



**ASEAN Centre for Energy**  
One Community for Sustainable Energy

# **ASEAN Energy Transition and LTMS-PIP**

**AIMS III Project Team**

**CASE Discussion Series: Energy Storage and Power Grid Interconnection**

**June 27, 2023**

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# Introduction

Established on 1 January 1999, the ASEAN Centre for Energy (ACE) is an intergovernmental organisation within the Association of Southeast Asian Nations' (ASEAN) structure that represents the 10 ASEAN Member States' (AMS) interests in the energy sector.



ACE shall accelerate the integration of **energy strategies** within ASEAN by providing relevant information and expertise to ensure the necessary energy policies and programmes are in **harmony** with the **economic growth** and the **environmental sustainability** for the region.



## Catalyst

To unify and strengthen ASEAN Energy Cooperation by providing:

- Platform for Sharing
- Policy Advisory
- Best Practices
- Capacity Building



## Knowledge Hub

To provide a knowledge repository for ASEAN Member States (AMS) and services through:

- Data Management
- Publication
- Dissemination



## Think tank

To assist AMS on research and identifying practical & specific solution on:

- Policies
- Legal & Regulatory Frameworks
- Technologies
- Innovative Solutions

# The APAEC Phase II: 2021 – 2025

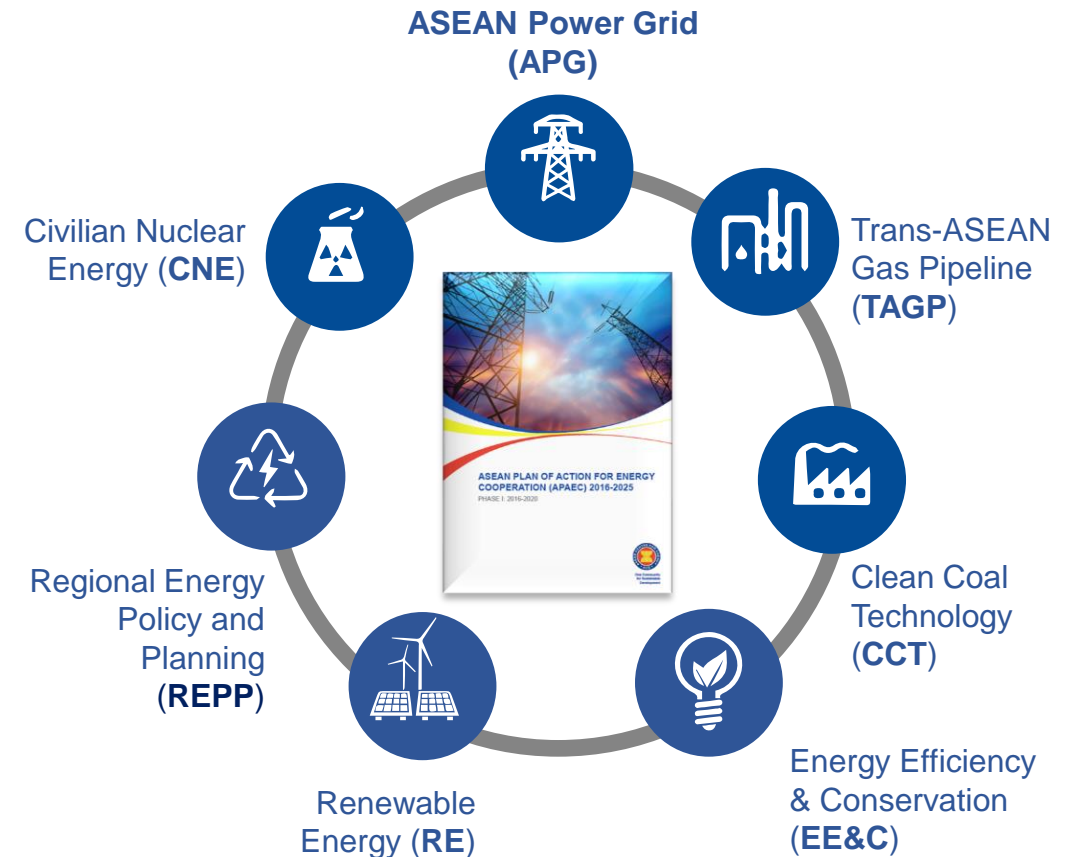
Regional blueprint for the energy cooperation in the ASEAN that builds on the success of APAEC Phase I: 2016-2020, sets out ambitious targets and initiatives to enhance energy security and sustainability and supports the UN SDG7.

ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025 Phase 2: 2021-2025

- **Theme:** “Enhancing Energy Connectivity and Market Integration in ASEAN to Achieve **Energy Security, Accessibility, Affordability and Sustainability** for All”.
- **Sub-theme:** “Accelerating Energy Transition and Strengthening Energy Resilience through Greater Innovation and Cooperation.”



## APAEC Programme Areas



# APAEC Program Area No.1 : ASEAN Power Grid (APG)

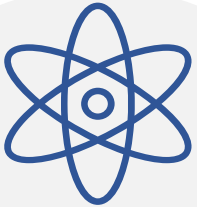


## Key Strategies:

To expand regional multilateral electricity trading, strengthen grid resilience and modernisation, and promote clean and renewable energy integration.



