



Solar PV in ASEAN – Challenges and Opportunities

Peerapat Vithayasrichareon

Centre for Energy and Environmental Markets (CEEM), UNSW Australia

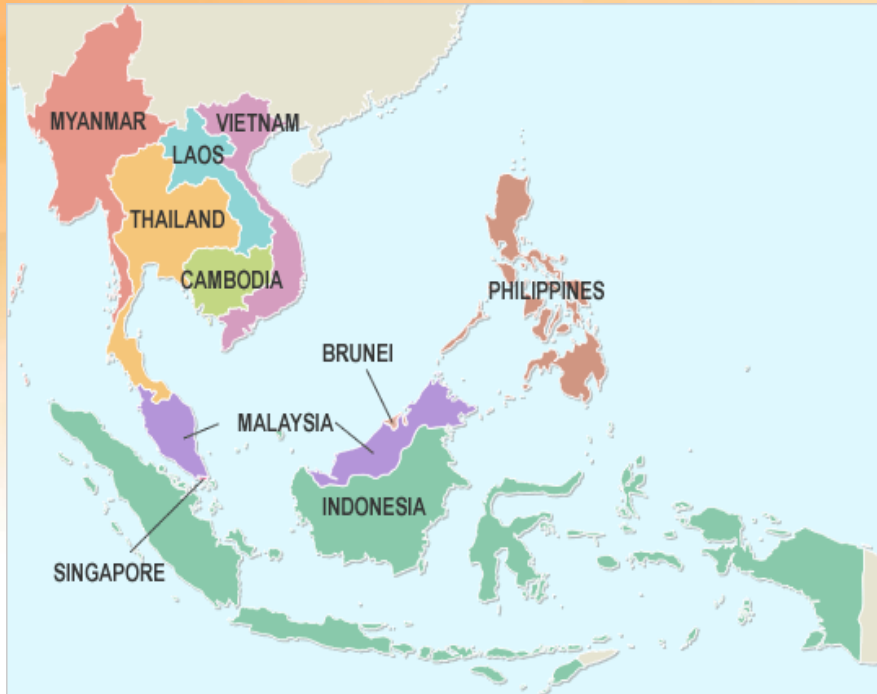
ESI Workshop on the value of PV in Singapore

18 February 2016

Presentation outline

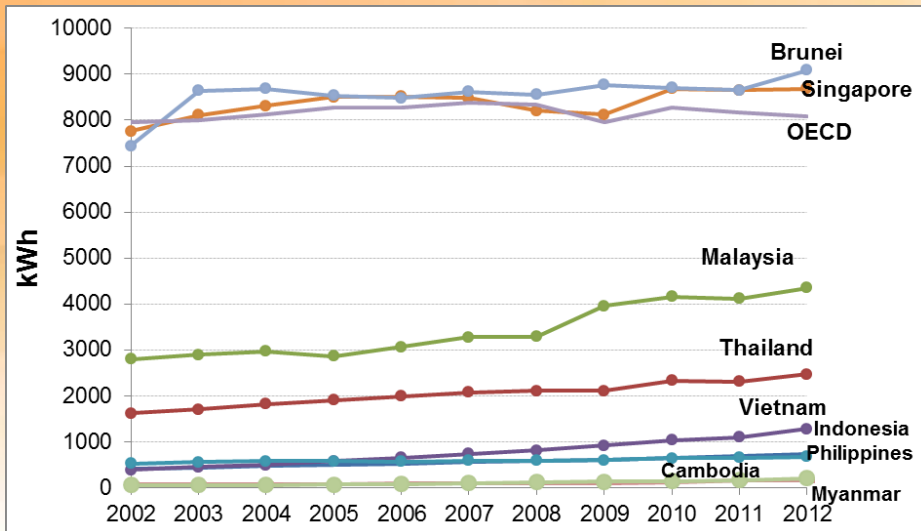
- Background - ASEAN context
- ASEAN Electricity Sector
- Key technology trends and renewables in ASEAN
- PV potential and progress in ASEAN
- Policies and measures to support PV deployment
- Barriers to PV deployment
- Overcoming the barriers
- Summary – a way forward

ASEAN context

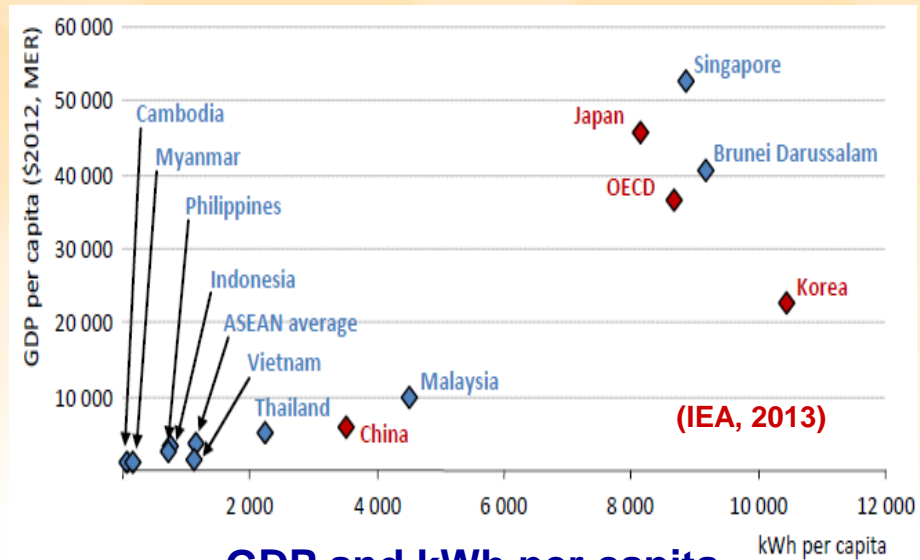


- Large population size – 9% of world population
- Fast socioeconomic development
- One of the fastest developing regions in the world
- Play an increasingly important role in the world energy demand
 - Rapid energy demand growth
 - 5% share of world energy demand compared with 2% in 1980
- Large investment in electricity supply infrastructure required to meet electricity demand growth.
- Five largest energy consumers in ASEAN are *Indonesia, Thailand, Malaysia, Philippines and Vietnam*

