
Problems of Oil Production

Lars Erik Aamot discusses the challenges facing Norway's oil production

Forty years ago the giant Ekofisk field was discovered on the Norwegian Continental Shelf (NCS). For Norway this was an event of historical proportions, which marks the beginning of the country's oil era. Oil production on the NCS commenced a couple of years after the discovery of Ekofisk. Production increased rather slowly in the first years, and as late as 1980 it stood at 0.5 million barrels per day (mbd) only.

From 1980 and onwards, production growth was much stronger, due to the build-up of production from several giant oil fields that had been

discovered in the years between 1975 and 1985.

Generally, recovery from the oil fields proved to be higher than was expected by the geologists before the fields were developed. Particularly during the 1990s, Norwegian oil production increased quickly – and by more than was forecasted by the authorities. Advances in upstream technology, such as horizontal drilling, partly explain why production growth was so strong. Liquid production (crude oil and NGLs) in Norway peaked in 2001 at a level of 3.4 mbd. This ranked Norway the second largest oil exporter after Saudi Arabia at that time. From the start, no one had ever expected Norway to become an oil producer of this size.

Since the start of this century, we have seen a steady decline in production. The decline has occurred despite increasing oil prices and the industry

investing more than ever on the Norwegian Continental Shelf.

In 2009 liquids production is estimated to be around 2.3 mbd or some 30 percent lower than the plateau level. For crude, the drop is almost 40 percent from the peak.

The decline in production since 2001 has been much steeper than Norwegian petroleum planners forecasted. We do not have a single good explanation as to why our projections for oil production in this period ended up to be too optimistic. But, as many other countries and companies have experienced, it is a demanding task to be correct when it comes to important issues like project slippage, production build-up and decline rates. Seen in hindsight, in Norway we underestimated the growth in production when we were in the build-up phase and underestimated the decline in production after 2001.

Despite the fall in production, Norway is still a significant supplier of oil. Our domestic consumption is small, so only a handful of countries export more oil than Norway today. And it has been of some comfort to us that gas production has continued to grow to the extent that total petroleum from Norway has remained fairly stable for more than ten years.

So, what is the outlook for Norway as an oil producer today?

The future depends to a significant degree on conditions that are beyond the control of the authorities, such as the geology of the NCS, available technology and crude prices. But it is also determined by the government and its resource management policies.

Even though recent production trends have not been positive, the prospects are by no means entirely bleak for Norway's oil sector. As we view it, some important issues for the country's future oil supply are:

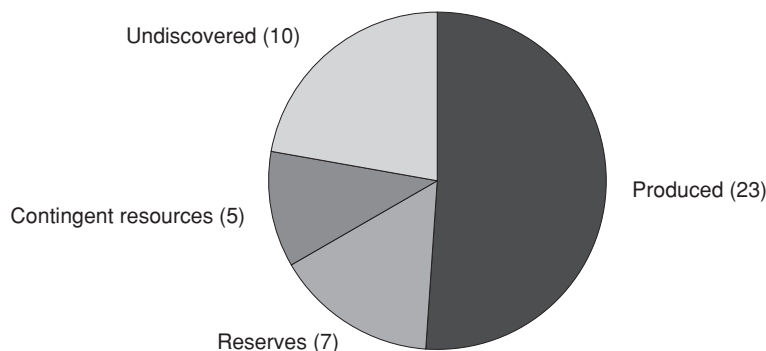
- How much of the remaining resource potential will we be able to discover and produce profitably?
- Will we continue to see strong interest from the industry to explore for, develop and produce petroleum in Norwegian waters?

- Will we be able to find solutions so that petroleum activities can co-exist with other industries (fisheries, tourism) in all areas not yet opened for petroleum activities?
- Will the operators on our shelf be able to improve oil recovery rates even further?

Regarding the remaining resource potential on the NCS, it is quite considerable. The NCS is vast, its size amounts to 2.2 million square kilometres, of which half has bedrock in which petroleum may be found, and only half of that has been opened for petroleum activity.

on the NCS. In order to stimulate the entry of newcomers, the government adjusted the tax system so it no longer discriminates between incumbents and newcomers when it comes to treatment of exploration costs. The newcomers have brought more dynamism and competition into Norway's oil sector. This has been particularly important in the wake of the big oil mergers at the end of the last century and the increasing maturity of NCS as an oil province. To address all the different opportunities in our oil sector, we need both the contribution from the 'oil' players and the companies recently.

