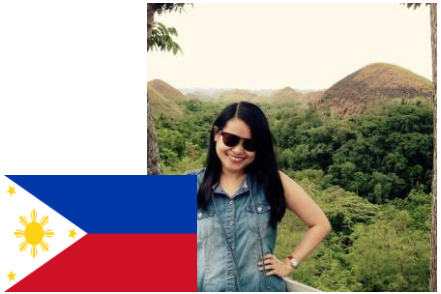
Southeast Asia Clean Energy Transition

July 13th, 2021

Team 1 - Project Assignment

YSEALI Energy Economics and Policy Seminar

Team 1 - Members



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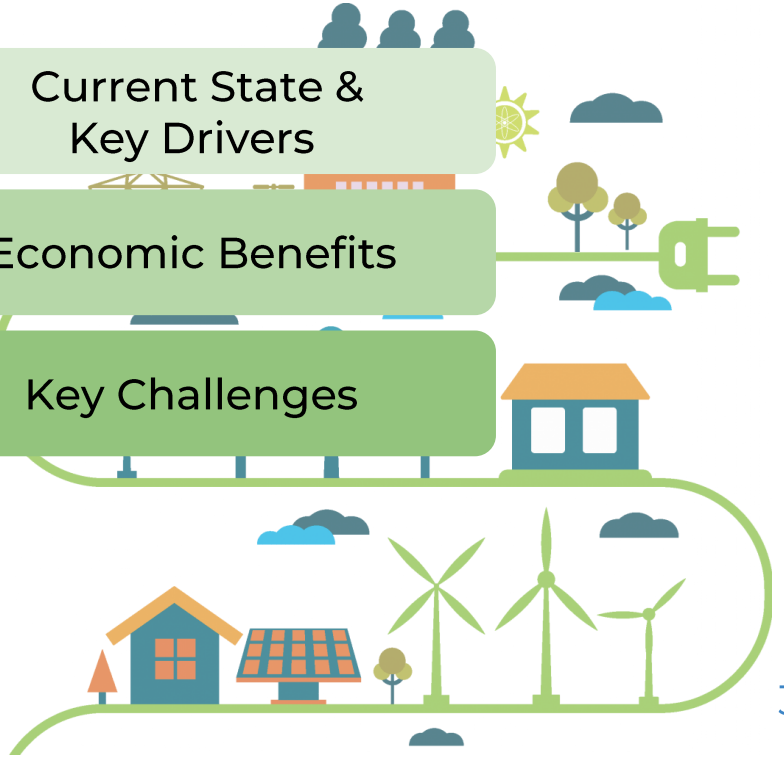
Outline

1. SEA Energy Policy
2. SEA Clean Energy Transition
   - Current State & Key Drivers
   - Economic Benefits
   - Key Challenges
3. Strategy & Action Plan



Southeast Asia Energy Policy

1. SEA Energy Policy

ASEAN Plan of Action for Energy Cooperation (APAEC)

Regional blueprint for the energy sector in the framework of AEC implementation.
Phase I : 2016 - 2020 | **Phase II : 2021 - 2025**

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

2. Trans ASEAN Gas Pipeline
To pursue the development of a common gas market for ASEAN by enhancing gas and LNG connectivity and accessibility.

3. Coal & Clean Coal Technology
To optimise the role of clean coal technology in facilitating the transition towards sustainable and lower emission development.

4. Energy Efficiency & Conservation

5. Renewable Energy

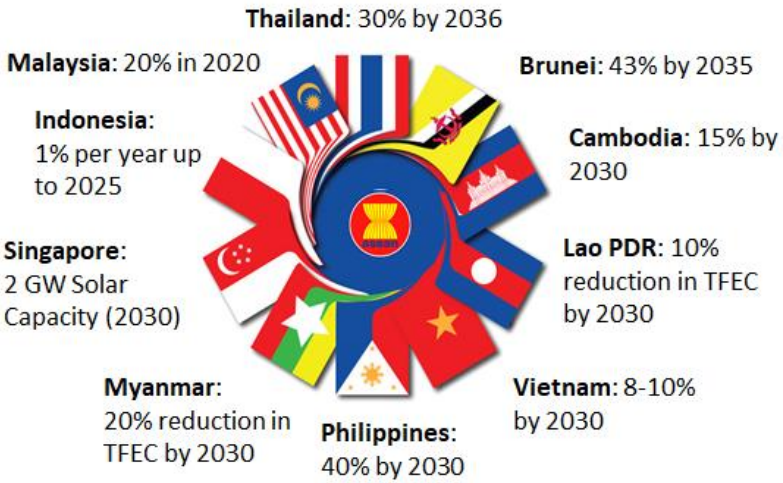
6. Regional Energy Policy & Planning
To advance energy policy & planning to accelerate the region's energy transition & resilience.

7. Civilian Nuclear Energy
To build human resource capabilities on nuclear science and technology for power generation.

Energy Efficiency & Conservation

To reduce **energy intensity** by 32% in 2025 based on 2005 levels and encourage further energy efficiency and conservation efforts, esp. in transport and industry sectors.

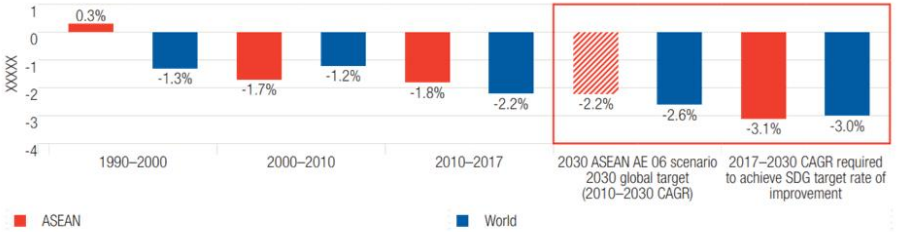
ASEAN Members - Energy Intensity Reduction Targets



Source: UNESCAP (2020). Regional Energy Trends Report 2020, IEA (2019). Southeast Asia Energy Outlook.

