



# AWR Lloyd

## Thailand's long term power fuel mix strategy: role of coal and lignite ?

**COALTRANS (THAILAND)**

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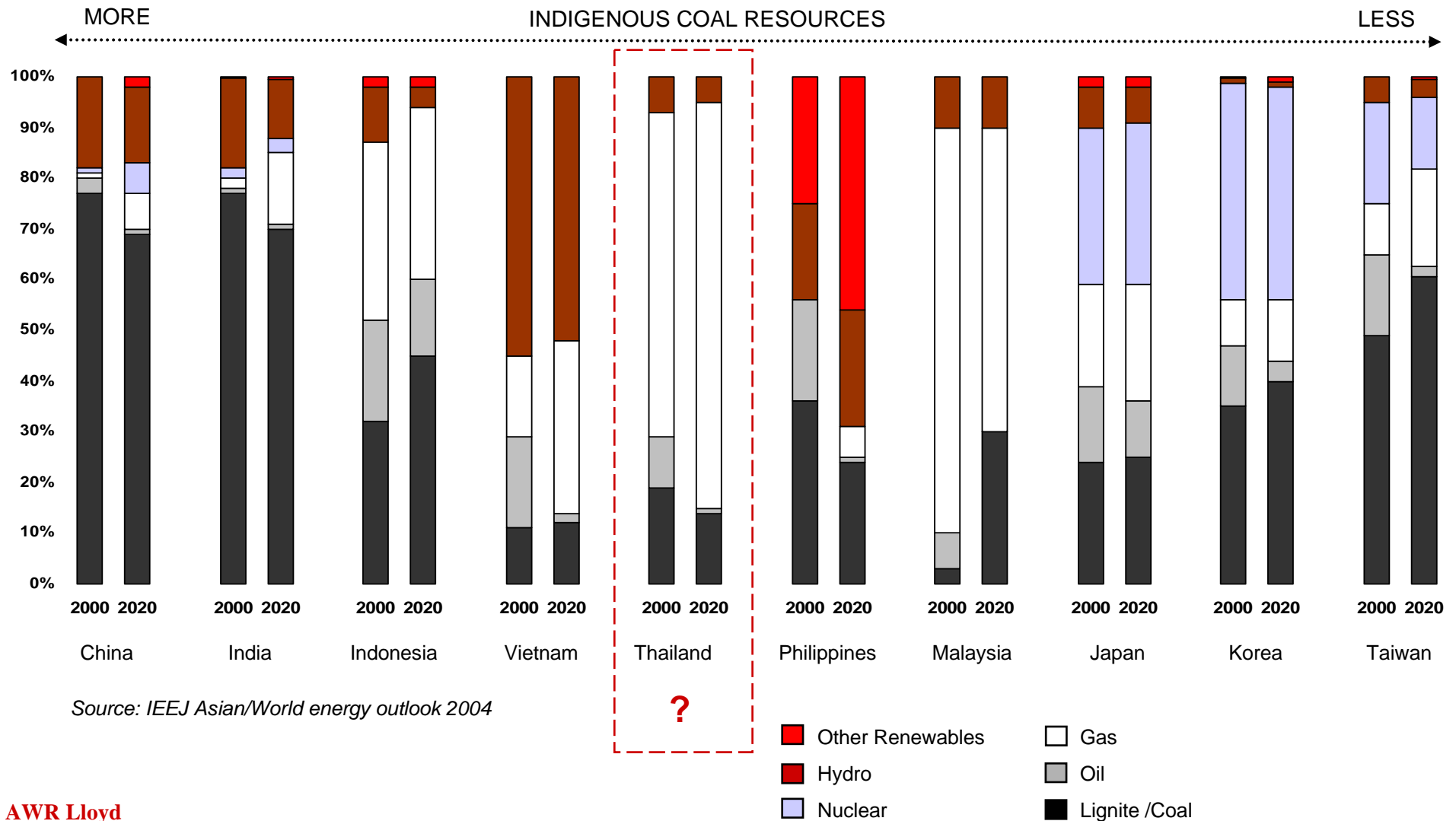
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4. Security of supply

5. Conclusion ?

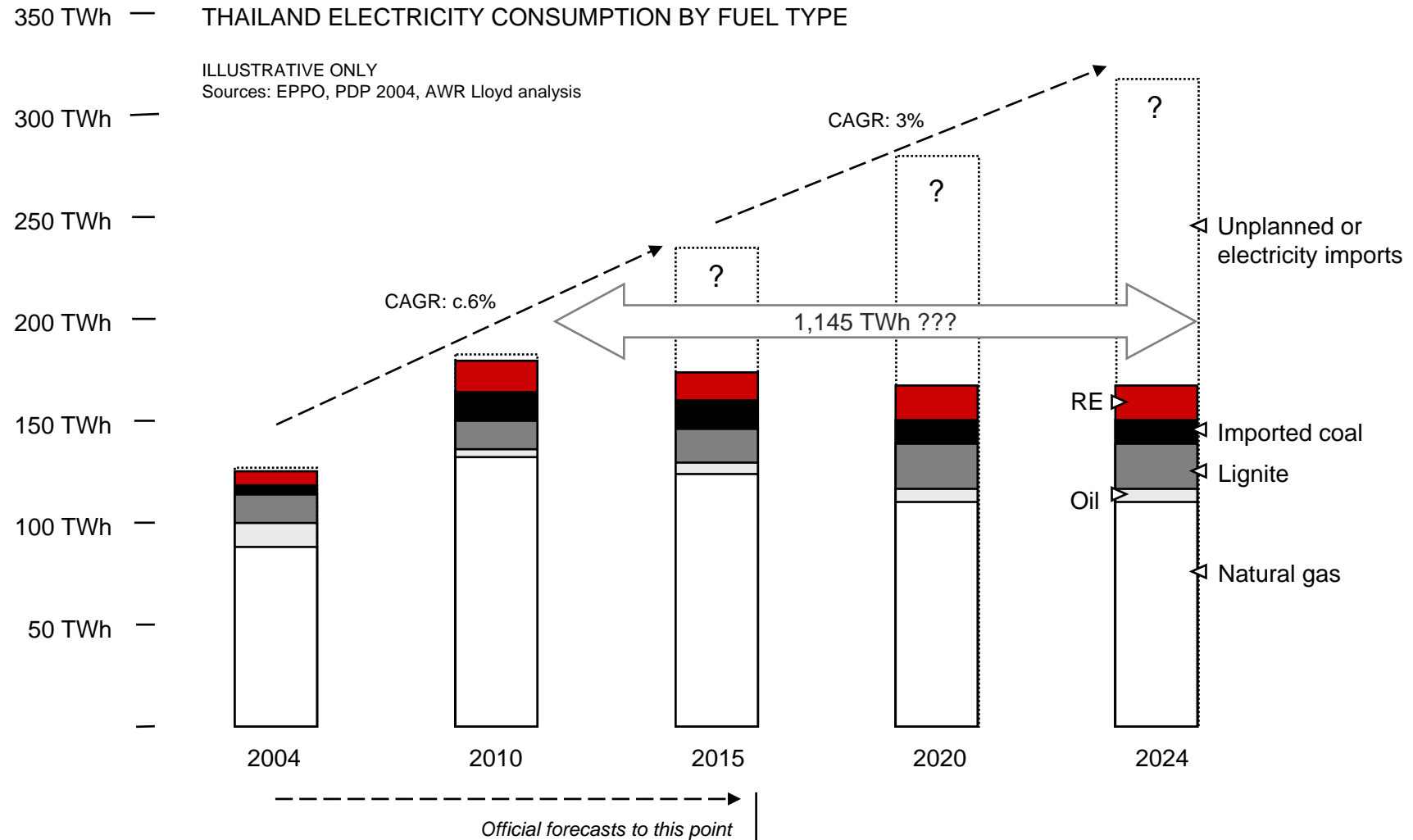
# Thailand compared to other Asian countries

Compared to most other Asian countries, Thailand's dependence on coal-fired power is already low and is forecast by some analysts to fall even lower, with gas-fired power strengthening its dominant position.



# Thailand's long term power fuel mix challenge

Taking a 20 year view and extrapolating from official forecasts, between 2010 and 2025 as much as 1,150 TWh of Thailand's electricity consumption may need to be planned in terms of power plant type and fuel supply



# Long term incremental fuel supply implications ?

Thinking in terms of one fuel source for all of the 1,145 TWh of incremental electricity demand over the next 20 years highlights and emphasizes the need to establish criteria for planning an optimal and achievable fuel mix

INCREMENTAL  
**1,145 TWh**

=



Lignite: 1.1 billion tonnes

or



Imported coal: 410 million tonnes

or



Natural gas: 7.5 TCF

or



LNG: 160 million tonnes

or



Wind turbines: 375 GW

or



Solar PV: 650 GW

*Criteria for deciding  
power fuel mix ?*

1. Economics
2. Emissions control
3. Security of supply

+  IMPACT ?