## Outcome Based Strategies:



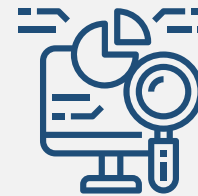
### OBS 1

Accelerate the completion of APG Project and initiate the expansion of multilateral electricity trading



### OBS 2

Work on Institutional framework and regulatory capacity as minimum requirement to advance multilateral electricity trading



### OBS3

Work on harmonizing the minimum technical requirements to advance multilateral electricity trading

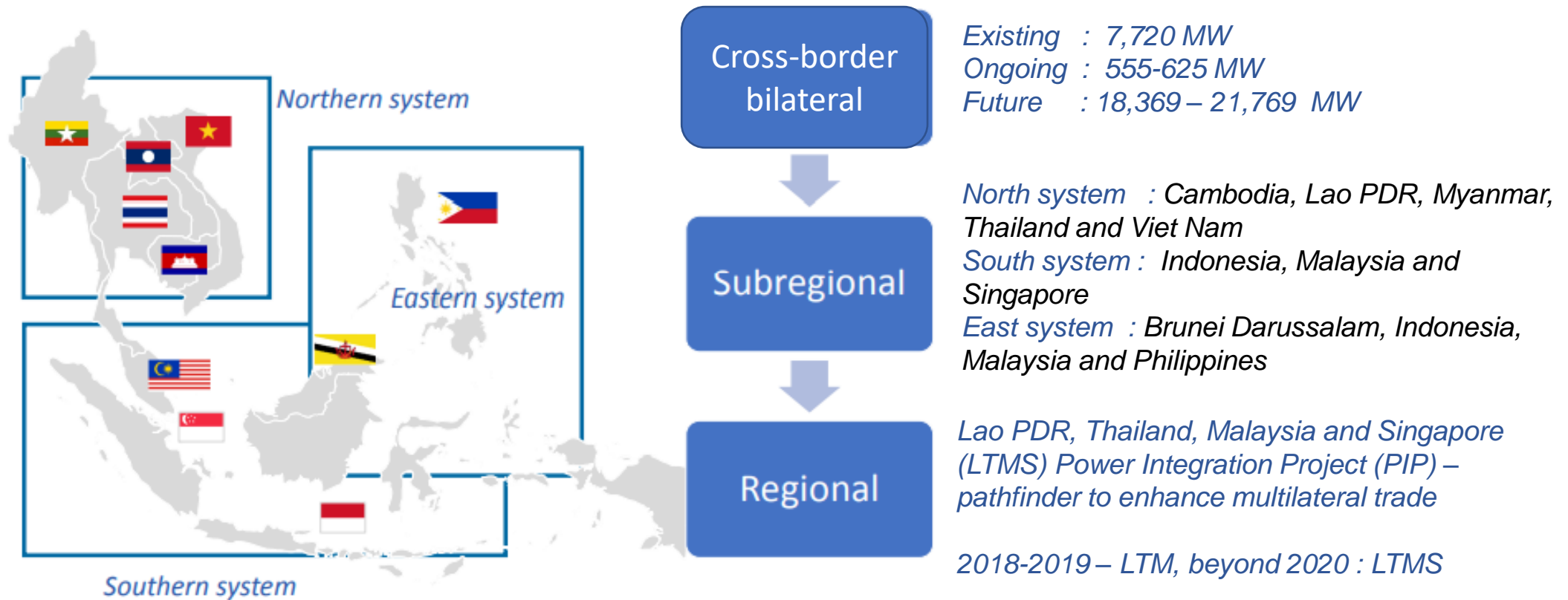


### OBS 4

Explore integrating renewable energy and other digital developments into APG Grid

# APG Concept: Pathway to establishing regional (multilateral) power trading

- The pathway to regional (multilateral) power trading in ASEAN has three different steps, where most progress has been made in bilateral cross border trading.

