

## Session 4

# “THE ROLE OF LONG-DISTANCE TRANSMISSION AND CROSS-BORDER ELECTRICITY FLOWS IN MID-CENTURY DECARBONIZATION”

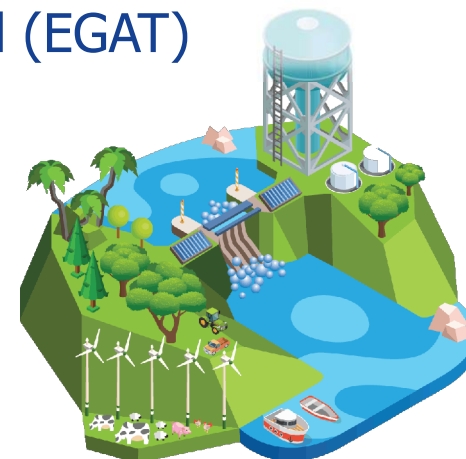
## Thailand Transmission Planning Perspective

**Mr. Tawatchai Sumranwanich**

Director, Generation and Transmission System Planning Division  
Electricity Generating Authority of Thailand (EGAT)



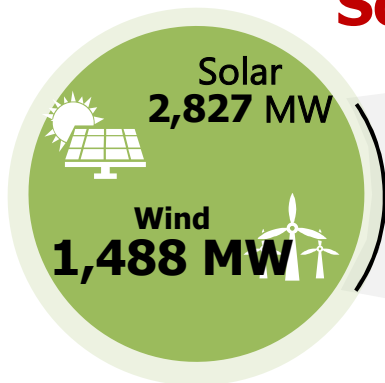
**October 18, 2019**



# Renewable Energy Target in Thailand

**CO<sub>2</sub> Emission  
from electricity generation  
0.395 kgCO<sub>2</sub>/kWh**

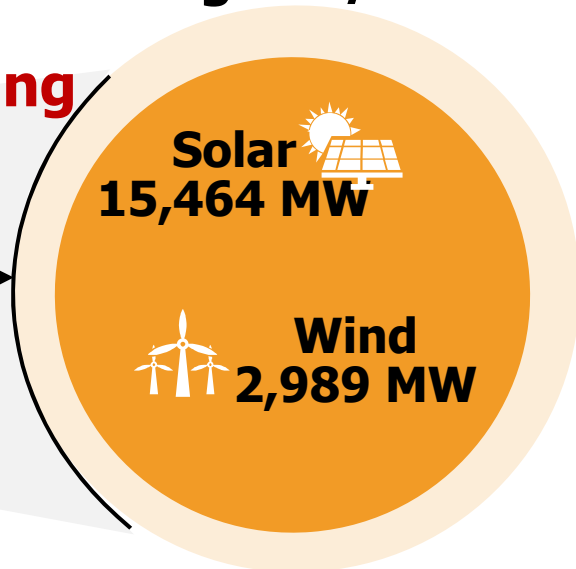
**CO<sub>2</sub> Emission  
from electricity generation  
0.283 kgCO<sub>2</sub>/kWh**



**Y2019**

**Solar and wind are booming  
according to PDP2018**

More than quadruple amount



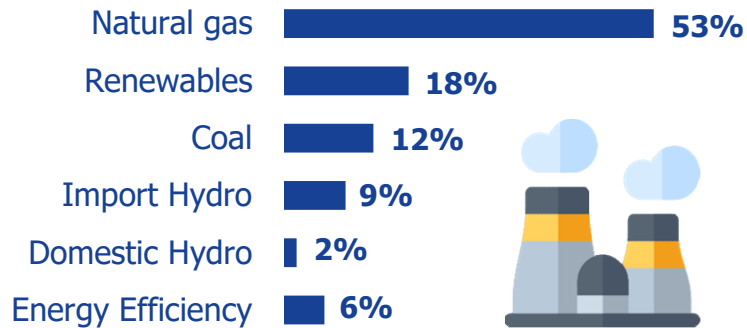
**Y2037**

**Thailand is moving to Low Carbon Society**

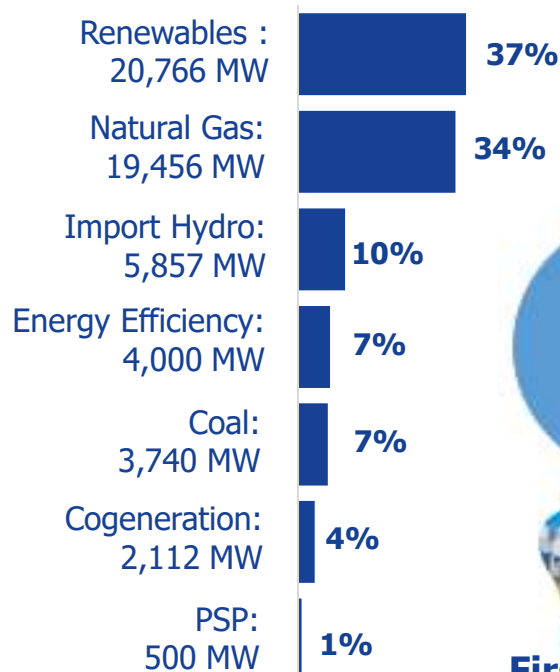


# Fuel Mix in Thailand

## Fuel Mix in 2037



## New generating capacity



## Renewable Energy

"RE energy increases from 8% in 2018 to 29 % in 2037"



