Energy Security: Challenges and Policy Options for the Asia Pacific Region

Presented by
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at
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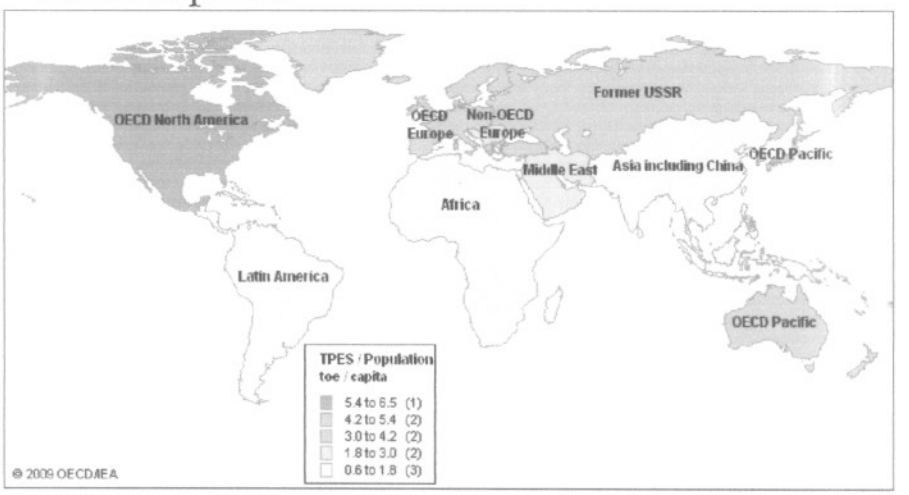
Structure of Presentation

- Energy Consumption trends in the Asia-Pacific region
- Energy Security concerns
- Potential Solutions
- Discussions

Energy Security

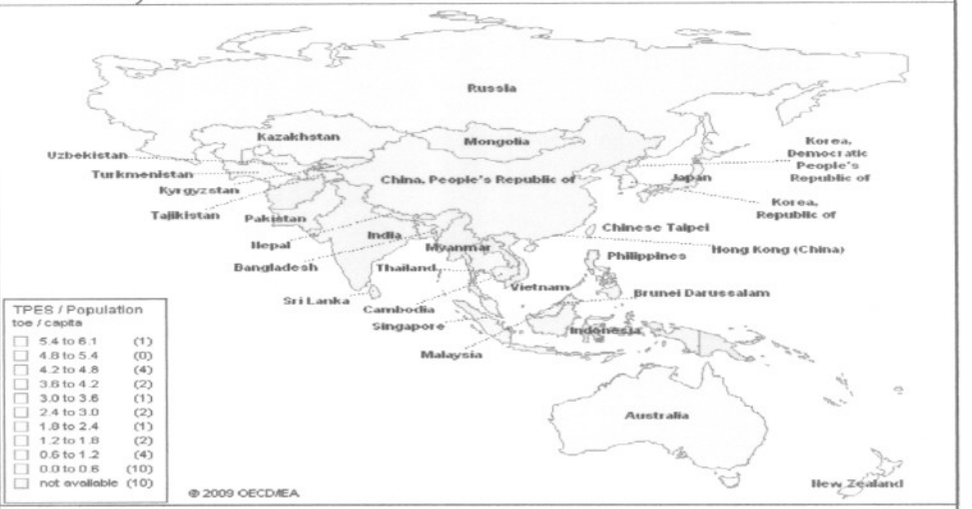
"We are energy secure when we can supply lifeline energy to all our citizens irrespective of their ability to pay for it as well as to meet their effective demand for the safe and convenient energy to satisfy their various needs at competitive prices, at all times and with a prescribed confidence level considering shocks and disruptions that can be reasonably expected" Integrated Energy Policy, GOI (2006)