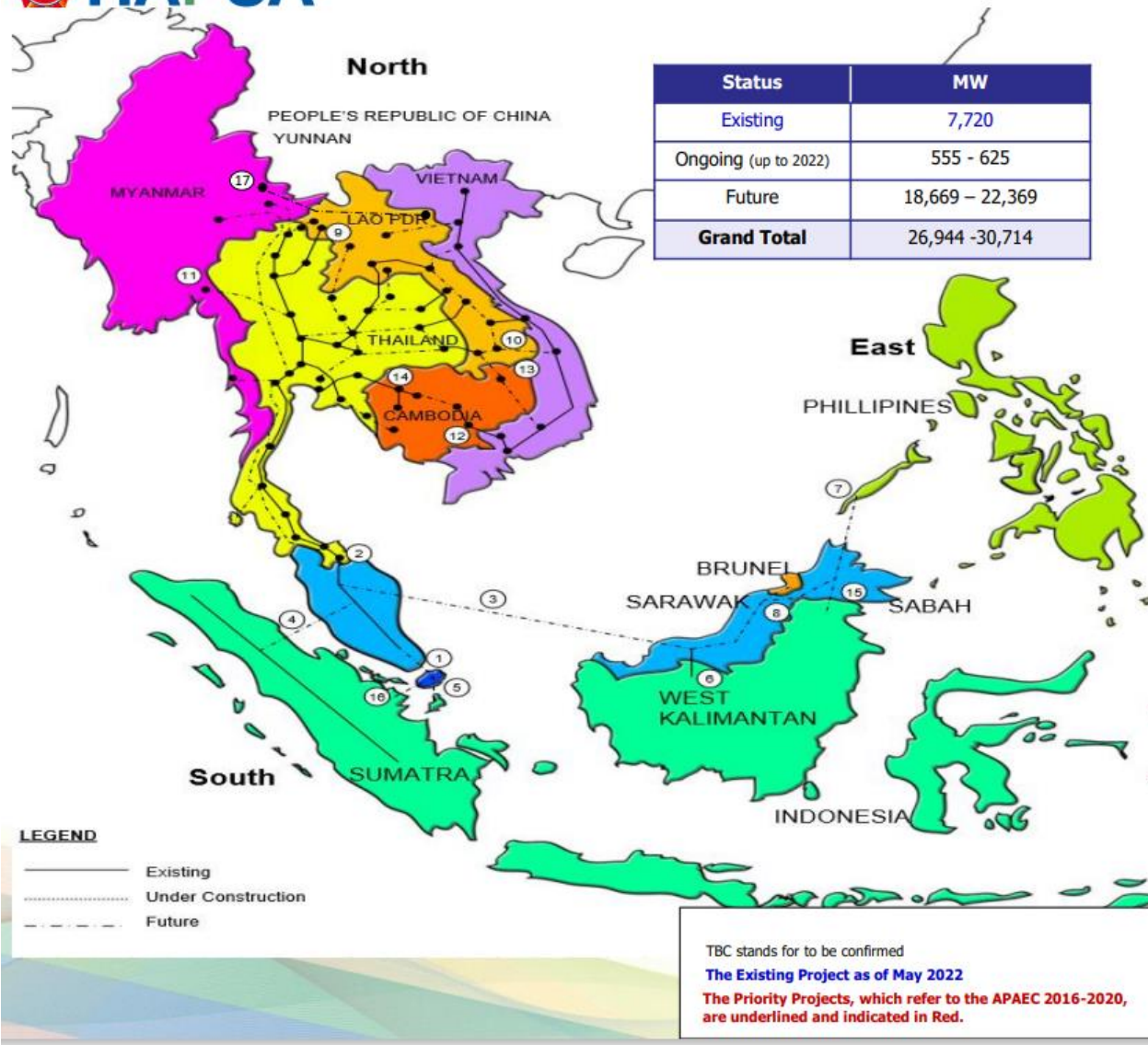


# Update: Cross Borders Bilateral Interconnection Project



## STATUS UPDATE OF APG INTERCONNECTION PROJECTS

(Updated in May 2022)  
Earliest COD



- 1) P.Malaysia – Singapore
  - Plentong – Woodlands Existing 2020
  - P.Malaysia – Singapore (2<sup>nd</sup> link Plentong – Woodlands) Existing 2020
- 2) Thailand – P.Malaysia
  - Sadao - Chuping Existing
  - Khlong Ngae – Gurun Existing
  - Su Ngai Kolok – Rantau Panjang TBC
  - Khlong Ngae – Gurun (2<sup>nd</sup> Phase, 300MW) TBC
- 3) Sarawak – P. Malaysia TBC
- 4) P.Malaysia – Sumatra TBC
- 5) Batam – Singapore TBC
- 6) Sarawak – West Kalimantan Existing
- 7) Philippines – Sabah TBC
- 8) Sarawak – Sabah - Brunei
  - Sarawak – Brunei 2021
  - Sarawak – Sabah 2022
- 9) Thailand – Lao PDR
  - Nakhon Phanom - Thakhek - Theun Hinboun Existing
  - Ubon Ratchathani 2 - Houay Ho Existing
  - Roi Et 2 – Suvannakhet - Nam Theun 2 Existing
  - Udon Thani 3 - Na Bong - Nam Ngum 2 Existing
  - Nakhon Phanom 2 – Thakhek – Then Hinboun (Exp.) Existing
  - Mae Moh 3 – Nan2 – Hong Sa (3Units) Existing
  - Udon Thani 3 – Nabong (converted to 500KV) Existing
  - Ubon Ratchathani 3 – Pakse – Xe Pian Xe Namnoi Existing
  - Khon Kaen 4 – Loei 2 – Xayaburi Existing
  - Thailand – Lao PDR (New) TBC
- 10) Lao PDR – Vietnam
  - Xekaman 3 – Thanh My Existing
  - Xekaman 1 – Pleiku 2 Existing
  - Nam Mo - Ban Ve TBC
  - Luang Prabang - Nho Quan TBC
- 11) Thailand – Myanmar TBC
- 12) Vietnam – Cambodia (New)
  - Chau Doc – Takeo – Phnom Penh Existing
  - Tay Ninh – Stung Treng TBC
- 13) Lao PDR – Cambodia
  - Ban Hat - Kampong Sralao Existing
  - Ban Hat - Stung Treng Existing
- 14) Thailand – Cambodia (New)
  - Watthana Nakhon – Aranyaprathet – Banteay Meanchey Existing post 2020
  - Thailand – Cambodia Existing post 2020
- 15) East Sabah – North Kalimantan TBC
- 16) Singapore – Sumatra TBC
- 17) Lao PDR – Myanmar (M.Long – Shan state) 2025

- Endorsed by the 39<sup>th</sup> ASEAN Ministers on Energy Meeting (AMEM), September 2021.
- Set out the transmission infrastructure needed to support multilateral power trade in ASEAN and renewable energy integration into the ASEAN Power Grid.

