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Myanmar

An Emerging ASEAN Energy Giant?

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Awakening Tiger

Myanmar - The Tiger

went dormant in 1963 until waking in 2011.

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Important Features

- Unique geographical location: Land bridge among most dynamic economies of the world, China, India and ASEAN
- Large country area (2xViet Nam, quarter larger than Thailand or France)
- Population about 52 millions
- All climate zones
- Abundant agricultural and mineral resources
- Likely large energy producer: Many unexplored off shore and on shore areas

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Important Features
(Cont'd)

- Huge hydro potential which together with fossil fuels could make it the "battery" of Asia together with "food basket" of Asia
- Labor force is large and trainable though low productivity now

But …….

- Weak bureaucracy and administrative capacity

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Important Features

(Cont'd)

- Education and human resources neglected
- Huge infrastructure backlog: power, telecommunications, transport (lowest score in Southeast Asia on WB Logistics performance and Quality of Infrastructure Index 2012)
- Risks from ethnic and religious conflicts
- Some political uncertainties with presidential elections end 2015

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1. Energy and Myanmar History

- One of oldest oil producer in world.
- First barrel exported in 1853
- Rangoon Oil Company-Burmah Oil (1886): Ancestor of BP
- Small oil producer now:20,000 bpd
- But significant gas discoveries in 1990s

2.Myanmar: Current energy resources

- Rice husk, bagasse, charcoal and waste: 75% of primary energy supply (TPES)
- Natural gas: second. 10% TPES but 5% energy consumption (80% exported)
- Crude oil: 8%TEPS but 25% imported; Production 20-25,000 bpd; imports 8000 bpd

Myanmar Energy Balances for 2011

	Coal	Crude Oil	Oil Products	Natural Gas	Hydro	Biofuels & Waste	Electricity	Total
Production	411	872	0	10051	443	10617	0	22394
Imports			236					240
Exports				-8633				-8633
TPES	411	881	286	1418	443	10617		14056
Total Final Consumption	232	0	1097	682		10577	492	13080

- 4 main gas fields, 2 older (year 2000), 2 more recent (2013 & 2014).
- Total production: 2230m cubic feet per day (cfpd) or 790bn cubic feet per year in 2015.
- To compare production: China (3.8trn cf per year); Indonesia (2.7 trn cf year); Malaysia (2.2 trn cf year);India (1.4 trn year)

- 80-85% gas is exported to Thailand and China.
- Yadana (Total, 730m cfpd) and Yetagun (Petronas, 500m cfpd) export to Thailand (75% and 90%) via pipeline.
- Zwatika (PPTEP; 300m cfpd)exports 80% to Thailand.
- Shwe (Daewoo; 700m cfpd) exports 80% via pipeline to China.

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- Myanmar is a modest natural gas producer but relatively large exporter.

