The Oil Drum: Europe
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

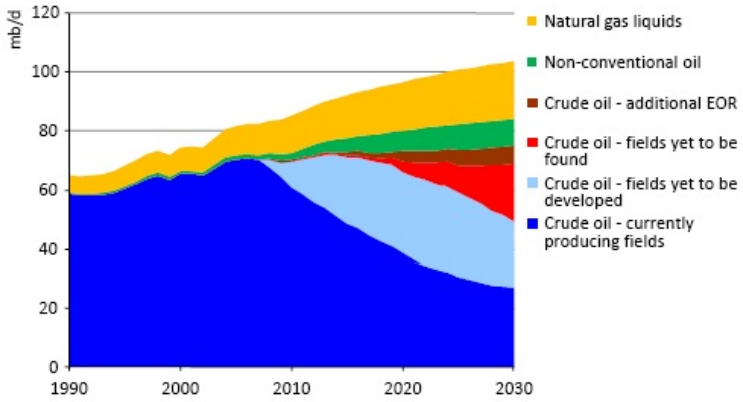
IEA WEO 2008 - NGLs to the Rescue?

Posted by Rune Likvern on December 5, 2008 - 9:48am in The Oil Drum: Europe
Topic: Supply/Production
Tags: bp statistical review 2008, condensates, eia ipm, iea weo 2008, ncs, ngl, north field, opec, sleipner, south pars [list all tags]

According to the IEA World Energy Outlook 2008, p. 261:

> Output of natural gas liquids — light hydrocarbons that exist in liquid form underground and that are produced together with natural gas and recovered in separation facilities or processing plants — is expected to grow rapidly over the Outlook period. Global NGL production is projected to almost double, from 10.5 mb/d in 2007 to just under 20 mb/d in 2030.

One can see from IEA's chart of World Oil Production by Source that the growth of natural gas liquids, or NGLs, is being depended on as a significant contributor to total world oil production:



World Oil Production by Source, Reference Scenario, shown as Figure 11.1 on page 250 of IEA WEO 2008.

In this post, I will document that there is good reason to believe that the IEA WEO 2008 projections in the reference scenario overshoots the likely world production of NGLs by as much as 35 - 50 % by 2030.

One way of estimating expected NGLs is as a ratio to natural gas production, representing the wetness or dryness of gas. One would expect this ratio to decline over time, based on what *normally* has been observed from fields, areas and regions with good quality data. Instead, the IEA is forecasting that this ratio will increase in the future.

NOTE: All diagrams are clickable and open in a larger version.

INTRODUCTION

In the oil and gas industry, there is a broadly used parameter that expresses the "dryness/leanness" or "richness/wetness" of natural gas. In this post, I document that this parameter is expected to change to dryness/leanness over time, based on an extensive analysis of actual data on fields, areas and regions. I also show that the IEA WEO 2008 forecast to 2030 implies the opposite result--namely that the shift will be toward richness/wetness.

The parameter measures volumetric NGL's content per volumetric unit Nat Gas produced, in this post expressed as barrels per standard cubic meter (Bbl/Scm).

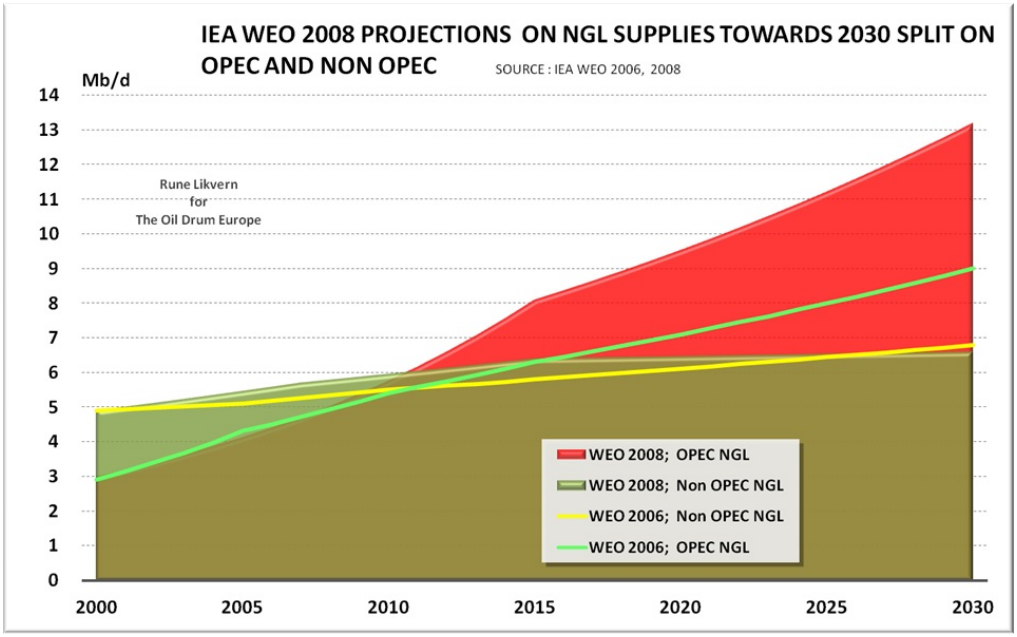


FIGURE 01 *The diagram above shows the projections of NGLs production to 2030 split between Non OPEC (green area) and OPEC (red area) from IEA WEO 2008. The same diagram also shows the projections to 2030 from IEA WEO 2006 for Non OPEC (yellow line) and OPEC (light green line).*

While projections on Non OPEC NGL production has literally remained unchanged from WEO 2006 to WEO 2008, OPEC production has been projected to grow an additional 4 Mb/d (an increase of close to 50 %) by 2030.

Normally the fields that are "richest/wettest" (that is requiring least Nat Gas to yield a barrel of NGL) are developed first from a portfolio within a region, inasmuch as these also normally give the highest return on investment. NGLs, depending on their composition, have a volumetric energy content that is 70 - 75 % of crude oil.

