maxwell@weeden

Charles =. Maxwell, Senior Energy Analyst
maxwell@weedenco.com
t: 203 =61 9862, f: 203 861 =729

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Nearing The Top Of Hubbert's Peak

(Revised from my " Hubbert " =eports of 8/08/01 & 10/25/02

While this piece in its original form was =ublished nearly three years ago, I believe that it is more relevant to our =nergy situation now than when it was first written. For this reason, we =re issuing it again with several small updating =hanges.

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The noted USGS and Shell geophysicist, M. King Hubbert =1903-1989), was the first man to effectively apply principles of geology, physics =nd mathematics (in combination) to the projection of future oil =roduction from the US reserve base. He was a brilliant scientist but was =escribed by contemporaries as sometimes abrasive and with a short temper. =e did not suffer fools gladly and was always a center of controversy. =is contributions to geology included seminal research papers on the =ormation of geological structures, the theory of petroleum migration, and =he influence of fluid pressure on the movement of faults. His most =amous predictive analysis was published in 1956. In it, he indicated =hat United States conventional crude oil production would peak in the early =970s and start down. Much scientific heat was generated by Hubbert's =onclusion at that time. It was widely assumed that America's oil output could =till climb for many decades as new areas were opened up and new =echnologies were applied.

In 1970-71, the US hit its high point of oil output. It =ubsequently entered a period of production decline that has carried to this =ay. Hubbert had been right on target. He had accomplished one of the =ost challenging intellectual goals of the 20th century: =easurement of the rate of depletion of a main commodity resource underpinning = society, with the implicit warning that it was not inexhaustible, =nd that its peak production was closer than many believed. Hubbert's =iews logically suggested that America would soon have to make a =ransition from oil surpluses to oil deficits, from cheap oil to expensive oil, =nd that this new universe of tightening supplies would create quite a =ifferent social and economic environment from what we were experiencing =hen (and are still experiencing now).

Hubbert lived to see his projections for the US come true. =owever, the oil industry and academia never fully accepted his views despite =heir apparent accuracy. Partly owing to this and partly because US =ompanies soon took their technology, experience, and capital to foreign =ands where oil output quickly surged, allowing our national needs to be met =y increasing imports of crude (close to 62% total US demand in the =ast six months), Hubbert's name, and the concepts he developed, are not =o well known today. However, it seems likely that they will be again, =ince the principles he used, now refined by computers, better data, and =mproved modeling techniques, are applicable to world crude output today in =he same way they were to US output in the 1950s. Depletion of the =lobal resource base of crude oil continues to accelerate, while the =lassic days of successful exploration (in terms of tens of billions of barrels =dded each year to the world's reserves) are falling far behind =s.

Has anyone pointed out to you recently (after proper =djustments for the true discovery date of reserves) that the world is now =onsuming approximately three-and -a half-times the volume of crude the oil =ndustry is finding each year? That the peak global oil discovery rate was =n the mid-1960s and that we have been in an inexorable descent since =hen? That in the late 1980s, new discoveries fell below the level of current = production, and they are still falling, despite the application of =any powerful technological tools in the 1990s? And, that 70% of the =il you are consuming today was found 25 years ago or longer?

These are points that oil companies (and governments) find it =wkward to discuss. One reason is that there are so many conflicting views =f "experts". Who is one to believe? Another is that while Hubbert's =eak cannot be "proven" to work in any exact time sequence, widespread =ebate about it would certainly raise warning flags for some elements in =ociety, and environmental passions in others. Should sleeping dogs be =akened in this case? Lastly, recognition of the effects of Hubbert's math =ould imply an end to volumetric growth for most oil companies in the intermediate term…not an eagerly awaited event.

However, we are at a point now where these issues need airing. Effective energy policies are part of an ongoing international =ebate, and investors are asking where the flow of funds into the energy =ector should be concentrated in order to bring the best results. The shadow of =. King Hubbert looms large over these discussions. Suddenly, we are =roubled by issues on a world scale that he was dealing with on a national =cale back in the 1950s. And the resolution of them is just as elusive today =s it must have been back then, only now we have no new world of =xploration to turn to as an alternative to our depletion of the old one.

Hubbert's projections in 1956 were embodied in a rising line =f conventional US oil production that eventually was to run over the =op (1970-71), leading to a long and inevitable descent on the other =ide. Enhanced oil recovery techniques, new seismic methods of finding =il, and new types of drilling and fracturing as examples of ongoing =echnological changes have not been able to displace this depletion curve very =uch. That is the truly frightening aspect of Hubbert's =eak. Up to now there has been such a vast effort to push it out in time, with =o little results to show for it.

