



The crux of getting decline rates right

The future of oil is difficult to comprehend for those who are only interested in the short term. Take Goldman Sachs as an example, whom in a recent update of their super-spike oil report announced that 'the Super-spike *end game* may be in sight'. Their reference to the end game needs to be taken literally here. Goldman Sachs sees the current high price run not as a long term fundamental shift in the oil markets, but as a short business cycle lasting several years. Predicting that the possibility of \$150 - \$200 oil is increasingly likely in the coming 24 months, but that prices will subside after 2011 towards \$75 per barrel.

Their optimism stems from a lack of rigorous analysis on decline rates. In a different report that preceded super-spike II, about the current top 190 oil and gas projects, we read that the bank expects oil production to increase by 1.4 - 1.6 million b/d annually up to 2014 from both OPEC and Non-OPEC. The fundamental flaw in this analysis is the assumption that the average underlying decline rate in peaked and plateauing oil fields is 2% - 3%. Leading for example to the estimate that North American production will grow from 13.7 million b/d in 2007 to 15.5 million b/d in 2014. An impossibility in a world where mainly Canadian unconventional oil production is growing while all of North American conventional oil production is in decline.

While it is not certain how high the world decline rate really is, 4% is the minimum figure from a multitude of studies. The in general optimistic Cambridge Energy Research Associates asserts that the average decline rate is 4.5%. In their latest medium term oil market report of Juli 2007, the International Energy Agency (IEA) assumes a decline rate of 4.6% for Non-OPEC and 3.2% for OPEC in general, giving a world figure of approximately 4%.

Because there is so much uncertainty regarding decline rates, the IEA is currently conducting the most detailed study so far on this issue. New data will be used in their 2008 medium term oil market report to be released coming June. Hopefully the agency will be able to sort out this crux of the whole oil issue that still needs to be solved. However, it is doubtful whether new data on the large oil fields in the Middle-East will arise, which implies that we will not get rid of a large degree of uncertainty altogether. In any case, the picture that the IEA will paint in June does not seem to be very pretty. The normally optimistic chief economist of the IEA, Fatih Birol, has in recent months increasingly addressed the notion that we need to leave oil before it leaves us. A remark which hints at high decline rates in the future.

Rembrandt Koppelaar

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Definitions

Crude Oil, petroleum found in liquid and semi liquid form, includes deepsea and lease condensates

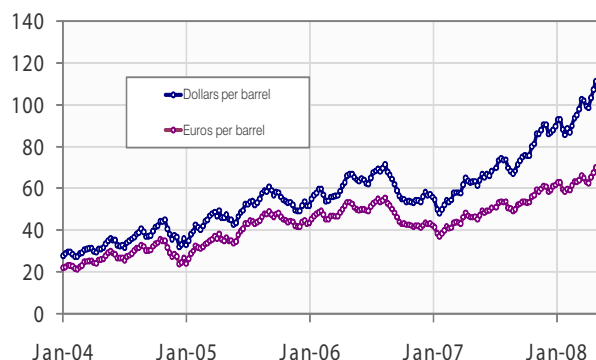
Liquids, all forms of liquid fuels including conventional, heavy, and extra heavy oil, oil shale, oil sands, natural gas liquids, lease condensates, gas-to-liquids, coal-to-liquids and biofuels

One Barrel of oil is equivalent with 159 litres

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Chart 1: Oil Price Weighed Average of Blends

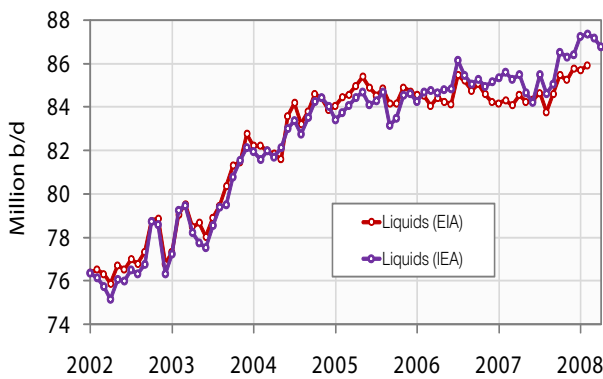


Source: Energy Information Administration

World liquids production status

In April world production of total liquids decreased by 400,000 barrels per day from March according to the latest figures of the International Energy Agency (IEA). Resulting in total world liquids production of 86.76 million b/d.

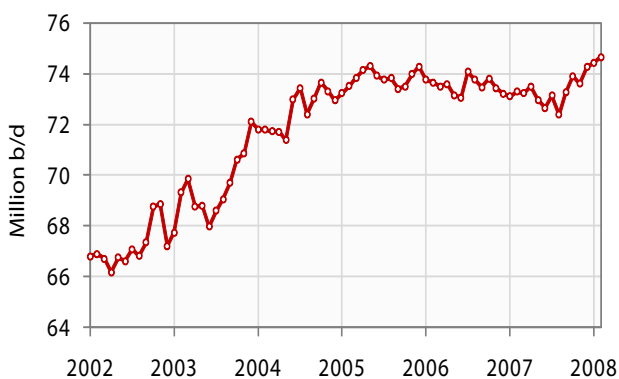
Average global production in 2007 was 85.41 million b/d according to the IEA. In the first four months of 2008 an average of 87.12 million b/d was produced. The EIA in their International Petroleum Monthly puts the average global 2007 production at 84.60 million b/d and for the first two months of 2008 at 85.80 million b/d.

Chart 2: World Liquids Production Jan. 2002 - April 2008


Source: Energy Information Administration, International Energy Agency

World crude oil production status

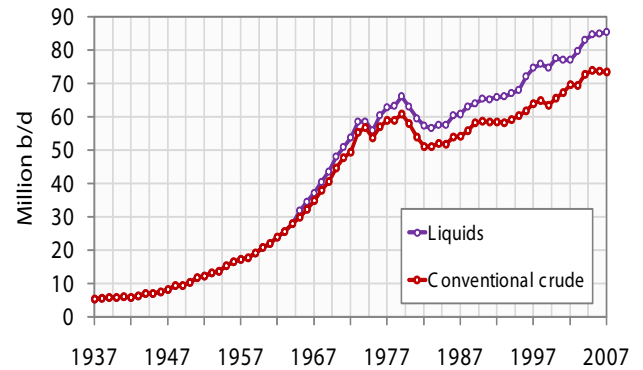
Latest available figures from the Energy Information Administration (EIA) show that crude oil production including lease condensates increased by 226,000 b/d from January to February. Total production in February broke a new all time high production record at 74.66 million b/d from the previous month.

Chart 3: World Crude Oil Production Jan. 2002 - February 2008


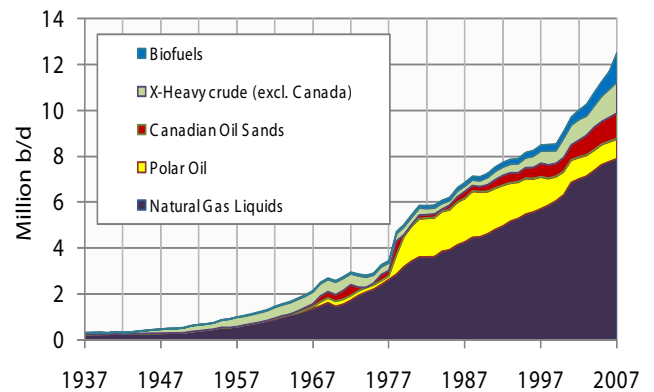
Source: Energy Information Administration

World conventional crude versus liquids production ratio

Approximately 86% of world liquids production in 2007 came from conventional crude oil including lease condensates. The remaining share of 14% was produced by other unconventional sources including Biofuels, Extra Heavy Oil, Tar Sands, Polar Oil and Natural Gas Liquids. In absolute amounts unconventional production has increased steadily, from 4 million b/d at the end of the 1970's, to approximately 12 mb/d in 2007 excluding lease condensates.

Chart 4: World Crude and Liquids production 1937 - 2007


Source: Energy Information Administration, IHS Energy, International Energy Agency

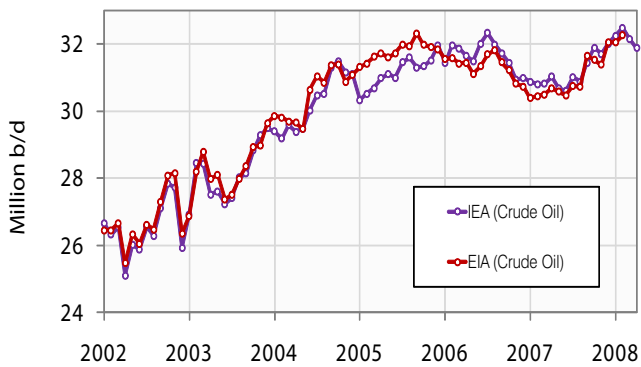
Chart 5: World Unconventional Production 1937 - 2007


Source: Energy Information Administration, IHS Energy, International Energy Agency, Canadian Association of Petroleum Producers

OPEC production status

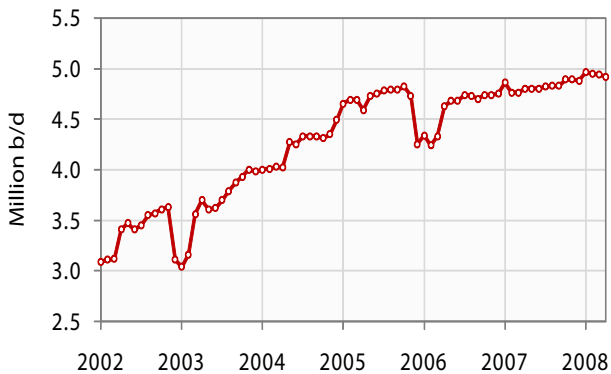
Total crude oil production including lease condensates of the OPEC cartel declined by 220,000 b/d to a level of 31.90 million b/d, from March to April, according to the latest available estimate of the IEA. Natural Gas Liquids production declined by 30,000 b/d to 4.92 million b/d from March to April. The average total liquids production of OPEC in the first four months of 2008 was 37.12 million b/d, versus 35.96 million b/d in 2007 and 35.71 million b/d in 2006.

Chart 6: OPEC Crude Oil Production Jan. 2002 - April 2008



Source: Energy Information Administration & International Energy Agency

Chart 7: OPEC Natural Gas Liquids Prod. Jan. 2002 - April 2008



Source: International Energy Agency

Non-OPEC production status

Total crude oil production including lease condensates of non-OPEC remained stable at a level of 41.57 million b/d, from January to February, according to the latest available estimate of the EIA. The average crude oil production of Non-OPEC in the first two months of 2008 was 41.57 million b/d, versus 41.60 million b/d in 2007 and 41.46 million b/d in 2006.

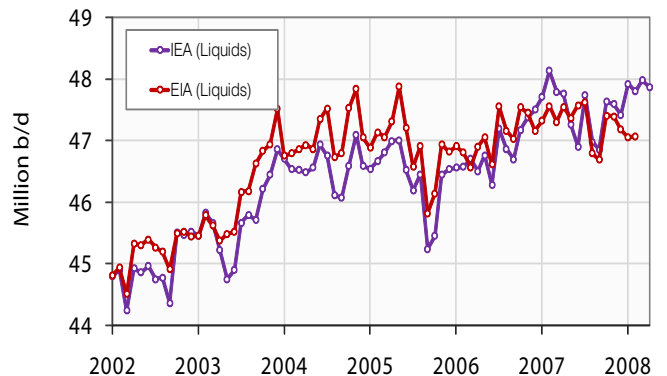
Total liquids production of non-OPEC declined by 120,000 b/d to a level of 49.97 million b/d, from March to April, according to the latest figures of the IEA. The average total liquids production of non-OPEC in the first four months of 2008 was 50.00 million b/d, versus 49.45 million b/d in 2007 and 49.29 million b/d in 2008.