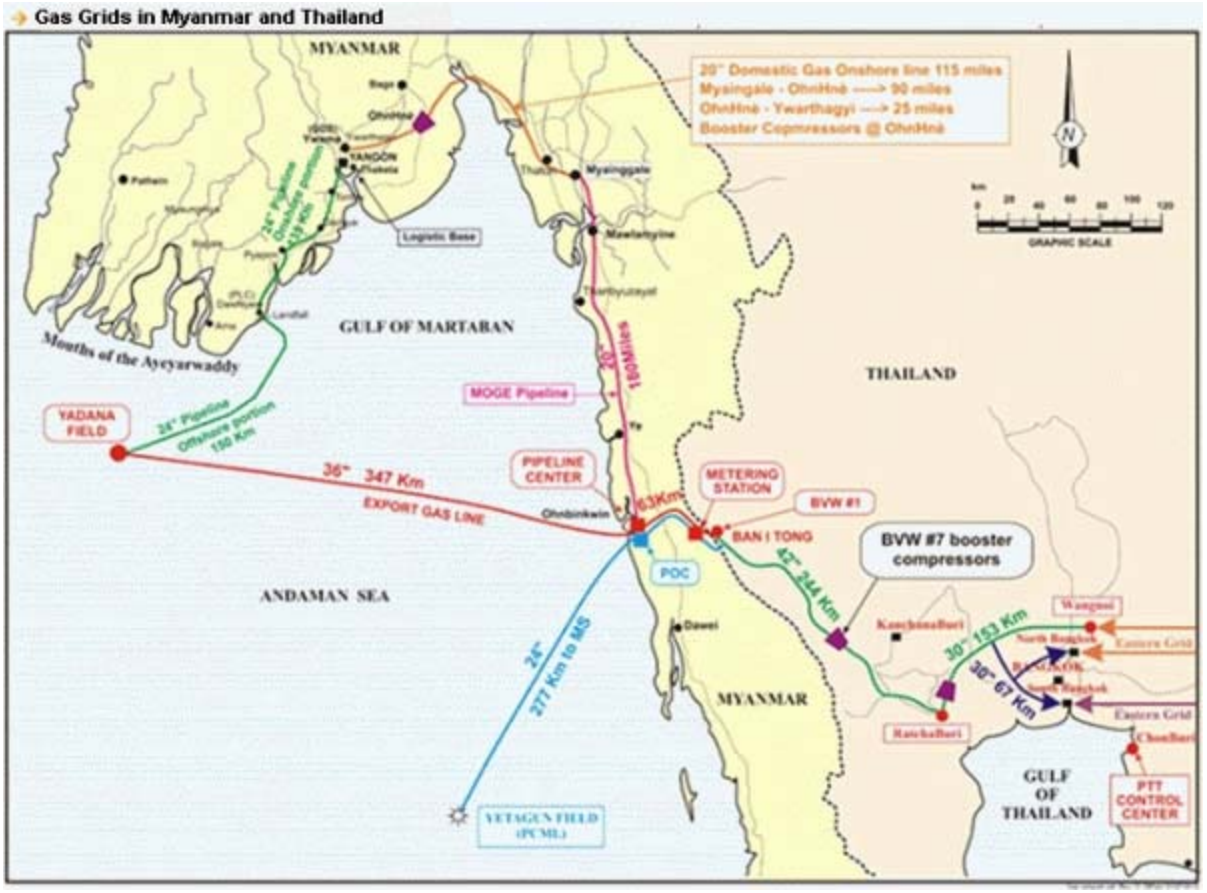
- Domestically 10 gas fired power plants produce 715MW with rehabilitation and new combined cycle adding about 1000MW of generation by end 2015.

Major Offshore Gas Fields Operating in Myanmar

Field	Awarded	Produce	Gas Output	Operator
Yadana	1992	2000	730m	Total
Yetagun	1990	2000	500m	Petronas
Shwe	2000	2013	700m	Daewoo
Zwatika	2003	2014	300m	PTT

Major Gas Fields in Myanmar and International Pipelines Network

Pipeline to Thailand



- Hydro: Small TEPS but generates 75% electricity; Installed capacity 2660MW of which 2044 MW for domestic market; rest exported to China.

- Coal is small with one electricity plant (120 MW).

- While energy rich, less than 30% population has access to electricity and in dry season only 75% of demand is met.
- Per capita consumption is 110 kilowatt-hours (Cambodia: 1640 kwh, Indonesia: 680kwh, Thailand: 2316 kwh).
- Installed capacity only 3735MW as Thailand in 1981. Grid losses 25%.

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- Huge underinvestment in power generation for domestic market.
- With reforms and economic growth projected at 8-9% over next 2 decades, very large investments in power needed.
- Projections indicate total generation need of 24,000MW by 2030. Thailand has installed capacity of 32,600MW in 2014 (excluding power imports from Laos).

- The current situation in Myanmar's domestic power market is important for energy security in ASEAN, China and India.
- Myanmar will need much more power domestically at time when electricity needs of its neighbors will increase and their domestic energy supplies (mainly natural gas) will become exhausted.

- Within Myanmar, large hydro will take time to build if at all, perhaps 2025-2030; New generation will first need to come from thermal plants (gas, oil, coal).
- The question is then: Will Myanmar's energy resources be sufficient to allow for continued sizeable energy exports?
- What can happen to gas export contracts (ending in 2030)?

- There is also an important question on timing. If and when resources can become available for exports?
- Thus MYANMAR will be a key player in ASEAN and ASIA's energy security over the next decades.

3. Myanmar's Energy Reserves and Potential

- **Natural Gas:**
- Current proven gas reserves at 10 trn cubic feet, just a bit larger than Thailand's dwindling reserves. But much smaller than Malaysia, Indonesia and Viet Nam.
- Reserves modest but mostly intact and could last for at least 30 years. In Thailand reserves exhausted in next 7-10 years.

