



OG21

EXTERNAL FACTORS ANALYSIS

Report

Rev 02: Approved
Date: July 3, 2020

SUMMARY



Covid-19 impact



Long term global outlook



Norway resources & opportunities



OG21 implications



Oil storage capacity rapidly filling up as a result of the Covid-19 demand shock. Picture from Cushing storage, Oklahoma, US, April 2020. Photo: Reuters

As part of the preparations for a new national technology strategy for the Norwegian petroleum sector, OG21 has conducted an analysis of external factors that could influence direction, organization and contents of the strategy.

The on-going Covid-19 pandemic has had devastating short term impact on oil demand. It has led to severe spending cuts and postponement of oil and gas projects all over the globe, including on the NCS. As a result, we expect a dramatic reduction in activity in the Norwegian petroleum industry until 2022.

How the Covid-19 crisis will play out in the longer term is uncertain: some believe it could cause a lasting and significant dent in the oil demand and accelerate the de-carbonization of the energy mix. Another view is that the fundamentals of oil demand to a large extent will not change – most of the observed reduction in oil demand is primarily linked to reduced car driving, which is likely to return to pre-Covid-19 levels after restrictions are lifted and economy picks up again. When and whether aviation will return to pre-crisis levels, is more uncertain, but aviation represents a much smaller part of the global oil demand than light vehicles.

The global storage capacity is likely to be filled up by May/June. High storage volumes are expected to depress oil prices for a while after demand has picked up, but the global storage capacity is relatively limited compared to the global oil demand (less than 20 days global consumption).

It is possible that the oil market, in the wake of the Covid-19 pandemic and the severe investment cuts that have been announced, will see a dramatic oil price up-cycle. Oil companies on the NCS and the Norwegian government will, if this plays out, be able to harvest a short-term windfall, but the longer term industry success will be dependent upon its ability to maintain capacity and competence throughout the down-cycle.

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The oil market is cyclical by nature with a time lag from investment signal to production response. Shale oil has changed the oil market dynamics by its short production response time to market signals. This leads to shorter price cycles. At some irregular intervals demand and supply shocks occur caused by large scale factors such as economy set-backs, technology break-through or conflicts. Profitability in a cyclical industry require economical robustness and a long term perspective.

Some large external factors make the long term oil demand and oil price look uncertain:

- Increased global conflict level, trade wars and protectionism threaten the underlying growth
- Urbanization and climate change awareness may lead to a change in mobility services
- A scale-up of renewables combined with improved battery technology could severely dent the demand for oil in the transport sector (currently representing half of global oil demand)

Since production naturally declines from producing fields, the petroleum industry needs continued and high investments, even in low-demand scenarios. For International Oil Companies (IOCs), attracting such investments could become challenging: The share holder returns from the oil and gas sector has been poor as compared to other sectors over the last 6 years, and institutional investors are becoming increasingly concerned about the industry's carbon footprint. In addition to putting pressure on IOCs to reduce emissions, investors also require faster returns than earlier to reduce their climate risk exposure.

Concerned institutional investors have a potentially significant impact on the IOCs' carbon footprints, but limited impact on total emissions from the O&G industry unless global policies are put in place and adhered to. IOCs, which institutional investors can influence directly, stand for only 15% of the global oil production. National Oil Companies (NOCs), owned by Governments, produce the lion's share of global oil without a similar pressure on reducing emissions. Furthermore, Government backed NOCs often have wider strategic perspectives than pure economic returns, including political clout and society stability.

Gas markets are largely regional, constrained by costly transportation over long distances. Gas demand in the European market looks bright in the short-term, but weak in the longer term if the European Green Deal should be implemented in its current form.

SUMMARY



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Large parts of the Norwegian Continental Shelf (NCS) are maturing. Still, less than half of the estimated resources have so far been produced. The NCS is currently highly competitive in the global market with low lifting costs and low CO₂-emissions per barrel.

The oil and gas sector has strong support in the Norwegian population today, but concerns for climate change are increasing. Delivering on the Konkraft roadmap, which aims at cutting CO₂-emissions by 40% by 2030 and to near-zero by 2050, could therefore prove very important for continued public support. The Konkraft goals are challenging not only from an emissions perspective, but also because costs simultaneously would need to be kept at bay to maintain the NCS competitiveness.

The analysis of external factors suggests a future with price volatility and market uncertainties. We believe the future attractiveness and competitiveness of the Norwegian petroleum sector is dependent upon:

- Robustness to fluctuations in oil and gas prices with potentially lower average prices than historically.
- World class safety and environmental performance to maintain social acceptance and attract investments – low CO₂-emissions both in production and throughout petroleum value chains.
- Shorter lead-times to attract investments.

The national technology strategy for the oil and gas sector, the OG21 strategy, needs to support this. That means (to be further detailed in the new OG21 strategy):

- Cost-reducing technologies within all disciplines.
- Improved sub-surface understanding to: reduce costs and risks of smaller fields/targets; better well placement; drain reservoirs more cost- and energy efficient.
- Technology to reduce lead times and accelerate production.
- Technology to reduce operational GHG emissions as well as emissions throughout oil and gas value chains.
- Technology to reduce safety risks and environmental risks.
- Digitalization as an enabler for lower costs, lower emissions and improved efficiency.
- Balance short term and long term technology needs.
- The sector's attractiveness for R&D in a regional and global context.
- The sector's capabilities to implement and scale technologies (data, people and organizational capabilities).
- The sector's ability to attract new talent and develop people to master new skills.

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1. PURPOSE: UNDERSTAND EXTERNAL FACTORS WHICH NEED TO BE CONSIDERED IN THE NEW OG21-STRATEGY

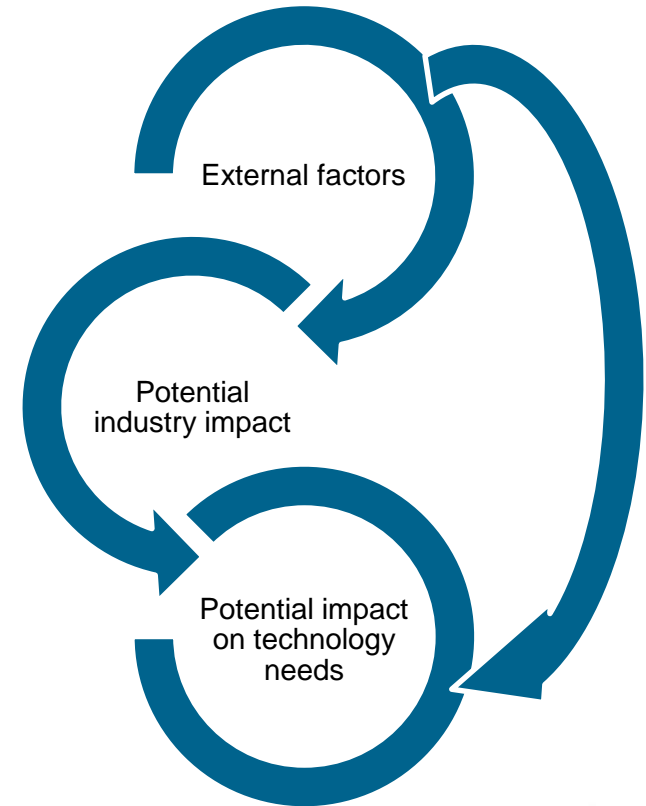
Purpose defined in OG21 business plan for 2020: Understand external factors that OG21 needs to consider in the development of the new OG21 strategy, which is planned for 2021.

Key questions:

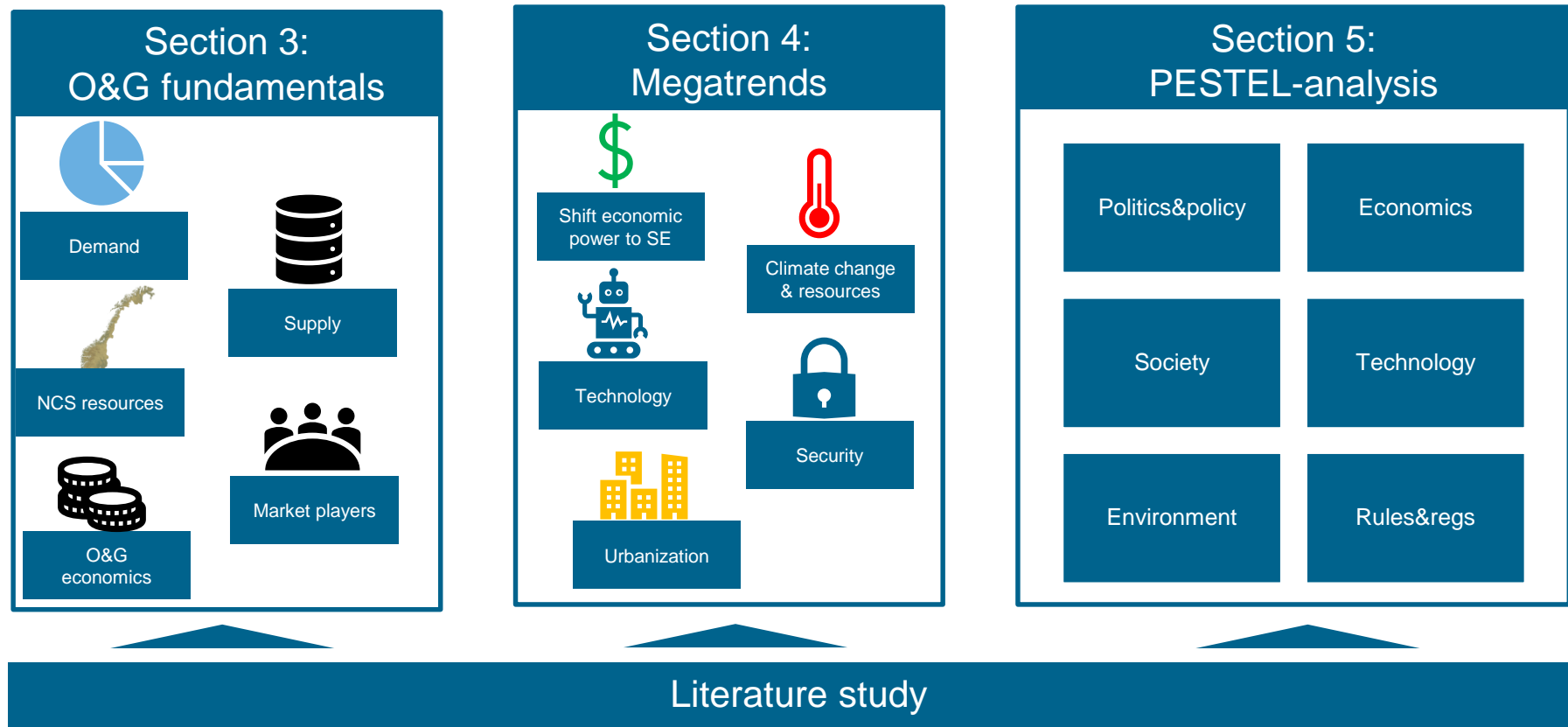
1. Which external factors and forces influence the role of oil and gas in the near- and long-term energy mix?
2. What is the potential impact on Norwegian petroleum sector activity and competitiveness?
3. How is technology affected by external factors and how could technology contribute to maintain the competitiveness of the Norwegian petroleum sector?