Per Capita Total Primary Energy Consumption



Energy Demand and GHG Emission Projections

Per capita Primary Energy Consumption in Asia, Pacific OECD & USSR



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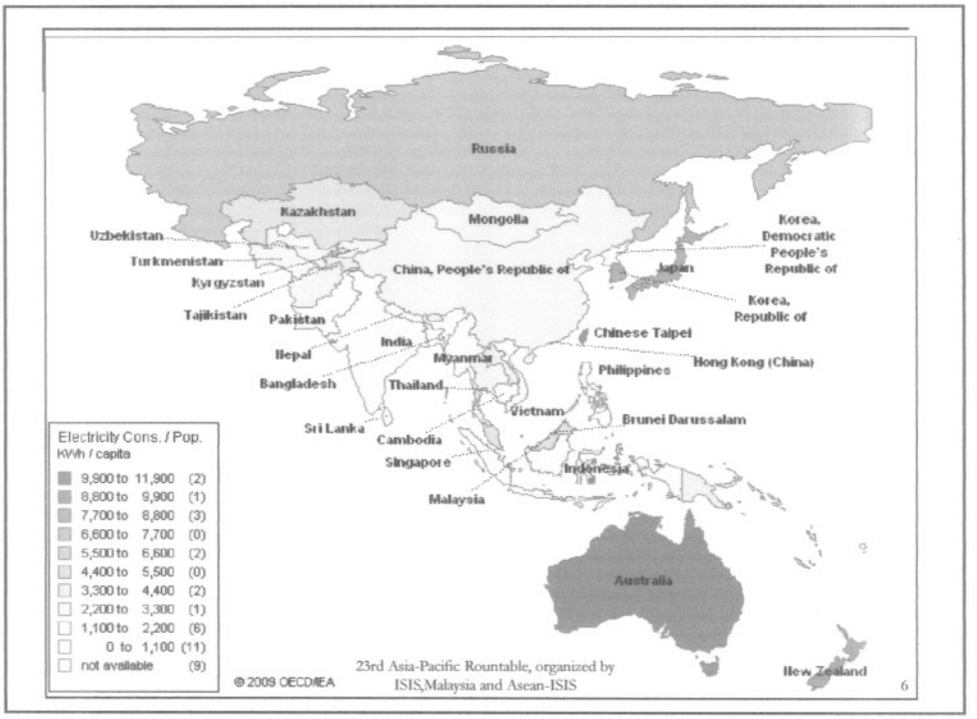

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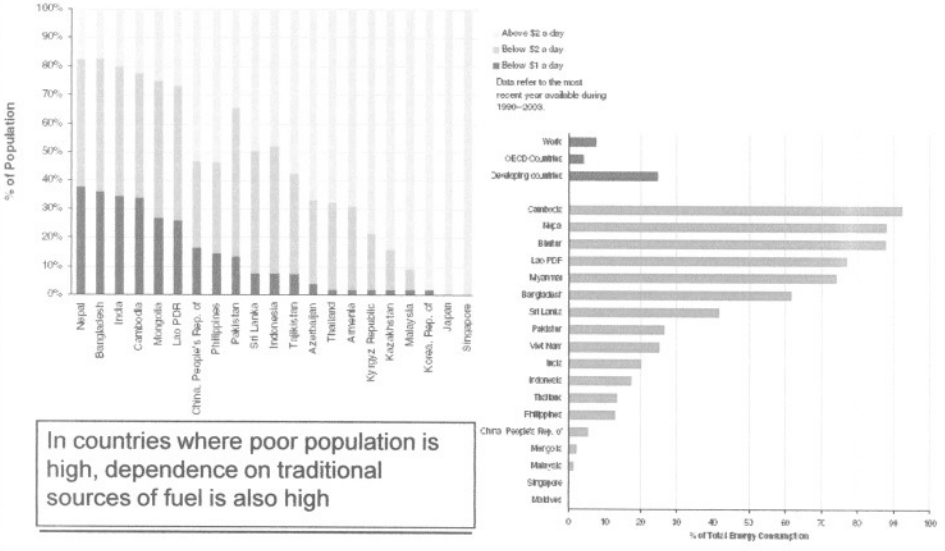
Energy Demand and GHG Emission Projections

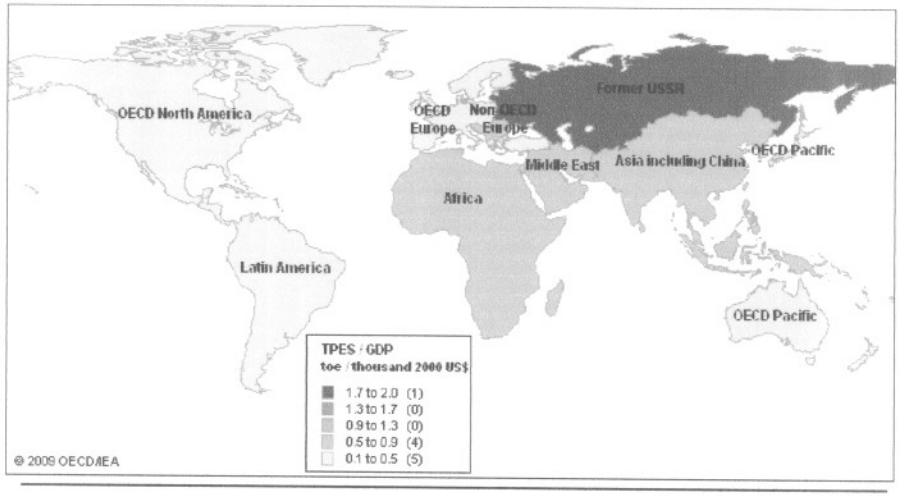
Socio-Economic Profile of the Asia Pacific Region:
Population of poor & Dependence on traditional sources of energy



