



# Renewable energy integration in SEA: Challenges and solutions to grid system

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TEAM 6

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# Challenges

## 1. Grid expansion

RE projects are location specific (i.e., weather and natural conditions) which may be far from grid center

## 2. Grid overload

Local grid system does not have enough capacity to dispatch renewable energy

## 3. Curtailment

Power output may be deliberately reduced, to balance energy supply and demand or due to transmission constraints

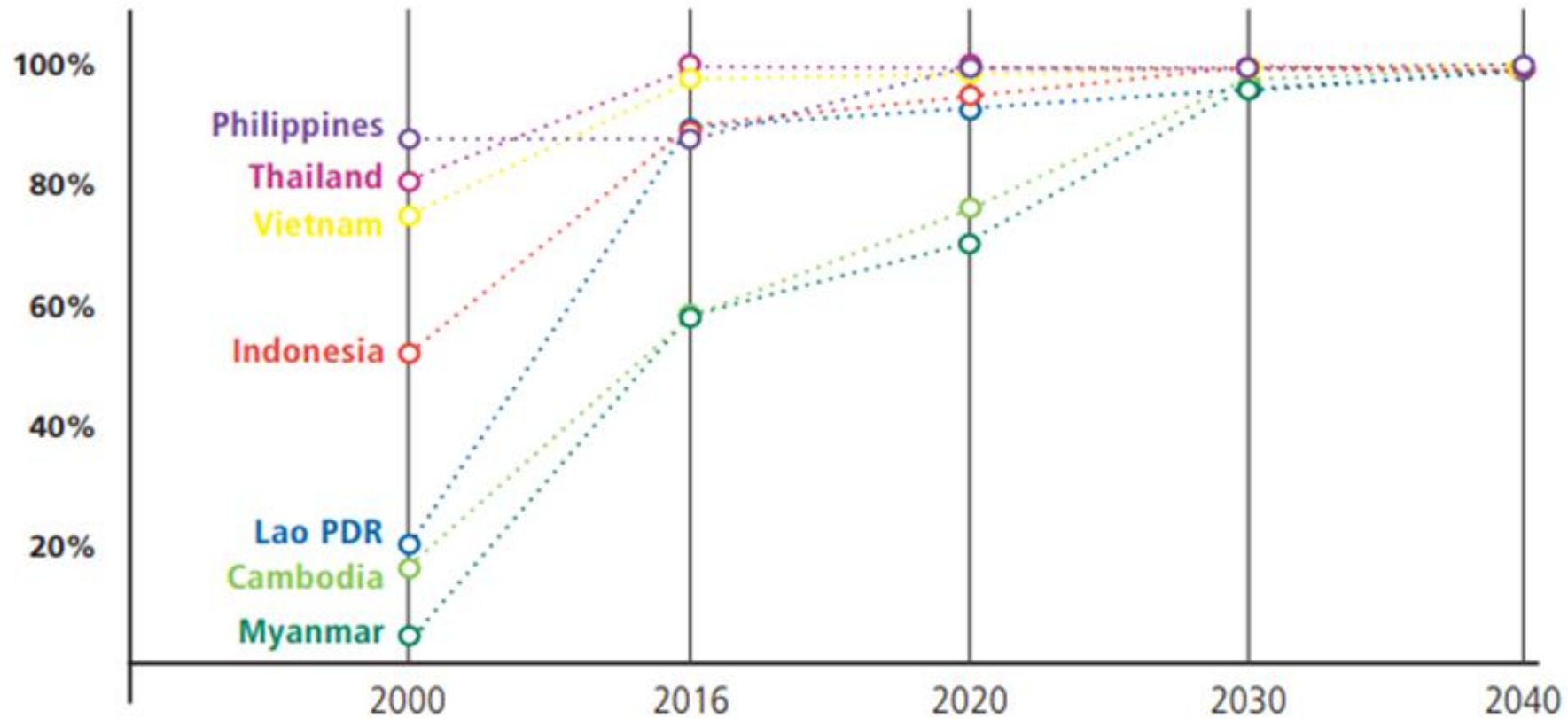
## 4. Technical issue

Voltage and frequency issues, which can damage equipment or even localize outages