Resources:

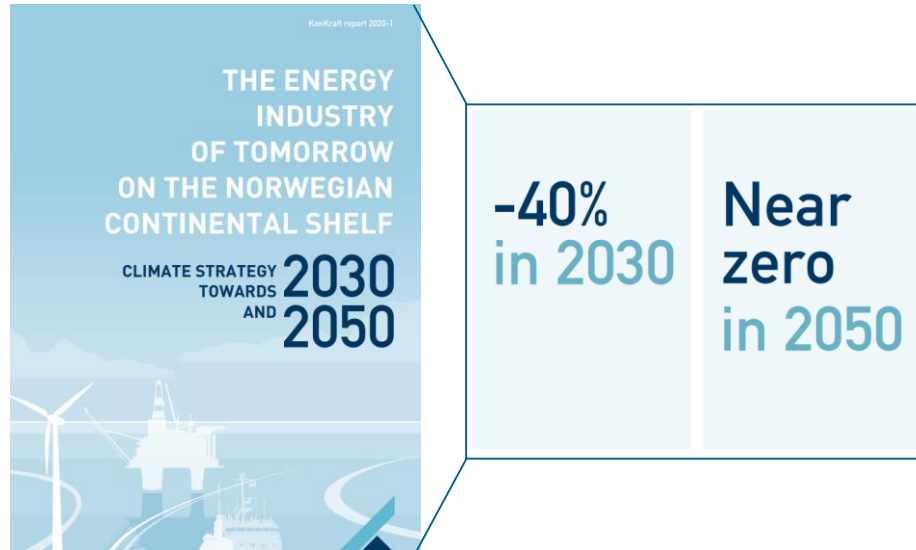
- Steering committee: The OG21-board
- Project team: Gunnar Lille, Espen Forsberg Holmstrøm, Christina Johansen, Ole Eeg, Jan Roger Berg, Kjetil Skaugset



2. METHODOLOGY – EXTERNAL FACTORS IDENTIFIED 3 WAYS



3. OIL AND GAS FUNDAMENTALS INDUSTRY AMBITIONS AND TARGETS



The oil industry in Norway have put forward very challenging CO₂-emission reductions goals: 40% reduction by 2030, and near zero in 2050 (Konkraft, 2020).

The whole industry is behind this: labour organizations as well as industry organizations for oil companies, ship owners and suppliers.

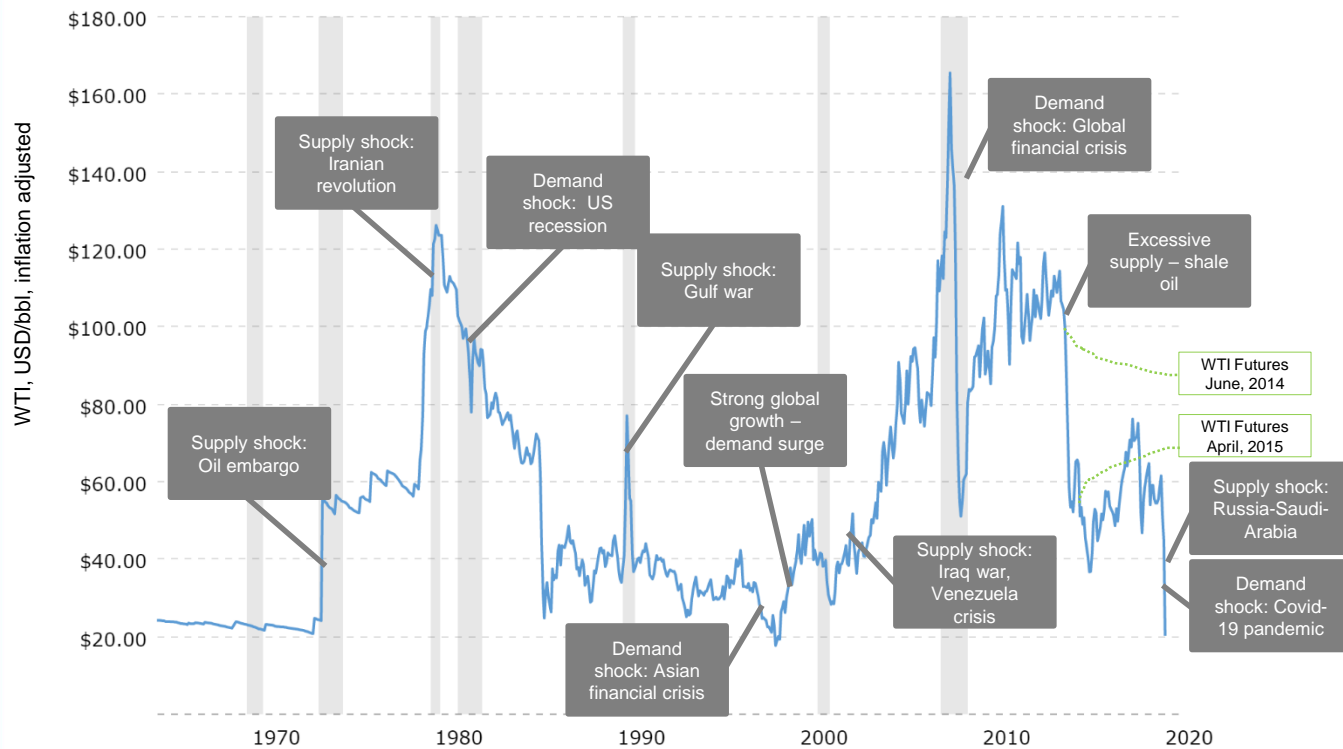
The recent agreement in the Parliament on temporary tax adjustments further strengthens the climate ambitions - it calls for a plan to reduce CO₂-emissions by 50% by 2030 as compared to the 2005-level.

Simultaneously as CO₂-emissions are to be cut, efforts to improve efficiency and reduce costs need to continue in order to maintain the competitiveness of the NCS.

Technology will have to play a vital role to solve this dual challenge, both short term by efficiently implementing technologies at high readiness levels and long term through research and development of new technologies.

3. OIL AND GAS FUNDAMENTALS

HISTORICAL OIL PRICE, DEMAND AND SUPPLY SHOCKS



Historically, oil prices have fluctuated, influenced by global economy, conflicts, geopolitics and technology. Historical future prices suggest that fluctuations are inherently difficult to predict.

The recent oil price collapse was unprecedented, caused by a historical large reduction in oil demand and simultaneously increased production.

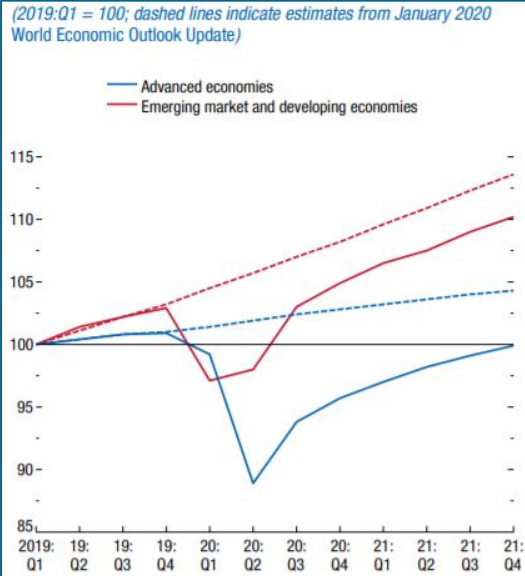
The oil price had already by June 2020 recovered to around 40\$/bbl. How long it will take before the oil price fully recovers, depends on several factors, e.g.:

- Virus spread and public health response
- Knock-on economic effects and economic policy response

History suggests that the oil price also this time eventually will regain to levels that balance long term demand with supply. Compared to earlier price spikes, the market this time has considerable spare capacity that may be released when demand picks up. A dramatic up-cycle can however not be ruled out as a result of the significant Covid-19 investment cuts.

THE COVID-19 PANDEMIC IMPACT ON GLOBAL AND NATIONAL ECONOMY

World GDP quarterly (IMF, 2020)



The International Monetary Fund released their World Economic Outlook mid-April with estimates on the Covid-19 impacts on global economy and growth. The base estimate shows a global GDP decline of 3% in 2020 (down 6.3% from the pre-Covid-19 prognosis for 2020), before a 5.8% global GDP growth in 2021. The estimate is based on the assumption that the pandemic will fade out by the end of 2020, but there is a significant downside risk that the pandemic may last longer causing the recession to continue throughout 2021 and possibly even further. This view is shared by several others, e.g. McKinsey in partnership with Oxford Economics (McKinsey, 2020).

The IMF base estimate for Norway is a 6.3% contraction in 2020, before the economy starts recovering with a 2.9% growth in 2021. IMF expects the unemployment rate in Norway to grow from 3.7% in 2019 to 13% in 2020 as a result of the pandemic.

SSB's estimate that GDP onshore Norway will be -5.5% in 2020 before increasing by 4.7% in 2021. Norway will however not fully recover at least until 2023, according to SSB (2020).

GDP growth generally leads to higher demand both for transportation services and for goods made from petroleum. Around half of the oil is used for transportation, and the other half is used for petrochemicals, other industries, heating etc. In normal circumstances a GDP contraction of 3% would result in a decreased oil demand of 1-2% percent. However, in April oil demand decreased by near 30% due to reduced transportation by road, air and sea.

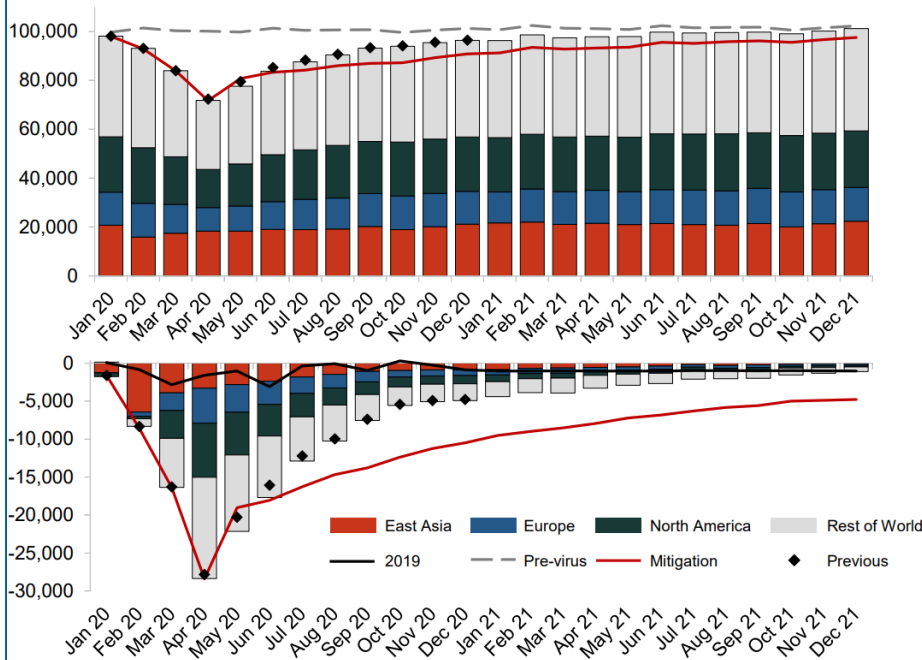
In the medium to long term we would expect a GDP contraction to cause a corresponding reduction in demand for goods made from petroleum. How the impact on oil demand for transportation will play out after covid-19-restrictions are lifted, remains to be seen. For instance, data from TomTom indicate that the traffic in the Guangzhou province in China, where restrictions were lifted in April, by early May had increased to higher levels than pre-Covid-19. This is probably caused by contagion fear related to public transportation.

