



Initiatives for Sub-Regional Power Trade in ASEAN: An Emerging Approach to Progress

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Highlights

- Building on the model of LTMS-PIP, countries and regional stakeholders have started consideration of new sub-regional approaches to power trade and integration in Southeast Asia as a way of making near-term progress on MPT, with consultations revealing a preference for these more manageable approaches among policymakers.
- There are compelling reasons to pursue such arrangements between subsets of AMS based on different power supply and demand profiles among neighbouring countries, with initiatives among BIMP and LTC countries emerging examples of this.
- Multilateral discussions on these initiatives are in their infancy, however countries should seek to move quickly towards concrete coordination on initial planning and feasibility, identification and resolution of technical issues, and infrastructure financing/investment solutions. LTMS-PIP governance structures provide a template for how this can be approached.
- Given the immense benefits of region-wide integration under the APG, sub-regional initiatives should be considered as an intermediate step in the process of ASEAN power system integration, providing the building blocks that can be joined together to implement deep regional integration over time. This will require harmonisation among sub-regional initiatives, and between these and regional efforts.

Introduction and Background

A vision for an integrated ASEAN Power Grid (APG) has been pursued by ASEAN Member States (AMS) since at least 1986, driven by a desire to reap the gains from trade in terms of lowered costs and enhanced reliability that stem from power system integration across borders. More recently, efforts to develop the APG have been increasingly motivated by the imperative to deploy and integrate significantly higher shares of renewable energy within the power systems of Southeast Asia, which has lagged many other regions in this regard (see Figure 1 for projections of renewable energy deployment in Southeast Asia). Renewable generation sources tend to be dispersed geographically, with opportunities for large-scale exploitation of these often most feasible away from key population centres. An interconnected region is one in which countries with lesser renewables potential can import low-cost clean power from their neighbours, creating export revenues for suppliers, and in which renewable generation can be balanced across countries in the case of inevitable variability. As such, the benefits of establishing the APG are manifold and well-documented.

International experience suggests that processes of regional power system integration tend to take decades and, despite a number of key successes such as the recent implementation of the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP), progress under the APG has to date been slow and piecemeal. Power trade has tended to be bilateral in nature, and multi-directional, multilateral power trade (MPT) remains in its infancy.

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There are a number of general and region-specific barriers to change that can explain this slow progress, however, motivated by the success of LTMS-PIP, countries and regional stakeholders have begun to examine potentially more nimble and manageable sub-regional approaches to MPT as a way of making progress on power system integration. This paper examines the potential for some of these approaches.

The findings and recommendations set out in this paper were informed by a series of consultations and facilitated discussion sessions with ASEAN policymakers, regulators and utilities, undertaken by ESCAP and ACE in the second half of 2024. Discussions with key stakeholders in national and sub-national settings across a targeted subset of AMS were designed to assess the views of these stakeholders regarding multilateral power trade, including the technical, regulatory and political challenges and/or opportunities in this regard. The discussion also aimed to inform ACE and ESCAP's initial proposals for the nature and location of a potential future MPT pilot project (noting that this should clearly facilitate greater deployment and integration of renewables) for further analytical investigation and discussion among AMS.

Figure 1. Technology-wise break-up of projected installed capacity under ASEAN Energy Outlook 8 Scenarios of ATS (ASEAN Member States Target Scenario) and RAS (Regional Aspiration Scenario), by leveraging on the proposed APG interconnections the region could potentially be able to integrate 42,6% of VRE penetration (367 GW of solar and wind) into the ASEAN level Installed Capacity in 2040 (source, ASEAN Energy Outlook 8)



The case for a sub-regional approach to multilateral power trade

The establishment of the LTMS-PIP in 2022 was a watershed moment in the process of regional power system integration in Southeast Asia, representing the first time that MPT arrangements – involving three or more countries in power trade – had been implemented in the region, and marking a symbolic step towards the long-term realization of the APG. While the LTMS-PIP is not yet a perfect model of MPT, and has faced several challenges in the years since its establishment, including due to water shortages in the hydropower facilities of Lao PDR, it also demonstrates that the implementation of MPT arrangements is possible to in ASEAN, based on sub-regional approaches to power integration and trade among a subset of AMS.

