



The Importance of Power Supply Mix on Energy Security and Sustainable Development

Yanfei Li
Energy Economist
Economic Research Institute for ASEAN and East Asia

Symposium on Sustainable Power Supply Mix in the Future
20 Nov 2015, Novotel Bangkok On Siam Square, Bangkok, Thailand

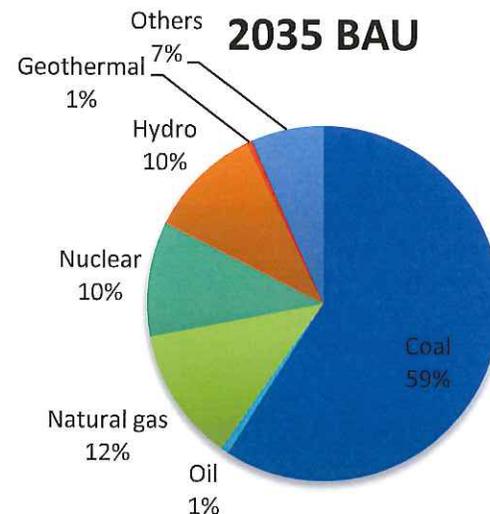
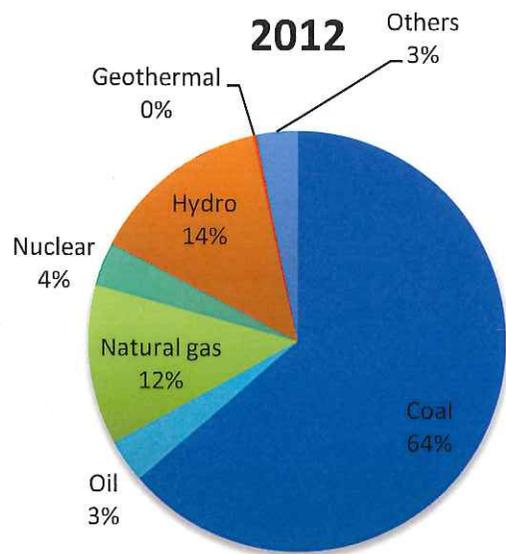


Outline

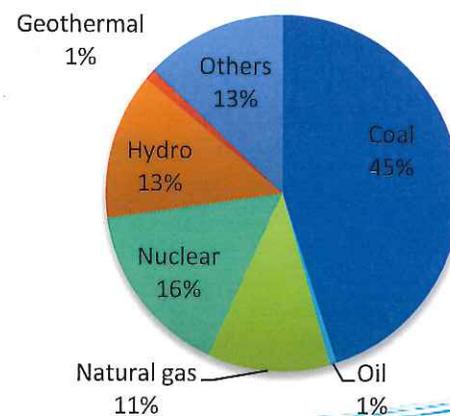
- The status of power generation mix in EAS and ASEAN
 - Energy security vs. sustainable development
 - Can we improve both?
 - What are the highlighted solutions?
 - What are the barriers and challenges of these solutions?
 - Clean coal?
 - Natural gas?
 - Renewables?
 - Nuclear?
 - Power grid interconnection?
 - Energy management system?
- } Supply side
- } Demand side

- Conclusions and policy implications

What Power Supply Mix Do We Have in the EAS Countries

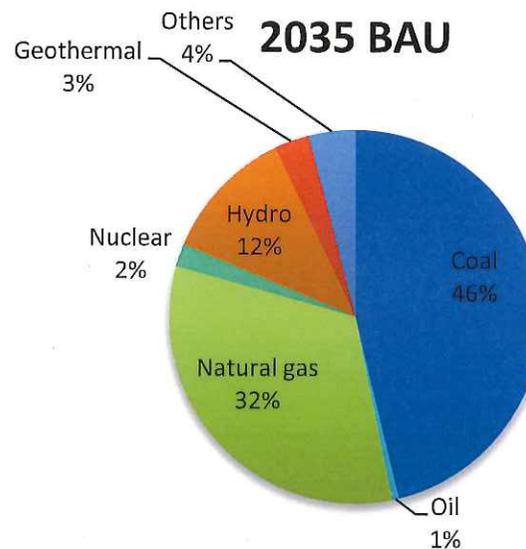
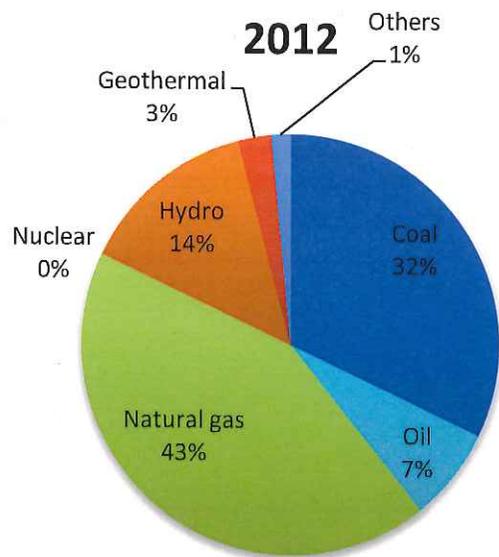