3. OIL AND GAS FUNDAMENTALS

THE COVID-19 PANDEMIC DEMAND SHOCK

Continue to monitor situation

Global oil demand impact analysis Covid-19, levels and changes vs. pre-virus estimates



McKinsey estimates on likely recovery to pre-crisis GDP growth, range from typically Q4 2020 to Q1 2023 or beyond, depending on how well countries and the international community respond to the virus spread and the economic knock-on effects (McKinsey, 2020).

The lockdown measures adopted by many countries from early March onwards, have had immediate effects on the global oil demand, down by nearly 30% in April. McKinsey (2020), Rystad Energy (2020) and IEA (2020), all estimate that global demand will still lag the normal by 3-5% in Q4 2020, given that effective measures to prevent virus spread are in place. If more virus spread waves should occur, due to restrictions lifted too early or measures on social distancing, isolation and quarantining not being adhered to, the demand recovery will be more sluggish.

Global storage capacity, approximately 1.6 billion bbl according to IHS Markit, is rapidly filling up and could reach maximum capacity before June. This puts a further downward pressure on the oil price in the short term. It also has the effect that even if demand should largely recover by the end of the year, the oil price is likely to be low for longer.

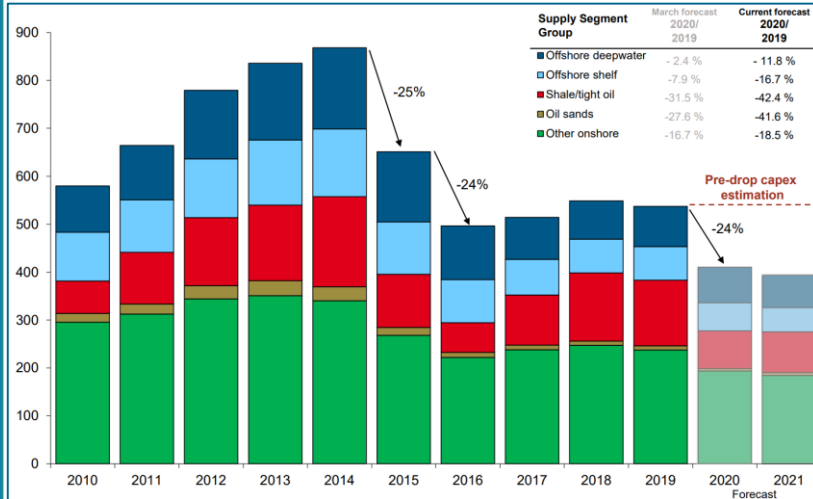
Whether the crisis would cause fundamental changes to oil demand as a result of e.g. changes in consumer behavior like remote work and reduced travel and changes in value chains to reduce global dependency, remains to be seen.

Implications for Norway and the NCS: Be prepared for high oil price volatility and low oil prices .

3. OIL AND GAS FUNDAMENTALS

THE COVID-19 PANDEMIC CURBS E&P INVESTMENTS

Continue to monitor situation



Source: Rystad Energy

«The cure for low oil prices is low oil prices».
Saying in the oil industry. Unknown origin.

E&P companies are in a better shape now than the last downturn 2014-18 to cope with low oil prices. According to Rystad Energy (2020), the total free cash flow from public E&P companies, would be positive this year even with an average oil price of 20\$/bbl. Still, Rystad Energy expects upstream spending may fall 20% in 2020 as compared to pre-crisis estimates. The estimate is based on an oil price scenario of \$34 per barrel in 2020 and \$44 per barrel in 2021.

The outlook for low oil prices puts indebted US shale producers with maturing debt and interest payments in a difficult position. The sharpest decrease in activities and investments is thus expected in the US market. Steep reductions in contracted onshore oil rigs as well as in fracking operations, are already observed, and the first example of bankruptcies of debt exposed oil companies was reported as early as April 1st, when Whiting Petroleum filed for bankruptcy protection.

The activity drop in the Norwegian petroleum sector could be significant. Rystad Energy estimates a reduced investment level in 2022 of 38-49% compared to the 2019 level (Sysla, 2019). Some examples of NCS impacts already announced:

- NPD expects postponement of 20% of NCS exploration wells planned for 2020.
- Equinor: 3 billion USD cost cut plan for 2020 – highlights exploration cuts and postponing US onshore activities.
- AkerBP: 20% cuts capex, exploration and opex. Non-sanctioned projects postponed.
- Aker Solution: Expects at least 20% revenue drop in 2020; 400 employees furloughed April 1; notice of furlough sent 6000 employees April 1.

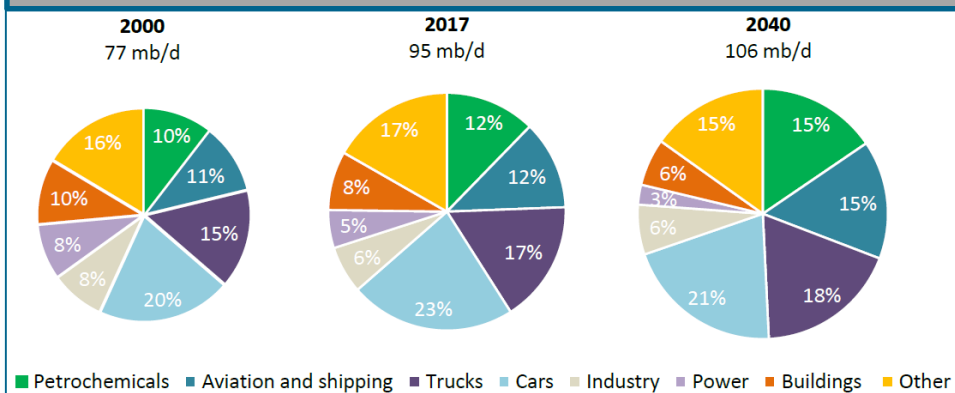
The Covid-19 responses may cause under-investments to meet longer term demand and lay the ground for a new up-cycle. Investment cuts may also have negative long term impacts resulting from reduced industry capacity and talent attractiveness.

Implications for Norway and the NCS: Be prepared for oil price volatility, the risk of losing talent and reduced capacity in the supplier chains.

3. OIL AND GAS FUNDAMENTALS

OIL IS USED FOR A VARIETY OF PURPOSES

Global oil demand by sector in IEA's New Policies Scenario



Source: IEA WEO 2018

Oil derived fuels for light and heavy vehicles combined stood for 40% of the oil demand in 2017, whereas fuel for even heavier transportation means (aviation and shipping) stood for 12% of the demand. Nearly half of the oil (48%) is used for other purposes than transportation.

IEA expected (pre-Covid-19) in the New Policies Scenario that oil demand for transportation purposes (as percentage of the total) would remain at the same level towards 2040. Less of the oil would be used for heating buildings and producing power towards 2040 in the NPS, whereas more would be used in the petrochemical sector (IEA, 2019a).

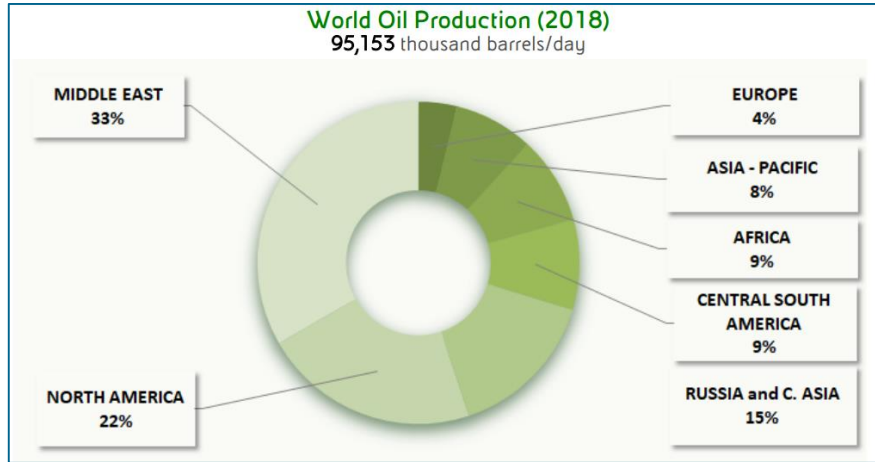
Historical demand shocks show that oil price is highly sensitive to reduced demand, at least in the short term. Demand shocks in the past have been caused by financial crises, and now lately the Covid-19 pandemic. Such demand shocks must be expected also in the future, causing volatility in oil prices.

Significant and lasting demand reductions could however also be caused by technological shifts such as faster than expected shift to renewables, electrical vehicles, autonomous vehicles, changed working habits requiring less travel, and the urbanization trend which also would result in less travel.

Implications for Norway and the NCS: Be prepared for oil price fluctuations and more intense competition for oil market shares.

3. OIL AND GAS FUNDAMENTALS

GLOBAL OIL PRODUCTION



Global oil production in 2018 was 95 million bbl/day. OPEC-countries produced 42% of this. OPEC+Russia produced 54%.

Three oil producing countries are by far bigger than others: US (16%), Saudi-Arabia (13%) and Russia (12%), (ENI, 2019)

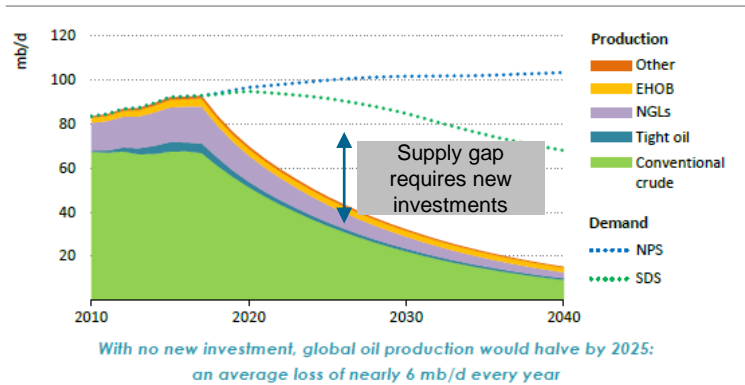
The recent production conflict between Saudi-Arabia and Russia, appears at first sight irrational as both Russia and Saudi-Arabia are dependent upon high oil revenues to balance state budgets. However, larger low-cost producers may seek volatility to squeeze marginal producers out of market and also reduce production costs, and thus prepare the ground for higher windfall when prices rise again (Halff, 2020). The conflict can in this perspective be understood as an attempt from Russia and Saudi-Arabia to demonstrate market power and tame US and US shale producers.

An agreement to cut OPEC+ production by 9.7 million bbls/d in May and June was reached on April 12. It does not include any US cuts; the US production is completely market driven and any US production cuts would be a result of decisions made by industry rather than by federal or state government. In fact, the non-OPEC production cuts from mid-March to June seem to approach 4 million bpd, of which the lion's share is in North America (US -1.9 mm bpd, and Canada -1.4 mmbpd).

