



Regional Power Trade as an Enabler for the Clean Energy Transition

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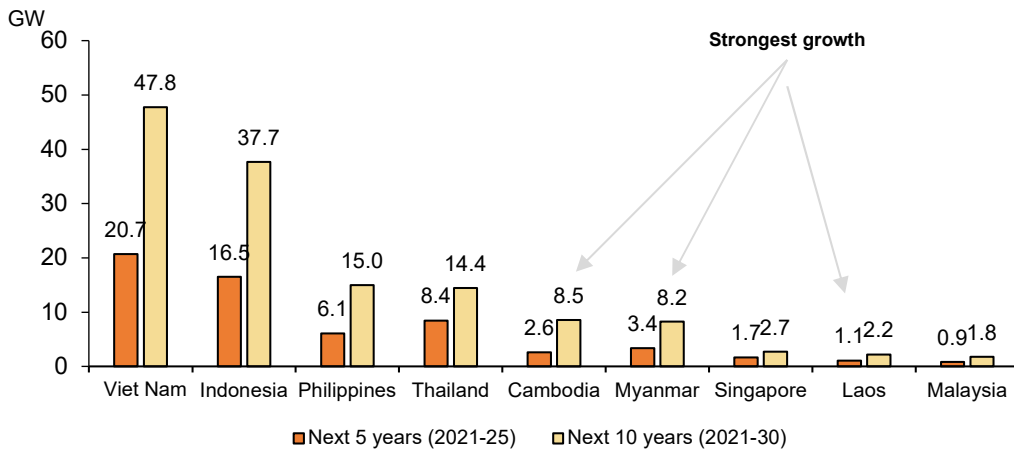


A robust backdrop for demand growth and clean energy transition among countries of Southeast Asia will drive significant infrastructure needs

Power supply and demand outlook in Southeast Asia

Commentary

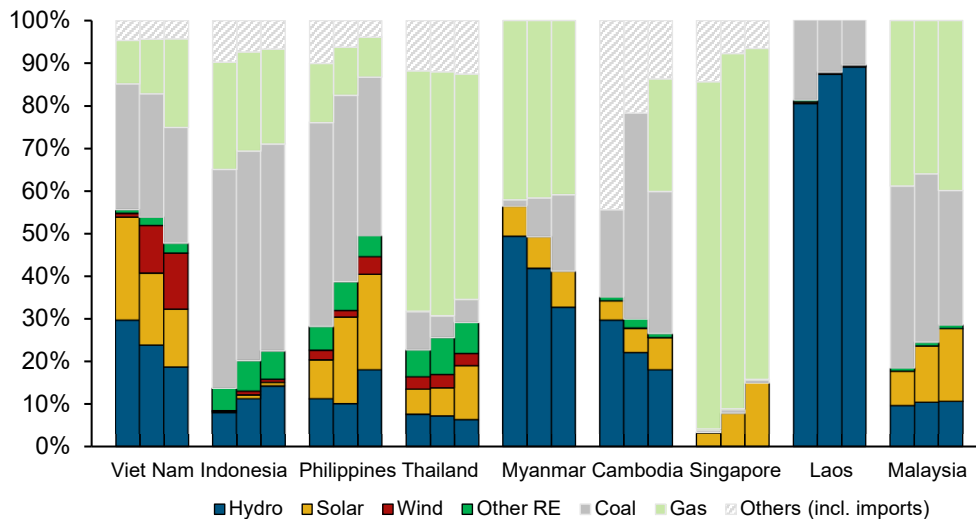
Projected incremental peak demand growth in the next 5-10 years



Growth in electricity demand is expected to remain strong

- Electricity demand has been growing rapidly over the past decade.
- Despite the reduction of demand in 2020 due to Covid-19, the peak demand growth in the region is expected to be solid.
- Peak demand of most countries is likely to roughly double over the next ten years.

Capacity fuel mix and targets (2020E vs. 2025 vs. 2030)

