



Peak Coal - Coming Soon?

Posted by [Chris Vernon](#) on April 5, 2007 - 1:15am in [The Oil Drum: Europe](#)

Topic: [Supply/Production](#)

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The general consensus view on coal supplies has long been that we have hundreds of years of the stuff left, and that oil and gas depletion are the pressing concerns. However, dissenting voices are emerging. Canadian geologist David Hughes recently [claimed](#) that "peak coal looks like it's occurred in the Lower 48 (US states)", and the consensus position on coal is also called into serious question by the **Coal: Resources and Future Production** report soon to be released by the Energy Watch Group in Germany. I present a summary of its findings here.

[Update 04/04/07]

The final version of the Energy Watch Group report was published today and is available at: <http://www.energywatchgroup.org/files/Coalreport.pdf>

In particular greater detail has been added regarding future US coal production, noting that the US has now switched from being a net exporter to a net importer of steam coal and arguing that total (volumetric) US coal production will peak between 2020 and 2030.

It is also noted that only 15% of coal produced globally is exported, the rest being consumed domestically, with Australia is responsible for almost 40% of global coal exports.

Finally, certain of the figures in the report have been revised, and so these have been revised (and marked as such with endnotes) in the below summary. These revisions do not change the overall trends.

Reserves

The report highlights that the "proved reserves at year end" published in the most recent BP Statistical Review of World Energy in June 2006 are stated as being for year end 2005, but are actually based on the latest World Energy Council (WEC) assessments, which contain data for the end of 2002.

So our best figures on this are actually over four years old. And our worst figures? Well, some haven't been updated in 15 years (China) and some in up to 40 years (Vietnam, Afghanistan).

But really the key message in the global data lies in the rate at which reserves estimates have been revised downwards. As Peak Oilers well know, conventional wisdom has it that reserves will increase as more exploration takes place and prices rise. Yet, in truth, estimates for global coal

resources have been consistently revised *down*, and by *55% over the past 25 years*, from 10 trillion tons hce (hard coal equivalent) in 1980 to around 4.5 trillion tons hce in 2005 [1]. Certain countries (including Germany and the UK) have been revised down by over 90% in this period. The UK reported proved recoverable reserves of 45bn tons in WEC 1980 [2], but these were continually revised downwards to reach only 0.22bn tons by the latest report. Cumulative UK production in this period amounted to only approx 1.8bn tons.

Even Poland, the biggest coal producer in the EU, reports reserves revised down by 50% over the last 10 years. Since production alone cannot explain such revisions, they are deemed likely to be due to improvements in data. The chief exceptions to this rule are India and Australia, both showing significant upward revisions, but as we have seen the global trend is firmly downward. Only South Africa shows continuously shrinking reserves roughly in line with cumulative production. Globally, the report concludes that data quality is very poor and that these downward revisions must be expected to continue.

China

So back to China, the world's largest producer, with the fourth largest reported reserves globally. The 2006 Statistical Review of World Energy credits China with 55 years of remaining reserves at current production rates (depleting its reserves at almost 2% per annum). But as previously mentioned, the Statistical Review faithfully reproduces proved reserves figures which were last changed in 1992 (note that China's cumulative production in the 15 years since comes to about 20% of those stated reserves), so we can knock 15 years off that number straight away, reducing the remaining total reserves to 40 years' worth. The Energy Watch Group report gives projected production profiles showing that China is likely to experience peak coal production in the next 10-15 years, followed by a steep decline. It should also be noted that these production profiles do not take into account uncontrolled coal fires which – according to satellite based estimates – add around 5-10% [3] to regular consumption. Since China's production dwarfs that of any other country (being almost double that of the second largest producer, the USA) the global coal production peak will be heavily influenced by China's production profile.

Types of Coal

Now, before I outline the situation in the USA, which comfortably holds the world's largest reserves of coal, it may be instructive to distinguish the different types of coal. There are four basic types, starting with the most energy-rich – anthracite (about 30 MJ/kg), bituminous coal (18.8-29.3 MJ/kg), sub-bituminous coal (8.3-25 MJ/kg) and lignite (5.5-14.3 MJ/kg). Those towards the anthracite end of the scale are often termed 'hard coal', and those towards the lignite end of the scale as 'soft coal', although the exact definition of these terms varies. The softest coals are sometimes termed 'brown coal'.

USA

The USA, then, as we have all heard, has reported proven coal reserves that would allow continued production at current rates for more than 200 years. Three federal states (Wyoming, Montana, Illinois) hold about 60% [4] of US coal reserves, but the low production rates relative to reported reserves in Montana and Illinois cast some doubt on the reliability or suitability of those reported reserves. As many of these reserves are of low quality, with high sulphur content and/or other drawbacks, it may be considered doubtful that they will ever be produced. Measured in terms of produced tons per miner, US productivity steadily increased until 2000, but has declined since, which also implies that 'easy coal' is running short.

