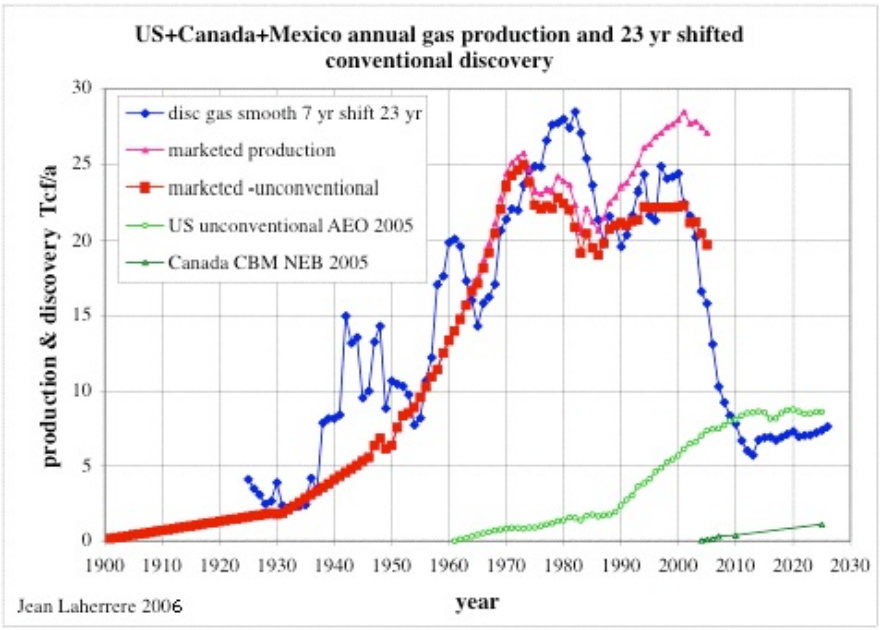
The Oil Drum: Europe
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Natural Gas: how big is the problem?

Posted by Luis de Sousa on December 5, 2006 - 11:11am in The Oil Drum: Europe
Topic: Supply/Production
Tags: electricity generation, gas storage, mitigation, natural gas, peak natural gas, russian gas [list all tags]

Doesn't this graph just chill you?



Let's try to have a broader look on the Natural Gas supply challenge that both Europe and North America face these days, with the help of Jean Laherrère.

Jean Laherrère presented an article entitled "Oil and Gas: what future?" at the Groningen annual Energy Convention, a few days ago. This article is available, as usual, at Jean's space in OilCrisis.com.

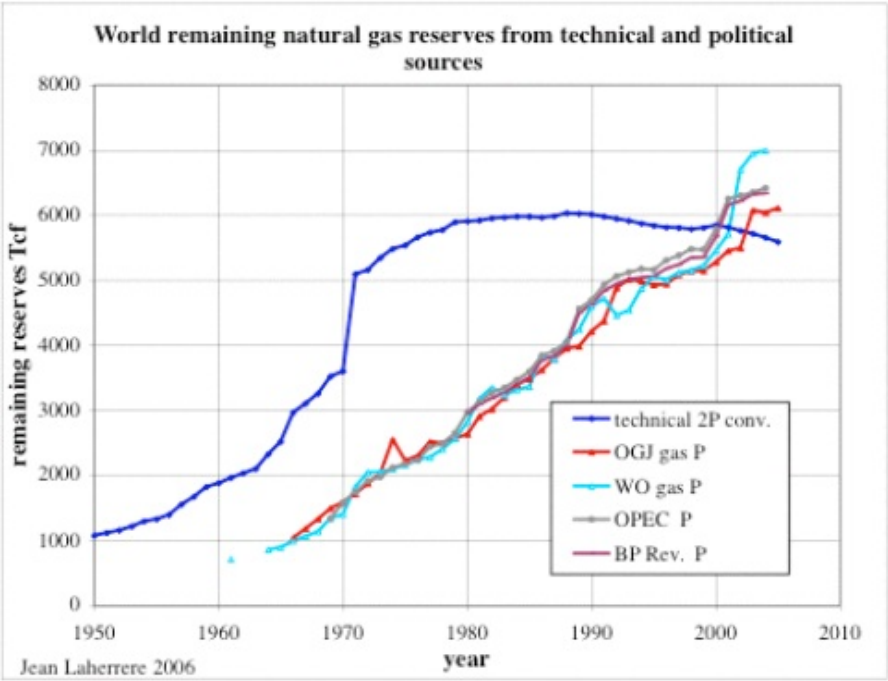
On the first half of the article Jean goes through the usual assessment of Discovery, Reserves and Production for Conventional Oil showing the same results as in previous papers, resulting of the merging of two major data bases: IHS Energy's and Wood Mackenzie's. In this latest paper he goes on and does the similar concerning Natural Gas.