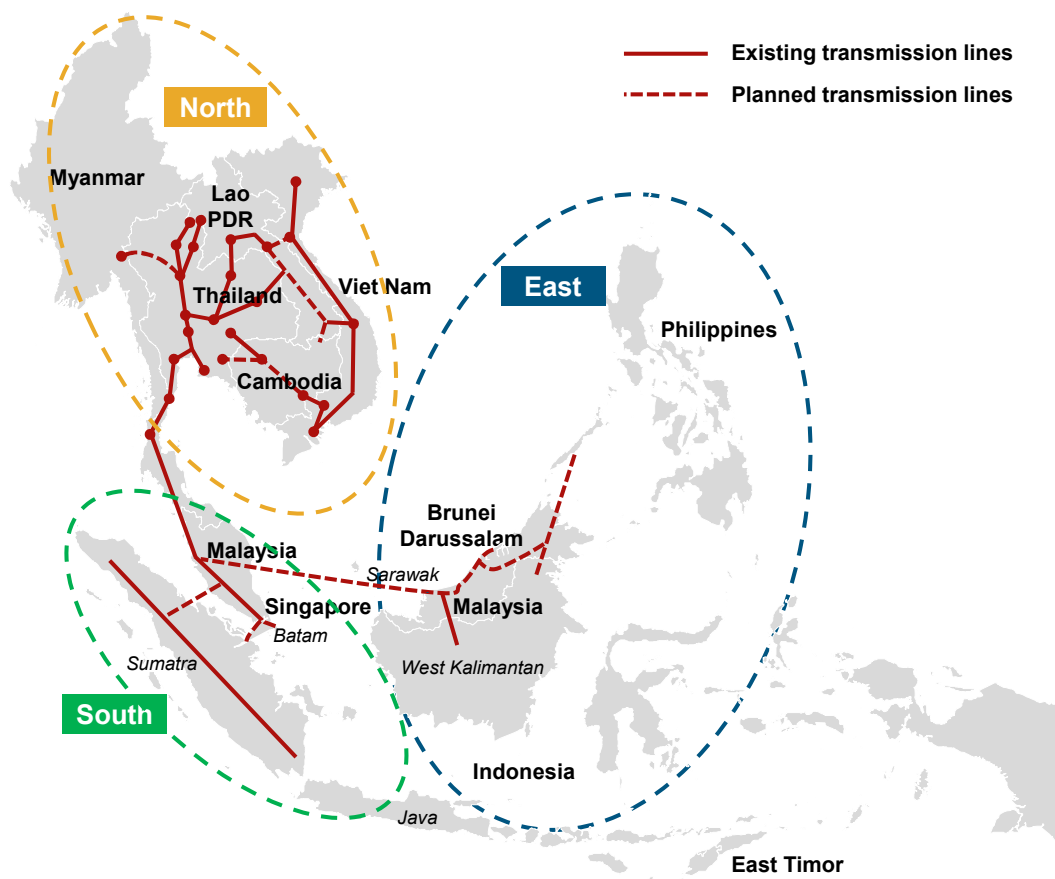


Renewables will play an increasingly important role in the long-term capacity needs for markets in the region

- Energy policy in the region is favourable towards renewables. The capacity share of renewables, particularly wind and solar, is expected to grow from 10% of today's level to 13% by 2025 and 15% by 2030, whilst ~37 GW of additional hydro is expected by 2030.
- Viet Nam leads in renewable development. The recent FIT policy has triggered around 16 GW of solar projects by end of 2020. Solar accounts for about 24% of the capacity mix
- Whilst each country in the region plans to transit to a cleaner power mix, existing coal capacity still takes substantial share of the capacity

The concept of an integrated ASEAN power grid has existed for decades, but present levels of interconnection still remain relatively low

Current level of interconnection across ASEAN



Commentary

- The concept of an ASEAN Power Grid (APG) has existed for decades but little substantive progress has been made and the grid remains underdeveloped.
- Existing transmission capacity stands at 7.6 GW, with ongoing additions (as of April 2020) ranging between 30-100 MW.
- The GMS has 24 high-voltage alternating current (HVAC) transmission connections across borders within the GMS.
- Future targets are for between 19 GW and 22.4 GW of new interconnection capacity, although no clear timeline has been set out.

Overall levels of power exchange also remain low

- The highest levels of grid interconnectedness and active bilateral interconnections are largely confined to countries within the GMS, as well as in Peninsular Malaysia.
- The Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP) has low levels of power exchange (as of August 2020, only 30 GWh of power had been traded since the inception of the project in January 2018)

Greater regional interconnection provides a number of benefits, including enhancing security of supply via reserves sharing and greater flexibility

