



## Tech Talk - North Dakota and the Bakken

Posted by [Heading Out](#) on August 14, 2011 - 1:32am

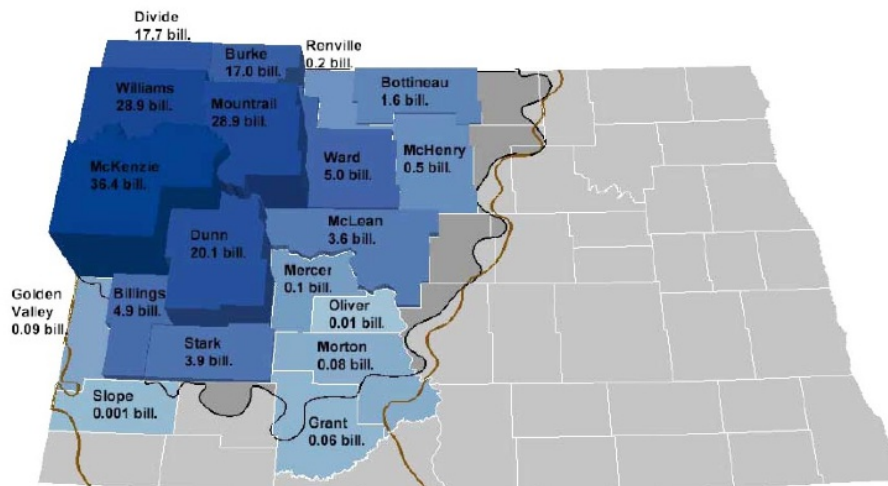
Topic: [Miscellaneous](#)

Tags: [bakken](#), [gas shales](#), [horizontal wells](#), [montana](#), [north dakota](#), [three forks](#) [[list all tags](#)]

[Nick](#) has pointed out that the chart I used [last time](#), in writing of the production in the deep waters of the Gulf, is out of date. North Dakota is heading for second place behind Texas, having passed Oklahoma, and has the ability [to pass Alaska](#) in a few years. In May, the state was averaging a production of [361 kbd of oil](#), and [361 bcf](#) of natural gas, from a total of 5,570 wells (all three figures being all-time highs). Gas flaring, at the moment, is at around 29%. The current rig count is at 183 and also an all-time high. So where is all the excitement? It is not in shallow gas given that, as the Director of the Department of Mineral Resources [has noted](#):

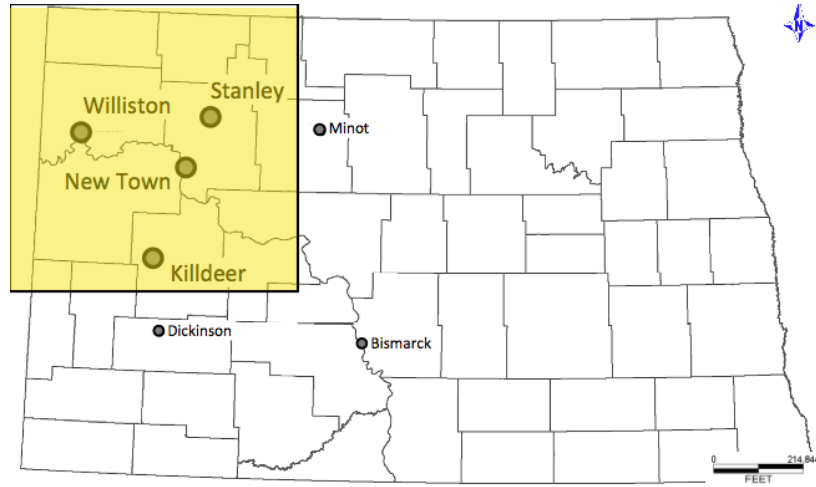
North Dakota Shallow gas exploration is not economic at the current price.

The answer lies in the Bakken and Three Forks with rigs that can drill more than 20,000 ft being the most actively employed. The Bakken has already been discussed in an earlier post at [The Oil Drum](#) and I don't really want to repeat much of that information, and so this presentation will, perhaps, rely a little more on visuals. The Bakken and Three Forks partially lie in Western North Dakota, and the [Department of Mineral Resources](#) (DMR) for the state, has shown how the total Original Oil In Place (OOIP) estimates vary from county to county within that region.



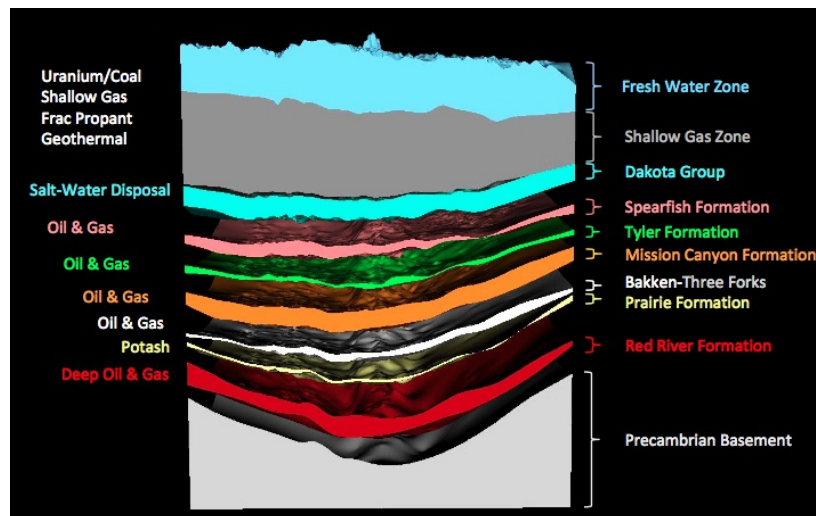
OOIP estimates by county ([North Dakota DMR](#))