New technology ?

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**2. Economics**

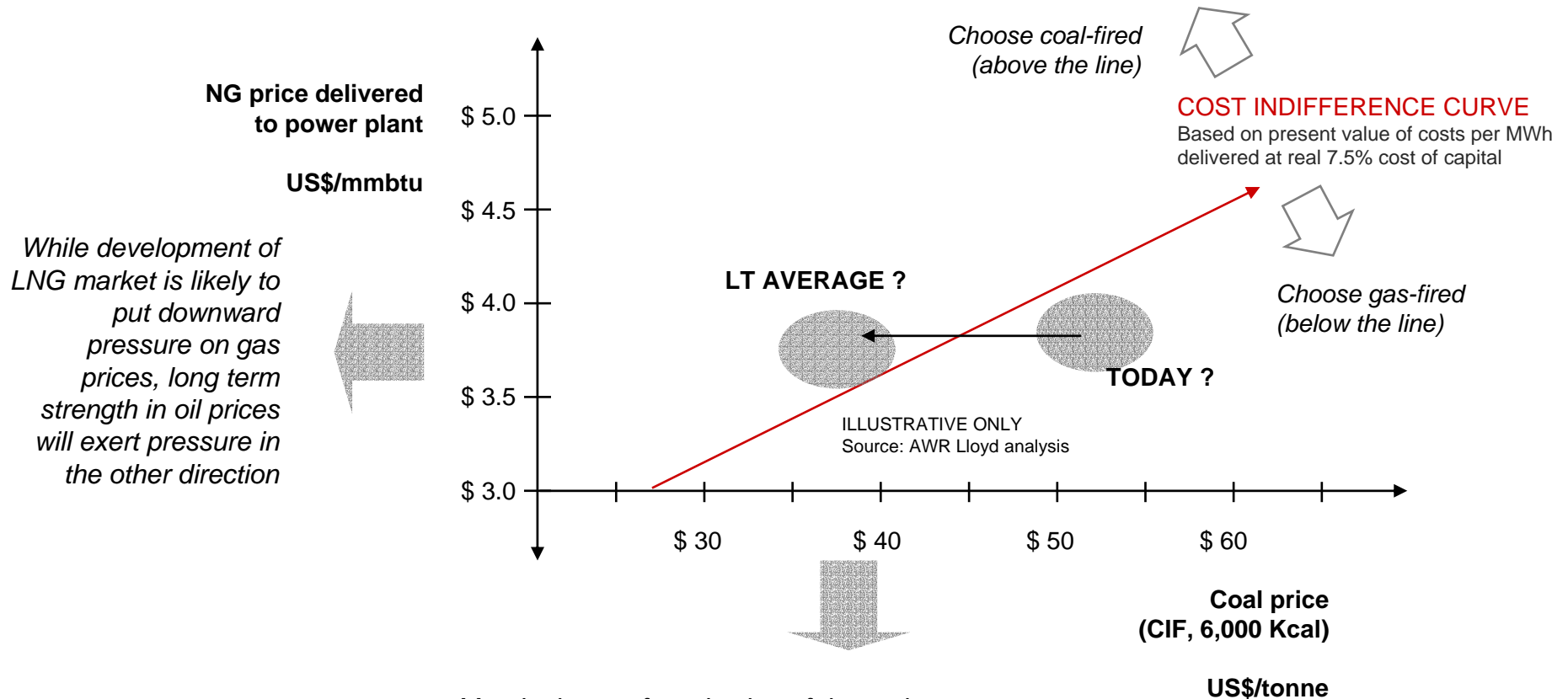
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# Long term coal / gas indifference curve ?

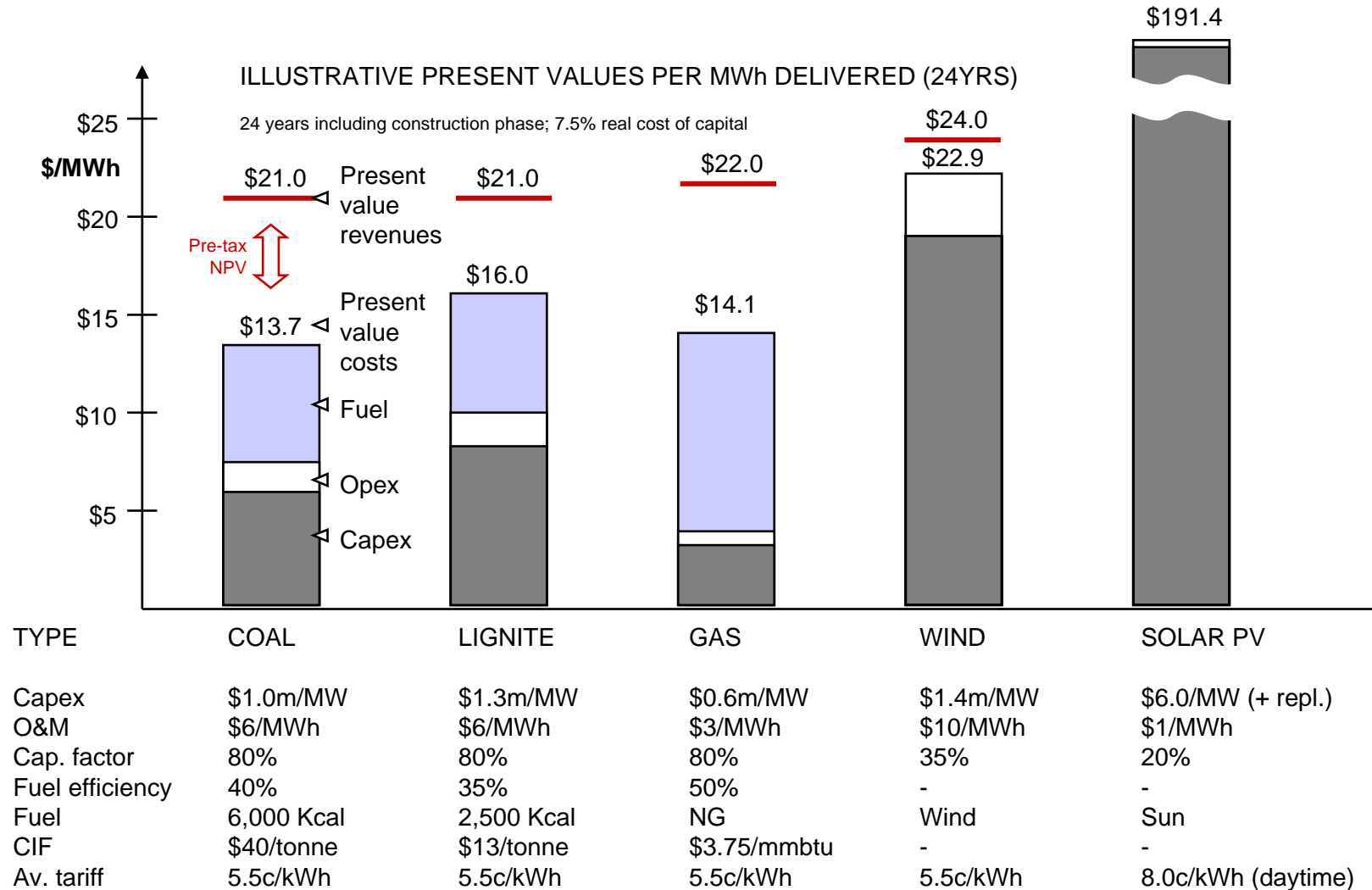
While prevailing prices for imported coal (spot) and gas would probably favor gas-fired power investment, taking a longer term view of CIF coal import prices to Thailand, there may be an argument to favor coal-fired power



*Marginal cost of production of thermal coal supply to Asia \$33-35 per tonne (FOB; 6,700 Kcal) + normalized freight = approx \$35-40 long term average price for CIF 6,000 Kcal ?*