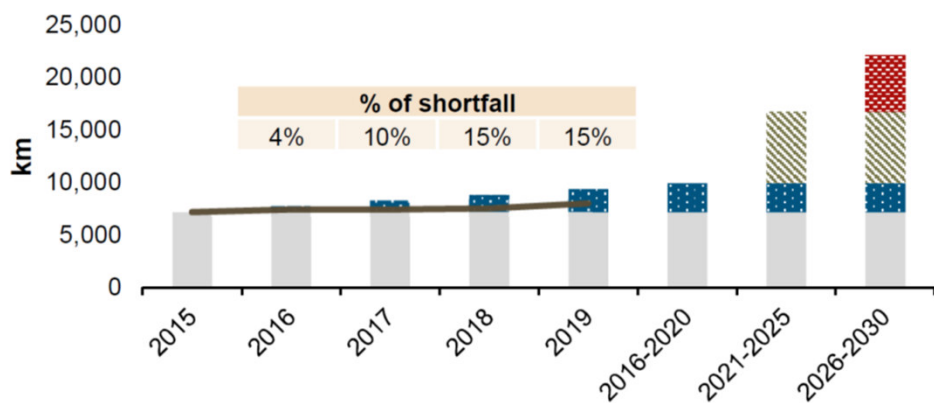
Security of supply in Southeast Asia



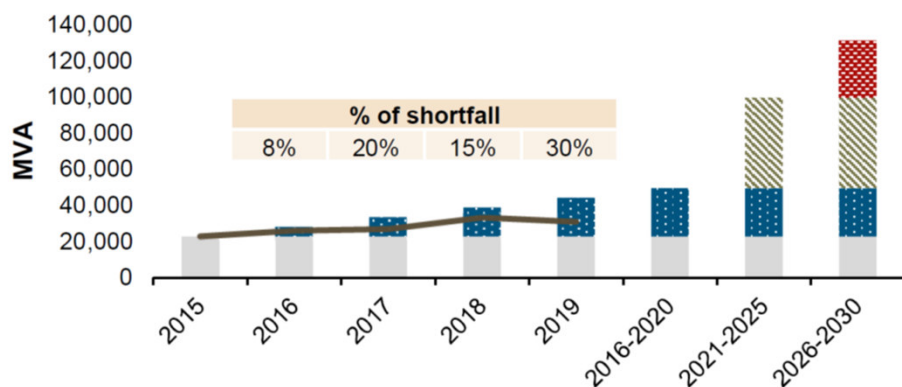
Commentary

Grid and Substation development in Viet Nam

500 kV Transmission Lines



500 kV Substations



Countries of Southeast Asia have varying degrees of supply and demand imbalance that lends itself to greater levels of power trade

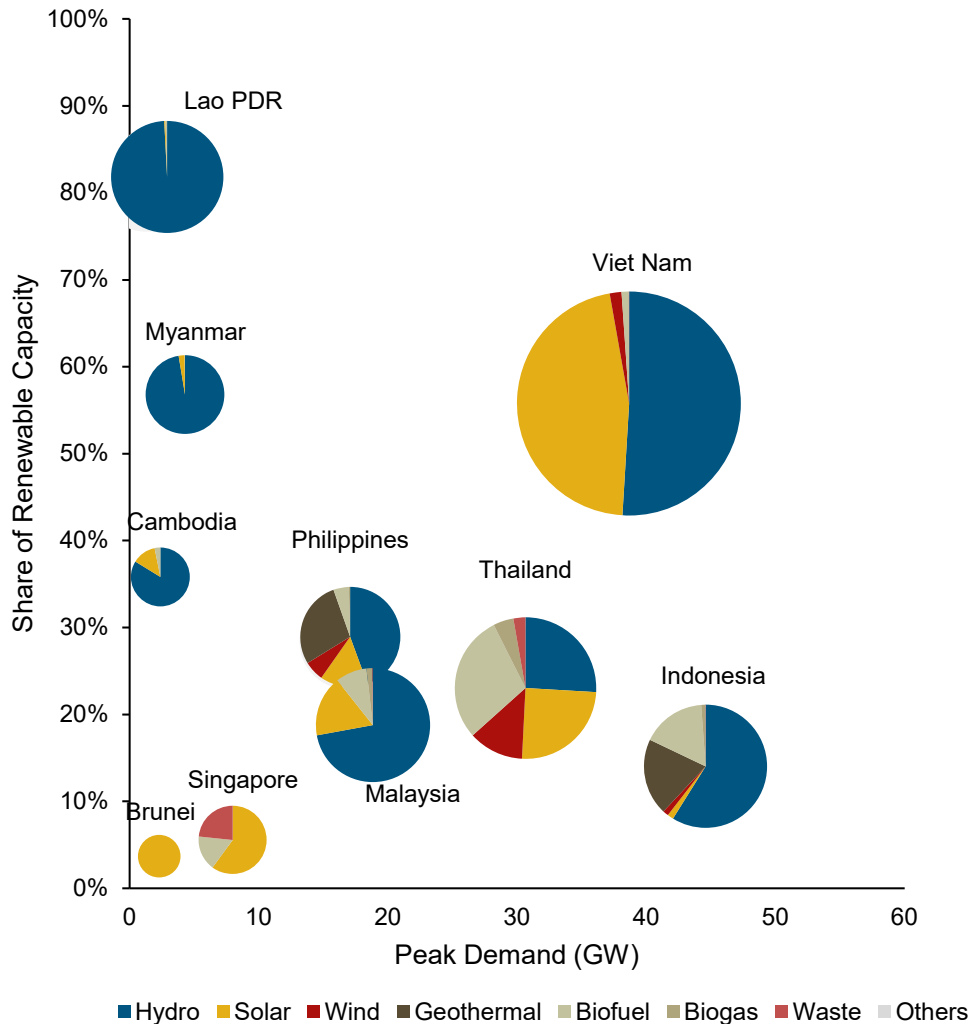
- Greater levels of interconnectedness will help make economic and efficient use of supply sources among the whole region.
- Viet Nam, Cambodia, and Myanmar where demand growth is particularly strong and which experience strong seasonality in hydropower production are most likely to benefit from increased levels of cross-border power trade to mitigate potential supply shortages.
- At the same time, Thailand, Malaysia, and Lao PDR exhibit high reserve margins.
- The supply and demand curve of each country varies greatly within the region, not only on a seasonal basis but also in terms of the misaligned 'non-coincident' nature of demand
- Integrating the ASEAN power system will enable member states to better manage the inherent variations in their own domestic supply and demand.
- Regional interconnection also provides flexibility from supply side to deal with the intermittency of wind and solar generation

Infrastructure - Existing
 2016-2020 Planned Additions (PDP VII 2016)
 2026-2030 Planned Additions (Draft PDP VIII)
 2021-2025 Planned Additions (Draft PDP VIII)
 Infrastructure - Actual

Information and staff. It may be shared outside ADB with appropriate permission.