Chart 8: Non-OPEC Crude Oil Production Jan. 2002 - Feb. 2008



Source: Energy Information Administration

Chart 9: Non-OPEC Liquids Production Jan. 2002 - April 2008

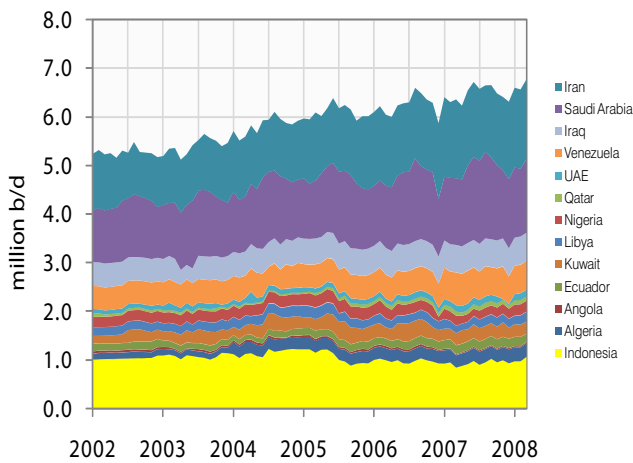


Source: International Energy Agency & Energy Information Administration

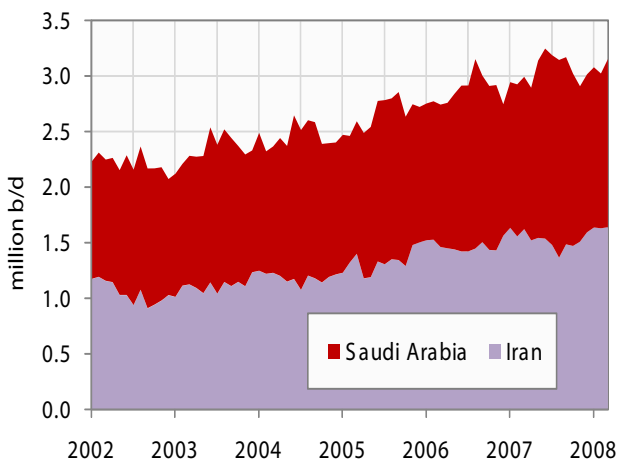
OPEC liquids demand developments

In 2002 OPEC-12 (excluding Iraq) consumed 5.26 million b/d according to the JODI database. Since then, demand has increased by 1.2 million b/d to 6.46 million b/d in 2007. The increase was mainly caused by higher consumption in Iran and Saudi Arabia, which increased by 476,000 and 357,000 b/d between respectively 2002 and 2007.

In 2008 this pace of growth appears to continue. Consumption in Saudi-Arabia in the first three months of 2008 was 1.45 million b/d and 1.63 million b/d in Iran. Compared to a consumption level of 1.52 million b/d in both Saudi Arabia and Iran in 2007.

Chart 10: OPEC-13 Liquids Demand January 2002 - March 2008


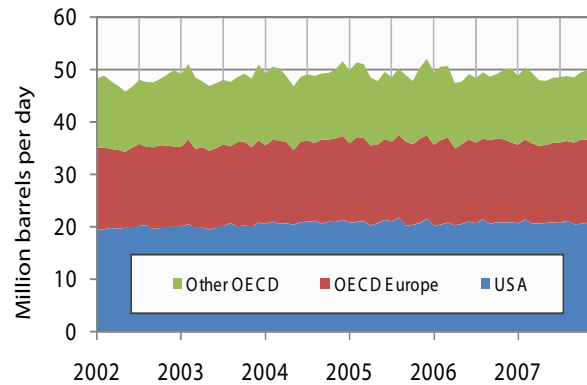
Source: JODI Database

Chart 11: Iran & S. Arabia Liquids Demand Jan. 2002 - March 2008


Source: JODI Database

Non-OPEC liquids demand developments

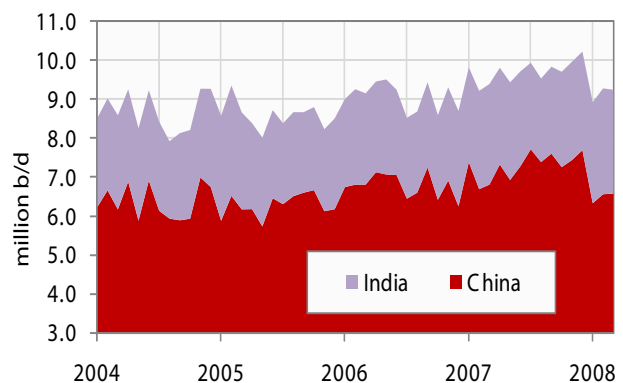
OECD liquids demand in recent years has started to decline according to the latest Energy Information Administration figures. In 2005 the OECD group of countries consumed on average of 49.67 million b/d, which declined to 49.25 million b/d in 2006. Of the total OECD decline in consumption in 2006, 196,000 b/d came from the US and 238,000 b/d from other OECD countries. While consumption in OECD Europe increased by 13,000 b/d in 2006. In 2007, OECD consumption declined further by 203,000 b/d to an average of 49.05 million b/d. This decline was mainly caused by a consumption decline of 257,000 b/d in OECD Europe and less importantly a decline of 74,000 b/d in other OECD countries except the United States. In the United States demand growth rebounded, leading to an average increase in consumption of 129,000 b/d in 2007.

Chart 12: OECD Liquids Demand Jan. 2002 - November 2007


Source: Energy Information Administration

In the first three months of 2008 Chinese oil consumption was 6.48 million b/d according to the JODI database. The low figure in comparison to 2007 is likely due to an error in the datasource. China consumed on average 6.27 million b/d in 2005, growing to 6.78 million b/d in 2006 and 7.29 million b/d in 2007.

Consumption in India was 2.67 million b/d in the first three months of 2008, versus an average of 2.43 million b/d in 2007 and 2.29 million b/d in 2006.

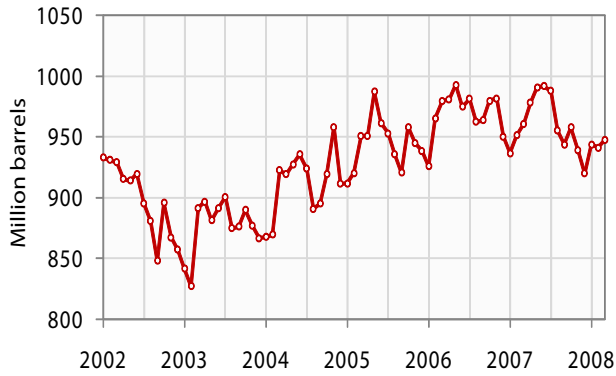
Chart 13: India & China Liquids Demand Jan. 2002 - March 2008


Source: JODI Database

Crude oil and oil product stocks status

Industrial inventories of crude oil in the OECD increased in March to a level of 948 million barrels from 941 million barrels in February according to IEA statistics.

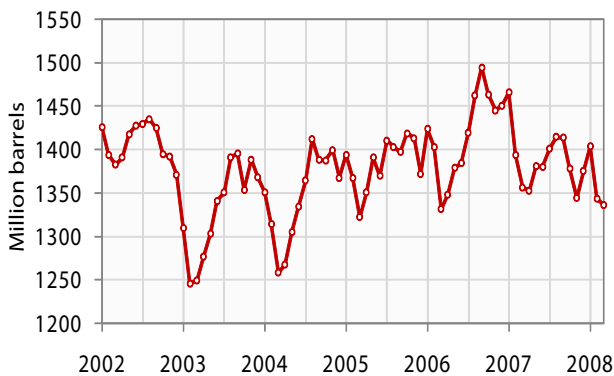
Chart 14: OECD Crude Oil Stocks January 2002 - March 2008



Source: International Energy Agency

Total product stocks in the OECD were 1336 million barrels in March 2008, slightly lower than the five year average of 1376 million barrels.

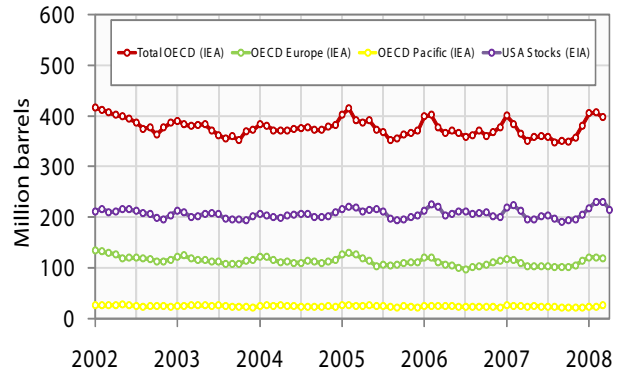
Chart 15: OECD Product Stocks January 2002 - March 2008



Source: International Energy Agency

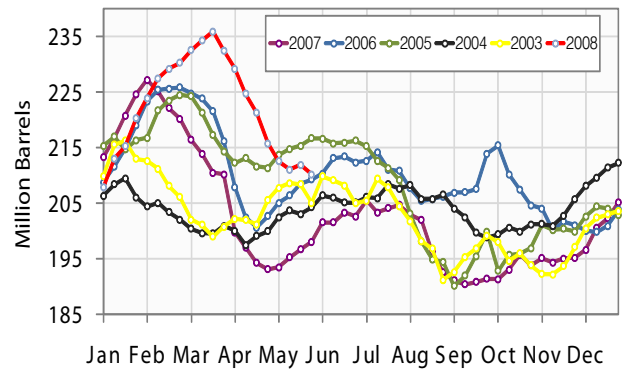
Gasoline stocks in the OECD declined by 9 million to level of 398 million barrels from February to March. More recent data from the EIA shows that gasoline stocks in the USA declined by 15 million barrels per day in April to a level of 215 million barrels.

Chart 16: OECD Motor Gasoline Stocks Jan. 2002 - April 2008



Source: International Energy Agency & Energy Information Administration

Chart 17: USA Motor Gasoline Stocks January 2002 - May 2008



Source: Energy Information Administration

World Crude Oil Export Status

The series was derived by subtracting the consumption of oil products, refinery fuel and direct crude oil sales from liquids production in producer countries. Data comes from the Joint Oil Data Initiative (JODI) for demand and the International Energy Agency (IEA) and Energy Information Agency (EIA) for supply. Biofuels are not included in consumption data but are included in production data. Because biofuels are not identified in the production data it is not possible to separate this flow. Given that net energy biofuel production has increased by approximately 50,000 to 100,000 b/d annually in recent years, the series is slightly optimistic.

This method gives a crude approximation of the export market because it assumes that all producers refine their own oil products to satisfy internal market needs. In reality not all oil producers have their own refineries to meet internal product demand. Therefore, more crude will be exported to foreign countries where it is refined into usable products. These usable products are then imported back to the country where the crude oil came from. To derive precise export statistics one would need to combine four components for each individual oil producing country: 1) crude oil export flows, 2) crude oil import flows, 3) total product export flows, 4) total product import flows. Statistics that show only crude oil exports or total product imports on an aggregate basis only reveal one component of the equation, and cannot be taken at face value.

Unfortunately, data on all four components is not readily available for countries outside the OECD. At the moment the statistics shown are purely based on the method of subtracting the consumption of oil products, refinery fuel and direct crude oil sales from liquids production in producer countries, unless otherwise noted.

From 2005 to 2006, worldwide liquids production increased by nearly 1 million b/d from 84.1 million b/d in 2005 to 85 million b/d in 2006 according to the IEA. Our proxy-exports database, which uses the methodology outlined above, shows that annual worldwide exports are roughly in the order of 46.3 million b/d, 47.5 million b/d, 47.4 and 47.3 million b/d and in 2004, 2005, 2006 and 2007 respectively. In the first three months of 2008 average world exports amounted to 48.02 million b/d.

