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Sustainability Challenges for Electricity Industries in ASEAN Newly Industrializing Countries

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IASTED Conference on Power and Energy Systems

Phuket, Thailand, November 24th – 26th 2010

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Presentation Outline

- **Background**
  - Sustainability aspects and the electricity industry
  - Background of ASEAN
- **Overview of the ASEAN-5**
  - Social and economic context
  - Electricity demand situations
- **Description of 3A's energy sustainability objectives framework**
- **Sustainability challenges in electricity industries in ASEAN-5 and their implications**

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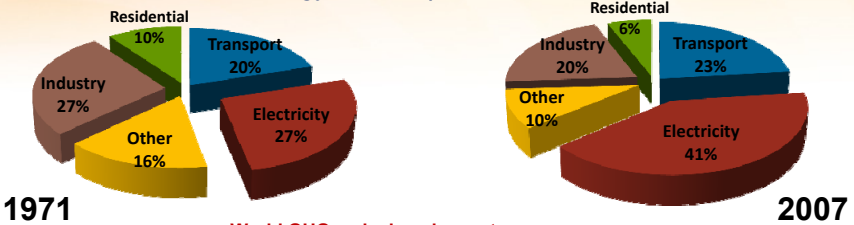
Sustainability and the Electricity Industry

- Energy sustainability involves vital social, economic and environmental dimensions
  - *Social – energy is a human basic need which improve quality of life*
  - *Economic – energy consumption is a key driver in economic growth*
  - *Environmental – energy consumption leads to GHG emissions*



World GHG emissions by sector (IEA, 2009)

- The electricity sector presents sustainability challenge given its role in socioeconomic development and environmental deterioration

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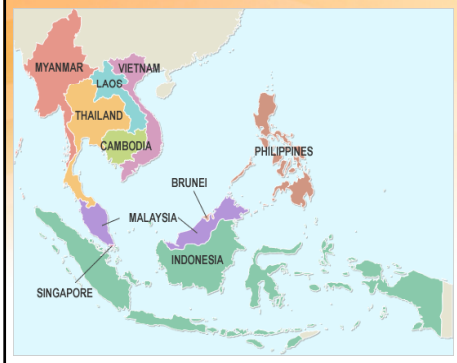
Background of ASEAN



- Large population size
- Rapid economic expansion
- Play an increasing role in the world energy demand
  - *Rapid energy demand growth due to socioeconomic development*
  - *4.3% share of world energy demand compared with 2.1% in 1980*
  - *Share of global CO_2 emissions is 3.5% compared with 1.1% in 1980*

- Low per capita energy consumption - *one fifth of the OECD.*
- Five largest energy consumers in ASEAN are Indonesia, Thailand, Malaysia, Philippines and Vietnam – **referred as ASEAN-5**

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Characteristics of ASEAN-5

- Countries in ASEAN-5 share some important characteristics
  - Large population and rapid urban growth
  - Improving social development (based on the HDI)
  - Rapid economic growth 5-8% on average
  - Increasing per capita income
  - Increasing contribution of industry sector value added to GDP at the expense of service and agricultural sectors - *moving towards industrialisation.*
- According to the International Energy Agency (IEA), the above factors constitute the major factors in electricity demand growth in developing countries.

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Energy Sustainability Framework

- Apply the 3A's energy objectives as a sustainability analytical framework to analyse sustainability challenges in electricity industries in ASEAN-5

Accessibility	• Access to electricity at prices that are affordable and sustainable (i.e. reflect marginal & external costs)
Availability	• Reflects energy security aspect which cover short-term quality of supply and long-term continuity of supply
Acceptability	• Relates to public attitudes and the environmental impacts. This aspect also include nuclear security issues

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Indicators and Criteria

- Draw together a set of indicators and criteria to assess each aspect of the 3A's energy objectives under the electricity industry context

3A's Energy Objectives	Dimension	Indicators and Criteria
Accessibility	Affordable price	1) Electricity prices ($)
		2) Avg. expenditure on electricity bills (% of income)
		3) Electricity tariff subsidy
	Energy Services	4) Electrification rate (%)
		5) Electricity intensity (kWh/GDP)
		6) Electricity consumption per capita (kWh)