While LTMS-PIP has its own key driver – the delivery of clean hydropower from Lao PDR to renewables-constrained Singapore – there are compelling reasons to pursue similar arrangements between other country subsets in the coming years,

drawing on different power supply and demand profiles among neighbouring countries that specify clear gains from trade, and driven by the increasing imperative to integrate greater shares of geographically disparate renewable energy generation into domestic power systems. In a series of consultations with representatives from ASEAN stakeholders clearly expressed a preference for sub-regional approaches to power system integration in Southeast Asia, noting the more manageable, constrained scope of such initiatives, and the less complex coordination and implementation involved in these.

Actions towards power integration at the sub-regional level are emerging in the context of broader, long-standing and ongoing ASEAN-wide efforts to advance multilateral power trade under the APG. Indeed, they are also doing so at a time in which there are significant developments in bilateral interconnection between countries in ASEAN. Perhaps most notably, Singapore has recently signed agreements with Cambodia, Indonesia and Viet Nam for the ultimate provision of 5.6 GW of clean power, to be delivered to Singapore via subsea cable in generation-to-grid projects (rather than those that establish new MPT). A coherent approach to coordination between regional, subregional and bilateral initiatives for greater multilateral power trade will be critically important in ensuring the benefits of this trade – in terms of power system development and clean energy transitions – are maximized and shared over time.

Current developments in sub-regional approaches

Planning for new sub-regional trading arrangements is already underway. In 2023, for example, Indonesia made a proposed Brunei-Indonesia-Malaysia-Philippines Power Integration Project (BIMP-PIP) a central part of the country's energyrelated agenda as ASEAN Chair. Like LTMS-PIP, BIMP-PIP has its own internal logic. While Brunei Darussalam currently lacks low-carbon power generation options, and Indonesian Kalimantan faces strongly growing electricity demand (including that forecast from the establishment of the new capital, Nusantara), the Malaysian state of Sarawak has ample hydropower potential and a demonstrated desire to export this to neighbours. Sarawak is already interconnected with West Kalimantan, with unidirectional power exports of approximately 900 GWh in 2023 – representing the only trade that occurs currently among BIMP countries (see Table 1 for a snapshot of crossborder power flows in ASEAN).

Interface	Direction	Power Trade (GWh)						
		2016	2017	2018	2019	2020	2021	2022
Thailand (EGAT) – Cambodia (EDC)	EGAT to EDC	147	87	410	1,161	810	284	915
	EDC to EGAT							
	Total	147	87	410	1,161	810	284	915
Thailand (EGAT/PEA) – Lao PDR (EDL)	EGAT to EDL					2,013	2,046	2,774
	EDL to EGAT					1,395	1,370	902
	Total					3,408	3,416	3,676
Thailand (EGAT) – Peninsular Malaysia (TNB)	EGAT to TNB				136	610	33	3
	TNB to EGAT				118	126	127	89
	Total				255	736	160	92
Vietnam (EVN) – Cambodia (EDC)	EVN to EDC	1,164	1,077	1,091	1,772	1,247	830	1,303
	EDC to EVN							
	Total	1,164	1,077	1,091	1,772	1,247	830	1,303
Vietnam (EVN) – Lao PDR (EDL)	EVN to EDL	47	30	29	35	26	45	49
	EDL to EVN							
	Total	47	30	29	35	26	45	49
Lao PDR (EDL) – Cambodia (EDC)	EDL to EDC			66	129	1,818	2,272	2,735
	EDC to EDL							
	Total			66	129	1,818	2,272	2,735
Sarawak Malaysia (SEB) – Kalimantan Indonesia (PLN)	SEB to PLN	684	1,119	1,509	1,697	1,568	973	797
	PLN to SEB							
	Total	684	1,119	1,509	1,697	1,568	973	797
LTMS-PIP	EDL to Keppel						183	83

Table 1 Summary of cross-border electricity trade in APG (source: Roadmap for Multilateral Power Trade in ASEAN

An interconnection has also been built between Sarawak and Sabah with power trade expected to start later in 2025. This interconnection will be a key component in addressing Sabah's current generation capacity constraints. There is agreement among government authorities in the two respective jurisdictions that a Sarawak-Brunei interconnection is a priority, while an interface between Sabah and North Kalimantan is also in advanced stages of planning.