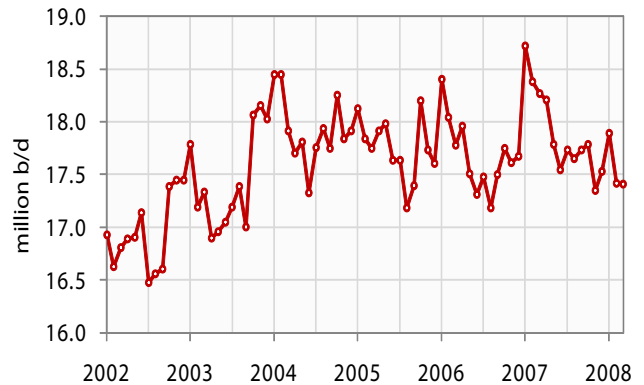
Chart 18: World Liquids Exports Estimate Jan. 2002 - March 2008



Source: derived from the IEA, EIA and JODI Database

In the first three months of 2008 average non-OPEC exports were estimated to be 17.57 million b/d. A proxy estimation of exports for 2003 gives a figure of 17.42 million b/d, increasing to 17.93 million b/d in 2004 and subsequently declining to 17.75 million b/d in 2005 and 17.68 million b/d in 2006. In 2007 non-OPEC exports increased to 17.89 million b/d.

Chart 19: Non-OPEC Liquids Exports January 2002 - March 2008



Source: derived from the IEA, EIA and JODI Database

A proxy estimation of exports for OPEC 13 (including Iraq) for 2004 gives a figure of 28.37 million b/d in 2004, increasing to 29.60 million b/d in 2005, 29.76 million b/d in 2006 and declining to 29.46 million b/d in 2007. In the first three months of 2008 OPEC exports amounted to an average level of 30.45 million b/d.

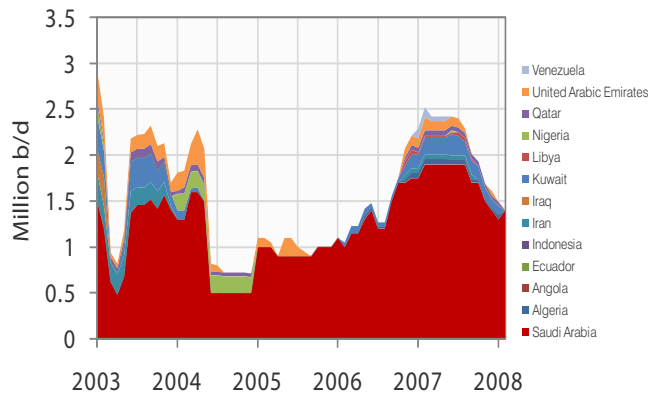
Chart 20: OPEC Liquids Exports January 2002 - March 2008



Source: derived from the IEA, EIA and JODI Database

Total crude oil spare capacity declined to 1.40 million b/d in February from a level of 1.49 million b/d in January according to the Energy Information Administration. Saudi Arabia still being the sole country with spare capacity.

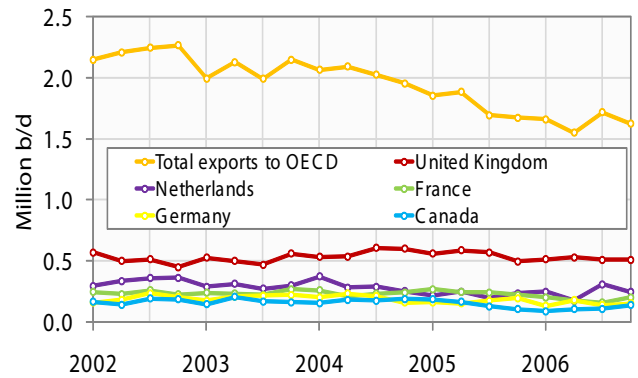
Chart 21: OPEC Spare Capacity January 2003 - February 2008



Source: Energy Information Administration

Data on actual flows from the IEA shows that crude oil exports from Saudi Arabia to the OECD declined by 140,000 b/d from 2005 to 2006.

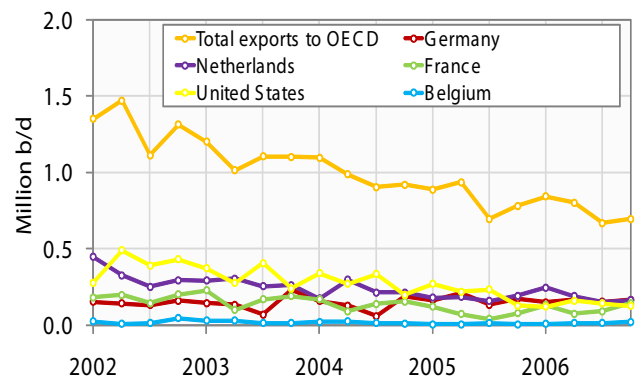
Chart 23: Saudi Arabia Crude Oil Exports 2002 - 2006



Source: International Energy Agency

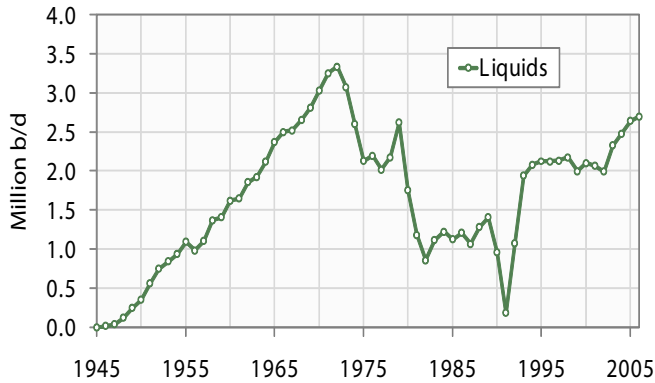
Data on actual flows from the IEA shows that crude oil exports from Mexico to the OECD declined by 50,000 b/d from 2005 to 2006.

Chart 24: Mexico Crude Oil Exports 2002 - 2006



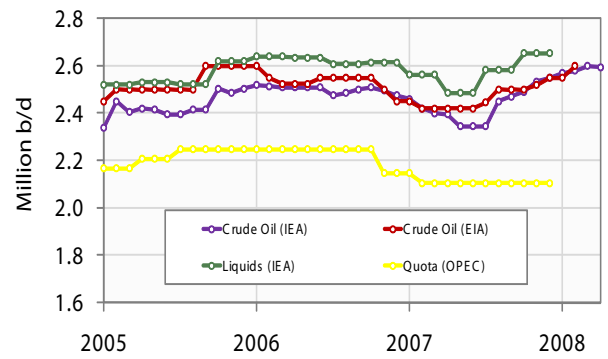
Source: International Energy Agency

Chart 25: Kuwait Production 1945 - 2006



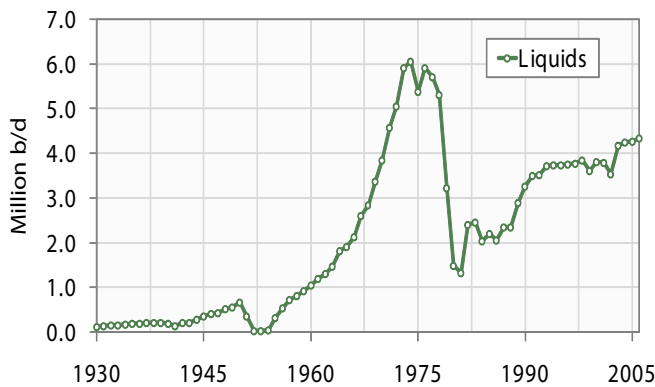
Source: ASPO Ireland & BP Statistical Review

Chart 26: Kuwait Production January 2005 - April 2008



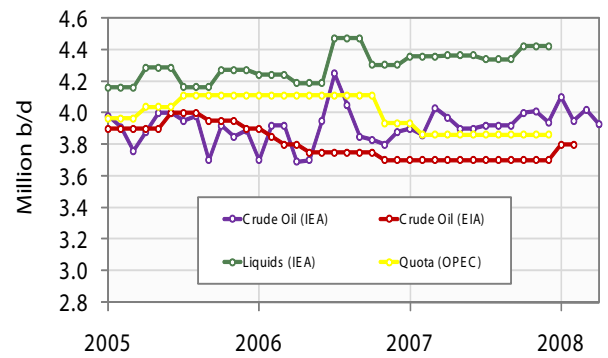
Source: Energy Information Administration & International Energy Agency

Chart 27: Iran Production 1930 - 2006



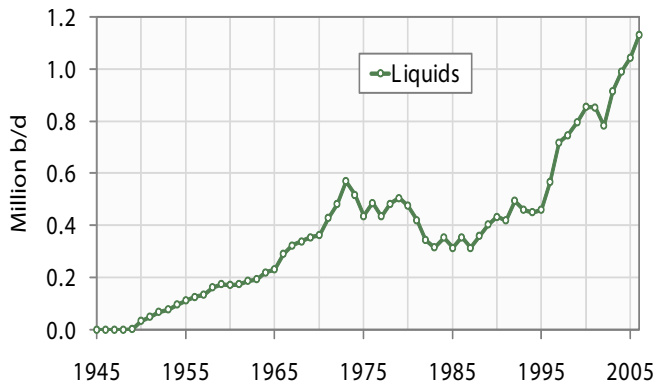
Source: ASPO Ireland & BP Statistical Review

Chart 28: Iran Production January 2005 - April 2008



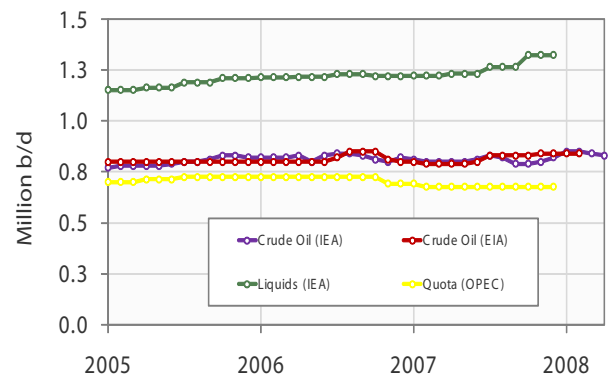
Source: Energy Information Administration & International Energy Agency

Chart 29: Qatar Production 1945 - 2006



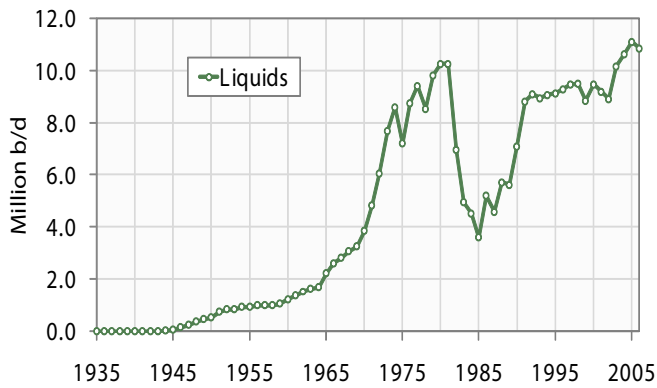
Source: ASPO Ireland & BP Statistical Review

Chart 30: Qatar Production January 2005 - April 2008



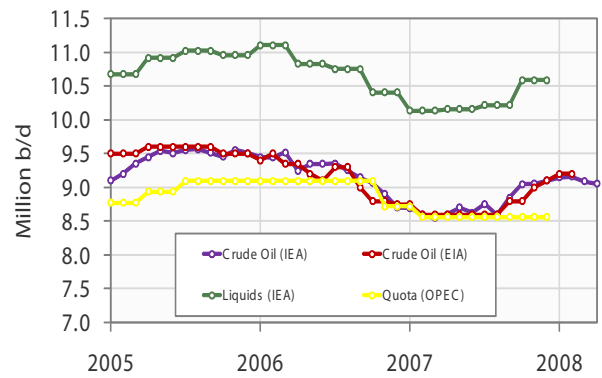
Source: Energy Information Administration & International Energy Agency

Chart 31: Saudi Arabia Production 1935 - 2006



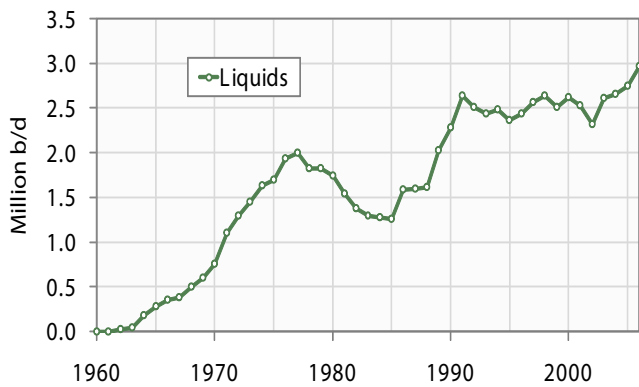
Source: ASPO Ireland & BP Statistical Review