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Indicators and Criteria

3A's Energy Objectives	Dimension	Indicators and Criteria
Availability	Short-term reliability of supply	1) Reserve Margin (%)
		2) SAIFI (no. of interruptions/year), SAIDI (minutes/year)
		3) Reliability operating standards (Checklist)
		4) Cross-border interconnections (Checklist)
	Long-term continuity of supply	5) Fuel mix in electricity generation (% share)
		6) Reliance of import (fuel and electricity)
		7) Fuel diversity (Shannon-Wiener Index)
Acceptability	Safety	1) Strategy for nuclear power
	GHG emissions	2) Renewable energy policy
		3) Share of renewable energy in electricity generation
		4) CO_2 emission per capita
		5) CO_2 intensity

Acceptability is mostly related directly or indirectly with CO_2 emissions

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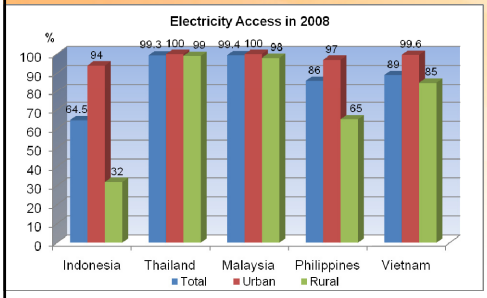
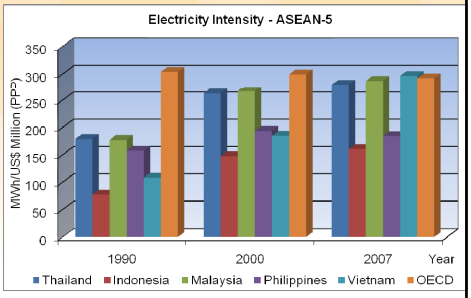
Accessibility



Data source: IEA, "World energy outlook 2009"



Data source: World Bank

- Electrification rate
  - *Urban - Nearly 100%*
  - *Rural - low in Indonesia & Philippines due largely to geographical barriers*
- Electricity intensity is increasing
  - *Electricity consumption grew faster than economic growth*
  - *Likely due to structural change of economy and increased electricity access*

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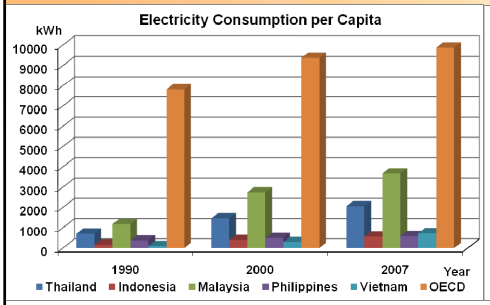
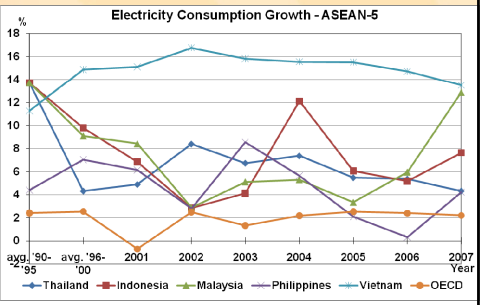
Accessibility

Data source: World Bank





- Per capita electricity consumption is still well below OECD average.
- But electricity consumption growth rate is quite high
  - *especially Vietnam – corresponds to the economic growth*
- Increased electricity consumption have subsequent impact on the environment – particularly CO_2 emissions

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Availability

Short-term reliability of supply

Country	Reserve Margin (%)	Cross border interconnection	SAIFI*	SAIDI* (minutes)
Thailand	25	Malaysia & Laos PDR	1.85	45.9
Indonesia [a]	Deficit	-	6.8	293
Malaysia [b]	40	Thailand & Singapore	Not available	68.6
Philippines [c]	30	-	1.15	80
Vietnam	25	China, Laos PDR & Cambodia	Not Available	Not Available

* At distribution level
[a] Java-Bali network
[b] Malaysia (Peninsular)
[C] Philippines (Luzon)

- For reasonable electricity supply: SAIFI = 0.9 – 0.92 interruptions, SAIDI = 53.4 - 69.6 minutes/year
- Typical reserve margin targets – 18 to 25% (IEA, 2002)
- Lack of interconnections in Indonesia & Philippines