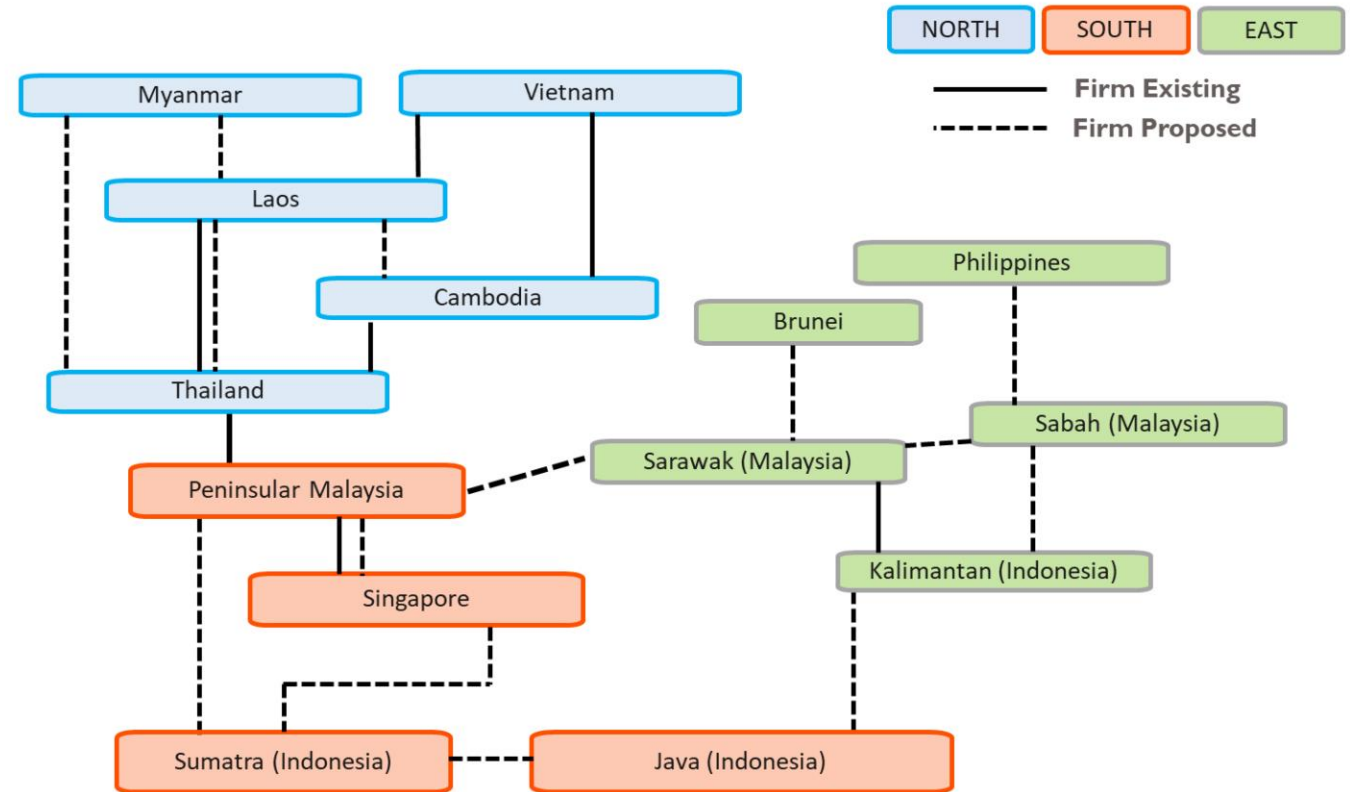


Figure 2-11: Sub-Regions as a reflection of the APG shape and their respective constituent AMS

# AIMS III – Upgrading ASEAN Power Grid for Increased Renewables

Resource Potential + Protected Areas + Urbanized Areas + Water Bodies + Terrain Features + Other Relevant Features = Technical Potential

Technical Potential				
vRE	Region/Country	Gross Capacity (GW)	Gross Annual Generation (TWh/year)	Gross Capacity Factor
Solar	ASEAN	8,119	12,004	12-23%
Wind	ASEAN	342	766	18-30%

## HAPUA STATUS UPDATE OF APG INTERCONNECTION PROJECTS (Updated in SEP 2021)

Status	MW
Existing	7,720
Ongoing (up to 2021)	555 - 625
Future	18,369 - 21,769
<b>Grand Total</b>	<b>26,644 - 30,114</b>