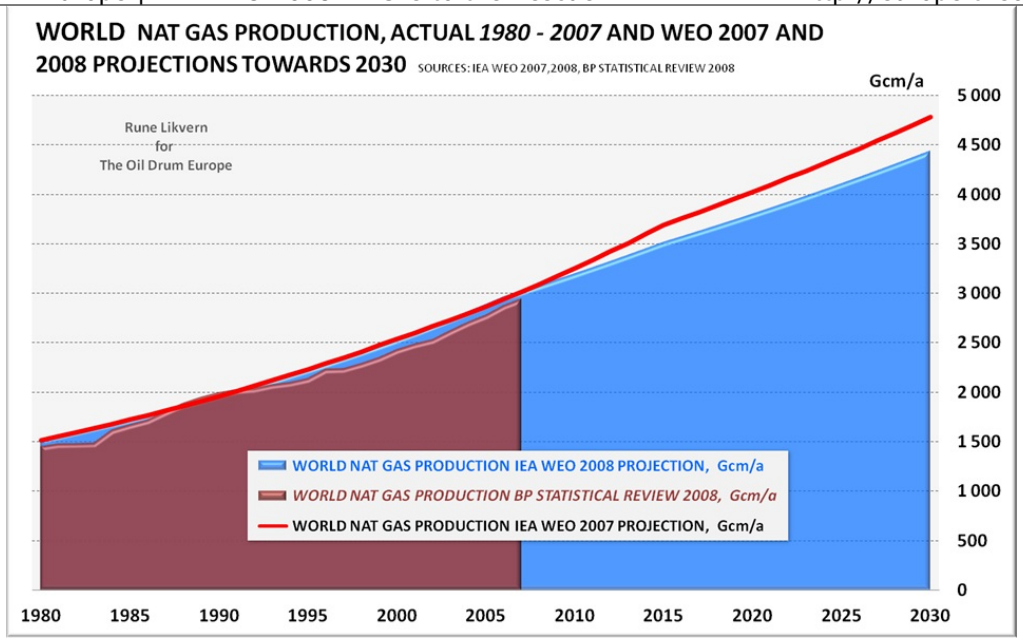


FIGURE 02 *The diagram above shows the projections on World Nat Gas production (blue area) from IEA WEO 2008 towards 2030. The red line shows the projections from WEO 2007, and the dark red area is actual World Nat Gas production as reported by BP Statistical Review 2008.*

The reason why the Nat Gas projections from WEO's are shown is because NGLs are produced from Nat Gas. Thus, Nat Gas production and NGL production are strongly connected. NGLs, as defined by IEA, are exempt from the OPEC quota system. This is IEA's definition of NGLs, from page 544 of ANNEXES of WEO 2008:

> Natural gas liquids (NGLs) are the liquid or liquefied hydrocarbons produced in the manufacture, purification and stabilization of natural gas. These are those portions of natural gas which are recovered as liquids in separators, field facilities or gas processing plants. NGLs include, but are not limited to, ethane, propane, butane, pentane, natural gasoline and condensates.

Regarding natural gas liquids (NGLs), the IEA says the following (Chapter 11, p. 261):

> Output of natural gas liquids – light hydrocarbons that exist in liquid form underground and that are produced together with natural gas and recovered in separation facilities or processing plants – is expected to grow rapidly over the Outlook period. Global NGL production is projected to almost double, from 10.5 mb/d to just under 20 mb/d in 2030. This increase is driven by the steady rise in natural gas output (see Chapter 12). The bulk of the increase comes from OPEC countries, where gas production (to supply local markets and new LNG projects) is projected to expand quickest. OPEC NGL production almost triples, from 4.7 mb/d in 2007 to over 13 mb/d in 2030. The Middle East accounts for four-fifths of this increase. Non-OPEC NGL production increases by about 1 mb/d, to close to 7 mb/d in 2030 (Figure11.11). These projections assume that the average NGL content of gas production is constant over the projection period.

Figure 3, below, shows what happens when we compare the IEA's projections of NGLs (from

Figure 01) with their projections of Nat Gas (from Figure 02).

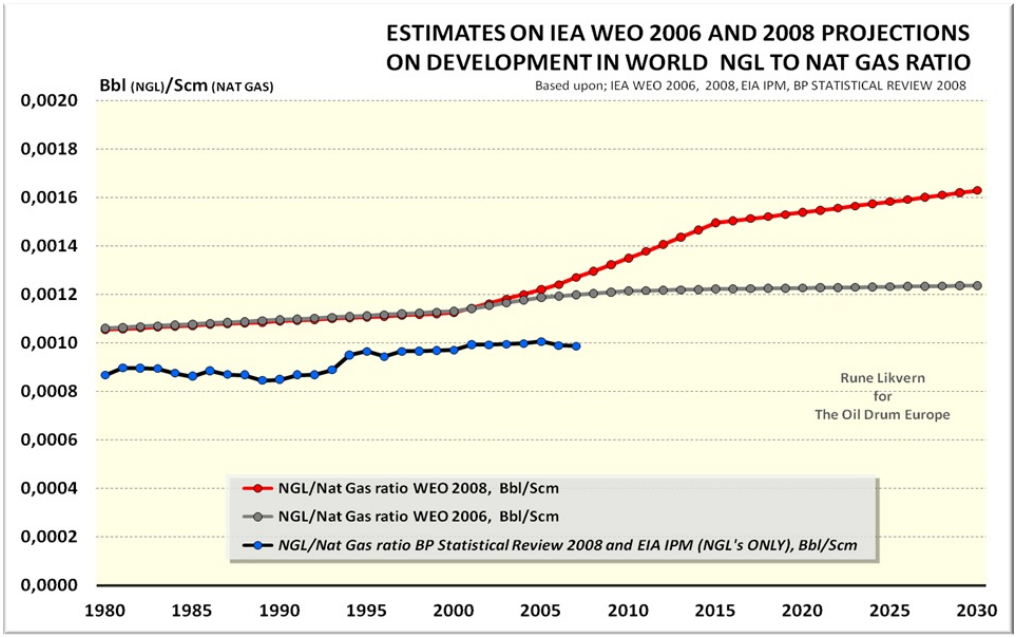


FIGURE 03 *The diagram above shows the derived World NGL/Nat Gas (expressed as Bbl/Scm) ratio derived from IEA WEO 2006 (grey circles connected with a grey line) and IEA WEO 2008 (red circles connected with a red line).*

Figure 3 indicates that the world average Nat Gas "richness/wetness" based on IEA WEO 2008 is expected to grow by approximately an additional 30 % relative to IEA WEO 2006, in the years to 2030.

