# ASEAN Installed Power Capacity Structure

- ❑ 75 % by fossil fuels
  - – 30 % coal
  - – 8 % oil
  - – 37 % natural gas
- ❑ In the Paris compatible scenario, fossil fuels need to be substantially reduced to 30 % by 2040
- ❑ Rich of clean energies, but not evenly distributed
- ❑ cross-border transmission is needed to make their full potential and efficient use.
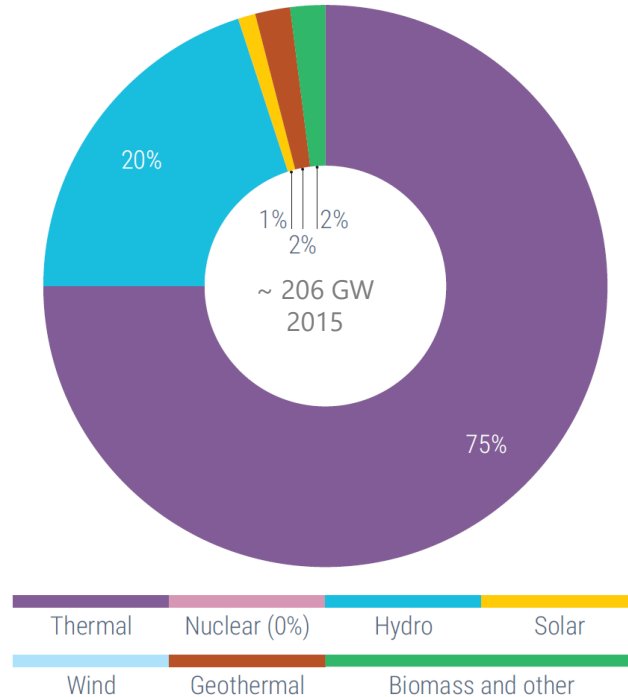
| Clean Resources in ASEAN, GW | | |
|---|---|---|
| | Biomass | 37.7 |
| | Geothermal | 33.29 |
| | Hydro | 240.97 |
| | Solar | 3.15-5.55 (kWh/m2/day) |
| | Tidal | 219.2 |
| | Wind | > 87 |



~ 206 GW
2015

20%  1%  2%  2%  75%

Thermal    Nuclear (0%)    Hydro    Solar
Wind    Geothermal    Biomass and other

*    ACE *etc,* Energy interconnection in ASEAN for sustain. and resilient societies, 2018
      H. Nishimura, SETA2020

# ASEAN Grid Interconnection Prospect in 2035



**To consider**
- ☐ Planning and financing
- ☐ Developing cross-border infrastructure
- ☐ Power trading and system operations.

China

Bangladesh

4/5 (CN→My)

0.5/1 (CN→L)

2/5 (CN→V)

Myanmar

0.5 (My↔L)

Lao PDR

5/3.5 (L→V)

Viet Nam

4/1.5 (My→T)

8/6 (L→T)

0.3 (L↔C)

0.2 (V↔C)

Thailand

0.4/-0.5 (C→T)

Cambodia

Brunei Darussalam

1/-0.5 (T→Ma)

0.4 (Ma→B)

Malaysia

3 (Sar→PM)

3 (Sab→P)

Philippines

2 (PM→S)

1.5 (Su→PM)

Singapore

2 (NK→Sab)

0.6 (In→S)

GW

**39 GW cross-border capability**

Indonesia

7 (Su→Ja)

