# Is the Typical NDIC Bakken Tight Oil Well a Sales Pitch?

Posted by Rune Likvern on April 28, 2013 - 11:40pm

In this post I present the results from dynamic simulations using the typical tight oil well for the Bakken as recently presented by the North Dakota Industrial Commission (NDIC), together with the “2011 average” well as defined from actual production data from around 240 wells that were reported to have started producing from June through December 2011.

This post is an update and extension to my earlier post “Is Shale Oil Production from Bakken Headed for a Run with “The Red Queen”?” which was reposted here.

The use of the phrase “Typical Bakken Well” by NDIC as shown in Figure 01 is here believed to depict what is to be expected from the average tight oil well.

The results from the dynamic simulations show:

- If the “Typical Bakken Well” is what NDIC recently has presented, total production from Bakken (the portion that lies in North Dakota) should have been around **1.1 Mb/d** in February 2013, refer also to Figure 03.
- Reported production from Bakken by NDIC as of February 2013 was **0.7 Mb/d**.
- Actual production data shows that the first year’s production for the average well in Bakken (North Dakota) presently is around 55% of the “Typical Bakken Well” presented by NDIC.
- The results from the simulations anticipate a slowdown for the annual growth in oil production from Bakken (ND) through 2013 and 2014.

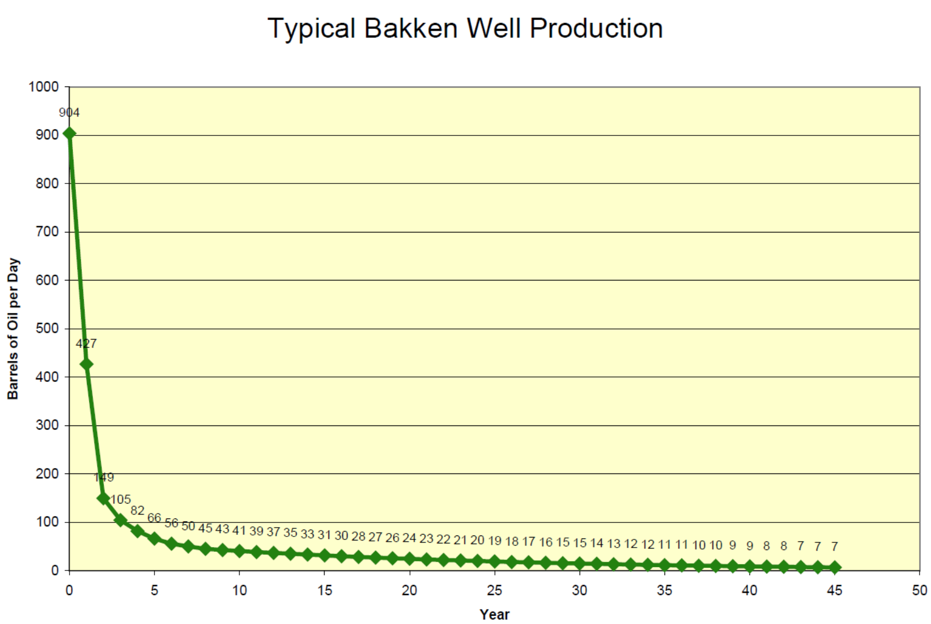


**Figure 01:** *The chart above is taken from the NDIC/DMR presentation Recent presentations “Tribal Leader Summit” 09-05-12 slide no 5 (pdf; 8.7 MB). The chart shows NDIC’s expected average daily oil production by year. The first number (on the y-axis) is the IP (Initial Production) number, and this is followed by the average daily production by year.*

The well shown above has a first year total oil production of 156 kb (427 Bbl/d).

Similar well profiles may be found in other NDIC presentations.

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In this post the term well productivity is used to describe total tight oil production from a well during the first 12 months of reported production.

In this case, the Bakken refers to tight oil production from Bakken (Sanish, Three Forks) as this is reported by the authorities of North Dakota.

As of February 2013, around 84% of North Dakota's oil production came from 4 counties; Dunn, McKenzie, Mountrail and Williams. These 4 counties cover an area of around 8 700 square miles of North Dakota's total area of 70 700 square miles.