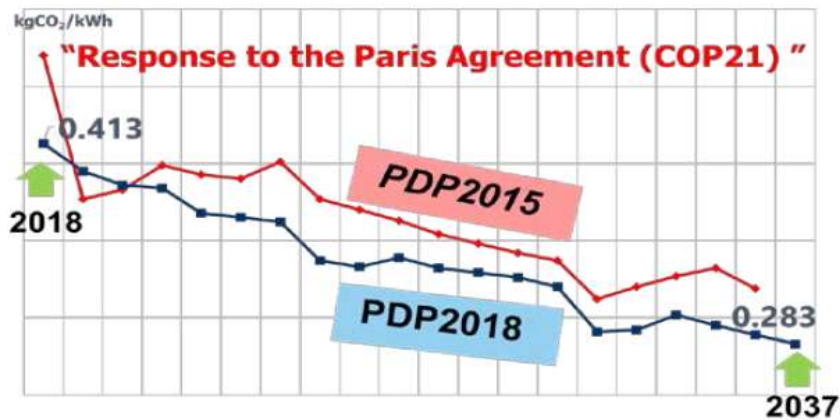
First Generation



Second Generation

## Low Carbon Target

- Reduce to **0.283** kgCO<sub>2</sub>/kWh per year



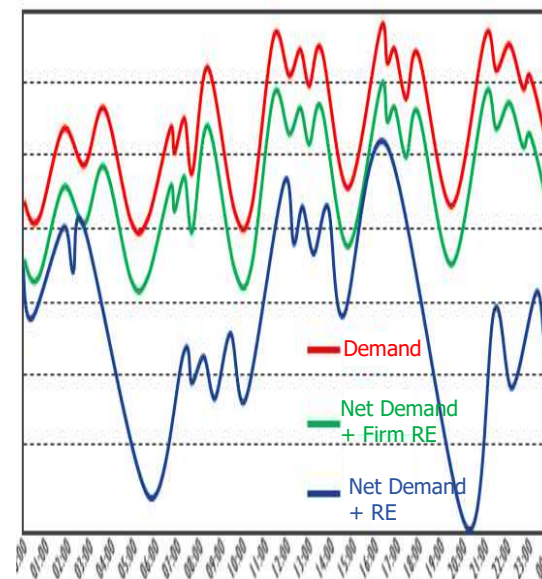
# Power System Flexibility



Small volume of RE (Green line), RE fluctuation can be neglected when compare to the load fluctuation

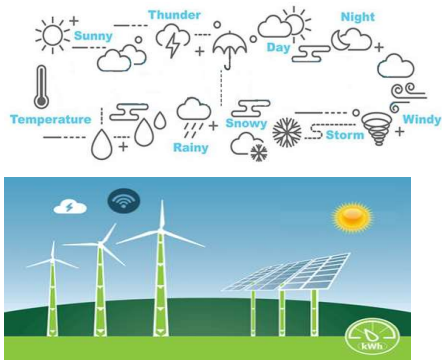


Higher sharing of RE (Blue line), RE fluctuation have to be compensated by **Flexibility Power System**

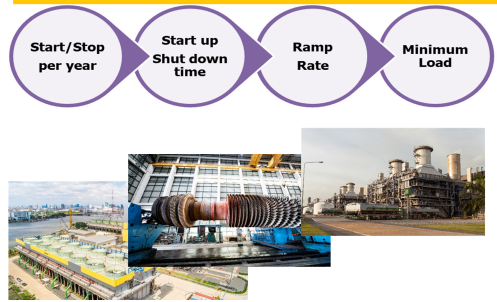


# How to integrate Renewables : Grid Modernization

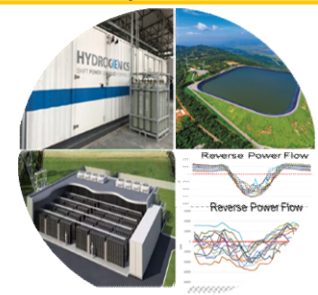
**4 RE Forecast Center**  
Facilitating RE to reduce congestion and reduce cost of electricity generation



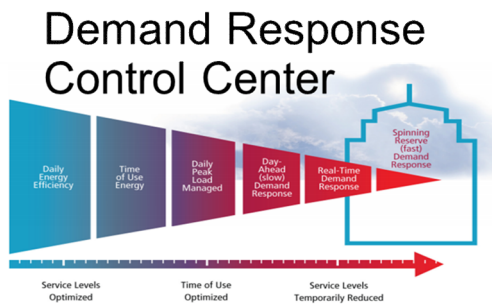
**1 Flexible Plant**  
Flexible power plant to accommodate variability of VRE



