The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

The North American Red Queen: Our Natural Gas Treadmill

Posted by nate hagens on November 9, 2006 - 10:12am

I recently attended the ASPO-USA World Oil Conference: Time for Action - A Midnight Ride for Peak Oil in Boston, MA. Interestingly, the conference organizers appended the acronym ASPO, to represent the Association for the Study of Peak Oil *and Gas* for this gathering. Indeed, much more time was spent discussing the North American natural gas problem than at any prior Peak Oil conference I am aware of. Prominent among the presenters addressing this situation was David Hughes of NRCan. Mr Hughes is a senior geoscientist with the Geological Survey of Canada who has been speaking widely on global and North American energy sustainability issues over the past few years to governmental agencies, industry forums and the popular press. He painted a sobering picture of North American Natural Gas Supply - in effect we are trying harder and harder and spending more energy and dollars just to maintain flat production. This post is essentially a summary of David Hughes ASPO NG presentation (he also gave a talk on the Oil Sands) with some added comments and perspective.

North American natural gas producers are likely in Georges shoes...

THE RED QUEEN

"Well, in our country," said Alice, still panting a little, "you'd generally get to somewhere else -- if you run very fast for a long time, as we've been doing."

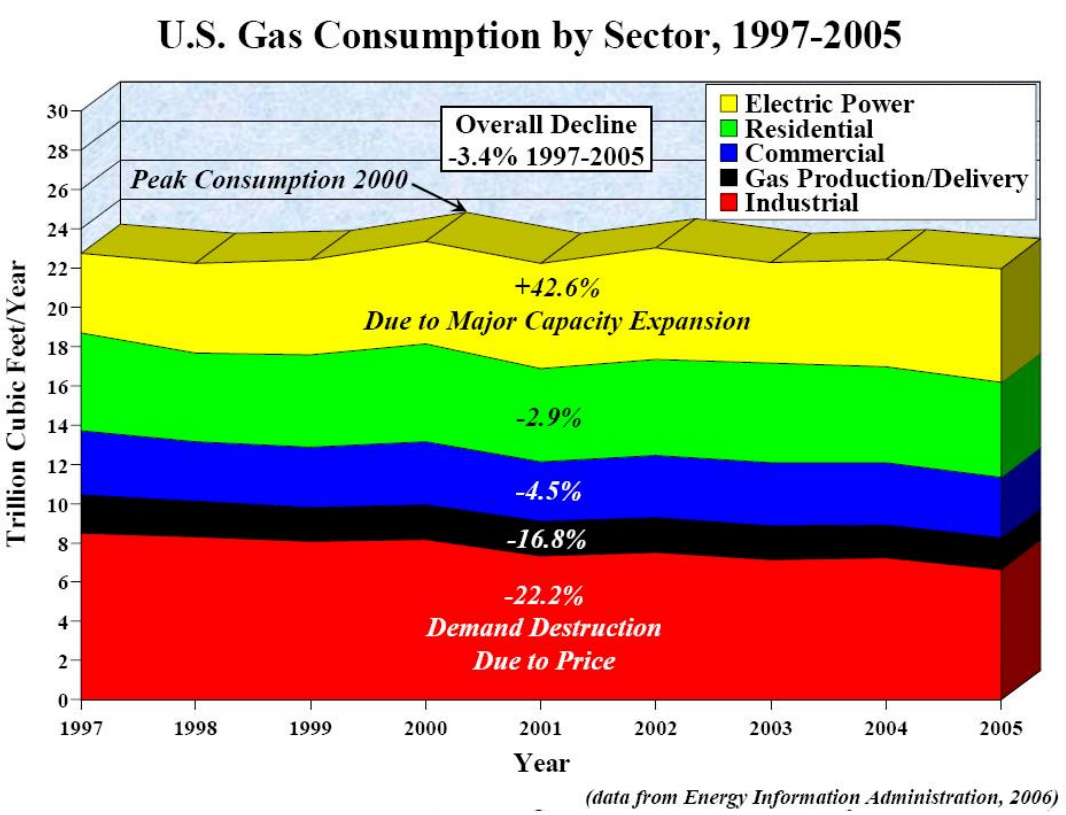
"A slow sort of country!" said the Red Queen. "Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!" Lewis Carroll - "Through the Looking Glass", 1865

NATURAL GAS

As was disussed here, the North American natural gas situation has a) been a story of two separate markets - flat to declining supply and flat to declining demand and b) the volatility in the market is giving policymakers the wrong long term price signals for this valuable commodity. (For basics on natural gas, both conventional and unconventional, search writings on theoildrum.com by both Heading Out, and Dave Cohen)