2035 APS

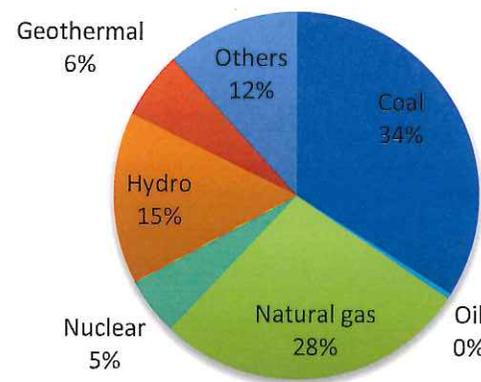


Source: ERIA (2015)

Power Mix in ASEAN

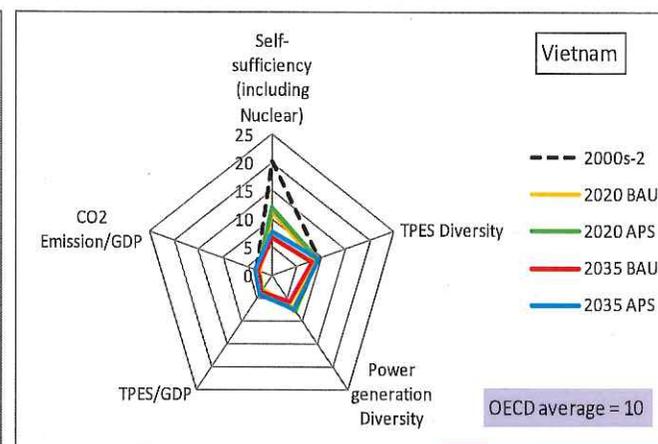
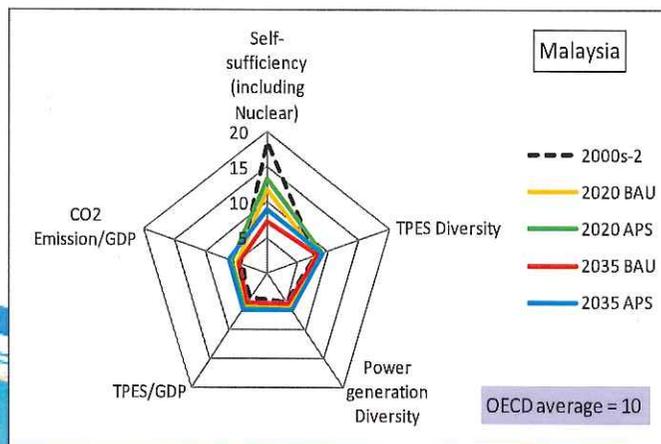
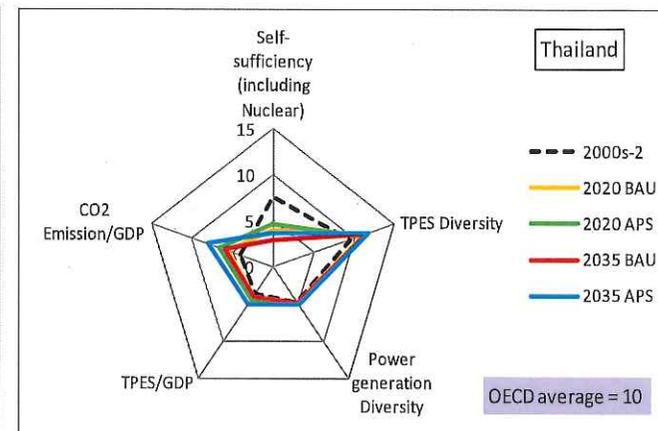
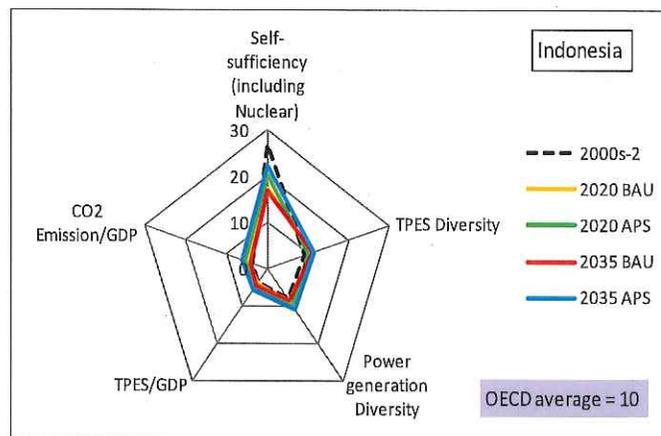
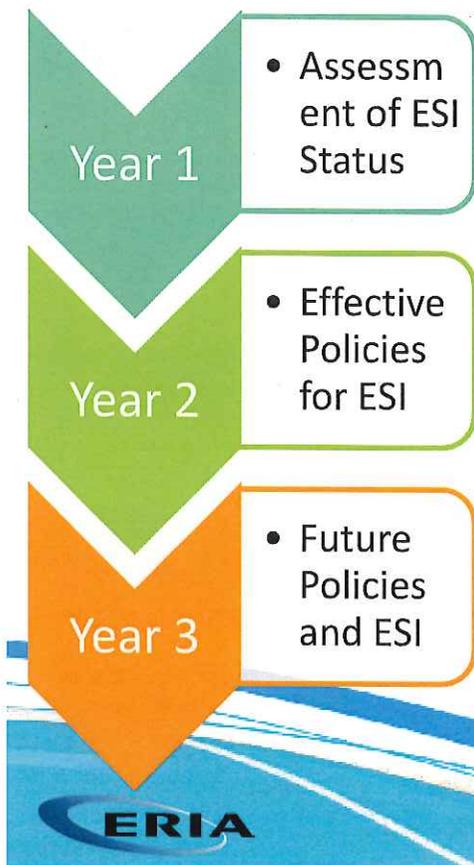


