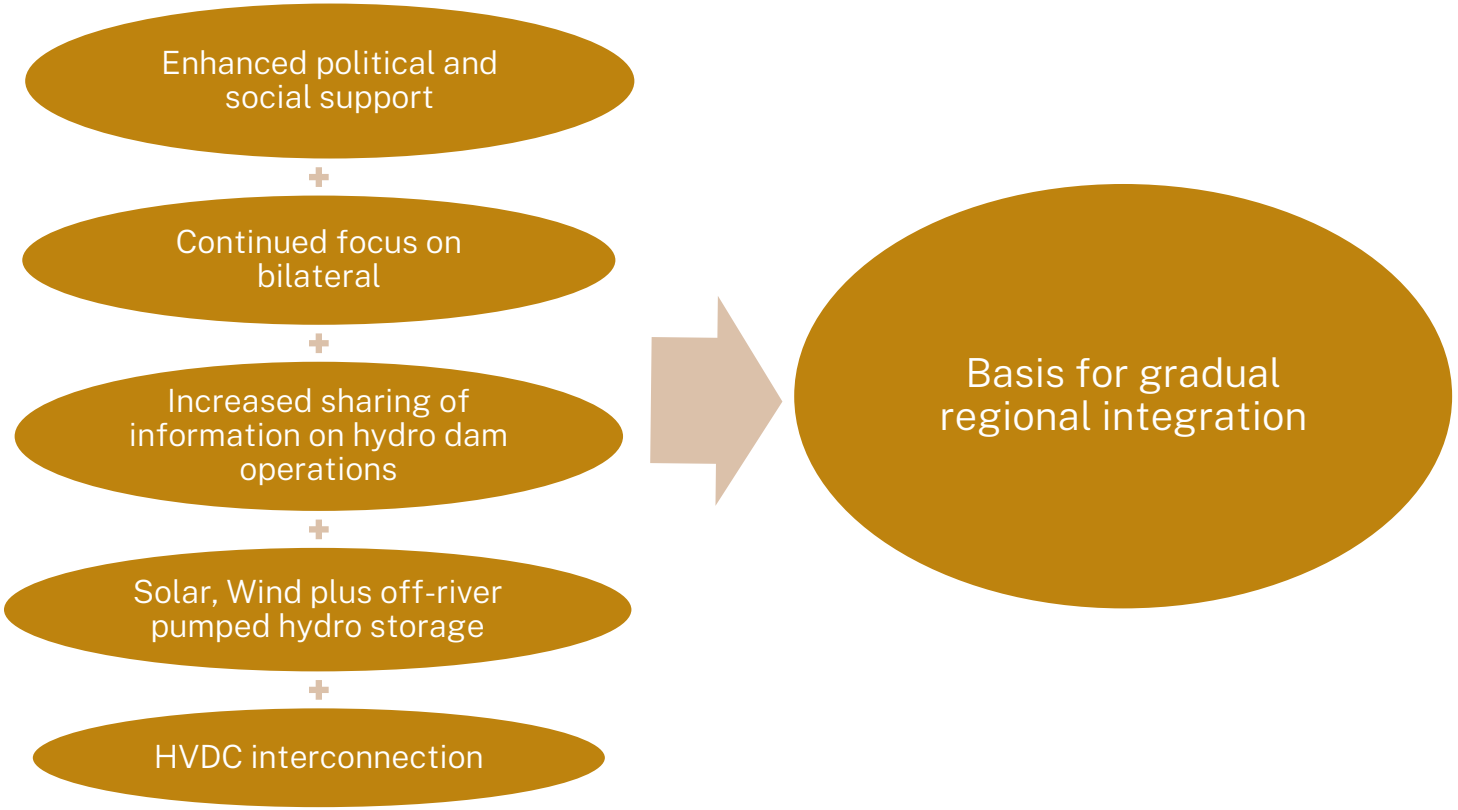
Q1 - When will the ASEAN Power Grid be finished, in your opinion?