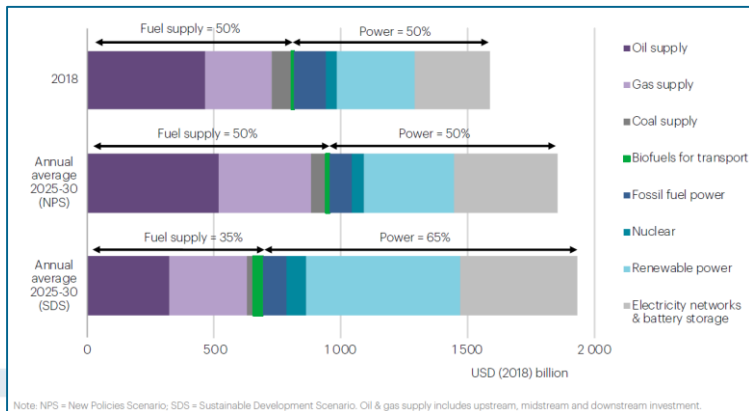
Even though the agreement demonstrates the US diplomatic sway over Saudi Arabia and Russia, it also reflects that the US is vulnerable to oil price fluctuations and that the achieved "self-sufficiency" in oil does not make it independent of OPEC+ or the global economy and markets.

3. OIL AND GAS FUNDAMENTALS

OIL DEMAND SCENARIOS AND NEED FOR INVESTMENTS



Note: EHOB = extra-heavy oil and bitumen; NGLs = natural gas liquids; NPS = New Policies Scenario; SDS = Sustainable Development Scenario.



Note: NPS = New Policies Scenario; SDS = Sustainable Development Scenario. Oil & gas supply includes upstream, midstream and downstream investment.

After the Covid-19 crisis, a likely scenario is that oil demand will return to near pre-crisis levels. McKinsey and Rystad Energy both estimate that demand will have nearly fully recovered by the end of 2020, but with depressed oil prices possibly lasting longer due to the oil stockpiling.

However, another scenario of fundamentally reduced oil demand, especially for transportation, is also possible: Digital platforms/connectivity have proven efficient during the Covid-19 and people and enterprises may want to continue to work remotely, reducing the need for commuting to work and the need for business trips.

Oil demand in the even longer term is dependent upon how successful the world is at curbing CO₂-emissions and switching to renewables. The two IEA forecasts NPS and SDS, of which the SDS meets the 2 degrees target, are shown in the upper graph together with the decline curve of the currently producing oil fields (IEA 2019a).

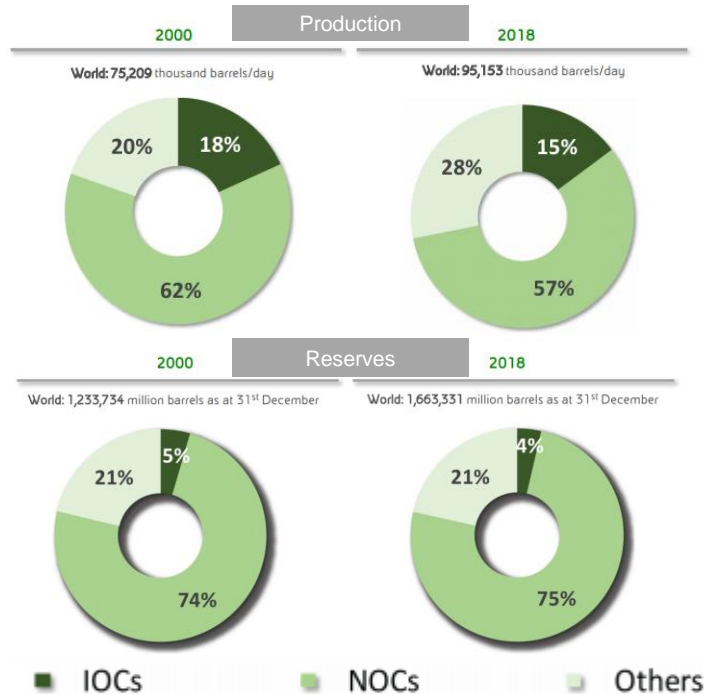
The lower graph shows that the global energy sector will need to see a massive ramp-up of investments into renewables and electricity systems if the 2 degrees target of the Paris agreement is to be met (IEA 2019b).

Simultaneously, investments in O&G projects would have to be kept almost at the same levels as of 2018 to meet the global O&G demand, even in the 2 degrees scenario. The reason is that declining O&G production will need to be replaced by new projects. Without further investments, the supply gap would be 30-50 mmb/d in 2040, depending on the scenario. Attracting such investments could be challenging, especially for IOCs. Returns in the O&G sector were already poor prior to the Covid-19 crisis: Energy had the lowest return of all sectors in the S&P 500 index in four of the six past years (includes ~30 largest US oil companies and oil service companies), (Economist, 2020).

Implications for Norway and the NCS: Need to maintain attractiveness to investors by offering high and fast returns and low CO₂-emissions.

3. OIL AND GAS FUNDAMENTALS

OIL OWNERSHIP AND MARKET POWER



National oil companies (NOCs) in 2018 produced 57% of the global oil and owned 75% of the reserves, (ENI, 2019). Many NOCs operate as extension of the government or government agencies, e.g. Saudi Aramco, Pemex and CNPC, and often have a role in providing services to the population such as employment and subsidized fuels. Some NOCs have strategic and operational autonomy, e.g. Petrobras. (Equinor is sometimes referred to as an NOC with autonomy, and sometimes as an IOC. In the ENI classification in the graphs, Equinor is classified as an IOC).

Each of the 14 OPEC countries have at least one NOC, but many also welcome IOCs to operate within their borders. OPEC countries in 2019 produced 39% of the global oil, and held 48% of crude reserves (EIA, 2020).

5 of the biggest OPEC producers are Persian Gulf States (Saudi Arabia, Iran, Iraq, UAE and Kuwait). Exports from these countries are shipped through the geo-politically important Hormuz Strait between Iran, the UAE and Oman.

International oil companies (IOCs) produced 15% of the global oil in 2018, and held 4% of the reserves. IOCs are mainly investor owned, and all of their decisions are ultimately made in the interest of the company and its shareholders.

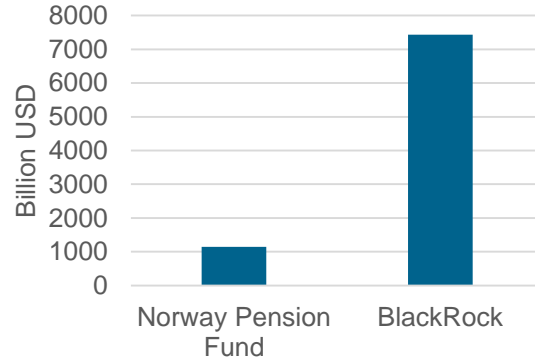
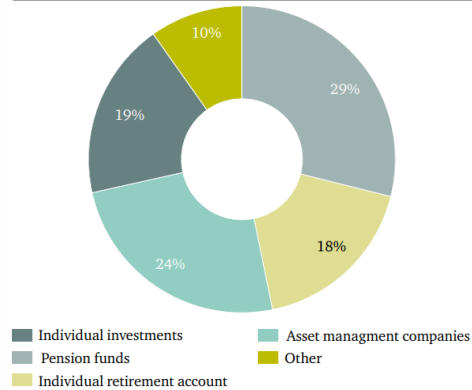
(*) IOCs: Anadarko, Apache, BG, BHP Billiton, BP, Chevron, ConocoPhillips, Eni, Equinor, ExxonMobil, Marathon Oil, OMV, Repsol, Shell, Total, Woodside Petroleum.

NOCs: ADNOC, Bahrain NOC, Bashneft, CNOOC, CNPC/PetroChina, CPC Taiwan, Dubai Petroleum, Ecopetrol, EGPC, Gazprom, INOC, Israel NOC, KazMunaiGaz, KNOC, KPC, Libyan NOC, Lukoil, MEDCO Energy, MOGE, Morocco NOC, Mubadala- Abu Dhabi, NIOC, NNPC, Novatek, Oil India, ONGC, Pakistan Oil Field, Pakistan Petroleum, PDO, PdVSA, Pemex, Pertamina, Petrobras, Petronas, PetroVietnam, PGNIG, PTTEP, QP, Rosneft, Saudi Aramco, Sinopec, SOCAR Azerbaijan, Sonangol, Sonatrach, Surgutneftegas, Syria Petroleum, Tatneft, Turkmengas, Uzbekneftegas, YPF.

3. OIL AND GAS FUNDAMENTALS

OIL MARKET INVESTORS AND DRIVE FOR REDUCED EMISSIONS

Ownership of US oil and gas companies in the S&P 500 index, 2014 (Stevens, 2016)



«Climate risk is finance risk», “In the near future – and sooner than most anticipate – there will be a significant reallocation of capital». Larry Fink, CEO BlackRock, letter to CEOs February 2020

Institutional investors invest on behalf of others. They are typically asset management companies, pension funds and insurance companies. US data suggest institutional investors hold more than 50% of shares in IOCs (Stevens, 2016).

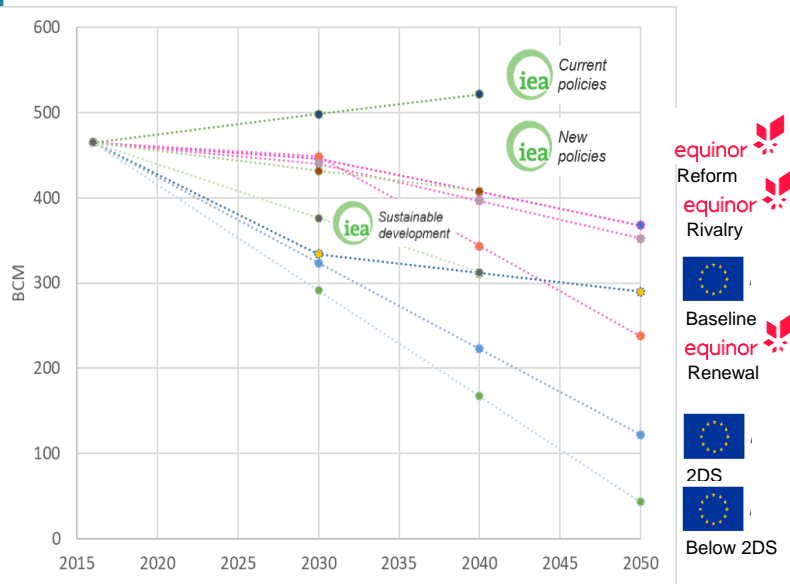
Institutional investors are increasingly demanding lower CO₂-emissions. Examples are many: several UNEP Finance initiatives subscribed to by leading banks and insurance companies; shareholder resolutions by pension funds; and statements by the world's largest asset management company, BlackRock.

Still, the oil companies that institutional investors have access to, the IOCs, only produce 15% of global oil. The limited market share of IOCs' may explain why CO₂-concerned IOCs not only focus on reducing their own emissions and emissions in their petroleum value chains, but also advocate for more stringent global CO₂-policies to level out the playing field.