Why does Hubbert's Peak work so well on the predictive =ide? Obviously, explorationists look for the largest, most accessible, =east complex prospects to drill first. So, early drilling in a =articular region tends to be more productive in building reserves than later = drilling. New seismic techniques applicable to land drilling in =he 1950s and to ocean drilling in the 1960s allowed most of the world's =il basins to be mapped in the 20 years after World War II, so it is not =urprising that discovery rates were high in those times. (Recent =pplications of technology might have encouraged additional field discoveries in =he 1980s and 1990s. However, in the event, these tools were focused more on =apidly draining existing reserves than on finding new ones, thus =ccelerating later depletion rather than significantly adding to reserves at =he time.) Most of these points were, of course, well known to the =ountry's geology professionals. Hubbert's genius was to fit them into a coherent mathematical system that would portray the future course of oil =roduction with reasonable accuracy.

Suppose that, in the short period of years we may have before =facts on the ground" close in on us, we are unable to shift the Peak from =he configuration it is likely to take. What does that mean to us as energy consumers and investors?

Every expert will have his or her own view as to whether, when, =r where the Peak will impact us. So, for the moment, let me give you =y personal take on it, starting with developments that could occur =n the relatively near future.

The non-OPEC world may well reach a peak in liquids output in =he period around 2010 at 54-55 million b/d vs. a current level of =lose to 50 million b/d. That is my own projection. However, it's

clear that forecasting is an art, not a science, and the assumed 2010 number =ould easily arrive in 2009, or 2011. Such a peak would be an important harbinger of a new era of oil pricing and higher in-the-ground =eserve values because it would imply that all incremental barrels =roduced after that by the oil industry to meet global increases in demand would =ave to derive from OPEC. That organization would then be left to =etermine the terms and conditions on which this crucial new supply would be =ade available to the non-OPEC world.

I am not suggesting that in this situation oil prices would =mmediately skyrocket. There is no reason to believe that OPEC would wish to =kill the goose that laid the golden egg". At least, not right away. =owever, the key point is that the price would no longer reflect the ebb and =low of supply and demand in a relatively free market, as it has for many =ears (with occasional manipulations thrown in). The price of oil =ould be largely determined by a few powerful oil producers in the =rganization that could still lift the incremental barrel, mainly Saudi =rabia, followed by Iraq, Kuwait, Iran, the UAE and possibly =enezuela.

My own guess would be that OPEC's pricing policy under these circumstances would, at first, be quite reasonable. Oil prices =ight climb at, say, double the rate of low world inflation in order to get =ack the purchasing power that OPEC has always claimed it lost from the mid-seventies onward. However, no consumer-country statesman in =he non-OPEC world could afford to be comforted by such apparent =ationality. OPEC is, after all, intent on running the crude oil system for its =wn benefit, not for ours. As the margin of excess produceability =orldwide would be expected to tighten, the Organization would surely be =empted to allow crude prices to rise a bit faster, and then a bit =aster…

The peaking of non-OPEC production that I am describing here =ould, likely resemble a large flattish dome in the 2009-2011 period. The =op could even extend longer. This is owing to the coincident start up =f the Kashagan field in the north Caspian region of Kazakhstan in =008, as I foresee it. Output here could add perhaps 300,000 b/d each =ear for the next six years, on my numbers. This would represent what = would consider to be a "last hurrah." Nothing like it would probably be =een again… a field known to exist 25 years ago that was developed =ater for political and environmental reasons. Kashagan, with up to =2-15 billion barrels in estimated recoverable reserves as I make it, =ould extend the peak of non-OPEC production by a year or so.

For the record, the U.S. reached its peak production of crude =il in 1970-71, and Russia in 1987. It appears likely that the North Sea, = comprising the UK, Norway, the Netherlands and Denmark, hit its =op in 2002. China, with new offshore production coming onstream from =ohai Bay in the years just ahead could peak in 2008-2009. Mexico appears to =e 6-7 years from its top and could be declining in output by 2010. =anada, with its growing tar sands output, may be able to push to modest new =ighs in the next decade, but it is unusual in this capability. These are =he principal non-OPEC producers. They are currently showing only =mall near-term gains as a group, while staring at large future =eclines.

How would the peak of production from OPEC (2020- 2030) and =on-OPEC (2010) look when put together? Much here depends on one's =utlook for oil pricing in the interim period after 2010. If the peak of non-OPEC production touched off a sharp rise in crude prices after 2010, =hen the slowing of world demand as a consequence of that would impact oil =utput and would obviously delay the overall peak. Under "normal" pricing = conditions, one might make a guess in the area of 2015 for the =lobal peak of crude oil output. However, as we approach that period, the =ffect on pricing of wider recognition that incremental barrels of oil might =ease to be available from the system altogether by, say, 2015, could =orce oil prices substantially higher, and delay the global topping =ut of production to, say, 2020.