2035 APS



Source: ERIA (2015)

Energy Security Index for ASEAN Countries I



Energy Security Index for ASEAN Countries II

- Key Observations:
 - Worsening trend in self-sufficiency
 - Many countries improve in diversity, while others are not due to domestic policies or resource endowment
 - Most countries expected to keep improving on energy efficiency
 - ESIs generally improve in the Alternative Policy Scenario (APS)

- Policy Implications
 - Diversify energy sources that are used as well as the partner countries involved in the import of energy
 - Expand the clean and efficient use of coal, complemented by renewable energy and maybe natural gas
 - Strengthen mutual interdependence in the region, through mechanisms such as APSA, TAGP and APG
 - Implement demand-side management measures
 - Prepare for the possibility of supply disruptions as import dependency increases

Power Infrastructure Development Plans of ASEAN Countries

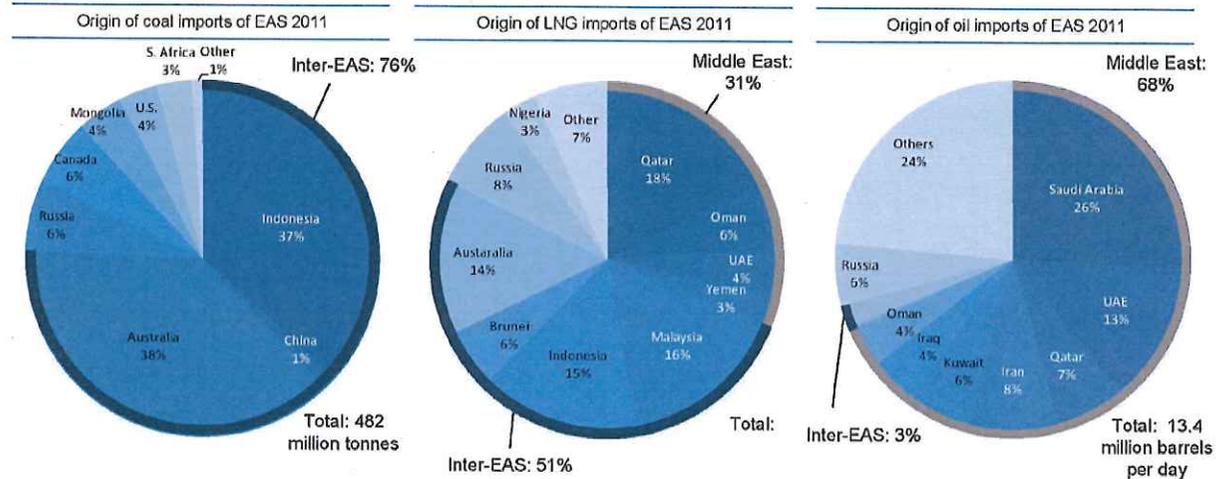
Country	Priority
Brunei	Natural gas, import, renewables
Cambodia	Hydro, coal
Indonesia	Coal, natural gas, hydro, renewables (esp. geothermal)
Laos	Hydro, coal
Malaysia:	Coal, natural gas, hydro, renewables, nuclear
Myanmar	Hydro, renewables, coal
Philippines	Natural gas, coal, hydro, diesel, geothermal
Singapore	Natural gas, renewables
Thailand	Import, renewables, coal, natural gas, nuclear
Vietnam	Coal, hydro, renewables, natural gas, nuclear