ASEAN is **slower** than the world in terms of the rate of **energy intensity improvement**. It is predicted to achieve 2.2% in 2030. To support SDG 7, it needs improvement of 3.1% growth in 2017-2030. Anything less will lower the global rate and slow progress.

One of the main target for efficiency is **electricity** for buildings, along with transportation and industry sector which comprises up to **76%** of increase in regional energy consumption since 2020.

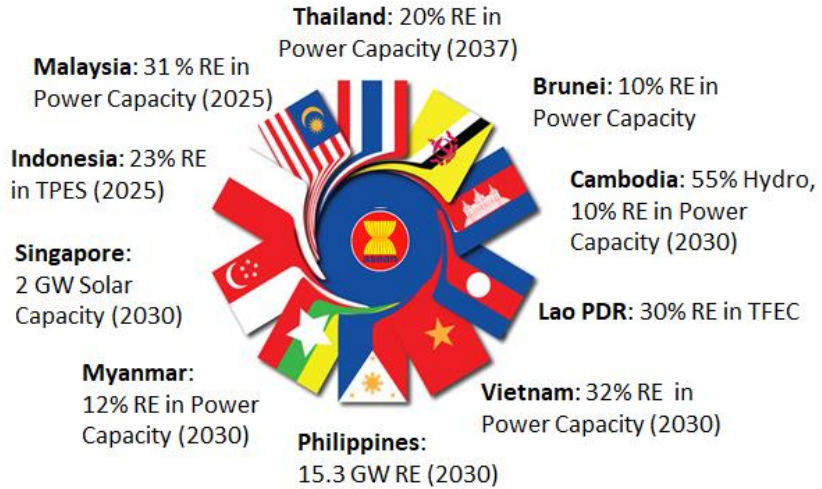


Source: *ESCAP, based on IEA, United Nations Statistics Division and the World Bank. AEO6 Scenario provided by ACE.*

Renewable Energy Policy

To achieve aspirational target for increasing the component of **renewable energy** to **23%** by 2025 in ASEAN Energy Mix, including through increasing the share of **RE** in installed **power capacity** to **35%** by 2025.

ASEAN Members - Renewable Energy Targets in 2025



Source: UNESCAP (2020). Regional Energy Trends Report 2020.

Electricity generation from renewable energy sources in Southeast Asia, 2000 and 2017

Notes: TWh = terawatt-hours. Data for Lao PDR are 2015.

Source: IEA (2019). Southeast Asia Energy Outlook.

Regional **system integration** can smoothen RE balance by aggregation of resources, assets, and flexibility options over a larger geographical area.

Clean Energy Transition

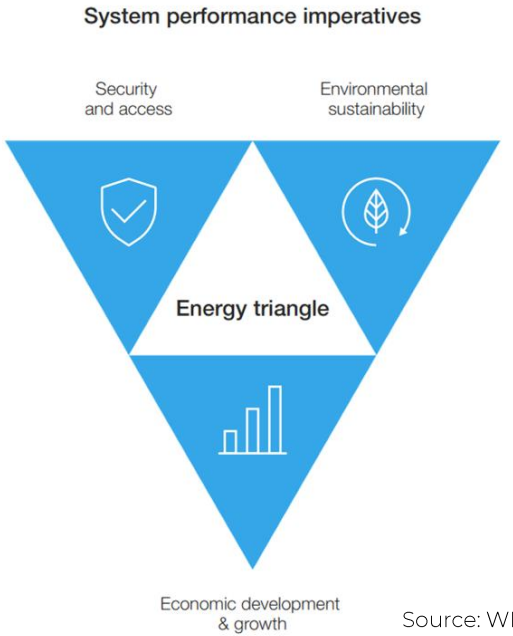
2. Clean Energy Transition

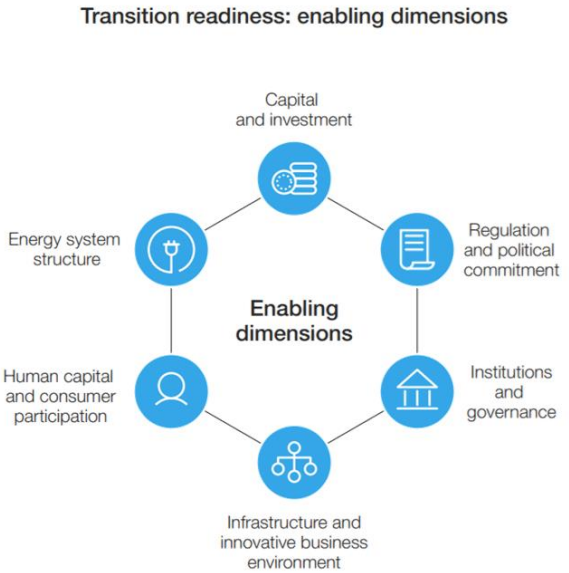
Energy transition is a pathway toward transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century (IRENA)

How to Measure it?

Energy Transition Index (ETI) was created by the World Economic Forum for the past 10 years.