Chart 32: Saudi Arabia Production Jan. 2005 - April 2008



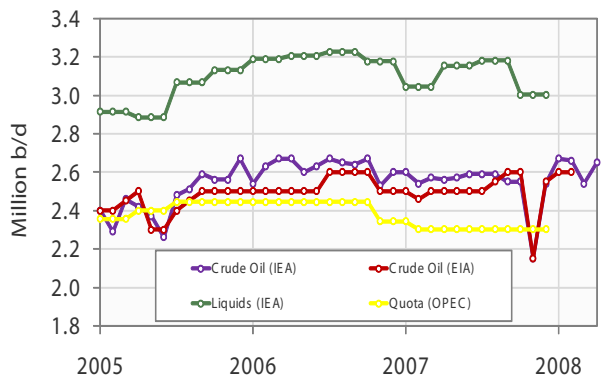
Source: Energy Information Administration & International Energy Agency

Chart 33: UAE Production 1960 - 2006



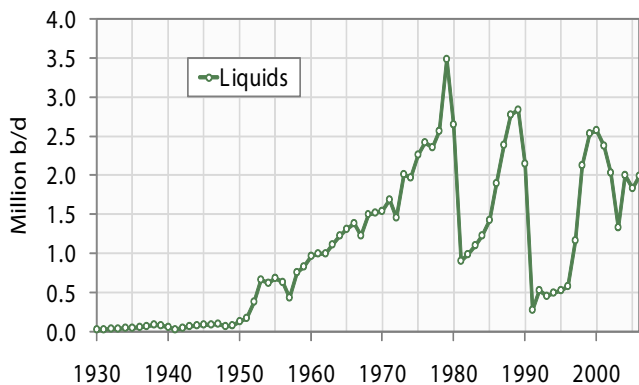
Source: ASPO Ireland & BP Statistical Review

Chart 34: UAE Production January 2005 - April 2008



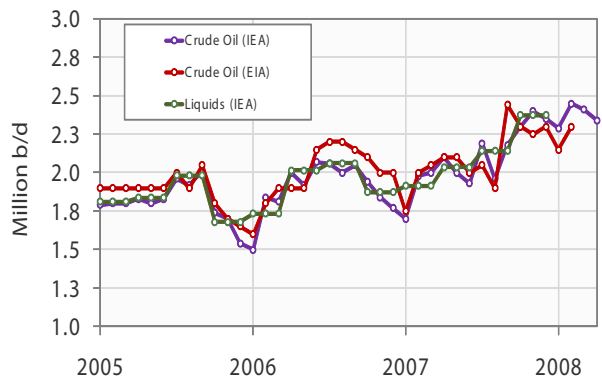
Source: Energy Information Administration & International Energy Agency

Chart 35: Iraq Production 1930 - 2006



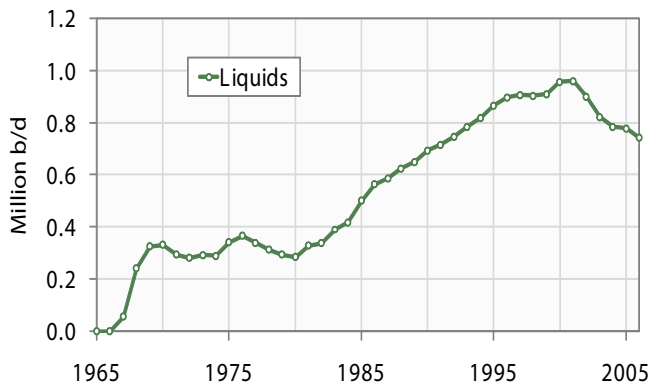
Source: ASPO Ireland & BP Statistical Review

Chart 36: Iraq Production January 2005 - April 2008



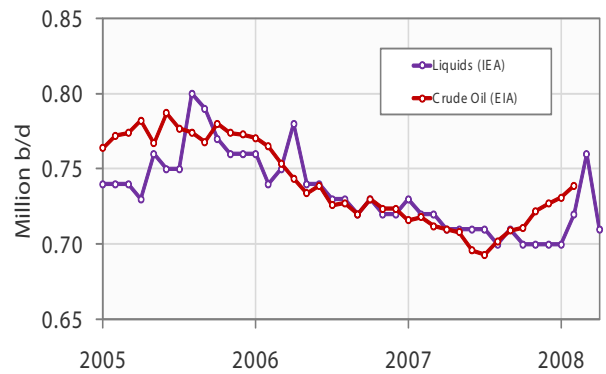
Source: Energy Information Administration & International Energy Agency

Chart 37: Oman Production 1965 - 2006



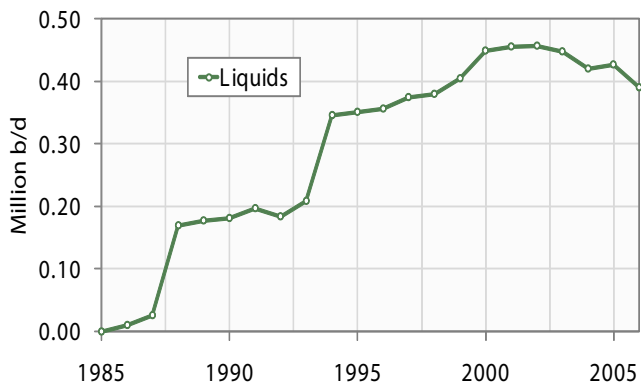
Source: Energy Information Administration & International Energy Agency

Chart 38: Oman Production January 2005 - April 2008



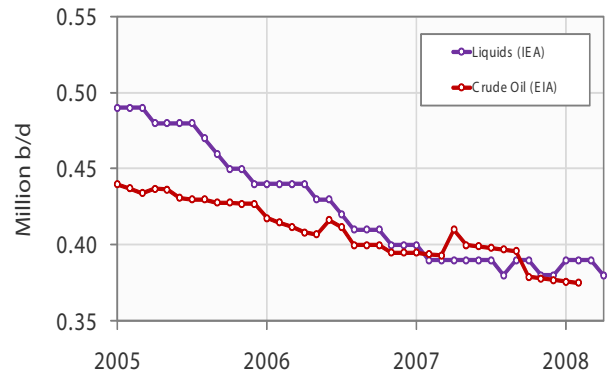
Source: Energy Information Administration & International Energy Agency

Chart 39: Yemen Production 1985 - 2006



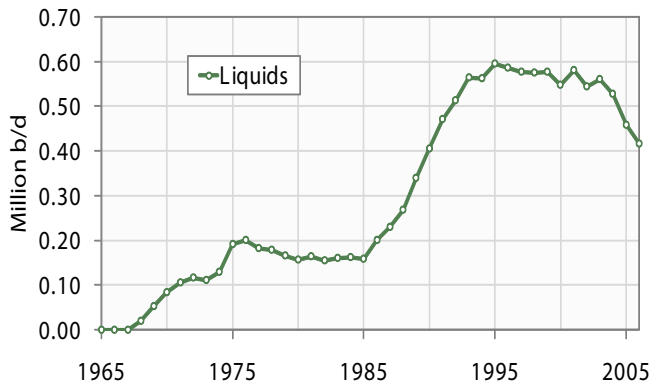
Source: Energy Information Administration & International Energy Agency

Chart 40: Yemen Production January 2005 - March 2008



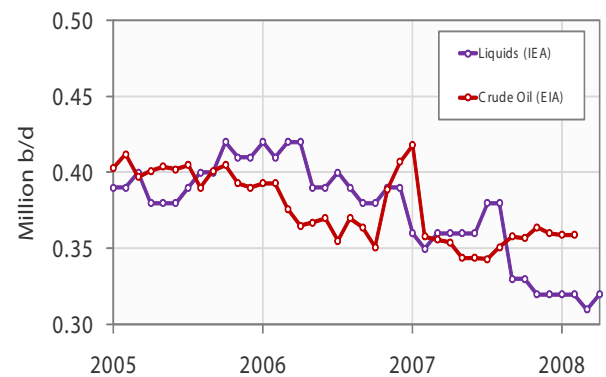
Source: Energy Information Administration & International Energy Agency

Chart 41: Syria Production 1965 - 2006



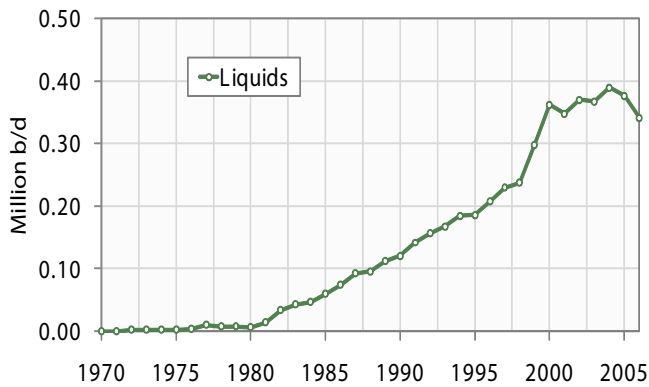
Source: Energy Information Administration & International Energy Agency

Chart 42: Syria Production January 2005 - April 2008



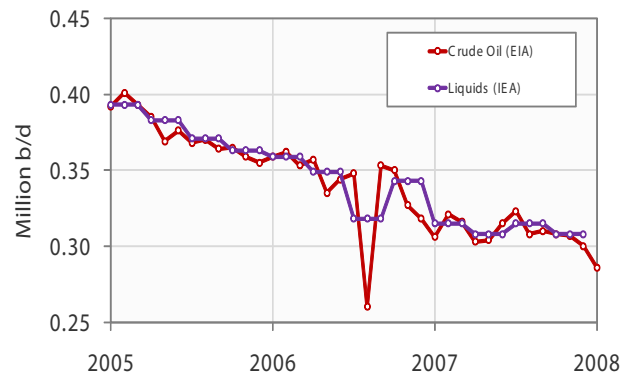
Source: Energy Information Administration & International Energy Agency

Chart 43: Denmark Production 1970 - 2006



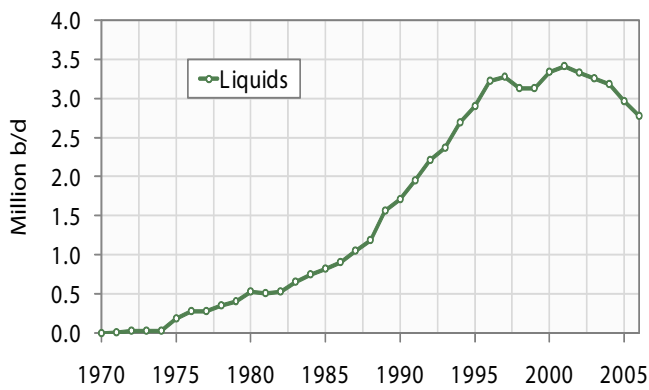
Source: ASPO Ireland & BP Statistical Review

Chart 44: Denmark Production January 2005 - February 2008



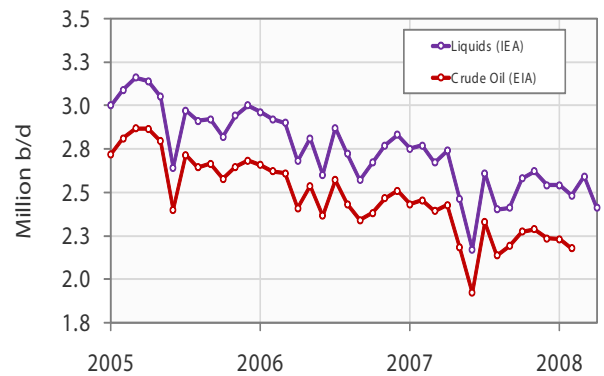
Source: Energy Information Administration & International Energy Agency