# Challenges

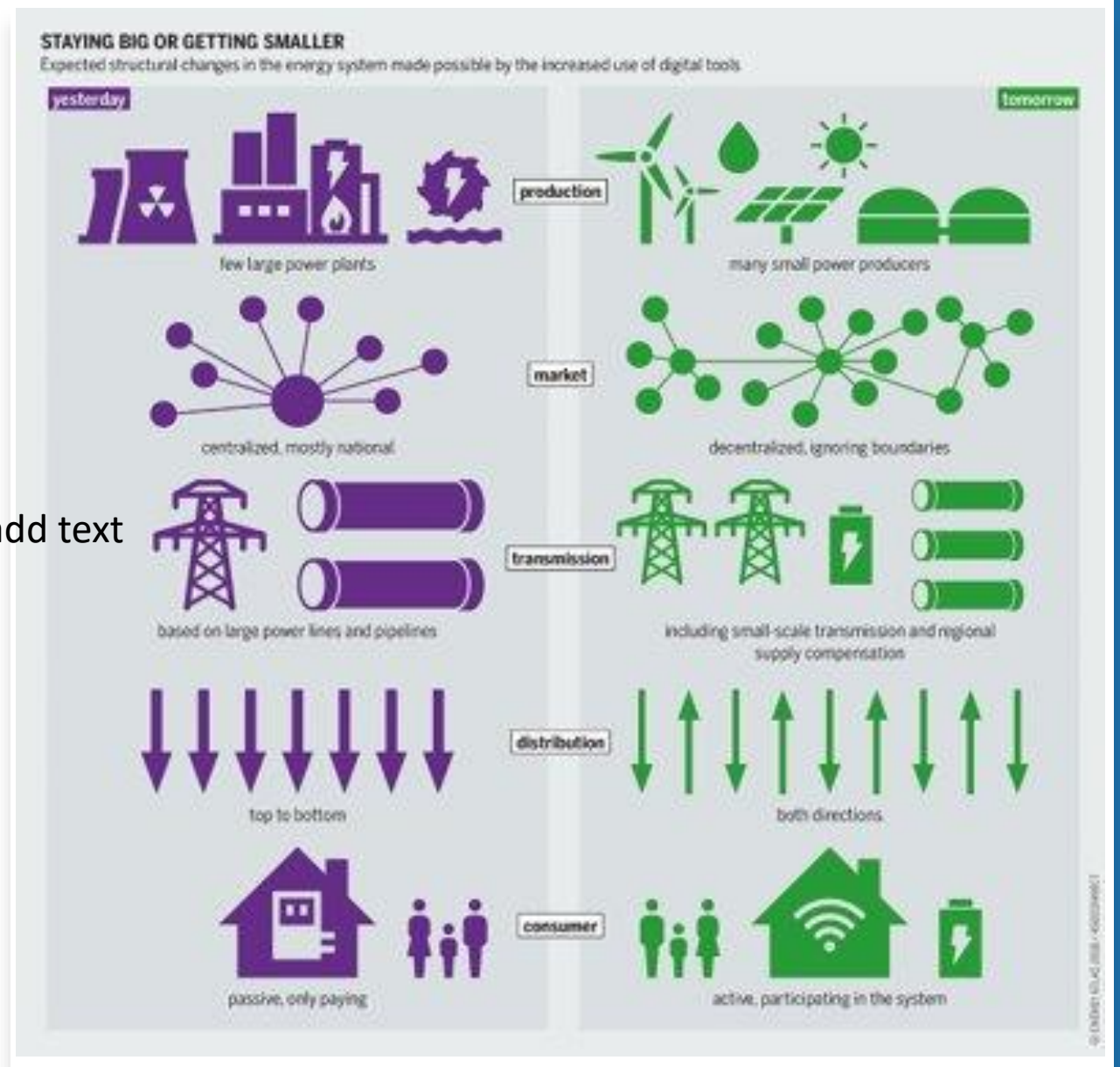
- Electricity Access Rates in Southeast Asia (Historic and Forecasted in IEA's Scenarios)




# SOLUTIONS:

- Better facilitate the connection and operation of generators of all sizes and technologies.
- Allow consumers to play a part in optimising the operation of the system.
- Provide consumers with greater information and options for how they use their supply.
- Significantly reduce the environmental impact of the whole electricity supply system.
- Maintain or even improve the existing high levels of system reliability, quality and security of supply.
- Maintain and improve the existing services efficiently.