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A proposed trans-Kalimantan high-voltage backbone would complete this topographic circle, although this would not necessarily be required for significantly enhanced power trade. The underpinnings of an integrated grid on the Island of Borneo are therefore in the making, allowing participating jurisdictions to reap gains from trade and facilitating much greater penetration of clean power within individual systems.

An 'LTC' trading bloc is also under discussion between Lao PDR, Thailand and Cambodia. These three countries are all already, to varying degrees, interconnected to each other. The Lao PDR-Thailand and Lao PDR-Cambodia interconnections are two of the three largest cross-border interfaces in Southeast Asia by trade volume, and there is significant power trade between Thailand and Cambodia. In 2022, power trade between LTC countries amounted to slightly more than 7,300 GWh, representing over 83% of trade in ASEAN in that year (see Table 1). Like LTMS-PIP therefore, the basic infrastructure to allow for greater trade and integration between LTC countries is largely in place, and, given grid topologies, expanding LTC trading would provide a number of advantages. The formalization of a LTC trading bloc would help to continue to secure access for Thailand and Cambodia to low-cost, clean Laotian hydropower, with attendant benefits for Lao PDR. Greater integration would also have particular gains for Cambodia, contributing to greater grid stability and strength while reducing the need for additional higher-cost generation. Increased cross-border connectivity could also help Lao PDR and Cambodia meet growing power demand while they work to further develop their national grids, which remain internally fragmented. For these reasons, LTC countries have recently significantly stepped-up collaboration towards greater integration through a number of multilateral discussions between countries, and towards the development of a feasibility study to map opportunities for greater LTC integration.

New subregional MPT combinations can evolve over time to include countries operating parallel or linked trading blocs once the necessary physical cross-border grid-to-grid infrastructure is established, and which could eventually include the implementation of a short-term power exchange platform that enables willing countries to trade power excesses and gaps on top of respective long-term power trade contracts. From a geographic perspective, it could be envisaged for example that Myanmar might be added to the current trading arrangements between Lao PDR, Thailand and Malaysia/Singapore ('LTMM'). Or Vietnam could be added to proposed LTC trading arrangements, given the strong integration between Vietnam and Cambodia, and so forth.

Implementing new sub-regional trading arrangements

Multilateral discussions are already underway between countries for both BIMP-PIP and LTC, although these are both largely in their infancy. If and when countries seek to enhance deepen these and discussions towards practical implementation of multilateral power trade, much can be learnt from the similar processes undertaken as part of the establishment of LTMS-PIP, while noting that the nature of trade will inevitably be different with diverse country participants and different grid topologies from one proposed trading bloc to another. The success in establishing LTMS-PIP can be attributed to a number of factors: strong political backing from governments at the Ministerial level and above, the simplicity of the trading model pursued, lean governance structures with government ownership over different working groups, and the ability to progress from simple arrangements to more complex ones by learning by doing over time^[v]. To the extent possible, these principles should be applied as new trading blocks are pursued.

There are several alternative pathways countries could pursue as well. For example, while LTMS-PIP working groups included only representatives from the countries involved, the constituent governments of new trading blocs may want to bring development partners, external technical experts and financiers into relevant processes.Core countries may also want to involve other AMS, to share relevant experiences and as a link to broader APG-wide efforts, as is discussed below. This is particularly the case given, for both BIMP-PIP and LTC and unlike LTMS-PIP, new infrastructure is likely to be required for deepened multilateral power trade in each, and the nature of trading arrangements more complex. While LTMS-PIP involves unidirectional trade between one country seller and one buyer, multidirectional and truly multilateral power trade should, eventually at least, be a key feature of future BIMP and LTC arrangements.

