COAL'S PRODUCTION FRONTIERS

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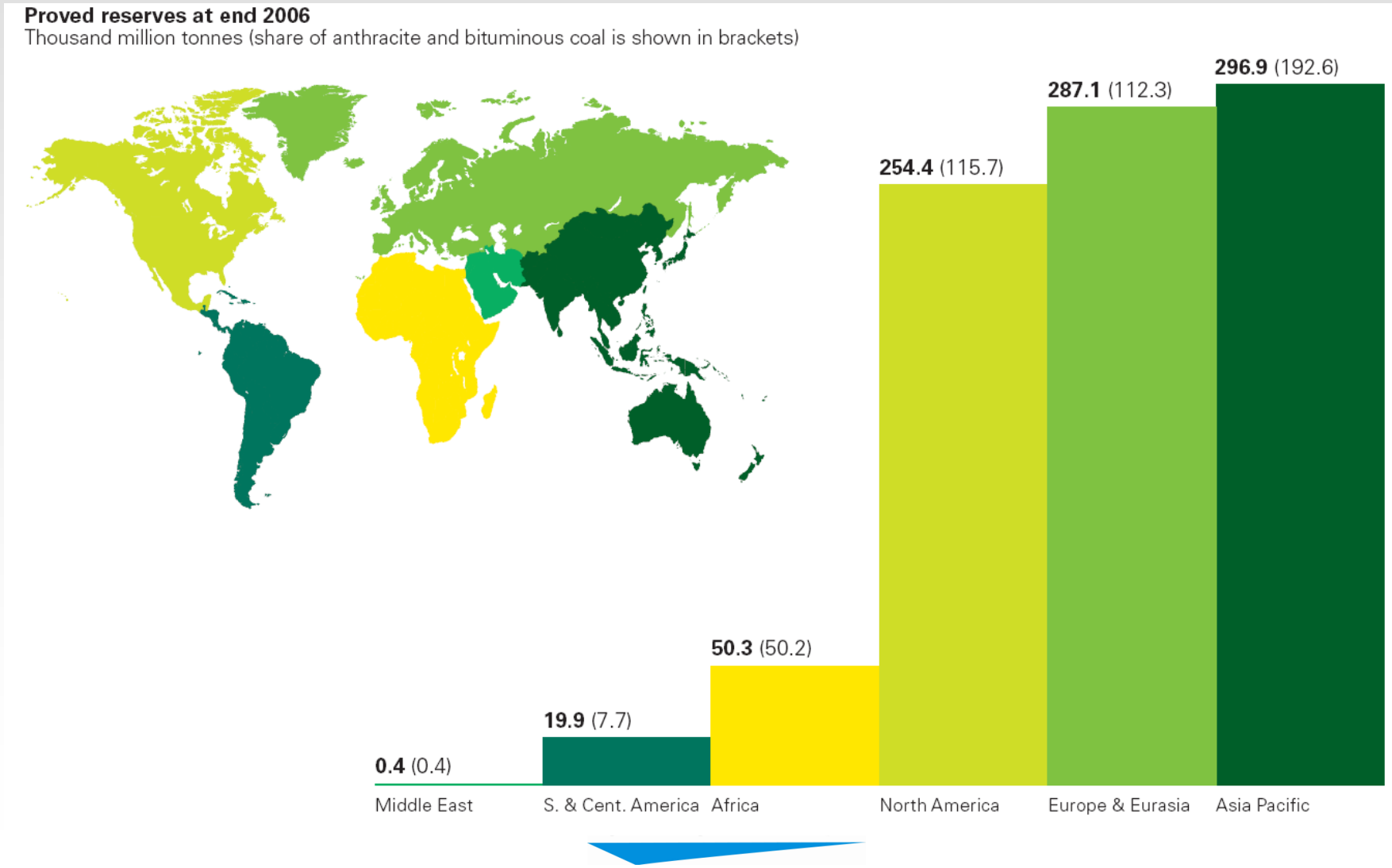
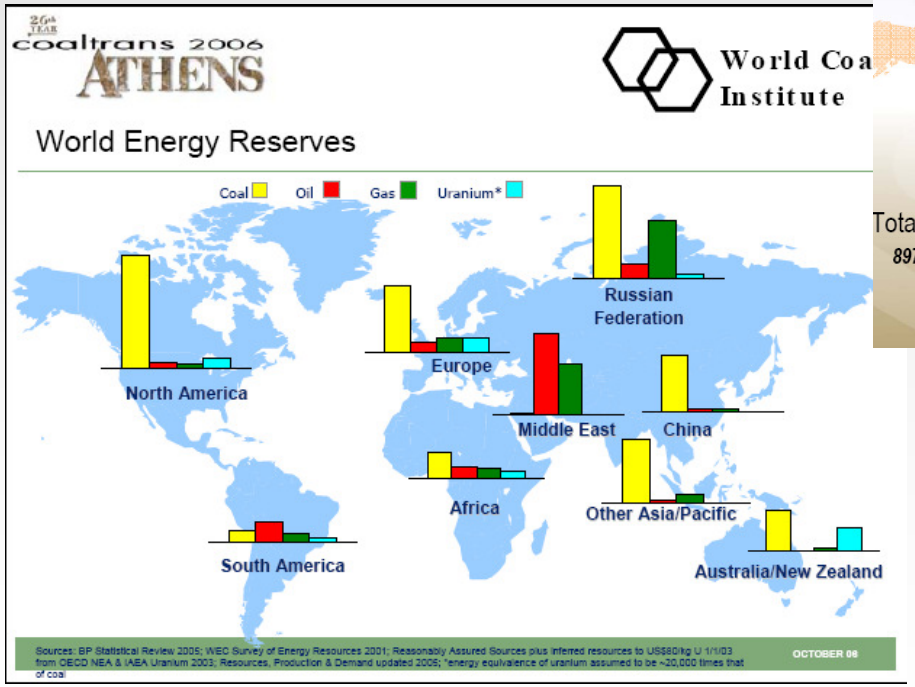
INTRODUCTION