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# Case study (1) - Malaysia

A nighttime aerial photograph of Kuala Lumpur, Malaysia, featuring the illuminated Petronas Twin Towers as the central focus. The city's skyline is filled with various skyscrapers and buildings, their lights reflecting against the dark sky. In the foreground, there is a large, dark green park area with a winding path and a small, illuminated fountain or water feature. The overall scene captures the vibrant urban atmosphere of the city at night.

# Malaysia has a 31% renewable capacity target by 2025 (including large hydro), which is supported by various policies & schemes

## Malaysia renewable summary

### Current situation



Renewable installed capacity of **2.4 GW** (7% of installed capacity)



Abundance of solar resources but limited opportunity for other technologies



Solar growth has been robust, supported by feed-in-tariffs, tenders, and net metering



Progressive evolution of renewable incentive schemes; limited policy uncertainty

### Renewable targets and forecast



In 2021, the Malaysian government increased the renewable capacity target **from 20% to 31% by 2025**



However, new definition of renewables includes large hydropower capacity, as a result, the renewable target (excluding hydro) has **declined from 7.8 to 5.8 GW by 2025**.



Renewable penetration is forecasted to reach **47% by 2050**



Solar PV will account for more than **90%** of total renewable addition in Malaysia by 2025 (excluding hydro)

### Policies and support schemes



#### Solar leasing scheme

Rooftop solar system installed with no upfront cost; payment for installation through adjustment in monthly electricity bill



#### Net metering

Pricing for net-metering set at retail tariff level



#### Tendering capacity

Fourth LSSPV tender conducted, doubling tendered capacity to 1 GW

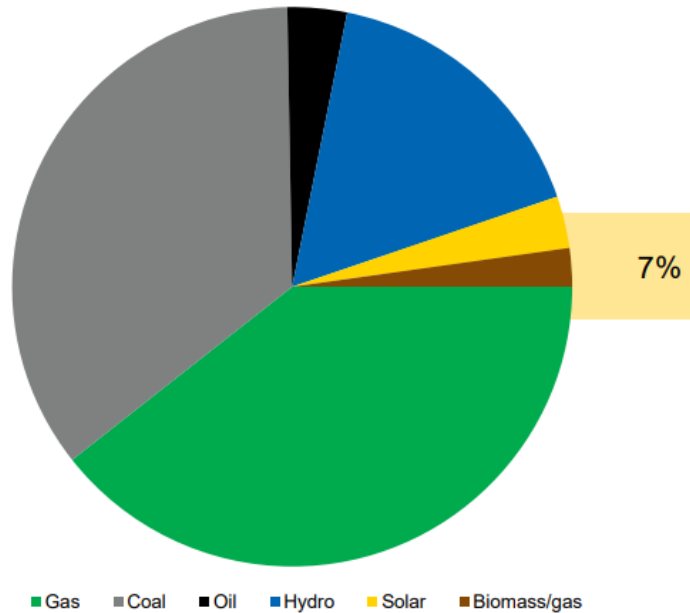


#### MySuria Program

Generating extra income for poor households through rooftop solar

# Renewables have grown considerably in recent years, but challenges of transmission, policy and cost remain

Renewables in Malaysia has reached 7% currently, supported by pricing incentives and tenders



- Large-scale solar PV tenders have been utilized by the government since 2016 and has been conducted periodically to achieve the renewable target.
- As the participation rate for the tenders have been positive, tenders for small hydro and biogas have been introduced as well.
- Feed-in tariffs (FITs) for solar were introduced in 2011. However, since 2017 solar FITs became applicable only for projects up to 1 MW.

However, challenges to the grid, slow pace of policy change and prohibitive cost create challenges for widespread adoption

## Transmission and integration



- Cap on maximum project size for solar PV per grid connection point, limiting project efficiency at scale
- Connection to transmission network at 132 kV or lower, because the solar energy generated is meant only for local consumption
- Renewable capacity at each connection point is capped at 85% of the local load at the point of connection

## Policy and cost



- Delays in Malaysia Electricity Supply Industry 2.0, which is meant to liberalize the market
- Green Technology Financing Scheme is capped at \$24 million per solar power developer
- Feed-in tariffs (FITs) no longer extended to projects above 1 MW.