Greater regional interconnection will also help accelerating the green energy transition in Southeast Asia and lead to a faster pace of decarbonisation

Renewable capacity mix in the region (2020)



Note: Chart bubbles not to scale
Source: IRENA; TLG analysis



Commentary

Greater ability for countries to develop and utilise renewables

- Southeast Asia countries are naturally endowed with high levels of renewable energy resource potential which, at a regional level, forms a rich and diverse base of technologies
- The intrinsic qualities and differences between clean energy technologies are highly complementary
- A cross-border electricity market enveloping countries and their respective natural resources will permit, for example, hydro resources in Lao PDR to fulfill demand requirements in Thailand when levels of solar generation naturally fall.

Reducing the economic cost of renewables curtailment

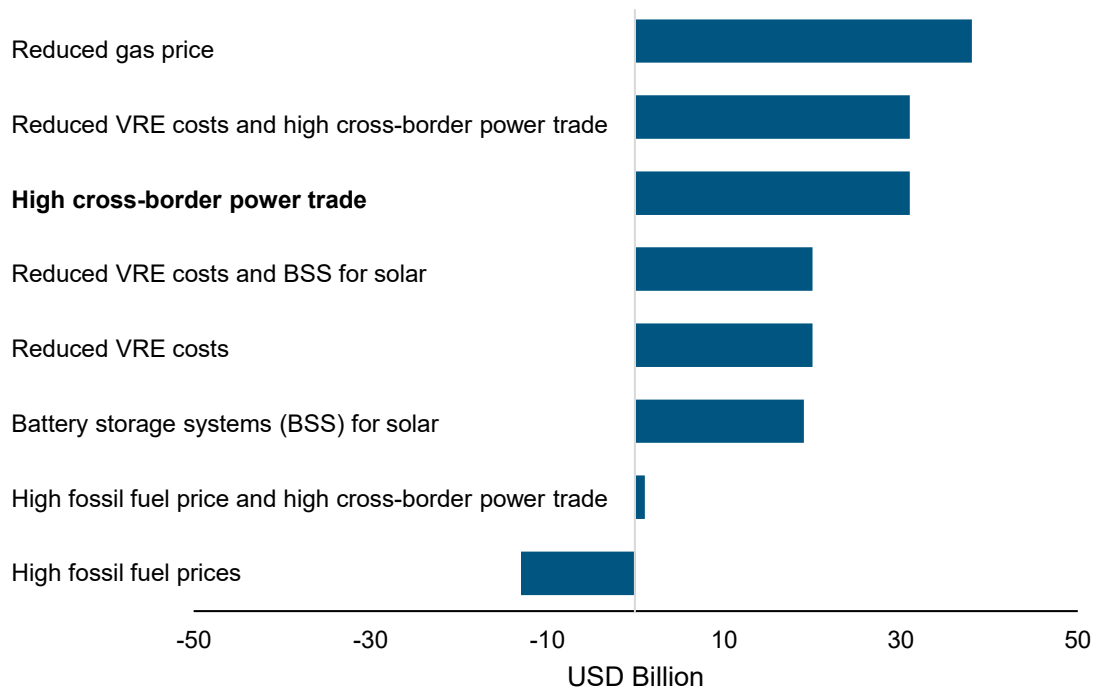
- Enhanced interconnectedness also reduces the risk of curtailment and associated economic costs, which tends to occur in two circumstances:
 1. **Market oversupply** – when renewables generation is producing at a rate that exceeds demand in the market;
 2. **Transmission constraints** – when renewables generation is unable to evacuate into the grid and reach demand centres due to the lack of available transmission capacity.

Regional power trading can also provide demonstrable economic benefits by reducing costs under a robust set of future energy scenarios

GMS RPT scenarios and forecast savings by 2035



Commentary



Projected cost savings within GMS are indicative of the broader regional benefits

- The GMS Master Plan (December 2020) commissioned by ADB projects that cost-saving benefits from integrating national generation and transmission plans within the GMS subregion will amount to **US\$20 billion by 2035**.
- **These savings are primarily derived from lower expected capital expenditure and operating costs such as fuel.**