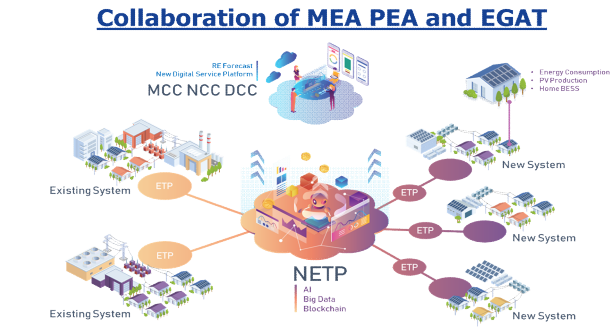
**2 Energy Storage**  
Managing peak loads, regulating voltage and frequency and creating a more flexible transmission system



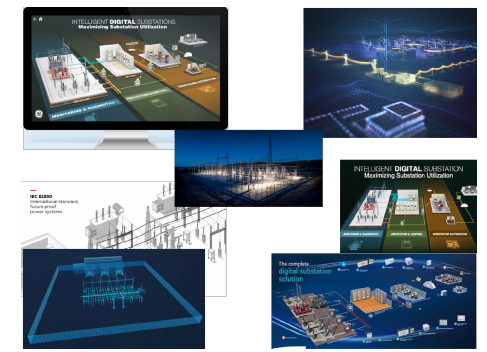
**6 Demand Response Control Center**  
Altering electricity demand in response to grid conditions or market prices



**5 National Energy Trading Platform**  
Improving grid balancing in short term and grid planning in long term by using Big Data Analytics



**3 Digital Substation**  
enabling use of transmission assets closer to its physical limits



# EGAT Floating Solar with Hybrid Hydro – Firm Capacity

## Integrated Renewable Firm Power System

Potential of EGAT's Multipurpose Dam

**9 Dams**

Potential of Water Surface Area

**28 km<sup>2</sup>**

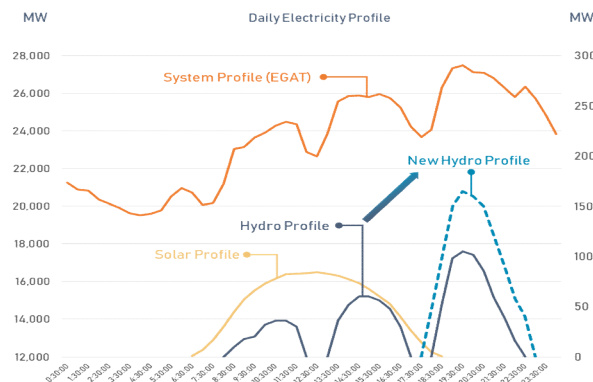
Potential of Floating Solar Power Plant

**2,725 MW**



**1<sup>st</sup> Development Project**  
 Contracted Capacity **45 MW**  
 Water Surface Area **0.72 sq.km.**  
 Capacity Factor **18.74 %**  
 Commercial Operation Date **2020**

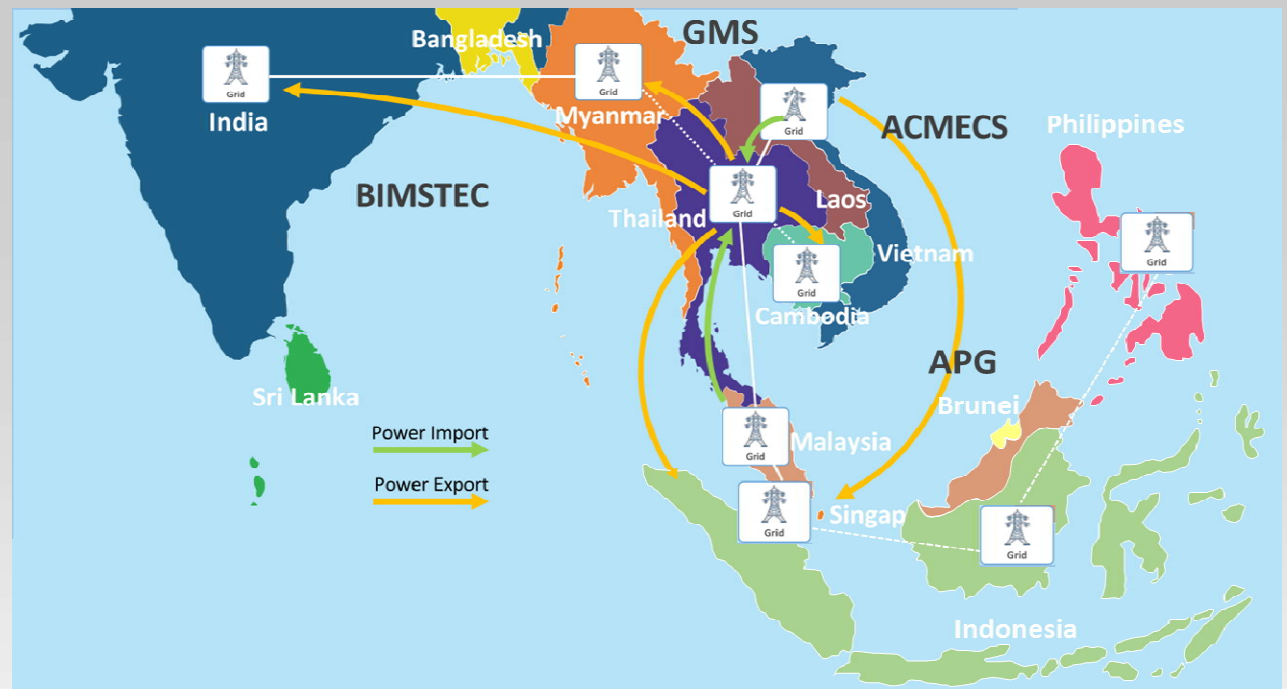
**2<sup>nd</sup> Development Project**  
 Contracted Capacity **24 MW**  
 Water Surface Area **0.04 sq.km.**  
 Capacity Factor **18.59%**  
 Commercial Operation Date **2023**