The Benefits of Clean Coal

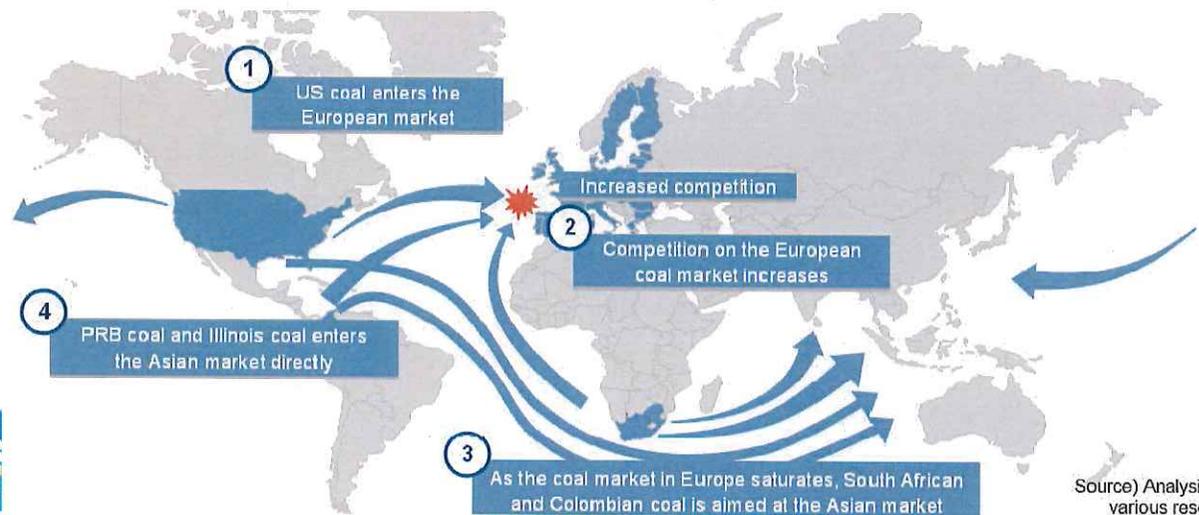


Clean Coal Technology Offers an Option for Both Security and Sustainability

- The EAS region has ample reserves and production of coal
- Historically, coal supply does not rely on the Middle East
- The shale gas revolution in the U.S. will drive the supply of the Western hemisphere (U.S., Columbia, and South Africa) to this region
- The supply of coal will thus be diversified and secured



Source) Compiled from IEA Natural gas information, Coal information, GTA data, Japan's trade statistics and original estimation

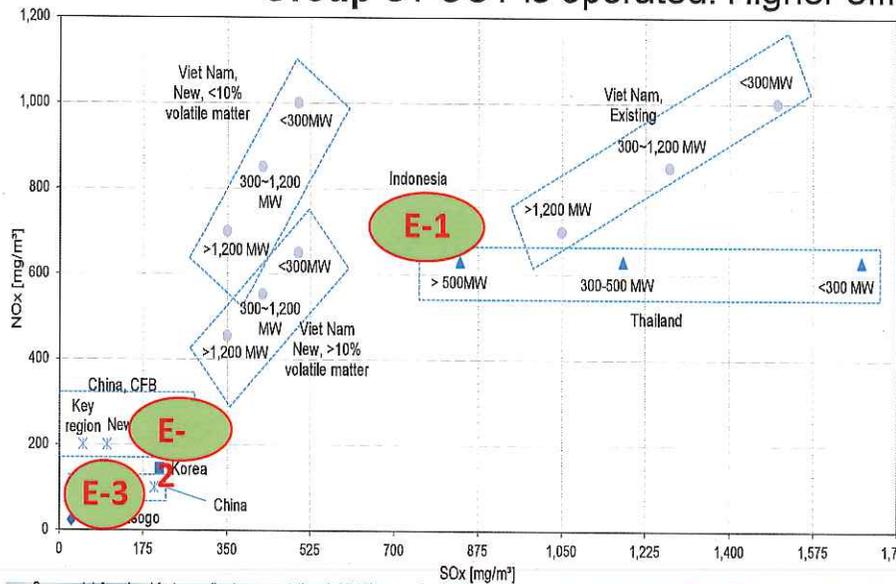


Source) Analysis from various resources



Clean Coal Technology: Technological Potential Map – Environmental Guideline

- Environmental standards should be harmonized across the EAS region.
- Countries in EAS region is classified into 3 groups depending CCT introduction situation
 - **Group A:** Non Coal-fired Power Plant (CFPP) or small CFPP in country. CCT introduction is expected in near future. (Myanmar, Lao, etc.)
 - **Group B:** CFPP already exist and CCT is introduced or planned. Promotion of CCT is expected. (India, Indonesia, Malaysia, Thailand, Vietnam).
 - **Group C:** CCT is operated. Higher efficiency CCT is promoted. (Korea, Japan, China)



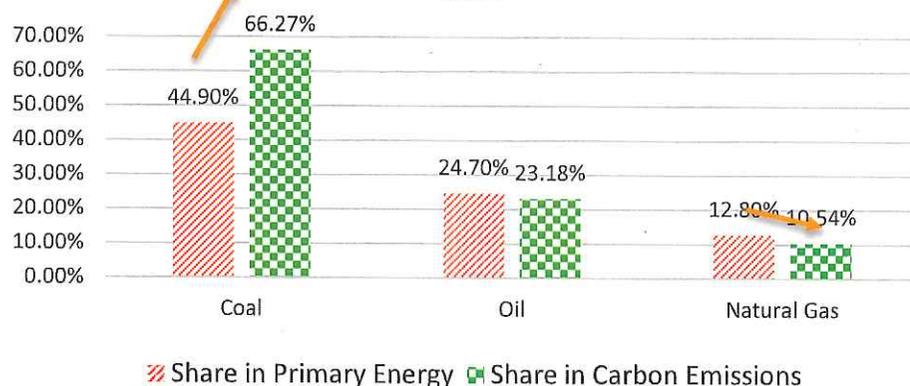
Guideline		E-1	E-2	E-3
Target Group		A	B	C
Environmental Target (mg/m ³)	SOx	<700	<250	<50
	NOx	<700	<250	<50
	PM	<100	<50	<10
Applicable Technology	SOx	FGD	←	←
	NOx	Low NOx Burner	deNOx unit	←
	PM	EP	←	High efficiency EP
	Others			Removal of heavy metal elements
CO ₂ reduction				CCS