# Malaysia's MySuria program disburses welfare funds to the poorest households through distributed small-scale solar

- The MySuria program was announced in the 2017 budget and was meant to boost the income of the lowest 40% of households in Malaysia through solar energy sales.
- The scheme is funded through the Green Technology Finance Scheme 2 (GTFS-2), which extends until 2022.
- MySuria capacity does not count toward the net-metering scheme capacity cap.
- System sizes are limited to 3 kW with a target of installing solar panels in 1,620 homes by August 2018—which amounts to a rough target of roughly 5 MW of capacity.
- So far, only 1 MW worth of projects across around 300 households have received approval from the Sustainable Energy Development Authority (SEDA). This leaves nearly 80% of the capacity under the scheme still available.
- A renewable energy power purchase agreement (REPPA) valid for 10 years will be entered into with either TNB or Sabah Electricity Sdn. Bhd. (SESB), and power generated sold at a predetermined price. SEDA estimates that a household can earn around 250 ringgit per month (or \$62/month) from selling back electricity to the grid.
- MySuria is an innovative program to boost renewables penetration in the low income demographic of the country, which otherwise has a low probability of adopting solar due to the prohibitive up-front cost.



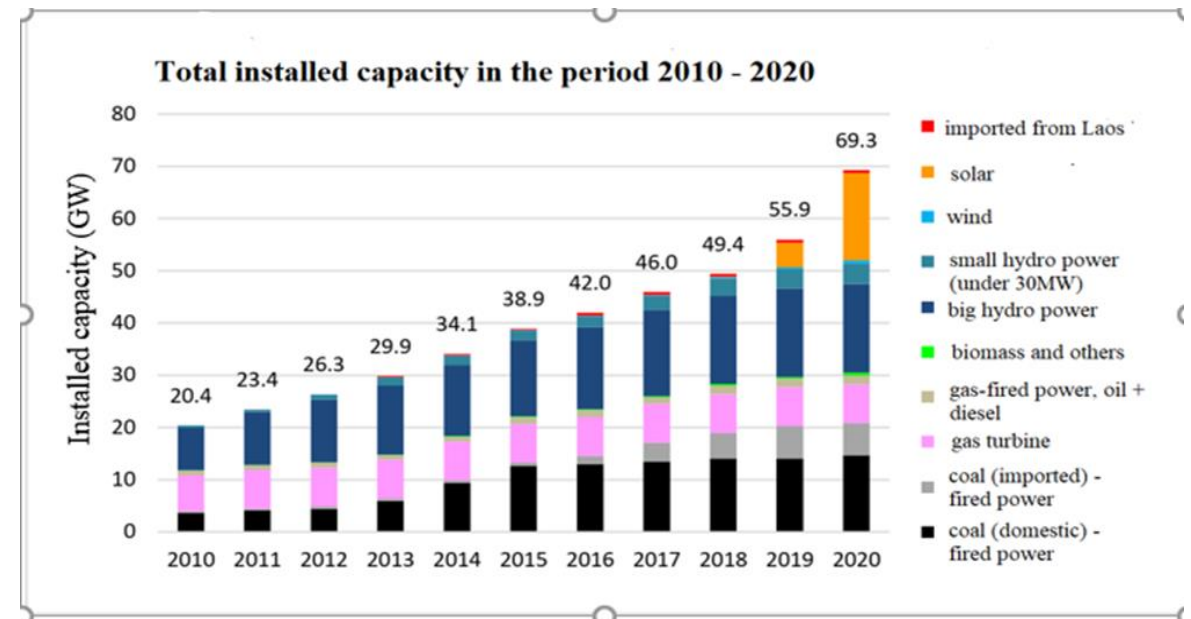
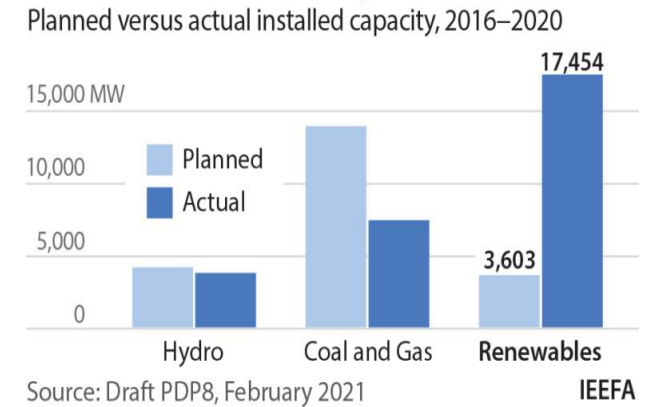
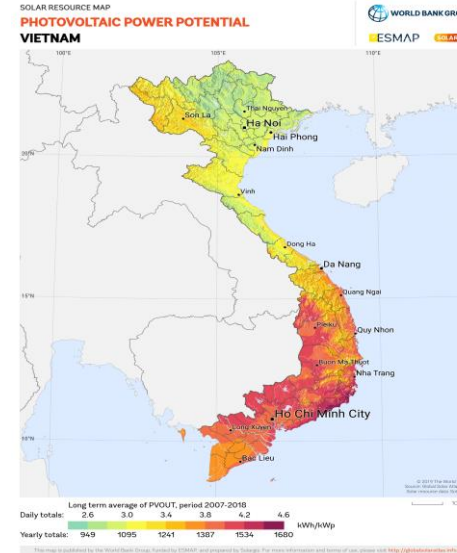