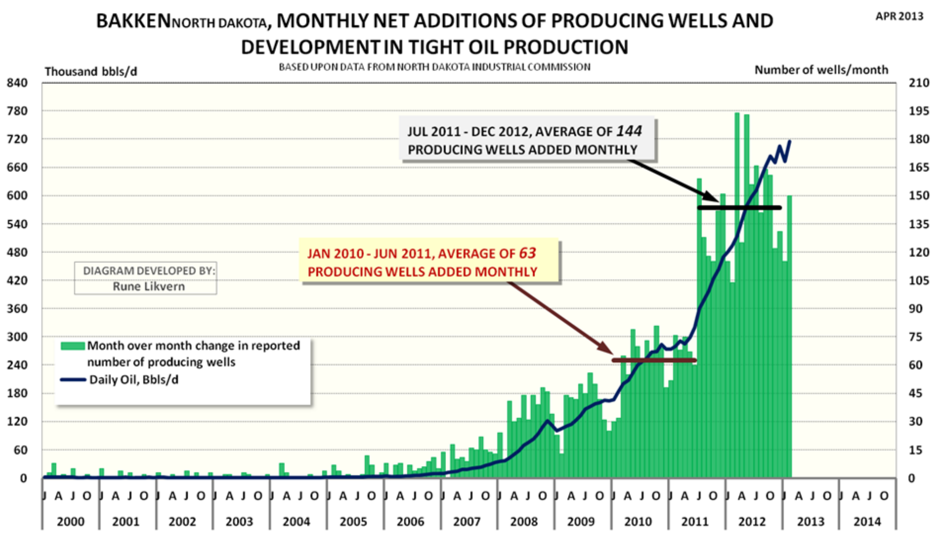


**Figure 02:** *The chart above shows monthly net additions of producing wells (green columns plotted against the right hand scale) and development in oil production from Bakken (ND) (thick dark blue line plotted against the left scale) as from January 2000 and through February 2013.*

Approximately 1,770 producing wells were added during 2012, in Bakken (ND), but the timing was not distributed evenly throughout the year. The big ramp up began in the summer of 2011. There was an increase in general from 63 to 144 producing wells (more than 120%) on average each month from July 2011 and through 2012. From January 2010 and through June 2011 63 producing wells were added on average each month. During the winter months of 2010/2011 oil production growth slowed as a response to fewer well additions.

The acceleration of producing well additions from the second half of 2011 resulted in a steeper build up of oil production as shown in Figure 02.

With time, and as more actual data is published, more precise estimates of the decline rates will become feasible. In the current analysis the decline rates used beyond 2-3 years after the start of production are the ones derived from the typical NDIC well shown in Figure 01.

Presently there are lively discussions about future decline for tight oil wells that span from moderate declines (beyond year 3) to those who expect tight oil wells in general to become stripper wells 6 to 8 years after they began to produce.

A well producing 10 - 15 Bbls/d is commonly referred to as a stripper well.

Presently the number of actual data for a significant amount of tight oil wells and their later time decline rates (beyond year 2 of the well life) is very limited, and for this reason it was decided to use the decline rates beyond year 2 for the "2011 average" well as these were derived from the typical NDIC well shown in Figure 01.

Decline rates later in well life (beyond year 2) that deviate from what has been used in this study may affect developments in late life total production (decline). The wells' first year production and net added producing wells were found to be the dominant parameters for development in near term total production.