ASEAN context



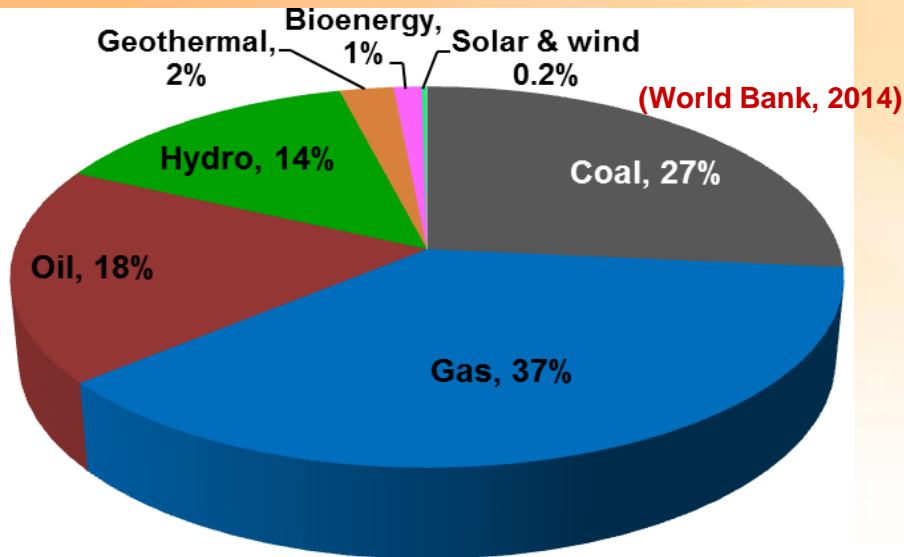
Electricity consumption per capita



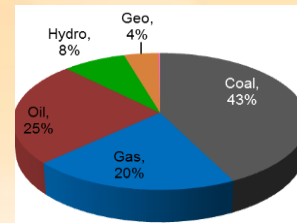
GDP and kWh per capita

- Fast electricity demand growth – around 5% per year
- Low per capita electricity consumption - *one fifth of the OECD.*
- Can be categorised into 3 subgroups in terms of development
 - Brunei and Singapore – largest kWh consumption per capita
 - Malaysia, Thailand, Vietnam, Indonesia and the Philippines
 - Myanmar, Cambodia and Laos

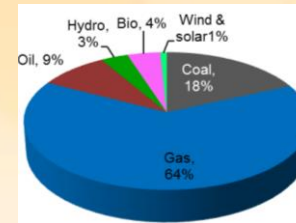
ASEAN Electricity Sector



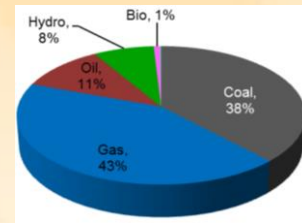
Share of electricity generation by fuel types in ASEAN in 2013



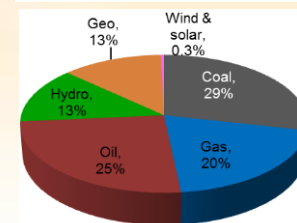
Indonesia



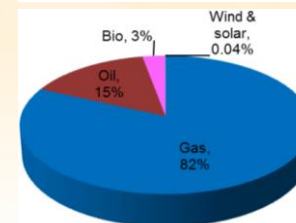
Thailand



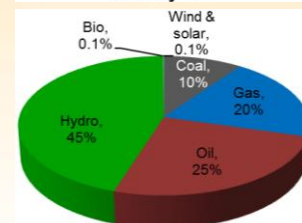
Malaysia



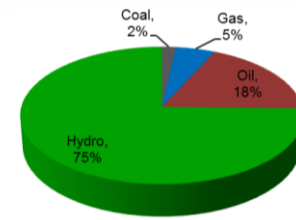
Philippines



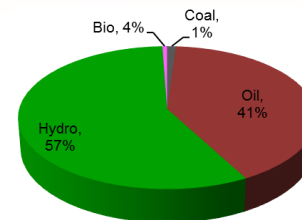
Singapore



Vietnam



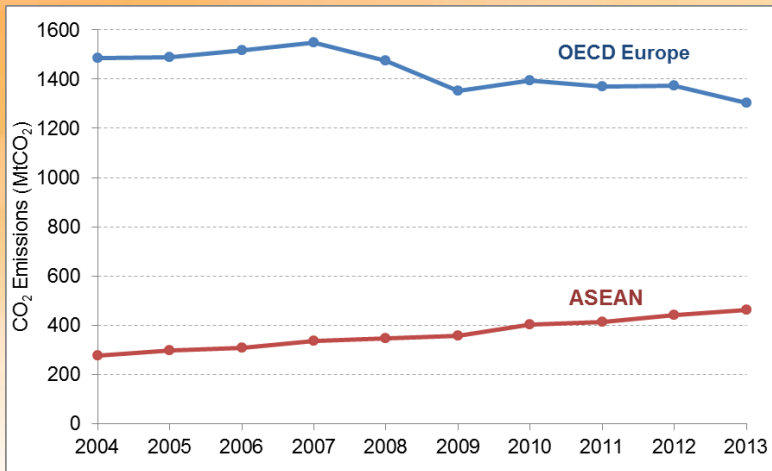
Myanmar



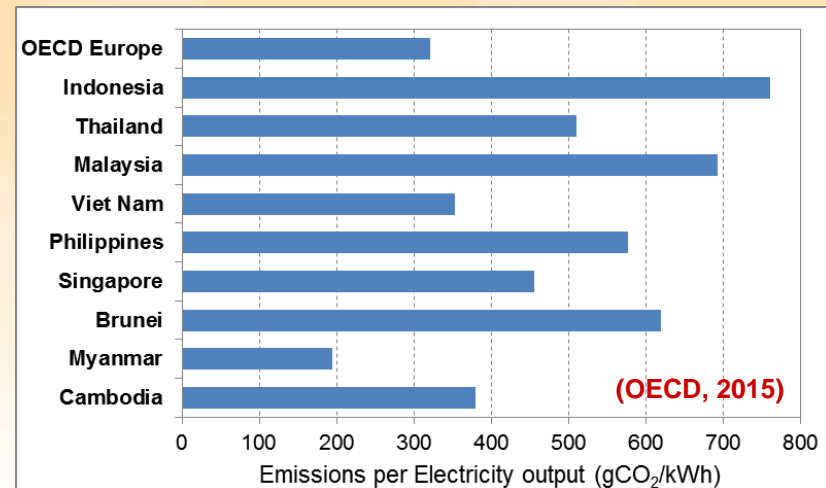
Cambodia

- Significant reliance on fossil fuels (coal, gas, oil) for electricity generation.
- Minimal non-hydro renewables