ETI is calculated for all nations every year using the framework on two aspects:
System Performance & Transition Readiness





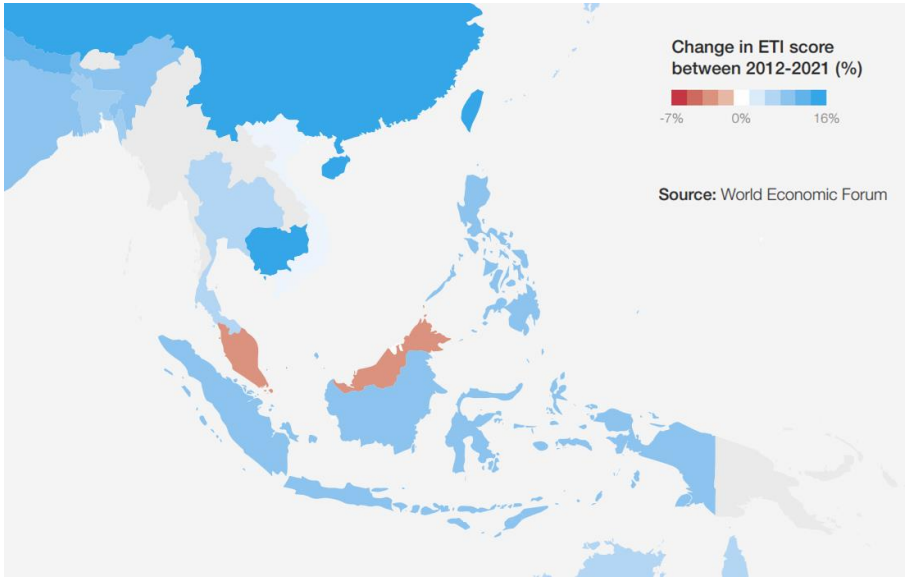
Source: WEF - Fostering Effective Energy Transition (2021 Edition)

Current State

Energy Transition Index Status (2020)

ASEAN's	**ETI**
21st: Singapore	(67)
39th: Malaysia	(64)
55th: Thailand	(59)
65th: Vietnam	(57)
67th: The Philippines	(57)
71th: Indonesia	(56)
82th: Brunei Darussalam	(54)
93th: Cambodia	(52)

World's Comparison	
Highest - 1st: Sweden	**(79)**
7th: United Kingdom	(72)
18th: Germany	(68)
24th: United States	(67)
68th: China	(57)
87th: India	(53)

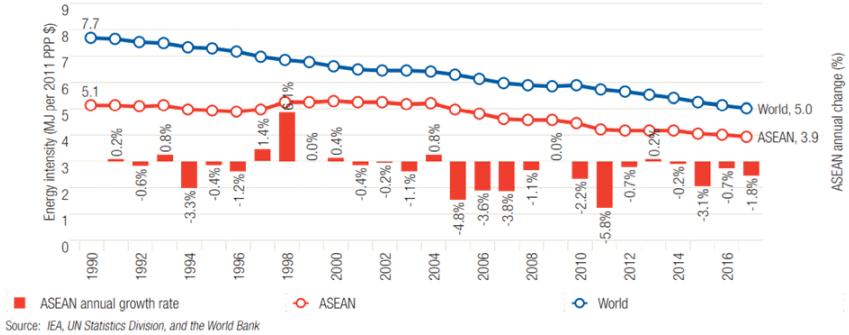


Source: WEF - Fostering Effective Energy Transition (2021 Edition)

Global Average ETI: 59

Current State

Energy Intensity



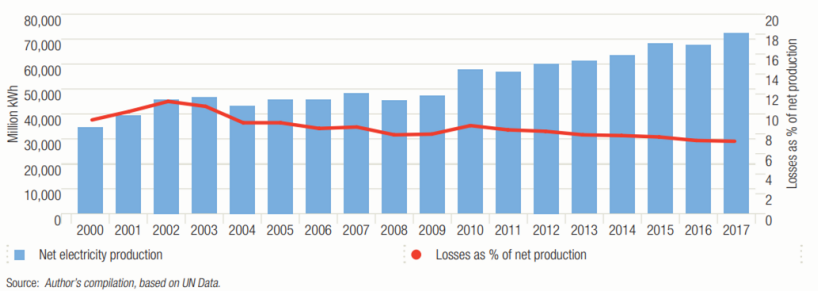
Source: *IEA, UN Statistics Division, and the World Bank*

ASEAN region has consistently held an overall **lower energy intensity** than the world. Indonesia and Malaysia set the lowest decrease at around 2.8%.

Average rate of SEA is 1.8% annually, fell behind the world's pace at 2.2% in 2000-2017.

Source: UNESCAP (2020). Regional Energy Trends Report 2020.

Grid System Improvements



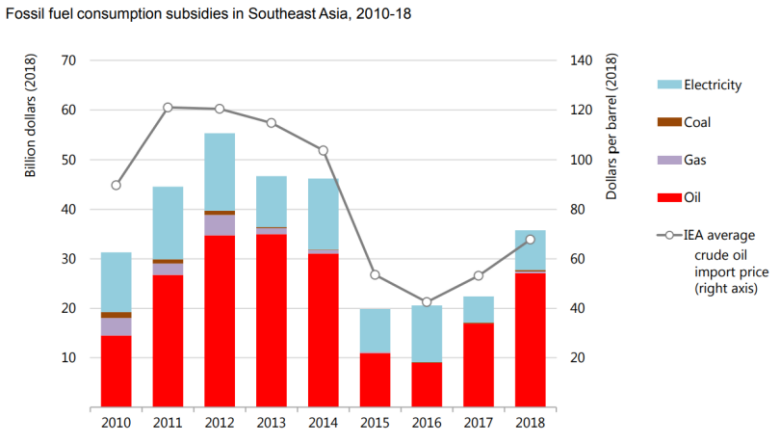
Source: *Author's compilation, based on UN Data.*

Electrification is key. To **improve efficiency** and reduce environmental impacts, several standards for new power plants has been raised.