## THE TYPICAL NDIC WELL

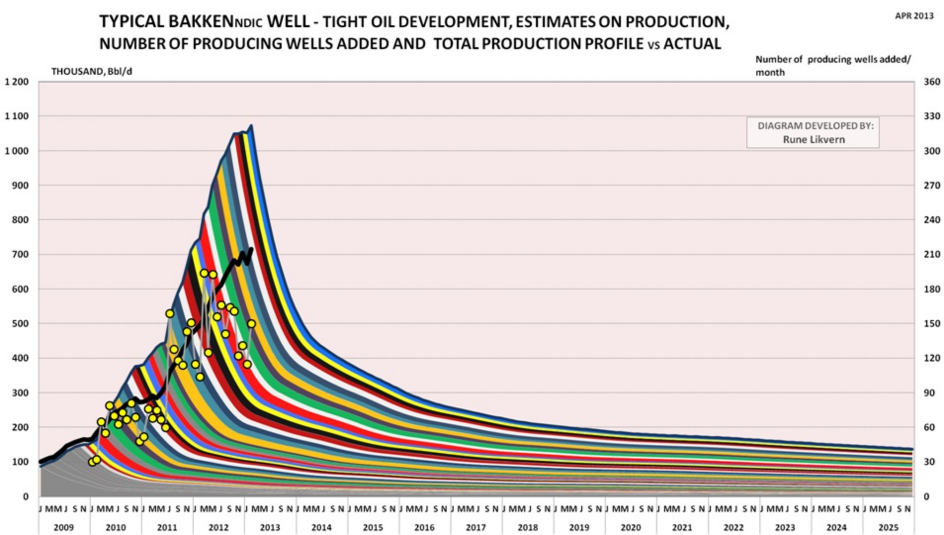


**Figure 03:** *The colored bands show total production (production profile for the typical NDIC well multiplied by net added producing wells during the month) added by month and its projected development (left hand scale). The yellow circles show net added producing wells by month (right hand scale). The thick black line shows actual reported production from Bakken (North Dakota) by NDIC (left hand scale).*

The model was calibrated to start simulations as of January 2010.

The results from the simulation show that if the wells added as from January 2010 were like the typical well used in recent presentations by NDIC, total production from Bakken (ND) by February 2013 would have been around **1.1 Mb/d**.

The thick black line shows actual production from Bakken (ND) reported by NDIC which was **0.7 Mb/d** in February 2013.

If the NDIC typical well represented the "average", the production build up would have been steeper as shown in Figure 03.

This supports earlier findings that the "average" well yields less than what has been reported, and actual well data from NDIC shows that the first year's production from the average well presently yields around 55% of the typical NDIC well production used in several public presentations.

## THE "2011 AVERAGE" WELL

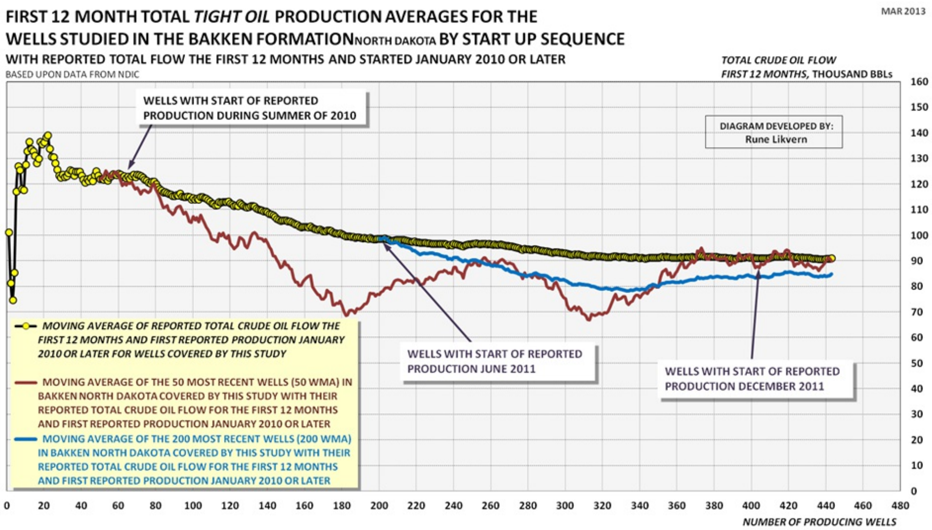


**Figure 04:** *The chart above shows development in the sequential moving average of reported total production for the first 12 months for wells studied and that started to produce as of January 2010 and through January 2012 (yellow circles connected by black line). The dark red line shows the sequential moving average of the most recent 50 wells (50 WMA; 50 Wells Moving Average.The blue line shows the sequential moving average of the most recent 200 wells (200 WMA; 200 Wells Moving Average).*

Figure 04 illustrates that the well productivity (as expressed by total oil production for the first 12 months) has been in general decline since the summer of 2010. Presently it appears that the well productivity stabilized around 85 kb during 2011. Simulations with the "2011 average" well suggest now that the level of around 85 kb has been maintained through 2012, refer also to Figure 06.