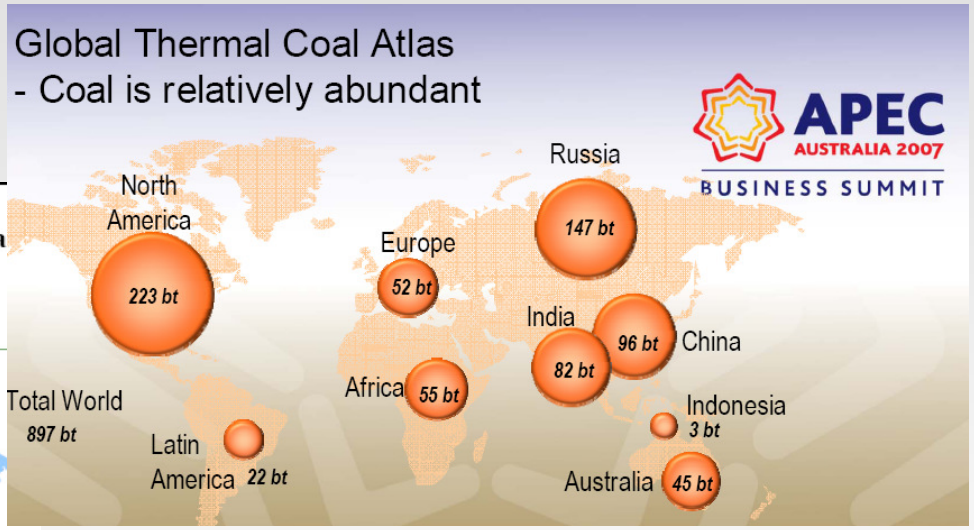
- Common assumption that coal resources are adequate to last 200 years or more
- If true, we can expect coal to be a dominant force in the energy industry for at least this century
- But are these figures reliable and, if so, what can producers do to enhance the possible competitive advantage?
- Coal resources are the foundation of long term planning and strategy development for the energy industry
- Need to ensure we can rely on the predictions and allow the coal industry and its producers to position itself in the energy sector as a long term dominant supply source

THE BASE CASE



Figures widely accepted





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Distribution of Reserves

Coal

Proved reserves at end 2006 Million tonnes	Anthracite and bituminous	Sub-bituminous and lignite	Total	Share of total	R/P ratio
USA	111338	135305	**246643**	27.1%	234
Total North America	**115669**	**138763**	**254432**	**28.0%**	**226**
Brazil	–	10113	**10113**	1.1%	*
Colombia	6230	381	**6611**	0.7%	101
Venezuela	479	–	**479**	0.1%	60
Other S. & Cent. America	992	1698	**2690**	0.3%	*
Total S. & Cent. America	**7701**	**12192**	**19893**	**2.2%**	**246**
Kazakhstan	28151	3128	**31279**	3.4%	325
Russian Federation	49088	107922	**157010**	17.3%	*
Ukraine	16274	17879	**34153**	3.8%	424
Total Europe & Eurasia	**112256**	**174839**	**287095**	**31.6%**	**237**
South Africa	48750	–	**48750**	5.4%	190
Total Middle East & Africa	**50581**	**174**	**50755**	**5.6%**	**194**
Australia	38600	39900	**78500**	8.6%	210
China	62200	52300	**114500**	12.6%	48
India	90085	2360	**92445**	10.2%	207
Total Asia Pacific	**192564**	**104325**	**296889**	**32.7%**	**85**
TOTAL WORLD	**478771**	**430293**	**909064**	**100.0%**	**147**
of which: European Union 25	17424	17938	**35362**	3.9%	65
OECD	172363	200857	**373220**	41.1%	177
Former Soviet Union	94513	132741	**227254**	25.0%	464
Other EMEs	211895	96695	**308590**	33.9%	86

Source of reserves data: *Survey of Energy Resources 2004*, World Energy Council.