The diagram also shows the development in the World's NGLs (exclusive of Condensates) to Nat Gas ratio based upon data from the US Energy Information Administration's International Petroleum Monthly and British Petroleum's (BP) Statistical Review 2008. (Since this data is exclusive of condensates, it is on a slightly different basis than the IEA's forecast.) This ratio showed moderate growth until the mid 90s, but has remained flat in recent years.

WHAT HISTORICAL DATA SHOWS

In this section, I document how NGL/Nat Gas ratios have changed over time for areas and regions. I also provide a more detailed look at NGLs production in OPEC and what might reasonably be expected based on information in the public domain about current developments.

THE SLEIPNER AREA (Norway)

The Sleipner area consists of the following producing fields: Sleipner East and West, Gungne and Loke. The Sleipner area consists of several fields that are classified as Nat Gas/Condensate fields. Sleipner East started to flow in 1993 followed by Sleipner West in 1996. To increase liquid (NGLs and Condensates) recovery from the fields, some of the Nat Gas is recirculated. This technique is also applied on other Nat Gas/Condensate fields.

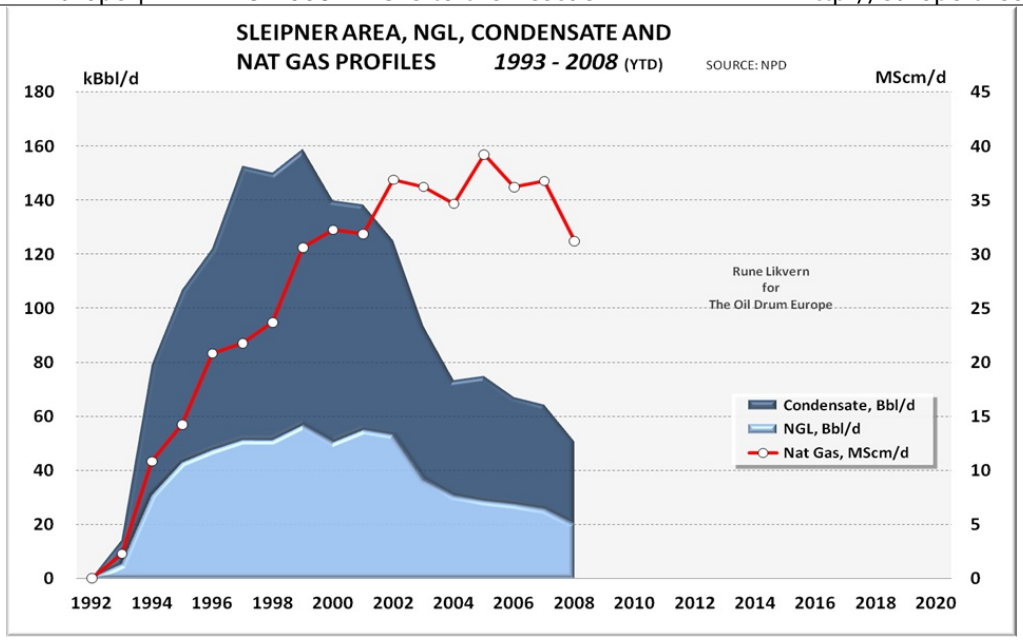


FIGURE 04 *The diagram above shows the actual production of NGLs and Condensates (light blue and dark blue areas plotted against the left y-axis) and Nat Gas production (white circles connected by a red line plotted towards the right y-axis).*

Figure 05 below illustrates that the NGLs production is now declining faster than Nat Gas production.