# Case study (2) - Vietnam



# Case study (2) - Vietnam Overview

- Renewable energy booming since 2017 (following generous FITs and other incentives)
- Masses of renewable projects put into operation in short time (e.g., Q2 2019: COD of 102 projects)
- Density of renewable energy projects in some provinces and areas (e.g., Ninh Thuan, Binh Thuan, Central Highlands and Southwest)
- Unparallel development of grid system (partly due to booming of renewable energy beyond national power plans)



Source: Draft PDP8, February 2021

# Case study (2) - Vietnam Challenges

## (i) Grid overload

- Insufficient capacity of some local grid to dispatch renewable energy
- Some examples:

## (ii) Curtailment

- Renewable power projects in many locations frequently required to operate at just 60% of designed capacity
- 0.365 TWh of solar power curtailed in 2020
- 1.3 TWh of renewable power expected to be curtailed in 2021

| Grid facility   | Designed capacity | In reality  |
|---|-------------------|---|
| 110 kV Ninh Phuoc - Tuy Phong - Phan Ri transmission line | 100 MWA           | Transmission line of 14 solar power projects (approx. 500 MWac)   |
| 220kV Thap Cham – Vinh Tan transmission line              | 518 MWA           | Transmission line of 10 solar power projects (approx. 1,300 MWac) |

# Case study (2) - Vietnam

## Challenges

### **(iii) Grid expansion**

- Grid expansion to reduce curtailment for renewable energy as a priority of the Government and EVN
  - In 2020: COD of more than 20 grid system projects to reduce curtailment for renewable energy
  - EVNNPT 2021 plan: construction commencement of 44 transmission line (220-500kV) projects and COD of 63 projects (capex of approx. USD\$ 750 million)
- Development of grid system lagged behind
  - Longer time to develop (e.g., 3-5 years) compared to time to develop renewable energy projects (1-2 years)
  - Delayed in development process (e.g., approval process, site clearance and compensation, forest land issue etc.)
- Question of efficiency in grid expansion for renewable energy projects

### **(iv) Technical issues:**

- Grid operation and maintenance due to intermittency of renewable energy
- Managing distributed energy resources (e.g., booming of rooftop solar systems (by end of 2020: more than 100,000 rooftop solar systems with capacity of around 9,500 MWp))

# Case study (2) - Vietnam

## Considerations for future grid

- Renewable energy expected to continue growing in upcoming periods, especially wind power projects
- Some big considerations
  - Efficient and prompt expansion of grid system
  - High-voltage direct current (HVDC) transmission line
  - Regional transmission line system
  - Smart grid
  - Battery energy storage system (BESS)
  - Private investment in grid system?

A photograph of a city street scene. In the foreground, a silver minivan is driving on the right side of the road, and a dark sedan is driving on the left. The background features a modern building with a glass facade and a Louis Vuitton store. A large number of flags, including national flags like the Malaysian flag and the flag of Cambodia, as well as various corporate and event flags, are flying from tall poles in front of the building. The sky is clear and bright.

**Thank you**

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Feel free to ask questions :)