



By Craig M. Pease

Will "Peak Coal" Limit Warming?

Just how much will the Earth's temperature eventually increase from global climate change? The answer requires knowing how rapidly the Earth's temperature increases with increasing atmospheric carbon dioxide levels, and also how much carbon dioxide human society will emit in the future.

The Intergovernmental Panel on Climate Change concludes that there will be about a 3 degree Celsius temperature increase for each doubling of atmospheric carbon dioxide. This leaves the second question: How much natural gas, oil, and coal will humans burn in the future, thereby increasing atmospheric carbon dioxide?

Here there are experts aplenty, but not nearly enough believable data. As stated forcefully by Matthew Simmons in *Twilight in the Desert* and by W. Zittel and J. Schindler in *Coal: Resources and Future Production*, there is a paucity of good, audited, publicly available data on global oil and coal reserves. Some oil reserve data are an obvious fraud, as with the preposterous near doubling of OPEC's stated oil reserves in the early 1980s.

This is a most intriguing state of affairs. We have high resolution atmospheric carbon dioxide records back 800,000 years, we know that 100 parts per million of the current 385 ppm atmospheric carbon dioxide level is from human activities since

the industrial revolution, and we have a more than decent understanding of the relation between atmospheric carbon dioxide and climate, yet there is real uncertainty over how much fossil fuel remains underground, available to be burned in the next 10 years.

This remarkable asymmetry no doubt arises in part because it is easier to document the past than predict the future. Inferring what is underground is never easy. However, I do not see why estimating fossil fuel reserves is intrinsically any more difficult than predicting future climate. Interestingly, much of the explanation is grounded in the obvious fact that the atmosphere is a public resource, whereas nondemocratic governments and private corporations control almost all underground oil and coal reserves.

It is relatively easy to exert a defensible private ownership claim on underground fossil fuel reserves. Importantly, this private control extends not just to the reserves themselves, but also to data about them, leading to the grossly impoverished scientific literature on global fossil fuel reserves. By contrast, it is hard to devise enforceable institutional means to prevent polluters from accessing the atmosphere, making it a commons. Happily, scientists too have ready access to the atmosphere, leading to the tsunami of science on global climate change.

However, once fossil fuels are extracted from the ground, they are sold into public economic markets, about which we have excellent historical data. Annual oil and coal production records from specific individual fields and geographic regions consistently show increasing annual production in the early years as a field is developed, then a peak, and decreasing annual production as the field plays out. Texas oil peaked in 1972, North Sea oil in 1999.

Global oil production must also eventually peak, as it is but the sum of

the production profiles of all individual fields, many of which have already peaked. M. King Hubbert's seminal 1956 analysis predicted that global oil production would peak at about 2000, work since extended by Abbas Bakhtiar in an *Oil & Gas Journal* paper, by Kennerth S. Deffeyes in *Hubbert's Peak*, and others. These analyses consistently predict that global peak oil production is today, plus or minus roughly five years.

Coal reserves estimates are even more speculative than oil reserves. The National Academy of Sciences' 2007 report on coal, though generally optimistic, contains the caveat that "recent programs to assess [coal] reserves . . . indicate that only a small fraction of previously estimated reserves are economically recoverable." Production of U.S. anthracite and bituminous coal (having the highest and second highest energy values) peaked in 1950 and 1990, respectively. The energy value of all coal

mined in the United States has declined very slightly from a 1998 peak, though total volume is still increasing. And the U.S. has the world's largest coal reserves.

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In a June 2007 post at *The Oil Drum*, Dave Rutledge quantifies Jean Laherrere's trenchant critique of the Intergovernmental Panel on Climate Change's analysis, estimating that burning all economically viable fossil fuel reserves will produce an ultimate atmospheric carbon dioxide maximum of 460 ppm, not even a single doubling over the value at the dawn of the industrial revolution. In contrast, all 40 IPCC emissions scenarios assume eventual cumulative carbon dioxide emissions higher than total available fossil fuel reserves. The IPCC richly deserves its Nobel Prize. But this is a colossal blunder.

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