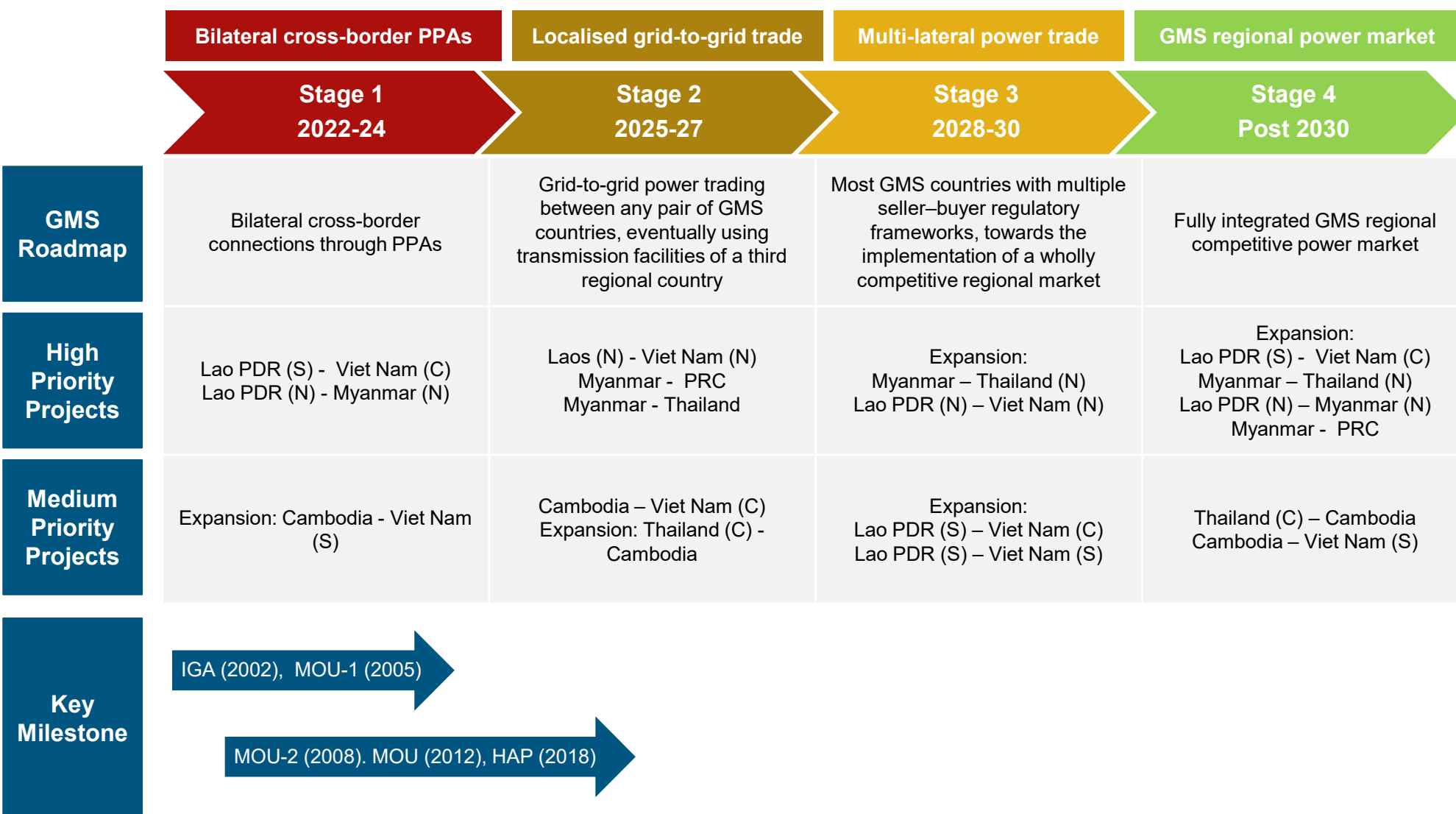
International experience is also highly supportive of the economic benefits that regional power trading brings

- In **Germany**, close cooperation between regional TSOs and joint procurement of ancillary services are estimated to produce EUR 230 million in savings of operating costs each year.
- In the **United States**, regional ancillary services trading between separate TSO entities saves an estimated USD 208 million each year.
- In the **West African Power Pool (WAPP)**, which encompasses 15 countries, regional integration saves an annual estimated USD 5-8 billion derived from lower operation costs and more sustainable power generation.

Demand Scenario	Projected Savings in the GMS by 2035
Low	US\$16 billion
Medium	US\$20 billion
High	US\$45 billion

The roadmap for power trade in GMS subregion comprises four stages

Currently power trade in Southeast Asia is still centered around bilateral cross-border PPA and has yet to make significant inroads towards a fully fledged and competitive GMS regional power trade market



Two working groups are driving RPTCC's progress

Ongoing Initiatives

Establish an implementation roadmap of the regional GMS grid codes

Establish an organization for the operationalization of the GMS synchronous zones

Establish the design of the regional high-voltage interconnection transmission network

Establish an organization to administer the fair settlement of power exchange

Provide guidance to establish GMS regional master plan (completed)

Assess new interconnection projects and manage existing portfolio (completed)



Implications

Different working groups oversee different spheres of implementing interconnectivity

- Two key entities, the Working Group on Planning and Operation (WGPO) and Working Group on Regulatory Issues (WGRI). The agendas for both working groups at the 26th RPTCC summit reflect their respective priorities.
- WGPO, the operations group, was tasked with compliance assessments for the GMS RGC, strategies for enforcement of the same, and feasibility studies, among other items. By contrast, WGRI was tasked with a pilot study of grid-to-grid trading.