- P.Malaysia – Singapore
  - Plentong – Woodlands Existing 2020
  - P.Malaysia – Singapore (2<sup>nd</sup> link Plentong – Woodlands) Existing
- Thailand – P.Malaysia
  - Sadoo – Chuping Existing
  - Khlong Ngae – Gurun Existing
  - Su Ngai Kokok – Rantau Panjang TBC
  - Khlong Ngae – Gurun (2<sup>nd</sup> Phase, 300MW) TBC
- Sarawak – P. Malaysia
  - Sarawak – Sabah – Brunei TBC
- P.Malaysia – Sumatra TBC
- Batam – Singapore TBC
- Sarawak – West Kalimantan Existing
- Philippines – Sabah TBC
- Sarawak – Sabah – Brunei 2022
- Sarawak – Brunei 2021
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- Thailand – Lao PDR
  - Nakhon Phanom – Thakhek – Theun Hinboun Existing
  - Ubon Ratchathani 2 – Houay Ho Existing
  - Ris B1 2 – Suwannabhat – Nam Theun 2 Existing
  - Lidon Thani 3 – Na Bong – Nam Ngum 2 Existing
  - Nakhon Phanom 2 – Thakhek – Then Hinboun (Exp.) Existing
  - Mae Moh 3 – Nan2 – Hong Sa (3Units) Existing
  - Lidon Thani 3 – Nabong (converted to 500KV) Existing
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  - Khon Kaen 4 – Loi 2 – Xayaburi Existing
  - Thailand – Lao PDR (New) TBC
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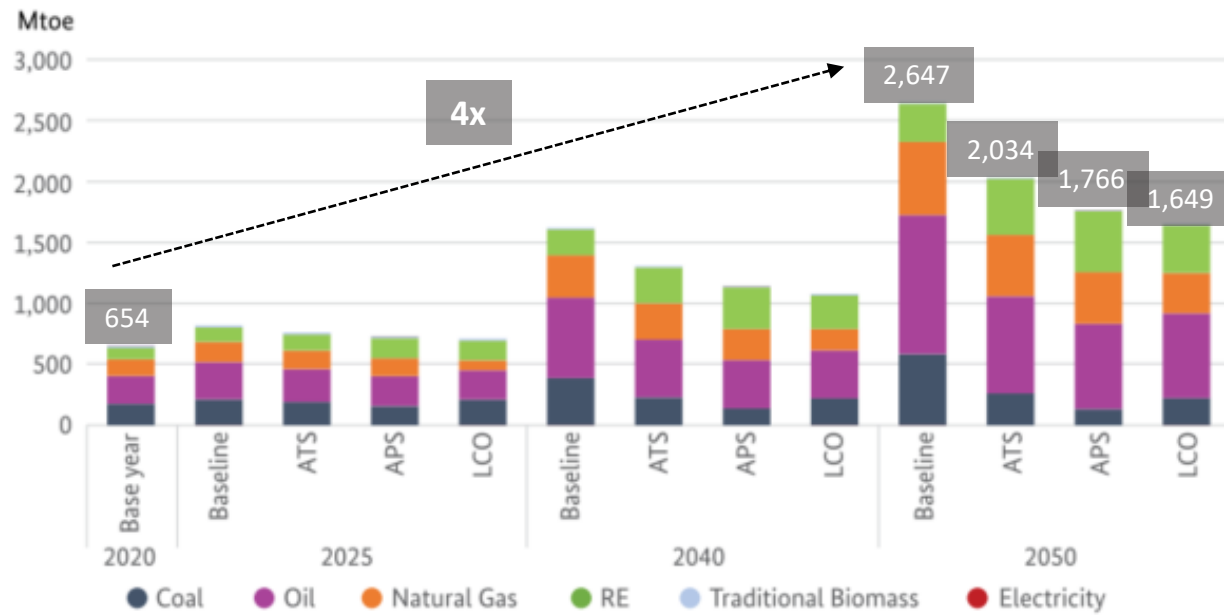
TBC stands for to be confirmed  
The Existing Projects as of September 2021  
The Priority Projects, which refer to the APAEC 2016-2020, are underlined and indicated in Red.

- AIMS III sets out the study of ASEAN Interconnection Projects – by considering the RE potential for each AMS, to achieve ASEAN aspiration RE Target in 2025 by 35% share in installed capacity
- With around 8TW and 340GW of solar and wind capacity being put into consideration, **AIMS III consolidating wind and solar into the ASEAN Interconnection Projects**