The Challenges for Natural Gas



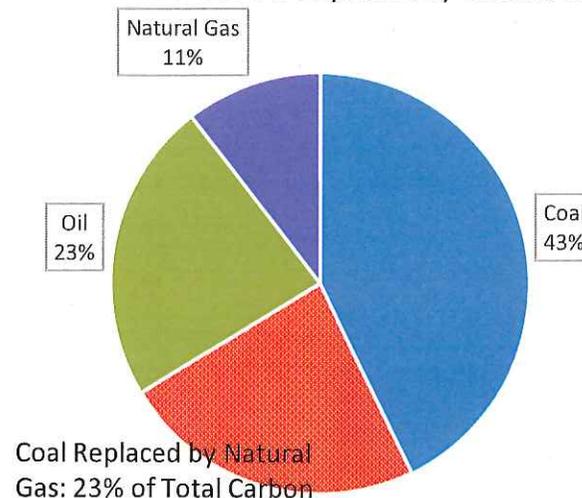
Outlook of clean energy and the role of natural gas in the EAS region (II)

Share in Primary Energy vs. Share in Carbon Emissions by 2035



Source: ERIA

Regional Carbon Emissions Cut by 23% if All Coal-fired Power Generation is Replaced by Natural Gas

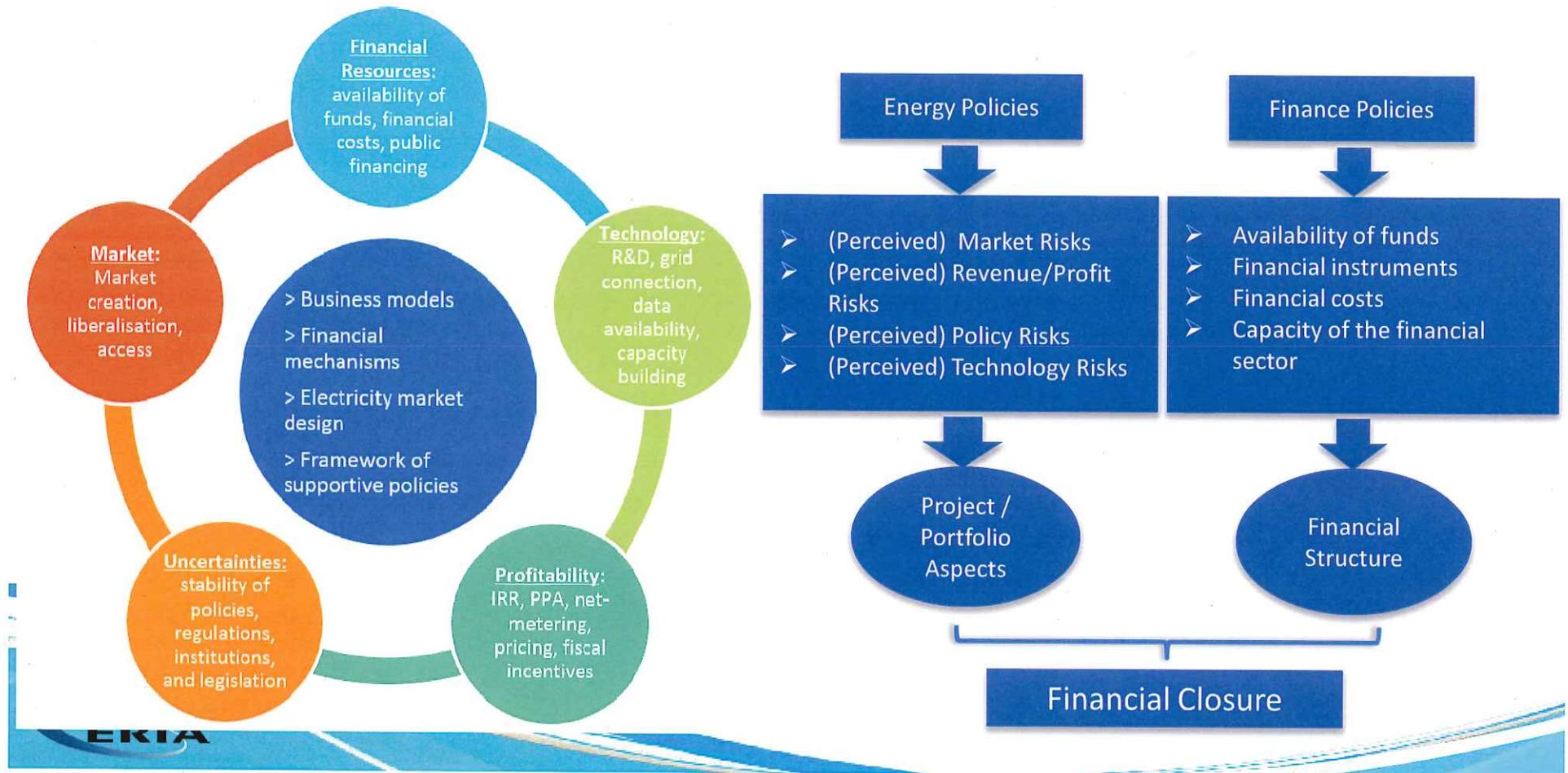




Challenges for Adoption of New and Renewable Energy



Financing Renewable Energy



Highlighted Policy Implications

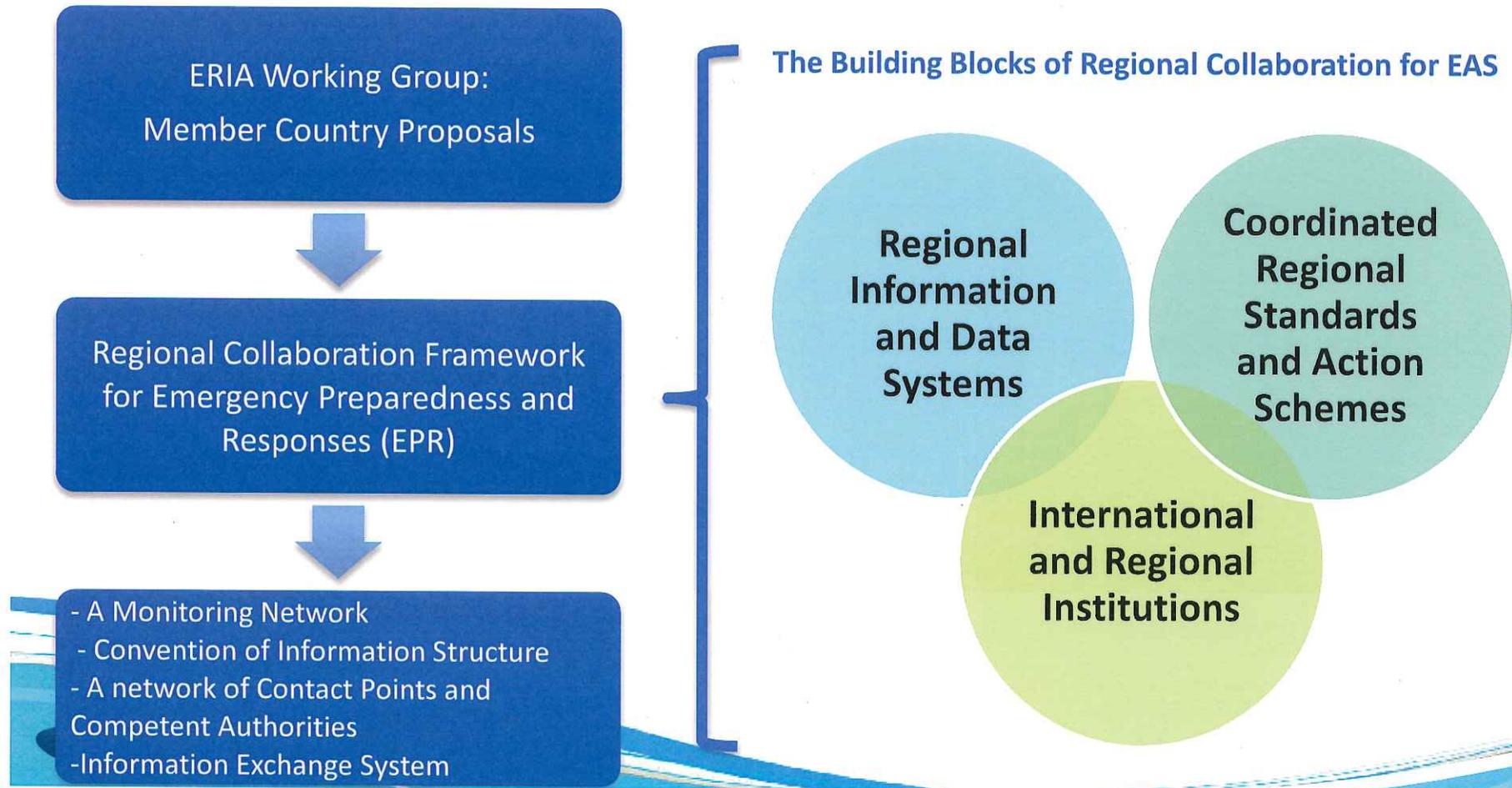
- **Mitigating risks** of investment in renewable energy (RE), which requires addressing issues in **market, uncertainty (institutional), profitability, technology, and financial resources**, should be the focus of RE policies.
- Incentives and technical support in **RE resource measurement** activities are required and to be enhanced.
- Effective business models and support policies to be identified for **distributed generation, roof-top solar, and off-grid RE generation systems**.
- **Green bonds/instruments market** needs to be developed in the region, especially after the Basel III regulations.
- **Upstream policies** for RE industries have significant impact on RE investment in the downstream.

There is also the risk of over-investment

Are We Ready to Embrace Nuclear Energy?



Study on International Cooperation Concerning Nuclear Safety Management in East Asian Countries (2014)



The Guideline and Cooperative Framework

- Membership
- Language
- Information and communication tool in emergency
- Timing to inform
- Maintenance of 24-hour contact system
- What kind of information to be shared in usual situation
 - Information exchange by using data server or email
- Frequency of training and drills
- Resources
- Revision of the “guideline”
- Ad hoc groups and etc.