Through 2012 it was observed from NDIC data that a high number of wells continued to be added in the "sweet spots" (like Alger, Heart Butte, Reunion Bay, Sanish, Van Hook to name a few). In areas/pools with wells that had a lower well productivity than the "2011 average" well, it was found that few or no wells were added during the second half of 2012.

Around 30 pools that show promising/good well productivity were also identified.

## Future developments of well productivity

Presently it appears that companies give priority to drilling wells that have the potential to meet targeted returns within the boundaries of (oil) price, (well) costs and (well) productivity. This may cause the average well productivity (as expressed by first year total productivity) to improve for the near term.

More than 870 producing wells were added between June 2011 through December 2011 and the study included more than 230 (more than 26%) of these wells to develop the composite well which in this post is referred to as the "2011 average" well and which is shown in Figure 05.

Of the studied wells that started during 2010 around 14% were equal to or better than the typical NDIC well shown in Figure 01.

Of the studied wells that started during 2011 around 3% were equal to or better than the typical NDIC well shown in Figure 01.

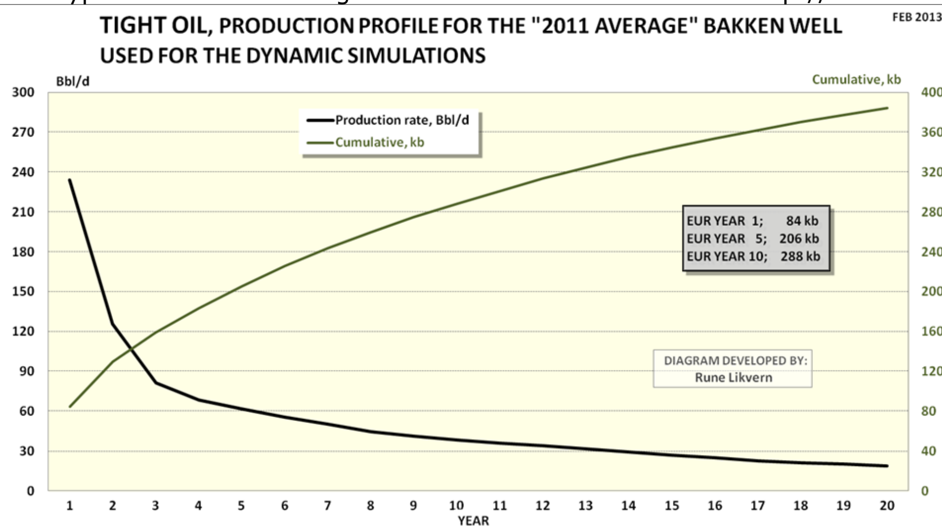


**Figure 05:** *The chart above shows the well profile and cumulative for oil from the "2011 average" well that was derived from 230 wells that started to produce as from June 2011 and through December 2011.*

This "2011 average" well was used for the simulations shown in Figures 06 and 07.

Dry wells and wells with tiny and erratic production were not included for the development of the "2011 average" well. These wells were found to be 1 - 2% of the total number of wells studied.

NOTE: The decline from year 1 to year 2 has been derived from actual data (refer to Figure SD2). Decline rates later in the wells' life according to those derived from the typical NDIC well shown in Figure 01.