The state has also produced some three-dimensional models of the formations in the region around Williston, which is where some of the most productive wells are found.



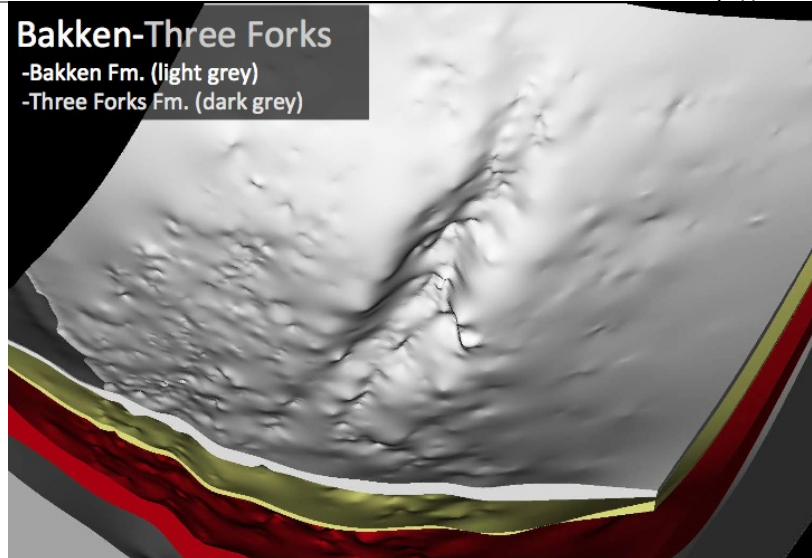
Region of North Dakota that is modeled. ([ND DMR](#)) The sides of the square cover 135 miles.

By developing the model it is possible to look both at the section showing the location of the productive beds in the region. Since the Department covers other valuable minerals beside oil and gas, they are also shown in the section:



Section through the ND geology ([ND DMR](#))

The Bakken lies at a depth of [around 11,500 ft](#) with the additional need for rigs to drill 20,000 ft coming from the use of horizontal drilling along the formation, which is typically only around 150 ft thick. One of the advantages of the model is that it can be used to generate a view of the Bakken itself, with the overlying ground removed. This also helps reveal that, while the above section shows the beds lying in a syncline, where oil might be expected to migrate out and up the sides away from the central dip, there is a central anticline where oil could be trapped, and the structure is not smooth. (Bear in mind also the scale of the model, so that small traps in the field are not picked up at this level.) The structure of the shale beds themselves also make it less sensitive to geological modifications which drive oil migration, though obviously not completely or else there would be little oil flow to the well.



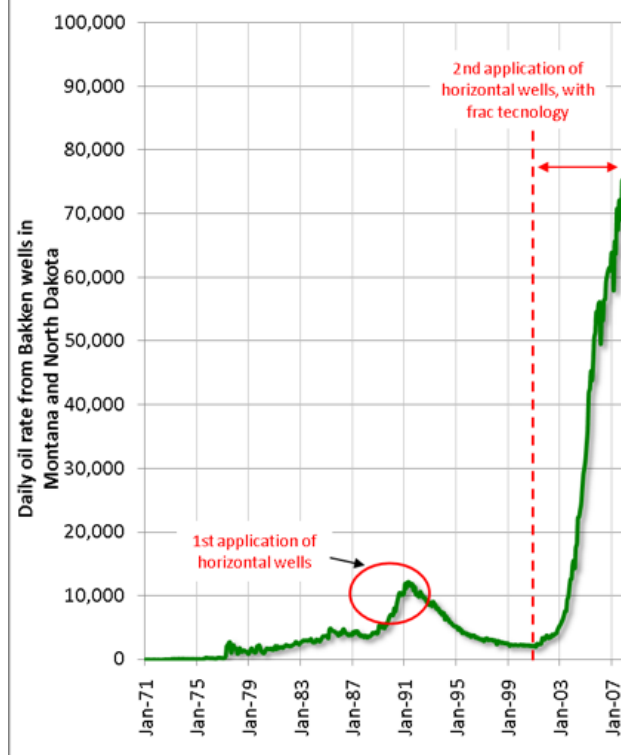
*Model of the Bakken formation around Williston ([ND DMR](#))*

The dominant feature that runs relatively North-South through the center helps then explain the location of many wells drilling into the reservoir.