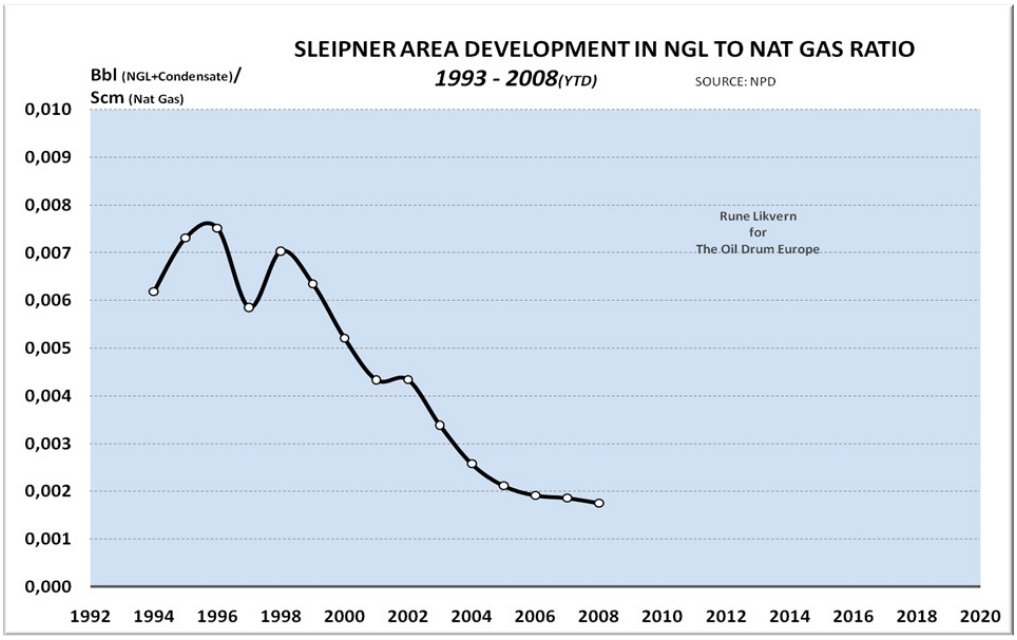


FIGURE 05 *The diagram above shows the development of the NGL to Nat Gas ratio for the Sleipner area. It also illustrates the rebound of the NGL/Nat Gas ratio as Sleipner West started to flow in 1996. The Sleipner is made up of rich Nat Gas/Condensate fields.*

Note how the NGL/Nat Gas ratio has declined with time. In other words, production has become dryer, or leaner, over time.

NPD data at year end 2007 gives the Sleipner area a Reserves divided by Production ratio or R/P of 4,0 for natural gas, and of 1,3 for NGLs. The low R/P ratio for Nat Gas suggests that Nat Gas production from the Sleipner area soon will enter into a steep decline. Inasmuch as the R/P ratio

for Nat Gas is higher than the R/P ratio for NGLs, this suggests that the Nat Gas will become increasingly drier, i.e. yield less NGLs from each volumetric unit of Nat Gas produced. Another way to put it is that NGL production will fall more steeply than Nat Gas production in the future.

THE NGL STORY FROM NORWEGIAN CONTINENTAL SHELF (NCS)

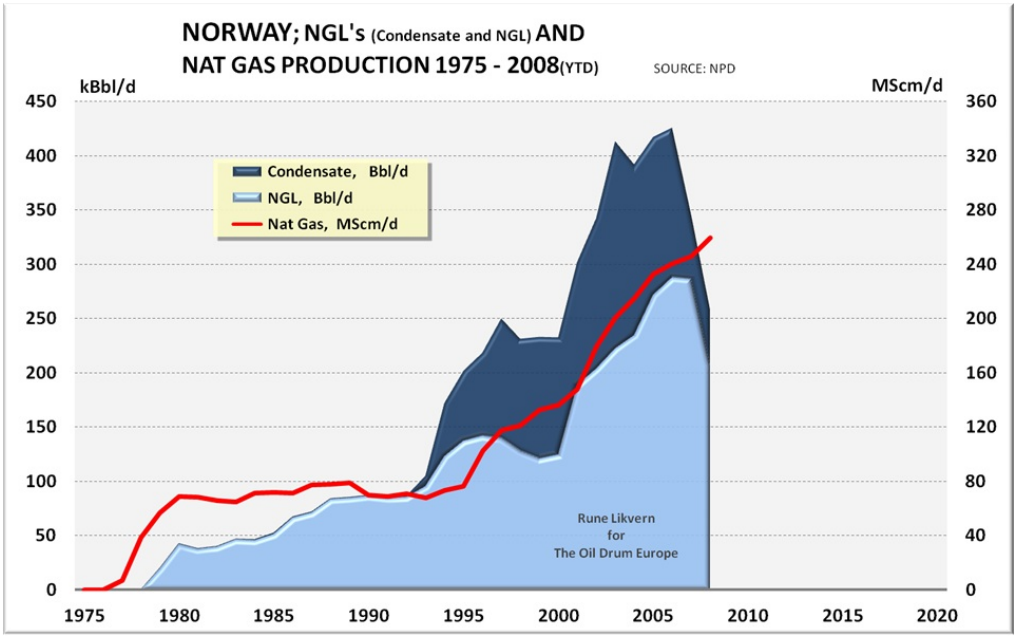


FIGURE 06 *The diagram above shows the actual production of NGLs and Condensates (light blue and dark blue areas plotted against the left y-axis) and Nat Gas production (red line plotted towards the right y-axis) from NCS (Norwegian Continental Shelf).*

Figure 6 illustrates that the NGLs production in NCS declines faster than the Nat Gas production, which is projected to grow in the years ahead.

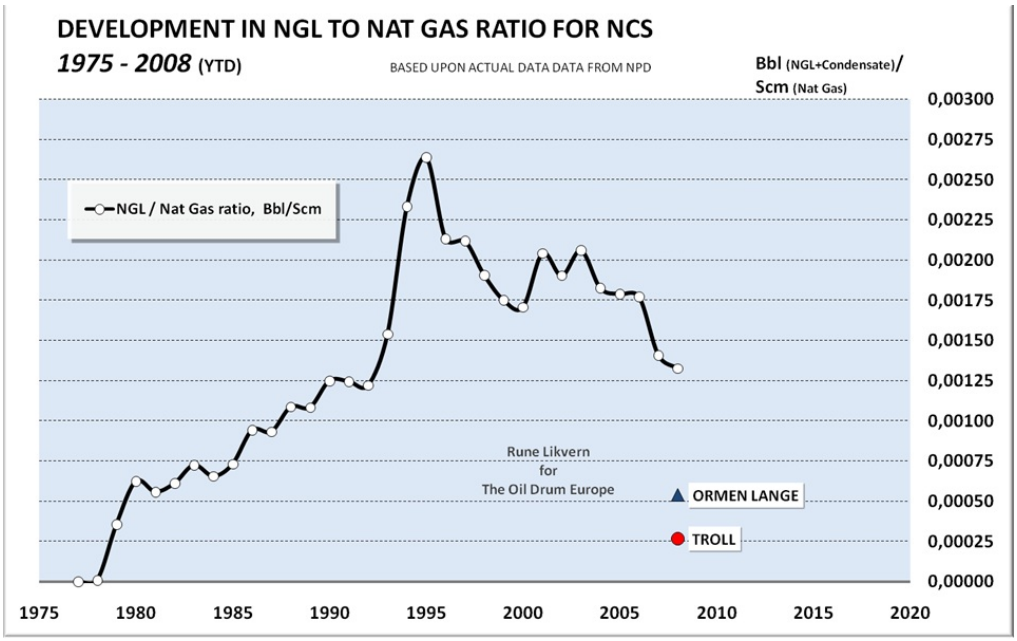


FIGURE 07 *The diagram above shows the development of the NGL to Nat Gas ratio for NCS.*