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What are proven reserves?

Proven reserves of coal

"Generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known deposits under existing economic and operating conditions"

BP Statistical Review

What does that mean?

The key is 'existing economic conditions'

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I mentioned "proven reserves"; so, what exactly does this term mean? Well if you go back to the Gold Standard - the BP Statistical Review - proven reserves of coal are defined as "<exact quote below>".

Let's take a minute to parse that definition. Basically, it gives proven reserves as a function of what's out there - "known deposits" - mining and mapping technology, and economics.

For coal, to within less than a factor of ten, "what's out there" is fairly well know, and is large. There may be 6 trillion tonnes or 10 trillion tonnes in situ, but nobody really denies that coal resources number in the trillions.

Furthermore. while there have been some refinements in technologies used to locate deposits, I would propose that even the most cutting-edge technologies used to retrieve coal -- say longwall mining underground and large-scale mechanized draglining for opencast mining -- have been around in their present form for decades or are refinements of scale, not method.

Probably the most dynamic and uncertain variable in this function, then, is "existing economic and operating conditions"...

Linus, 11/04/2008

Existing economic conditions

- Production costs often shown as export costs because they are the best documented and have some form of sensible forecast
- These typically are about $8-$14 per tonne pithead and about $25 (Colombia) to over $50 (Poland) per tonne FOB
- Domestic market costs vary widely – from South Africa captive mines at under $10 per tonne delivered to over $60 in Europe.
- Lignite production costs typically $3 - $7 per tonne – but not if heat adjusted!
- Probable to say that production costs at mines – typically – is about $10 per tonne pithead and it is common to consider the economic conditions as those relevant to export coals
- But the realities of the domestic markets are far removed from those of traded thermal markets
- Similarly, coking coal is included in the reserve figures but market (economic) conditions are unique
- Same applies to PCI, anthracite and lignite markets

➢ Multiple markets within 'coal' market

Global Production

DATA SET (mt)	2007
OUTPUT	
Global hard coal output	5600
Lignite production	900
Domestic use	5600
TRADED COAL	
Global hard coal world trade	900
Of which hard coal maritime	820
Of which hard coal trade by rail	80

- It is clear that over 85% of the world's hard coal production is used in domestic markets
- That is the primary market that defines economic viability of production
- These dynamics vary considerably but are less profitable than modern international markets, even if the latter is more volatile

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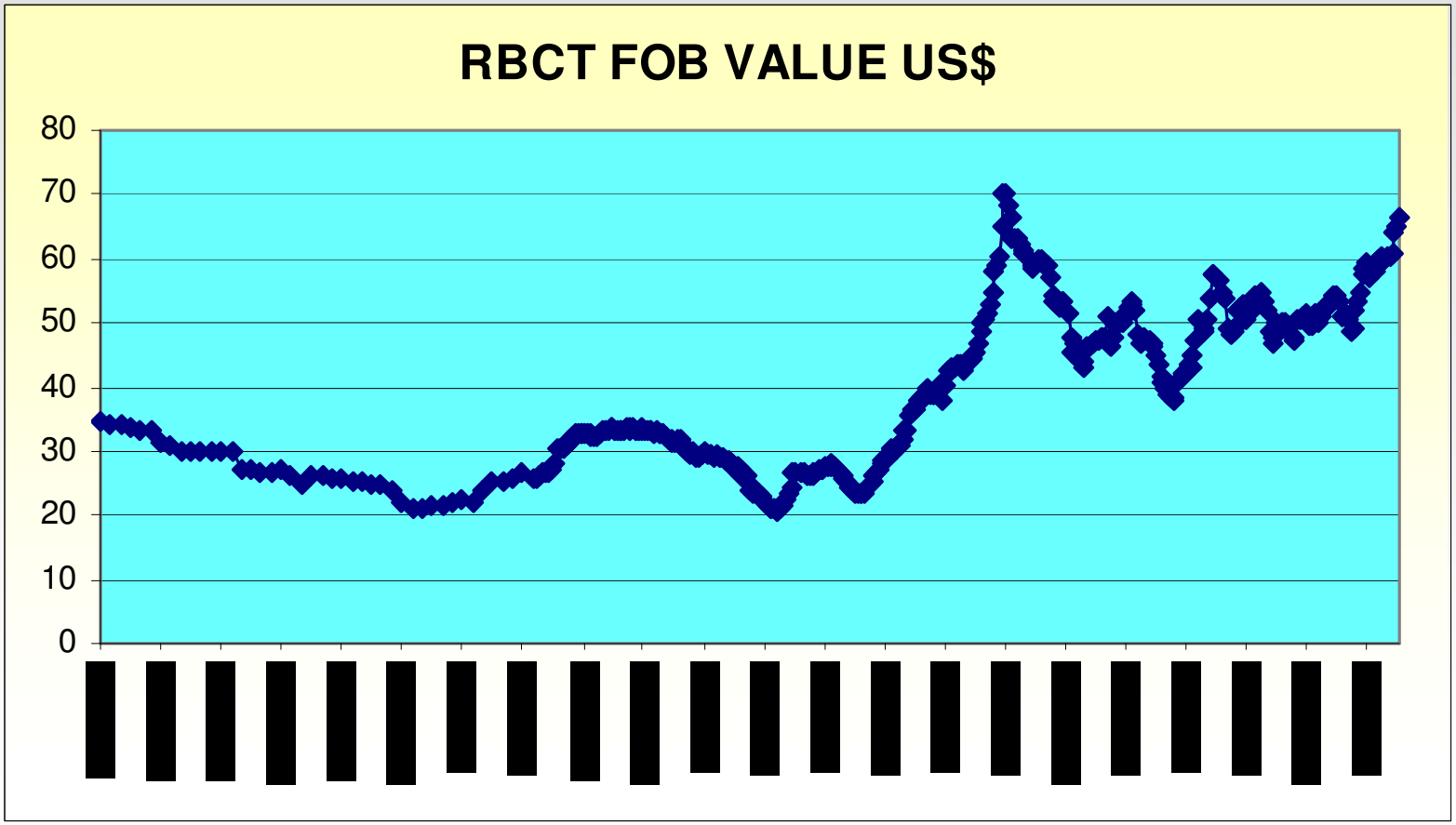
What are the revenues?