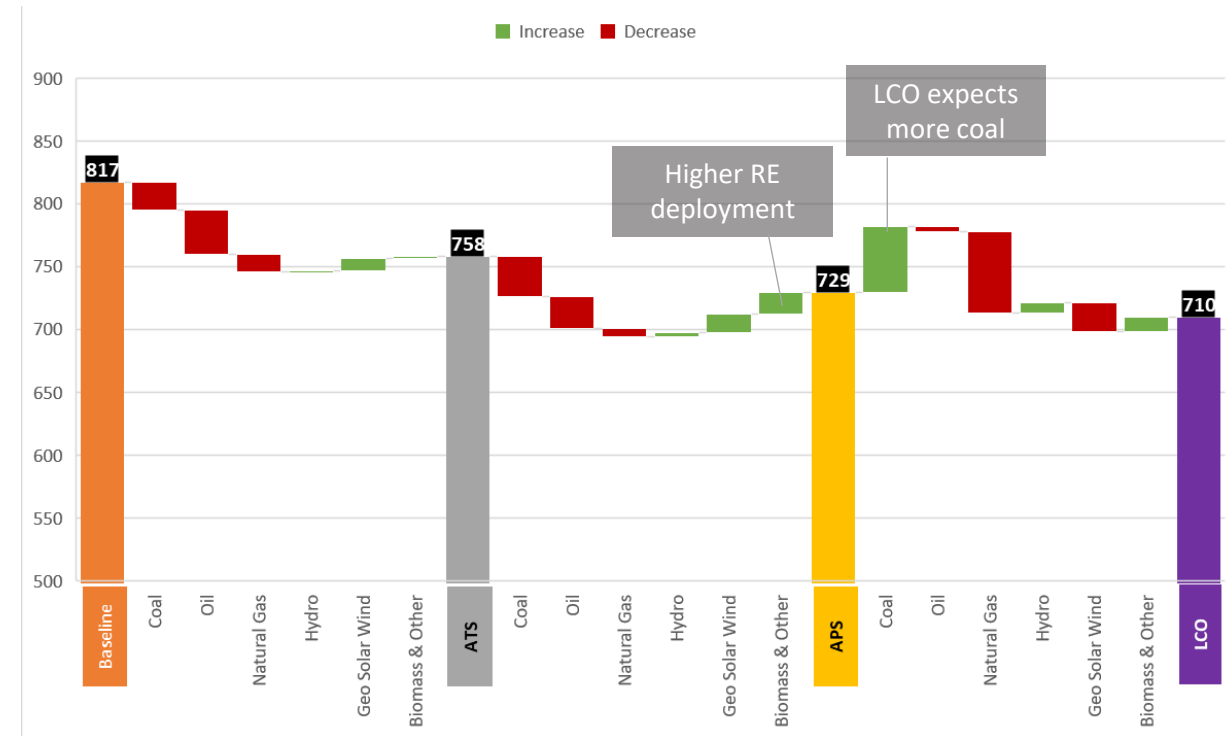
# Various pathways for ASEAN energy supply towards Energy Transition

## Energy Supply Projection by Fuel Across Scenarios



- Baseline Scenario projected a 4x of energy produced to drive economic growth from 2020 to 2050. Energy efficiency measures reduce the energy supply to 3x, 2.7x, 2.5x of 2020 level in ATS, APS, and LCO Scenario, respectively.
- In all scenarios, **fossil fuels remain the largest component.**

## ASEAN TPES Fuel Shifting in 2025 (Mtoe)

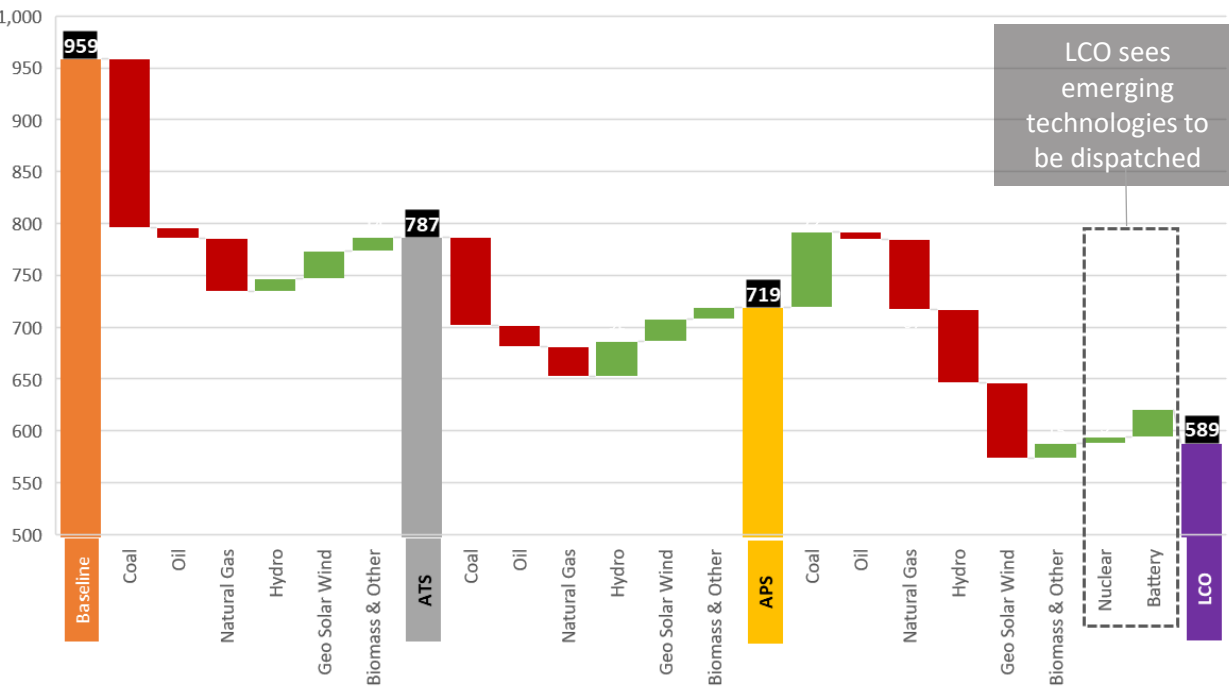


- To reach APAEC targets in 2025, **energy efficiency measures need to be coupled with increasing share of RE.**
- LCO Scenario further reduces the TPES, favoring coal and bioenergy over natural gas and solar-wind.