Figure 07 illustrates how the NGL/Nat Gas ratios increased as more fields were brought on

stream, until it "peaked" in 1995 and has been in general decline since. This ratio may wobble around a little as more fields starts to flow, but the general trend with time is towards "dryer"/"leaner" Nat Gas. For NCS, this ratio rebounded again as the Åsgard and other fields in the Halten area were brought on stream earlier this decade.

What future development can be expected of the NGL/Nat Gas ratio for NCS?

NPD data on estimated remaining recoverable reserves from producing and sanctioned fields on NCS at end 2007 results in the following R/P numbers for NGLs and nat gas;

- NGLs; R/P = 14,3
- Nat Gas; R/P = 25,7

NGLs are produced mainly from fields classified as Nat Gas and Nat Gas/condensate fields, thus the above R/P numbers suggests that the NGL to Nat Gas ratio will decrease with time for NCS, i.e. the Nat Gas will become "drier"/"leaner".

Figure 7 also shows the present NGL/Nat Gas ratios for the Troll and Ormen Lange fields. These fields are what are considered as "dry"/"lean" Nat Gas fields. With time, as the other fields deplete, the NGL/Nat Gas ratio for NCS can be expected to approach the ratios of Ormen Lange and Troll.

OPEC NAT GAS AND NGL PRODUCTION

Since the IEA WEO 2008 projects strong growth in NGLs between 2007 and 2030, I will take a closer look on NGLs and Nat Gas production within OPEC.

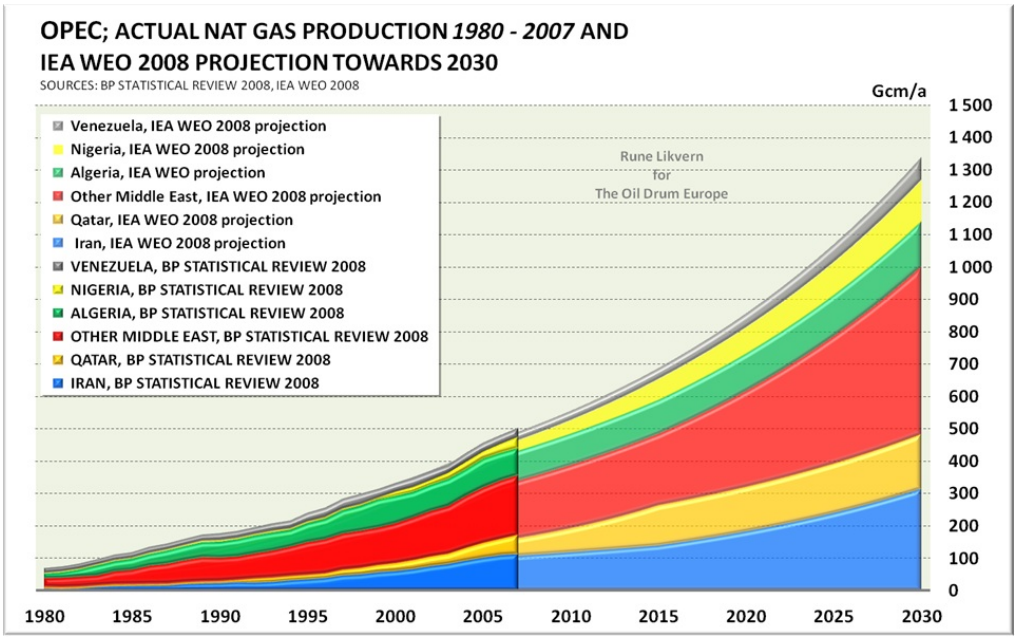


FIGURE 08 *Actual and IEA WEO 2008 projected development of Nat Gas production for OPEC.*

Note that the above chart uses an approximation to OPEC production, rather than the precise list of countries. The diagram does not include developments of Nat Gas production for Angola, Ecuador, Indonesia and Libya. Among these countries, Indonesia and Libya are listed in the BP Statistical Review 2008 with a total of 4,5 Tcm at end 2007. On the other hand, the chart includes data Middle Eastern countries which are not OPEC members. These differences should be small, and partially offset.

Figure 08 indicates that IEA WEO 2008 expects strong growth in Nat Gas production from OPEC. OPEC had more than 51 % of the World's proven Nat Gas reserves as of end 2007, and just above 18 % of the World's production.

Strong growth is forecast in the Middle East to come from Iran (South Pars) and Qatar (North Field), which now is estimated to hold approximately 35 Tcm combined or 20 % of the Worlds reserves. Reserves in the Middle East have a high H_2S (above 100 ppm), CO_2 (above 2 %) or a combination of these two nuisances. H_2S and CO_2 must be removed to meet buyer's sales specifications which adds to development costs.