Key priorities for WGPO and WGRI working groups span:

- Barriers to cross-border trade
- Priorities for increasing regional trading
- Open access proposals
- Methodology for wheeling charges
- Bilateral trading measures
- Balancing mechanisms

Looking to the future – an GMS-ASEAN Program of Work



Knowledge and lessons learned from past and ongoing projects.

- i. ASEAN – ADB knowledge sessions for example under the ADB Clean Energy Forum (ACEF)



Analysis and technical work and feasibility studies to support selected APAEC priorities and projects based on member country agreement.

- i. ADB-funded TA – Accelerating the clean energy transition in ASEAN (June 2021)
- ii. Other technical assistance grants for analytical work and project preparation work



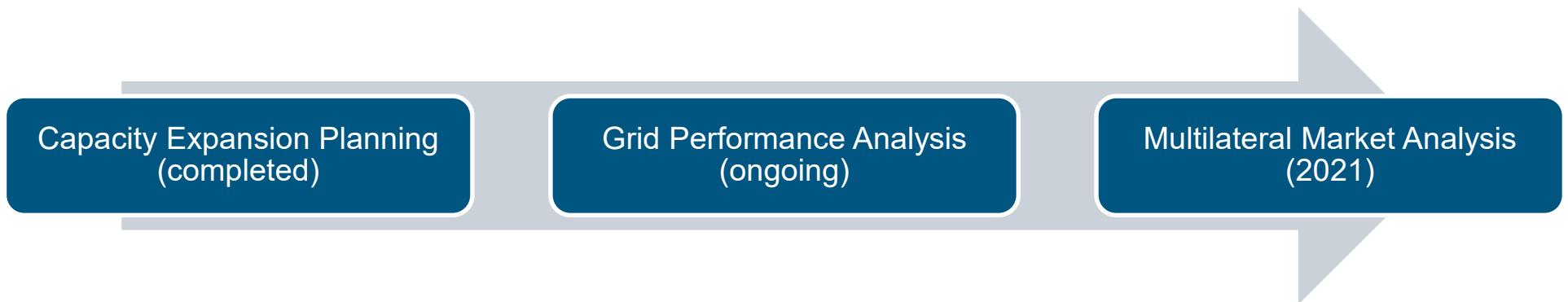
Sovereign and non-sovereign project financing

- i. ADB's own resources
- ii. ASEAN Catalytic Green Finance Fund
- iii. Climate Funds – GCF, CTF and bilateral resources

ASEAN Interconnection Masterplan Study (AIMS) III is a parallel effort by to spur progress in regional interconnection

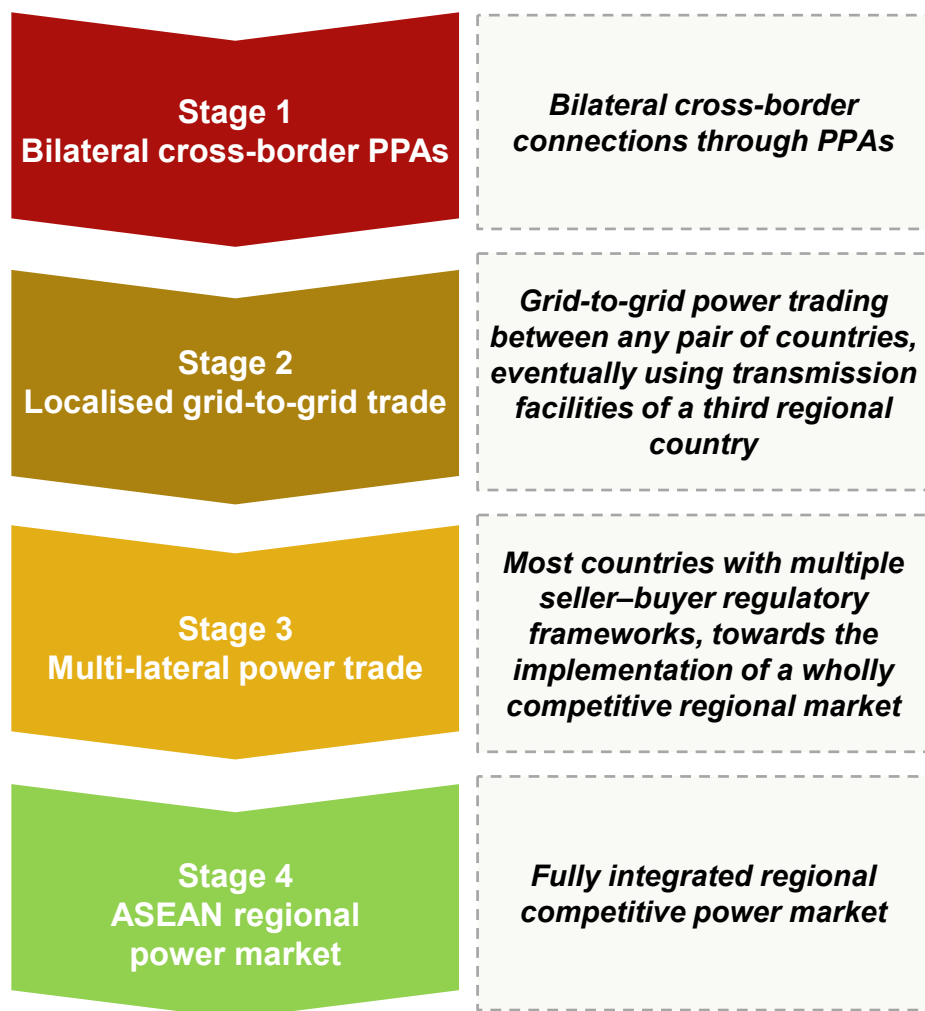
- AIMS is a non-ADB long-term study that **informs future investment requirements, capacity expansions, and grid analyses** across the three ASEAN sub-regions.
- The first phase of the study (AIMS I) kicked off in 2003 and culminated in the proposal of the APG. The study's second phase, AIMS II, concluded in 2010 and examined the feasibility of bilateral power purchasing and grid-to-grid exchanges through 2025.
- AIMS III updated the APG plan with new parameters mandated by the ASEAN Plan of Action for Energy Cooperation (APAEC). The installed capacity forecasts have been amended to meet the **APAEC target of achieving 23% of installed RE capacity by 2025**,
- AIMS III found that the **cost of interconnection under the APAEC case amounts to \$3 billion**.
- AIMS III underscores the role interconnection and cross-border power trade as an enabler of renewable energy growth. Achieving ASEAN renewables targets by **2025 will require 19,918 MW of interconnection capacity**, complementing the findings of ADB's GMS Master set out earlier in this presentation.