Between 2000 and 2017, ASEAN more than doubled electricity production while **reducing transmission and distribution losses** from a peak of 11.2% in 2012 to 7.2% in 2017.

Current State

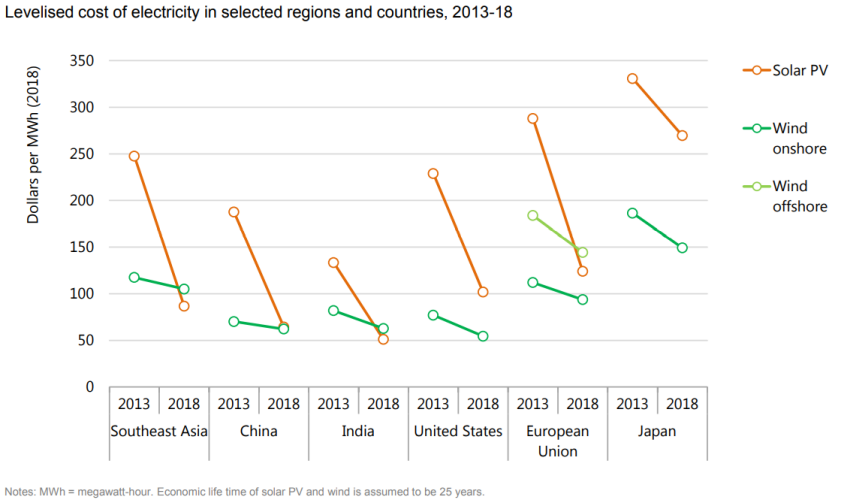
Pricing Subsidies



Pricing regulations continue to distort energy choices and burden state budgets, despite some improvements. Fossil energy has depleted resources and dependency to market stability and indexed price.

Source: IEA (2019). Southeast Asia Energy Outlook.

LCOE of Renewable Energy



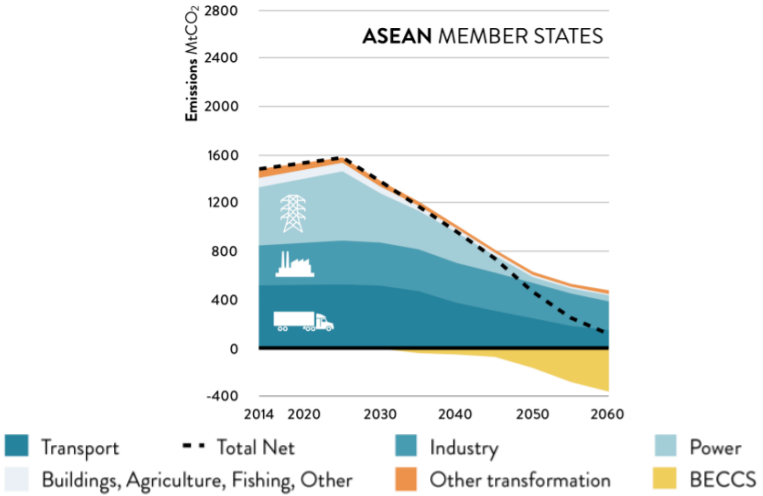
Notes: MWh = megawatt-hour. Economic life time of solar PV and wind is assumed to be 25 years.

Falling costs of RE expand opportunities for clean energy and encourage divestment of fossil fuel. Cost for battery/storage is still high, need competitive technology.

Key Drivers: ASEAN Energy Transition

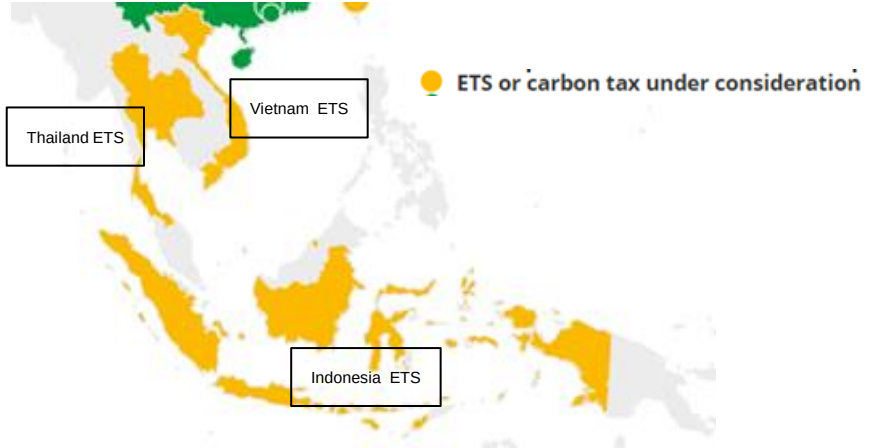
A. Climate Change and Net-Zero Initiatives

Quote from Swiss Re : “ASEAN GDP would be 17% - 29% lower than it would be without such warming by 2050, while the OECD falls only 8%.”



Energy sector is the **main contributor** of CO_2 emissions in ASEAN.

Source: Climate Analytics (2019). Decarbonising South and Southeast Asia.