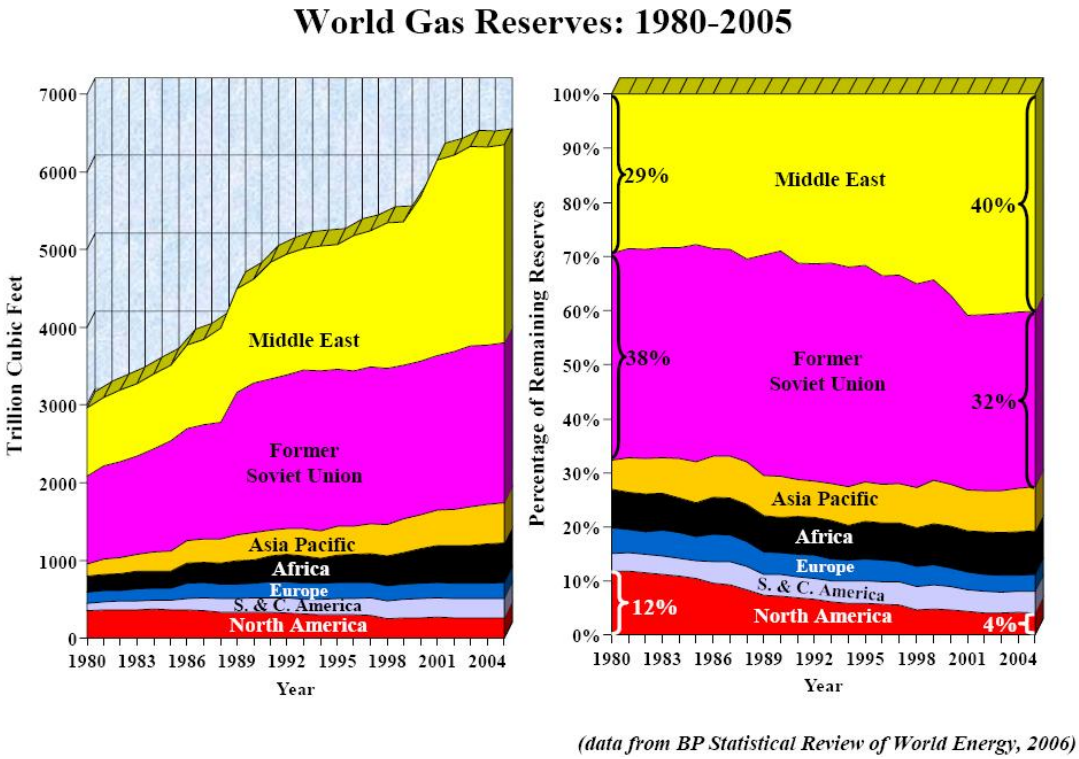
Here, I update the supply side of North American NG with information I learned at last weeks ASPO conference. This post is based largely on the excellent and thorough presentation given by Dave Hughes from Natural Resources Canada (NRCan). His entire presentations (which I encourage everyone to read), along with the other ASPO presenters, can be found HERE.

We need gas to heat our homes, make plastic, make nitrogen for fertilizer, make diapers, produce electricity, etc. Second only to oil, natural gas has many uses vital to our modern way of life. With the glaring exception of electricity due to large capacity buildout when everyone expected cheap gas of the 1990s to last, NG consumption has been declining domestically:



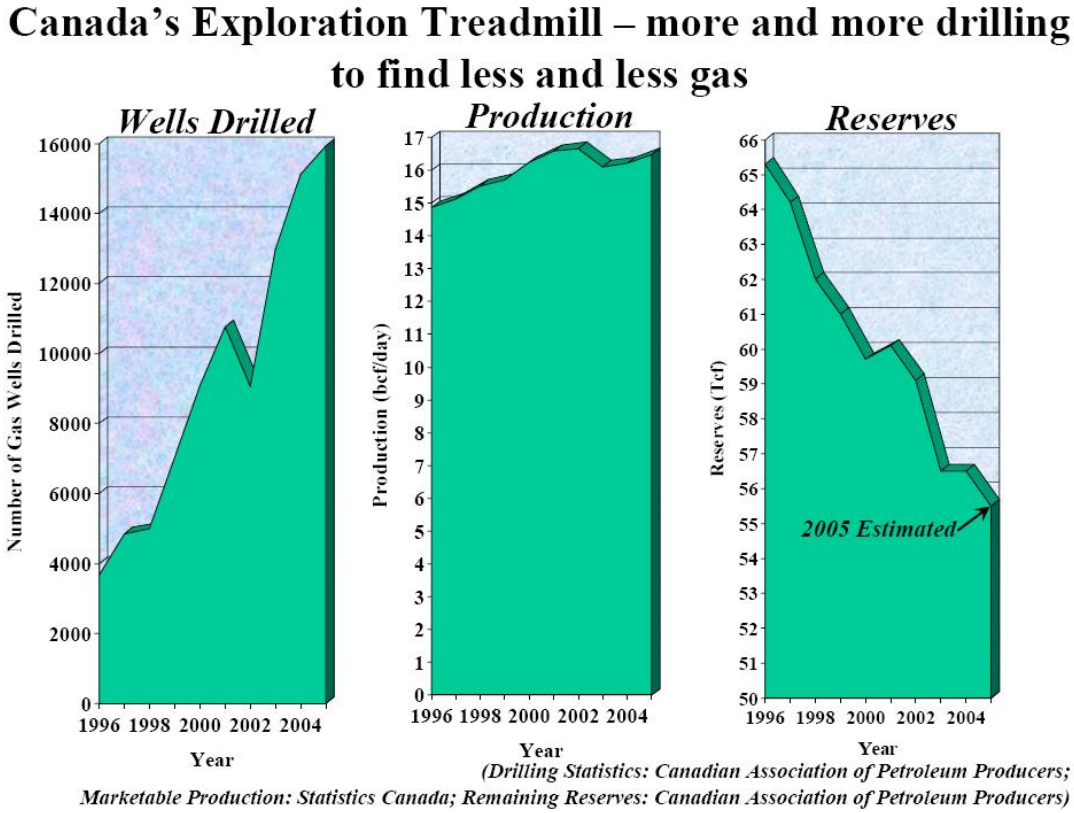
United States Natural Gas Consumption (Source David Hughes ASPO Presentation)

As can be seen, total NG consumption in the United States has been relatively flat over past decade. The demand side of the equation (almost as important as supply) is a story in itself and will be addressed in a subsequent post. With respect to supply, the good plentiful stuff has been found, pumped and used on our continent. The US peaked in production in 1973 with another peak in 2001. Canada appears to have peaked in 2002 and is currently piping 51% of her gas to the United States. Though there remains a large amount of natural gas reserves worldwide (though data is unreliable), it is difficult and expensive to transport. (Dave Cohen will be writing on the LNG side of Mr Hughes presentation soon.) As the graphic below indicates, in the past 25 years, Canada, United States and Mexico have gone from having 12% of world reserves to 4% and we have 10 years of reserves at current production rates.



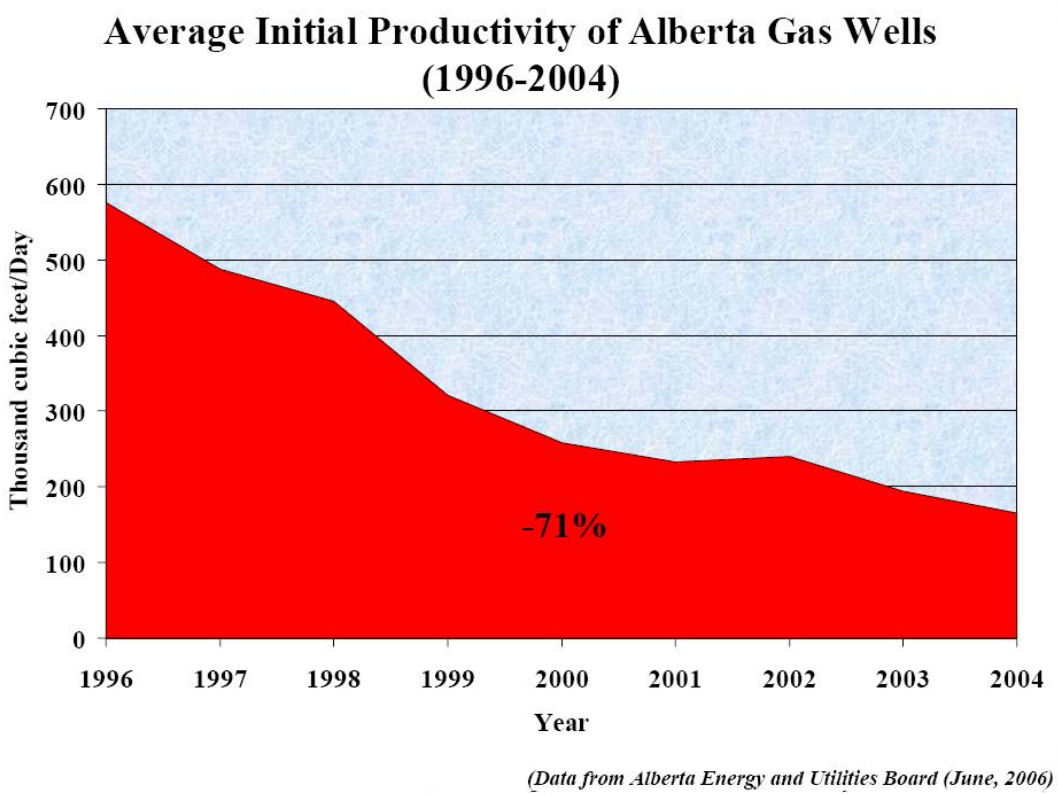
World Natural Gas Reserves (Source David Hughes ASPO Presentation)