In countries where poor population is high, dependence on traditional sources of fuel is also high

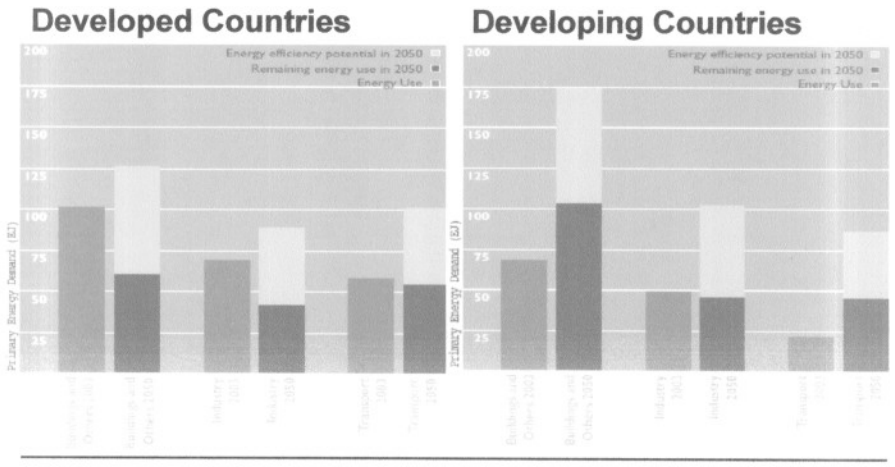
Source: UNDP 2006, Human Development Report 2005, New York, UNDP

Comparison of Energy Intensities in 2006

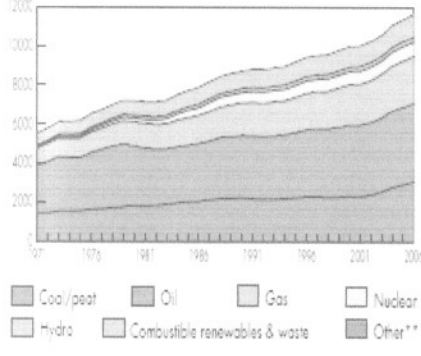


Energy Demand and GHG Emission Projections

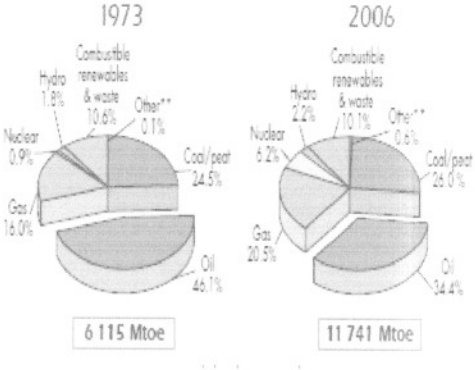
Potential for energy efficiency improvement in developed and developing countries by sector



Evolution from 1971 to 2006 of world total primary energy supply* by fuel (Mtoe)



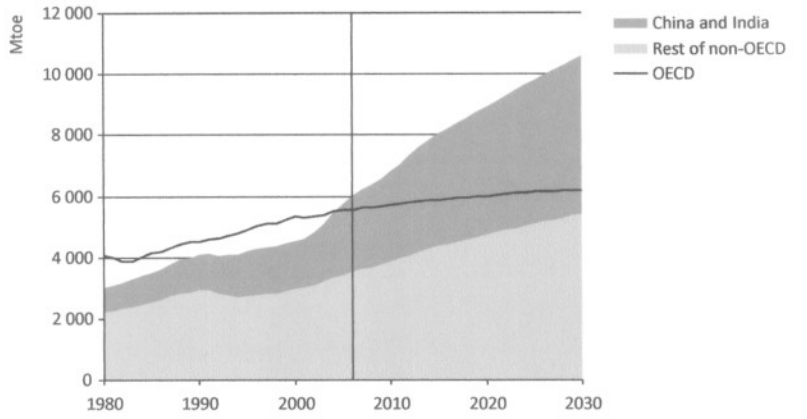
1973 and 2006 fuel shares of TPES*



Although oil and coal are dominant sources of energy. Combustible renewables & waste such as solid biomass, liquid biomass, biogas, industrial waste and municipal waste will continue to play an important role in the primary energy supply especially in Asia.