# Illustrative net present value comparisons

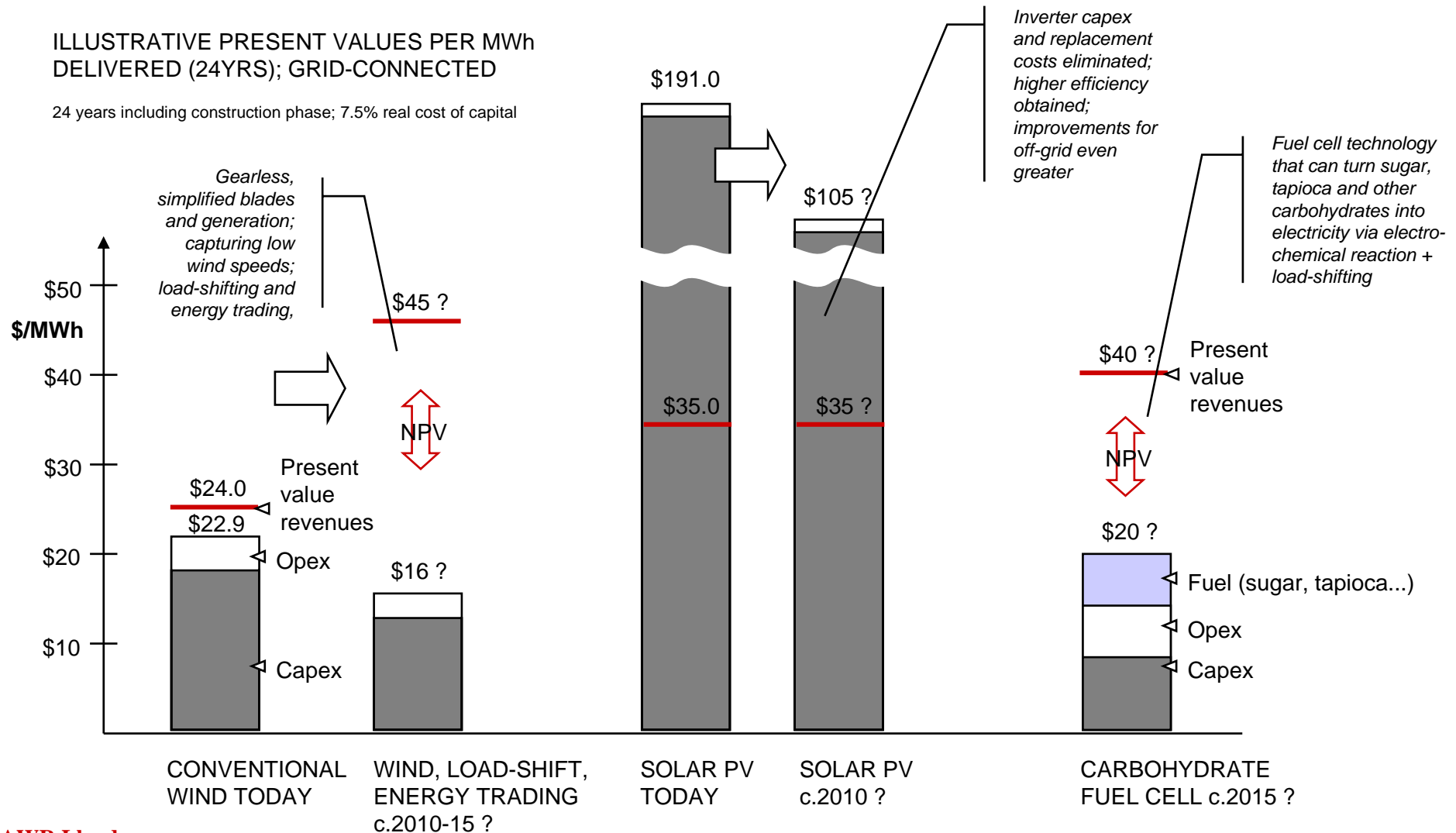
On an NPV basis, though, gas-fired may still have the edge over coal-fired. Renewables still have a way to go to compete, although wind power can now be an NPV positive investment





# Watch out for new renewable energy technologies ...

Although renewables are still lagging behind, a number of new technologies are being developed (in Thailand !) which could have a dramatic impact on the economics of wind, solar and fuel cells