# How to integrate Renewables : Grid Connectivity

## Benefits

- Energy Security
- Energy Access
- Energy Resource Sharing
- Investment Cost Saving
- Integration of RE
- Long-term Decarbonization



## Power Trade Development

← Y1968 ————— Y2018 —————→

### Bilateral

1

#### Unidirectional Power Trade

- 3,577.6 MW

#### Grid to Grid

- EGAT-TNB (HVDC) : 300 MW
- EGAT-EDL : Nam Ngum 1-Xeset

### Multilateral

2

#### LTM-PIP

Energy Purchase and Wheeling Agreement (EPWA)

- Phase 1 : 100 MW
- Phase 2 : 300 MW

### Regional

3

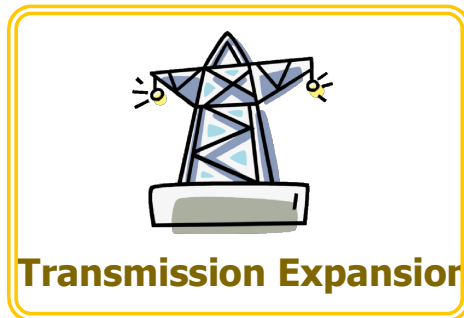
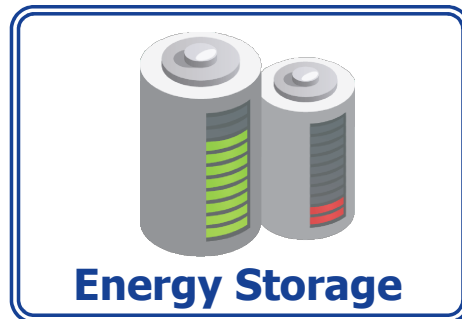
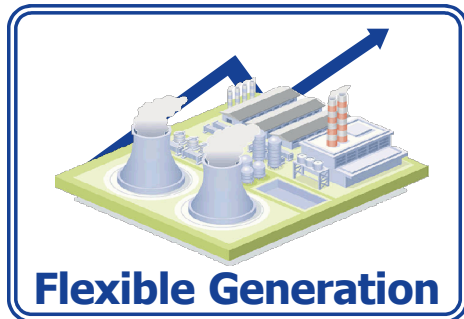
#### Sub-Regional & Regional Trading

- ACMECS
- GMS
- APG

#### Cross-Regional Trading

- BIMSTEC

# Power System Flexibility - Thailand

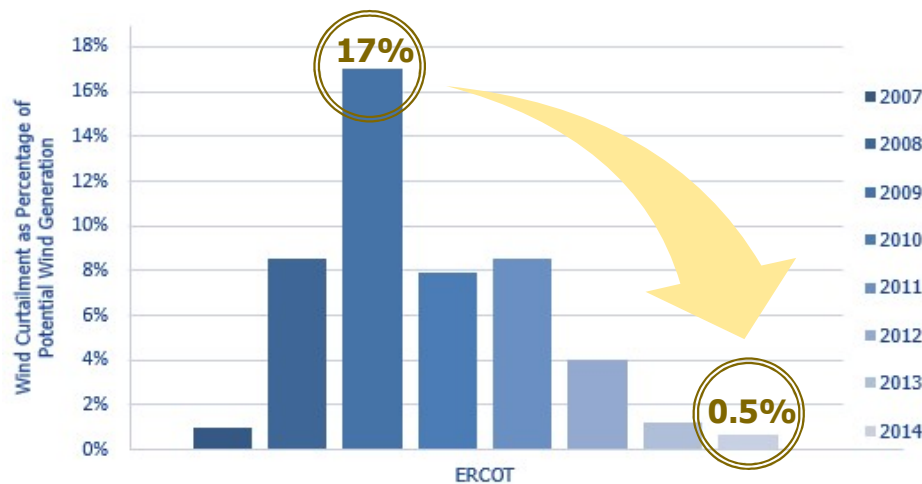


**Power System Flexibility**

- Flexibility Generation
- Energy Storage
- Transmission Expansion/Grid Reinforcement
- Demand Response

Considering to the wind power curtailment ratio within ERCOT<sup>1)</sup> the curtailment decrease from 17% in 2009 to 0.5% in 2014 due to Grid Enhancement.