Energy Demand and GHG Emission Projections

The Reference Scenario: World primary energy demand



Non-OECD countries account for 87% of the increase in global demand between 2006 & 2030, driven largely by China & India

Key Economic Indicators in Asia

	China	India	Indonesia	Philippines	Thailand	Vietnam	Total or Average
Average Electricity Consumption per capita	1,379 kWh	435 kWh	440 kWh	574 kWh	1,752 kWh	443 kWh	837 kWh
Reliance on Fossil Fuels (2002)	78%	80%	71%	56%	85%	43%	69%
Net Energy Imports by 2030	18%	76%	0%	68%	80%	15%	42.8%
Net Oil Imports by 2030	70%	90%	60%	97%	94%	57%	78%
Total CO_2 Emissions in 2005	3,128 Mt	1,218 Mt	291 Mt	75 Mt	193 Mt	56 Mt	4,961 Mt
Total Projected Annual CO_2 Emissions in 2030 under BAU Scenario	9,500 Mt	6,800 Mt	745 Mt	262 Mt	734 Mt	301 Mt	18,318 Mt

Sources: APERC, 2006 (for APEC countries); IEA, 2006 and TERI, 2006 (India); WDI, 2006.

Energy Security Concerns in Asia

- The region imports around 44% of its oil (2006)
  - Oil imports were
    - 7% in 1980s
    - 32% in 1990s
- Sources will be less diverse
  - Currently 50% comes from middle east
  - Will increase to 80% by 2030
- The region is extremely vulnerable to supply disruptions and price volatilities

Can Coal meet the regions needs ?

Country	Proven Recoverable Reserves (in million tonnes)
USA	242721
Russian Federation	157010
China	114500
Australia	76600
South Africa	48000
Ukraine	33873
Kazakhstan	31300
Poland	7502
Colombia	6959
Canada	6578
Indonesia	4328
New Zealand	571
Zimbabwe	502
Venezuela	479
Mozambique	212

Source: Survey of Energy Resources 2007, World Energy Council

~~India will require more than 1000 million tonnes of non-coking by 2031~~

- Would reserves in existing supplying countries be adequate to meet future demands?
- Are pressures likely to be faced due to increased domestic use in these countries?

NATURAL GAS (Trade)

(Mtoe)	Import		Export		Import/Consumption (%)		Export/Production (%)		Self Sufficiency (%)	
	1999	2006	1999	2006	1999	2006	1999	2006	1999	2006
Turkmenistan	0.00	0.00	13.79	37.24	0.00	0.00	74.89	71.36	398.21	349.17
Indonesia	0.00	0.00	32.30	28.40	0.00	0.00	55.13	60.25	222.86	251.54
Kazakhstan	9.08	10.73	1.65	6.27	80.88	41.87	43.48	29.63	33.82	82.61
China	0.00	0.77	2.50	2.48	0.00	1.64	12.03	5.12	113.67	103.67
Azerbaijan	0.00	3.70	0.00	0.00	0.00	39.65	0.00	0.00	100.00	60.35
Uzbekistan	0.00	0.00	12.63	10.44	0.00	0.00	27.52	20.16	137.97	125.25
India	0.00	6.60	0.00	0.00	0.00	20.44	0.00	0.00	100.00	79.56
Pakistan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00
Malaysia	0.00	0.00	17.97	24.62	0.00	0.00	54.06	48.10	217.68	192.67
Myanamar	0.00	0.00	0.07	7.41	0.00	0.00	5.23	71.27	105.52	348.07
Thailand	0.07	7.41	0.00	0.00	0.51	26.97	0.00	0.00	99.49	73.03
Viet Nam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00
South Korea	13.99	27.23	0.00	0.00	100.10	102.41	-	-	0.00	1.61
Total Region	31.34	68.51	80.92	116.87	15.93	20.76	32.85	30.80	125.20	114.98