*Location of wells in the modeled region of North Dakota ([ND DMR](#))*

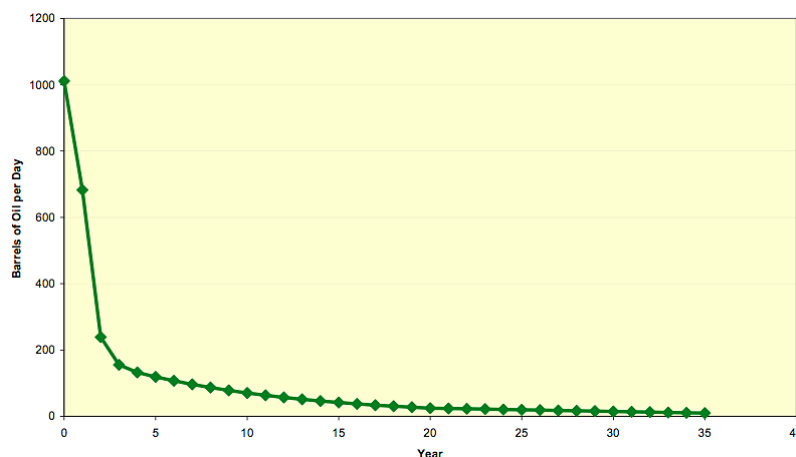
While the formations have been known for some time, it was only with the development of horizontal wells and fracking capabilities that the opportunities to extract the oil became viable. To borrow a picture from that earlier post by [Piccolo \(H/t Gail\)](#)



### *Change in Bakken production with the introduction of horizontal wells and Fracing ([TOD](#))*

As the number of horizontal wells has grown, one finds, as I noted above, that 20,000 ft of drilling will include perhaps 9,000 ft of horizontal well in the formation itself. Such a well, for example, the [Credo Petroleum well](#) that is cited, may initially produce 1,267 bd of oil and 1.24 mcf/day of natural gas.

However, one of the concerns that has been expressed, both by Art Berman and later myself, has to do with the long-term production rate from long horizontal, frac'ed wells in shale, and it is therefore instructive to see the information that is now available on a typical well, which has been compiled by the ND DMR.

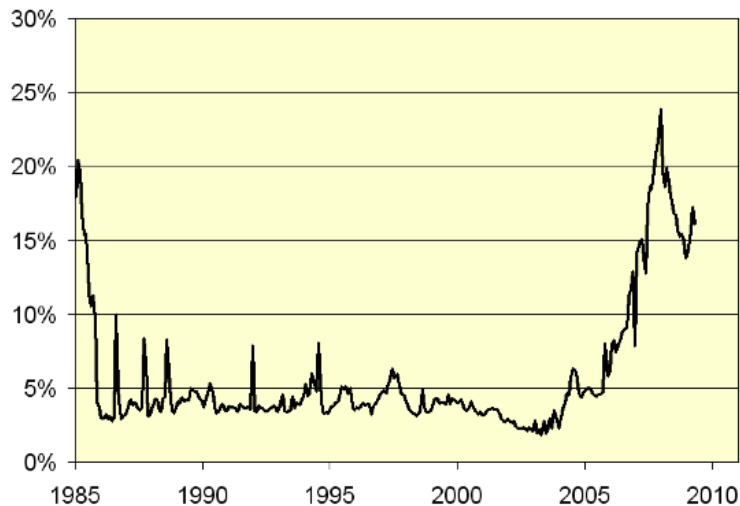


### *Typical Bakken well production ([ND DMR](#))*

At the time of the presentation (last year), there was still a large proportion of the gas [being flared](#).



## North Dakota Monthly Gas Flared



*Gas flared as a percentage in ND ([ND DMR](#))*

Since then, as I noted at the start of the piece, the amount flared in May of this year has [risen to 29%](#).

There is a more than adequate array of pipelines to handle the fuel that is being produced; at the moment, it is the oil that is the critical and valuable component. But even with a projection that the state will see about 2,000 wells a year being drilled over the next few years, with the expectation that the field will last some 20 years, the overall production is not expected to [increase much beyond the levels](#) that it is now attaining. This is because of the relatively rapid drop in well production, for which there is now a considerable data base. That doesn't stop some from projecting, however, that the field can increase in production to levels as [high as 1 mbd](#) or so. That would, of course, include production from Montana and Canadian parts of the Bakken, which I have not discussed here.

One point that should be noted is that the lease rates for Bakken in North Dakota are quoted as being around \$7,000 to \$8,000 per acre, while those in Montana are [reported to be considerably less](#). To date, there has [not been that much activity](#) in Montana, though with time this will change. Already permit numbers are rising, and there has been some success to equal that in North Dakota.

Brigham Exploration, one of the most aggressive in Montana, recently unveiled five wells there ranging from 909 boe/d to 2,962 boe/d, the latter volume a "record for the state," Pritchard said. The five wells averaged 1,579 boe/d.

At present, however, most of the rigs (170 to 10) remain on the North Dakota side of the border. That too will change, with time.

Overall, the Bakken is likely to see further increases in production as the areas being drilled expand, but with the relatively short life of the well at significant levels of production, it is harder to see the higher levels of production overall that others have cited, and one also has to remember that is often the sweetest spots that get drilled first.



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