Implications for Norway and the NCS: Offer high and fast returns and reduce CO₂-emissions to attract investors. Support global CO₂ policy development to reduce competitive disadvantages of climate change concerned nations and enterprises.

3. OIL AND GAS FUNDAMENTALS

GAS DEMAND – ROBUST SHORT TERM, UNCERTAIN LONGER TERM



Norwegian natural gas is primarily sold to the EU and UK markets. Only a small portion is sold as LNG (<5%) to the global market. In some scenarios the gas demand in Europe appears to be fairly robust over the next 20-30 years, e.g. in IEA's current policies and new policies scenarios (IEA, 2019a) and the Equinor's reform and rivalry scenarios (Equinor, 2019). Other scenarios anticipate lower gas demand, e.g. the IEA sustainable development scenario.

In the European Commission's "European Green Deal" there is very little room for natural gas without CCS by the year 2050 (scenarios 2DS and Below 2DS), (EC, 2019).

The European Commission proposed March 4th, 2020, a European Climate Law that would make the «European Green Deal» plan binding. The Law has to be approved by the European Parliament and the Council of Ministers. The Covid-19 situation created some resistance and uncertainty on the adoption of the climate law, but the EU recovery package, "Repair and Prepare for the Next Generation", announced May 27th, reinforces the strategic direction and measures of the European Green Deal. The European demand for gas long term is uncertain not only because of the Green Deal, but also due to factors such as expected increases in CO₂-prices, substitution with renewables experiencing a downward cost curve, and energy security issues.

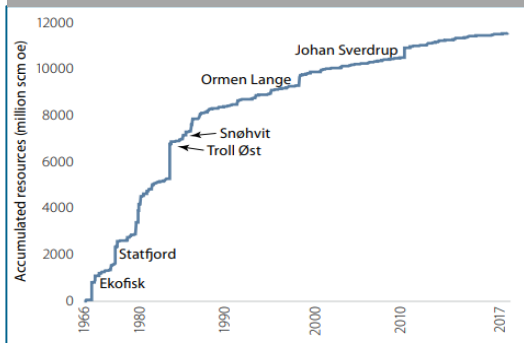
Implications for Norway: Evaluate strategies to reduce gas demand uncertainty:

- Diversification into more LNG – the Indian and Chinese markets are poised to grow substantially towards 2050, (IEA WEO2018).
- CCS on gas fueled power stations – power and heat is 1/3 of gas consumption in EU today.
- Hydrogen production from natural gas with CCS. (The Government's hydrogen strategy was launched June 3rd, 2020.)

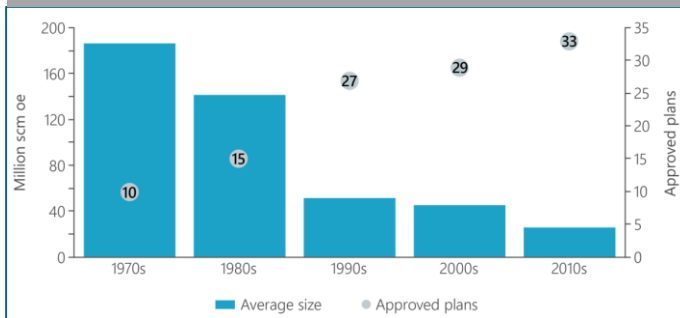
3. OIL AND GAS FUNDAMENTALS

NCS IS MATURING, NUMEROUS NEW AND SMALL DEVELOPMENTS

Creaming curve for the NCS (NPD, 2018)



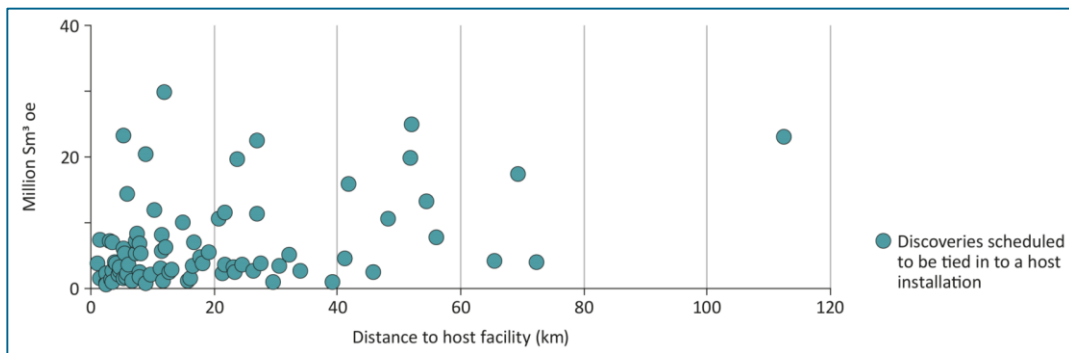
Smaller fields are economical (NPD, 2020)



The creaming curve for the NCS clearly shows that the NCS is a maturing basin. With the exception for Johan Sverdrup, large discoveries were primarily made during the first three decades of activities. New discoveries are still being made, but the discovery portfolio is dominated by smaller discoveries (NPD, 2018).

Many of the new discoveries are being developed – the number of field developments is increasing, whereas the average field size is decreasing (NPD, 2020).

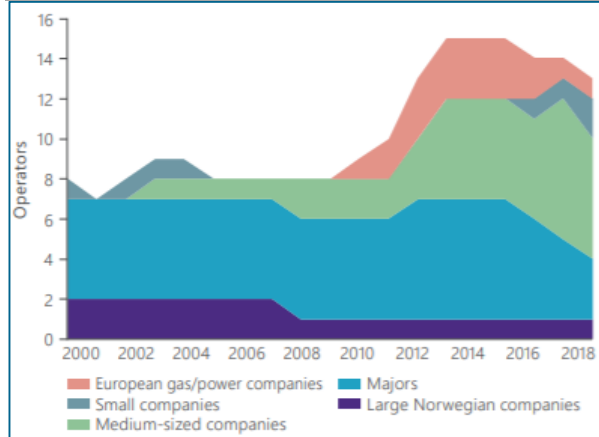
Many small discoveries would have to be tied back to a host to become economical (NPD, 2020). Keeping existing infrastructure alive at acceptable costs and within safety risk acceptance criteria, is crucial for the continued development of the NCS.



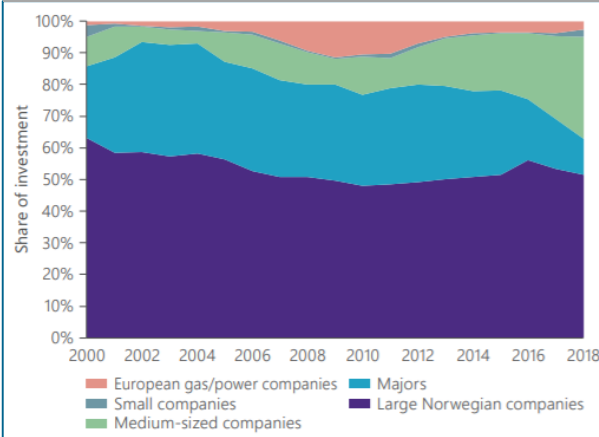
3. OIL AND GAS FUNDAMENTALS

NCS PLAYER LANDSCAPE IS CHANGING

Players on the NCS (NPD Resource Report, 2019)



Share of investments (NPD Resource Report, 2019)



As of end of 2018, there were 39 oil companies active on the NCS. 25 of these were operators of which 13 operated producing fields (NPD 2019, 2020).

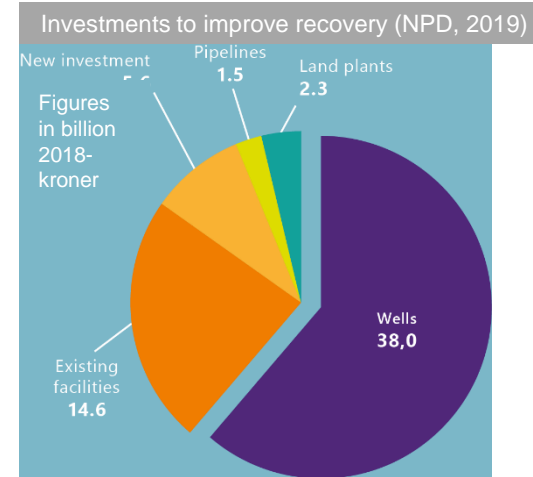
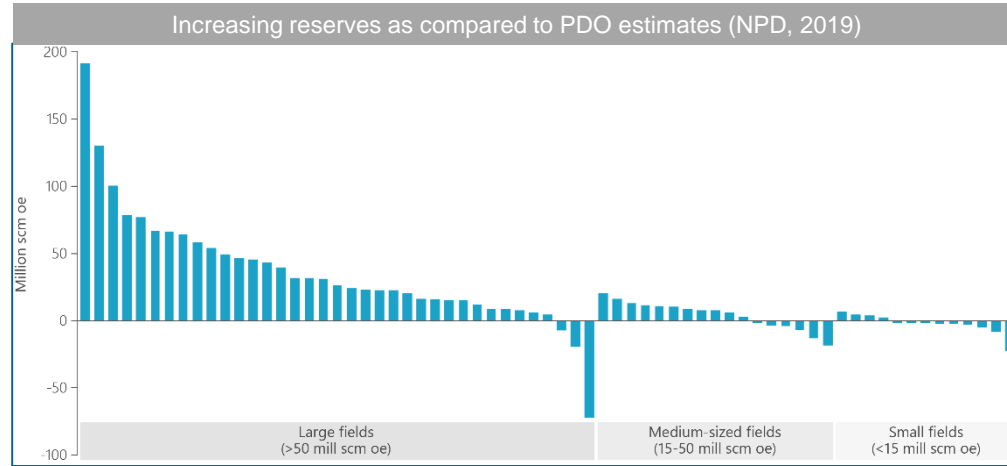
Equinor is by far the dominant player on the NCS. Medium-sized companies are becoming more and more important in terms of number of operatorships and investments, whereas international majors' activity on the NCS is decreasing. European gas and power companies were on the rise until 2014, but most have since then lost interest for the NCS.

Private Equity (PE) funds are playing an increasingly more important role on the NCS. Vår Energi, backed by the PE fund HitecVision, has grown to become the 2nd largest producer on the NCS. But also Mime with backing from Blackstone and Pandion, backed by Kerogen Capital, are examples of PE funded oil companies that are strengthening their positions on the NCS (PWC, 2020).

Implications for OG21: Engage more of the medium-sized companies in the OG21 strategy development.

3. OIL AND GAS FUNDAMENTALS

INCREASED RECOVERY UNLOCKS HUGE VALUE



Efforts to increase recovery pays off. Most fields produce more than originally planned for in the PDOs, and combined the increased reserves adds up to 3 times the Johan Sverdrup field. We believe technology development over the years is a significant contributor to the observed increased recovery, often in combination with additional wells which NPD reports as a major contributor to increased recovery (NPD, 2019).