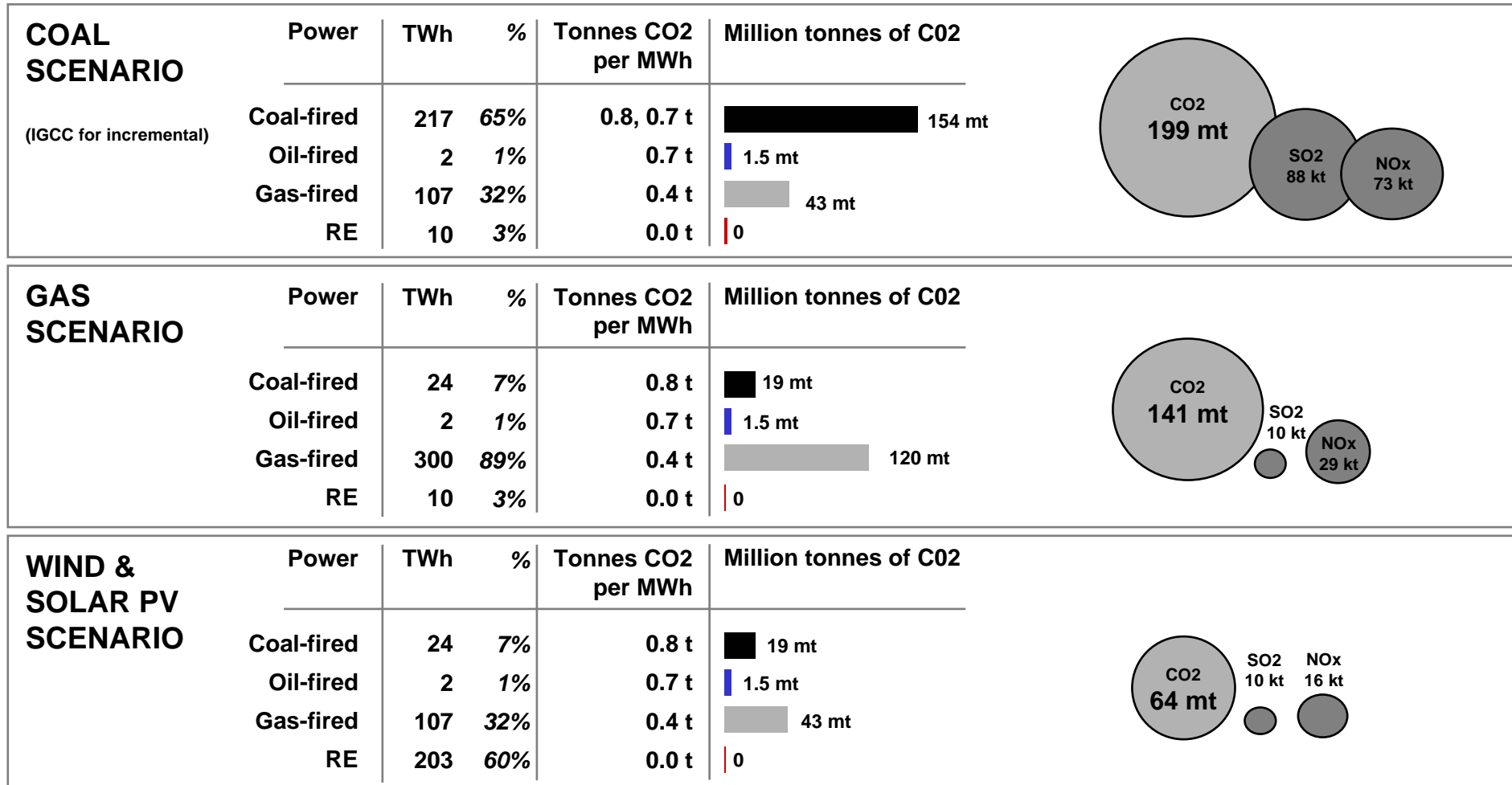


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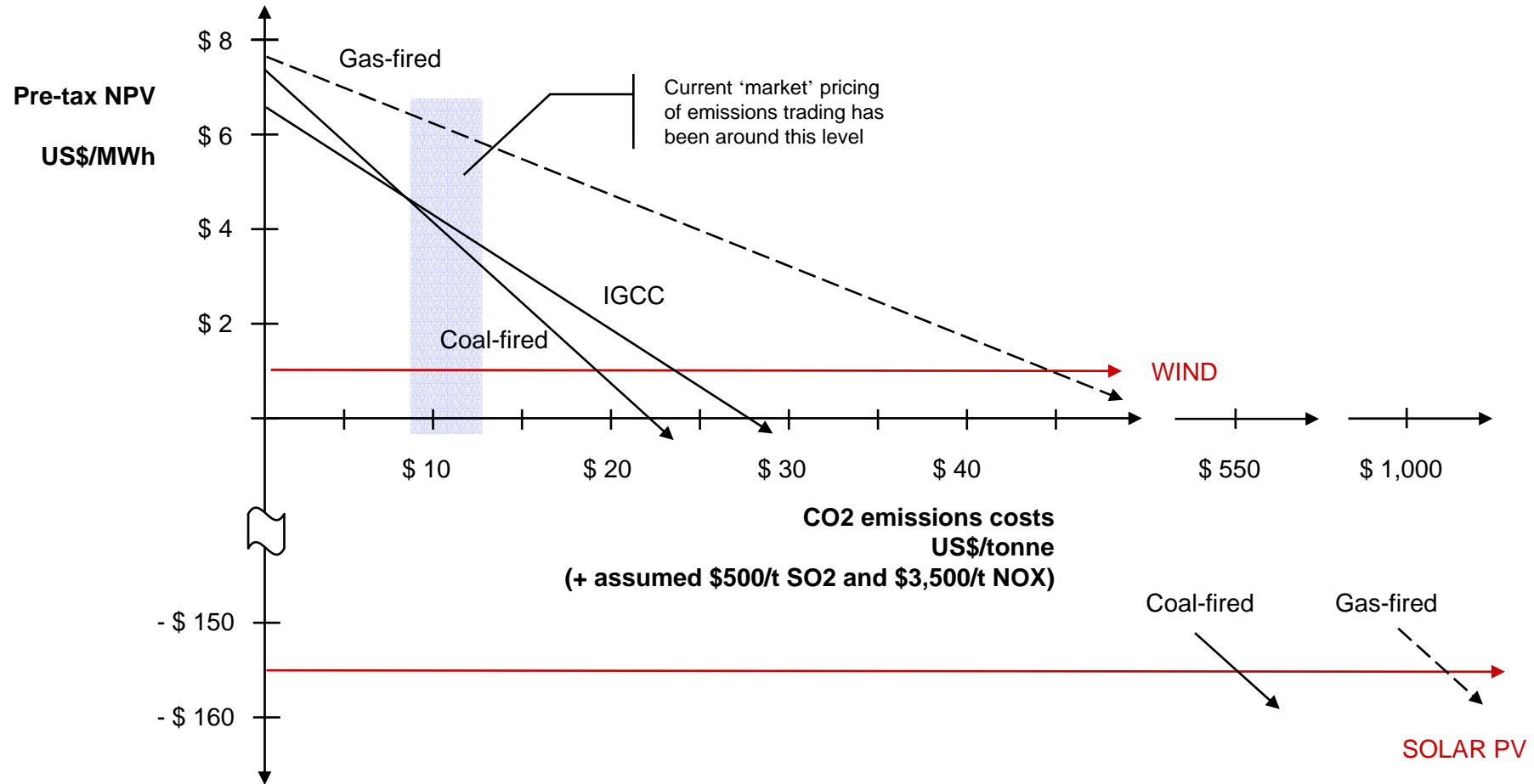
# Emissions levels in 2025, alternative scenarios ?

Even if all incremental power generation by 2025 was 'IGCC' coal-fired, the emissions levels from CO2, SO2 and NOx would still be significantly higher than in gas-based or renewables scenarios



# Emissions compliance costs and indifference equilibrium ?

Imposing emissions costs inevitably and immediately makes gas-fired more attractive than coal-fired using consensus fuel price forecasts. But such penalty costs will still have to rise significantly to favor renewables



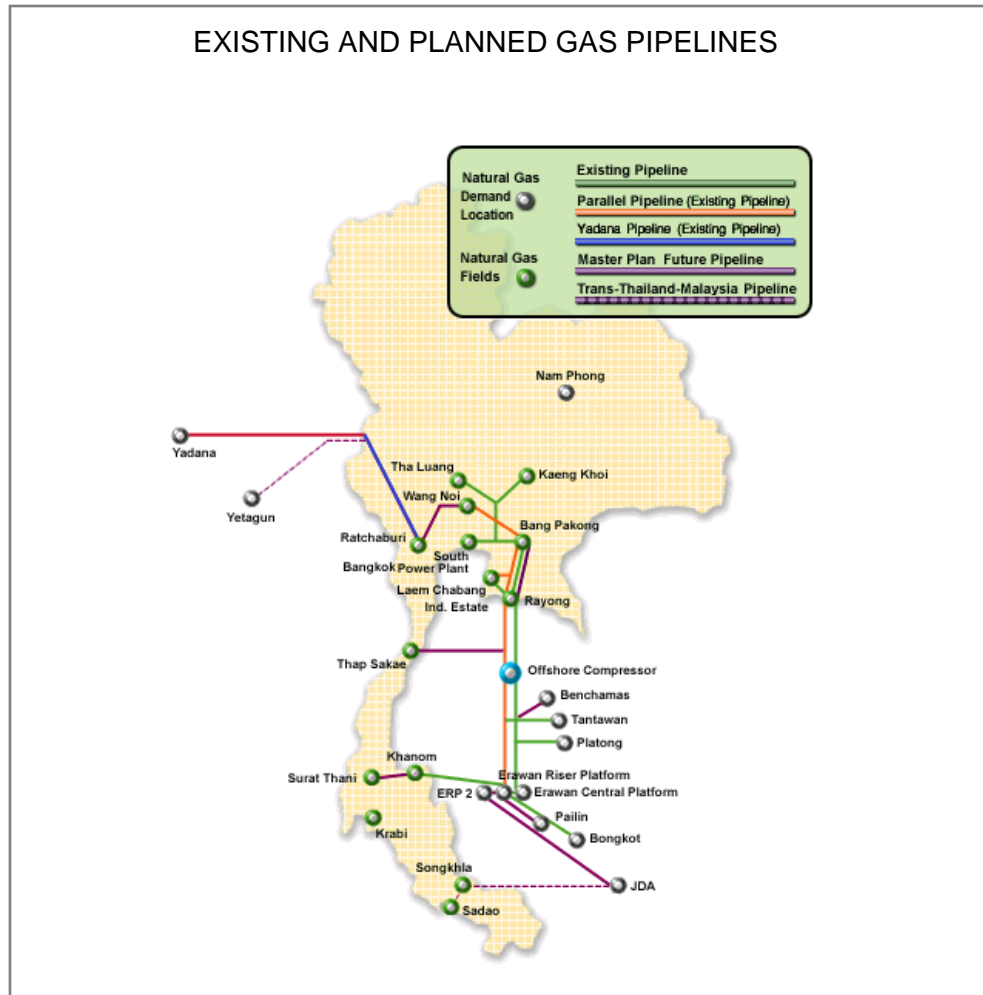
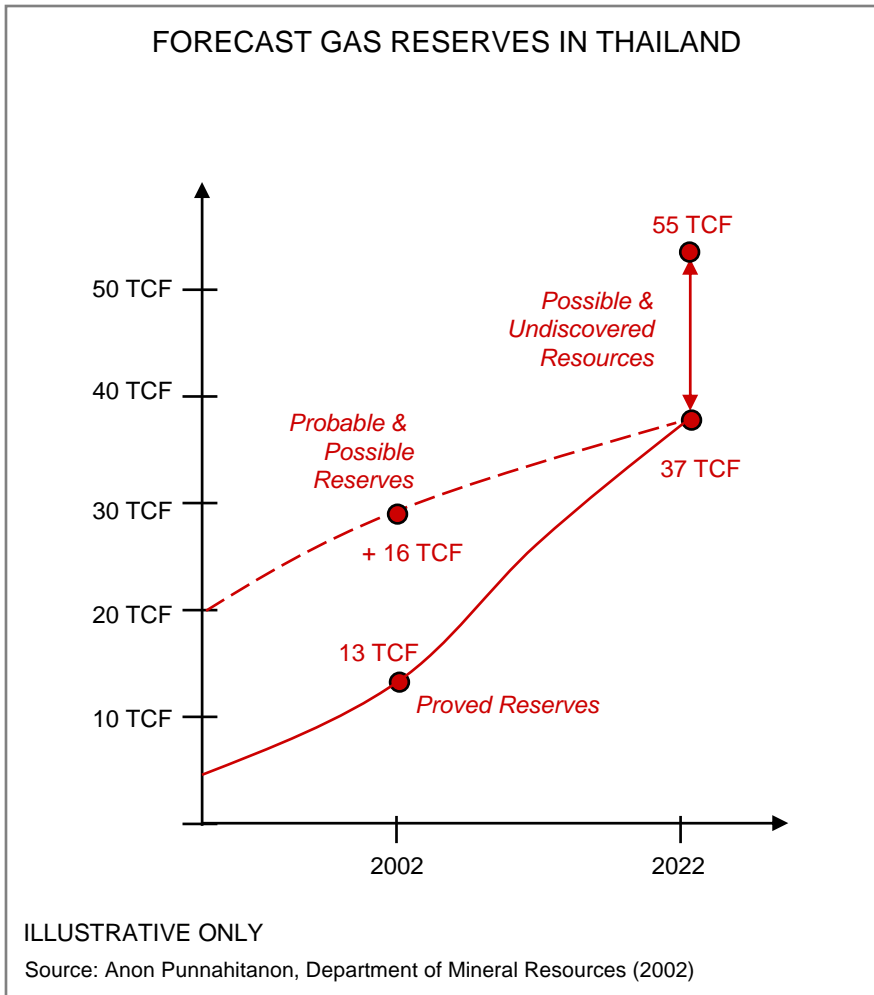
ILLUSTRATIVE ONLY: PRE-TAX NPV PER MWH DELIVERED (REAL 7.5% DISCOUNT RATE)  
Source: AWR Lloyd analysis