The USA had passed peak production of anthracite (by far the rarest form) by 1950 and peaked in bituminous coal in 1990, but sub-bituminous coal more than made up for this decline in terms

of tonnage. However, due to the lower energy content of softer coals, the *total energy content of annual US coal production peaked in 1998*.

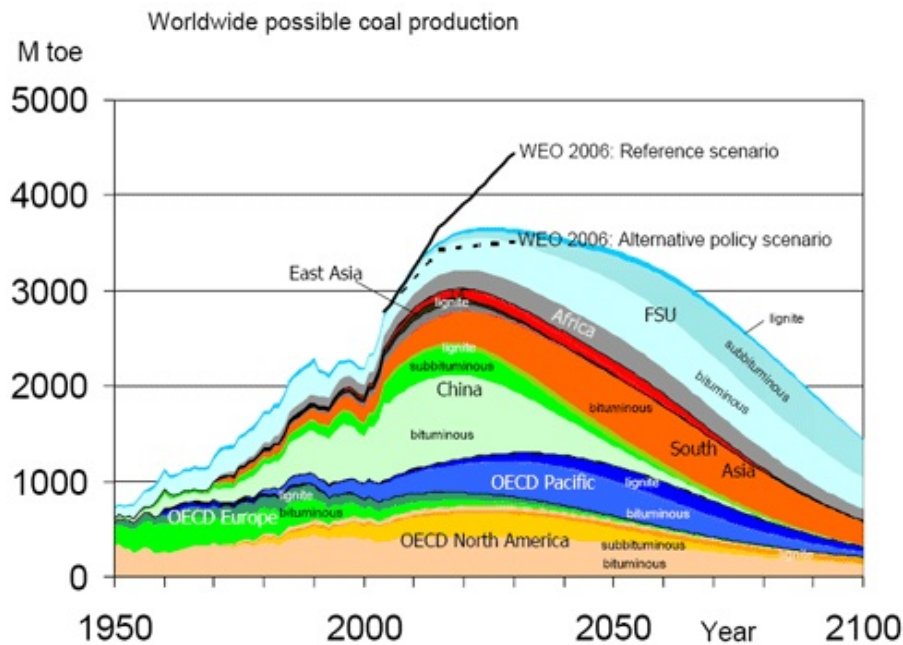
Global Picture

So, having looked at the world's biggest coal producer and the holder of the world's biggest reserves, we may perhaps turn our attention to the global picture.

Six countries (USA, Russia, India, China, Australia, South Africa) hold about 85% [5] of world coal reserves, when this is measured in terms of energy content. According to the latest assessment by the WEC, total world reserves at the end of 2002 stood at 479bn tons of anthracite and bituminous coal, 272bn tons of sub-bituminous coal and 158bn tons of lignite.

According to the Energy Watch Group, global coal production can increase for 10-15 years (mainly driven by China), but then production of anthracite and bituminous coal will peak around 2020 at a production rate around 30% higher than at present. Lignite production is predicted to peak somewhere between 2050 and 2060. However, as the quality of coal produced will be declining continuously *the world coal energy peak is projected to come around 2025*. It is also important to note that 'peak coal exports' should come even earlier, as lower-energy-density coals are not worth transporting long distances.

When we compare this with the scenarios (represented by the dashed and the solid line) from the IEA's 2006 World Energy Outlook (WEO) we get the following graph:



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As we can see, according to this report the WEO reference scenario is unrealistic, and only the production in the WEO alternative policy scenario (which assumed political measures constraining coal due to fears over greenhouse gas emissions) is actually feasible. The Energy Watch Group's report, however, is not considering potential policy constraints, and is describing only what production may be physically possible.

I must stress that one of the key findings of this report is that data quality is very poor globally, and so all of the findings should be taken with that caveat, but the trends do seem clear. Indeed,

we sent a copy of this report to Richard Heinberg and he has [revealed](#) that a Dutch study-in-progress using different criteria has reached preliminary results confirming this report's findings. And the poor data quality is itself hardly reassuring for an energy source which is becoming increasingly central to our global future.

This report clearly carries many serious implications, but for now I'll just share the information and leave these to be discussed on TOD. Further analysis of the report has also recently been released in Heinberg's [March MuseLetter](#).

[1] Revised from 4.2 trillion tons in draft report to 4.5 trillion tons in final version.

[2] Revised from 145bn tonnes to 45bn tonnes. This was my error. WEC 1980 listed 145bn tonnes as the estimated additional resources for the UK. 45bn tonnes was the listed "proved reserves".

[3] Revised from 10-20% in draft report to 5-10% in final version.

[4] Revised from "over 70%" in draft report to 60% in final version.

[5] Revised from 90% in draft report to 85% in final version.



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