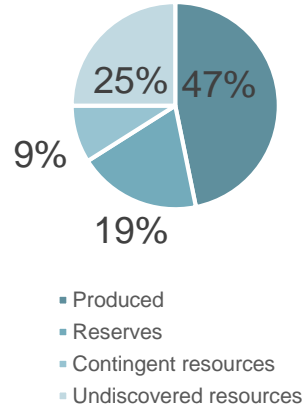
The IOR picture is different for medium and small fields. A relatively high number of such fields are not capable of adding reserves as compared to PDO-estimates, but rather have to adjust reserves down. This indicates a higher relative uncertainty related to the development of smaller fields, which may be explained by a shorter time frame for production and hence learning, and higher relative costs of additional wells.

New knowledge and technology for improved subsurface understanding, cost-efficient field development and cost-efficient wells, will become ever more important as the NCS is maturing and the average field size is decreasing.

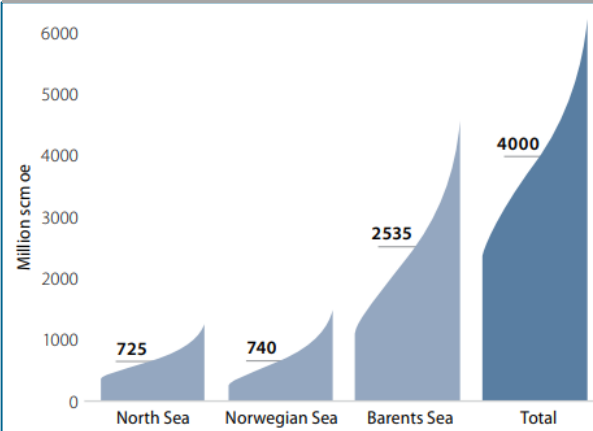
3. OIL AND GAS FUNDAMENTALS

LESS THAN HALF OF THE NCS RESOURCES PRODUCED

NCS Total: 15.6 billion Sm³ o.e.



Estimated undiscovered resources (NPD, 2018)



Even though the NCS is maturing, less than 50% of the potential economically viable resources have been produced (NPD, 2020).

19% of remaining resources are booked reserves, whereas 9% are contingent upon investment decisions.

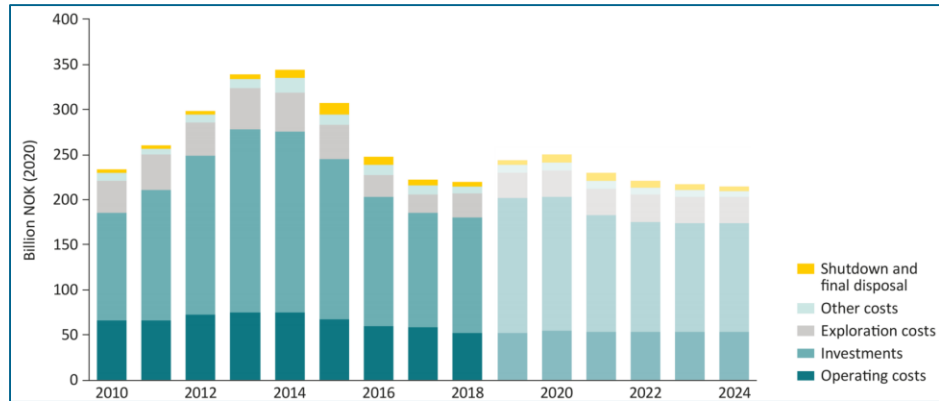
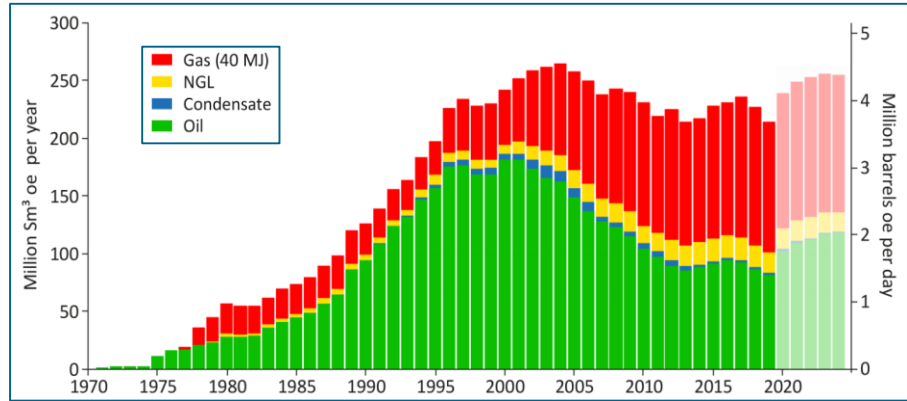
25% of estimated resources are yet to be found. The Barents Sea dominates this category, although related with a high uncertainty span. Half of the Barents Sea estimate is from unopened areas far North. The North Sea and Norwegian Sea are believed to still hold significant, undiscovered resources, which the continued discoveries of smaller, commercial fields proves to be true.

New resources are increasingly more difficult to find, and new knowledge and technology for subsurface understanding is vital for finding new resources and replacing reserves.

The oil demand impact of the Covid-19 pandemic have caused operators on the NCS to reduce exploration activity significantly. This is unfortunate from a reserves replacement perspective, especially since time is critical for efficient use of existing infrastructure.

3. OIL AND GAS FUNDAMENTALS

PRODUCTION HIGH SHORT TERM, LONG TERM IS UNCERTAIN



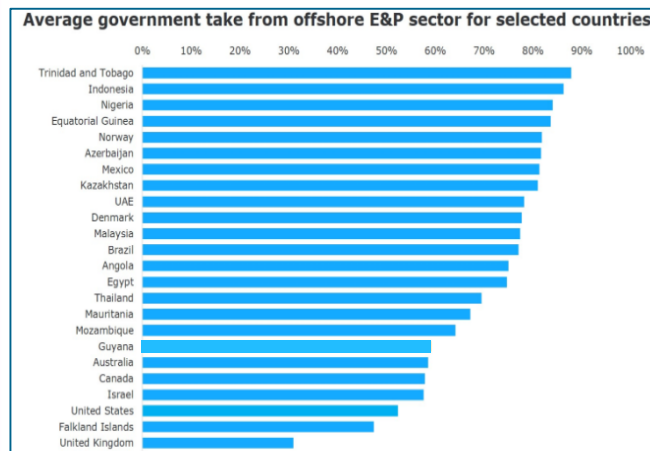
Production on the NCS was at the start of 2020 expected to increase in the years ahead to be close to historically high in 2024. The production increase is a result of on-going projects coming on stream, and would not be impacted by the Covid-19 pandemic unless operators hold back production due to low prices or the government mandates production cuts.

April 29, the Government announced that Norway will cut 250' bbl/d in June, 134' bbl/d in Q3 and Q4 of 2020 and that production start-up of several new fields will be delayed into 2021. The production curb expires year-end 2020.

Longer term industry activity and NCS production is also threatened by the Covid-19 crisis. Before the outset of the pandemic, the activity level on the NCS was expected to reach a peak in 2020 before slightly being reduced towards 2024. As a result of Covid-19, operators on the NCS have already announced significant reductions in exploration expenditures, field development and operations costs. This will have profound impact on the supplier industry in the short term, and likely also the capacity in the supplier industry in the longer term. Furthermore, it may have lasting consequences for reserves replacement and possibly also the capability of time-critical development of smaller fields (as the infrastructure that smaller fields need to be tied back to, is aging).

3. OIL AND GAS FUNDAMENTALS

NCS HIGH GOVERNMENT TAKE AND INCENTIVES TO ATTRACT INVESTMENTS



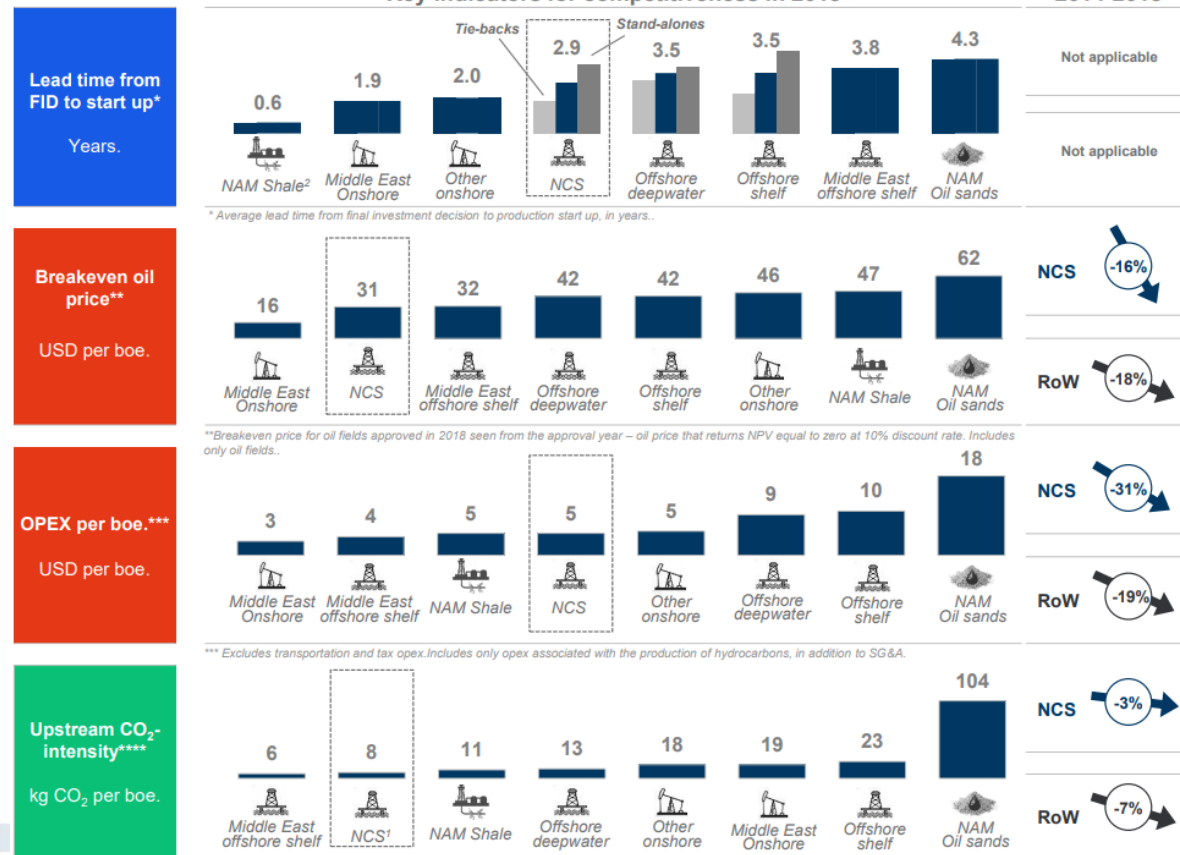
The government take on the NCS, resulting mainly from a marginal tax of 78% (enterprise tax 22% + petroleum tax 56%), is in the upper range compared to other global offshore oil provinces (Rystad Energy, 2018). However, other tax mechanisms have been put in place to ensure tax neutrality and attract investments, including: deductions of costs and losses with no ring-fence; opportunity to carry losses and up-lift forward; depreciation of investments over six years; 20.8% uplift of investments deductible to the petroleum tax, distributed equally over the first 4 years; and the exploration costs reimbursement system (www.norskipetroleum.no).