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Source: McCloskey

Coal producer profitability

Producer		2007 producers (US$)			
	Period	Criteria	Revenue	Gross profit	Profit (US$/t)
BHP Billiton	Yr to June	Thermal	3769	675	**7.76**
		Coking	3769	1509	**39.29**
Rio Tinto	Half year	Australia	1127	306	**19.13**
		US	727	139	**2.28**
Anglo Coal	Half year	S Africa	676	207	**22.97**
		Australia	653	111	**9.51**
		Colombia	298	135	**25.69**
Xstrata	Half year	Aust Coking	255	85	**36.95**
		Aust Thermal	900	195	**9.71**
		S Africa	378	108	**9.81**
		S America	251	121	**25.74**

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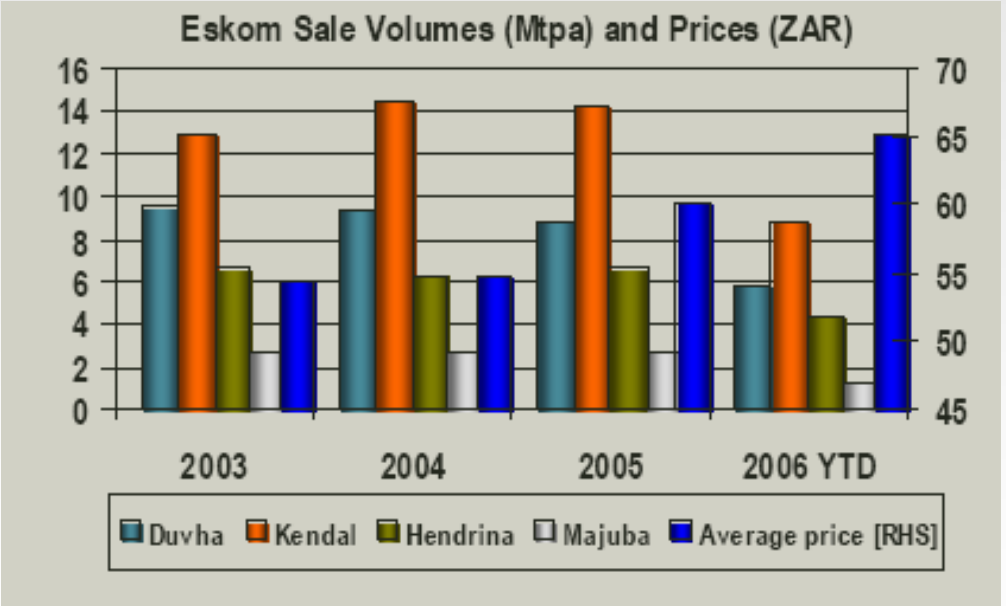
Source: Company reports, McCloskey

Definition of economic viability

- So, if we are to assess what are the real economic coal resources we first need some sort of parameters to work by
- In many cases, this probably equates to a pithead production cost of $10 - $20 and delivery to point of sale for another $10 - $20
- Suggests that ‘economic’ conditions mean coal deliverable to port or market at about $40 per tonne .