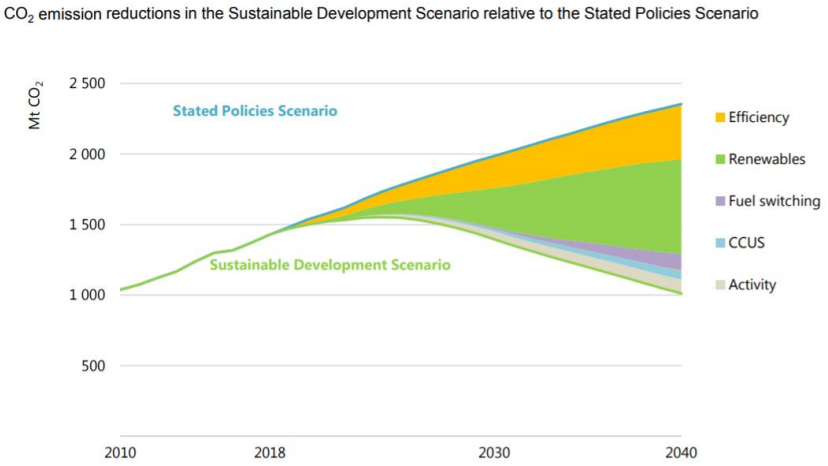


Carbon pricing guide immediate **investment in renewable energy** and spending decisions in green technology with the long-term in mind.

Source: The World Bank,. Carbon Price Dashboard

Key Drivers: ASEAN Energy Transition

A. Climate Change and Net-Zero Initiatives



Deployment of renewable energy plays a big role to **bridge the gap** between the Stated Policies and Sustainable Development scenarios in SEA Energy Outlook.

Source: IEA (2019). Southeast Asia Energy Outlook.

Net Zero target as a pathway to accelerate the energy transition in ASEAN.

Key Drivers: ASEAN Energy Transition

B. Digitalization

Digitalization takes place in all energy sectors including fossil fuel (e.g. oil, gas, coal). However, the key area will be on electricity sector, especially on smart grid.

Oil & Gas

- Increase productivity, enhance recovery (*~5%*)
- Reduce production cost (*~ 10%-20%*)
- Improve safety
- Enhance environmental performance

Coal

- Improved processes
- Reduce costs
- Enhance environmental performance

Electricity

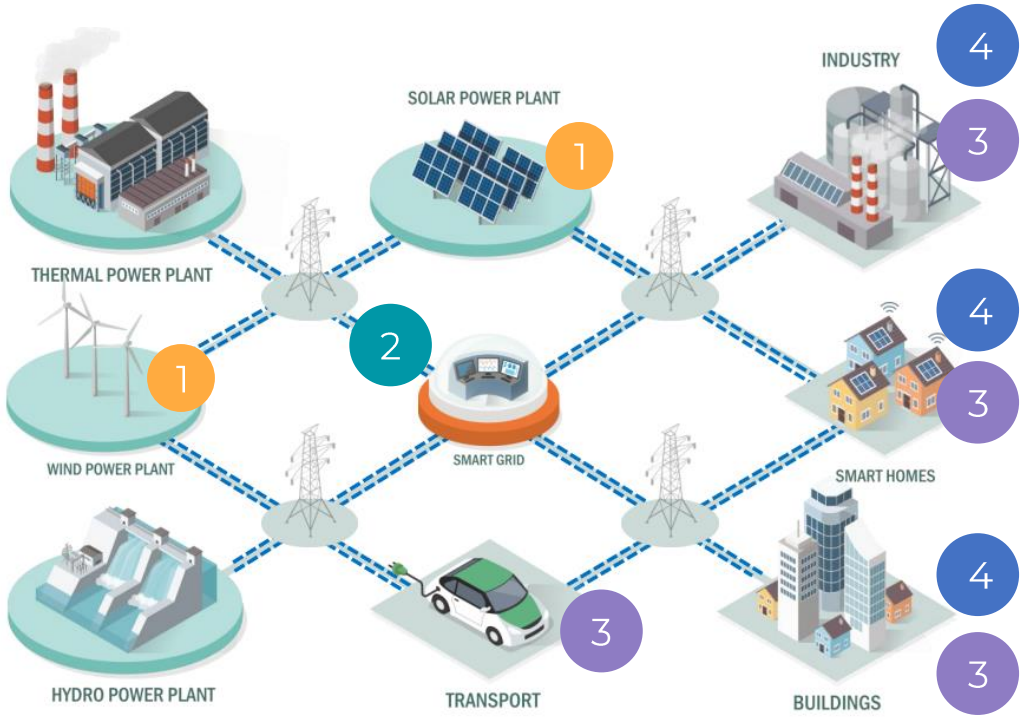
(Power plants, power grids)

- Reduce O&M costs (*Potential USD 80 million cost saving per year*)
- Extend lifetime
- Improve efficiency
- Enhance stability