Jean Laherrère's work is really priceless, in fact he has the data (which most of us hasn't) but he really knows what information to get out of it, producing excellent easy to read graphs.

Reserves

Jean explains that for Natural Gas the assessment of remaining reserves is more difficult, for both data bases concern different domains: Wood Mackenzie reports solely recoverable gas reserves whilst IHS Energy reports considerable amounts of stranded gas. Although not as reliable as oil

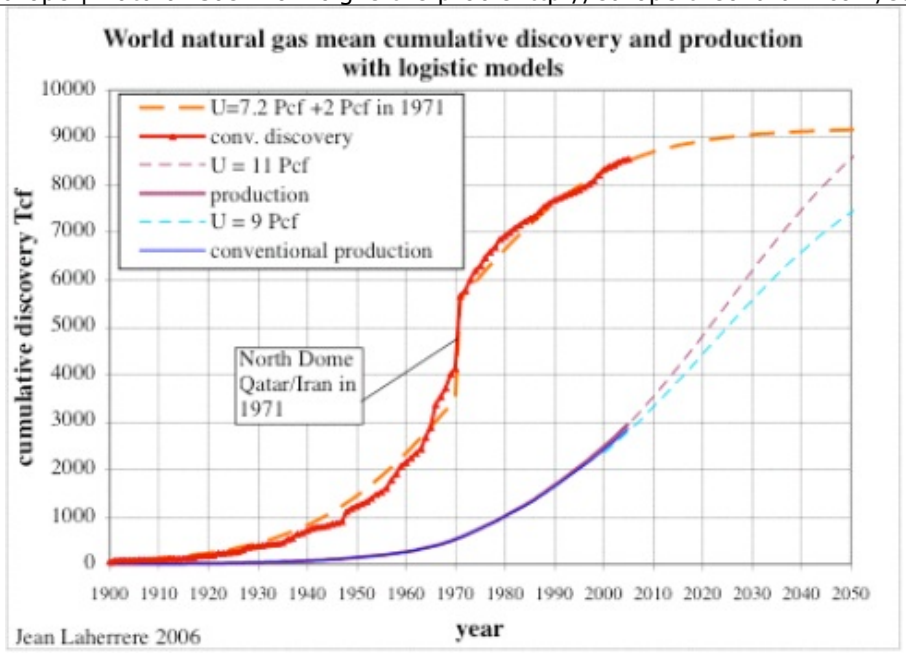
data, the data for gas already yields a clear downward trend:



The peak in Natural Gas remaining reserves was crossed in the late 1980s (circa 6000 Tcf), just ten years after Conventional Oil. The cross point with political reserves happened in the turn of the century, equally ten years after the same event for Conventional Oil. This ten year lag is very interesting for it shows the same pattern of political under-reporting followed by over-reporting registered for Conventional Oil. The same story, happening ten years later.