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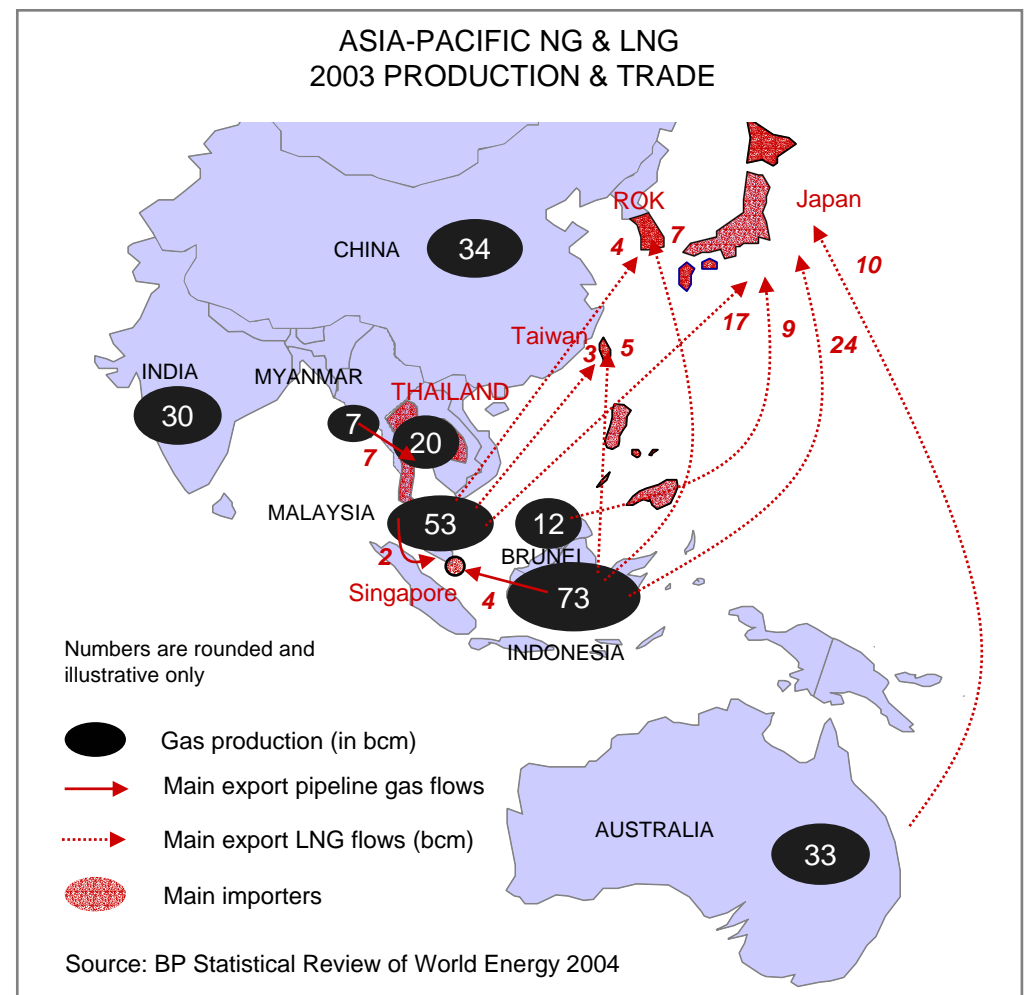
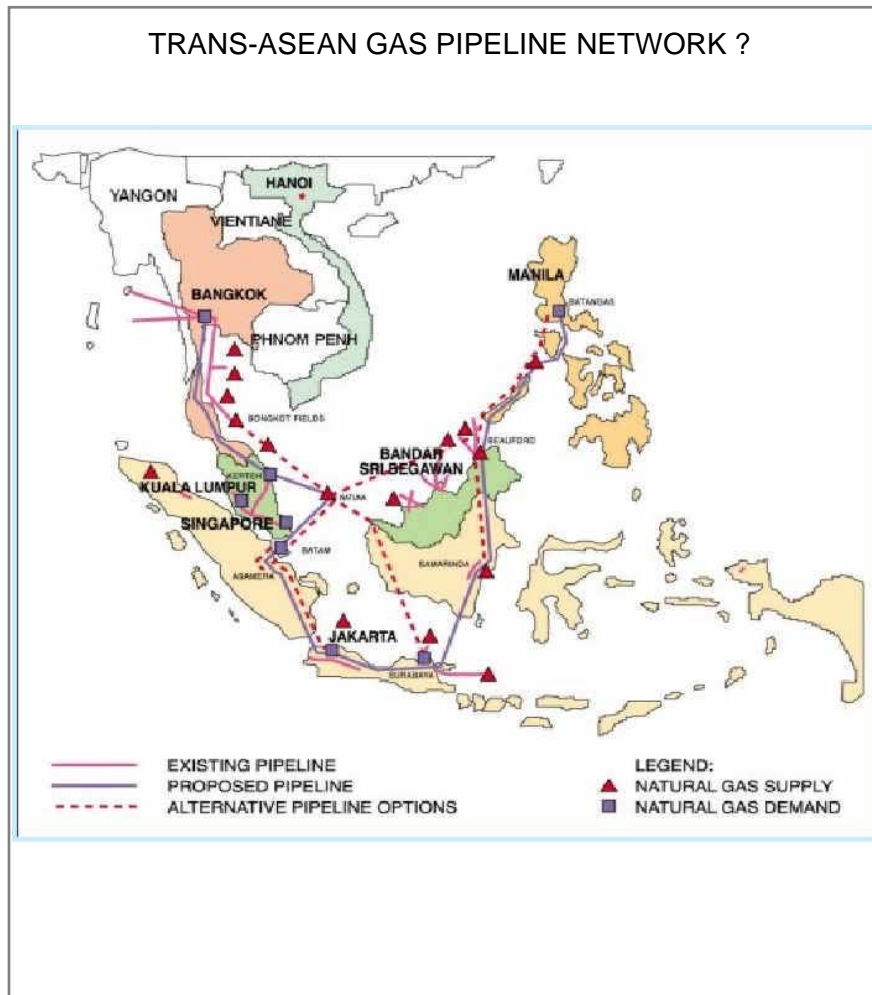
# Domestic gas supply

Although Thailand imports about 25% of its gas consumption from Burma, a high risk country, Thailand currently has its own gas (2P) reserves of 33 TCF, sufficient for around 5,000 TWh of electricity supply.