We are drilling more, finding less, what we do find depletes faster and has fewer cubic feet. The below graph sums up much of the Canadian NG situation.



The Canadian Treadmill (Source David Hughes ASPO Presentation)

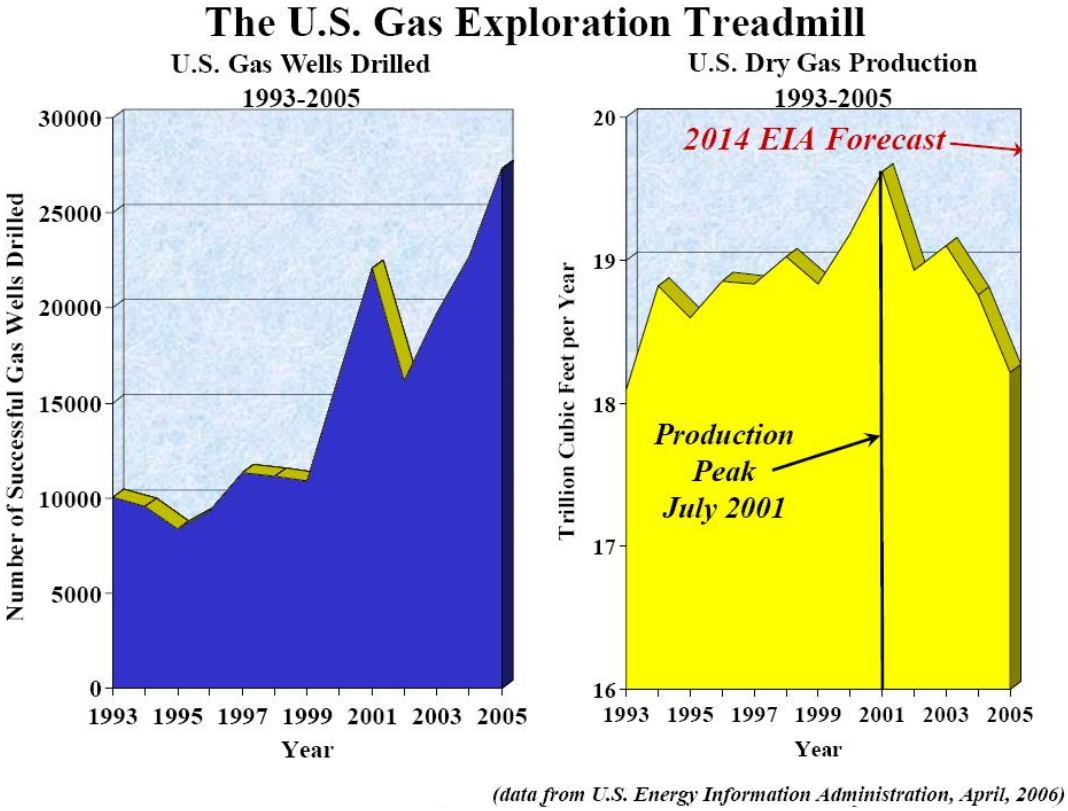
Not only does Canada use more rigs, but each new pinprick in the earth is producing less of the commodity and at slower rates. The province of Alberta has about 3/4 of the gas reserves of Canada. The trend of the below graph is obvious:



Alberta Gas Productivity (Source David Hughes ASPO Presentation)

With Alberta also increasingly using NG to turn bitumen into oil (or gold into lead as Hughes repeated), how does the priority chain stack up for the remaining NG reserves? Other provinces?, more tar sands?, send it to USA?, heat Albertians (I think thats a word) homes? Not talked about much even in circles that have connected the dots of energy supply problems, are the local and regional alliances that may or may not fall along traditional borders. Another post for another day...