Status of AIMS III



Benefits realised from cross-border power trading need to be at the heart of a coherent and integrated approach towards power sector planning

Four key stages of regional power trade evolution



Key points

Power sector planning in the region continues to be fragmented and primarily driven by individual member PDPs

- At present, power sector development in Southeast Asia is mainly driven by individual member states own priorities around security of supply, affordability, and sustainability.

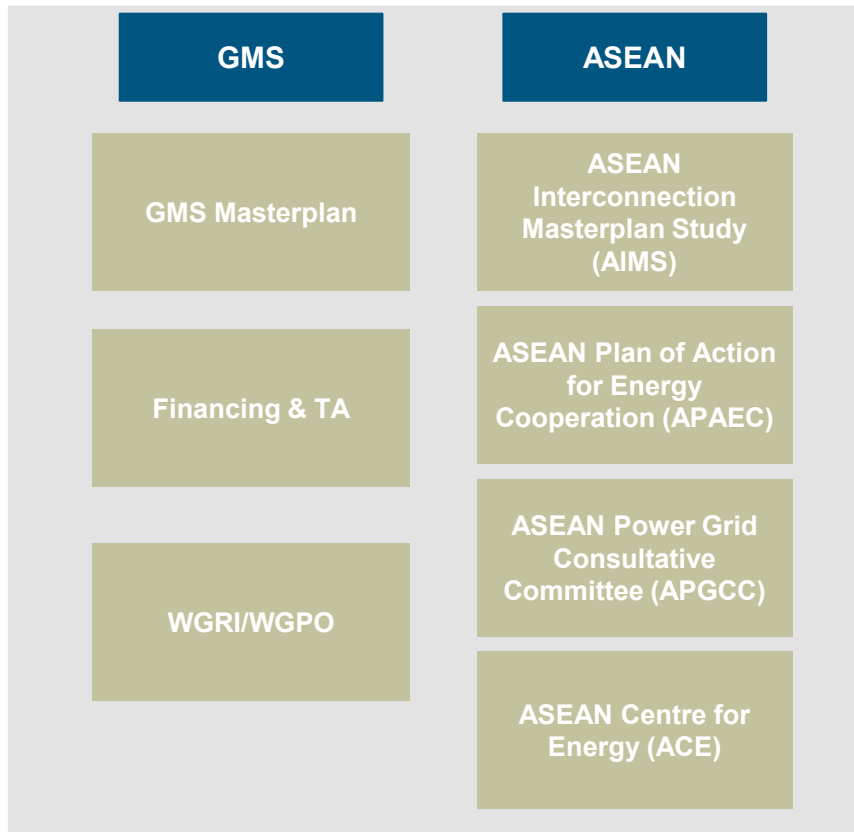
Thus far, power imports/exports have largely been considered on a standalone basis with localised benefits

- Whilst there has been growing momentum with cross-border power trade in areas such as the GMS this has mostly been discrete cross-border PPAs and grid-to-grid projects with localized benefits.
- Unlocking the benefits of multi-lateral power trade will require a 'step change' in engagement among member states to form an integrated plan that sets out investment needs, drives alignment on technical and regulatory aspects, and promotes a framework for mutual economic benefits across the region.

The clear economic and decarbonisation benefits of regional power trade, and its ability to drive the post-Covid 'green recovery', requires a much broader dialogue



Complimentary objectives of GMS and ASEAN/HAPUA present opportunities for collaboration



The scope of regional power trading and its knock-on effects increasingly necessitates a broader base of stakeholders in the conversation.