Environmental situation in ASEAN



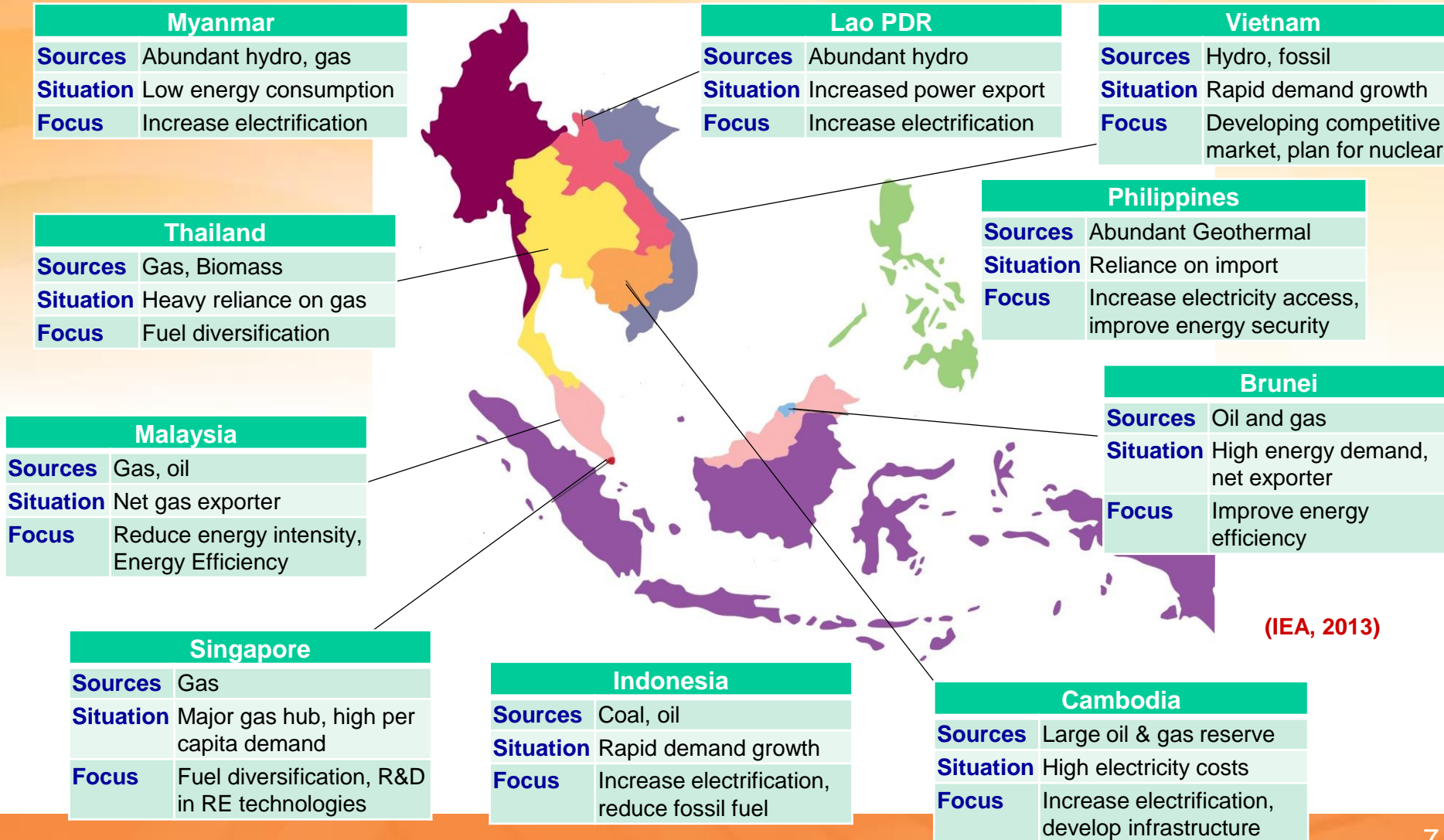
CO₂ emissions from the electricity sector



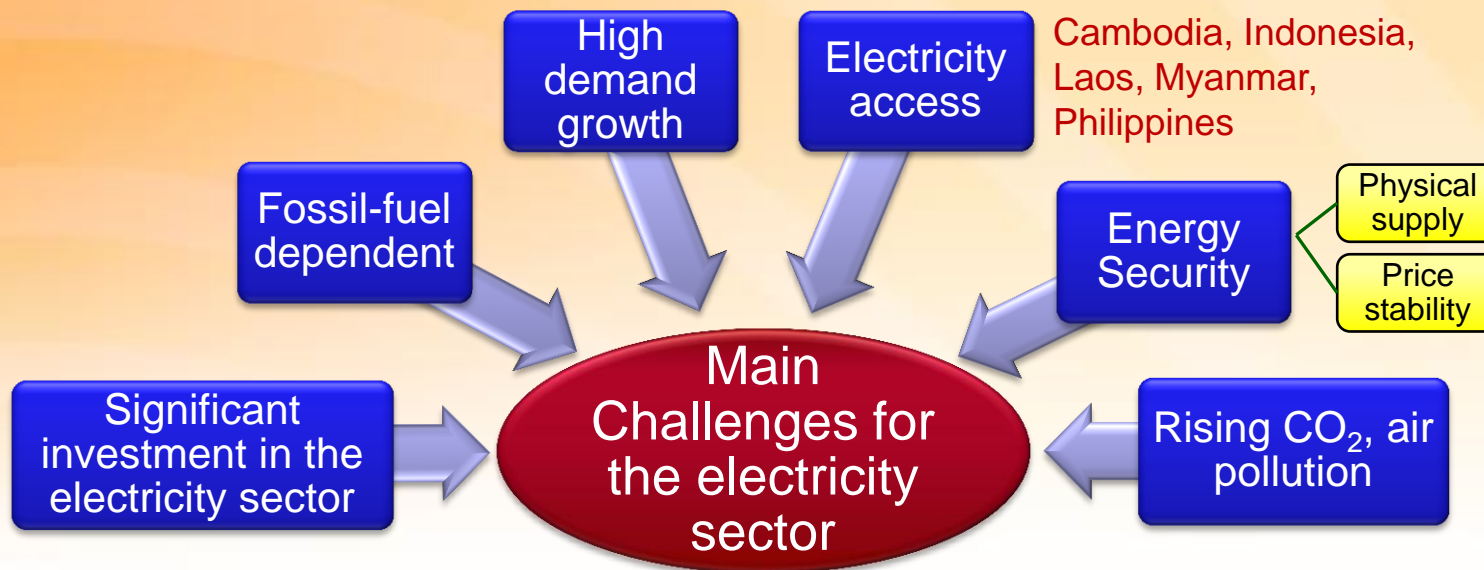
Emission per kWh output in 2013

- CO₂ emission is increasing – due to increased demand, large share of fossil fuel in electricity generation.
- CO₂ intensity (per kWh of electricity output) in ASEAN is high
 - High-emitting generation sources, inefficient power stations
- Share of global CO₂ emissions is 4% compared with 1% in 1980.