Lest we forget, there is another treadmill south of the border. Here is US production:



United States Treadmill (Source David Hughes ASPO Presentation)

By 'treadmill', I mean we are drilling more and more just to stay in place. As geology turns up the speed of the treadmill, we may not be able to keep up at prices consumers can afford. Indeed, Mr. Hughes mentioned (and this point was echoed by Matt Simmons)that if we stopped drilling today, we would produce 30% less gas next year, and 30% less the following year, etc. In other words, without an athlete running on that treadmill, we'd be down to less than 25% of our current production in just 4 years. And this is the AVERAGE depletion rate - new wells drilled today are depleting at up to 60% or higher. (In Canada first year decline rates are as high as 39% but tend to become less with successive years (ie production follows a parabolic decline). The overall decline rate in Canada is now about 20%).

And the new fad (old technology) of horizontal drilling used by Devon Energy and others, in effect gets gas out of the ground even quicker without meaningfully increasing the total EUR. (Its like the industry found a bigger straw, and since society is thirsty, the default strategy is to get the gas to market as soon as possible. This is neo-classical economic behavior at its best, but as evidenced by Chesapeakes announcement last month to shut in production due to low commodity prices, has its lower boundaries).

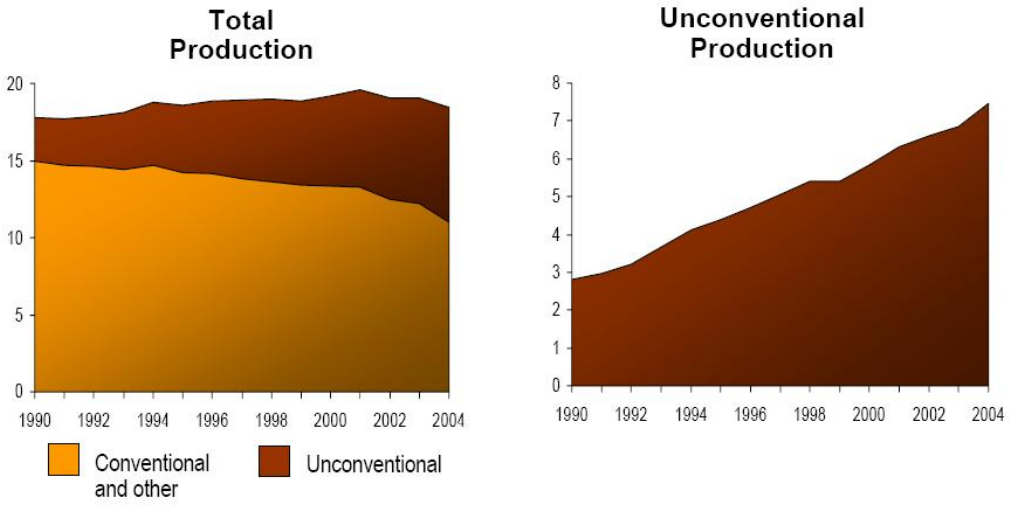
The flattening of production is occurring with an overall increase in rig count, and the vast majority of rigs being used to drill for gas. Increasingly, rigs are moving out of the Gulf of Mexico (GOM).

> Cameron Gingrich, lead project analyst for Ziff Energy, a Calgary-based consultancy, says "The Gulf's gas will fall from 25% of the total U.S. supply in 2000 to 8% in 2014, as total offshore output will drop from 13.9 to 5.8 billion cubic feet a day.

This has additional 'Red Queen" implications. The gas productivity differs in Gulf of Mexico vs onshore. Equity firm, Johnson Rice, specializing in E&P companies, recently noted that the 65 rigs

recently leaving the GOM (most for overseas), translates into 500-650 land rigs needed. Lest we forget that our other favorite fossil fuel is also desired, oil drilling is a source of demand for incremental rigs 330-340 rigs are being used for oil, up from 220 a year ago (Source - Johnson Rice)

It's important to note that in the above graphic that the Energy Information Agency is optimistic that by 2014, despite the increase in rig count, faster depletion and smaller wells, we will make new highs in domestic production due to increases in unconventional sources, like coalbed methane (called coalbed gas in Canada) and shale gas. The below graph is data from the EIA on a UCO presentation:

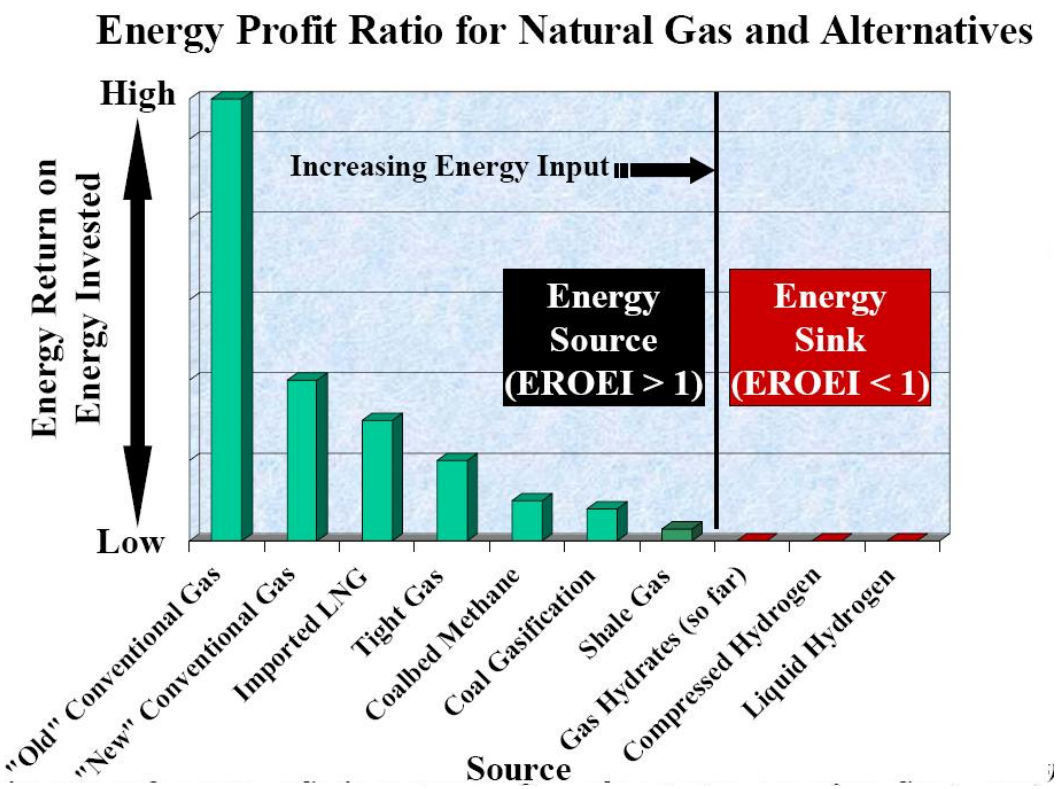


Unconventional production from tight sands, coalbed methane and shale gas is boosting compression demand

United States Conventional vs Unconventional NG Production - (Source UCO Corporate Presentation)

I recently spent 3 months in British Columbia. One phenomenon I witnessed, and I expect more and more in the US, was vitriolic public reaction to proposed CBM development. I attended a rally in Smithers, BC, where residents were opposing a proposed CBM project in Telkwa, BC. 20%+ of the local adult population showed up to listen (heckle?) to a panel of government and energy officials explaining the merits of CBM for the community. The residents were concerned about the water quality of the Bulkley River (shown here with my dog Quinn), rightly so as it is their lifeblood and one of the best steelhead fisheries on earth. What was not discussed at the rally/forum was that without natural gas, how will people heat their homes in a town that has winter air inversion issues? (i.e. everyone using wood, would be bad)