In any case, the point of these paragraphs concerning the peak =f oil output for the non-OPEC world, and then the world as a whole, is =o make the case that rising prices could be expected to ration

supplies, =nd, in investment terms, raise returns for those oil-based entities that =ight still hold sizable reserves and production growth potential in an operating universe that was critically short of both after =010.

The wider implication of Hubbert's methodology is that it could =efine limits to non-OPEC production increases over the next six years, =nd then bring it to a halt altogether. This would, over time, encourage significant crude oil price increases that might:

- Slow developed countries' growth, forcing political changes =n the way energy is produced, used and conserved, and also influencing =and usage laws, transportation systems, immigration laws, and tariff = regulations, to name a few priority issues.

- Place developing countries without sustainable oil, gas, or =oal reserves at a sizeable disadvantage in achieving future economic =rowth.

- Impose energy conservation policies on every political unit =nd every private citizen throughout the non-OPEC world by reason of =he power of pricing, the law, and the influence of social cohesion. =

- Modifiy the relative power of states in today's =nternational order, with the oil "haves" ascending on the scale and the oil "have =ots" descending. To thwart this, "crises" might be instigated by =ountries which would suffer most from these changes, with unknown =onsequences.

- Create internal civil stress in countries where the lower =conomic orders of citizens would have their economic lives substantially =ltered by lack of petroleum products they could afford (examples would =e kerosene for cooking in India, two-stroke fuel for motor bikes =nd small cars in China, diesel for trucks in Turkey, Brazil, sub-Sahara =frica, and so on).

- Change the relative valuation of stock markets, and the =elative valuation of sectors within stock markets around the world. =/LI>

In terms of timing these possible developments, it should be =oted here that the oil industry does not have fee ownership of crude oil =eserves in the OPEC nations. So, by and large, though the major integrated =ompanies may buy volumes from OPEC countries, their own production =s almost entirely in the non-OPEC world. As such, this production would be =ell distributed around the non-OPEC peak in a time sequence but it =ould still be tied to it in aggregate. So, the period 2010-2011, in the =ftermath of the non-OPEC peak, is anticipated to be the critical one for =il companies as well as consumers who draw supplies from them.

It should be noted again that Hubbert's Peak only applies to conventional crude oil production, not natural gas liquids or =ondensates, and not the heavy oils of Saskatchewan, or Cold Lake and Peace =iver in Alberta, or the tar sands of Athabasca (all of these in =anada), or the Orinoco (Venezuela), or the many other reserve bases of =low-flowing or non-flowing oils around the world. Companies developing these =eavy oils or "synthetic" crudes would escape (for a reasonable time) =he problems of accelerated depletion and declining discovery rates =hat are presently affecting 99% of the oil produced today, and which might =ffect as much as 96% of the oil produced in 2010.

I see the energy business as capable of attracting and =uccessfully employing vast amounts of capital in future years, as well as the =alent to manage it. However, the new basis for doing business, that is, restrained supplies at higher prices vs. virtually unlimited =upplies at the lower prices of the past, will entirely change the =tructure of opportunities, supplier-customer relationships, the establishment =nd direction of energy producing organizations, and the =aluations we have have historically put on

them. After 145 years of Col. =rake's petroleum industry, a wholly new one is emerging. None of us has =ver seen the like of it before.

If you believe that markets discount the future, =ear or far, and sometimes both, then it is not too early to ponder the =ossible effects of M. King Hubbert's work on the lessened availability =f future crude supplies, and how this might bear on consumers, industry, governments, and not the least, the oil business itself. =t is, of course, the sudden appearance of such potential =evelopments that constitutes the greatest danger to our economic and political =ystem. A situation might arise where it is obvious that radical change is = required in the use or output of energy but we have difficulty =eciding what steps should be taken and how we should execute them. This =ight cause delays that could sharply penalize our standard of =iving. So, in becoming alert to this possibility, far-seeing observers might =egin considering the trend of events from the perspective of the Peak.

-CTM

Research Disclosures

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Rated =old: 8 **of 17** (47%)
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- **Hold**: Risk adjusted, =welve month total return estimated between -15% and 15%.
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- **Trading Buy**: 1 month total return estimated to be above 10%
- =/FONT>**Trading Sell**: 1 month total return estimated =o be below -10%.

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