Characteristics of ASEAN

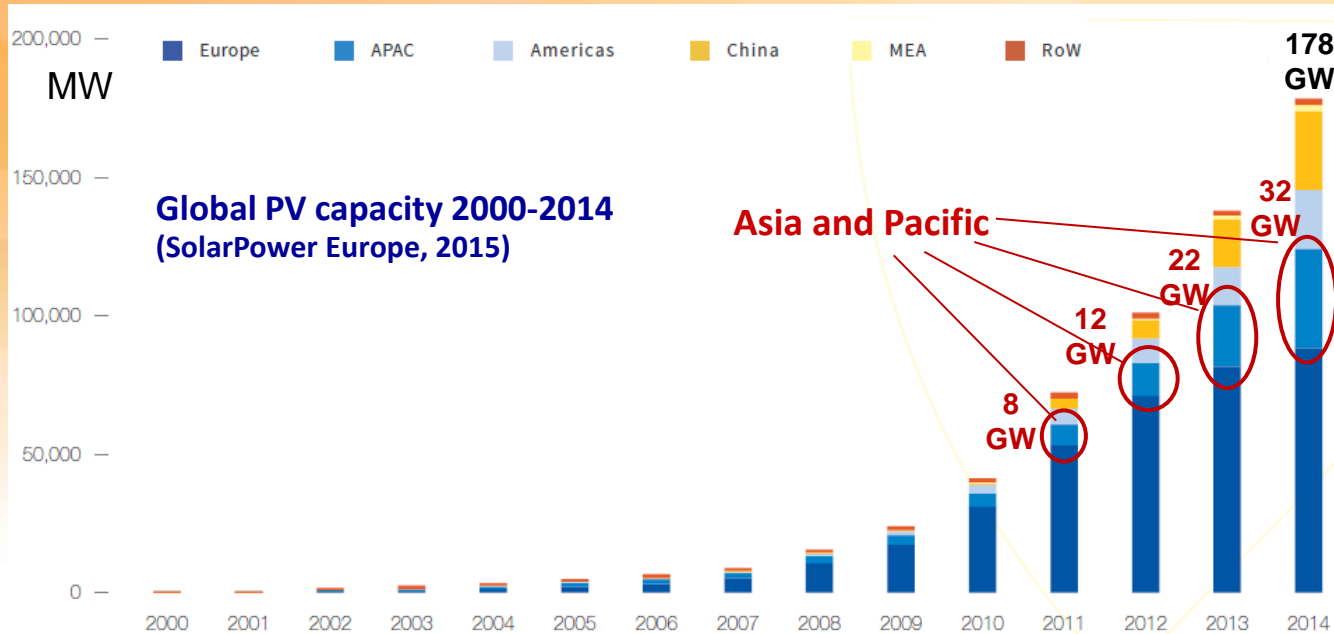


Challenges for electricity sectors in ASEAN



- Satisfying electricity demand growth in a sustainable manner – minimise costs, energy security, environmental impacts
- 134 million people in ASEAN have no electricity access – 22%.
- **Renewables** can potentially address most of these challenges
 - Cheap to run, no emissions, high investment cost but reducing rapidly.
 - No energy security concerns due to reliance on fuel import or fossil-fuel price fluctuation

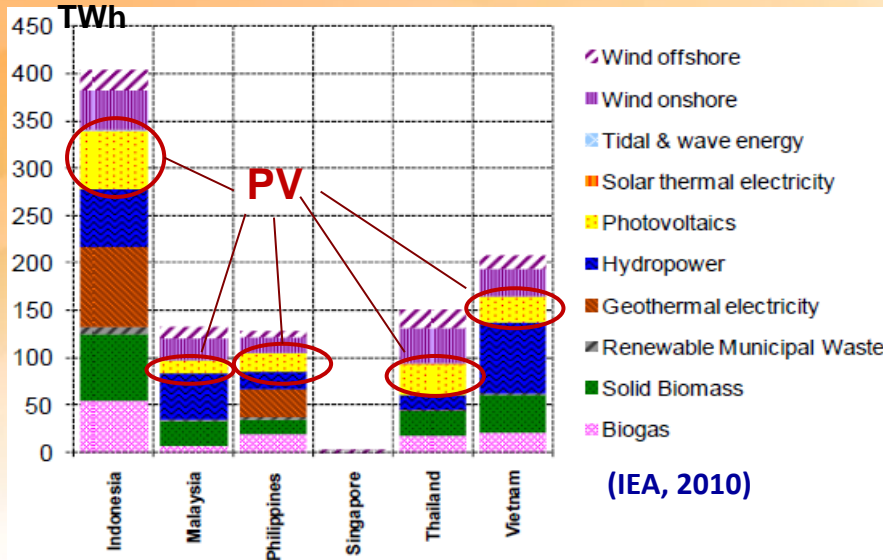
Key technology trends



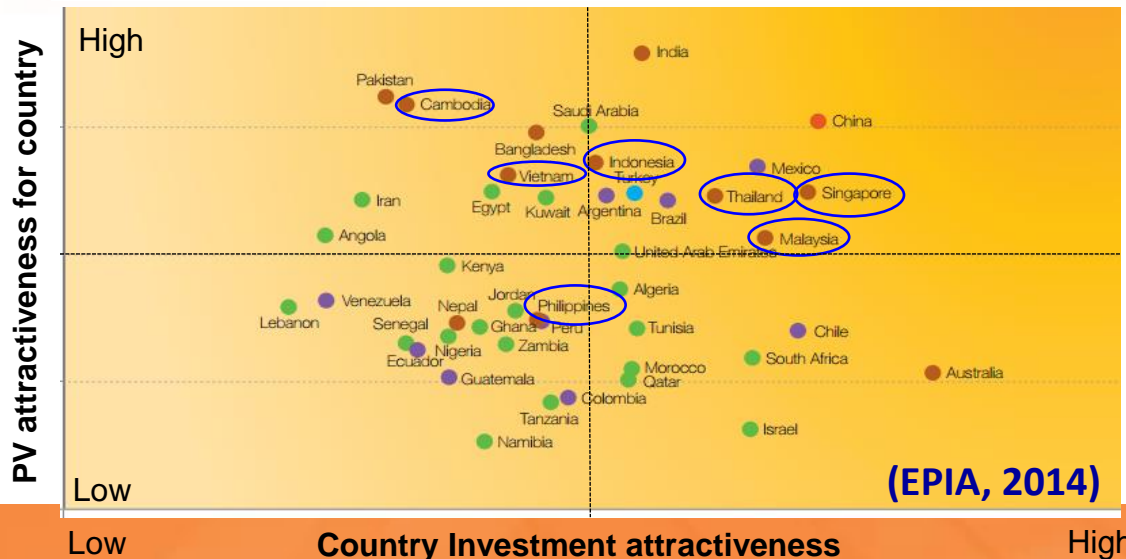
Leading countries in Asia Pacific:
Japan, Korea, Australia, Thailand, Taiwan