± 800 kV DC
± 660 kV DC
± 500 kV DC
± 350 kV DC
1000 kV AC
400-500 kV AC
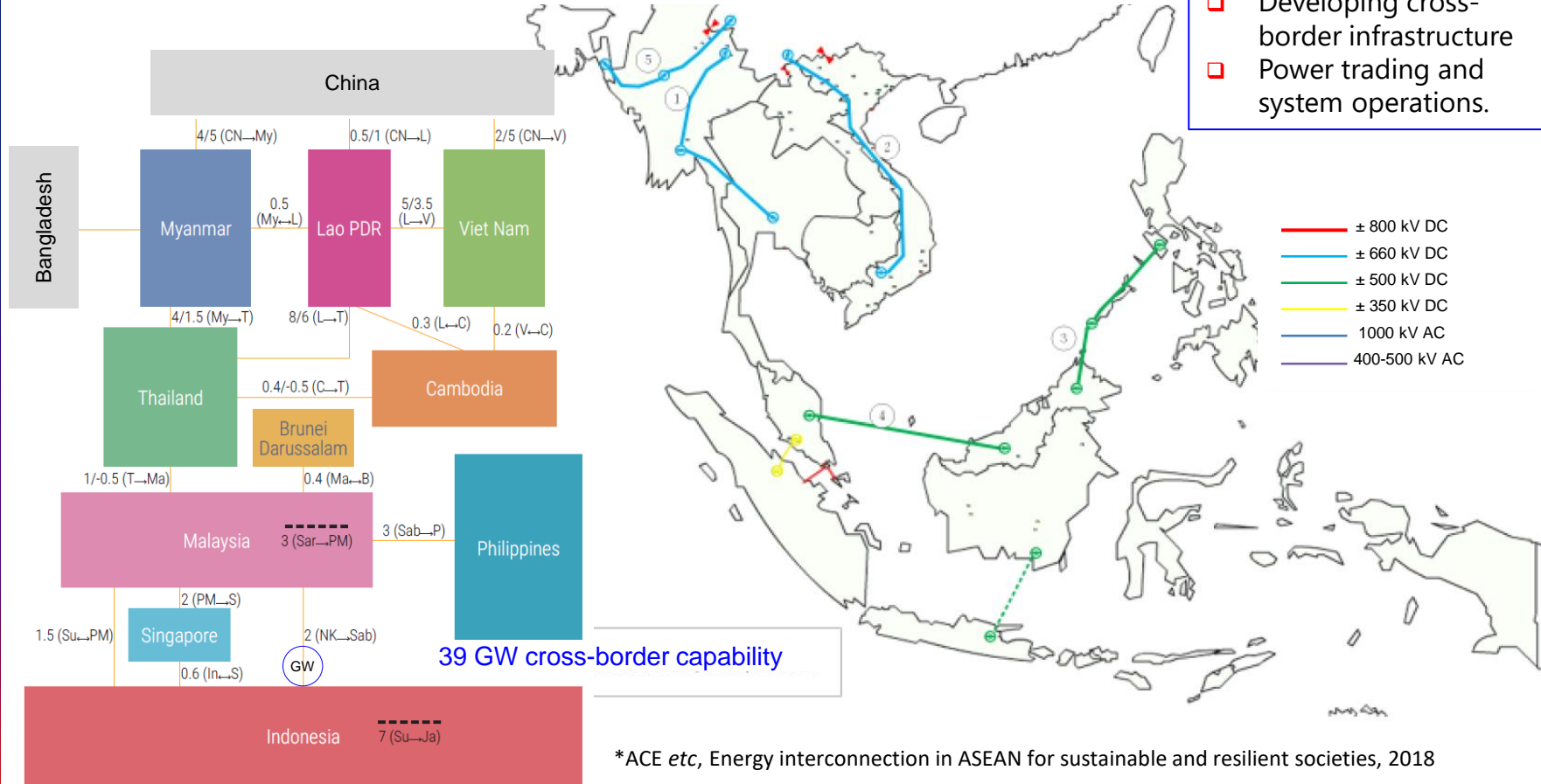
*ACE *etc*, Energy interconnection in ASEAN for sustainable and resilient societies, 2018
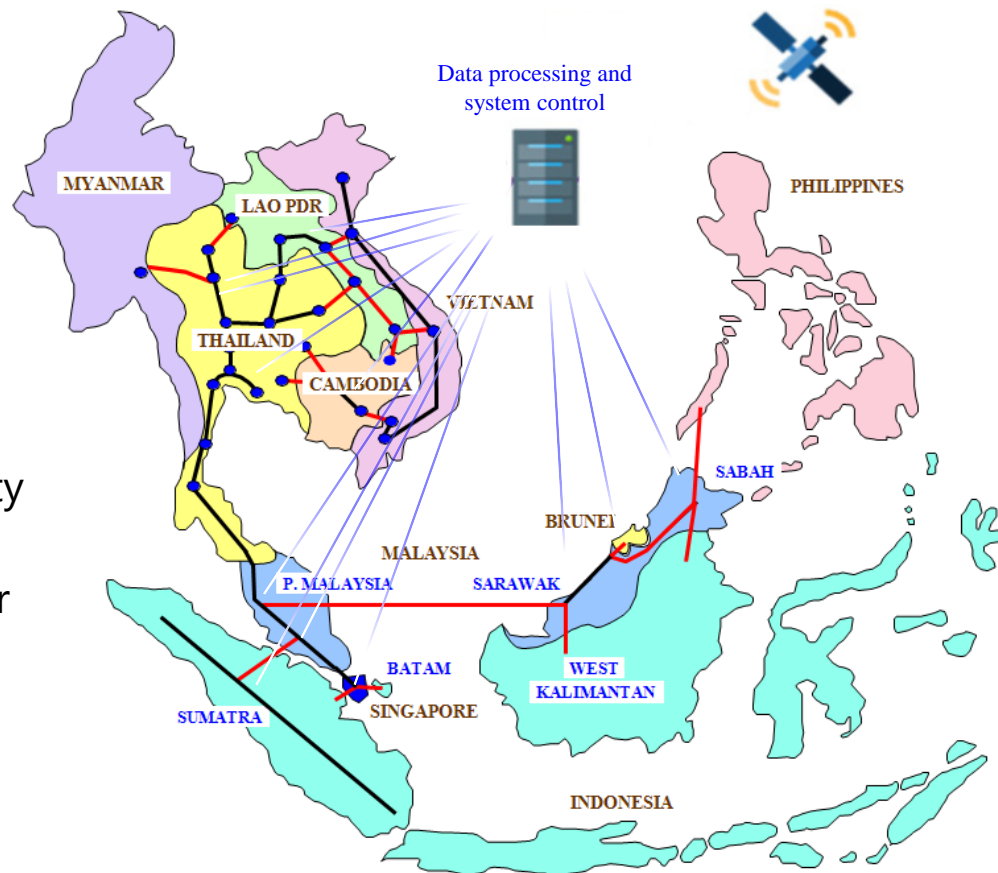
CREATING GROWTH, ENHANCING LIVES