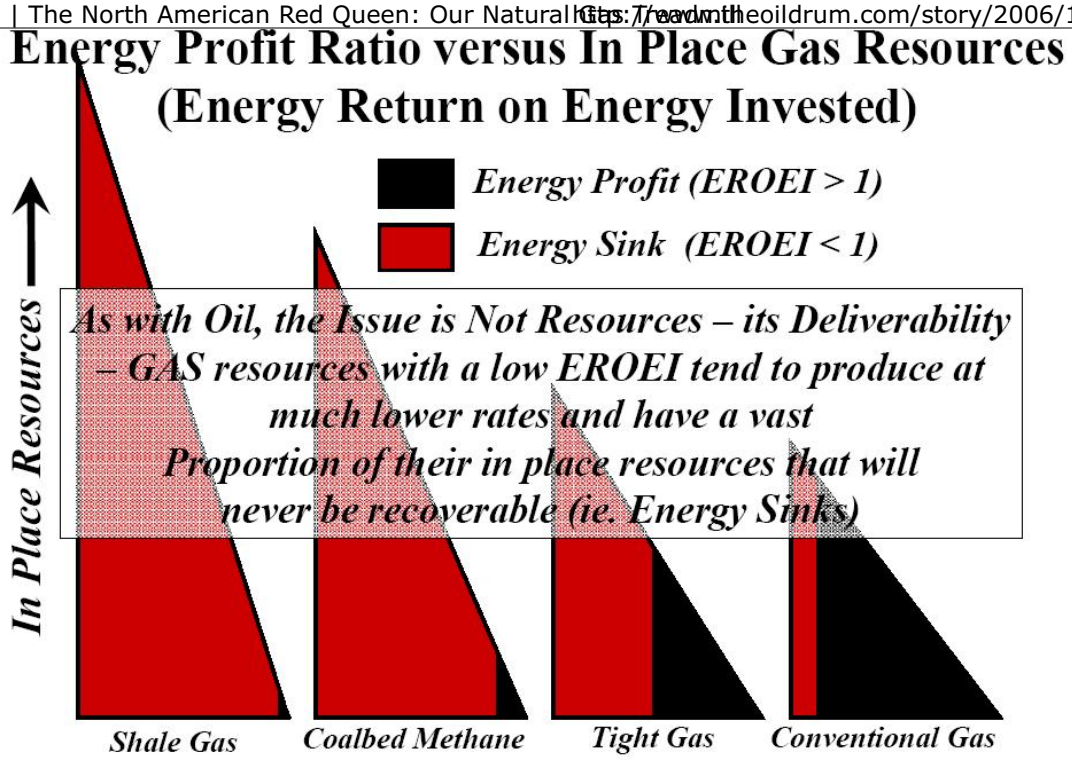
This type of public opposition is likely to intensify as we move from the easy, less obtrusive oil and gas locations domestically to more obscure, less quality ones in more remote/pristine places involving different land and water implications.. Unfortunately, our energy demands have laid the groundwork for an immense arms race between energy and the environment. Each time people raise their perceived value of ecosystems and nature, energy prices will be ratcheting up again. Tough choices are going to have to be made.



Energy Profit Ratio for gas sources (Source David Hughes ASPO Presentation)

In many senses, the story Ive presented so far can be explained by the above graph. We have used the 'best, first' for natural gas (and oil). The harder stuff takes much more energy (and dollars, and environmental externalites, and labor, and time, etc). A previous TOD article on net energy, or how much energy is left for society after the energy sector uses what it needs, can be found here.

CBM wells in the US with water production generally produce water for the first couple of years then gas with a lower decline rate. In Canada, however, most commercial CBM production comes from "dry" wells with higher decline rates - more like shallow conventional gas wells. (Source - D. Hughes). There is a large energy (and $) expenditure to get to the point where you are actually producing gas.



Dave Hughes Summary Points for NA Natural Gas(Source David Hughes ASPO Presentation)

Mr. Hughes pointed out that the amount of reserves that are energetically recoverable for the non-conventional sources are much less than the total reserves in government forecasts. The total area in each of the above triangles represents the gross resource while the black area represents the net. While government and industry are accustomed to quoting gross reserves, society cares about net energy. (well they don't but they should.) The Red Queen analogy is basically a net energy argument in a Tainter sense - the more resources we throw at extracting resources, the less the rest of the economy can grow.

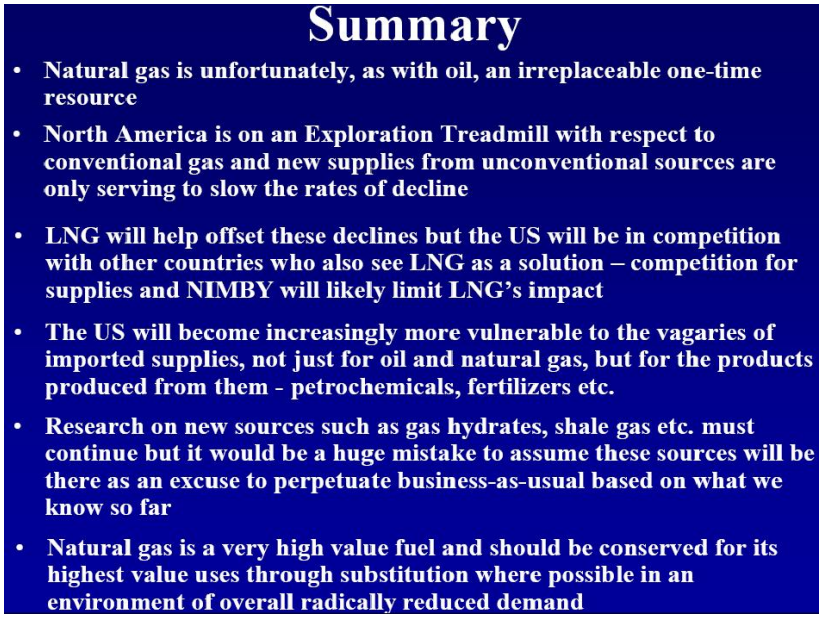
Technology will attempt to buttress the decline in the net energy and quality of fossil energy sources. However, in many cases this 'benefit' may end up being a Faustian bargain. As horizontal drilling techniques speed up the flow of gas in order to stay on the treadmill, they change the ultimate depletion profile of the resource,(and I now include oil in the discussion). The technology that Devon Energy uses for gas wells in Texas or SaudiAramco uses for maintaining pressure on Ghawar, is getting us extra production today but at a cost of borrowing from the right hand of a typically bell shaped distribution curve.