- PV is one of the fastest growing RE technologies worldwide
 - Rapid technological progress and cost reductions.
 - Potential to address energy security and climate change concerns.
 - Third most important RE sources in terms of installed capacity
- Largest growth has been in Europe but Asia is catching up

PV potential in ASEAN

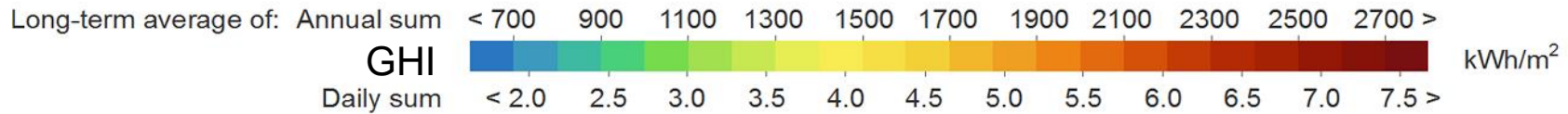
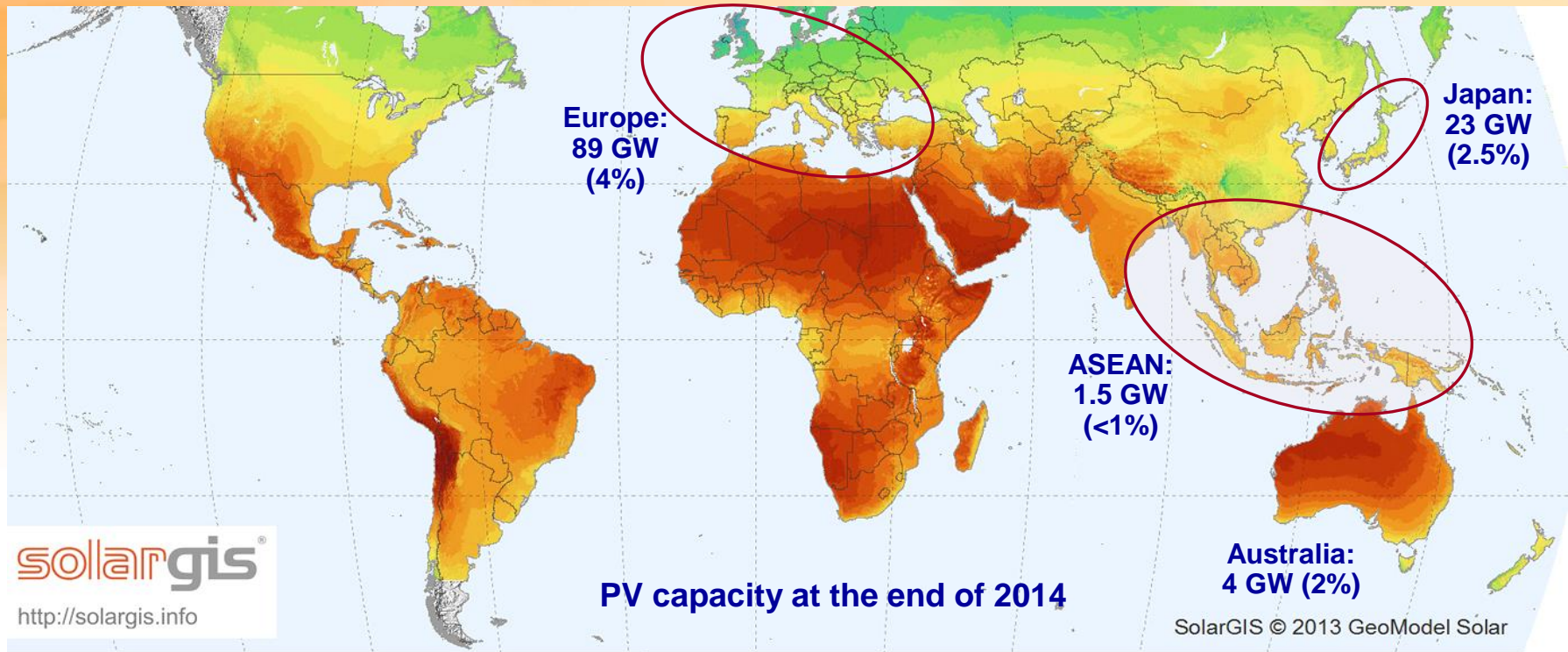


- Huge renewable energy potential in ASEAN
 - Hydro, solar, biomass
- PV deployment is still low – economic and non-economic barriers



- **PV attractiveness** – i.e. cost competitiveness, irradiation.
- **Country's attractiveness** – i.e. political and business environment, policy framework

PV potential in ASEAN – Global Context



Progress of PV in ASEAN

- Majority is solar farms but less for distributed or off-grid PV systems
- Thailand, Malaysia and Philippines are leading the development.
 - Incentivizing private sector to invest in RE technologies
- Potential to become a new manufacturing base of PV systems in the next ten years
- Thailand has the highest installed PV capacity
 - 1.6 GW already in operation (COD) and will increase to 2.5 GW (committed capacity)
 - Mainly solar farms – grid connected and selling directly to Electricity Generating Authority of Thailand (EGAT) and Provincial Electricity Authority (PEA)
 - Expanding to residential rooftop PV and community ground-mounted PV systems

Influence of energy and climate policies

- Policies have a key role to play to promote and ensure successful integration of RE technologies.
 - Increase the value of RE in relation to fossil-fuel technologies
 - increase confidences for investment and deployment in solar PV
- As with other new RE tech, PV remains a policy driven market
 - FiTs are the main policy for driving deployment of renewables in ASEAN.
 - New investment/installation is influenced by support schemes.
 - Asia and Pacific region has become a significant market for PV installation – China, Korea, Japan, Australia, Thailand

Renewables supporting measures

Regulatory policies and mandate

- RETs, carbon pricing, FiTs, RPS, RE Certificates (REC).
- RET schemes create demand for additional RE energy by placing a legal obligation on electricity utilities.
- FiTs is the most widely used scheme