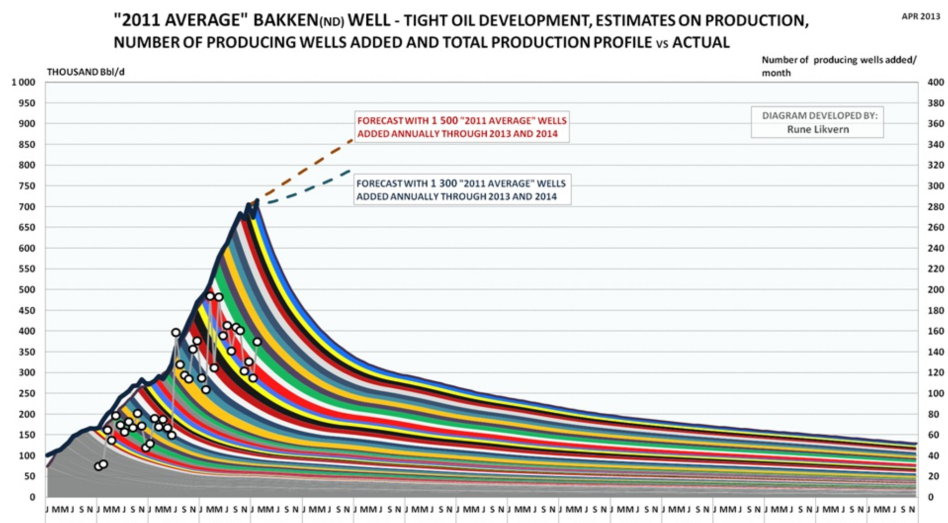


**Figure 06:** *The colored bands show total production (production profile for the "2011 average" well multiplied by net number of wells added during the month) added by month and its projected development (left hand scale). The white circles show net added producing wells by month (right hand scale). The thick black line reported production from Bakken (North Dakota) by NDIC (left hand scale).*

The chart also shows forecast developments for total oil production with, respectively, 1 300 (dark blue dotted line) and 1 500 (red dotted line) added through 2013 and 2014.

The model was calibrated to start simulations as of January 2010.

Simulations with the “2011 average” well result in an almost perfect fit with total reported production by NDIC as from early 2011. The model comes in lower than actual production during 2010 and the explanation for this is believed to be due to higher well productivity for wells started during 2010, refer also to Figure 04.

If the model over time develops a growing deficit against actual reported production, this would suggest that newer wells have an improved well productivity relative to the “2011 average” well and vice versa.

## SOME FORECASTS WITH THE ”2011 AVERAGE” WELL

**BAKKEN$_{ND}$ 1), ACTUAL ANNUAL TIGHT OIL PRODUCTION AND FORECASTS OF ANNUAL PRODUCTION FOR 2013 AND 2014 VERSUS TWO SCENARIOS WITH ADDITIONS OF PRODUCING WELLS**

| | ANNUAL PRODUCTION Mb/d | ANNUAL PRODUCTION Mb/d |
|---|---|---|
| 2010 | 0.24 | 0.24 |
| 2011 | 0.35 | 0.35 |
| 2012 | 0.60 | 0.60 |
| | *FORECAST WITH 1 300 "2011 AVERAGE" WELLS ADDED ANNUALLY* | *FORECAST WITH 1 500 "2011 AVERAGE" WELLS ADDED ANNUALLY* |
| *2013* | *0.72* | *0.74* |
| *2014* | *0.76* | *0.82* |

1) Includes Bakken, Sanish, Three Forks and Bakken/Three Forks Pools

**Table 1;** *Actual annual production and forecasts for tight oil production from Bakken (ND) with 1 300 and 1 500 “average 2011” wells added annually through 2013 and 2014.*

**NOTE:** Forecasts should be viewed in the context of developments in well productivity, (well) costs, (oil) price, decline rates from the “older” population of wells and the strategies the companies deploy as they come to hold acreage by production.

## PLATEAU OF 700 kb/d THROUGH 2013

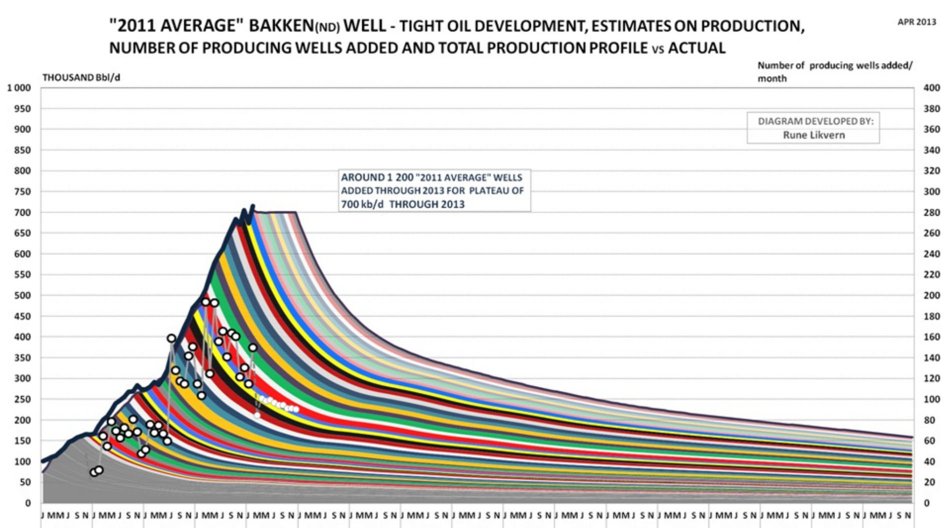

**Figure 07:** *The colored bands show total production (production profile for the "2011 average" well multiplied by net number of wells added during the month) added by month and its projected development (left hand scale). The white circles show net added producing wells by month (right hand scale). The thick black line reported production from Bakken (North Dakota) by NDIC (left hand scale).*