Source: EIA database

NON- FOSSIL ENERGY RESOURCES

Hydro Potential

Country	Hydroelectric Potential (MW):	Developed (MW)	% of potential developed
Afghanistan	*745*	*262*	35.17%
Bangladesh	*755*	*230*	30.46%
Bhutan	*23,760/30,000*	*468*	
India	*84,000/150,000*	*32,300*	
Nepal	*43,000/83,000*	*600*	
Pakistan	*54,000*	*6,500*	12.04%
SriLanka	*9,100*	*1,250*	13.74%
Kazakhstan	*20,000*	*2,000*	10.00%
Turkmenistan	*Modest*		
Uzbekistan	*Modest*		
Tajikistan	*40,000*	*4,000*	10.00%
KyrgyzRepublic	*26,000*	*3,000*	11.54%
Myanmar	*39,720*	*747*	1.88%

Uranium availability

(2003 figures)	Metric Tonnes	% of World Total
Kazakhstan	847620	19.8
Uzbekistan	118460	2.8
Mongolia	61950	1.4
India	59915	1.4
China, People's Republic of	49750	1.2
Viet Nam	6440	0.2
Indonesia	1155	<0.05
Thailand	10	0
Total	1145300	26.708
World	4288081	100

- Region has
  - 1.1 million metric tonnes of uranium (27%) of world total ; 300,000 mt Th (India)
  - Huge hydroelectric potential - China (13% of the world's total potential) and India (6% of the world's total). Only a small proportion of this potential has been developed so far.

Source: ESCAP

Is nuclear power expensive ?

Electricity cost (US cent/kWh)

	MIT 2003	France 2003	UK 2004	Chicago 2004	Canada 2004	EU 2007
Nuclear	4.2	3.7	4.6	4.2 - 4.6	5.0	5.4 - 7.4
Coal	4.2		5.2	3.5 - 4.1	4.5	4.7 - 6.1
Gas	5.8	5.8, 10.1	5.9, 9.8	5.5 - 7.0	7.2	4.6 - 6.1
Wind onshore			7.4			4.7 - 14.8
Wind offshore			11.0			8.2 - 20.2

First 5 gas row figures corrected for Jan 2007 US gas prices of $6.5/GJ (second figure for France & UK columns is using EU price of $12.15/GJ).

Chicago nuclear figures corrected to $2000/kW capital cost. Canada nuclear shows figures for ACR, not Candu.

Currency conversion at June 2007.

Comparison of Infrastructure requirements for different modes of power generation (per annum)*

CO2 emissions from nuclear power is negligible

Fuel	Shipments	Tonnes/shipment
Coal	238	70,000
Petroleum	112	10,000
LNG	143	55,000
Uranium-enriched	2 Aircrafts Boeing 747 (Cargo)	

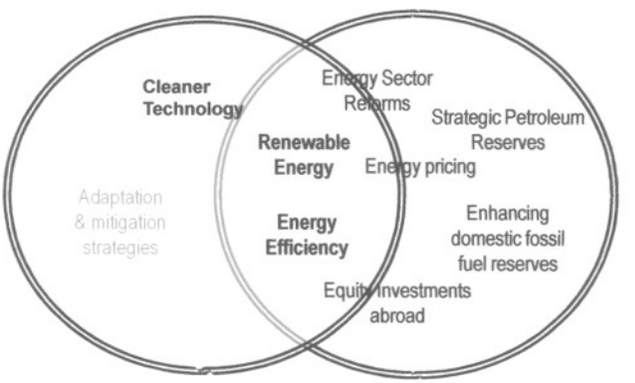
* 6494 MW nuclear power generation capacity equivalent

Other Renewable Energy Resources – In the Asia pacific Regions

- Biomass: 311 to 502 Mtoe in developing Asia
  - (approximately 5 to 6 % of global resources)
- Solar :
  - South Asia 927 to 31,981 Mtoe/year
  - Pacific Asia 979 to 23, 741 Mtoe/year
- Wind potential in land surface with wind class of 3 – 7 (thousand sq. km)
  - Pacific Asia : 4, 188
  - China ; 1, 056
  - Central and South Asia: 243
- ~~Other sources are Ocean and geo-thermal~~

Up-take of RETs in the region need to be scaled up

Convergence between energy security responses and climate change responses



Thank you