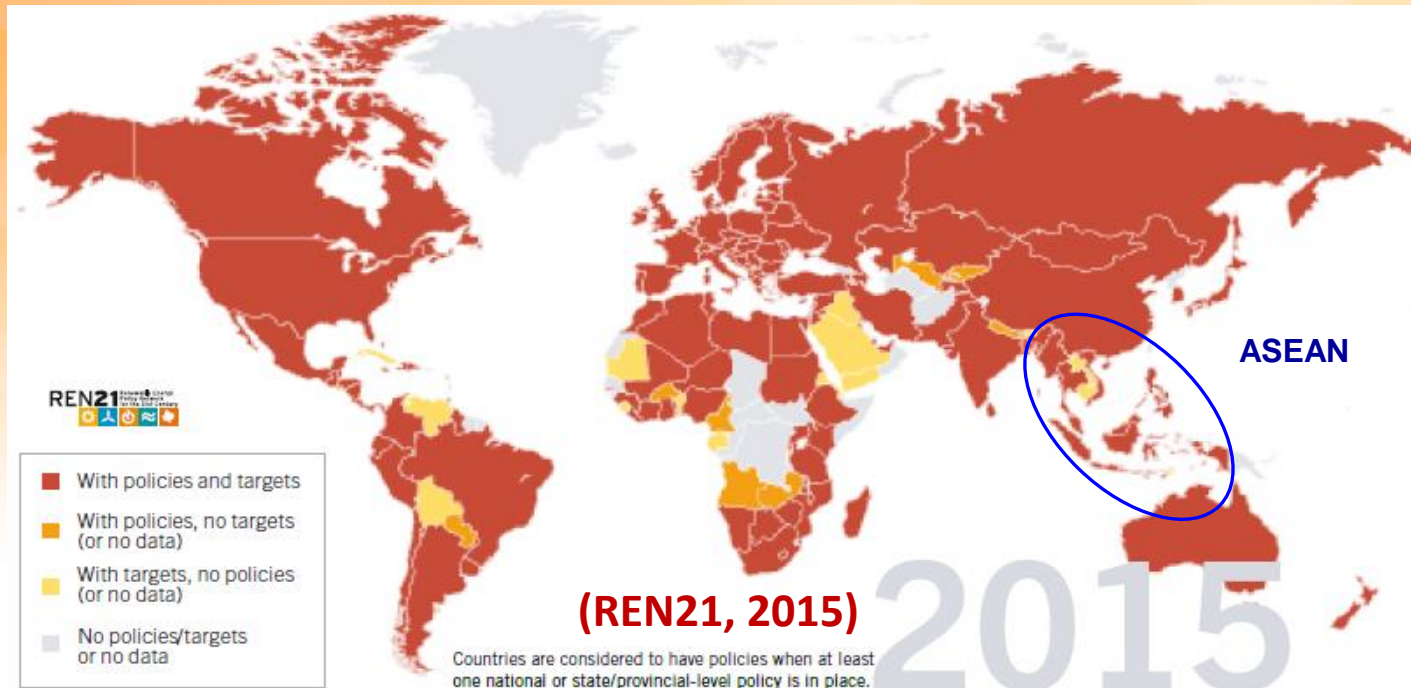
Fiscal incentives

- Address the cost and finance barriers that hinder investment in RE technologies
- Capital subsidies, rebates and tax reduction
- Providing social, economic, environmental benefits

Public financing

- provided by governments in the forms of loans and grants to support innovation in RE technologies

Energy and climate policies



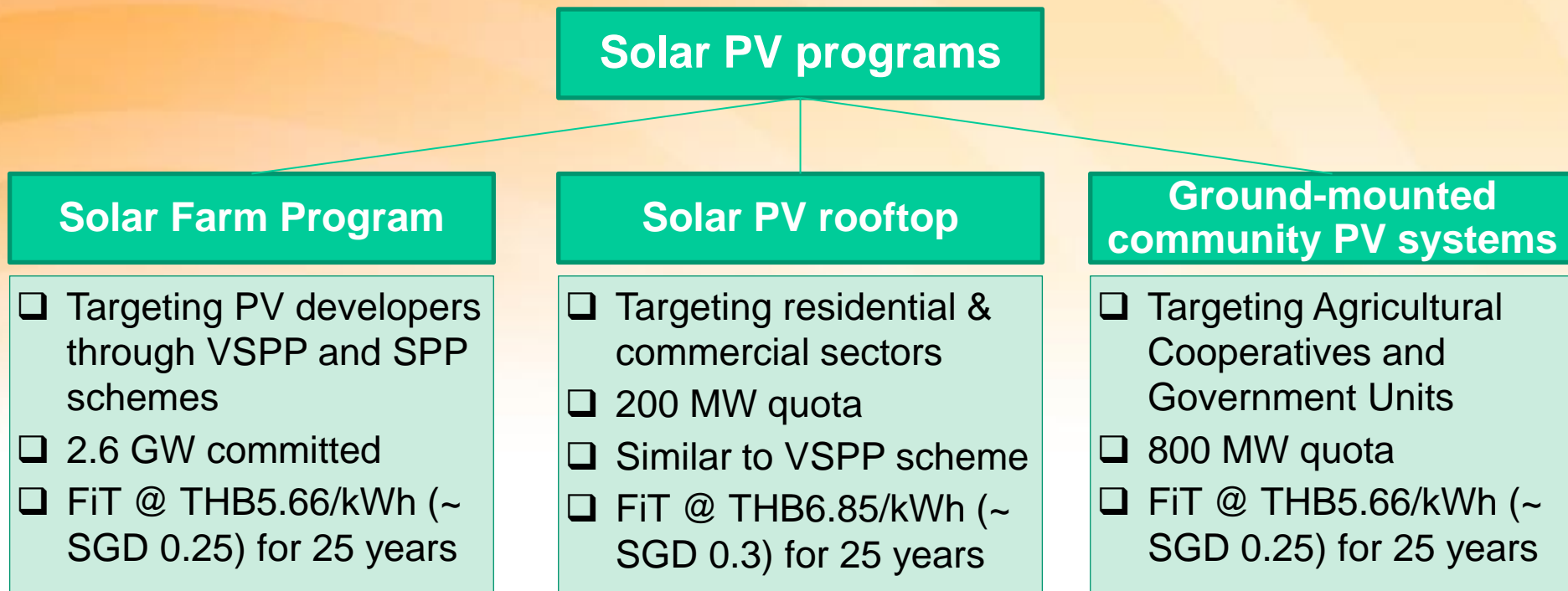
- Countries with RE policies and targets have increased significantly
- Energy policies vary across ASEAN countries - depends on political and economic situations, resource endowments
 - Common themes – increase energy security, reduce costs, environmentally sustainable.