Chart 45: Norway Production 1970 - 2006



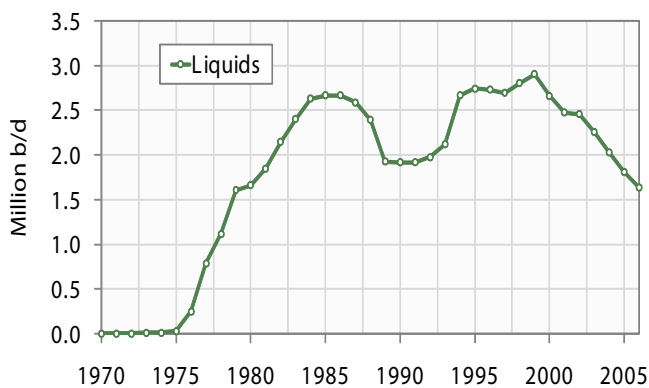
Source: ASPO Ireland & BP Statistical Review

Chart 46: Norway Production January 2005 - April 2008



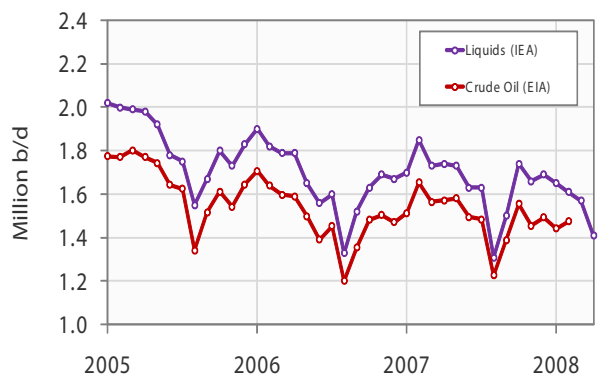
Source: Energy Information Administration & International Energy Agency

Chart 47: United Kingdom Production 1970 - 2006



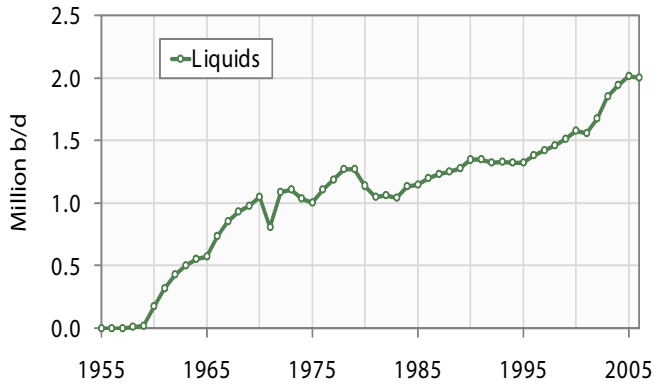
Source: ASPO Ireland & BP Statistical Review

Chart 48: United Kingdom Production Jan. 2005 - April 2008



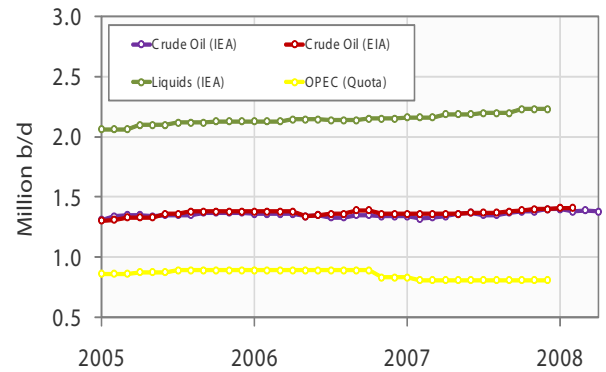
Source: Energy Information Administration & International Energy Agency

Chart 49: Algeria Production 1955 - 2006



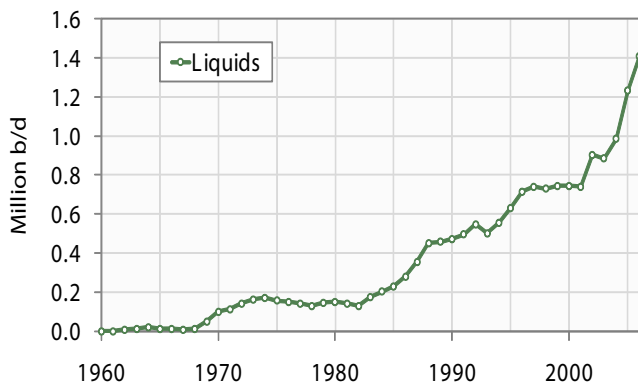
Source: ASPO Ireland & BP Statistical Review

Chart 50: Algeria Production January 2005 - April 2008



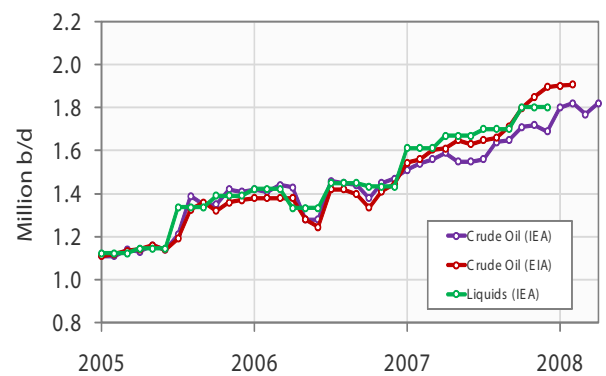
Source: Energy Information Administration & International Energy Agency

Chart 51: Angola Production 1960 - 2006



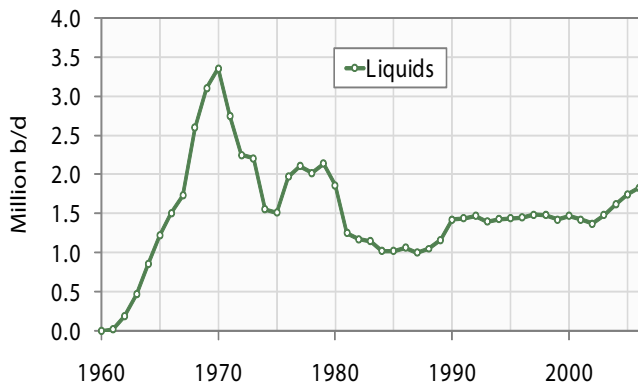
Source: ASPO Ireland & BP Statistical Review

Chart 52: Angola Production January 2005 - April 2008



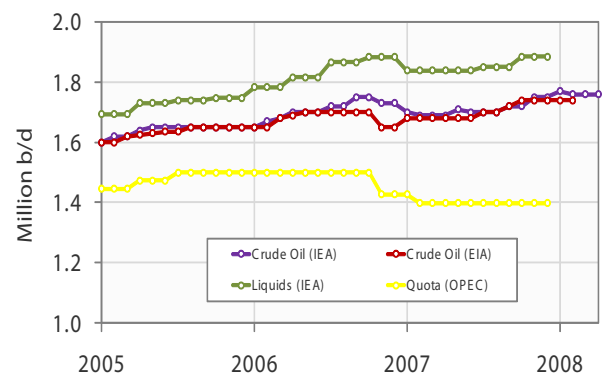
Source: Energy Information Administration & International Energy Agency

Chart 53: Libya Production 1970 - 2006



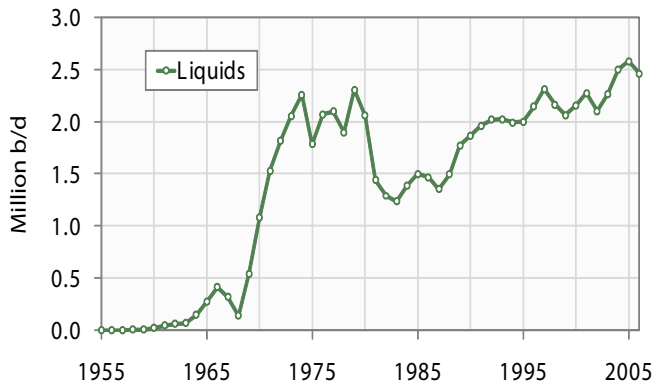
Source: ASPO Ireland & BP Statistical Review

Chart 54: Libya Production January 2005 - April 2008



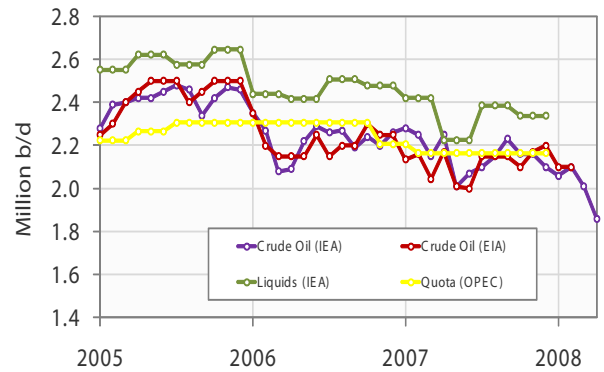
Source: Energy Information Administration & International Energy Agency

Chart 55: Nigeria Production 1955 - 2006



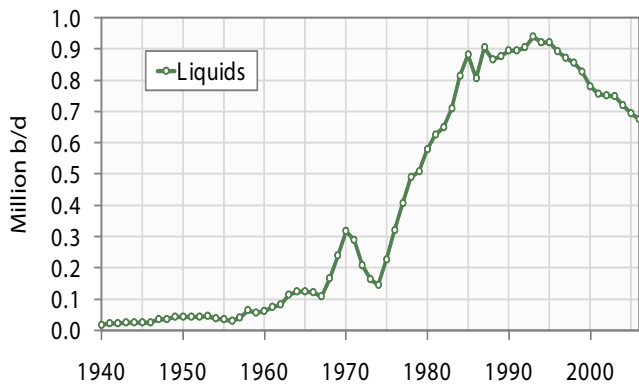
Source: ASPO Ireland & BP Statistical Review

Chart 56: Nigeria Production January 2005 - April 2008



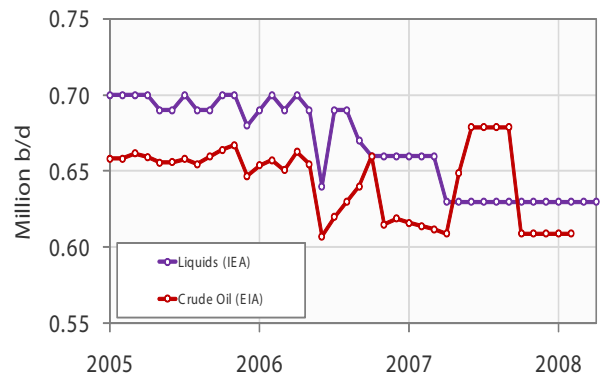
Source: Energy Information Administration & International Energy Agency

Chart 57: Egypt Production 1940 - 2006



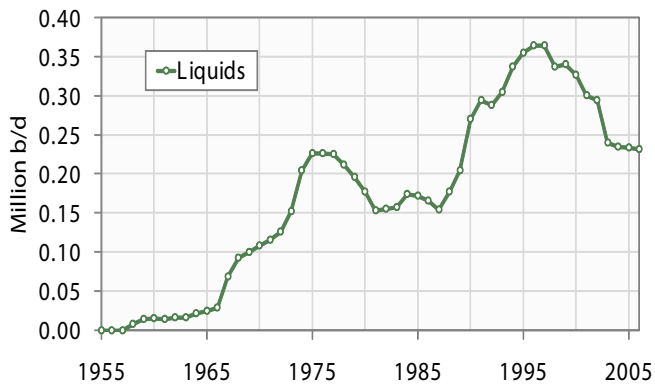
Source: ASPO Ireland & BP Statistical Review