The transparent colored bands shows a plateau of 700 kb/d through 2013 and the white (smaller circles) estimated number of "2011 average" wells added each month to sustain the plateau of 700 kb/d.

The model was calibrated to start simulations as of January 2010.

Simulations with the "2011 average" well found that around 1 200 wells were needed through 2013 to maintain a plateau of 700 kb/d. As shown in Figure 07, the number of wells added monthly will decline as a result of a "thickening" production base from a growing population of wells.

## TIGHT OIL IN A GLOBAL SUPPLY PERSPECTIVE

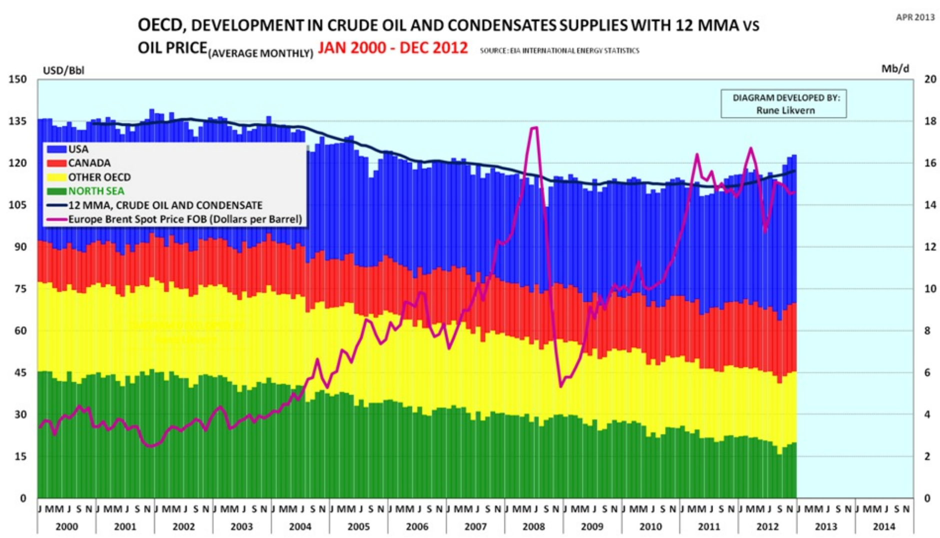


**Figure 08:** *The chart above shows development in crude oil and condensates (C + C) production for OECD split on Canada (red columns), North Sea (green columns), USA (blue columns) and the rest of OECD (yellow columns). (Data from EIA.)*

Between December 2011 and as of December 2012 OECD had an annualized growth in (C+C) supplies of 0.71 Mb/d. This growth was facilitated through the rapid production growth from tight oil in USA and from oil sands in Canada that more than offset the decline in oil production from the North Sea and other OECD countries.

As shown in Table 1 a slowdown in the growth in tight oil production from Bakken (and other tight oil formations) should be expected through 2013. This needs to be seen in conjunction with production developments from conventional oil reservoirs in Alaska, Gulf of Mexico and the Lower 48 to get a complete understanding of what to expect through 2013 and beyond for developments in total (C+C) production for USA.

For 2013 it is expected that (C+C) production from the North Sea will continue to decline at an annual rate of 10%. Thus total OECD (C+C) production for 2013 may experience less growth than in 2012.

