The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Tech Talk - an explanation of the coming series

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One of the problems in trying to project future demand and supply of oil and other fossil fuels is that the decisions on their availability and use are often controlled by factors other than their geological availability. Yet, at the same time, fuels cannot be created out of thin air (or empty rock) nor can viable technologies be created similarly, purely by having the prevailing governing bodies pass the appropriate legislation (see, for example, cellulosic ethanol production). If fossil fuels are to be brought to market in a timely manner there are certain basic steps that have to have occurred.

The first step is that the deposit of whatever type has to have been found and identified. Thus, when folk discuss the shortfalls inevitably coming in the supply of crude oil, the first indication made usually refers to the decline in the discovery of sufficient new oil in reservoirs to replace that which is being removed. And when the question is raised as to whether we are going to run out of oil and if so, when, the first place to look is toward what resources remain that could be counted as a future reserve for production.

In that definition lies the first of the stumbling blocks that many commentators fail to recognize in writing about the future availability of fuels. It is a point that I made in my discussion of shale gas; namely that while there may be a lot of it out there, at present the volumes commercially producible are, in total, significantly less than the total volume (perhaps as little as 7%). The total volumes that exist in the various fields are considered the resource (i.e. in this case 862 Tcf of natural gas), while the amount that can be commercially extracted is considered the reserve (in this case 60 Tcf). Confusion over the relevant values in each category, and the conditions under which volumes switch from one category to the other have been part of the debate on the glohal energy future that has, on occasion, bubbled up in places like The Oil Drum.

So if I am to develop a valid picture of where the world future is going in terms of the fossil fuels that will continue, in large measure, to power it over the next 20 years, it is important to look at the underlying resources that are available, and whether or not they can be considered reserves. In many cases that is a relatively easy initial assessment since the volumes in question are already being produced, or are in process of being produced.

But in that process there is another somewhat controversial number, and that is the rate at which production from a field will decline over the time that the fuel is being extracted. Back in 2009 when I wrote the initial tech talk explaining some of the reasons for this decline in an oilfield, the assumed value for this decline rate was on average 4% per annum, yet there are fields which have declined much faster than this. For example, production from the Cantarell field in Mexico fell more than 75% between 2004 and 2010, with decline rates reaching more than 12% per year. Mexico has not been alone in seeing production collapse rates of this level, and yet the impact of declining production from existing fields, and the resulting need to replace it, is a factor that is not fully recognized, yet must be in any rational discussion of future conditions. If, for the sake of example, we accept that global oil production today is 88 mbd, a global decline rate average of 4% in production from existing wells per year, will require that, just to maintain production, an additional 3.52 mbd of new production must be brought on line each year. If, however, the true

rate of decline is on average 5%, then this number jumps to 4.4 mbd, and if the true decline is 6%, then it rises to 5.28 mbd.(Bear in mind that this does not include the anticipated increases in demand which still run at around 1.5 mbd).

Now there are countries, such as the Kingdom of Saudi Arabia (KSA), that can manage production and the opening of new developments so that there is sufficient new production in existing fields that decline rates within the field can be kept to perhaps 2%, and new fields brought on line that reverse the total decline. KSA has been relatively forthright in the past in recognizing that without such activity they would have faced declining levels of production of perhaps 800,000 bd of their total of around 9 mbd of production. The problem, of course, is that all fields are finite. Particularly when production has been running for decades, there comes a point where the volumes available have been consumed, and there is nothing left.

Conventionally that has been a steadily changing process. As I noted in that earlier tech talk, vertical wells progressively fall in production. However, in recent years, the production of oil and natural gas is being increasingly supplied from horizontal wells which do not have the same changes in production geometry over time. Rather, the well may continue at relatively stable production levels until the underlying water used to maintain pressure in the formation, rises to the level of the well. And at that point the decline rate becomes very steep indeed.

In passing I should note that this "watering out" of the wells, which happens in oilwell production is not the likely cause of the dramatic fall in natural gas production from shale gas wells that has been documented.

I am reviewing these points about the changes in production with time, to explain why it is very difficult to make more than very broad generalizations when one talks about oil or natural gas (or coal for that matter) production into the future, looking only at the overall numbers. The volumes of fuel that will be available are more accurately assessed from considering the individual countries from which the production is and will be coming, what the potential futures of the fields in those countries are, and the other considerations (such as imminent or ongoing civil war) that might affect field production.

What I intend, therefore, to do next is to start with the major oil producers, as listed in the earlier review, although not always in that order. By looking at the different fields both past, present, and future, in light of existing and possible relatively novel technologies for extraction (such as, for example, burning some of the oil in place so as to help produce the rest) I will try to bring a more accurate assessment of what the future production is likely to be, and thus build up an assessment of global production as the series continues. The top three historic producers have been the United States, Russia and Saudi Arabia, and so the series will start with North America, and more specifically the United States.

But particularly in these times when the stability of some of the producing countries is becoming more questionable, external factors do have to be addressed. Unfortunately many of these changes, being political, are harder to predict. As a result, while I will include the reasons for some of the decisions I use in building this series, I will not go into those in much depth. Rather I will focus more on the likely levels of future production that might be achieved.