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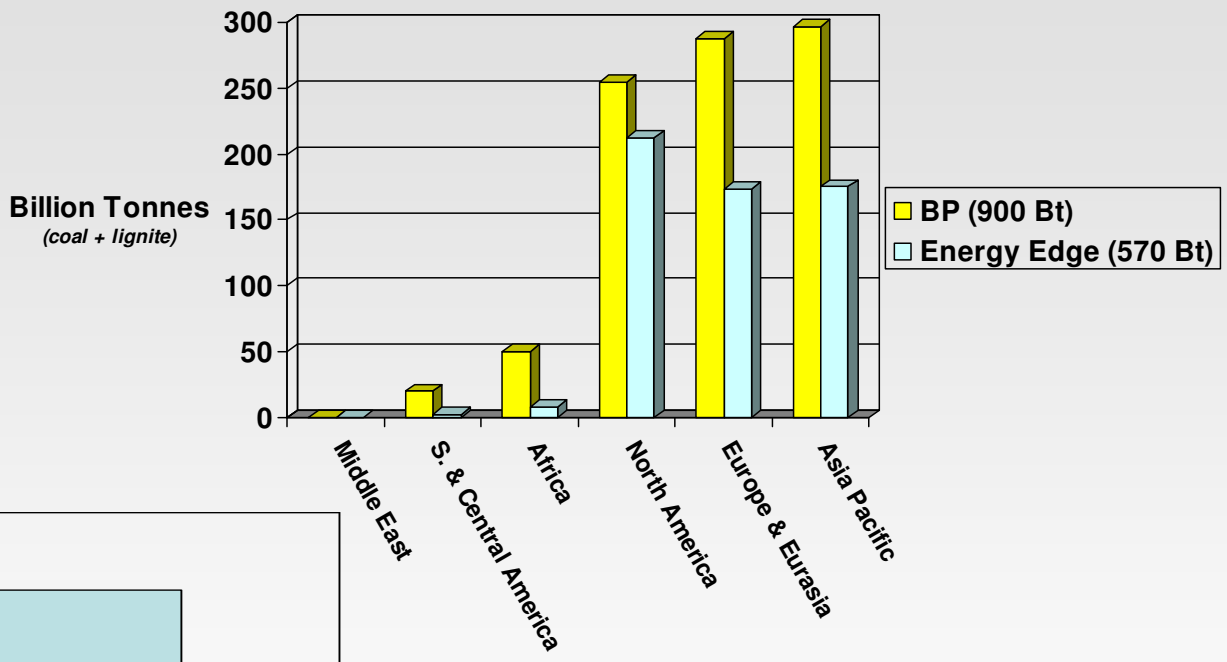
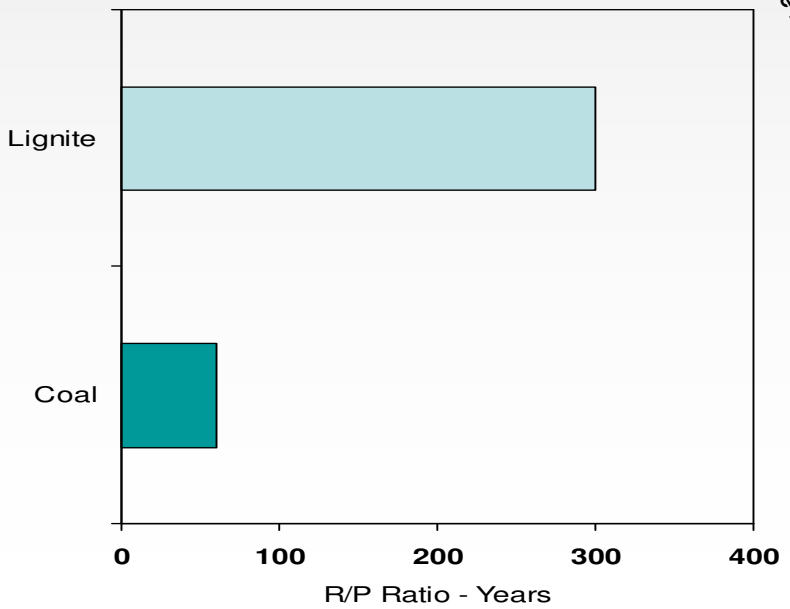
Possible global coal reserve life





- Lignite and hard coal reserves exist in roughly equal proportions (270 Bt to 300 Bt, respectively)
- However, comparing current coal production rate (5 Bt/PA) to Lignite (<1 Bt/PA) means Lignite has more than 5 times as many years availability at current R/P ratios

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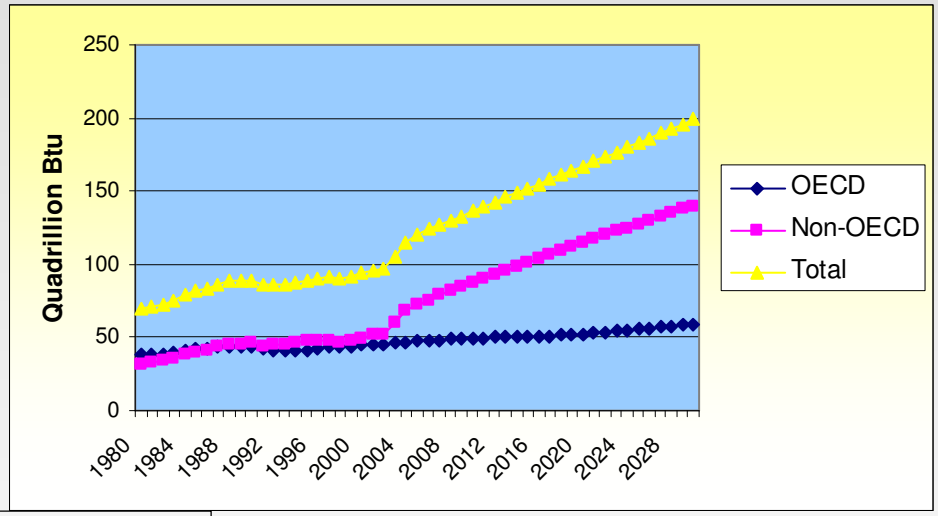
Overview by country – export industry