- But Myanmar's potential for major gas finds is huge…..
- Most of Myanmar offshore shelf is completely unexplored! That is not even seismic test were done in deepwater. "The last unexplored frontier".
- Myanmar has 53 onshore and 51 offshore blocks.
- In 2014, 20 offshore blocks were allocated thru auction.

- 10 deepwater and 10 shallow water blocks. Also 18 onshore blocks allocated.
- All major large oil companies are present.
- The US Geological Survey is only one estimating the undiscovered technically recoverables reserves: 79.6 trn cubic feet or 2.25 trillion cubic meters, in addition to 10 trn cubic feet proven.

- This means Myanmar could have 12th largest natural gas reserves in world, larger than Malaysia now and could thus become an even large exporter than today.
- Timing of likely possible coming on stream is important: probably not before 2025-2030 although some earlier allocated areas could start producing earlier for domestic market.
- It takes about 10 years for full development.

Proven Reserves of Natural Gas (Trillion Cubic Feet)

Country	2010	2014
Brunei	13.8	13.8
Cambodia	0	0
Indonesia	106	104.37
Laos	0	0
Malaysia	83	83
Myanmar	10	10
Philippines	3.48	3.48
Singapore	0	0
Thailand	12.079	9.039
Vietnam	6.8	24.7
ASEAN	235.159	248.389

- **OIL :**Current oil reserves are small at 50 million barrels, about 100 times smaller than Viet Nam.
- Because large increases in exploration (together with gas), US Geological Survey estimates possible reserves at 2.3 billion barrels of oil and 2.1 billion of condensates, about size of Viet Nam.

- **Hydropower:**
- Current capacity is 2660MW.
- 2 dams with total capacity of 840Mw export to China. All dams above 100MW are build by China.
- Potential huge: 108,000MW about 40-50,000MW exploitable.

- 92 dams for capacity of 46,100MW have been identified with 44 large dams for capacity of 41,276MW requiring foreign investment and technology.
- In Upper Ayeyawady, eight dams have capacity of 20,000MW! Many of the dams originally planned for export to China and Thailand.

- Best known cases are Myitsone (6000 MW), Mongton/Tasang (7,110MW) and Kunlong (1,400MW).
- These dams and others (30 altogether) at different stage of planning or construction mainly by China, Thailand and India have been stopped by President.
- Small dams (30-250MW) proceeding.

- Problem with dams is that they mostly are in ethnic areas. There are serious environmental concerns.
- Concerns about building dams for export of electricity to China, Thailand and India.
- Rivers are all undammed.
- Completion of larger dams will probably not be before mid or end 2020.

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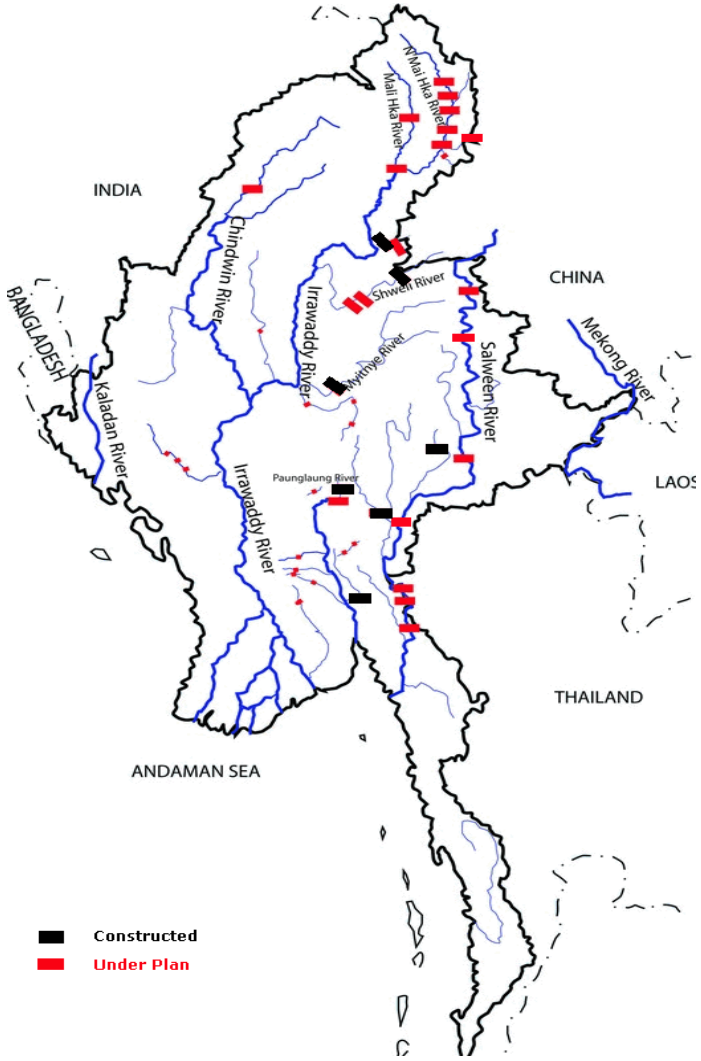
Major Dams in Myanmar