International experience clearly demonstrates the benefits of the establishment of multilateral bodies tasked with intergovernmental coordination in enabling trade, and indeed, over time AMS have set up multiple bodies, made up of policymakers, utilities and regulators respectively, to assist with various institutional functions enabling trade. As additional enabling functions are handed progressively to these existing bodies at the regional level, new sub-regional trading blocs may consider the parallel development of very simple and functionally constrained coordination bodies in due course.

The sub-regional approach: a means to a greater end

The case for the development of sub-regional arrangements for multilateral power trade in the short- and medium-term, drawing on lessons learned from LTMS-PIP, is clear. As policymakers noted in recent consultations, these provide a constrained, manageable and implementable solution for pursuing greater cross-border integration between a limited number of neighbouring countries where compelling gains from trade can be made. For these reasons, and as set out in the ASEAN Centre for Energy's Roadmap for Multilateral Power Trade in ASEAN, published in October 2024, subregional approaches should provide the basis for the expansion of multilateral power trade now, with actions that can be taken in the present and near future to make concrete progress on key initiatives, including those discussed above.

However, these sub-regional initiatives, as positive as they are, should be considered as an intermediate step in the process of ASEAN power system integration rather than its final destination. While very supportive of short-term action to progress trading among subsets of AMS, in consultations policymakers also stressed that such action should also facilitate deeper integration at the regional level towards the ultimate achievement of the APG vision, supported by the well-established cooperation and strong architecture characteristic of ASEAN-level energy-related processes.

The realization of an APG, as it is currently conceived or in a similar form, would have immense benefits for clean energy transitions and power system development in Southeast Asia which are well documented, magnifying the gains made at the sub-regional level and expanding these to all ASEAN countries. This means sub-regional trading arrangements should be seen as the building blocks for future deeper regional integration under the APG. It also means that, in parallel to the pursuit of sub-regional approaches, policymakers should keep focus on the regional picture, ensuring that the planning, preparation and multilateral coordination required for ASEAN-wide integration is robust and ongoing. This will ensure that the building blocks are as much as possible in place when, over time, sub-regional initiatives are pulled together into a regional and mutually beneficial power grid for Southeast Asia.

Key Actions and Next Steps

While precise actions will differ depending on the particular sub-regional trading arrangement being pursued and the mix of countries involved, there are a number of key actions that constituent countries should seek to undertake as they go through the process of setting up these arrangements, including with reference to lessons learned from the approaches put in place to implement trading for LTMS-PIP. Given these lessons learned are well-documented and given that LTMS-PIP is at this point a relatively mature undertaking, the following are most applicable to the cases of BIMP-PIP and LTC, as discussed in this paper. Special consideration should be given, however, to the interaction between LTMS -PIP and LTC, given that Lao PDR and Thailand are already key countries in LTMS-PIP arrangements, including how exports from Lao PDR are shared between Cambodia, Thailand and Singapore, among other countries.

- Firstly, the feasibility studies that have been set in motion for both BIMP-PIP and LTC should be completed as a matter of priority. This should include key infrastructure requirements (and time horizons) as well as other necessary technical and institutional building blocks for trade (i.e., 'minimum requirements'). Importantly, it should also set out a vision for potential opportunity trades as infrastructure is developed, as part of an overall vision for ultimate final stage integration in the long-term, including high-level costings for different levels of ambition and time horizon.
- Based on the findings of the feasibility study, working groups should be established to tackle the various outstanding political, regulatory and technical issues of concern. The LTMS-PIP division of labour between groups working on tariffs, commercial, technical and legal aspects could likely be replicated in different contexts. There may also be benefits to broadening these further than membership just by constituent countries, with observership from a range of technical and finance-related stakeholders, and with particularly sensitive negotiation taking place behind closed doors. A clear coordination and negotiation functionality (and schedule) should be established, overseen by a Governing Board at Minister or senior official level.