The exploration costs reimbursement system enables oil companies that are not yet in a positive tax paying position to either immediately get a refund of the tax value of exploration costs or carrying forward the losses to a later year when the company has a taxable income. The system reduces entry barriers for new companies to the NCS by treating established and new companies equally from a tax perspective. The system has attracted new companies to the NCS, and contributed to several important discoveries, e.g. Edvard Grieg and Johan Sverdrup.

To counteract the negative industry effects of Covid-19, the Government proposed temporary tax adjustments in its revised state budget for 2020 (Prop.113L, 2019-2020). It included full depreciation of investment costs towards the petroleum tax the first year and also deduction of the entire uplift towards the petroleum tax the first year, although with the uplift reduced from 20.8% to 10%. The temporary tax adjustments would apply to all new projects with PDOs/PIOs delivered before January 1st, 2022. The Government's proposal did not meet the industry's expectations fronted by the Norwegian oil and gas association, and the response was that it would not do much to stimulate activity. After negotiations in the Parliament, a compromise was reached June 8th with the temporary changes applying to all ongoing projects and projects with PDO/PIOs delivered by the end of 2022, and the uplift adjusted to 24% deductible to the petroleum tax the first year. Otherwise the agreement is in line with the Government's proposal. The resulting temporary tax adjustments have a profound impact on project economics if discount rates normally used by oil companies are applied.

3. OIL AND GAS FUNDAMENTALS

NORWEGIAN OIL AND GAS CURRENTLY COMPETITIVE



* Average lead time from final investment decision to production start up, in years.

**Breakeven price for oil fields approved in 2018 seen from the approval year – oil price that returns NPV equal to zero at 10% discount rate. Includes only oil fields.

*** Excludes transportation and tax opex. Includes only opex associated with the production of hydrocarbons, in addition to SG&A.

****Total yearly upstream CO₂ emissions divided according to supply segment production in the same year.

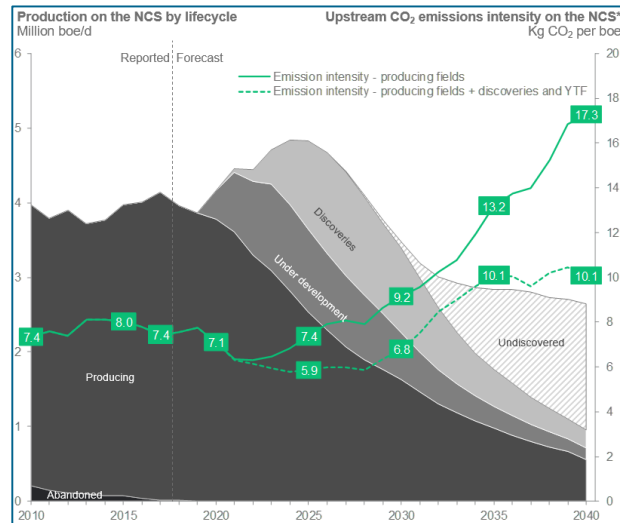
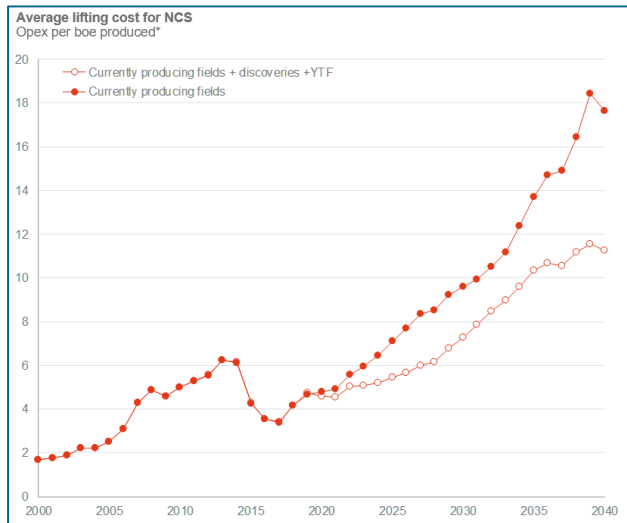
The competitiveness (and attractiveness) of a petroleum region is a result of factors such as stable and favorable frame conditions and how cost-efficiently resources can be discovered and produced. Typical metrics to determine cost-efficiency are break-even prices and OPEX. However, industry and investors are increasingly becoming wary of long term uncertainty of oil and gas demand due to possible substitution with renewables, higher CO₂-emission costs and new policies and regulations curbing GHG emissions. Shorter lead times from decision to production and lower CO₂-emissions are therefore becoming important competitiveness metrics.

The NCS is currently competitive compared to other oil provinces on breakeven prices, operational costs and CO₂-emissions (Rystad Energy, 2019).

Average lead times from investment decisions to production start up on the NCS, compare well with other offshore provinces in the world, but are higher than for onshore provinces, where especially shale oil in the US stand out with low lead times.

3. OIL AND GAS FUNDAMENTALS

MASSIVE EFFORTS NEEDED TO REDUCE NCS COSTS AND EMISSIONS



The NCS is maturing. As the production declines the relative lifting costs per barrel increases. If we're following the current trend, lifting costs per barrel will be doubled by 2030. If that happens we will no longer be the cheapest producer, but rather among the highest cost producers (Rystad Energy, 2019).

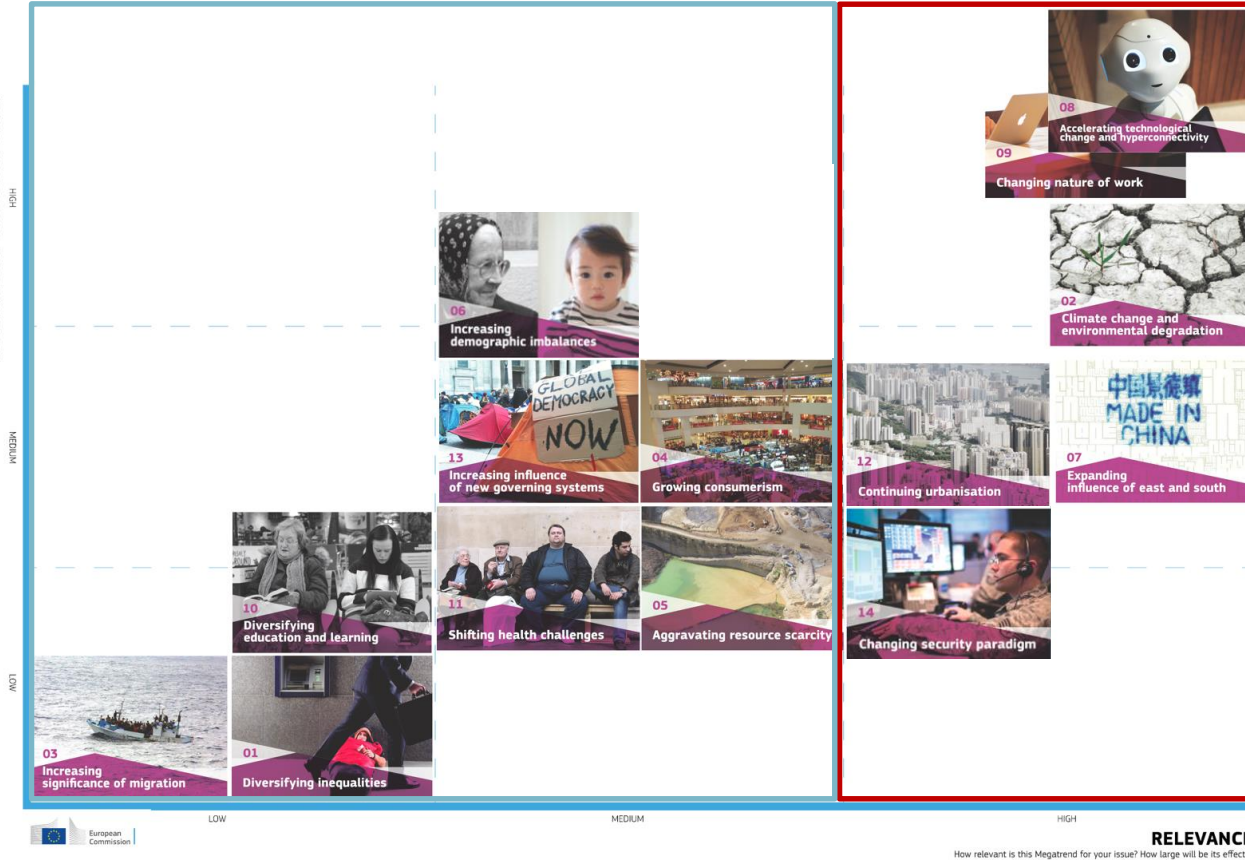
The same type of projection applies to CO₂-emissions. As production decreases the emissions per barrel increases. By 2030 we will no longer be the cleanest producer in the world, unless we do something.

Implications for Norway and the NCS:
Meeting the industry targets of 40% reduced CO₂-emissions by 2030 appear in this context as a necessary but massive undertaking, especially when considering that costs have to be reduced simultaneously.

4. MEGATRENDS OVERVIEW

AWARENESS AND KNOWLEDGE

To what extent is the target group of your project aware of the relevance of this Megatrend? To what extent is it understood? To what extent there is evidence establishing the link between this Megatrend and the issue?



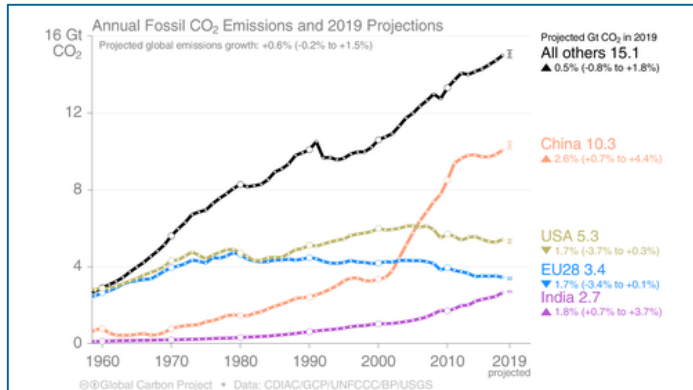
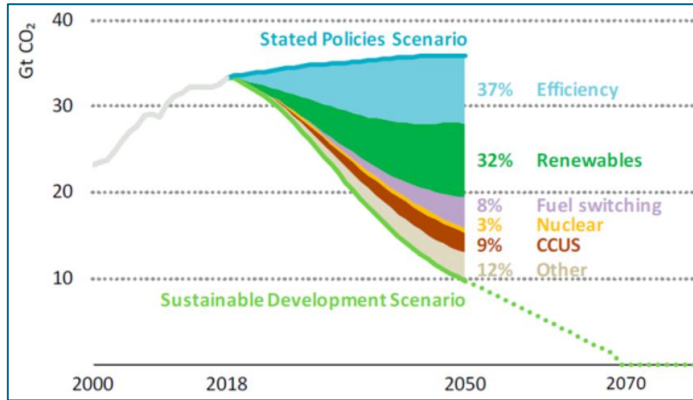
Megatrends are long-term driving forces that are observable now and will most likely have significant influence on the future.