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Electricity in short and medium term

- Electricity demand to increase by a least 15% per year from peak of 2200MW in 2014.
- By 2030, capacity to reach 24,000MW
- Small dams can add 2500MW over next decade; big dams longer delays.
- Some additional thermal possible but mainly from coal; limited from gas as export contracts.

- Coal is best option in short term but resistance
- In short term, Myanmar might have to import LNG via floating terminal or thru Thailand pipeline
- Also possibility to build terminal in Dawei for Thailand and Mynmar.
- Myanmar has good potential for small hydro, solar and wind but off grid
- Import of electricity from Thailand also possible

4. Myanmar and ASEAN Energy Security

- Myanmar is strategically important for energy security for Thailand (import of gas, import/export of electricity), for China (overland oil and gas pipeline, gas and electricity exporter), India (gas exporter) and ASEAN (gas exports, pipeline and grid connections).

Thailand:

- 80% of Myanmar gas exported to Thailand which accounts for 15-20% of Thailand's imports for power and petrochemical. Rest of Thai gas is domestic and LNG imports (3-4%) via LNG terminal of 5 million tons/year.
- Thai domestic gas to run out in next 7-10 years-peak in 2017;70% of Thai electricity gas produced.

- Power demand to rise rapidly in particular for rail transport.
- Overdependence on gas for electricity; limited other options as opposition to coal and nuclear.
- Uncertain new discoveries: price distortions encourage imports and overlapping area with Cambodia.LNG to be increasingly imported.
- Energy sector of Myanmar strategic for Thailand.

- Uncertainties in energy supply now subject of big debate in Thailand.
- Reforms needed to address price distortions and subsidies for different fuels, terminate monopoly of PTT in exploration, distribution, LNG terminal operation and control of pipelines.
- Need to create a domestic competitive power market.

- This is also a condition for the full development of the Trans ASEAN Gas Pipeline (TAGP) and the ASEAN Power Grid (APG), 2 pillars of ASEAN energy security.