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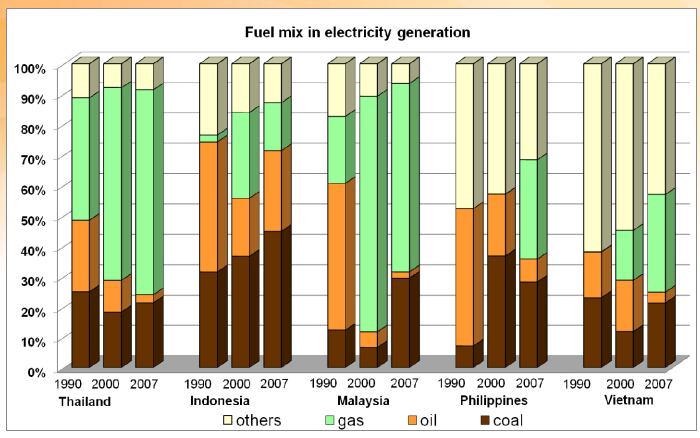
Availability



Long-term continuity of supply

Data source:
IEA, "Electricity information 2009"

- Increased use of natural gas except Indonesia
- Share of coal increased again after 2000

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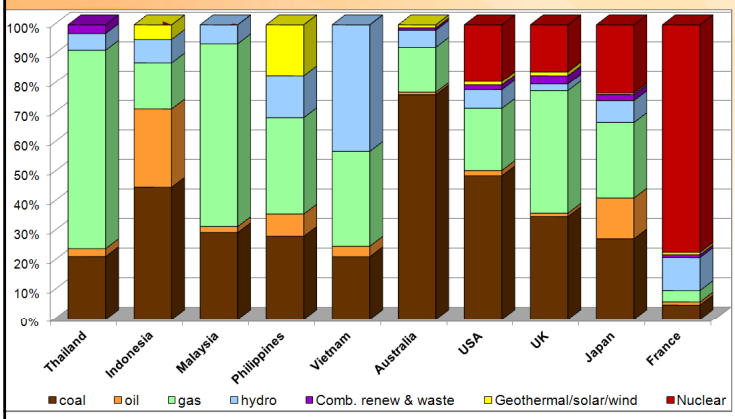

Long-term continuity of supply

Data source:
IEA,
"Electricity information 2009"

- Thailand & Malaysia highly dependent on natural gas ~ 60%
- Relatively well diversified fuel mix in Indonesia, Philippines, Vietnam

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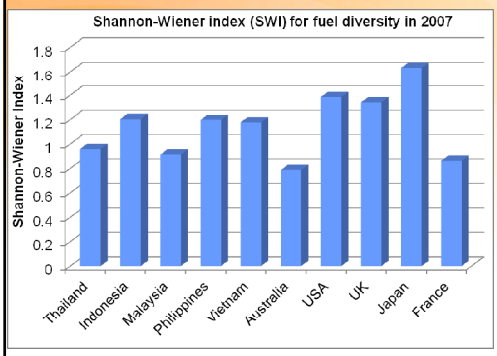

- SWI is applied to measure fuel diversity
  - *SWI < 1.0 – highly dependence on a particular fuel*
  - *SWI > 2.0 – numerous fuel sources*

- Thailand, Malaysia – SWI < 1.0 due to high dependence on gas
- Higher SWI in Indonesia, Philippines, Vietnam
- But SWI does not reflect fuel types – energy security implications
  - *i.e. Significant share of oil in Indonesia affects energy security*

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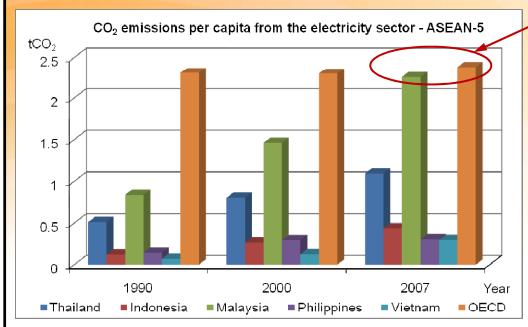
Acceptability

Environmental Acceptability



Data source: IEA, "CO_2 emissions from fuel combustion, 2009 edition"

Relatively close to OECD!!