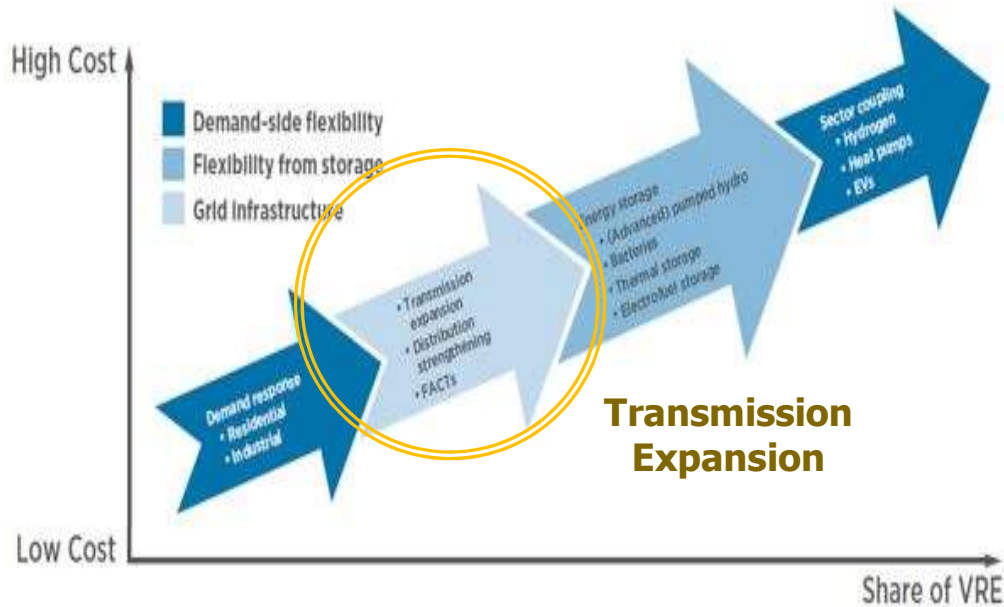
**Transmission expansion** is one of Power System Flexibility measure to be considered.



1) Wind and Solar Energy Curtailment: Experience and Practices in the United States, NREL



# Transmission Expansion/Grid Reinforcement



## Penetration of RE

- Renewable Resource not purely distributed
- RE fluctuation with weather condition
- More RE requires more Power System Flexibility which Transmission Expansion/ Grid Reinforcement is one of solutions
- Long-term transmission planning is to maintain system reliability and security
- Challenging of Time line Scale between RE Development (1-3 years) versus Transmission Development (5-7 years)