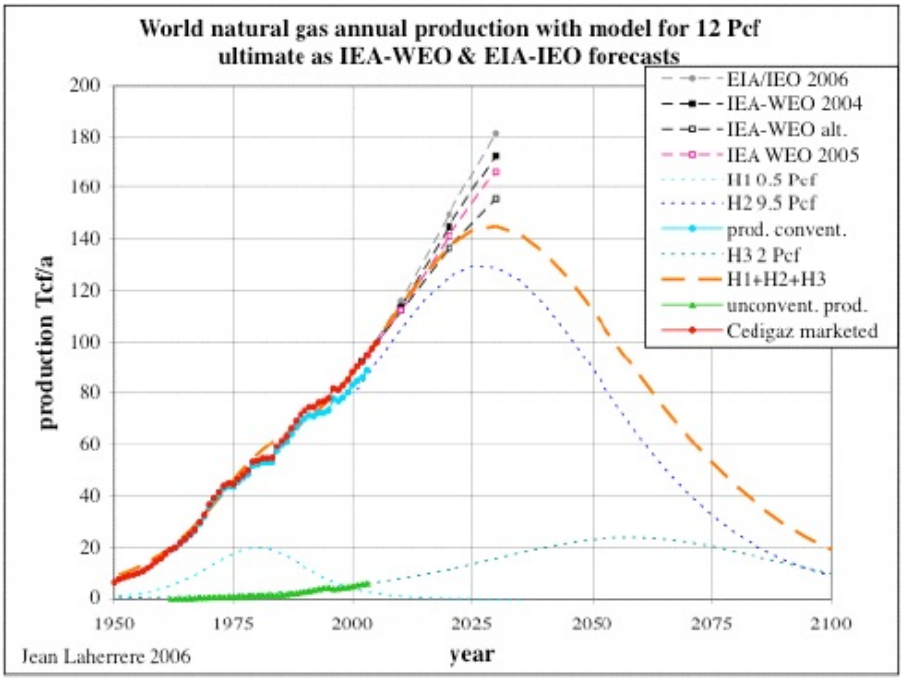
Discovery

Modelling discovery is also harder, for in 1971 the North Dome gas field was found in the Persian Gulf (shared by Iran and Qatar), totaling circa 1500 Tcf (or 15% of the Ultimate). So Jean took this field out and adjusted a logistic curve to the remaining Cumulative Discovery, which fitted pretty good, and added back North Dome. Modeling it this way the logistic points to an Ultimate over 9000 Tcf; Jean indicates that this number is line with previous assessments that pointed to an Ultimate circa 10 000 Tcf.



Production

To forecast future production Jean added a cycle for Unconventional Gas, with an Ultimate of 2000 Tcf, and two for Conventional Gas: an early one with an Ultimate of 500 Tcf and a peak circa 1980 and another with an Ultimate of 9500 Tcf and a peak circa 2025.

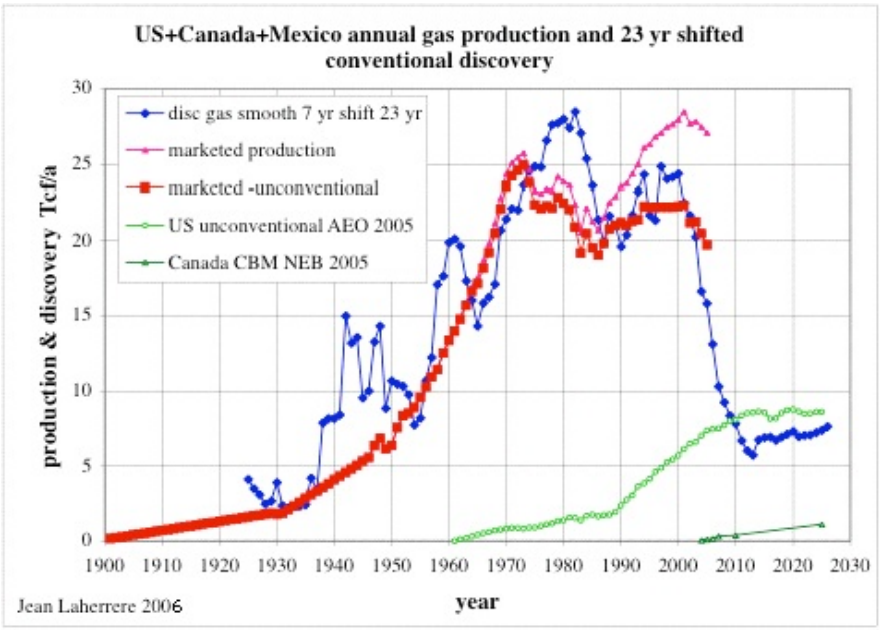


At peak production, All Gas (Conventional + Unconventional) will go over 140 Tcf/y, from the current 97 Tcf/y, an increase of 45% in little more than 20 years. Still, numbers from the IEA or EIA already disagree largely from this assessment, showing that neither of these two institutions is using logistic modeling techniques.

So far so good, right? Wrong. As probably most of TOD readers know, there's no such thing as a World Natural Gas Market, meaning that geographic regions unconnected with gas pipelines must be assessed separately. So does Jean.