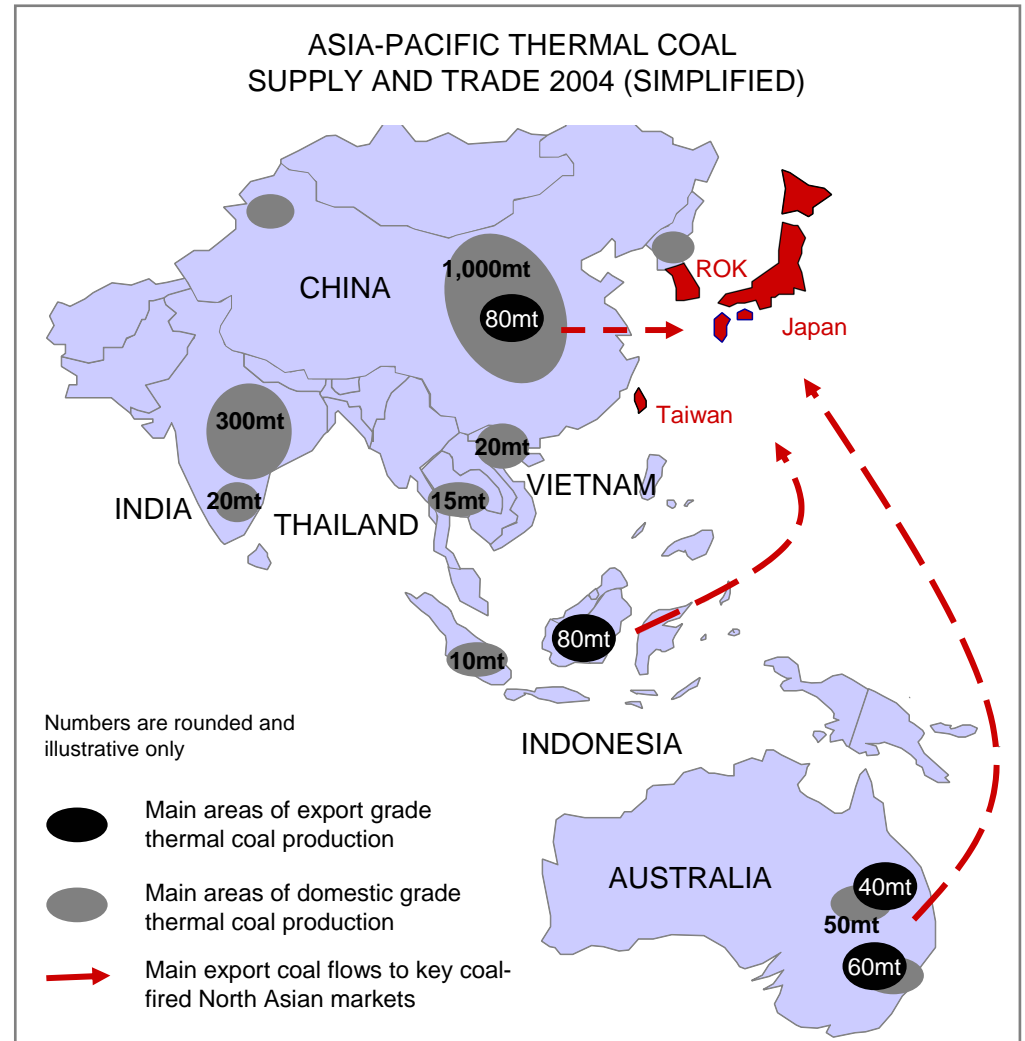
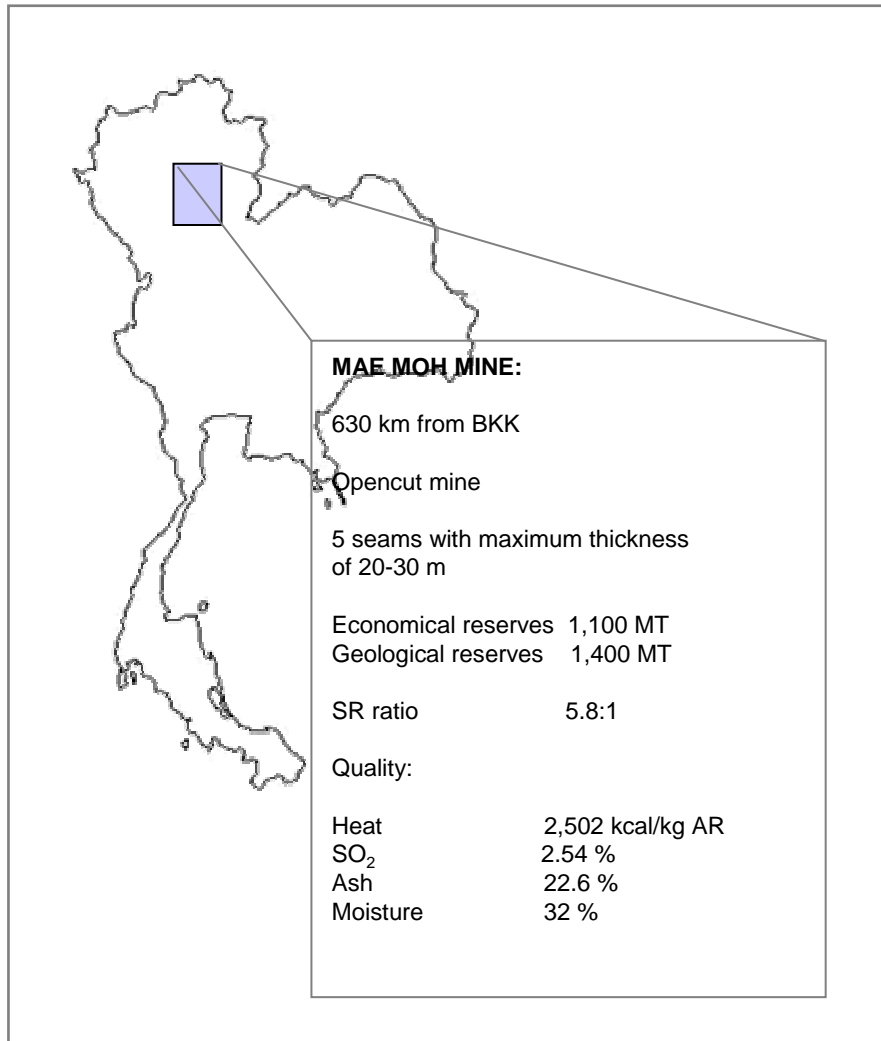
# Regional gas supply

Over the longer term, with the growth of a regional LNG market and with the development of a trans-ASEAN gas pipeline, Thailand will also be able to diversify its access to gas imports.



# Coal and lignite supply

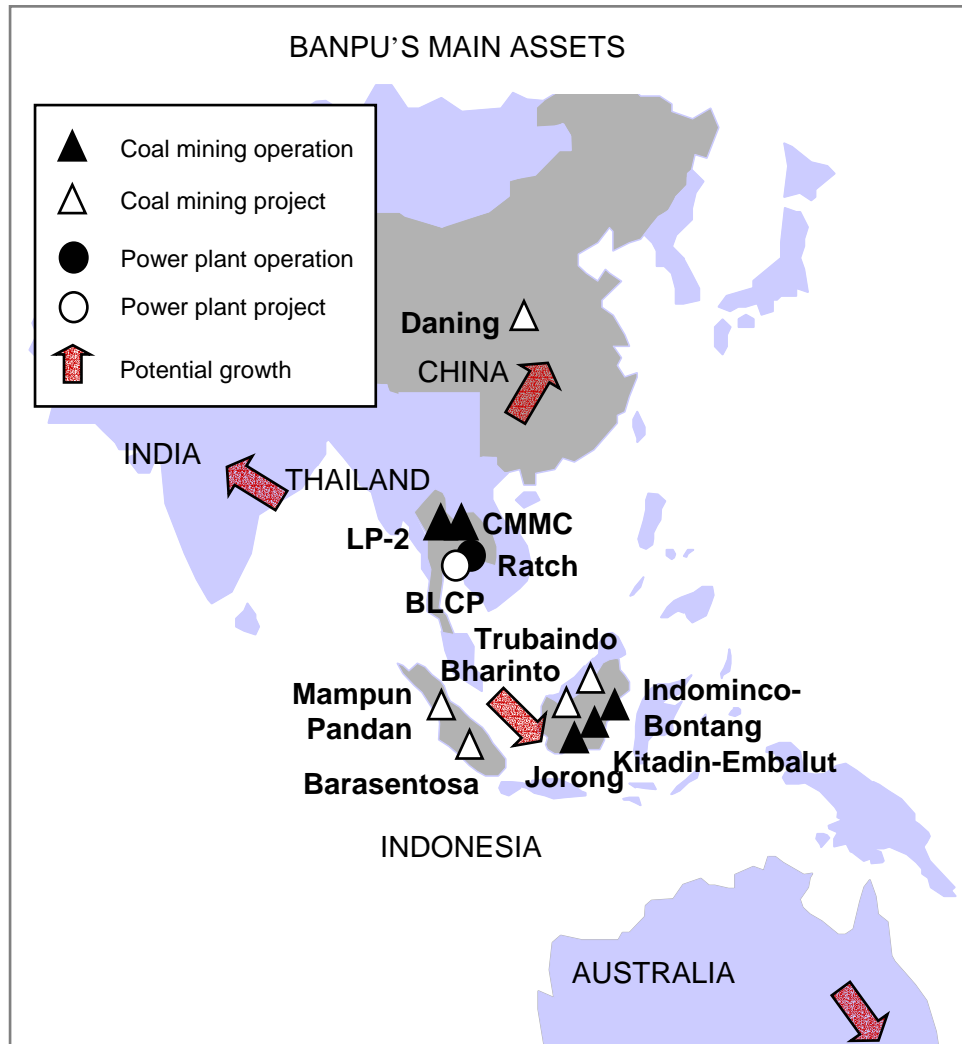
Thailand has access to its own reserves of lignite (2.5 billion tonnes ??) as well as a growing (currently approx. 250 million tonne per annum) regional market for seaborne thermal coal





# Banpu: Thailand's regional coal 'champion'

Thailand is also 'lucky' to be home to one of the region's most dynamic coal-mining groups, Banpu. Banpu has expertise both in coal-fired power plant development (e.g. BLCP) and coal-mine development



## ***Banpu today:***

Coal production 2004: 15.5 MT  
(c.30% sold to Thailand)

Power generation capacity (eq.): 1.4GW  
(including BLCP, coal-fired by 2006/7)

Financial muscle: enterprise value of \$1.3 bn  
(net debt only 12% of EV; liquid investments worth \$0.4bn)