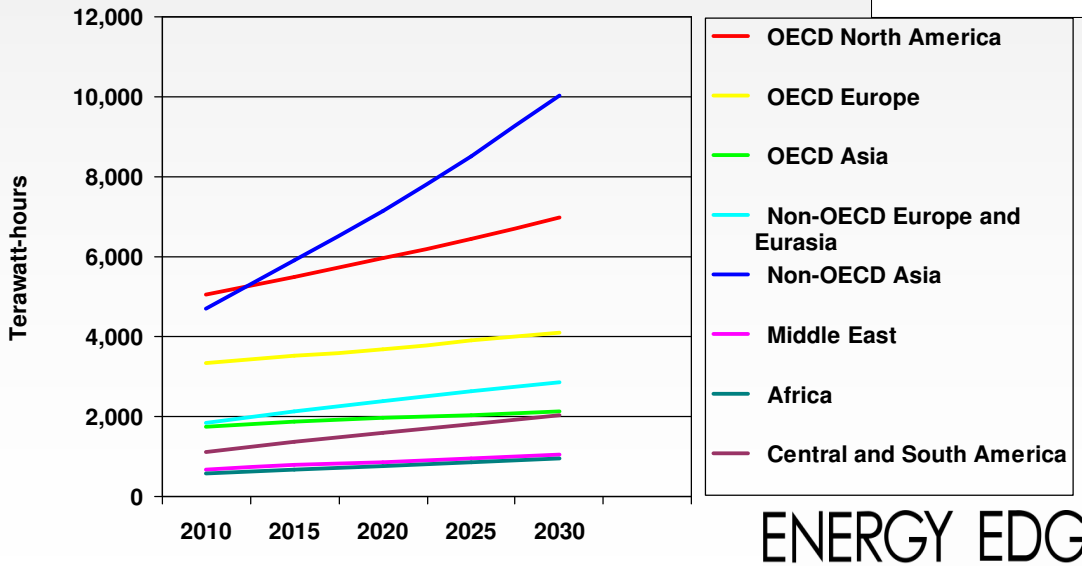
- Tier 1; Self-sufficient or better: North America and Russia
- Tier 2; Prime exporters: Australia and Colombia
- Tier 3; Facing possible shortfalls from indigenous supply: India and China
- Tier 4; Facing possible shortfalls of imported coals: Japan, Korea and much of Europe

- In Tier 3 and Tier 4, we highlight the risk that needs attention in terms of better understanding of coal resources

Long term demand and supply

Coal demand seems set to rise both overall and regionally





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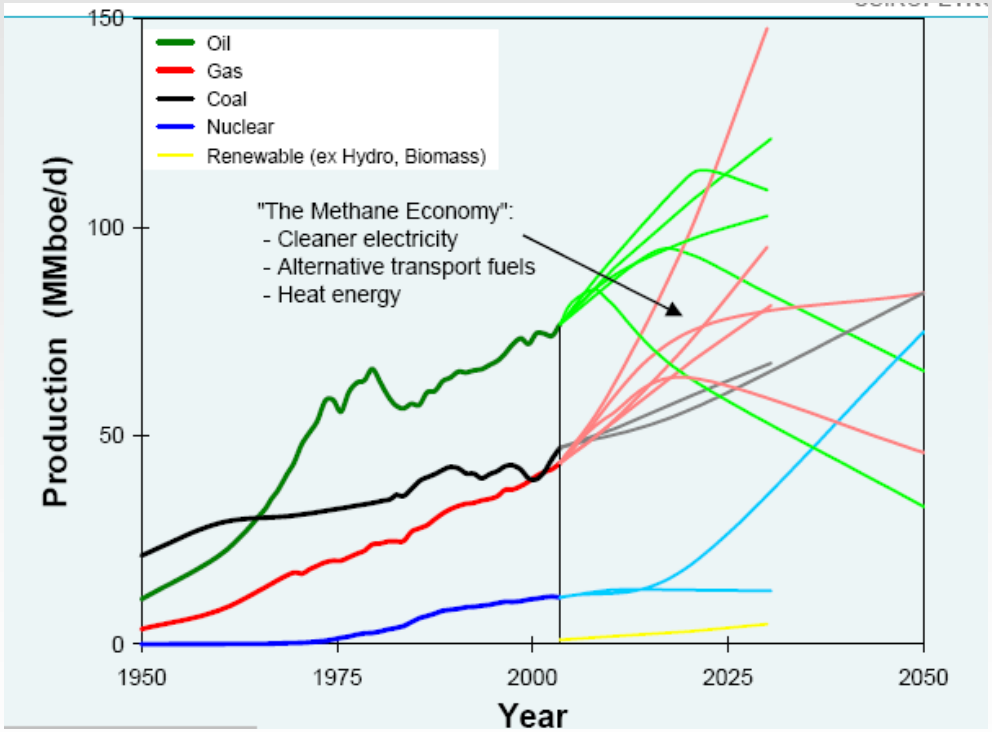
Impact of clean coal technologies