North America

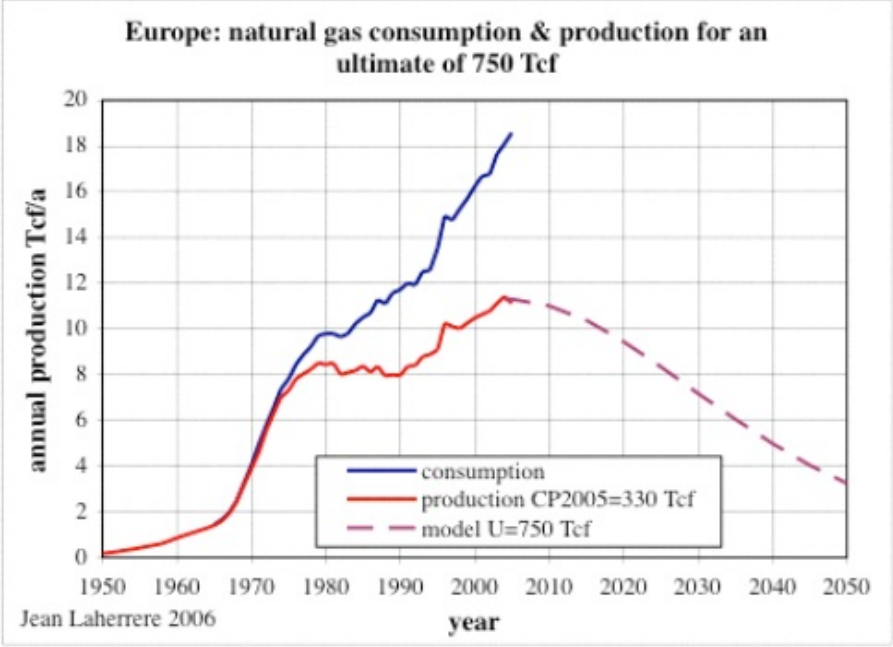
This is when things start looking grim. Production is neatly mirroring Discovery with a 23 year lag. This contrasts to Conventional Oil where the production curve doesn't mimic the discovery the same way. While Conventional Oil production at peak will be around 75 Mb/d, the discovery peak went over 120 Mb/d. Natural Gas Production looks like a smoothed version of Discovery, less noisy, but with the same background trends at the same yearly ratios.



Simply put, by 2010 Conventional Gas production can be half of what is today in North America, falling from 20 Tcf/a to 10 Tcf/a. Jean doesn't hesitate to say that shortages will soon occur in this part of the world. Production already peaked in 2001, declining 5% up to 2005, so a downward trend is already there, but will that cliff unfold? Unconventional Gas production has been rising too slowly to avoid the peak, can it avoid the cliff?

Europe

Europe is yet to go over the peak, and up to now, good neighbours (Algeria and Russia) have been helping sending all the gas asked for. Europe will shortly face its dependency; modeling production with an Ultimate of 750 Tcf, Jean shows this graph:

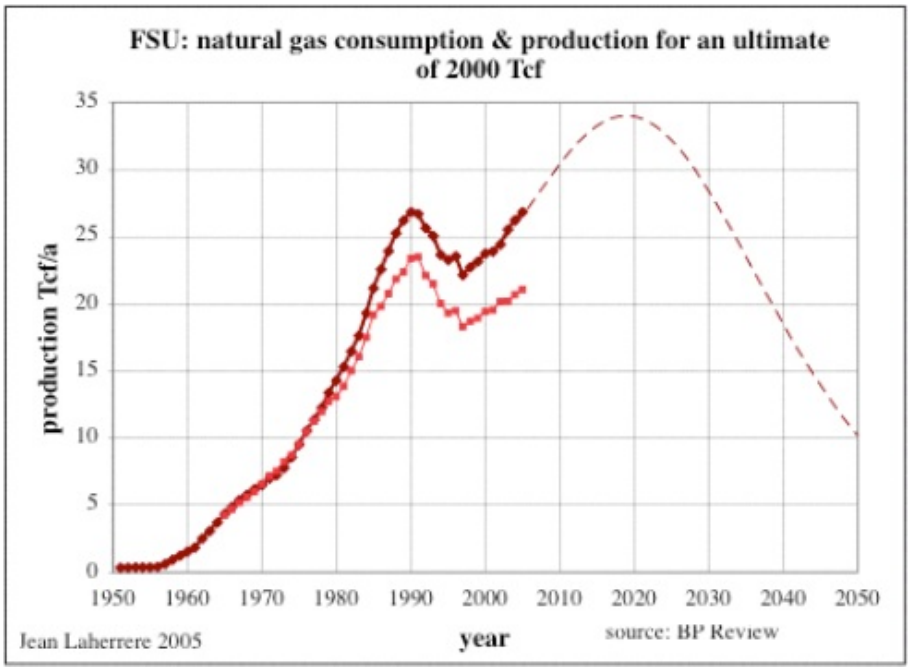


Consumption has been growing at a much sharper pace than Production, which to make matters worse is going into decline.

More good neighbours please.

FSU

Last but not least Jean looks into production in the FSU, the big neighbour. Jean's estimate for the FSU's Ultimate is 2000 Tcf which means a production peak before 2020. Moreover, in spite of a growth up to a production rate of 35 Tcf/y, internal demand will leave by then a meager 10 Tcf/y to export. Finally Jean casts doubts on the will of Gazprom to make the investments needed to ramp up production in the years to follow.