Page Options



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	When will the ASEAN Power Grid be finished, in your opinion?	1.00	5.00	2.95	1.02	1.05	80

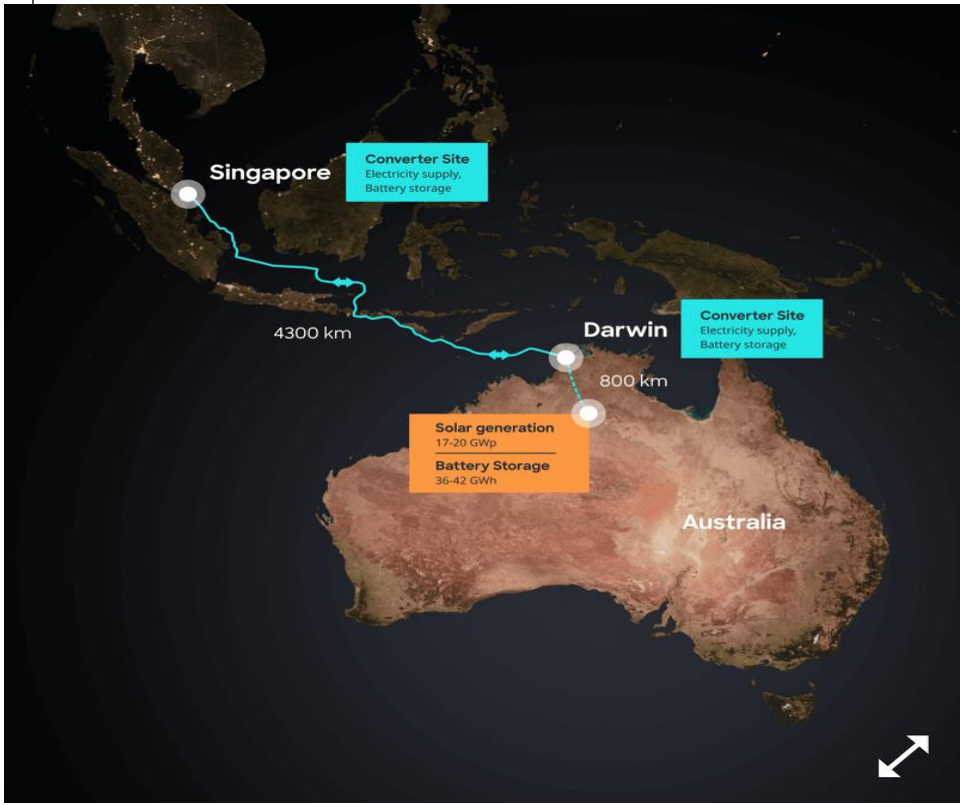
5. Ways forward



Recent bilateral initiatives

- A$30 billion by Sun Cable
- Expected operation in 2028
- 3.2 GW generation capacity, contribute to 15% of Singapore electricity supply
- Despite stakeholders' view differences over exporting electricity or hydrogen, the project is progressing

Australia-Asia Power Link connection to Singapore via Indonesian waters



Recent bilateral agreements

- Feb 2023: Vietnam Oil and Gas Group and Singapore's Sembcorp Industries signed an agreement enabling Vietnam to export about 2.3 GW offshore wind power to Singapore

- March 2023:

- Asian Development Bank and Monsoon Wind Power Company Limited signed a US$ 692 million project financing package to build a 600 MW windfarm project for Lao PDR exporting to Vietnam
- Keppel Energy granted conditional approval to import 1GW of electricity from Cambodia to Singapore
- Singapore and Indonesia signed energy cooperation contract for electricity trade

The world largest 2.2GW floating solar farm project in Batam, Indonesia, exporting power to Singapore

5. Conclusion

1. Enhancing solar- and wind-based cross-border electricity trade would contribute to affordable and climate friendly energy security

2. Political and social support is needed

3. Focus on bilateral trade would pave the way for regional integration

For more info, read:

Thang Nam Do, Paul Burke, Bin Lu 2023. Harnessing solar and wind for sustainable cross-border electricity trade in the Greater Mekong Subregion, Frontiers in Environmental Science.

https://doi.org/10.3389/fenvs.2023.1188335

Thang Nam Do, Paul Burke, 2023. Is ASEAN ready to move to multilateral cross-border electricity trade? Asia Pacific Viewpoint.

https://doi.org/10.1111/apv.12343

Bin Lu, Andrew Blakers, Mat Stocks, Thang Nam Do, 2021. Low-cost, low-emission 100% renewable electricity in Southeast Asia supported by pumped hydro storage, Energy

https://doi.org/10.1016/j.energy.2021.121387

Discussion

In your opinion, what are relevant Australian experiences for GMS/ASEAN?

	Technology	Policy	Market
Clean energy transition			
Regional power market development			