Source: IEA (2021): Power System's Digital Transformation

Key Drivers: ASEAN Energy Transition

B. Digitalization



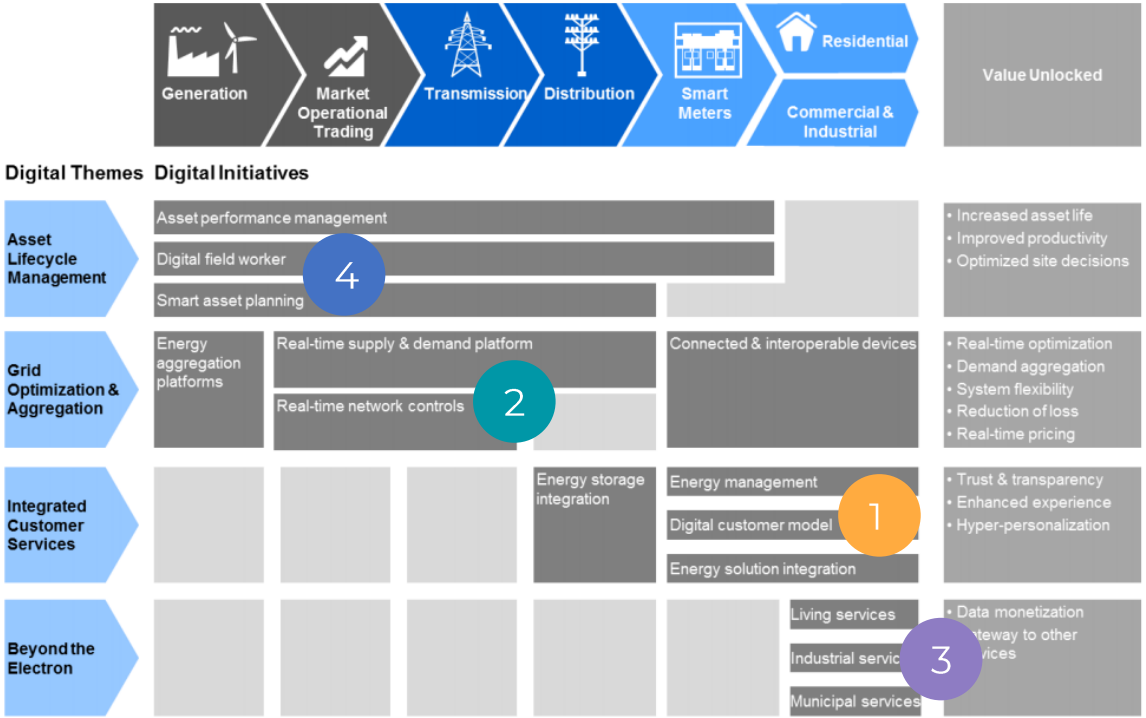
Adapted from IEA (2021): Power System's Digital Transformation

Why digitalizations for electricity sector?

1. **Variable renewable energy** generation (e.g., wind, solar, etc.)
2. **Multi-directional** electricity flow (e.g., distributed generation)
3. **Sector coupling** (e.g., electric vehicle, electrification of heating & cooling)
4. **Roles of electricity consumer** increase (e.g. prosumers, demand response, etc.)

Key Drivers: ASEAN Energy Transition

B. Digitalization



Source: WEF(2016) Digital Transformation of Industries ; New Work Academy, DENA-Big Data Meets Energy

Example application of digitalization

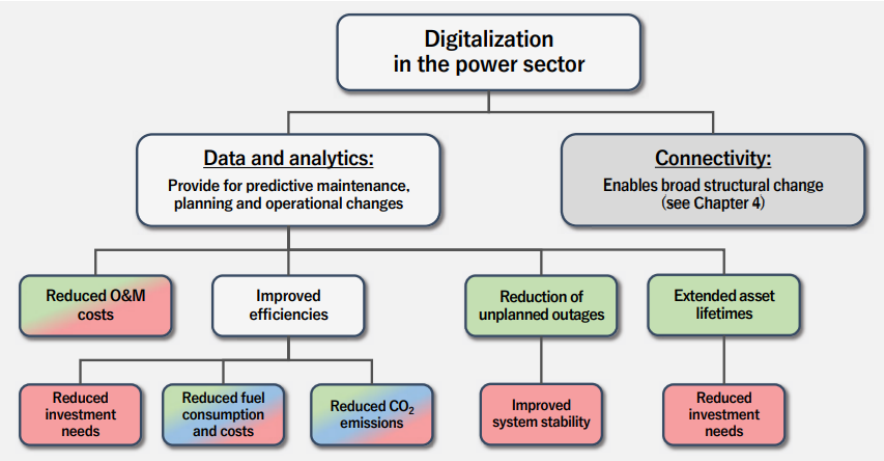
1. Demand side management
2. Grid efficiency & resilience
3. Digitally enabled business model - e.g. pay-as-you-go (PAYGo)
4. Preventive Maintenance

etc.

Key Drivers: ASEAN Energy Transition

B. Digitalization

Digitalization in the energy sector create values in **power system operation, financial, and environmental aspects**



Source: IEA (2021): Power System's Digital Transformation

System operation Financial Environmental

Digitalization in the energy sector has the **highest potential in greenhouse gas mitigation** (compared to transport, manufacturing, and agriculture)

POTENTIAL ABATEMENTS BY COUNTRY AND SECTOR FOR THE AMBITIOUS SCENARIO

	HEAT AND POWER		TRANSPORT		MANUFACTURING AND CONSTRUCTION		AGRICULTURE		TOTAL
BRAZIL	-10	10%	-20	20%	-15	15%	-55	55%	-100
CHILE	-15	58%	-8	33%	-1	5%	-1	4%	-25
CHINA	-777	55%	-234	17%	-325	23%	-65	5%	-1401
INDIA	-198	38%	-122	23%	-133	25%	-72	14%	-526
KENYA	-4	31%	-2	13%	0	4%	-6	53%	-12
SOUTH AFRICA	-26	59%	-3	7%	-7	17%	-7	17%	-44
VIETNAM	-14	38%	-5	15%	-13	36%	-4	11%	-35
TOTAL	-1043		-394		-495		-211		-2143