# The evolving electricity generation system – capacity

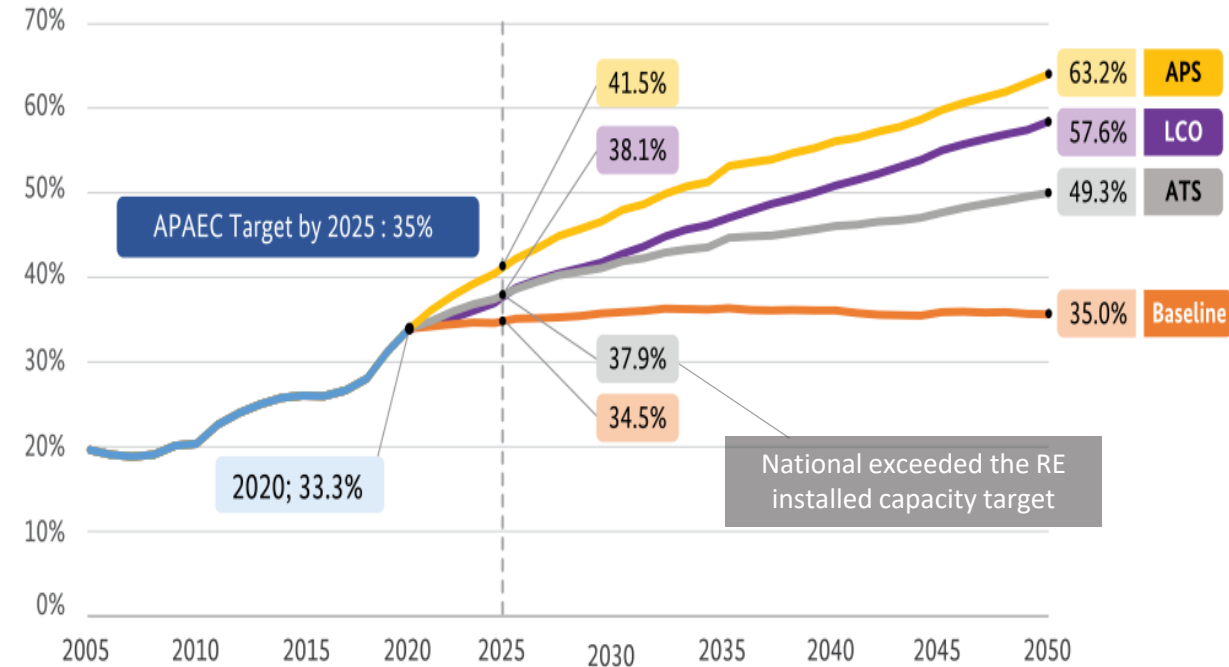
## Installed Capacity Fuel Shifting in 2050

■ Increase ■ Decrease



- ❑ As the need of installed capacity decrease due to energy efficiency, **clean energy penetrates the power system.**
- ❑ Even with the same level of electricity needed in APS, lower installed capacity is required in LCO Scenario. Coal, bioenergy, & nuclear replace natural gas, hydro, solar & wind.
- ❑ The **preference for nuclear was observed**: the high energy content of the nuclear fuel, offering lower costs for the electricity generated.