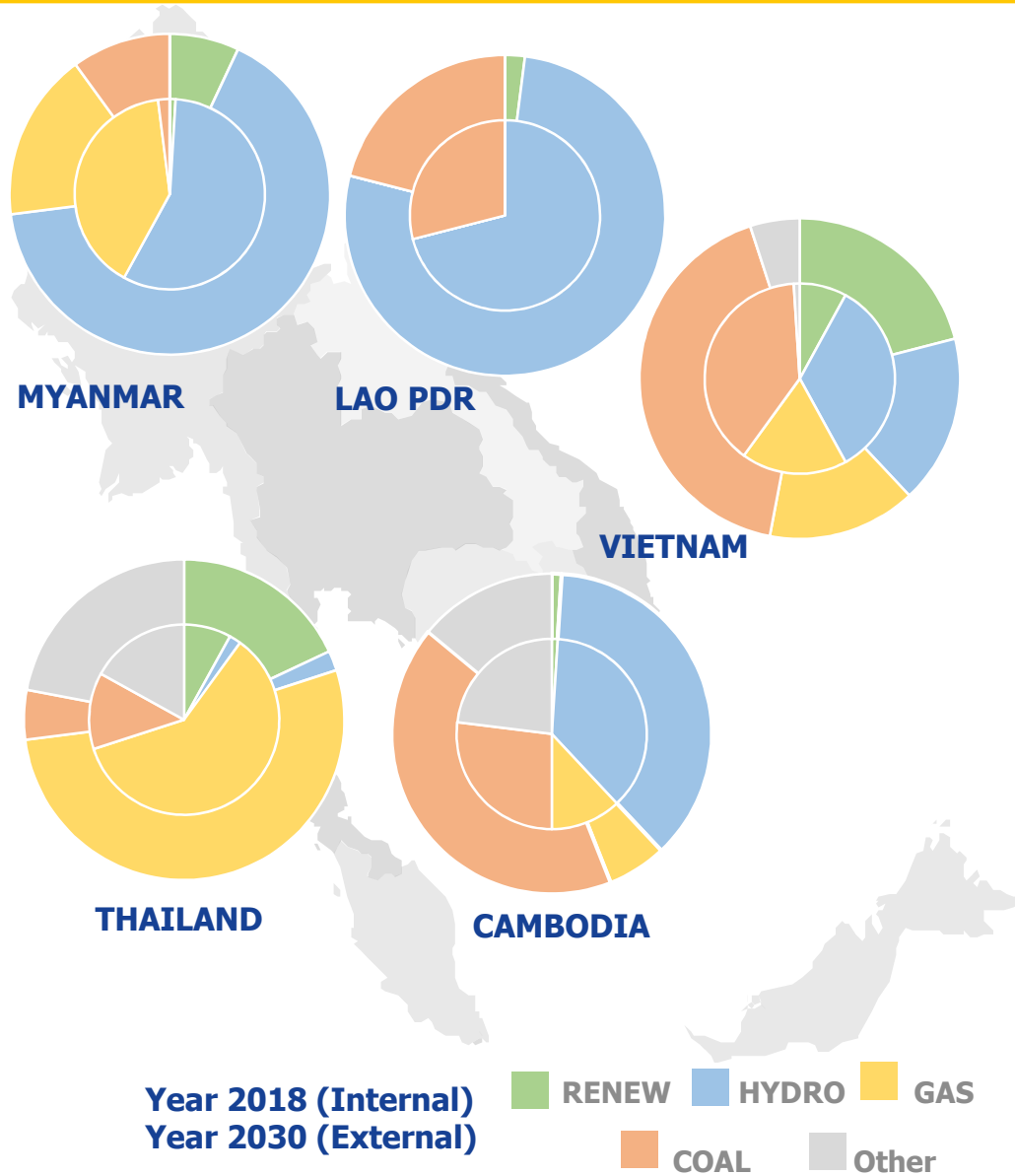


2-3 year



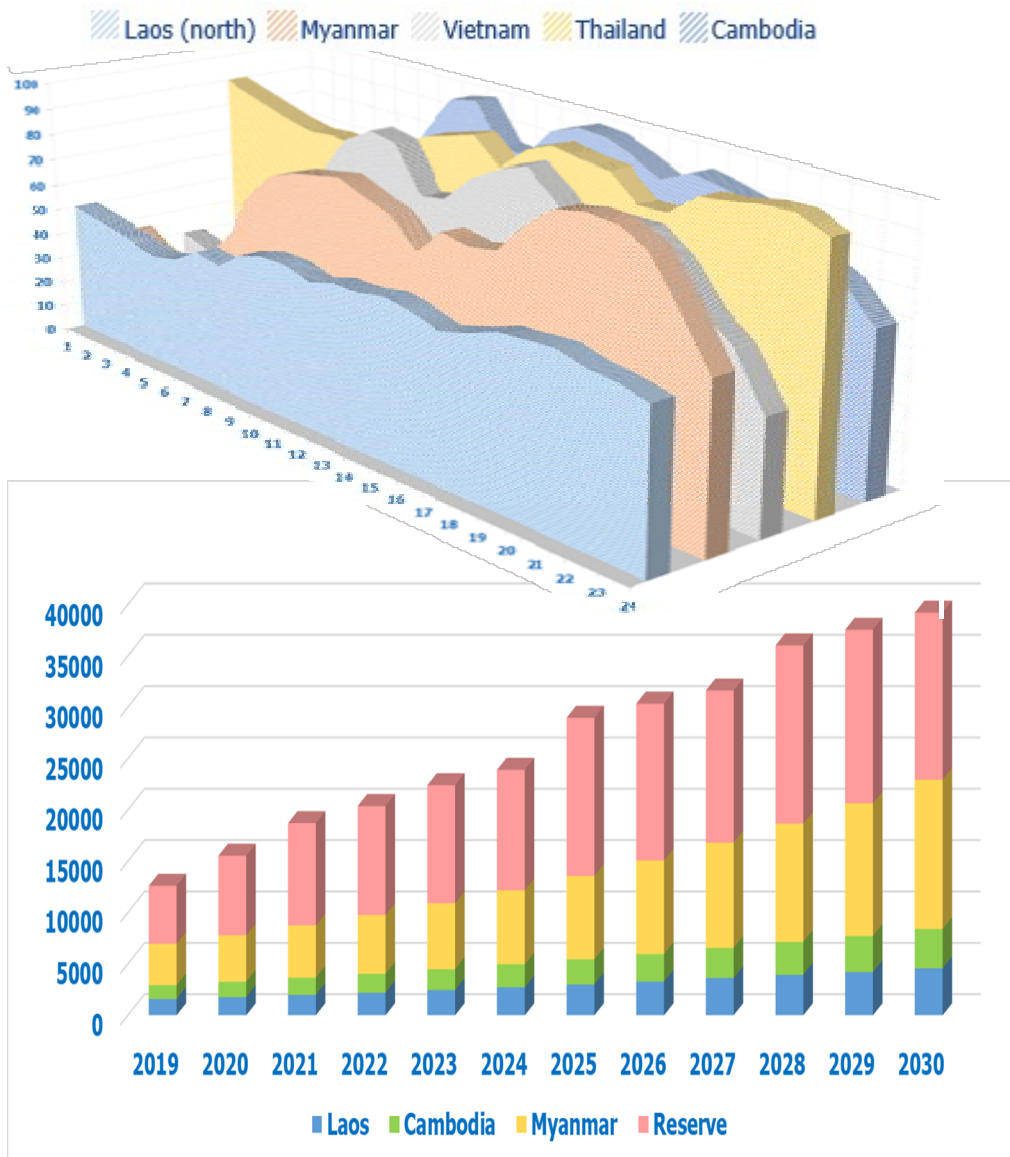
5-7 year

# Renewable Energy in ASEAN



## ASEAN RE Plan

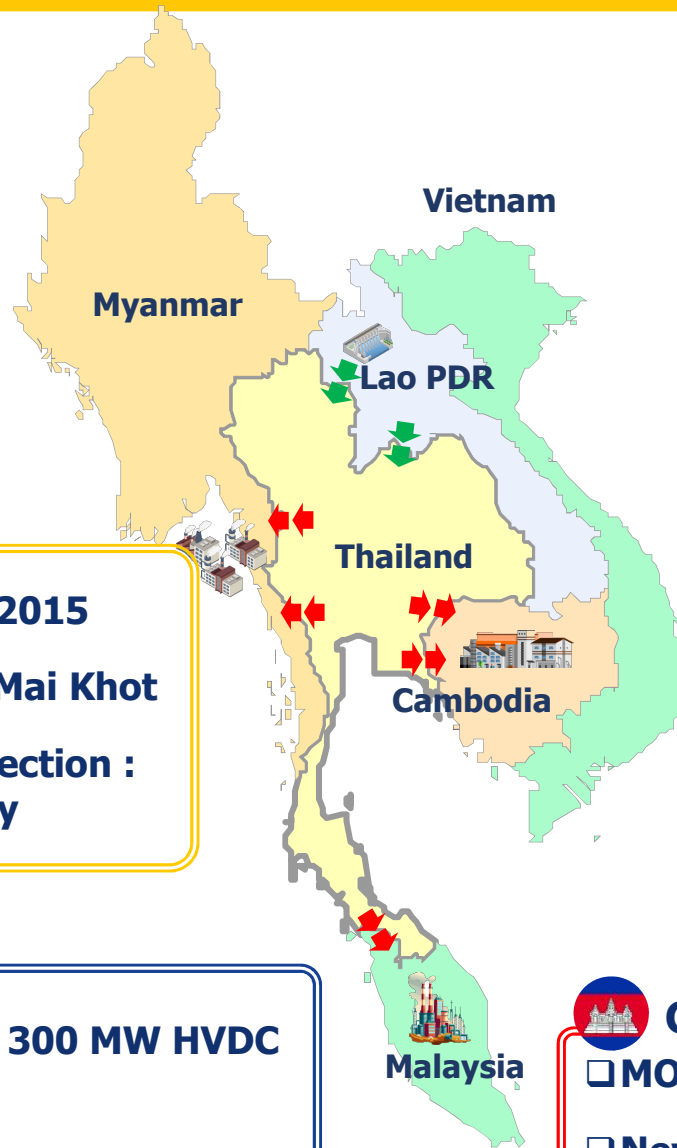
- Increasing portion of RE in each ASEAN National Plan
- Dependable and Uncertainty of Renewable
- Regional transmission to compensate Uncertainty of Renewable



## Interconnections

- Lowering RE curtailment during off - peak load
- Decreasing investment in reserve energy by sharing reserve margin for peaking time
- Sharing Reserve Margin via interconnection network