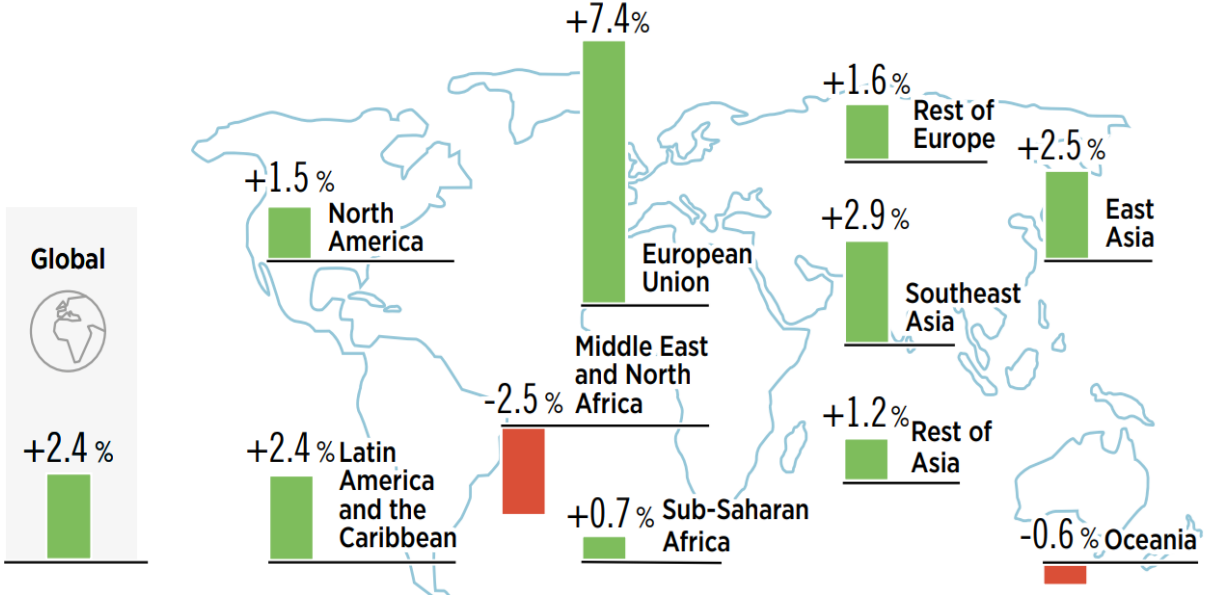
ALL ABATEMENT FIGURES ARE IN MT CO2E PER ANNUM.
THE (%) FIGURES REPRESENT THE SECTOR PERCENTAGE SHARE OF THAT COUNTRY'S TOTAL POTENTIAL ABATEMENT.

Source: GeSI-Digital Solutions for Climate Action

Macroeconomic Benefit of Energy Transition

- **GDP Growth**
- **Employment Growth**
- **Increased Global Welfare**
- **Greenhouse Gas Mitigation**

Energy Transition can accelerate GDP growth due to increased investment & changes in consumer expenditures

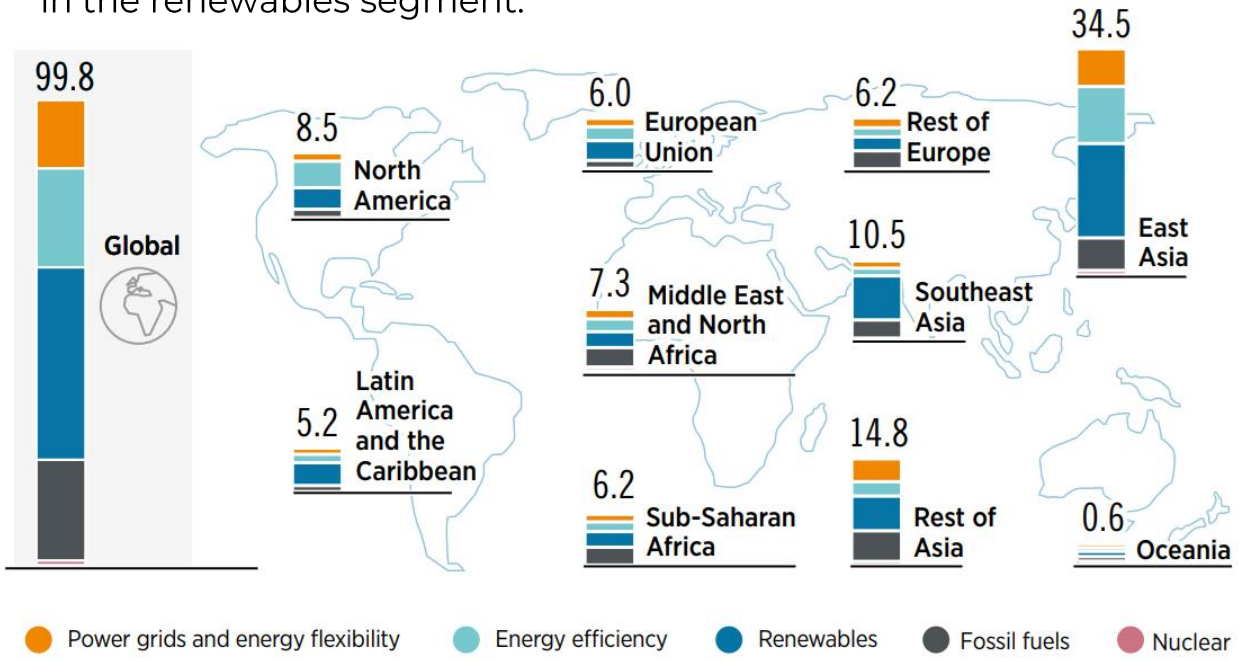


Source: IRENA (2020) - Global Renewables Outlook (2020 Edition)

Macroeconomic Benefit of Energy Transition

- GDP Growth
- **Employment Growth**
- Increased Global Welfare
- Greenhouse Gas Mitigation

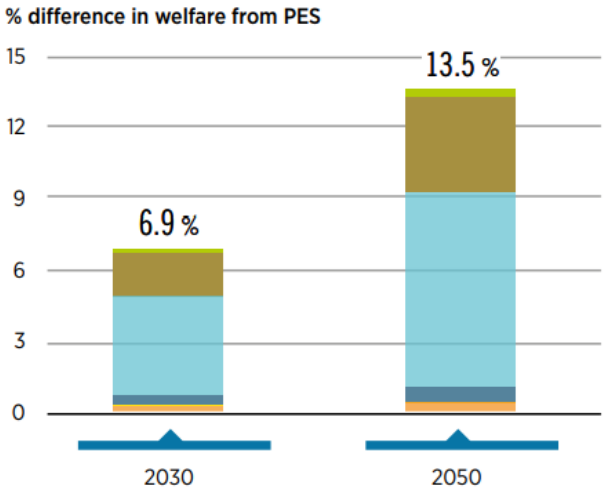
Energy Transition create employment. Majority of the jobs will be in the renewables segment.