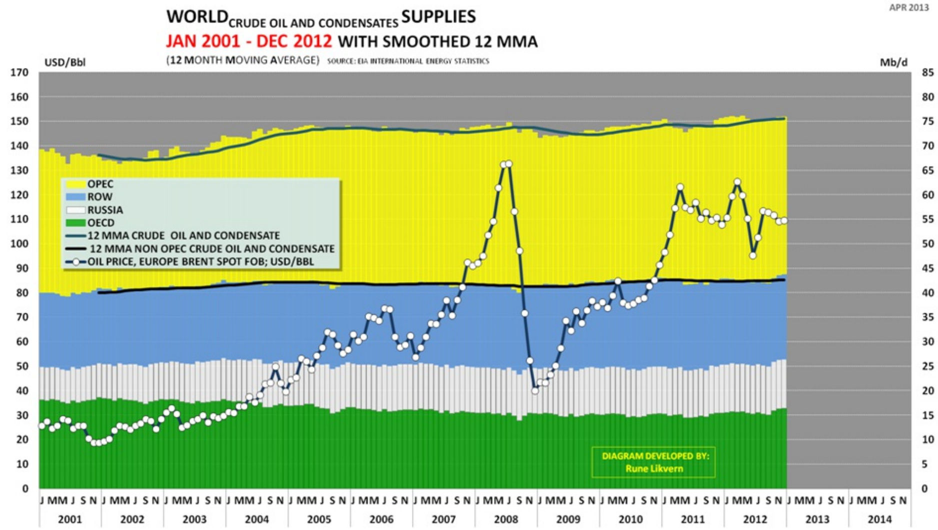


**Figure 09:** *The chart above (based upon data from EIA International Energy Statistics) shows developments in (C+C) production for the world split on economic zones (plotted towards the right hand scale).*

The economic zones are OECD (green), Russia (white), Rest Of World (ROW, which includes Brazil and China) (blue) [OECD, Russia and ROW is also referred to as Non OPEC] and OPEC (yellow).

Development in the oil price (Brent spot) is shown as white dots connected by the black line (plotted towards the left hand scale).

Figure 08 shows that annualized **Non OPEC** (C+C) production has been flat for recent years. The growth from tight oil (USA) and oil sands (Canada) has offset declines from the rest of the OECD and provided growth in OECD (C+C) supplies. Annualized growth in Russian (C+C) production has slowed to around 0.14 Mb/d during 2012. ROW (C+C) has seen an annualized decline of roughly 0.54 Mb/d since 2011.

Chances are that (C+C) production for **Non OPEC** may decline in 2013 (and beyond) despite the expected growth from tight oil.
Growth in global (C+C) supplies during the last 2 years has primarily come from OPEC.

*If* **Non OPEC** experiences a decline in (C+C) supplies in the near future, this leaves OPEC to offset this decline and also provide for any growth in global (C+C) supplies. This combination may put OPEC's (C+C) capacity to a stress test during 2013 or later.

## SUPPLEMENTARY DOCUMENTATION FOR THE "2011 AVERAGE" WELL

All the wells included in this study have verified full time production series.

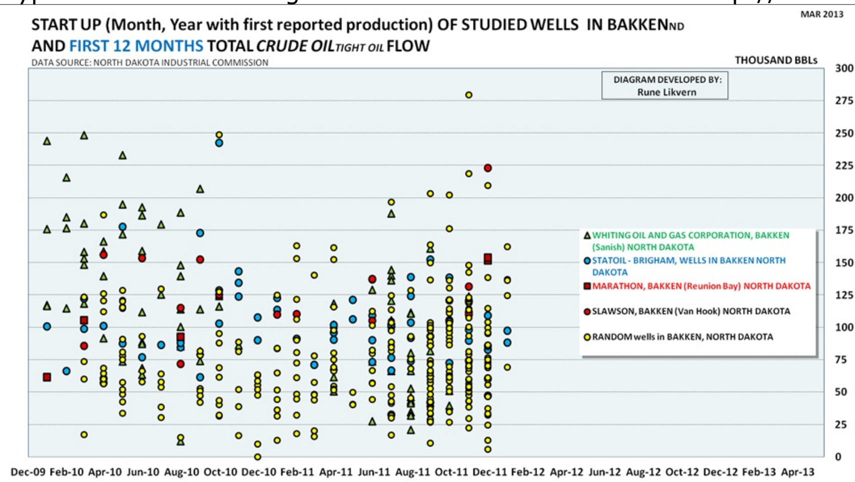


**Figure SD1:** *The chart above shows the first 12 months' production for the wells studied against their reported start of production and the study included the production history of more than 440 wells that started to produce as from January 2010 and through January 2012. This represents around 22% of the wells meeting these criteria.*

Around 2 060 wells were reported to have started to produce as from January 2010 and through January 2012 and thus had 12 months or more of reported production in January 2013.