## ***Banpu tomorrow (?):***

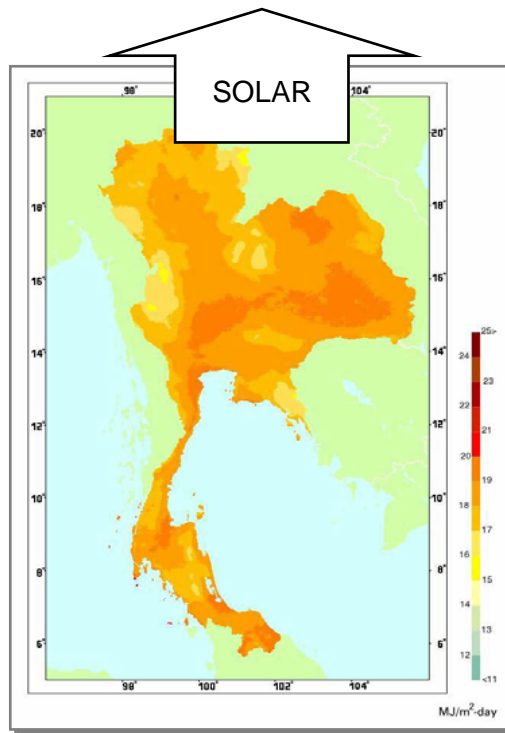
Potential to expand to up to 21mtpa from existing coal resources

Existing + latent financial resources sufficient for further 30mtpa coal or 3,000MW coal-fired power

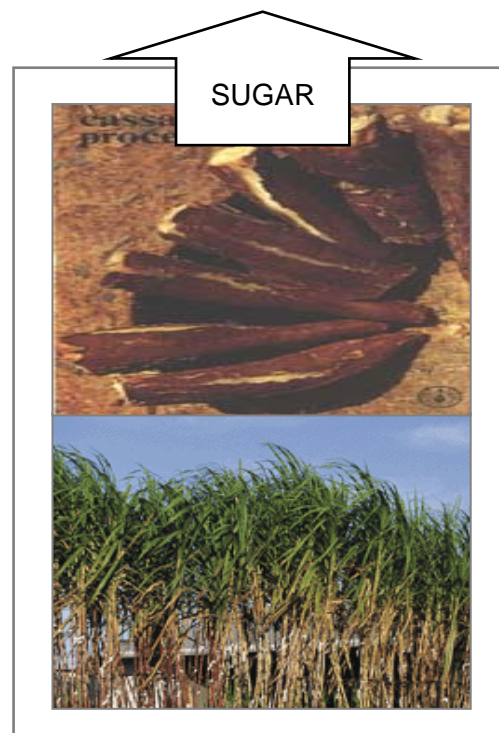
# Thailand's renewable resources ?

Thailand has good renewable resources sufficient to support large solar PV and carbohydrate fuel cell power development. With new technologies currently under development, wind could also be an important power source

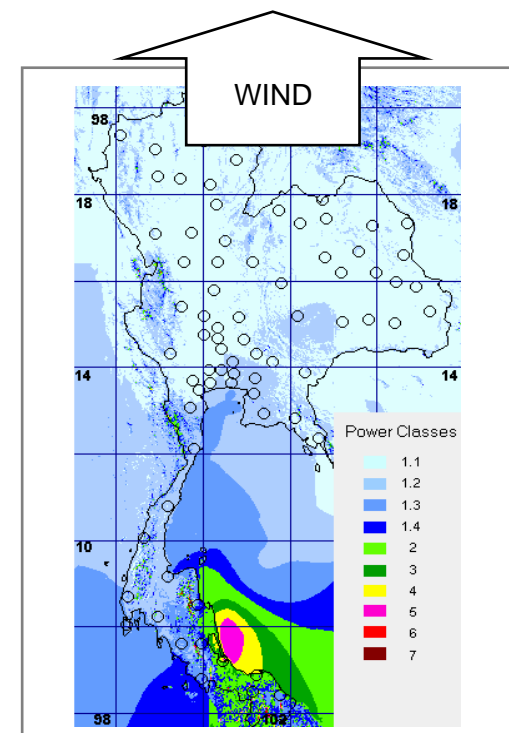
*With average intensity of daily radiation 5kWh/m<sup>2</sup>, Thailand considered to have significant solar PV potential. In 1999 Greenpeace estimated by 2020, 3.5TWh could be generated from solar PV in Thailand (1% of supply)*



*Thailand is one of the world's leading producers of sugar cane (65mtpa) and cassava (21mtpa). Resources could easily be sufficient to support a multi-GW power generation system based on carbohydrate fuels*

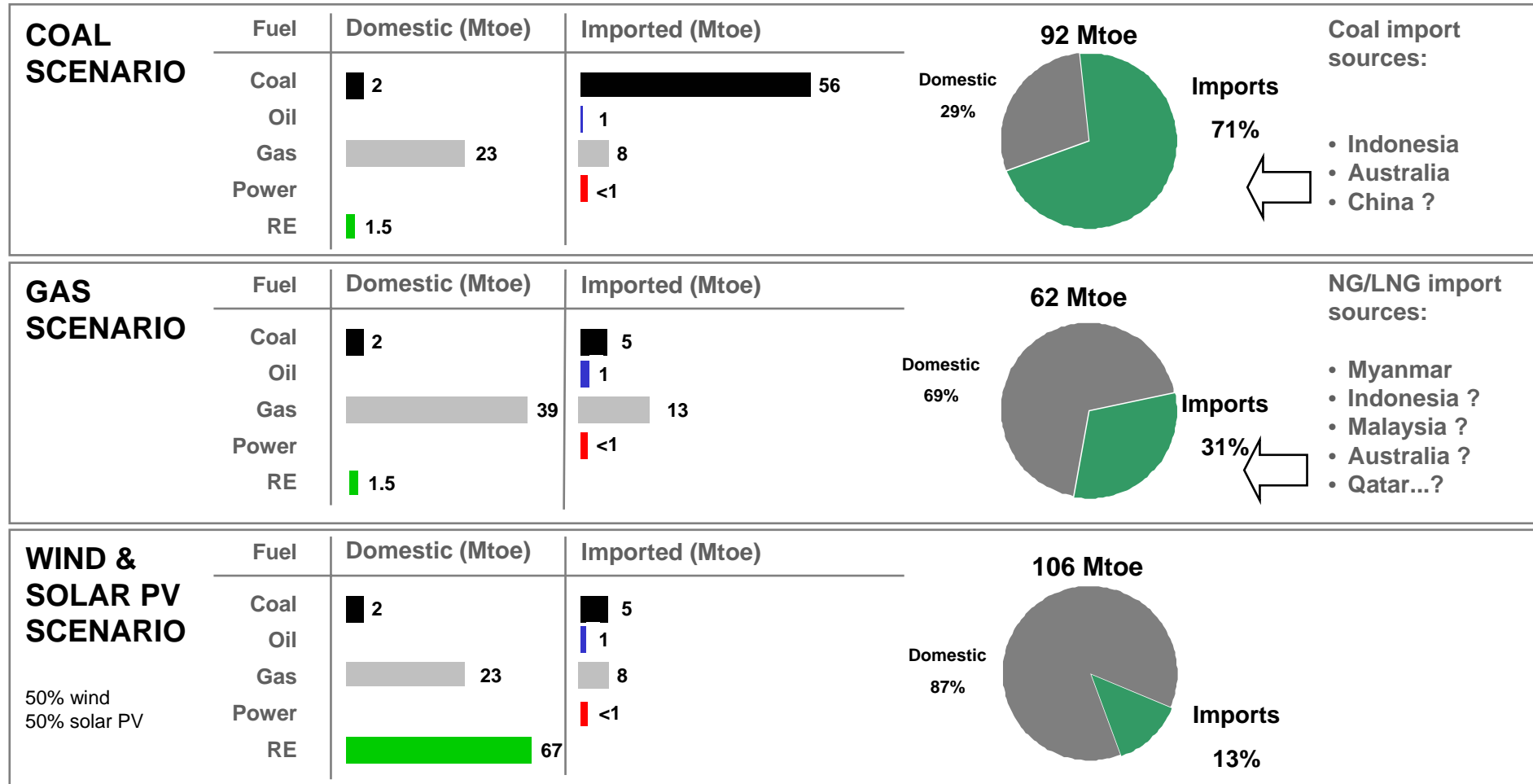


*Most of Thailand has low wind speeds (av. 4 metres per second or less). In south, however, particularly in the area around Songkhla (and off-shore) wind speeds (at elevations of around 50 metres) average 7 metres per second or more*



# Import dependency scenarios (2025) ?

Looking at different 'extreme' case scenarios, a coal-focused power strategy would inevitably lead to a much higher level of dependence on imports than either a gas-focused or renewables-focused strategy