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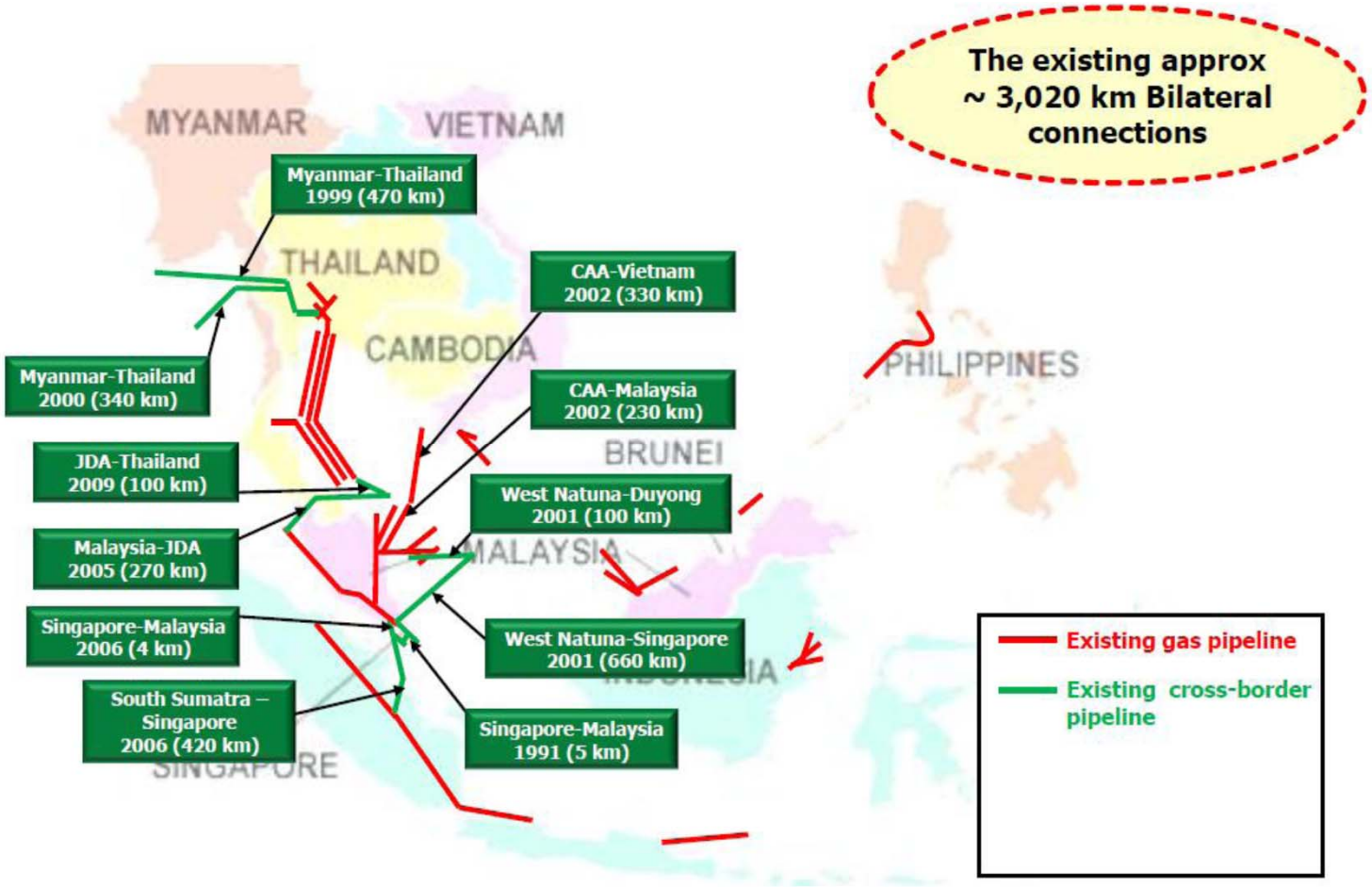