- CO_2 emissions are still below those of OECD but the rate of increase is rather alarming
  - *Increased between 100-300% since 1990*
  - *While emissions in OECD remain rather constant*

- Many factors contributed to CO_2 emissions – i.e. fuel mix, efficiency of generating plants.

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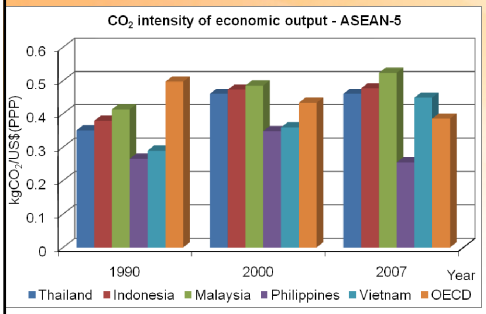
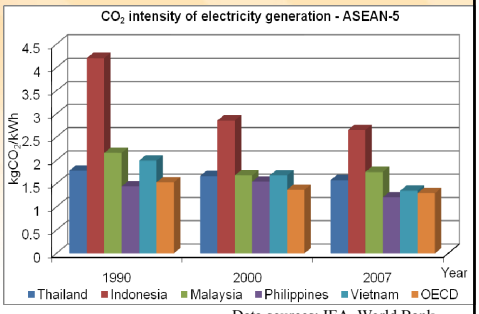
Acceptability

Environmental Acceptability





Data sources: IEA, World Bank

- CO_2/GDP is increasing, except Philippines
  - *CO_2 emissions from the electricity sector outpaced economic growth*
  - *Responds to changes in electricity intensity*
- CO_2/kWh is decreasing
  - *Change in fuel mix – to lower emitting natural gas*

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Acceptability

- Keen interests by the Governments in nuclear power
  - *Meet rising demand and reduce fossil-fuel dependence*
- Considerable social and environmental implications
  - *Lack information and regulations concerning safety, waste management, etc. – led to social consensus issues*
  - *Directions in addressing these issues are still unclear*

Thailand	Plan for 2000MW to be operated in 2020-2021.
Indonesia	Planned to build 4 nuclear plants by 2025 but was cancelled due to tight credit and public opposition.
Malaysia	Express interest in the possible deployment of nuclear power after 2020
Philippines	Plan for 2400 MW of nuclear power during 2025-2034 and also contemplating reviving the Bataan nuclear power plant (mothballed in '86)
Vietnam	To commission the first nuclear plant in around 2017-2020.

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Acceptability

- The ASEAN-5 see the importance of renewable energy
  - *to mitigate rising CO_2 emissions and enhancing energy security*
- Policies and targets to promote renewable energy
  - *Feed-in tariffs, investment incentives (i.e. tax & duties exemption)*
- Promising technical potential for renewable energy resources
  - *Biomass, geothermal, mini- & micro-hydro and solar*
  - *But still largely unexploited*

Country	Share of non-hydro Renewable capacity	Share of Renewable capacity (with hydro)
Thailand	2.9%	8.6%
Indonesia	4.9%	12.9%
Malaysia	0%	6.4%
Philippines	17.2%	31.6%
Vietnam	0%	43%

- Although some off-grid solar PV i.e. water pumping, lighting

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Country	Renewable energy policy
Thailand	**Target**: increase renewable generation capacity by 80% by 2011 mainly from Biomass . • Feed-in tariffs for electricity generation from renewable energy.
Indonesia	**Target**: Increase renewable generating capacity of micro-hydro, geothermal, wind, solar and biomass to 17% by 2030
Malaysia	**Target**: 350 MW of grid connected renewable electricity by 2010 • Established the Small Renewable energy power program so that developers can sell power to utilities under the Renewable Energy Power Purchase Agreement.
Philippines	**Target**: 700 MW of new geothermal capacity between 2010-2014 • Taxes and duties exemption for geothermal power projects. • Feed-in tariffs.
Vietnam	**Target:** adding 25-50 MW of renewable energy capacity including micro-hydro, wind, biomass and solar PV. • Investment incentives, preferential pricing, and preferential taxes for development of new and renewable energy resources