Chart 58: Egypt Production January 2005 - April 2008



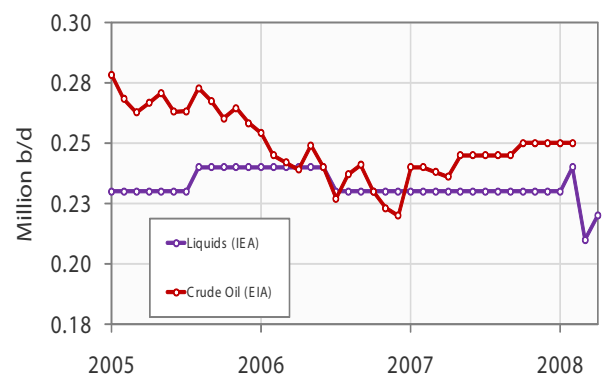
Source: Energy Information Administration & International Energy Agency

Chart 59: Gabon Production 1955 - 2006



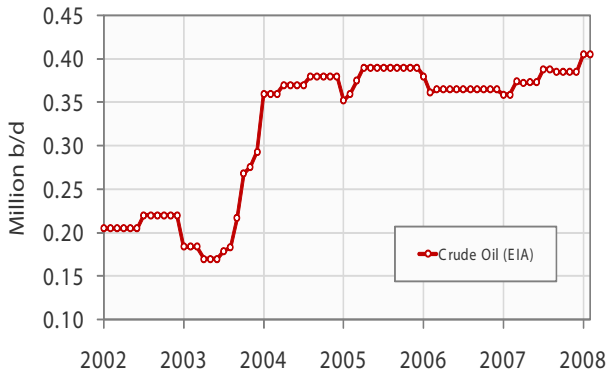
Source: ASPO Ireland & BP Statistical Review

Chart 60: Gabon Production January 2005 - April 2008



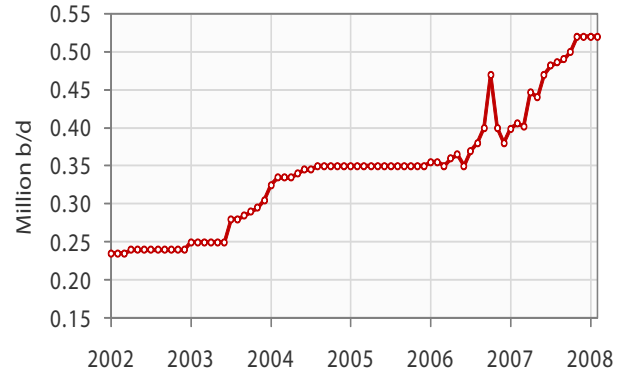
Source: Energy Information Administration & International Energy Agency

Chart 61: Equatorial Guinea Production Jan. 2002 - Feb. 2008



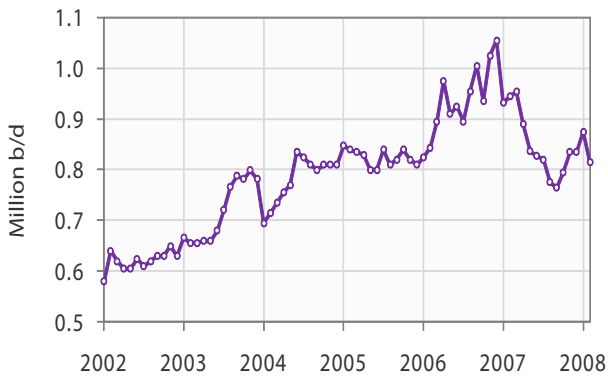
Source: Energy Information Administration

Chart 62: Sudan Production January 2002 - February 2008



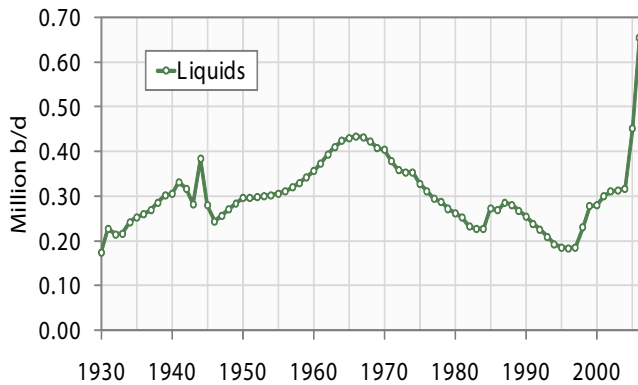
Source: Energy Information Administration

Chart 63: Other Africa Production January 2002 - February 2008



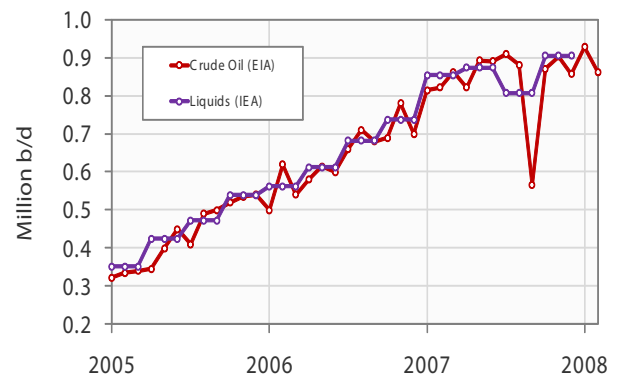
Source: Energy Information Administration & International Energy Agency

Chart 64: Azerbaijan Production 1930 - 2006



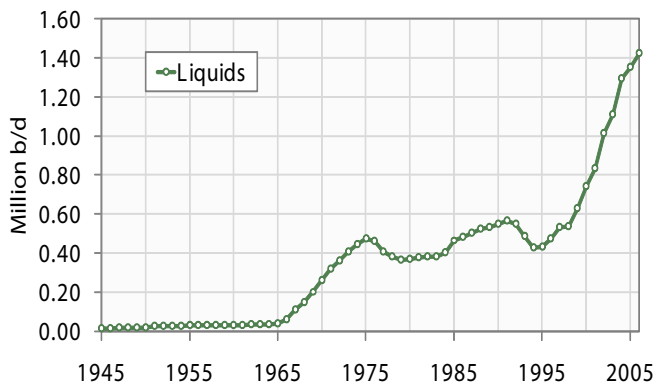
Source: ASPO Ireland & BP Statistical Review

Chart 65: Azerbaijan Production January 2005 - February 2008



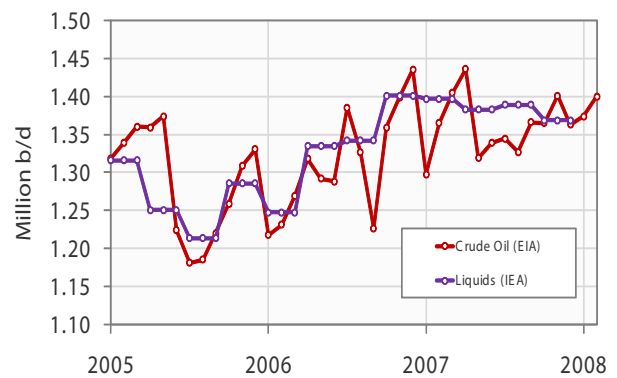
Source: Energy Information Administration & International Energy Agency

Chart 66: Kazakhstan Production 1940 - 2006



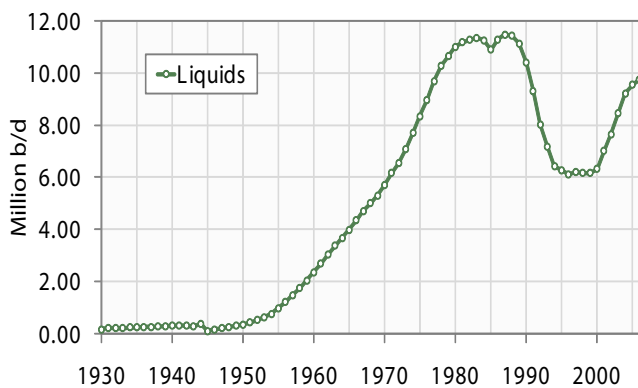
Source: ASPO Ireland & BP Statistical Review

Chart 67: Kazakhstan Production January 2005 - February 2008



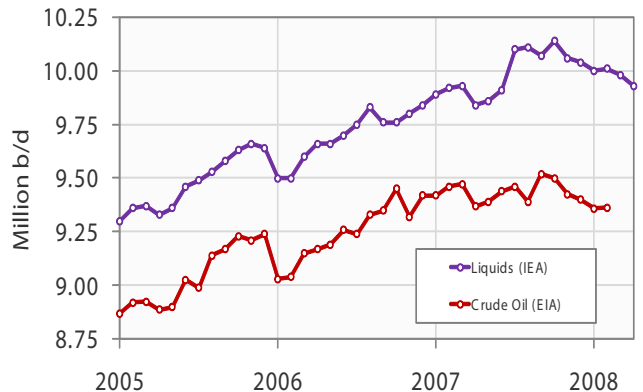
Source: Energy Information Administration & International Energy Agency

Chart 68: Russia Production 1955 - 2006



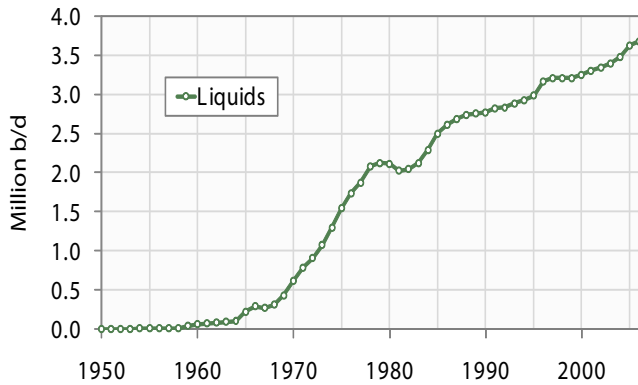
Source: ASPO Ireland & BP Statistical Review

Chart 69: Russia Production January 2005 - April 2008



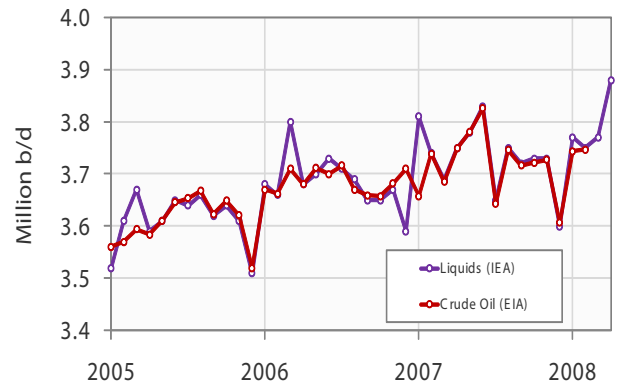
Source: Energy Information Administration & International Energy Agency

Chart 70: China Production 1950 - 2006



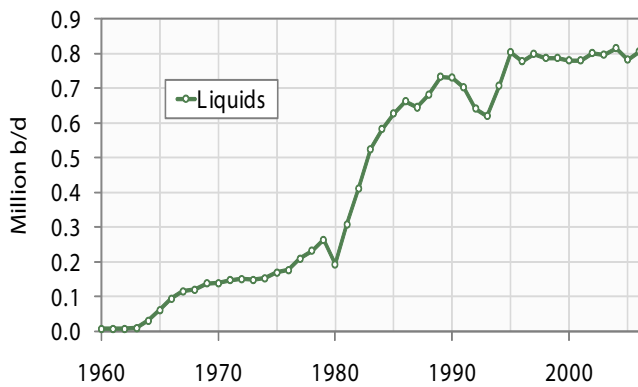
Source: ASPO Ireland & BP Statistical Review

Chart 71: China Production January 2005 - April 2008



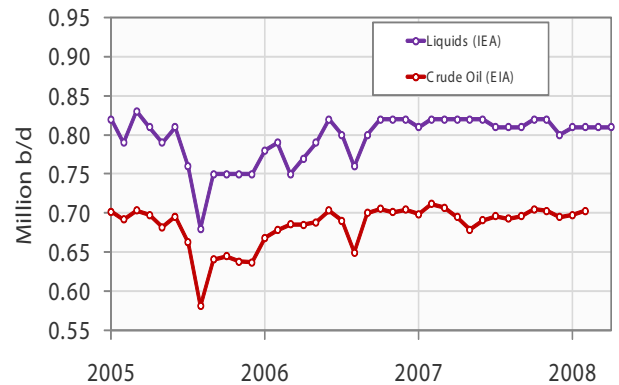
Source: Energy Information Administration & International Energy Agency