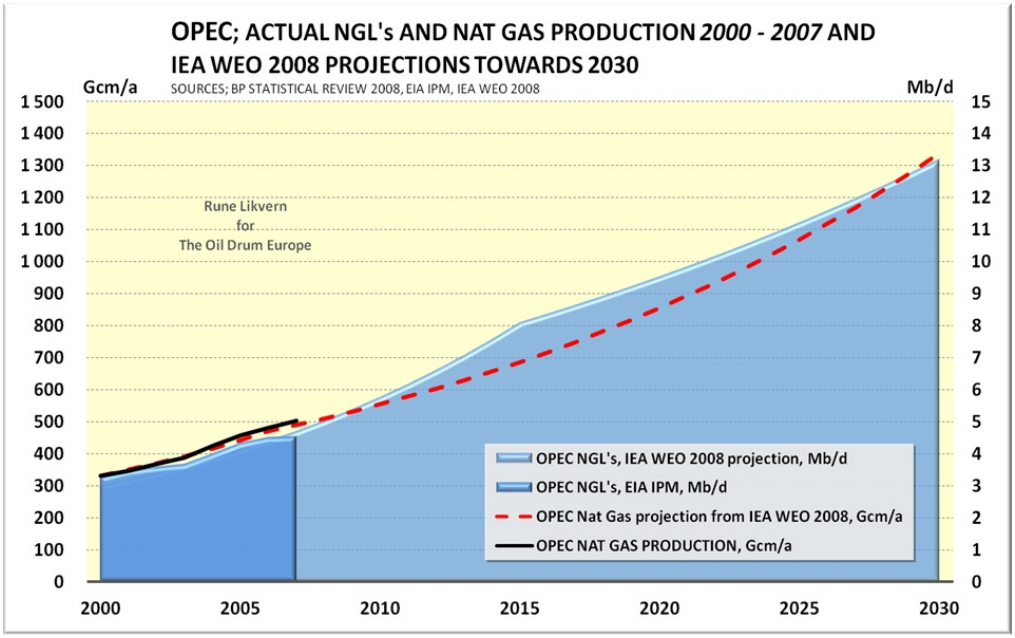


FIGURE 09 *The diagram above shows OPEC actual NGL production together with IEA WEO 2008 NGL projection towards 2030 (blue areas) plotted towards the right y-axis. It also shows actual (black line) and IEA WEO 2008 projected development of Nat Gas production for OPEC (red dotted line) plotted towards the left y-axis.*

In Fiugre 09, above, note that NGLs are forecast to grow faster than Nat Gas until 2015, and thereafter have a slower growth.

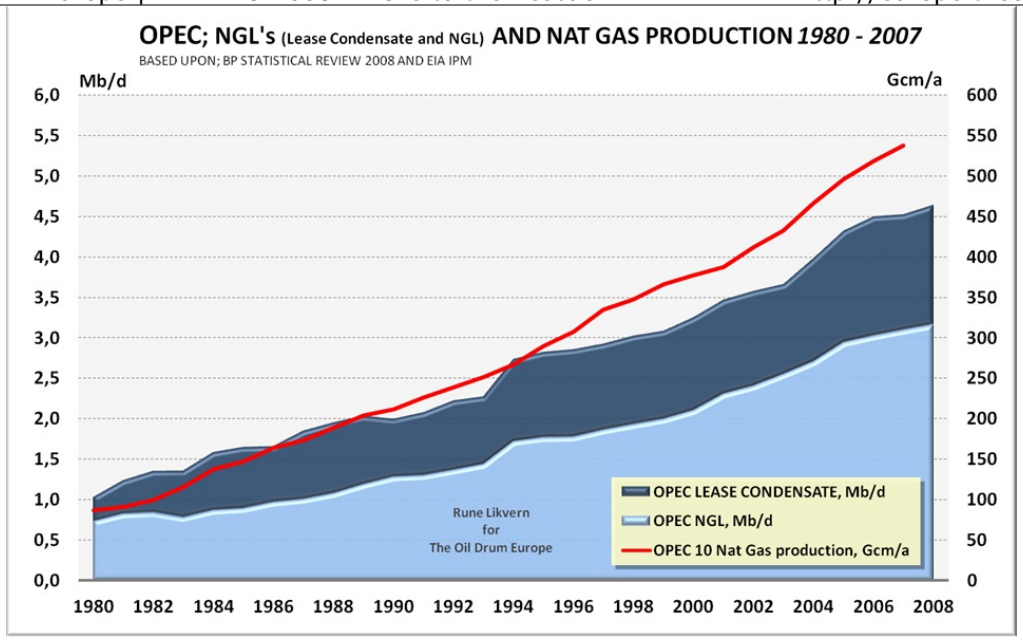


FIGURE 10 *The diagram above shows OPEC actual NGL and Condensate production (plotted against the left y-axis) against actual Nat Gas production (red line) plotted against the right y-axis for the years 1980 to 2007.*

In Figure 10, note how Nat Gas has grown faster than NGLs in recent years, suggesting that the average OPEC Nat Gas is becoming leaner/drier.

From 1979 to 1987, OPEC cut back total oil production of 11,8 Mb/d, due to recession and increased output from Alaska, the North Sea and Western Siberia. In the same years, output of NGLs within OPEC continued to grow. As NGLs are not part of the OPEC quota system, this would suggest that OPEC members had good incentive to develop fields yielding NGLs for additional income outside the quota system.