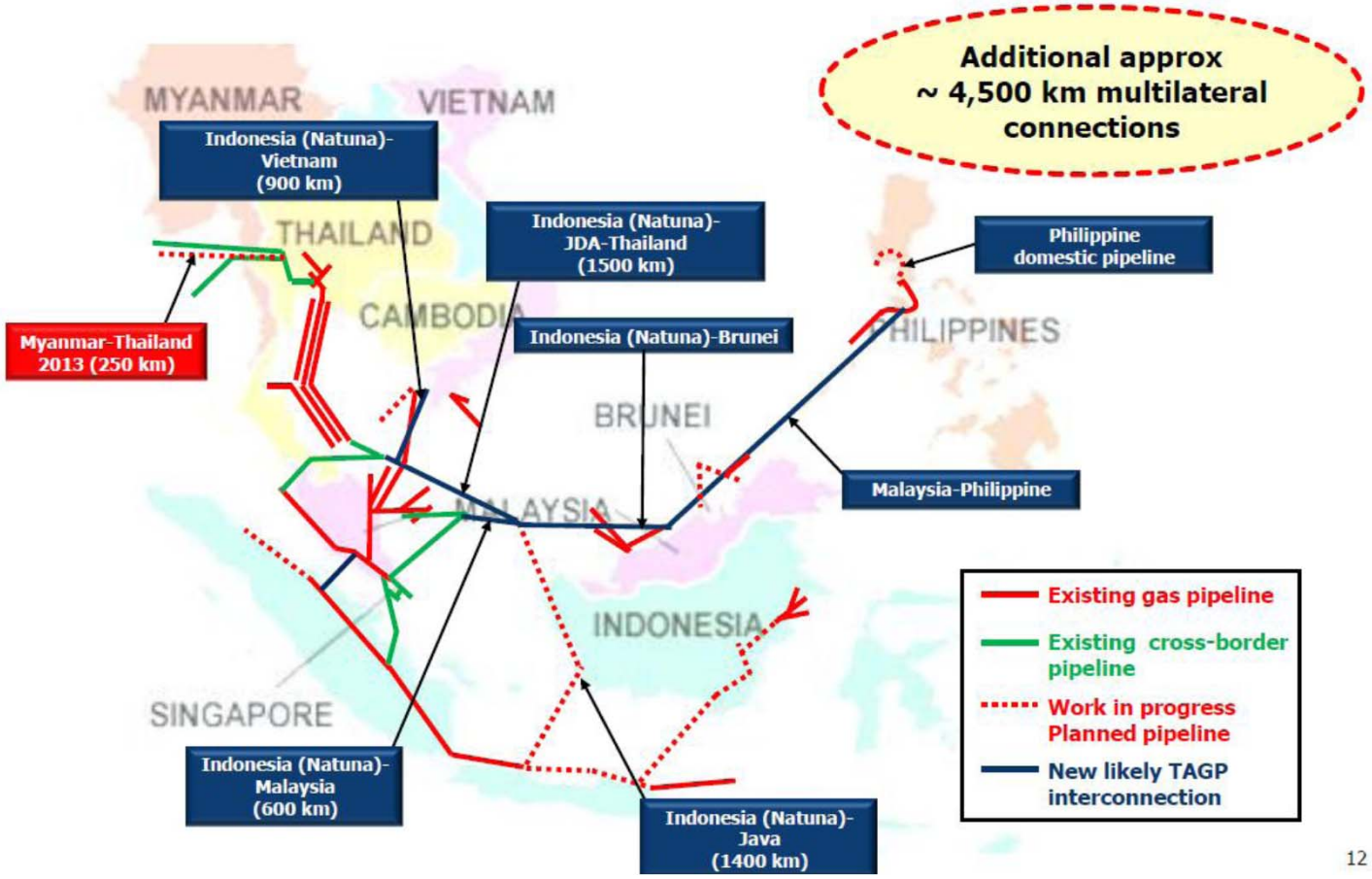
TRANS ASEAN GAS PIPELINE