- Very difficult to assess – take your pick
- Likely production 7-10 billion tonnes per year by 2030
- CCT could add 1-2 billion more
- Shenhua looking at gasifying 100 Mt of coal by 2030?
- Can resources tolerate a 12 bn tpy production rate?



Source: IEA

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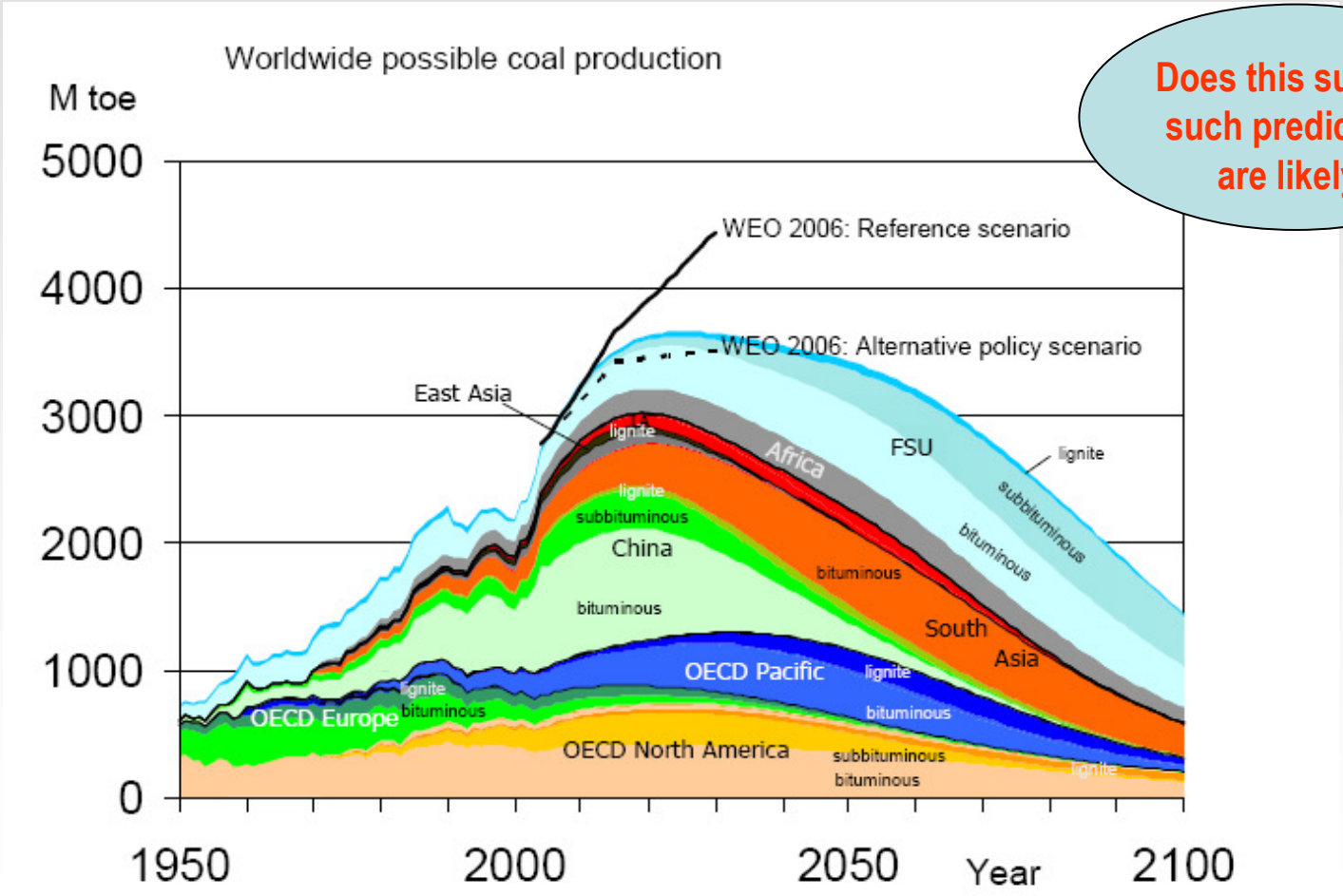
The Peak Coal theory



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Source: Energy Watch Group

No – but why not?