Chart 72: India Production 1960 - 2006



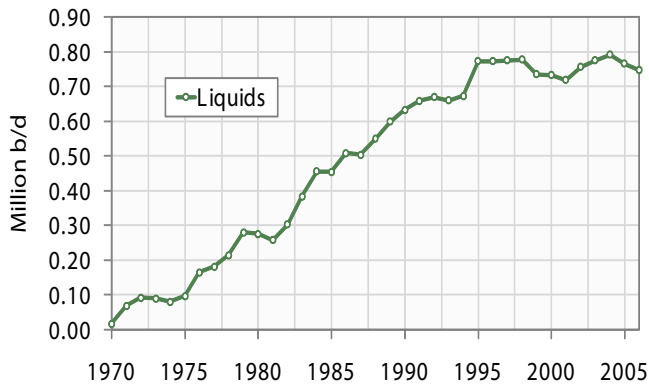
Source: ASPO Ireland & BP Statistical Review

Chart 73: India Production January 2005 - April 2008



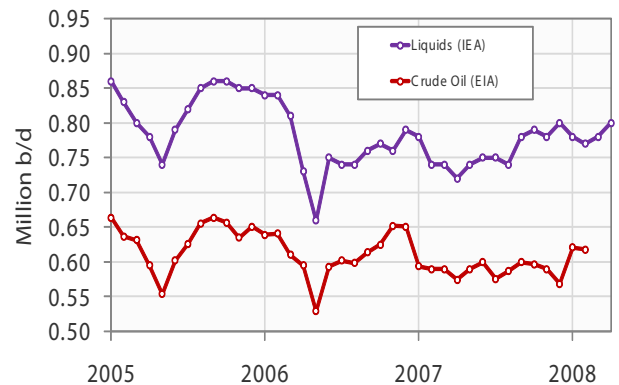
Source: Energy Information Administration & International Energy Agency

Chart 74: Malaysia Production 1955 - 2006



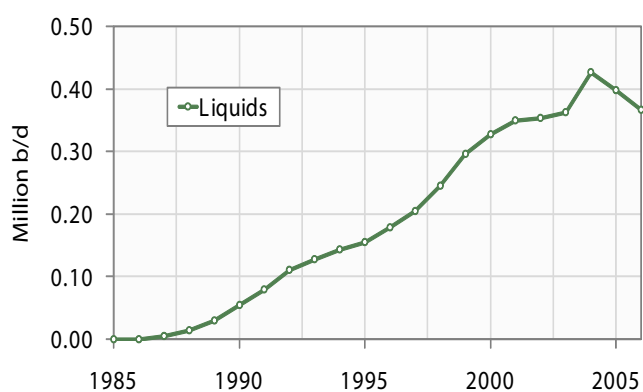
Source: ASPO Ireland & BP Statistical Review

Chart 75: Malaysia Production January 2005 - April 2008



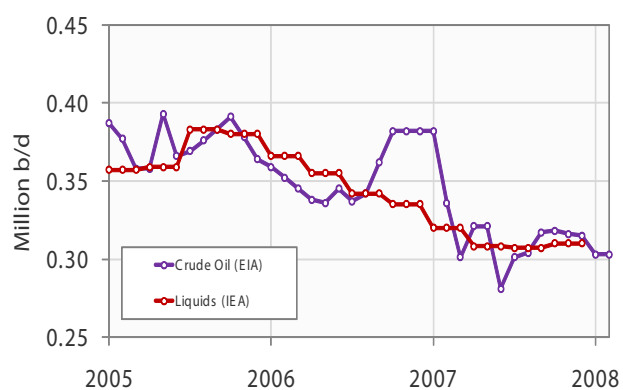
Source: Energy Information Administration & International Energy Agency

Chart 75: Vietnam Production 1955 - 2006



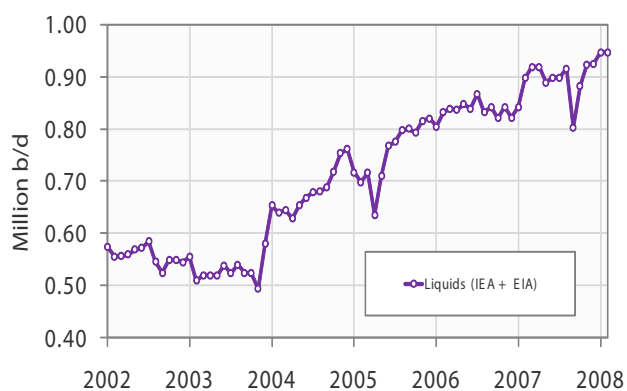
Source: ASPO Ireland & BP Statistical Review

Chart 76: Vietnam Production January 2005 - February 2008



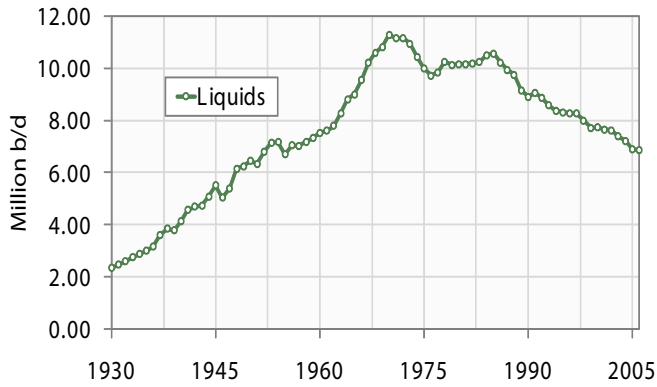
Source: Energy Information Administration & International Energy Agency

Chart 77: Other Asia Production January 2002 - February 2008



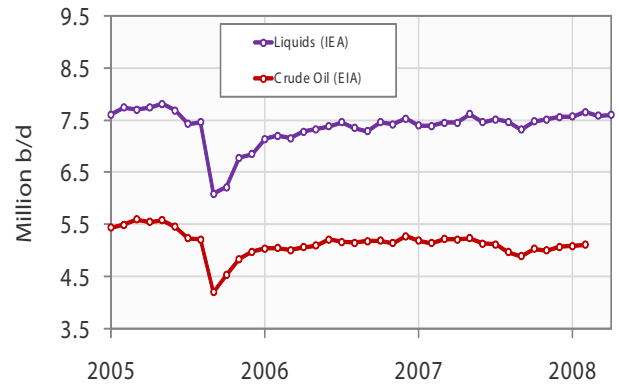
Source: Energy Information Administration & International Energy Agency

Chart 78: United States Production 1930 - 2006



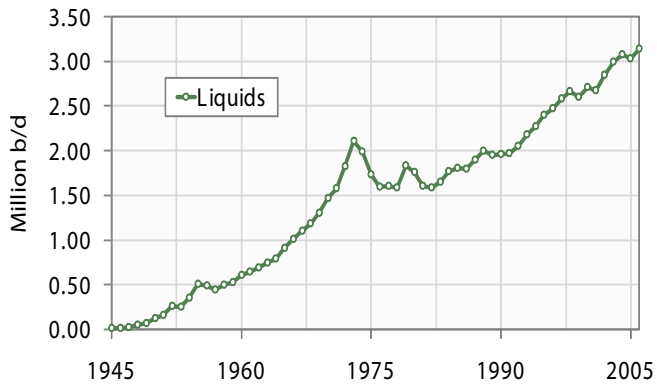
Source: ASPO Ireland & BP Statistical Review

Chart 79: United States Production January 2005 - April 2008



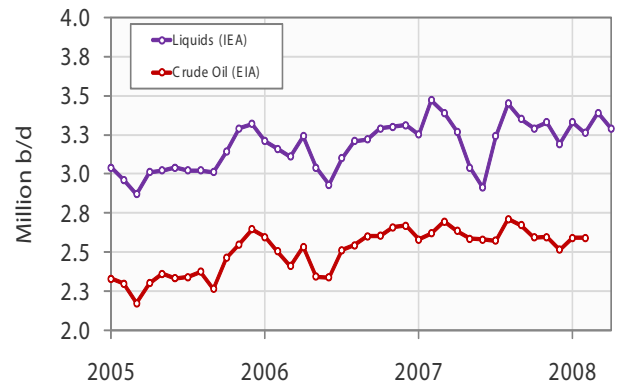
Source: Energy Information Administration & International Energy Agency

Chart 80: Canada Production 1945 - 2006



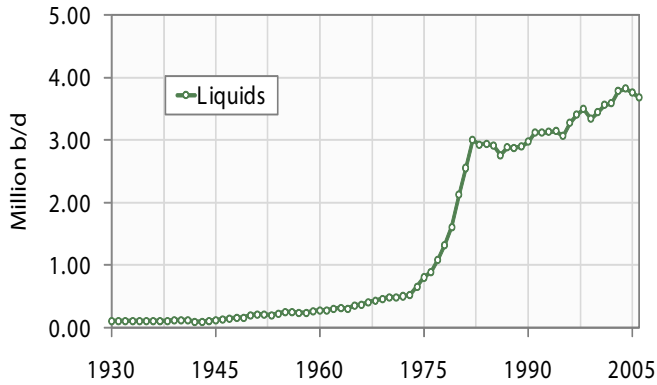
Source: ASPO Ireland & BP Statistical Review

Chart 81: Canada Production January 2005 - April 2008



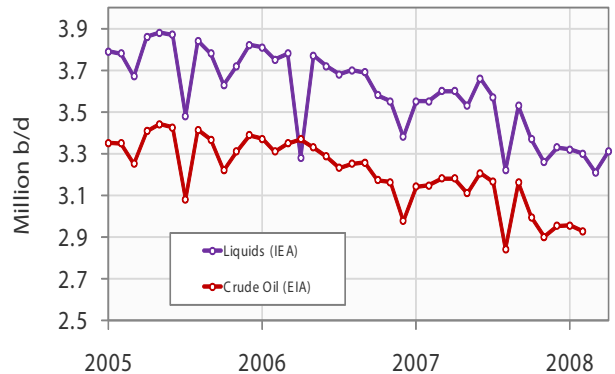
Source: Energy Information Administration & International Energy Agency

Chart 82: Mexico Production 1930 - 2006



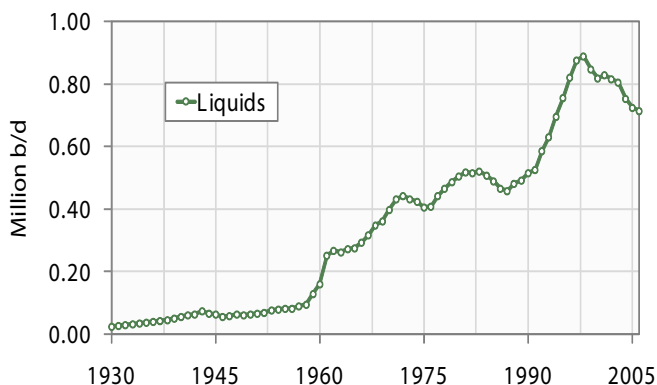
Source: ASPO Ireland & BP Statistical Review

Chart 83: Mexico Production January 2005 - April 2008



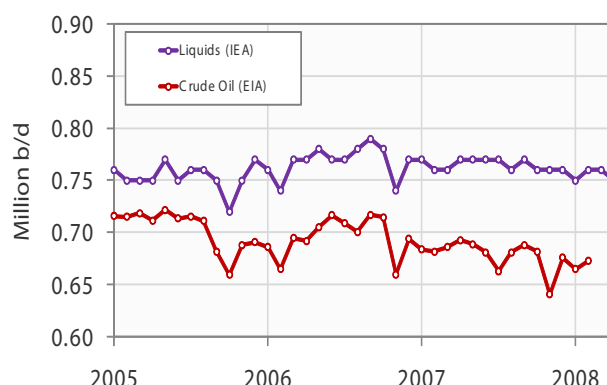
Source: Energy Information Administration & International Energy Agency