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Based on the 3A's framework

Accessibility	Availability	Acceptability
▪ ASEAN-5 is progressing in terms of accessibility *- higher electricity consumption, Increasing electrification rate* ▪ Indonesia and Philippines need to improve electricity access in rural areas - *Off-grid renewable energy* ▪ Electricity tariff subsidies - *need to implement appropriate subsidy policies*	**Short-term** ▪ Reliable supply in Malaysia and Thailand – *low interruption indexes, high reserve margin* ▪ Low reliability in Indonesia **Long-term** ▪ Long run energy security implication *- high gas dependence & indexed with international prices*	▪ Challenging aspect for every country in the ASEAN-5 *- Rapid increased in CO_2 emissions* *- Social acceptability on large power projects (e.g. nuclear, geothermal)* ▪ Require effective measures to promote renewable energy

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Key challenges for electricity industries

- In general, these challenges concern:
  - Satisfying rapid demand growth in a sustainable manner
  - Energy security due to fossil-fuel reliance
  - Environment emissions and public consensus on power projects
- More specifically
  - Sufficient generation investment to meet the demand
  - Improve electricity access in rural areas – Indonesia, Philippines
  - Tariff subsidy revision – maintain affordability for low income group while still obtain sufficient revenue
  - Diversify fuel mix – enhance security of supply
  - Increase the share of renewable energy

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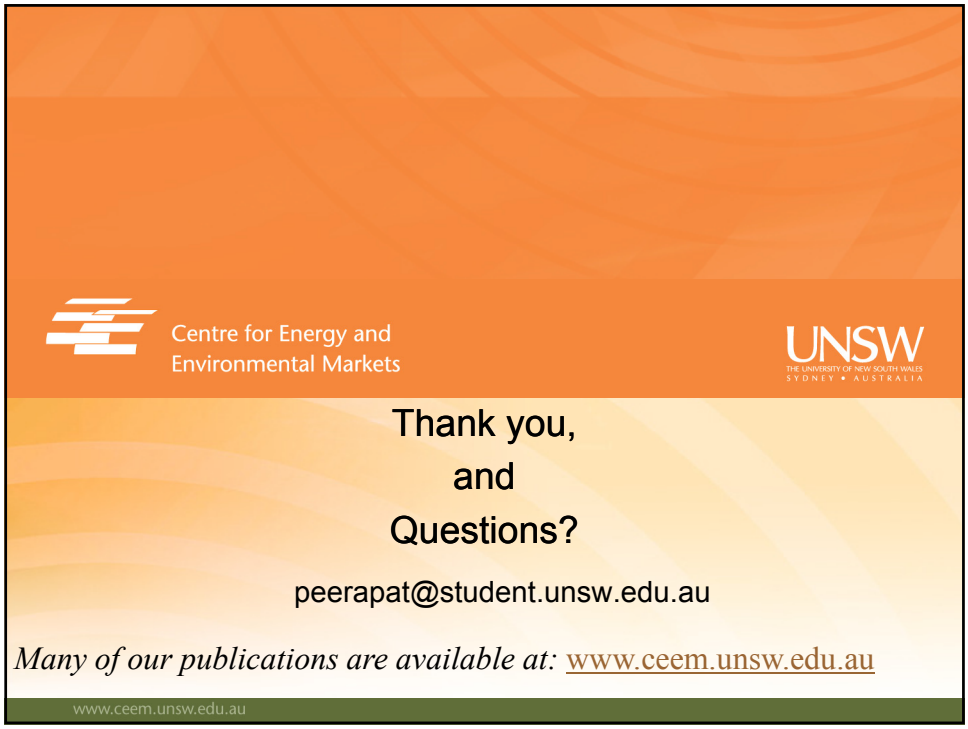
Implications of such challenges

- Generation investment and resource planning in these countries
  - Significant investment in power sector is predicted to meet rapid demand growth
  - Total investment is power sector in ASEAN is predicted to be $0.6 trillion in the next 20 years (IEA, “World energy outlook 2009”)
  - Need to consider these challenges during investment decision-making processes – i.e. generation & fuel mix (energy security), CO_2 emissions
- Complex nature of generation and network investment
  - Must build ahead of time, capital intensive.
  - Key drivers are uncertain – fuel prices, demand, environmental policies (carbon prices)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