# Technical Considerations for Resilient Cross-border Grids

❑ High–precision sensor systems, for simultaneous data acquisitions and transmission among grids

❑ Large grid simulation and analysis for comprehensive condition monitoring and predicting, and speedy switching to ensure grids resilience and prevent outages

❑ Therefore, an integrated operational platform that performs

– real-time analysis and speedy response

– system status monitoring and predictive maintenance estimates

– SI-traceable metering at all necessary nodes

❑ Regulatory framework on use and operation of interconnected grids and energy metering.

# Metrological Strategy to Ensure Grid Resilience

❑ A **metrological strategy,** combined with IOT, ICT, Big Data technologies for the observability and controllability of interconnected grids.

❑ A measurement framework for improving and using **Phasor Measurement Units** (PMU), and for maintaining their reliability and accuracy.

Data processing and system control

MYANMAR

LAO PDR

THAILAND

VIETNAM

CAMBODIA

PHILIPPINES

SABAH

BRUNEI

MALAYSIA

P. MALAYSIA

SARAWAK

BATAM

WEST KALIMANTAN

SUMATRA

SINGAPORE

INDONESIA

# Measurement Development for Data Acquisition

❑ Tools for **loss measurements** at various apparatus and locations under high voltage and current (HV, HC) for localizing disturbance so to ensure transmission efficiency and grid stability

❑ Improvements of HV and HC **measurement accurac**y for precise grid management and metering.

❑ Tools to determine **power quality** and its propagation, to assess and suppress its effects on grid stability.

❑ Methods and systems for **calibration**s and verifications

❑ …



Commissioning of a Power standard system

# Data Metrology for Data Quality in Processing and Decision Making

❑ To evaluate process and analyze data uncertainty

❑ To develop and validate algorithms & software for on-line performance assurance of sensors and their remote calibrations

❑ To establish data traceability chain & system.



Data Acquisition & Collection    Data Transmission    Data Processing    Data Analytics    Data Application



lifecycle of data

# THANK YOU

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