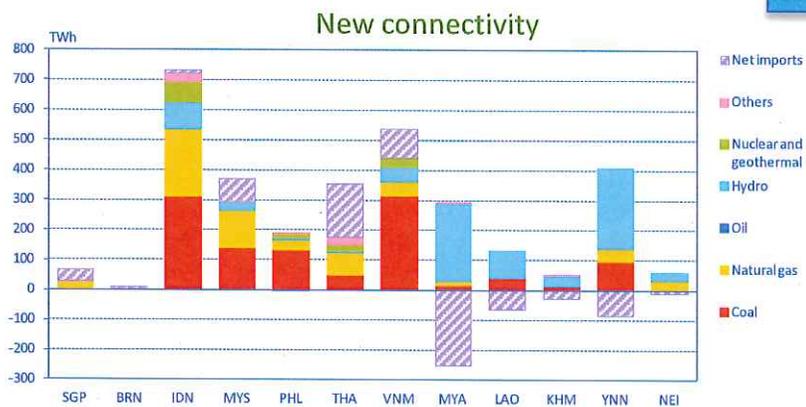
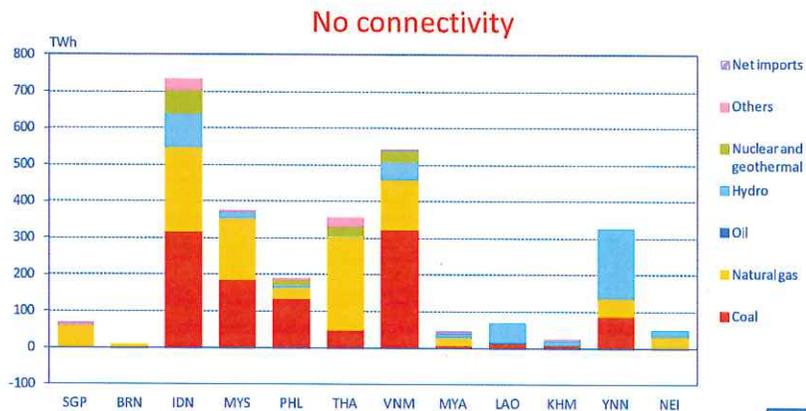
Sample Structure from the Nordic Manual

1. **Scope**
2. **Co-operation in emergency preparedness**
 - 2.1 **Nordic Working Group of Emergency Preparedness (NEP)**
 - 2.2 **Exercises and drills**
 - 2.3 Nordic contribution to international work
 - 2.4 **Exchange of background information regarding emergency arrangements**
 - 2.5 Public information
3. **Response arrangements**
 - 3.1 **Communication policy between the Nordic authorities during emergencies**
 - 3.2 Notification and exchange of information
 - 3.2.1 Threshold of dissemination of information
 - 3.2.2 Communication means
 - 3.2.3 Public information issues
 - 3.3 **Co-operation and co-ordination during response phase**
 - 3.3.1 Co-operation regarding safety assessments and protective measures
 - 3.3.2 Additional exchange of information of urgent nature between the Nordic authorities and Russian or Lithuanian nuclear installations
 - 3.4 Assistance
4. **Revision of this document**

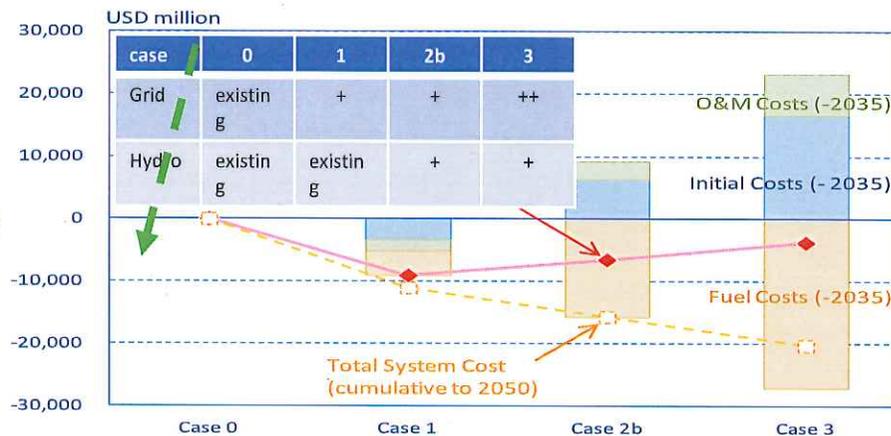
The ASEAN Power Grid Interconnection Bears Many Benefits



Effective Investment of Power Infrastructure in East Asia through Power Grid Interconnection I



System costs and cumulative savings by case



Investment on Power Grid Interconnection

Highlighted Power Grid interconnections



- Grid interconnection seems to provide enough economic benefit, besides energy security and carbon reductions, to rationalize large investment amount for interconnection.