Solar PV in Thailand

- Major leader in ASEAN due to strong policy support
- Driven by the Alternative Energy Development Plan (AEDP) and a range of incentives
 - Fiscal incentives: Imported duty exemption on machinery, corporate income tax exemption for 8 years
 - Public financing: Investment grants, equipment leasing
- Thailand has some of the largest solar farms in the world
 - Located in central and northern part of Thailand
 - The largest is 128 MW (contracted at 90 MW), Land size: 380 hectares



Solar PV in Thailand (cont')



- Different programs for different target groups
- Feed-in-Tariffs (FiTs) with long-term PPAs (25 years)
- Rapid growth in utility-scale PV but not distributed PV (e.g. rooftop)
- There's still policy uncertainties

Key Energy Policies and RE Targets (1)

Country	Key Energy Policies	Renewable targets
Indonesia	<ul style="list-style-type: none"> • Increase electricity access to 99% by 2020 • 26% GHG reduction targets by 2020 • Reduce the share of fossil fuel 	<ul style="list-style-type: none"> • 26% renewable electricity by 2025 • 160 MW of PV capacity or 1% share of generation by 2025
Thailand	<ul style="list-style-type: none"> • Diversify fuel mix from natural gas • Reduce energy intensity by 25% by 2030 compared with 2005 levels 	<ul style="list-style-type: none"> • 10% renewable electricity by 2021 • 6 GW of PV by 2036
Malaysia	<ul style="list-style-type: none"> • Reduce energy intensity by 10% by 2025 compared to BAU • Reduce CO₂ intensity by up to 40% compared to 2005 levels by 2020. 	<ul style="list-style-type: none"> • 2.1 GW of renewable electricity by 2030 • 14% renewable electricity by 2030
Vietnam	<ul style="list-style-type: none"> • 100% electricity access by 2020 • Reduce CO₂ intensity by 10% by 2020 compared with 2010 levels 	<ul style="list-style-type: none"> • 5% renewable electricity by 2020
Philippines	<ul style="list-style-type: none"> • Increase electricity access to 20% by 2017 (for small township) • Expand the grid to interconnect major islands 	<ul style="list-style-type: none"> • 40% renewable energy by 2020 • 15 GW of renewables by 2030 • Additional 280 MW of PV

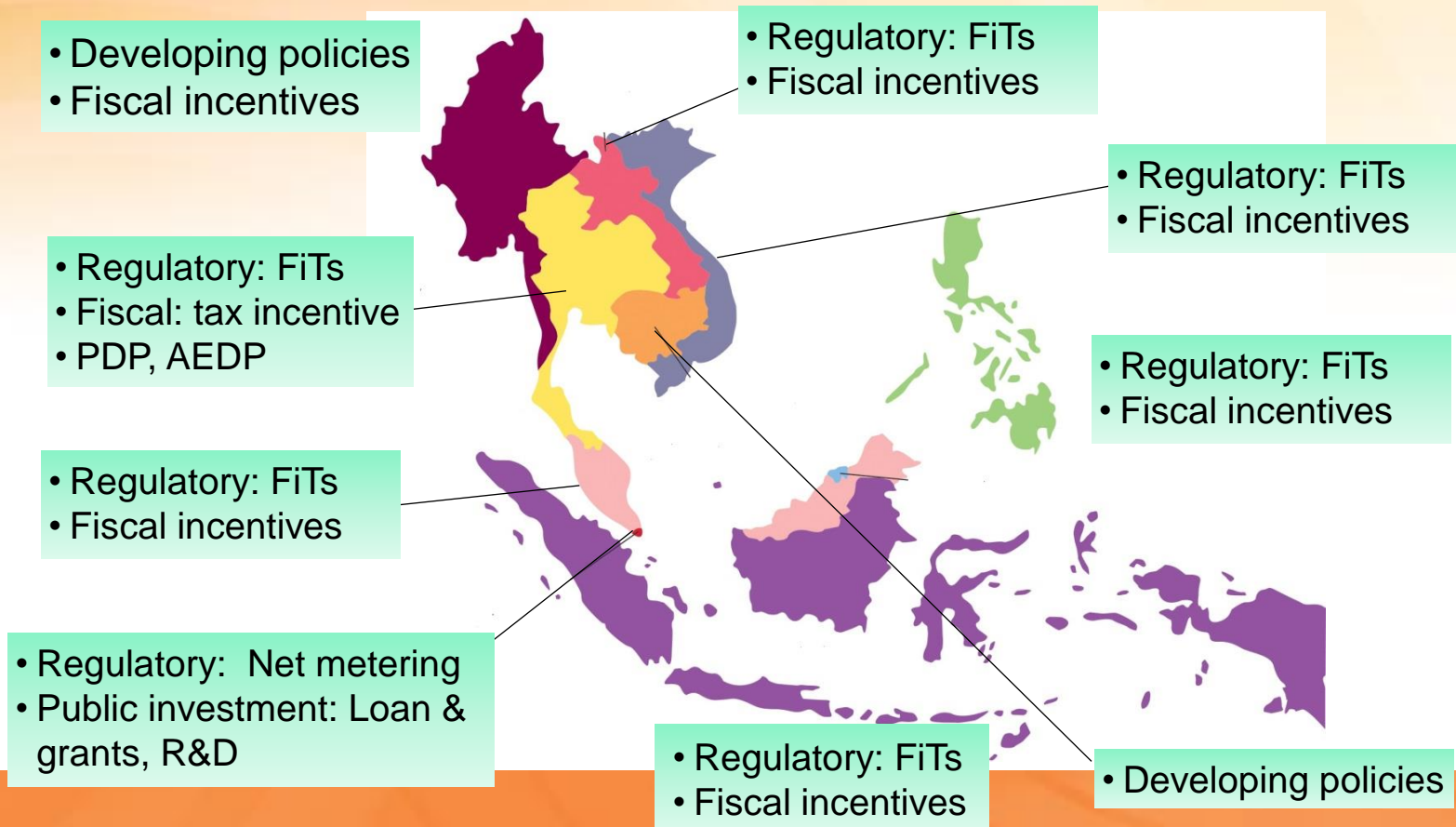
Key Energy Policies and RE Targets (2)