# Thailand Interconnection



## Lao PDR

MOU, Sep 6, 2016 : 9,000 MW

### Project Name

Theun Hin Boon 214 MW

Huay Ho 126 MW

Nam Theun 2 948 MW

Nam Ngum 2 597 MW

Hongsai 1,473 MW

Xepian Xenamnoy 354 MW

Nam Ngiep 269 MW

Xayaburi 1,220 MW

Interconnection : 5 Grid to Grid interconnection point

## Myanmar

New MOU, June 15, 2015

Potential Project : Mai Khot

Potential Interconnection : Mae Sot - Myawaddy

## Malaysia

MOU, May 6, 2004 : 300 MW HVDC

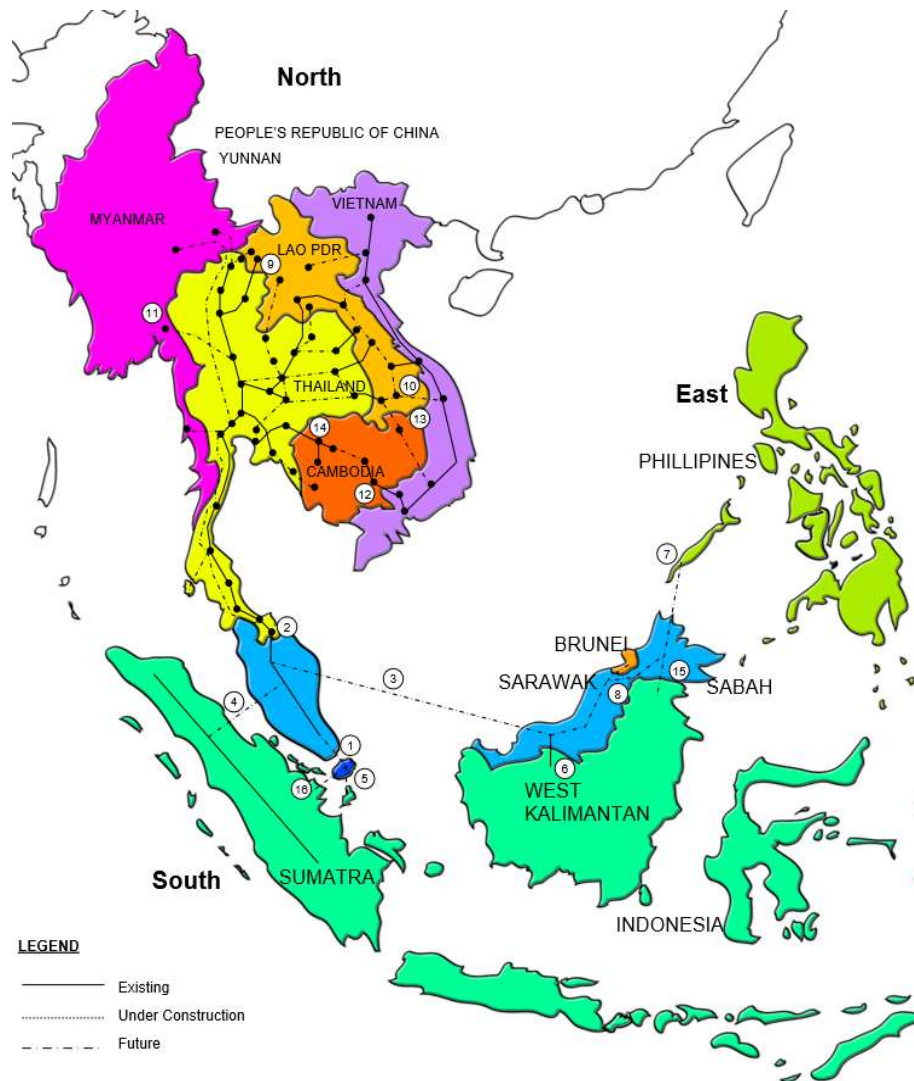
New LTM-PIP

## Cambodia





MOU, Feb 3, 2000

New Cooperation power system study

# ASEAN Interconnection Master Plan



## Findings

-  **16 proposed interconnection projects**
-  **20,000 MW of cross-border power purchase**
-  **3,000 MW of economic exchange**
-  **A net saving of 788 MUSD**

# Transmission Planning for Interconnection

## Integration of Renewable

Promote the use of clean energy in region

## Investment Cost Saving

lower reserve margin

## Enhancing Security

reliability of regional power system by integration of RE



## Strengthening Power Cooperation

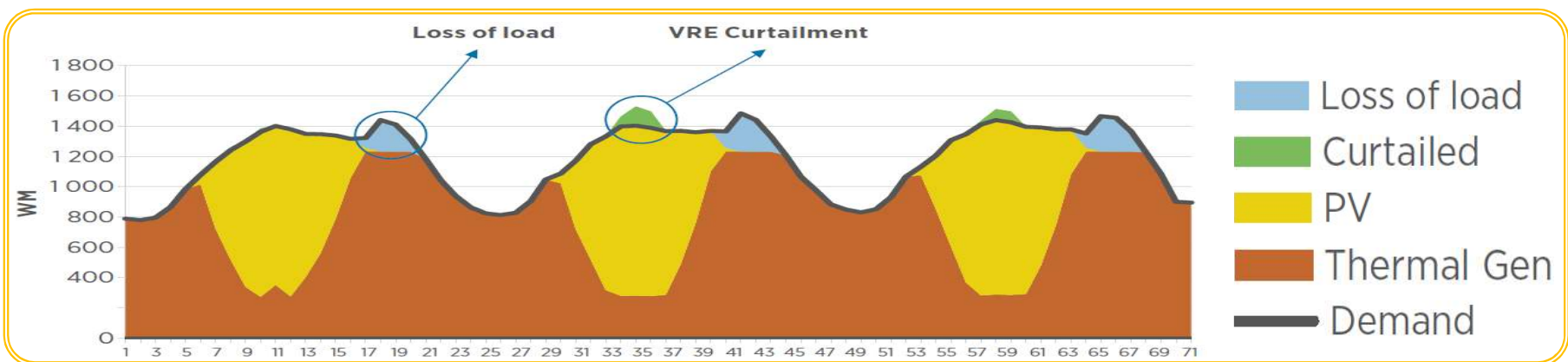
among ASEAN member countries

## Resource Sharing

Increase the utilization of resource efficiency

## Long term Decarbonization

Lower the emission level by utilize renewable





# EGAT

*"Power For Thai Happiness"*