443 of these 2060 wells were subject to in depth studies of the full time series of production.

The wells studied were from 30 companies and 89 pools in Bakken North Dakota.

The density of wells with a production above 200 kb during the first 12 months was found to decrease with time.

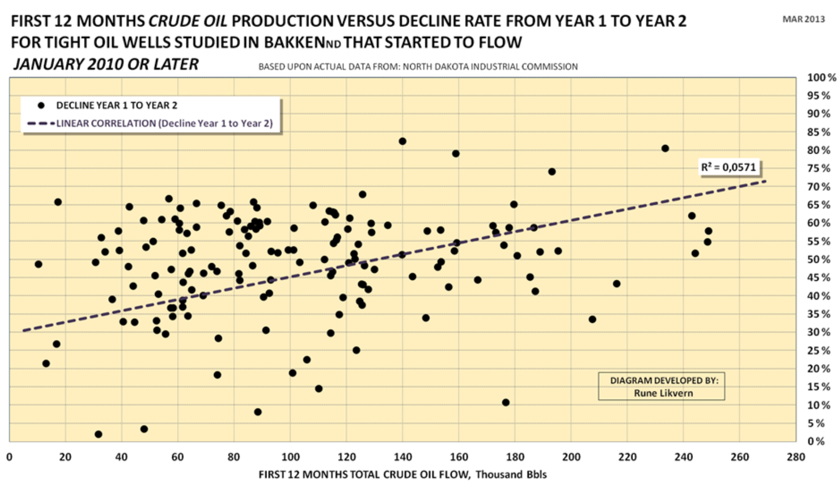


**Figure SD2:** *The scatter chart shows decline rates for oil from year 1 to year 2 for 156 wells that started as from January 2010 and through February 2011 and thus had a history of 24 months of production or more as of January 2013.A total of 860 wells started to produce during the studied period that met the criteria.*

Figure SD2 illustrates that the decline rate is all over the place. A linear fit suggests that decline rates from year 1 to year 2 should be expected to be a function of first year (first

12 months) production. It appears that the higher the first year's production the higher the decline rate from year 1 to year 2 becomes.

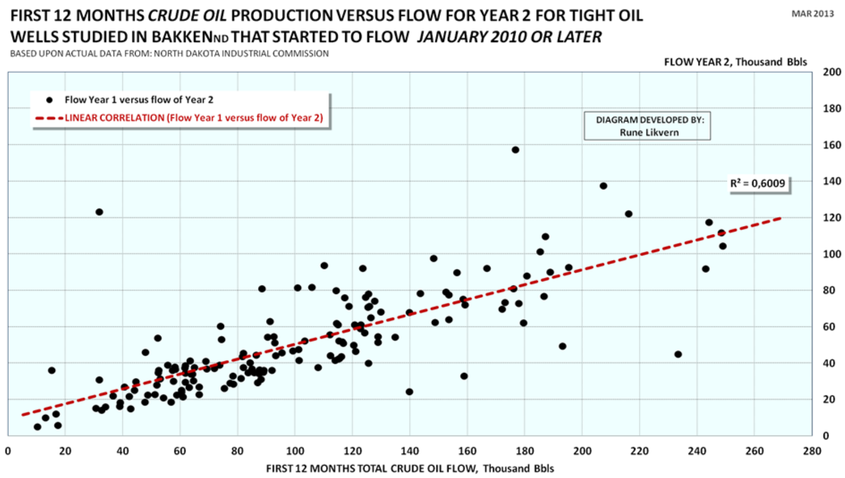


**Figure SD3:** *The scatter chart above is a variant of the one shown in Figure SD2, and here first year (first 12 months) production has been plotted against the production of year 2 (months 13 through 24) of the wells' life.*

The production developments in Bakken and other tight oil plays are very much a function of monthly additions of producing wells, developments in well productivity, decline rates (for the growing population of "older" producing wells), development in costs, strategies deployed by the companies for development of their acreage, adequate infrastructure and not least the developments/expectations for the **oil price**.