Figure 1: Distribution of total recoverable, liquids resources, bboe



Source: Norwegian Petroleum Directorate

Total resources on the NCS are estimated by The Norwegian Petroleum Directorate (NPD) to be 85 billion barrels of oil equivalent (bboe). Total recoverable quantities of liquids, including undiscovered resources, are estimated to be around 45 bboe (Figure 1), of which 50 percent is not produced yet. Half of the expected, remaining resources is yet to be found. These estimates are obviously uncertain, as large areas have few seismic data and no exploration wells. But clearly, there is a good potential left.

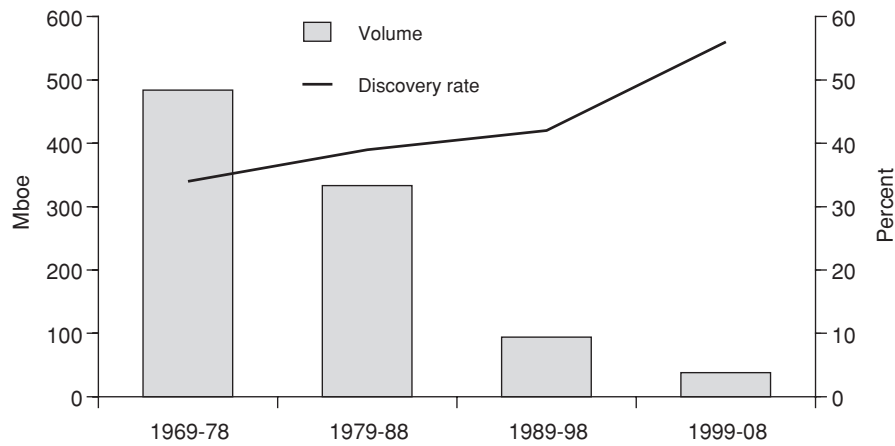
Only drilling can confirm what is in the ground. In the past years we have seen a strong interest from the industry to explore for and develop petroleum in Norway. This is encouraging.

In the course of the last ten years, 50 to 60 new companies have been prequalified as operators or licensees

Exploration activity has been quite good for many years. Last year saw a total of 56 exploration wells being drilled, the highest number ever. Field investments are also at an all time high, but this reflects the general cost inflation in the oil industry, and not merely the level of activity. The high level of activity indicates that the NCS remains an attractive place to invest for the oil industry. Although the resource potential might be higher in other places, fiscal conditions are reasonably attractive and have been stable for many years; in addition, the political risks are low.

However, exploration results have been somewhat mixed. Although the number of discoveries has remained high, field size has declined and more gas than oil has been found. (Figure 2) These results reflect the combination of a positive trend in the mature areas and a few disappointments in frontier

Figure 2: The average size of discoveries and the discovery rate



Source: Norwegian Petroleum Directorate

areas. Since 1994 no giant oil field has been discovered on the NCS. In 2000, eleven fields on NCS produced more than 100,000 barrels/day. Today the number is five.

But it is still possible to make large discoveries on the NCS, such as in deep waters in the Norwegian Sea, in the Barents Sea and areas not yet open.

The government recognises that the industry needs new attractive acreage if exploration activity is to be upheld and new reserves proven. In recent years the government has aimed at awarding licences close to existing infrastructure to be able to produce resources before the infrastructure ceases to be used. The government has also streamlined the policies for third party use of existing infrastructure.

Looking ahead, frontier areas are expected to hold the lion's share of undiscovered resources, although recent drilling results have not come up to the expectations of the authorities and the companies.

A fundamental precondition for petroleum activities on the NCS is the coexistence of the oil industry and other users of the sea and land areas affected by such activities. We have been successful in this regard for 40 years.

Earlier this year the Parliament decided to start an impact assessment for the waters around Jan Mayen. A decision on whether or not to license

acreage in this area will be made when the impact assessment is finalised. Next year, a decision on how to go forward in our northernmost areas, including the prospective areas in the vicinity of the Lofoten archipelago north of the Arctic Circle, is expected. This decision will be taken in connection with the update of the so-called integrated management plan for the Barents Sea and the sea areas off the Lofoten Islands.

Increased recovery activities on producing fields are important for our short- and medium-term production outlook. Increased recovery from producing fields is likely to be a significant source of new oil supplies from the NCS. For a long time, improved oil recovery has been a high

priority for the Norwegian authorities. On average, fields on NCS have an oil recovery factor of 46 percent. This is respectable compared with oil provinces in other parts of the world. However, it is probably possible to arrange for significantly higher recovery based on profitable production in the longer-term perspective. A small rise in the recovery factor may give substantial volumes of additional oil.