Chart 84: Argentina Production 1930 - 2006



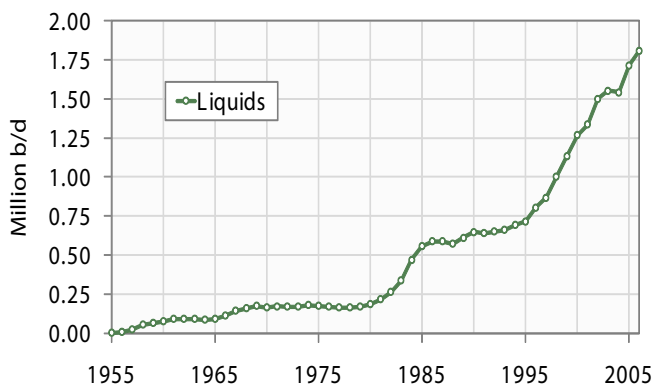
Source: ASPO Ireland & BP Statistical Review

Chart 85: Argentina Production January 2005 - April 2008



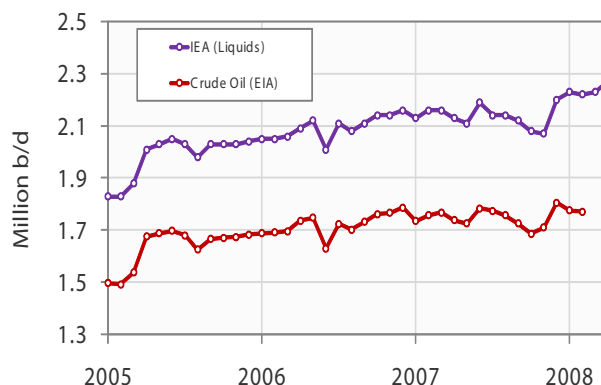
Source: Energy Information Administration & International Energy Agency

Chart 86: Brazil Production 1955 - 2006



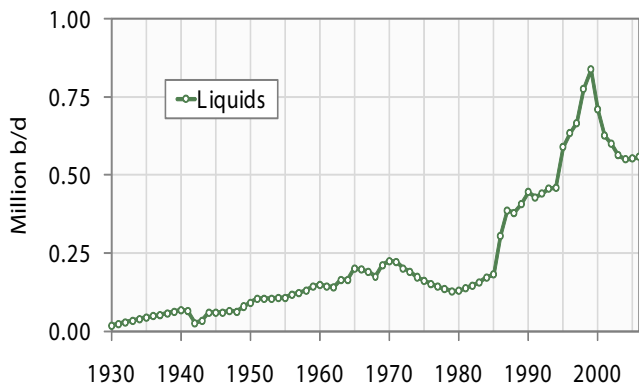
Source: ASPO Ireland & BP Statistical Review

Chart 87: Brazil Production January 2005 - April 2008



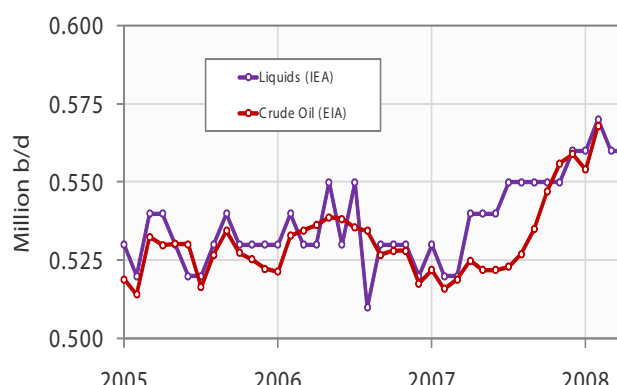
Source: Energy Information Administration & International Energy Agency

Chart 88: Colombia Production 1930 - 2006



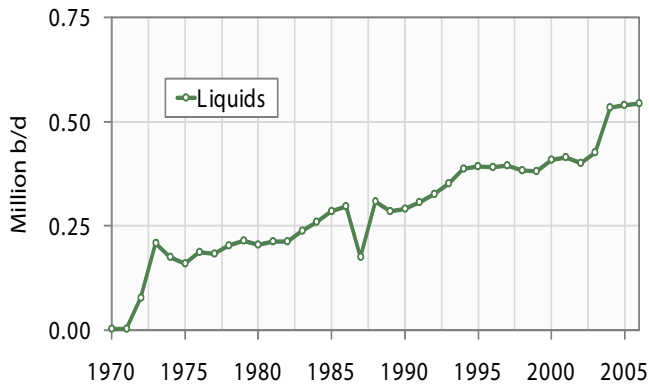
Source: ASPO Ireland & BP Statistical Review

Chart 89: Colombia Production January 2005 - April 2008



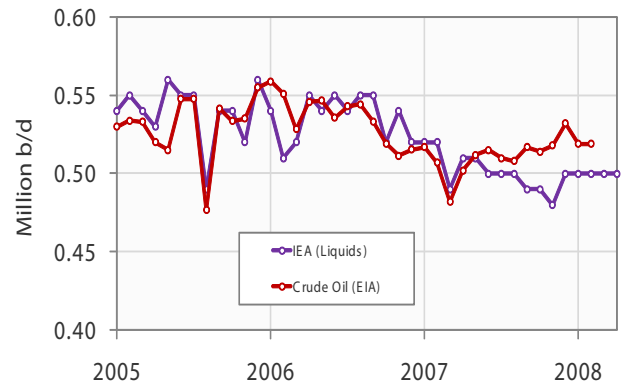
Source: Energy Information Administration & International Energy Agency

Chart 90: Ecuador Production 1970 - 2006



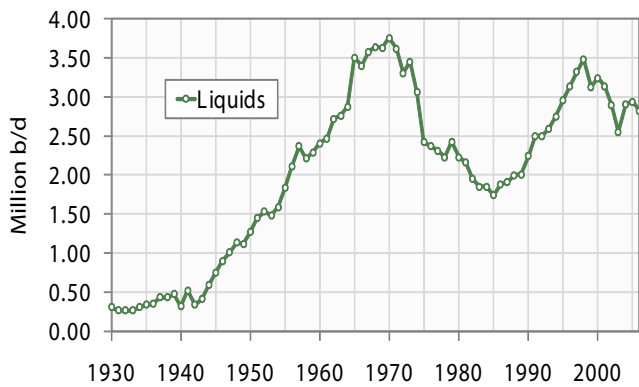
Source: ASPO Ireland & BP Statistical Review

Chart 91: Ecuador Production January 2005 - April 2008



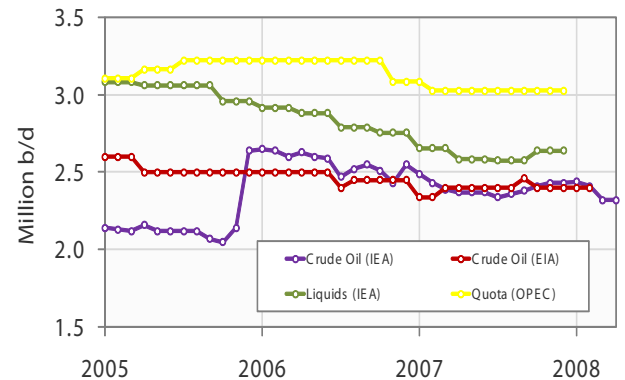
Source: Energy Information Administration & International Energy Agency

Chart 92: Venezuela Production 1930 - 2006



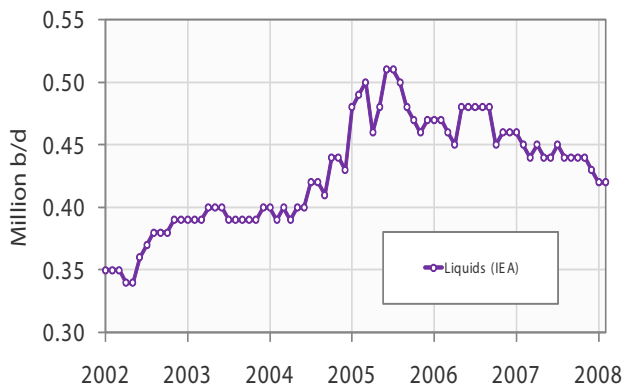
Source: ASPO Ireland & BP Statistical Review

Chart 93: Venezuela Production Jan. 2005 - April 2008



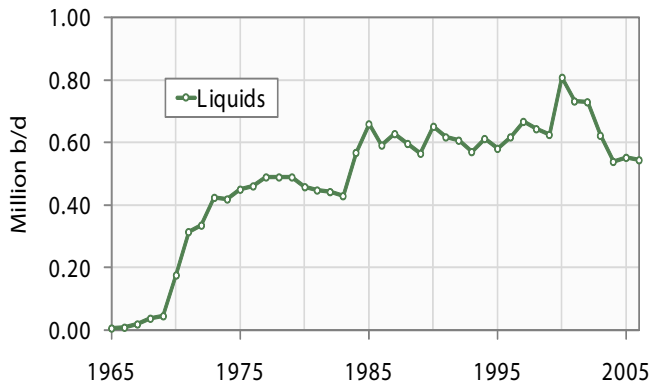
Source: Energy Information Administration & International Energy Agency

Chart 94: Other S. America Production Jan. 2002 - April 2008



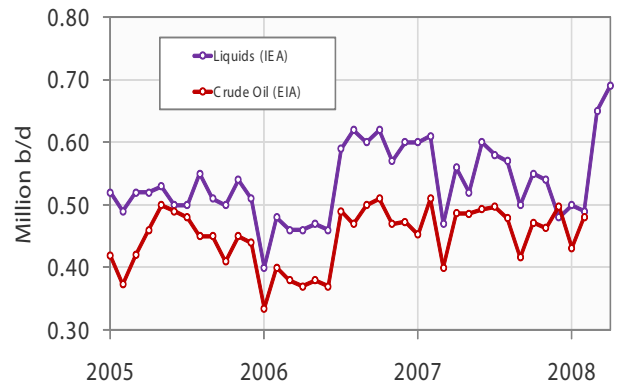
Source: International Energy Agency

Chart 95: Australia Production 1970 - 2006



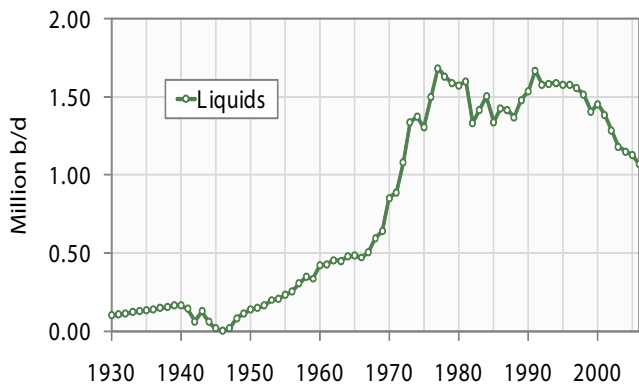
Source: ASPO Ireland & BP Statistical Review

Chart 96: Australia Production January 2005 - April 2008



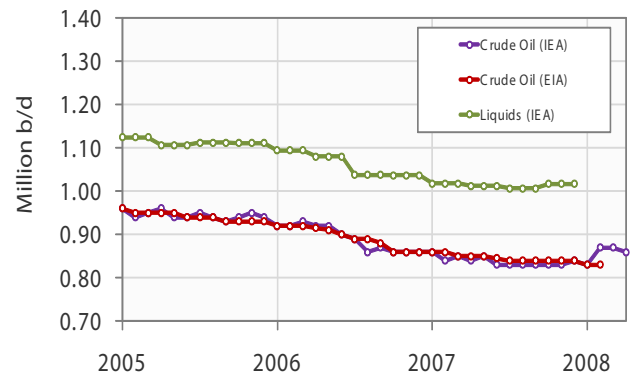
Source: Energy Information Administration & International Energy Agency

Chart 97: Indonesia Production 1930 - 2006



Source: ASPO Ireland & BP Statistical Review

Chart 98: Indonesia Production January 2005 - April 2008



Source: Energy Information Administration & International Energy Agency