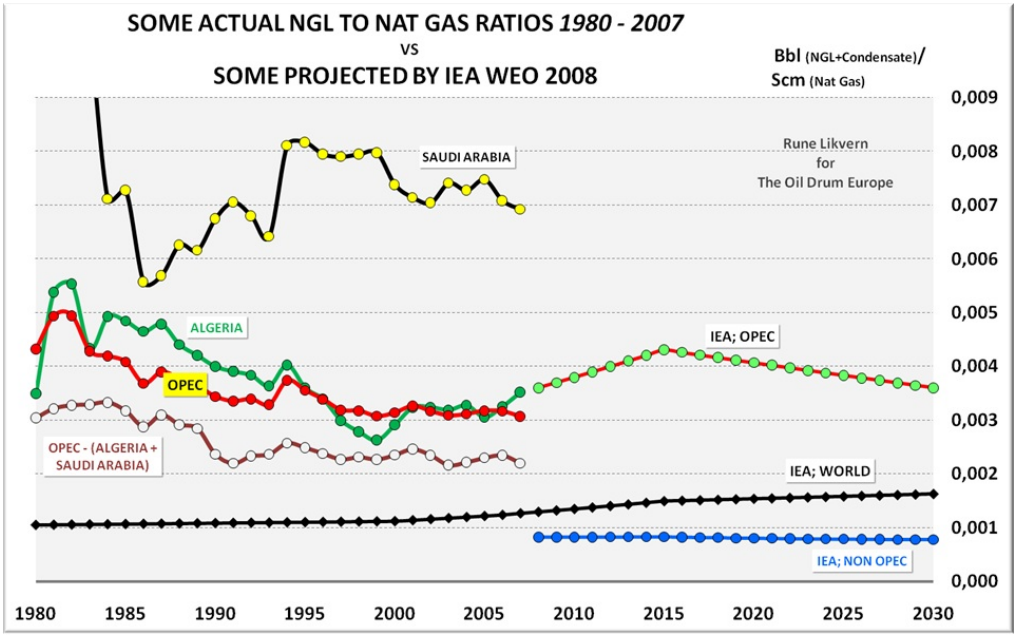


FIGURE 11 *Additional NGL to Nat Gas ratios and further projections derived from IEA WEO 2008 for OPEC, Non OPEC and the World.*

Note that IEA shows a decline in NGLs to Nat Gas ratios with time. The reason this ratio

continues to grow for the World is that OPEC's relative share in World Nat Gas production is projected to grow. The general trend for the NGL to Nat Gas ratio for Algeria (green line), Saudi Arabia (yellow circles connected with black line), OPEC (red circles connected with red line) and OPEC - (Algeria and Saudi Arabia) is downward with time, that is "drier"/"leaner" Nat Gas.

As of 2007 Algeria and Saudi Arabia had around 30 % of OPEC's Nat Gas production and close to 50 % of OPEC's NGL production. For Saudi Arabia the high NGL to Nat Gas ratio suggests a high portion of associated Nat Gas. For Algeria, the recent uptick in the NGL to Nat Gas ratio seems to be associated with the start up of Algeria's third and fourth largest Nat Gas/Condensate fields In Salah and In Amenas.

It is in this context that the derived projected increase in the NGL to Nat Gas ratio for OPEC (light green circles connected with red line) from IEA WEO 2008 becomes interesting. A closer look on projected growth in OPEC's near future Nat Gas production reveals that much will come from North Field in Qatar and South Pars in Iran. Data on the website to StatoilHydro, who is partner in South Pars 6 - 8 (South Pars is listed to have 28 phases), suggests an initial NGL/Nat Gas ratio of 0,0011 Bbl/Scm. Data from SHELL's Pearl GTL, project which is fed from North Field, suggests a NGL/Nat Gas ratio of 0,0024 Bbl/Scm. The GTL process is fed almost pure methane, which is also true for the LNG plants for Qatargas. Other sources list South Pars to have a NGL/ Nat Gas ratio of 0,0015 Bbl/Scm.

This data suggests that an average NGL/Nat Gas ratio of 0,002 Bbl/Scm can be expected for North Field/South Pars. This ratio is close to the current ratio for OPEC - (Algeria and Saudi Arabia), based on Figure 11.

In Figure 12, below, I show the IEA estimate of future NGL production together with my estimate of future NGL production. My estimate assumes that IEA's estimates of future Nat Gas production are correct--a rather large assumption. In making my forecast, I also assume the NGL/Nat Gas ratio for OPEC current Nat Gas production will remain unchanged at its current level of 0,003 Bbl/Scm until 2030. I also assume an average of 0,002 Bbl/Scm for new Nat Gas from OPEC, based on the discussion above and the IEA WEO 2008 projection on Nat Gas until 2030. I will leave to the readers to decide if the assumptions used above should be considered conservative or about right given the documentation provided earlier in this post.

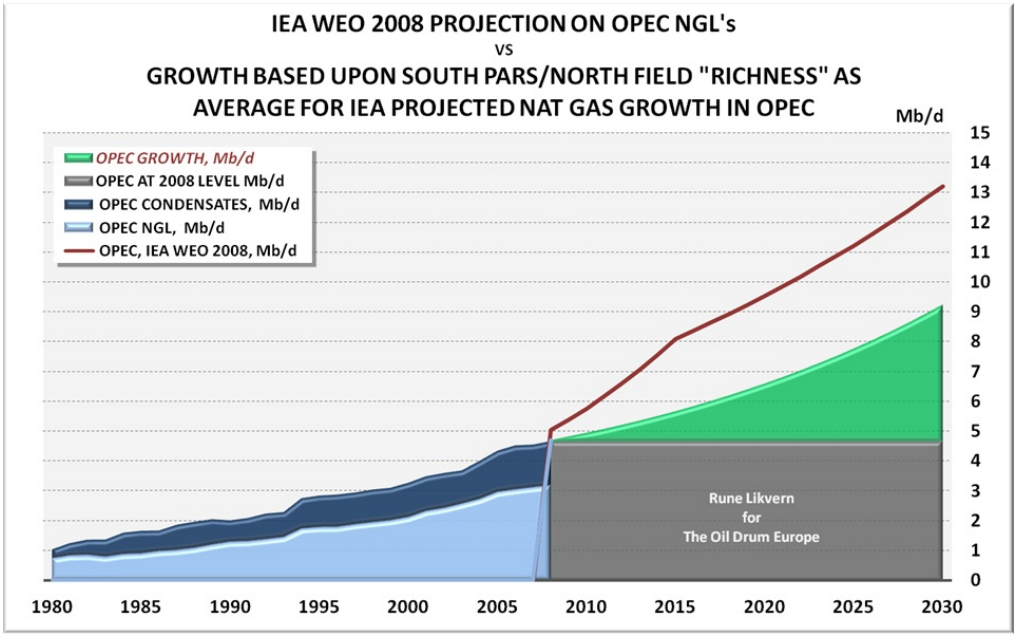


FIGURE 12 *The diagram above shows actual production of NGL (light blue area) and Condensates (dark blue area) for OPEC, as this has been reported by EIA in International*

Petroleum Monthly. The dark red line shows the IEA WEO 2008 projection (from the reference case). The grey area shows production at 2008 levels, while the green area shows the growth in NGL's from OPEC applying the assumptions prior to this diagram.