## RE Share in Installed Capacity

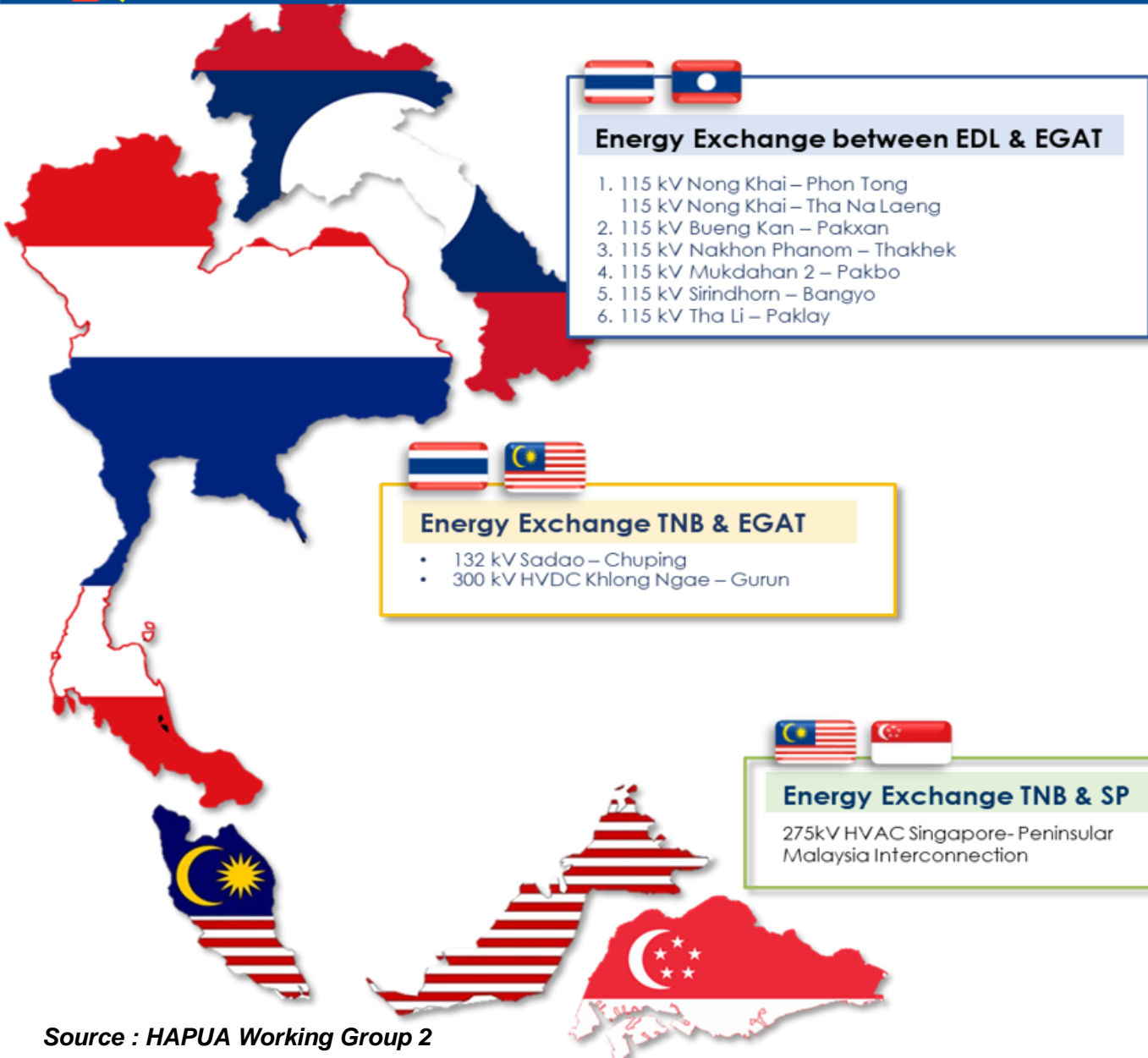


- ❑ In installed power capacity, continuing **national efforts would lead to the achievement of the regional target, 37.9% of RE.**
- ❑ In APS, 41.5% share can be achieved in 2025
- ❑ In the long term, a maximum of 63.2% RE share can be achieved in 2050. The LCO Scenario is set to maintain the regional targets.

Source : The 7th ASEAN Energy Outlook,

<https://aseanenergy.org/the-7th-asean-energy-outlook/>

# Pathfinder for MPT: LTMS Power Interconnection Project



## LTM- PIP: Phase 1



**COMPLETED**

- Power purchase amount was **up to 100 MW**, transferred through the existing interconnection system between Lao PDR – Thailand – Malaysia
- Operational period is during 2018 – 2019, **with a total of 30.2 GWh**

## LTM- PIP: Phase 2



**COMPLETED**

- Power purchase amount has been **expanded up to 300 MW**, transferred through the existing interconnection system between Lao PDR – Thailand – Malaysia
- EPWA was signed among three-parties to push the LTM PIP Phase 2 into operation on December 27, 2019
- Operational period is during January 2020 – December 2021
- **A total of 2.6 GWh**, of electricity has been traded as of Dec 2021

## LTMS- PIP



**IN PROGRESS**

- Power purchase amount is up to 100 MW, transferred through the existing interconnection system between Lao PDR – Thailand – Malaysia – Singapore
- Contract Period : 2 years (2022- 2024)
- Effective Date: 22<sup>nd</sup> June 2022
- 1<sup>st</sup> Power Flow date : 23<sup>rd</sup> June 2022
- **Total of 265.73 GWh** electricity has been traded (as of 30 April 2023)
- Singapore proposed for the next phase of LTMS-PIP to **increase the maximum power purchase capacity up to 300 MW with 5-year contract**

# LTMS-PIP Key Drivers: Strong Intergovernmental Support and Cooperation

- At the 40<sup>th</sup> AMEM on 15 September 2022, the LTMS Energy Ministers celebrated the successful commencement of the project
- There were three LTMS Ministerial Meetings convened at the annual ASEAN Ministers on Energy Meeting (AMEM). Three Joint Ministerial Statements were issued, reaffirming shared commitment to advancing multilateral cross-border power trade in ASEAN.
- In the 3<sup>rd</sup> Joint Statement of the LTMS-PIP issued on 15 September 2022, LTMS Energy Ministers welcomed further discussion on the enhancement and future plans of the LTMS-PIP to support continued multilateral power trade.



3<sup>rd</sup> LTMS Ministerial Meeting at the 40<sup>th</sup> AMEM,  
15 September 2022

# LTMS – PIP Challenges: Lesson Learned

The achievement of LTMS PIP has been praised for its key drivers of the strong intergovernmental support and cooperation.

However, some of these challenges during the completion of the project needs to be highlighted as lesson learned :

- 1. Technical Challenges:** undiversified resource, hydropower decreased in delivering generation capacity during dry season, grid codes harmonisation, and grid strengthening.
- 2. Institutional Arrangements:** tremendous efforts and understanding among different parties on wheeling charges methodology and other regulatory and commercial frameworks.
- 3. Geopolitical Challenges:** trade-off between interdependence and sovereignty, third party access and dispute resolution mechanism.



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