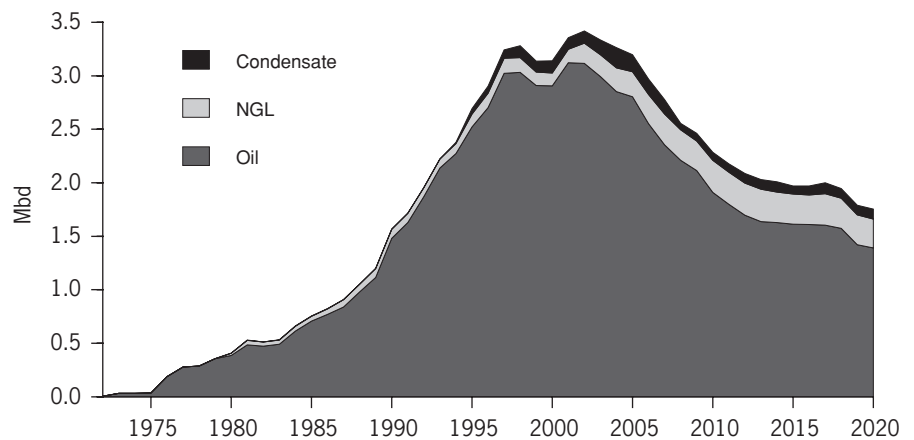
All fields on the NCS contain both oil and gas. Their recovery therefore cannot be viewed independently of each other. Injection of gas has in many instances been an effective technology to improve oil recovery on the NCS. As much as 30–40 bcm of gas – equal to one-third of total gas export – is injected into oil fields every year to maintain reservoir pressure and to stimulate oil production. Whether used for injection or export, the government will promote the use of gas that maximises the value to the society.

What conclusions about Norway's oil prospects can be derived from the considerations above?

It is clear that after 40 years of petroleum activities, Norway has moved well into the harvesting phase of its petroleum era. Nevertheless, its oil fields have many years left to produce.

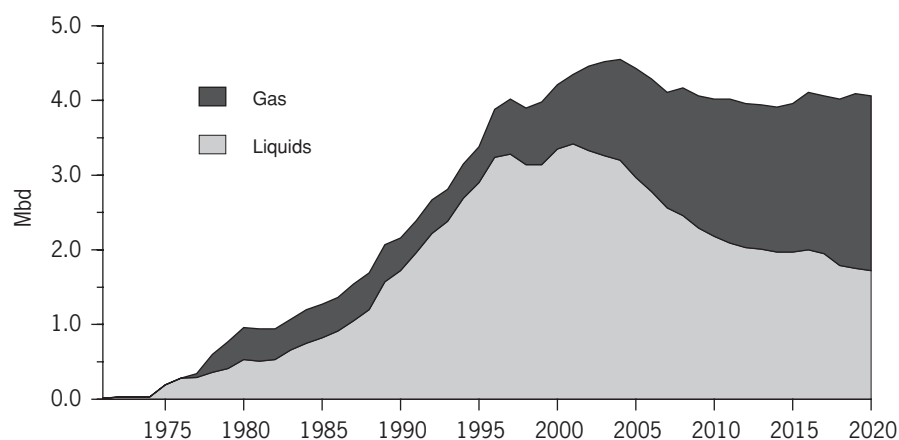
Future production levels are uncertain, but a continued fall in oil production is probably not possible to avoid. If our projections are right, Norwegian

Figure 3: Norwegian liquids production



Source: Norwegian Petroleum Directorate

Figure 4: Production of liquids and natural gas



Source: Norwegian Petroleum Directorate

liquids supply in 2020 will be around 1.7 million barrels per day (Figure 3), with a further decline thereafter. Supportive oil prices, use of new technology and government policies can moderate the rate of decline, but not stop it. Whatever oil prices and whatever measures the government takes, the geological realities of the NCS are the same.

But as natural gas production is expected to grow for some more years, total petroleum production from Norway could stay at the current level of about 4 million barrels of oil equivalent per day well into the coming decade. (Figure 4)

For the industry investment opportunities on the NCS should be plentiful, but they will be different from the past. And they will be more diverse – from ‘easy’ tie-ins to existing fields, to challenging green field developments in the high north. Fields will on average be smaller and gas developments more frequent than oil developments.

Thus, in spite of decreasing oil supply, Norway will remain an attractive area for energy investment and a large energy exporter for many years to come.