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- Agreement on technical issues is likely to be a core sticking point in the process towards greater sub-regional integration, so a primary priority should be to work through key issues in the relevant working groups. In particular, negotiations on wheeling charge methodologies, grid codes, technical standards, and Available Transfer Capability (ATC) allocation could be lengthy and likely require careful attention. Along with legal and regulatory issues, data sharing protocols and dispute resolution processes, these can then form the basis of an eventual substantive multilateral agreement that sets out the parameters, and paves the way for, enhanced sub-regional multilateral power trade. The experiences of Malaysia and Thailand from LTMS-PIP can be brought to bear in the negotiations on BIMP-PIP and LTC respectively. In addition, the considerable efforts currently being undertaken to resolve key technical issues and requirements for regional power trade under the third phase of the third ASEAN Interconnection Master Study should be leveraged for insights into how technical barriers can be tackled within new sub-regional trading arrangements.
- Questions of financing should be tackled as early as possible in sub-regional integration processes. LTC currently interconnected, countries are however infrastructure investment and upgrades will still be required, most notably to the Cambodian grid, and, for BIMP-PIP, significant investments are envisaged. These are most often complex and expensive, especially in the context of limited national financing and fiscally constrained domestic utilities. This underlines the need for both the participation of finance-related stakeholders in working group discussions, and the clear definition of financing needs under different ambition levels and timeframes, if possible in feasibility studies. Innovative financing solutions can then be sought, ideally in parallel with the relaxation for ASEAN integration-related projects of green taxonomies applied by international financial institutions. Countries may also consider 'common-use asset' approaches to financing, which pool funding across various relevant public and private financiers in different jurisdictions.
- With the transfer of clean power- a key driver for crossborder integration of power systems, stakeholders should consider the development of regional and sub-regional Renewable Energy Certificate (REC) schemes, which provide certainty to buyers about the provenance of energy purchased. A major project (entitled 'RECAP') is currently underway in the BIMP context to map out conceptual frameworks for potential sub-regional REC schemes, which should be pursued, and could also be applied in the LTC context, with appropriate caveats given any specificities of this context.

- In many ways, the newly established Energy Exchange Malaysia (ENEGEM) can serve as a testing ground for the implementation of sub-regional and, eventually, regional electricity exchange. By piloting market mechanisms, trading frameworks, and regulatory harmonization within ENEGEM, stakeholders can gather valuable insights and refine the structures needed for broader electricity trading arrangements among countries. This approach allows for the gradual scaling up of electricity exchanges, starting with sub-regional initiatives before expanding, when appropriate to a fully integrated regional market. Lessons learned from ENEGEM's implementation can inform the development of transparent market rules, efficient pricing mechanisms, and governance structures, ensuring a smoother transition toward greater power system integration in Southeast Asia, sub-regionally and beyond.
- Looking more broadly than BIMP-PIP and LTC, it must be stressed that infrastructure development plays a crucial role in enabling MPT. Given the high costs and long lead times required for cross-border transmission projects (and especially for subsea cables), prioritizing investments based on sub-regional needs can help accelerate implementation. A structured approach to sub-regional prioritization will ensure that interconnections essential to the APG receive necessary support and financing. This includes conducting detailed assessments of high-impact transmission corridors, identifying bottlenecks, and aligning national grid development plans with ASEANobjectives. wide power trading Ensuring that interconnection projects are strategically phased and wellcoordinated will be key to enhancing regional energy security and enabling a more integrated electricity market.
- Given the broad-based multiplicity of benefits of power system integration at the whole-of-region level, subregional approaches to integration should as a first principle be considered building blocks for ASEAN-wide efforts in this regard. Establishing strong and structured coordination between sub-regional approaches and the APG will therefore be critical to the success of the power system integration project in Southeast Asia over time. For example, as sub-regional initiatives go through the process of defining agreement on key technical issues (as well as for supportive mechanisms such as RECs frameworks), efforts should be made to link these to standards and protocols being set in parallel at the ASEAN level. This will work to crowd in experience, finance, and technical know-how and to therefore accelerate crossborder integration for the region as a whole in the years to come.

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