As the diagram illustrates, my forecast using the stated assumptions comes close to the NGL projections for OPEC made in the IEA WEO 2006 reference case.

The question is: What made IEA revise the NGL/Nat Gas ratio in their WEO 2008 ?

WHAT DOES IT TAKE TO MEET THE IEA WEO 2008 PROJECTION IN 2015?

Between 2007 and 2015, half of the growth in OPEC Nat Gas production is projected by IEA to come from Iran and Qatar (South Pars and North Field) which suggests an average NGL/Nat Gas ratio of 0,002 Bbl/Scm, based upon data from several of the companies that are involved in these developments.

In order for IEA's forecast to be accurate, this would require that the other half in Nat Gas production growth from OPEC between 2007 and 2015 come from fields with an average NGL/Nat Gas ratio of 0,012 Bbl/Scm, which is 6 times "richer"/"wetter" than Nat Gas from North Field/South Pars. 0,012 Bbl/Scm is close to double the "richness" of present Saudi Arabian production, ref Figure 11 above. Anyone in the oil industry would testify that Nat Gas/Condensate fields with such a high liquid ratio, *(0,012 Bbl/Scm)*, would be fantastic.

As NGLs (inclusive Condensates) are not part of the OPEC quota system, there would be a huge incentive within OPEC to develop such Nat Gas fields as quickly as possible.

FOR THOSE OF YOU THAT WANTS MORE DATA ON NGL/Nat Gas RATIOS

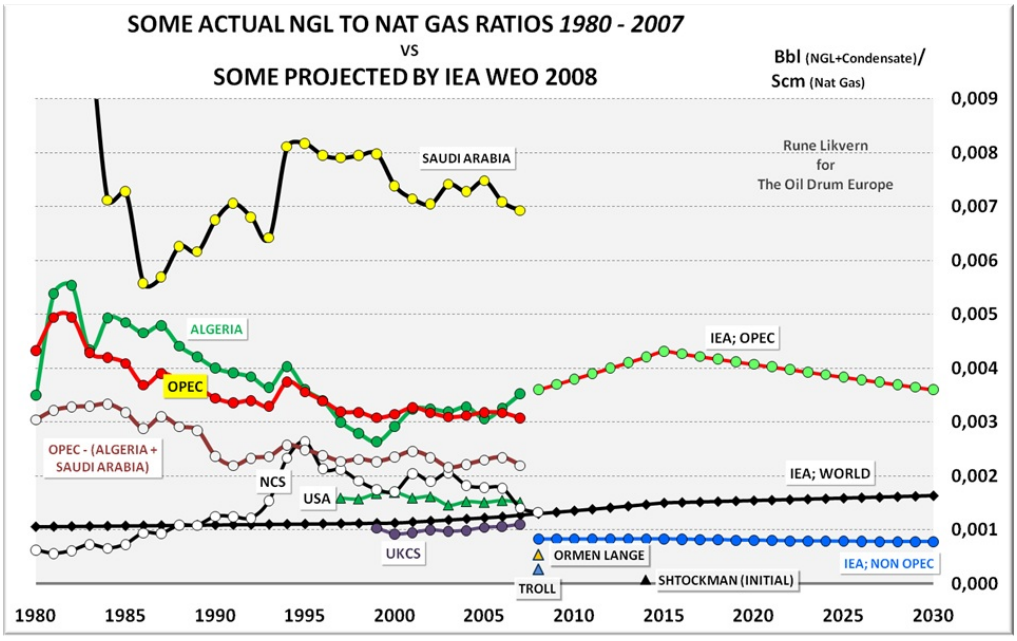


FIGURE 13 *The diagram above shows some more developments on NGL to Nat Gas ratios.*

Note that the ratio for NCS is presently at about the world average; further the US ratio has remained almost flat throughout the last ten years. Data from EIA for the USA at the end of 2007 gave an R/P ratio for Nat Gas of 12,2 and NGL of 11,0 suggesting a slight decline to be expected in the future. For the United Kingdom Continental Shelf (UKCS), the ratio has been below the world average, but recently shown a little growth, now believed to be due to increased exports of "rich gas" from NCS.

The diagram suggests that Nat Gas outside OPEC, USA and the North Sea is much drier/leaner than the world average derived from IEA WEO 2008. Note that the Russian giant Shtockman field (presently scheduled to start to flow in 2013) is a very dry gas field.

Methodology

The analysis presented in this post has strictly adhered the IEA WEO's definition (ref. above) of NGL's, if not otherwise stated. It has also used the IEA WEO 2008 projections of growth in Nat Gas production for the world and groups of countries. This analysis has not considered the possibility that the IEA WEO 2008 Nat Gas projections, to which the ratios are applied, may be inaccurate.

From here, I will leave it to the readers to add comments and/or suggestions.

SOURCES:
[1] IEA WEO's 2006, 2007 and 2008
[2] EIA International Petroleum
[3] EIA, U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves. 2007 Annual report, October 2008.
[4] BP Statistical Review 2008
[5] DTI/BERR/DECC, Energy Statistics, Oil and Gas
[6] NPD, Annual resource accounting and Production Data
[7] SHELL, webpage data on PEARL GTL project
[8] Qatargas, webpage and various annual reports on LNG projects
[9] StatoilHydro, webpage on data for South Pars and In Salah, In Amenas
[10] Wikipedia on data for North Field and South Pars