- The dialogue around regional power trade needs to be substantially broadened to not only include energy ministries and key utilities, but also government departments covering finance, trade and investment.

There are also several opportunities for cooperation between GMS and ASEAN/HAPUA

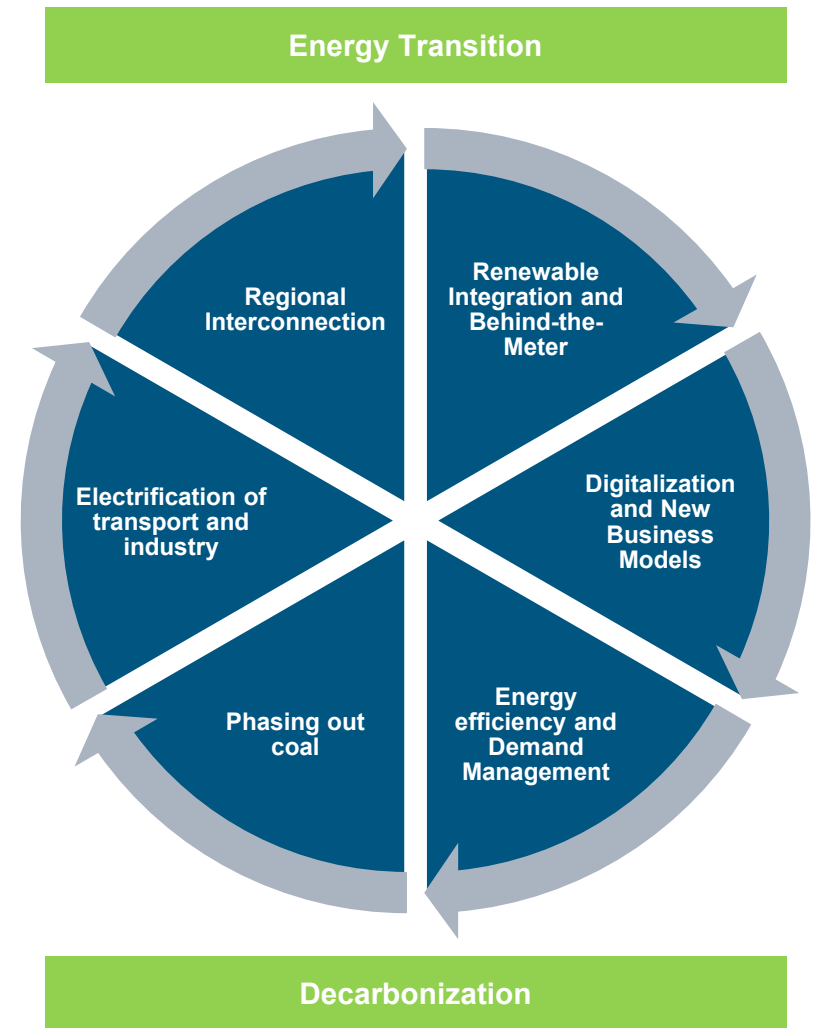
- Both ADB and ASEAN/HAPUA have convergent policy priorities existing in key areas for their respective interconnection working groups. For ADB, regional interconnectivity falls under the purview of the RPTCC whilst for ASEAN, the Heads of ASEAN Power Utilities/Authorities (HAPUA) oversees activities.

There are multiple flagship infrastructure projects under way as part of the ASEAN/HAPUA agenda that GMS can offer expert advice on.

- The GMS working groups on policy and regulation are particularly well placed to consult on projects such as the APG, with the ASEAN Interconnections Masterplan Study (AIMS) a particularly important area where ADB and ASEAN can and should foster greater cooperation.

A strong regional power trade platform will act as an enabler for the energy transition and achieving the long-term goal of decarbonization in the region

- **Regional power trading can underpin the broader energy transition in GMS.** The interconnection of diverse national supply mixes and renewable resources creates an enabling platform for decarbonization in the region.
- Interconnection between countries allows for sharing of a **larger pool of reserves and flexibility, resulting in greater energy security, energy efficiency and renewable integration.**
- **Grid digitalisation can empower new business models**, with improvement on service quality through deploying smart grid and smart meters. 'Big Data' consolidated from smart devices can enable new products and services and improvement on operation, which also benefits development of regional interconnections.
- An **Energy Transition Mechanism (ETM)** has been proposed as a replicable and scalable market-based model to transition away from coal. Greater interconnectivity also reduces curtailment effects by expanding the number of available demand centers, and by increasing total available transmission capacity. This also **helps reduce the use of thermal power, and support decarbonisation.**



Proposed Next Steps

- **Involvement of GMS ministers' is essential to accelerate and realize the benefits of regional power trade**
- **Discussions on regional power trade to be brought at the level of GMS Senior Officials' Meeting (SOM)**
- **Set up a Task Force, which could pave the way for the establishment of a Technical Working Group at a later stage (will include RPTCC under it)**
- **Take steps to plan for a multi-country power trade pilot**