By taking the energy from the ground we are borrowing from the future to begin with (a loan from mother earth?). By using advanced techniques to get it out faster, we are adding 'leverage' to the equation, in a situation when our financial system has already maxing out on credit. In my experience as an investment manager, leverage always ends badly.

SUMMARY

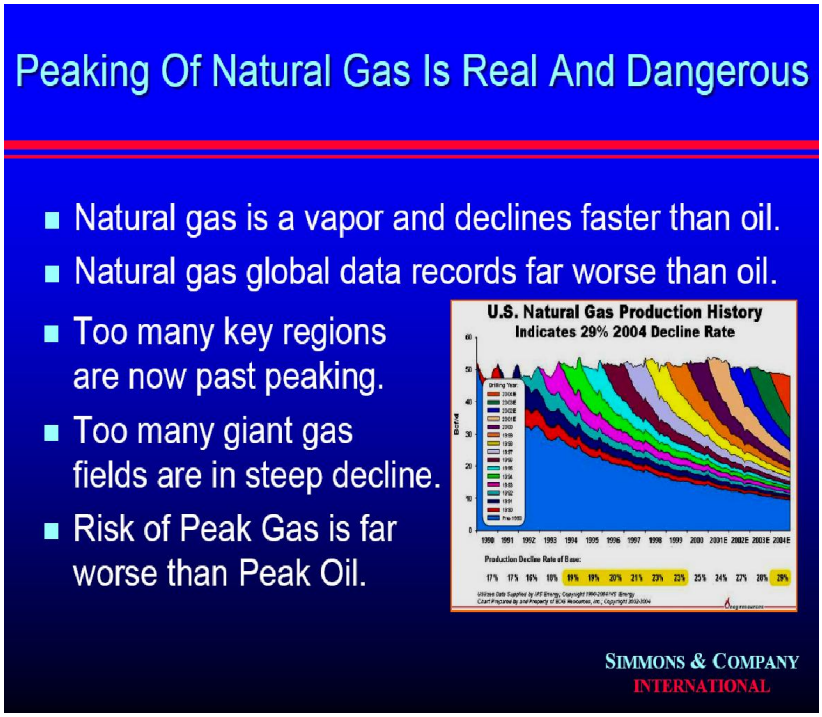
I encourage everyone to read the online pdf of Mr Hughes ASPO presentation- there is much more valuable information than I could present here.

Here are Mr Hughes summary points:



Dave Hughes Summary Points for NA Natural Gas(Source David Hughes ASPO Presentation)

Later in the conference, Matthew Simmons equally interesting and sobering presentation also concluded on the topic of natural gas:



Matthew Simmons closing slide from ASPO/Boston(Source ASPO Presentation)

THE BOTTOM LINE

Natural gas is very important. It is also not easily transportable other than over land. Conventional natural gas in North America is past its peak. It is well past the peak of the easy to get at, environmentally (relatively) friendly, and energetically highly profitable point. To get more, we need more rigs, more holes, more places to drill, and more by unconventional means such as shale gas. Alternatively, we could buttress our treadmill with Liquefied Natural Gas imported from Qatar, Russia, Iran (the vast majority of reserves), or elsewhere - this may or may not come to pass, but will probably be written on extensively at theoildrum.com.

We have taken the low hanging natural gas apples from the tree and now have to climb the tree. Soon we will require ladders. Eventually large ladders and parachutes. To get that last apple we might need a helicopter and commandos, who eat more than one apple a day in any case. We should take advantage of these mid-tree apples and use them to our best advantage, while trying to replace as many apples in our diet with pears (wind), peaches (biomass), oranges (solar), or a wafer thin dinner mint (conservation).

If the treadmill really speeds up, at least we have Astro to keep us warm.

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