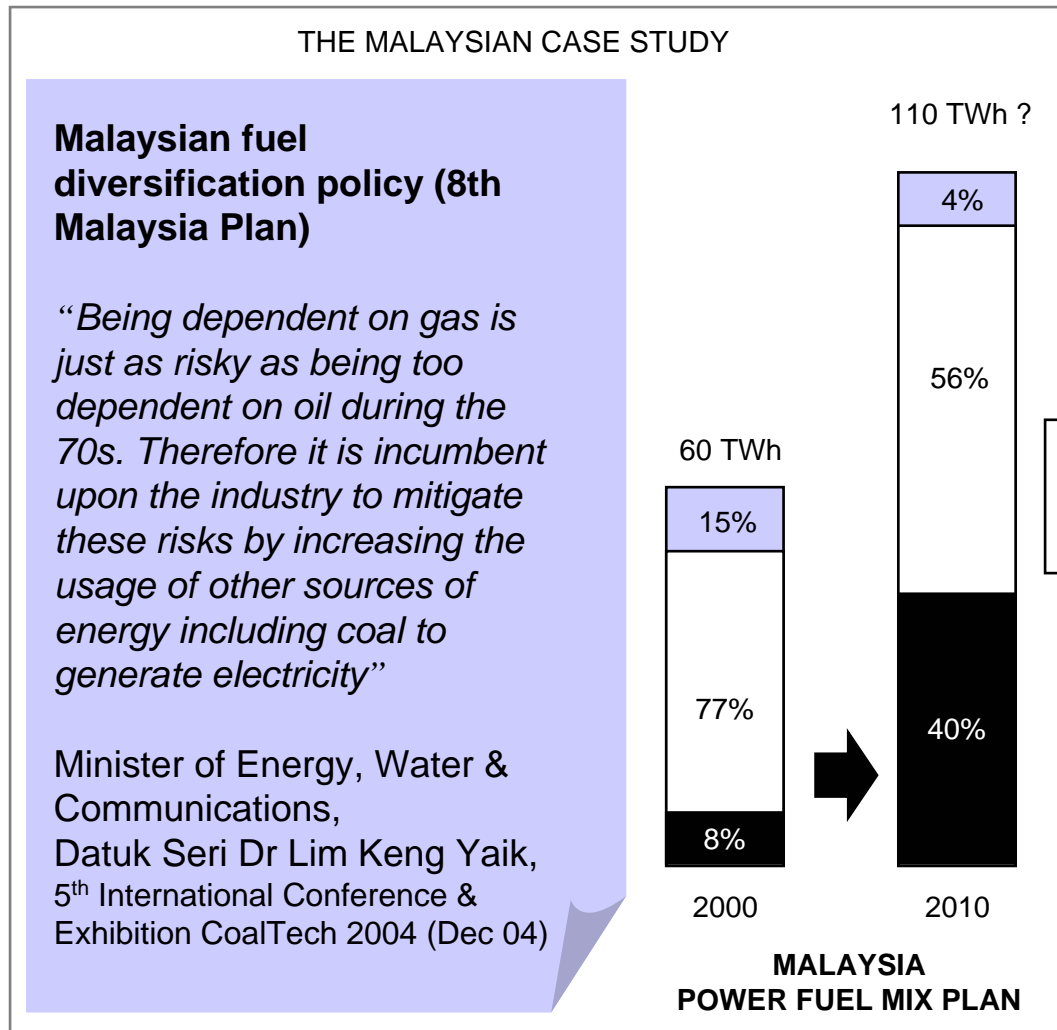
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# While there is a need to diversify fuel strategy ...

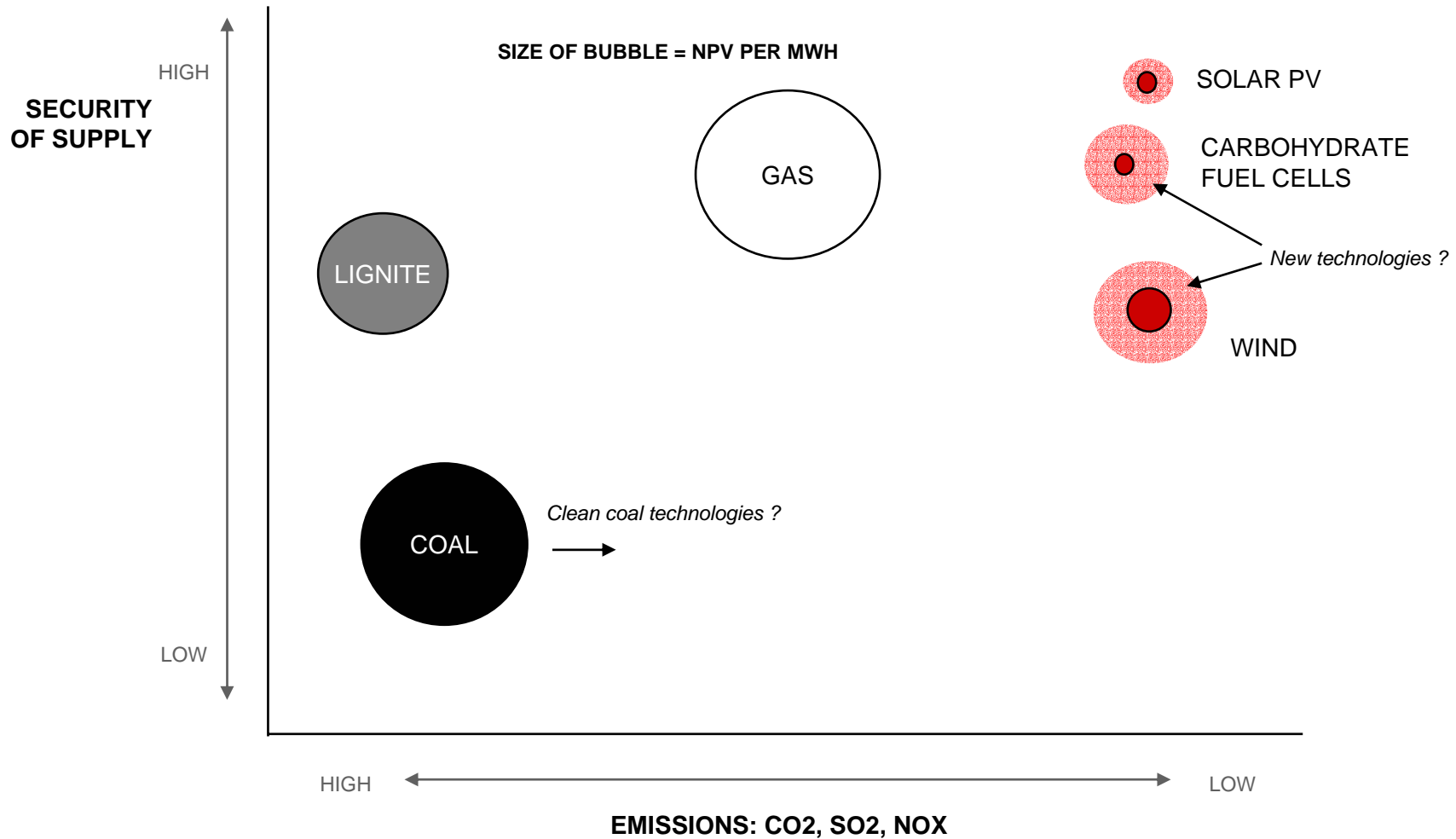
So what about Malaysia's strategic shift of emphasis to coal ? Over-dependence on one fuel source brings risks. Thailand should ensure that although gas retains its lead, coal and renewables also feature prominently



- Malaysia has larger gas reserves than Thailand and Malaysia has no ‘Mae Moh’ and no ‘Banpu’
- Policy is to diversify away from excessive dependence on monopoly gas company
- Gas also already has dominant position in Thai power supply; PTT has monopoly pipeline control
- Still strong linkage between gas and oil prices and LNG market still in infancy
- Risks of excessive dependency on gas should be taken into consideration with due emphasis on encouraging some additional coal-fired power and the development of renewable energy in Thailand

# ... gas is likely to remain 'king' for some time to come

Although Thailand's power fuel strategy will depend on the weightings given to economic, security and emissions criteria – and the need to diversify - it is clear that gas should retain its leading role for some time to come



## APPENDIX

### **Who is AWR Lloyd ???**

# AWR Lloyd services the energy, mining and metals industries

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Equity valuation  
Corporate analysis  
Industry research

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- **Non-ferrous**  
Base metals  
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Precious metals and minerals
- **Iron and steel**  
Iron ore  
Ferro-alloys  
Steel-making and products



# AWR Lloyd has been advisor to Thai energy clients since 2000



## AWR LLOYD IN THAILAND:

- Advisor to leading Thai energy clients since 2000
- Bangkok office since 2001
- 6 corporate finance professionals ‘on-the-ground’
- Existing clients: coal-mining, power, oil, renewable energy