Country	Key Energy Policies	Renewable targets
Singapore	<ul style="list-style-type: none"> • Energy supply diversification • Reduce energy intensity by 35% by 2030 compared with 2005 levels • Reduce CO₂ intensity by 10% below the 2020 BAU levels 	<ul style="list-style-type: none"> • 5% share of renewables by 2020 • 350 MW of PV by 2020 (~5% of projected peak demand)
Brunei	<ul style="list-style-type: none"> • Improve energy efficiency • Reduce energy intensity by 25% by 2030 from 2005 levels 	<ul style="list-style-type: none"> • 10 MW PV by 2030 • 10% RE by 2035
Myanmar	<ul style="list-style-type: none"> • Reduce primary energy consumption by 8% by 2030 compared to BAU 	<ul style="list-style-type: none"> • 15-20% RE by 2020
Cambodia	<ul style="list-style-type: none"> • Develop hydropower • Increase electricity access through off-grid RE 	<ul style="list-style-type: none"> • 15% RE by 2015
Lao PDR	<ul style="list-style-type: none"> • Increase electricity access to 90% by 2020 • Upgrade interconnectors to increase power exchange between Vietnam and Thailand 	<ul style="list-style-type: none"> • 30% RE by 2025 • 33 MW from solar

(OECD/IEA, 2013), (REN21, 2015)

Policy Measures for PV

- In addition to RE targets, effective financial and non-financial measures must also be in place
- Policies related with solar are bundled with other RE technologies



Barriers to PV development in ASEAN

Social

- Lack of public awareness on the impact of climate change and the benefits of RE technologies

Economic

- Relatively high capital and financing cost at present.

Technical

- Lack of knowledge in the technology, installation, maintenance
- Impact on the power grid due to its variability and partly unpredictability. Lack of data for grid impact studies.
- Inadequate transmission and distribution networks

Environmental

- Land size for utility-scale solar PV – limited in some countries (e.g. Singapore)

Institutional

- Lack of effective policies - uncoordinated and incoherent policies between government agencies, weak RE targets
- Regulatory arrangements - long process in obtaining licenses, settlement

Overcoming the barriers

Social

- Disseminating information and consumer awareness on the impact of climate change and the benefits of PV
- Transparency and public involvement in the electricity sector

Economic

- Providing fiscal incentives and public financing
- Increase R&D efforts to reduce costs and increase efficiency
- Internalising environmental externality costs

Technical

- Encourage more research and studies on the grid impact of PV
- Need other grid technologies to complement PV – Storage options, smart grids
- Zoning of renewables to avoid congestion.

Environmental

- Build solar farms in remote areas
- Promote residential and community-scaled PV (e.g. rooftops)

Institutional

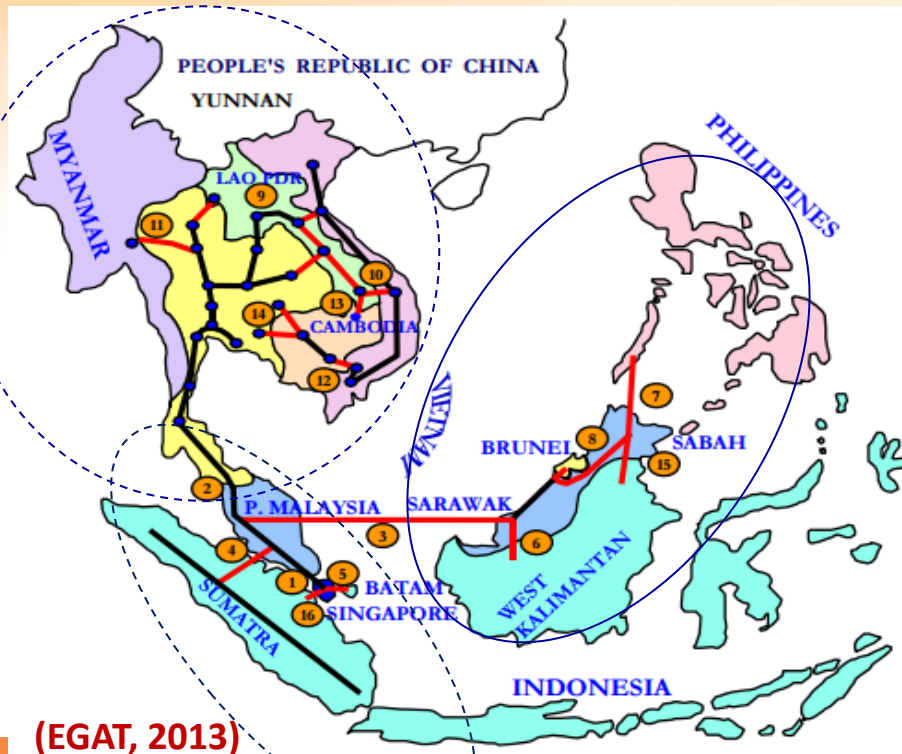
- Schemes with fair remuneration and predictable level of support
- FiTs, RPS, Net metering
- Coherent policies among different governmental agencies
- Streamlined procedures for providing permits/licences

Regional collaboration is important

- Collaborations among ASEAN countries are essential to achieve higher PV deployment (and other RE technologies)
 - R&D collaboration, transfer of knowledge, know-how.
 - Optimizing and sharing of solar resource through cross-border interconnection – non coincidence of peak demand.
 - Geographical diversifications - improved matching of PV generation and demand across different countries
- Common regulatory frameworks need to be established to ensure benefits for every country in the region.
- ASEAN Plan of Action for Energy Cooperation (APAEC) 2016 – 2025 provides a good framework but needs commitment
 - Enhance energy cooperation and strengthening energy security through a more diversified power generation mix.
 - ASEAN Power Grid (APG)

Possible regional collaboration

- APG, power sector integration, regional electricity markets
 - 11 existing cross-border interconnections (6 countries)
 - Thailand, Malaysia, Singapore, Lao PDR, Vietnam, Cambodia
 - 27 interconnectors to be built by 2030



- Key challenges
 - Financing
 - different national policies, market structures
 - Different operational & regulatory framework
 - Implementing cross border multilateral trading

Summary and a way forward

- Huge potential for solar PV in ASEAN but needs support schemes
 - High solar irradiance in ASEAN but PV energy penetration level is still extremely low (less than 1%)
 - Need effective and coordinated policies and regulatory frameworks.
- Solar PV can help to address some of the main challenges facing ASEAN electricity sector
 - Electricity access in remote areas (Philippines, Indonesia, Cambodia),
 - Energy security – diversify fuel mix from fossil-fuel
 - Environment - climate change and local air pollution
- Need to strengthen regional collaboration among ASEAN countries in a number of aspects



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peerapat@unsw.edu.au

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