Source: IRENA (2020) - Global Renewables Outlook (2020 Edition)

Macroeconomic Benefit of Energy Transition

- GDP Growth
- Employment Growth
- **Increased Global Welfare**
- Greenhouse Gas Mitigation



Based on IRENA analysis

Economic
- Consumption and investment
- Employment

Social
- Education
- Health

Environmental
- Greenhouse gas emission
- Material consumption

Source: IRENA (2020) - Global Renewables Outlook (2020 Edition)

Macroeconomic Benefit of Energy Transition

- GDP Growth
- Employment Growth
- Increased Global Welfare
- **Greenhouse Gas Mitigation**

	2017	2030	2050
East Asia	11.2 Gt CO_2/yr	8.4 Gt CO_2/yr	2.2 Gt CO_2/yr
European Union	3.4 Gt CO_2/yr	1.9 Gt CO_2/yr	0.6 Gt CO_2/yr
Latin America and the Caribbean	1.2 Gt CO_2/yr	1.0 Gt CO_2/yr	0.6 Gt CO_2/yr
Middle East and North Africa	2.5 Gt CO_2/yr	2.0 Gt CO_2/yr	1.1 Gt CO_2/yr
North America	6.2 Gt CO_2/yr	3.7 Gt CO_2/yr	1.4 Gt CO_2/yr
Oceania	0.4 Gt CO_2/yr	0.4 Gt CO_2/yr	0.1 Gt CO_2/yr
Rest of Asia	3.5 Gt CO_2/yr	3.8 Gt CO_2/yr	2.0 Gt CO_2/yr
Rest of Europe	2.0 Gt CO_2/yr	1.6 Gt CO_2/yr	0.7 Gt CO_2/yr
Southeast Asia	1.4 Gt CO_2/yr	1.6 Gt CO_2/yr	0.8 Gt CO_2/yr
Sub-Saharan Africa	0.8 Gt CO_2/yr	0.6 Gt CO_2/yr	0.3 Gt CO_2/yr

Southeast Asia

2017	2030	2050
1.4 Gt CO_2/yr	1.6 Gt CO_2/yr	0.8 Gt CO_2/yr

Source: IRENA (2020) - Global Renewables Outlook (2020 Edition)

Key Challenges, Strategy & Action Plan

Key Challenges

A. Energy Sector

1. Post-pandemic impact to national and regional energy planning, especially on power sector
2. Readiness of workforces in Renewable Energy Sector and limited mobility due to travel restriction
3. Reliability of Power Sector (both vertically integrated and open market present both present different issues)
4. Renewable Energy curtailment due to grid capacity
5. Geographical and topological constraints to push clean energy due to high capital cost and other technical limitation

Key Challenges

B. Economics and Policy Sector

1. Lack of understanding toward our energy-economics causality in each country which leads to less accurate approach of policy making
2. Unstable and unpredictable regulatory framework and policies in Renewable Energy Deployment
3. Complex policies for inter-regional electricity trade, pricing approach and investment scheme in power sector
4. Financial/economic consideration to develop affordable energy system especially in rural areas or outer area (border)
5. Pre-existing socio-political conditions that clouded the urgency to adopt renewable energy

3. Strategy & Action Plan

Gap Analysis

Source: UNESCAP (2020). Regional Energy Trends Report 2020.

	Energy Efficiency	Renewable Energy Targets
Target	To reduce **energy intensity** by 32% in 2025 based on 2005 level.	Aspirational target to increase the component of **renewable energy** to 23% by 2025 in ASEAN Energy Mix.
Current Status	In the area of Energy Efficiency and Conservation (EE&C) programme, ASEAN achieved an Energy Intensity (EI) reduction of 21% by 2018, surpassing its aspirational target of 20% in 2020 (over 2005 levels).	Current share of renewable energy in regional primary energy supply at around 15% (IEA, Southeast Asia Energy Outlook 2019)
Gaps	• Trends towards low carbon economy • Standards and development of energy-saving technologies • Increased consumption of electricity for building, transport and industrial sectors • Low economic growth, post-pandemic	• Room for harmonizing national policy targets with regional aspirational targets • Slow deployment of large-scale renewable energy systems • Minimum access to RE financing • Unsustainable energy pricing

Accelerating SEA Pathways to Energy Transition

1. Expanding Renewable Energy Supply and Infrastructure

- Workforce on RE
- RE technology and digitalization focusing on storage and grid reliability
- Regional collaboration to accelerate the adoption of RE
- Further study at 'unbundling' of electric system

2. Redirecting Governance and Policy Toward Energy Reform

- Policy integration for countries in ASEAN with similar market structure and topography
- Subsidy curtailment on fossil, pricing externalities
- Transparency and predictability to attract investment (mainly LNG and RE)

3. Focusing on Sustainability and Energy Efficiency

- Energy literacy and building efficiency
- Socio-environmental research for sustainable RE development (wind turbine, batteries, PV cells)
- Biodiversity protection (electronic waste, noise air & land pollution).

4. Enhancing Off-grid and Rural Energy Access

- Enabling environment for private sector to invest on RE for microgrids
- Ensuring affordability and availability of energy resources
- Integration (Clustering) of lessons learned from other member states

Thank You

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