- The issue is that there probably are trillions of tonnes of coal in the world
- The problem is that the resources aren't well defined – because they don't have to be
- There are historically no benefits for producers in having coal resources proved up past 15-20 years – most Life of Mine plans only go that far
- Fully exploring deeper deposits (say below 250m) is expensive and only done shortly before the reserves are needed for exploitation
- Improvements to classification systems are getting better but still inconsistencies on international reporting requirements – need to bring all countries into line
- The benefits to the countries are the attraction quality reserves bring for investment and for companies that are seen to have realistic assets
- CCT's could further exacerbate the global coal demand and supply balance by pressurising mineable resources
- Underground coal gasification offers the opportunity to integrate CCT's into coal production without reducing the economically viable coal reserves

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L10 Standard current estimates put proven coal reserves at about 10% of total resources, as opposed to 47% and 67% for gas and oil, respectively. For coal to be truly peaking, resources, not proven reserves would have to be peaking. The distinction is phonetically subtle, but real; that of absolute physical limitation (peak resource) as opposed to market conditions (peak reserves) which should resolve themselves through natural economic adjustments.

This is not to say that the invisible hand of the market will maintain the status quo, however.

There are many structural obstacles faced by the coal industry in converting resources into proven reserves in order to maintain production needed to meet projected needs.

Among these are first) the fact that coal mines have not been

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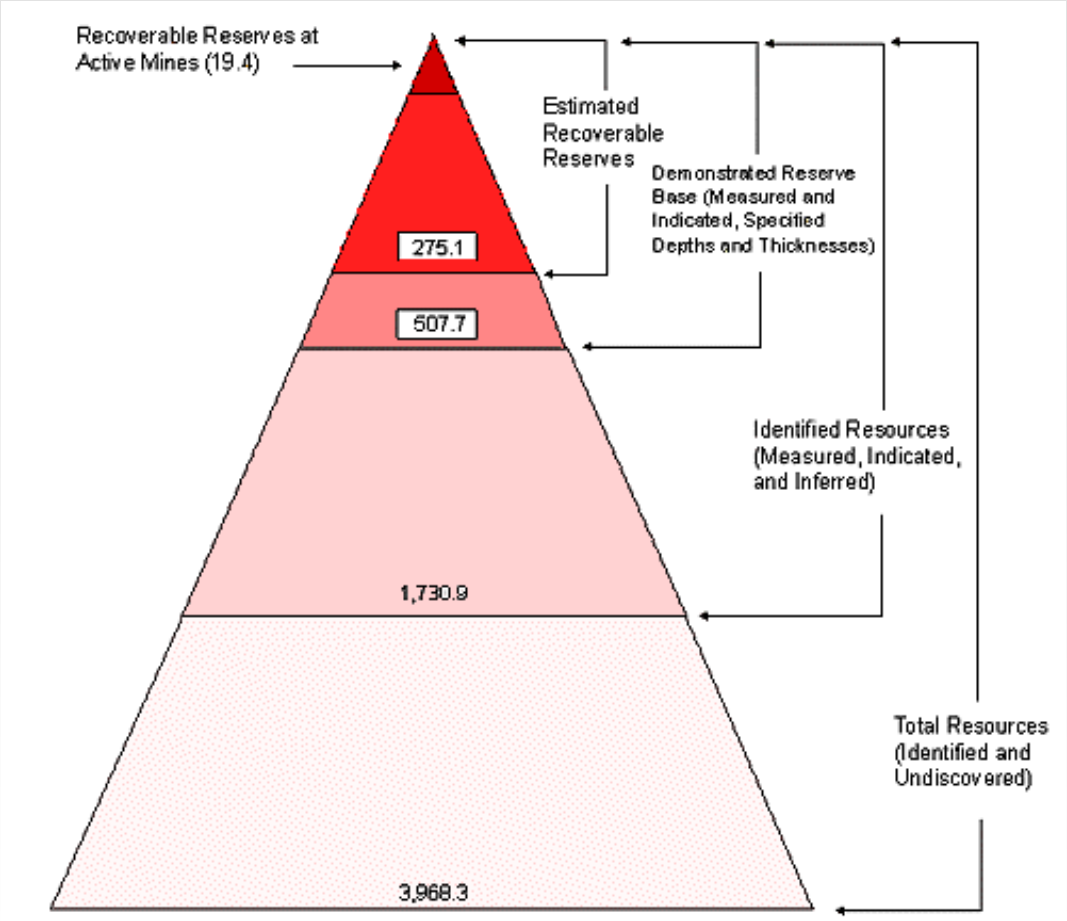
Moving up the triangle

Increasing confidence



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Summary

- The energy industry needs to consider seriously the options that may allow the extraction of energy by techniques that do not require mining – such as UCG
- Coal reserves and resources need to be better understood and the role the cost of production will have defined
- Industry needs to move closer to a common reporting code that will allow mineable resources to be defined
- Develop a clearer picture developed of what resources are mineable and what can be exploited by non-conventional means