Route	Interconnection line construction cost		Net benefit (gross benefit - line cost)		Benefit/Cost ratio
	Mil. USD	US¢/kWh	Mil. USD	US¢/kWh	
THA-LAO	1,400	0.25	19,881	3.51	14.2
VNM-LAO-THA	1,950	0.29	22,610	3.36	11.6
LAO-THA-MYS-SGP	1,860	0.26	25,490	3.60	13.7

Challenges:

- Set up regional regulatory body to harmonize regulations and standards relevant to grid interconnection.
- Create a regionally coordinated investment mechanism that optimizes the future investment plan of power station and grid.

On the Demand Side

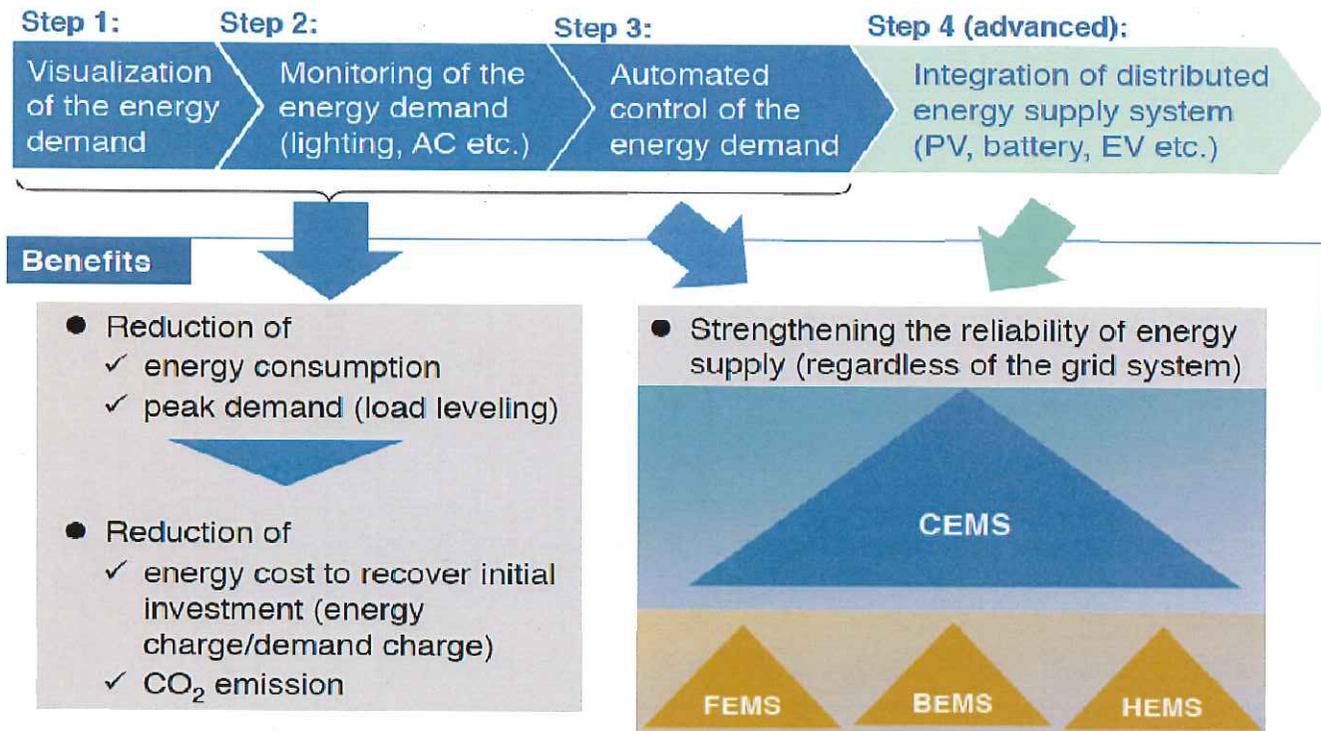
- Energy Efficiency and Conservation Should not be Overlooked



Advancement of the Energy Management System

Key Issues: The needs of EMS technologies in the EAS countries

- Identify applicable EMS technologies and analyze the impacts and potential
 - Case studies on PT PLN head office building (Indonesia) and MEA Nonthaburi District Office (Thailand)
- Integrated and progressive approach towards the adoption of EMS, namely
 - Manner & Attitude
 - Optimize the operation existing facilities
 - Invest in highly-efficient technologies



The Challenges:

- Economics
- Financing
- Energy market reform and integration
- Regional cooperation
- Political and geopolitical complications



Some Highlighted Policy Implications

- ASEAN countries face *fast-increasing energy demand*, *reduced self-sufficiency* and *the call for sustainable development* – clean energy, although progress has been made in *enhancing diversification*
- No single technology or solution could guarantee improved energy security and sustainable development in the power sector of ASEAN countries. A mixed approach should be taken, with the following components considered:
 - *Clean coal technology* and *new renewables* are increasingly becoming competitive, but both need policies to *discourage the use of low efficiency and high GHG emissions technologies* as well as to support on *financing*
 - Investment into energy infrastructure, including generation assets, power grid assets and energy management systems should be *optimized* and *accelerated*.
 - *Power grid interconnection*, especially with *multilateral exchange of electricity* bears many benefits will lower the power system costs and investment needs for all participating countries
 - *cross-border energy cooperation* must be accelerated