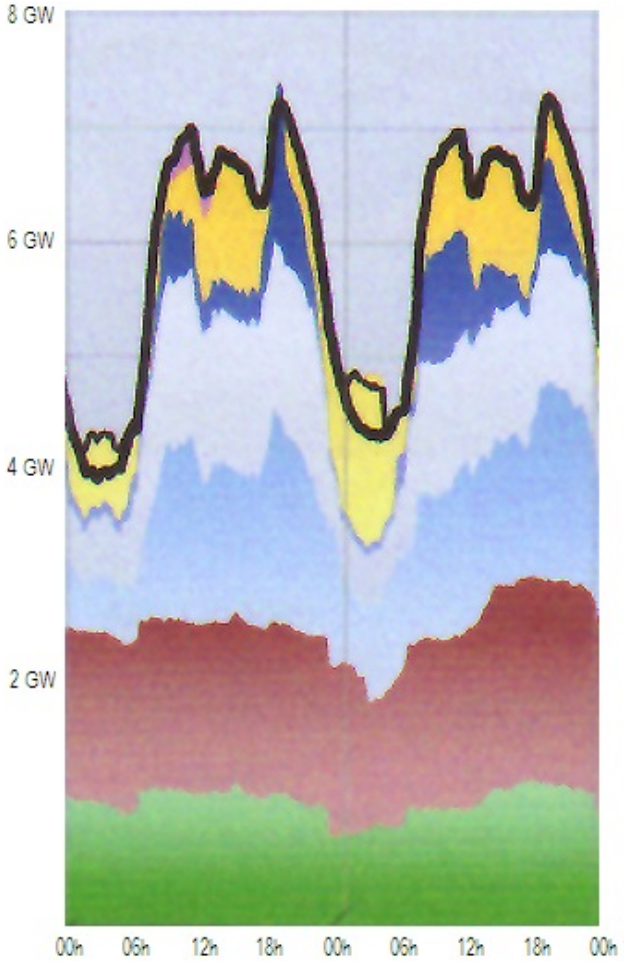


The Importance of Gas

From Jean's work we get to know that both wealthy sides of the Atlantic are heading for trouble. With Peak Oil in site, all we needed was an even sooner Gas Peak. Let's have a look at what Gas means to our daily life.

First of all Gas is a much more effective way to generate heat at home than using electricity or oil products. Electricity is partially generated from Gas; there are losses in transport and losses in transforming electricity into heat. From Oil we have the overheads of transport and refinement. With Gas we just have a little overhead in transport; there are nearly zero losses and no refining.

Secondly Gas is today the best energy source we have to tackle the daily periodic variations in electricity demand. Whilst Coal and Nuclear provide the base energy, they do not allow for the sharp variations in output required when folks start to wake up or when they arrive from work and turn on all of their electronic gadgetry. Take the following graph, showing the supply and demand put to the Portuguese electric grid on a sample period of two days last Spring:



Electricity Demand and Supply on two sample days in Portugal. Red - Coal, light blue - Small Hydro, white - Gas, dark blue - Big Hydro, green - Other Renewable, yellow - Imported (Nuclear), magenta - Diesel Oil, thick black line - Demand.

The electricity generated from Coal keeps quite steady during the course of the day, while Hydro and Gas provide the agility needed to accommodate the variations. During the night cheap Nuclear energy is imported to fill the dams that discharge during the day. Hydroelectric generation is not always possible like this, during the Summer minimum flow has to be maintained and during the Winter maximum flow cannot be surpassed. So the real agility comes from Gas.

The use of Diesel Oil is also possible, recurred to on crisis periods where available Gas isn't enough and direct electricity imports are impossible (such was the case in the morning of the first day).

As seen above heat generation from Gas is potentially more effective than from Oil products, making it a cheaper way to generate electricity. When the Diesel power plants are turned on it means that the immediate generating capacity is close to full. These periods are, to my knowledge, still rare. Portugal is probably different from the majority of the other OECD countries, but an interesting case, for every major energy source is used for generating electricity.

Mitigation

Options aren't many; the imminence of the subject makes it hardly solvable with new infrastructure: new pipelines from distant suppliers, new power plants using different sources of energy, more LNG terminal ports and more LNG tankers; they all take time to come on line. This side of the issue has been extensively covered at TOD (here, here, here or here).

We need a gaseous inflammable substance to use in our power plants and to send through the pipelines to our homes. That can be obtained by Coal gasification - what was formerly known as Town Gas. But this option might stump into constraints in the Coal industry, Town Gas might only be the translation of the infrastructure constraints from Gas transport to Coal mining (and gasification).

Still there is some electricity generation capacity from Oil, but it is unlikely that either Europe or North America will be able grow imports much more from what they are now. And of course, for home heating Oil doesn't help much.

The only mitigation option left is Conservation, will it be enough?

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