- 4 (on 10) ASEAN countries are significant gas exporters
- 3000 KM of mainly bilateral one way pipelines are completed but 6 main multilateral connections still priority and not done (4,500km).
- One issue is the falling regional reserves (except perhaps later for Myanmar) and need to import LNG.

ASEAN Gas Pipeline Existing Connections



Trans ASEAN Gas Pipeline: Projected Connections



- In addition to ASEAN supply issues, LNG terminals are developing in an uncoordinated way (Thailand, Malaysia, Indonesia, Viet Nam, Singapore which wants to become a hub).
- Apart from uncertain domestic supply and pricing/subsidies issues, a lot of legal/regulatory obstacles are to be solved: gas transit agreements, pipeline tariffs, third party access dispute resolution.

- Energy debate in Thailand is good example.
- In fact IEA estimates that ASEAN gas production will reach 260 bcm by 2035 (202 bcm in 2012), essentially concentrated in Indonesia and Myanmar, and to lesser extent Malaysia. Thailand would loose most of its reserves.

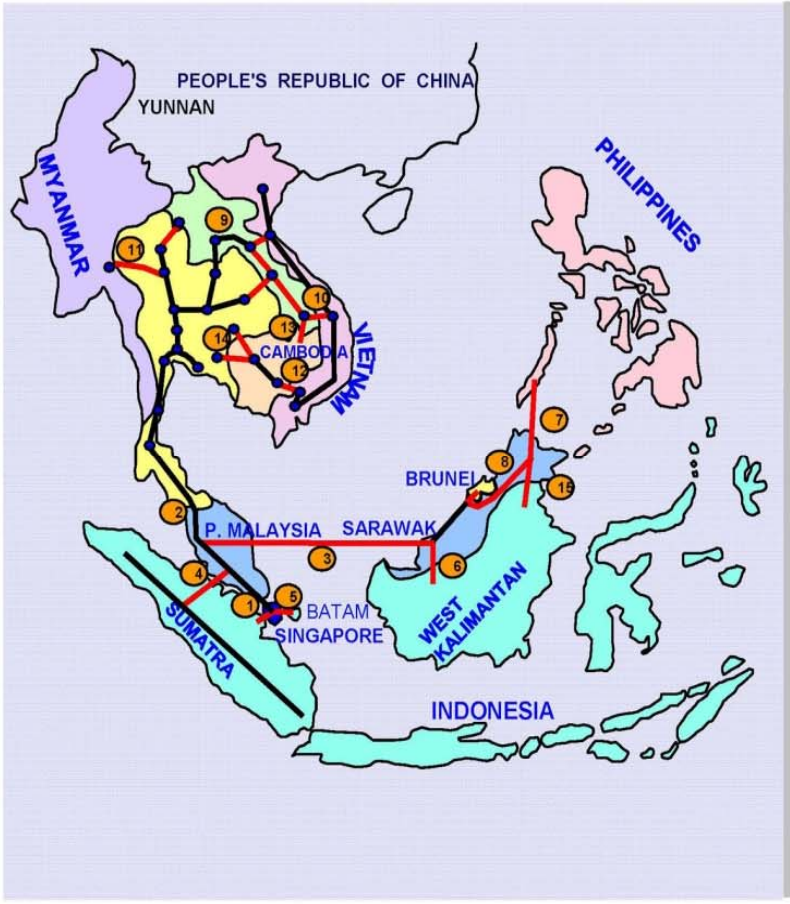
- Thailand is largest user of gas because of demand for electricity production.
- ASEAN wide, demand is estimated at 250 bcm in 2035 (149bcm in 2012). Thailand's demand estimated at 43 bcm in 2012 will rise to 65 bcm in 2035 if gas for electricity generation decreases to about 50% by 2035.
- So for all these reasons, completion of the TAGP should be a priority.

- For Thailand in particular expanding the connections to Myanmar and making them two way would allow to improve the energy security for both countries, allowing Myanmar to import LNG thru Thailand and Myanmar to export gas to Thailand and other ASEAN countries.

ASEAN Power Grid (APG)

- The APG is the complement of the TAGP and would allow a full electricity market to develop in ASEAN while ensuring power security.
- By 2015, 15 major bilateral interconnections will be completed but several links are still missing to create an integrated Southeast Asia power grid.

ASEAN Power Grid



		Expected COD
1)	P.Malaysia - Singapore	Existing
2)	Thailand - P.Malaysia	
	• Sadao - Bukit Keteri	Existing
	• Khlong Ngae - Gurun	Existing
	• Kolok - Rantau PanjangNewly	Proposed
3)	Sarawak - P. Malaysia	2015/16
4)	P.Malaysia - Sumatra	2015
5)	Batam - Singapore	2015
6)	Sarawak - West Kalimantan	2012
7)	Philippines - Sabah	2015
8)	Sarawak - Sabah - Brunei	2015
9)	Thailand - Lao PDR	
	• Roi Et - Nam Theun 2	2009
	• Udon - Nabong	2011
	• Mae Moh - Hong Sa	Under Negotiation
10)	Lao PDR - Vietnam	2010
11)	Thailand - Myanmar	2014
12)	Vietnam - Cambodia	2009
13)	Lao PDR - Cambodia	2010
14)	Thailand - Cambodia	Existing
15)	East Sabah - East Kalimantan	Newly Proposed

- Again as with gas, technical standards and harmonization, legal and regulatory issues and lack of domestic competitive markets and national monopolies are main issues to be solved.
- The increased penetration of renewables (solar, wind, biomass) is changing nature of traditional power supply: increase in offgrid power.

- There are bilateral trade points such as between Lao and all its neighbors, Malaysia and Thailand, China-Myanmar-Lao-Vietnam.
- Myanmar given its domestic capacity will also be a major strategic players in electricity trade in ASEAN and will also link ASEAN to China.
- Completing the AGP helps address power shortages in Myanmar in short term.

Myanmar and China

- As for ASEAN, Myanmar is strategic country for China energy security.
- Not only as major supplier of gas and electricity now and in the future
- But also strategic because dual oil and gas pipeline allows China to bypass Strait of Malacca.

- 800 km oil and gas pipeline from deep water port of Kyaukphyu to Yunnan and beyond.
- Oil pipeline can carry 440,000 bpd (22 million tons) or 10% of China oil imports in 2010.
- China is also major financier of major Myanmar dams which will export a lot of power to China. China-Myanmar relations are vital for ASEAN.

Oil and Gas Pipelines from Myanmar to China

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ASEAN Gas Pipeline Connections

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Myanmar will become an energy giant in Asia

Merci!