The Megatrends Hub is developed by The Joint Research Centre (JRC) for The European Commission. The trends identified by the JRC align well with scenarios and foresights developed by other institutions and consultancy firms.

We have mapped the JRC identified megatrends in accordance with their relevance or impact for the NCS, and to which extent the trends are known or being discussed in the industry.

The megatrends that we believe are most likely to influence the Norwegian petroleum sector, directly or indirectly, are shown within the red box. These trends are discussed on the following pages.

4. MEGATRENDS CLIMATE CHANGE



Continued unabated, anthropogenic pollution and greenhouse gas emissions causes global warming, ocean acidification, desertification and changing climate patterns (IPCC, 2018).

Although the average annual growth in global CO₂-emissions over the last decade was lower than for the previous decade, the path is unsustainable even if stated policies are being fully implemented (IEA 2019a). According to IEA, a number of mitigation measures would have to be efficiently implemented to bring the world on a trajectory to a sustainable future.

The European Commission is, through the European Green Deal, determined to lead the way by transforming the EU to a net-zero carbon economy by 2050. Despite the set-back Covid-19 has had on the economy, the EC has reaffirmed that the European Green Deal will continue to be Europe's growth strategy.

The EU Emission Trading System (ETS), which Norway and the Norwegian petroleum sector are part of, is the established vehicle to cut emissions in Europe. The ETS is designed to continually cut CO₂-emission within its boundaries by limiting the number of quotas and thus increasing the costs of emitting CO₂.

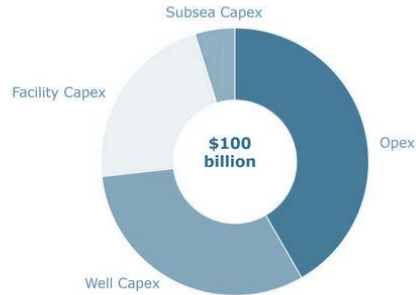
In addition to paying for CO₂-quotas, operators on the NCS pay a Norway and industry specific CO₂-tax. The combined relatively high costs related to CO₂ emissions, drive the search for CO₂ reducing opportunities, which is one of the reasons why the NCS is a global leader on low CO₂ emissions. On one hand this may contribute to attracting investments from ESG-concerned investors. On the other hand it puts NCS at a cost disadvantage as compared to other petroleum provinces with low or no CO₂-emission costs, and it may lead to close-down of oil fields with high CO₂-emissions prematurely seen from a resource perspective.

The European Green Deal provides little room for natural gas in the long term and new strategies concerning Norwegian natural gas exports needs to be evaluated, see section on gas demand scenarios.

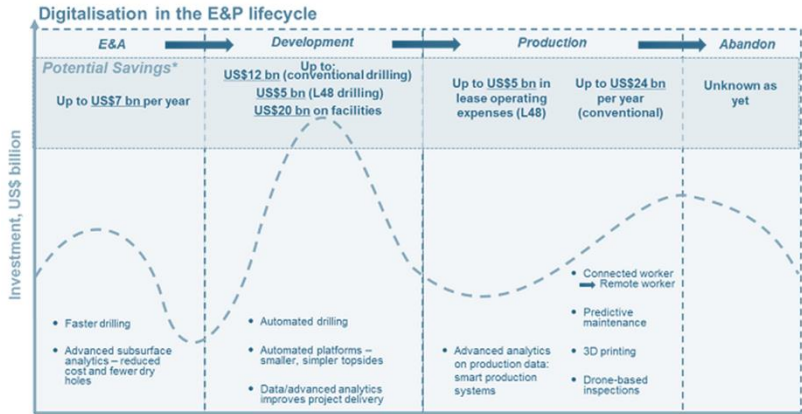
4. MEGATRENDS

TECHNOLOGICAL CHANGE, CONNECTIVITY AND CHANGING NATURE OF WORK

Digitilization and automation potential by budget cost



Source: Rystad Energy ServiceCube, September 2019



*Based on Wood Mackenzie research, and assumes what is potentially achievable in the next five years using known technologies

Advancements in enabling technologies are accelerating. This includes technologies such as robotics and artificial intelligence, photonics and in the foreseeable future, also quantum computing. Technologies are changing the nature and speed of new scientific discoveries and are transforming systems of production, management, and governance.

For the NCS, advanced digital technologies could contribute to increased subsurface understanding, and thus address the significant uncertainty related to the NCS field development project portfolio. Furthermore, we believe advanced data analytics utilized for subsurface understanding will result in fewer dry holes, reduced costs and provide more productive wells.

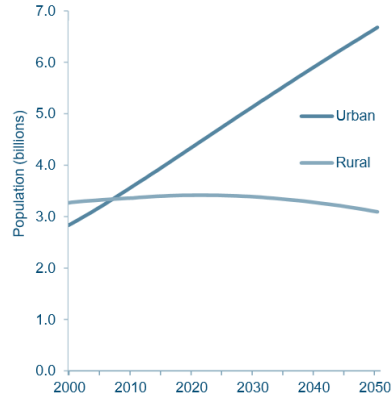
Automated drilling and robotics is expected to increase drilling speed and efficiency, while reducing HSE risk. Costs can be reduced and productivity increased by using advanced digital technologies to optimize production systems, enable automation and remote working, improve predictive maintenance, 3D printing and drone-based inspections.

To leverage the full potential of digital technologies, business models and work processes would have to change. Suppliers, technology companies and energy companies will find new ways to work together, e.g. with new risk/reward structures, innovative contracts, earlier engagements etc.

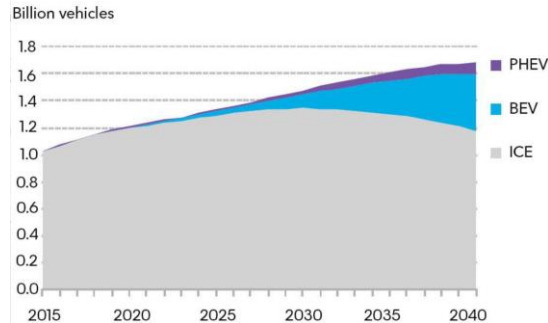
Sharing of data inside companies, throughout value chains, between partners and in some cases even between competitors, will become increasingly important. Collaboration towards platform independency and common APIs will make data sharing more efficient.

4. MEGATRENDS URBANIZATION

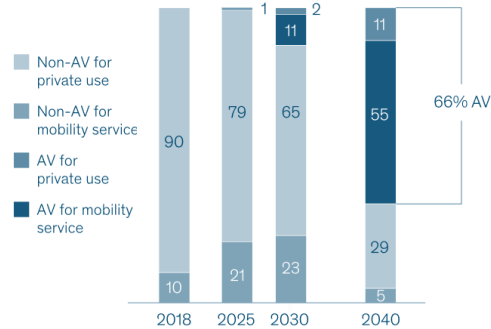
Urban and rural populations of the world, 2000-2050



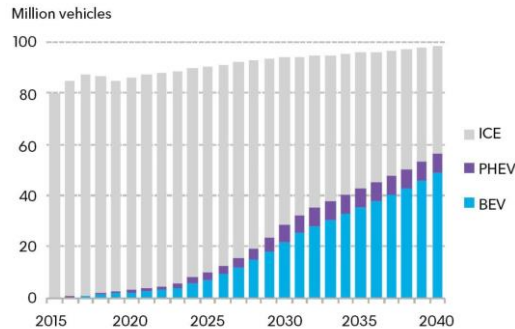
Global long-term passenger vehicle fleet by drivetrain



Estimated passenger-kilometers traveled by vehicle type,¹ %²



Global long-term passenger vehicle sales by drivetrain



Over half of the world's population lives in cities. By 2030, 60% of the population - 4.9 billion people - will live in urban areas. The importance of urban identity is increasing. Nine out of ten mega-cities will be in the developing world, which will present 90% to 95% of the urban expansion in the coming decades. Much of the urban population growth is expected to take place in Asia, Africa and Latin America.

Electrification, automation, shared mobility, carpooling, car sharing and new car ownership models: when you put them all together, you get the potential for radical change in the way people and things will travel around in cities.

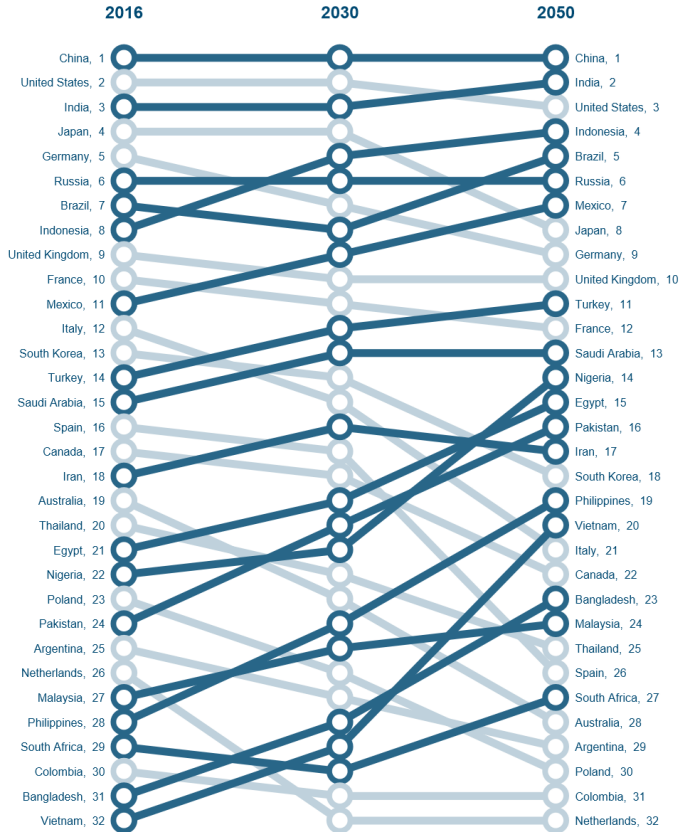
By 2040 there could be a large autonomous and electric vehicle fleet offering mobility as a service in most cities.

Light vehicles with internal combustion engines (ICEs) represent around ¼ of the total global oil demand. Scenarios by McKinsey and ??, describe the number of ICE vehicles to peak around 2030 or even earlier. This would have profound consequences for oil demand, and tighten the competition for oil market shares.

Implications for NCS: Protect market share by reducing costs.

4. MEGATRENDS

EXPANDING INFLUENCE OF EAST AND SOUTH



Global economic growth will be driven by emerging market economies, which will gradually increase their share of world GDP over time.

PWC projects that the world economy will roughly double in size by 2042, growing at an annual average rate of around 2.6% between 2016 and 2050. It is expected that this growth will be driven largely by emerging market and developing countries, with the E7 economies of Brazil, China, India, Indonesia, Mexico, Russia and Turkey growing at an annual average rate of almost 3.5% over the next 34 years, compared to just 1.6% for the advanced G7 nations of Canada, France, Germany, Italy, Japan, the UK and the US, (PWC, 2017).

The recent global Covid-19 pandemic showed vulnerabilities of a hyper-globalized world. This socio-economic disruption has already led to a discussion of global value chains and dependencies. One possible outcome is reshoring of strategic sectors, but it could also lead to more geopolitical cooperation and coordination.

The oil market turbulence caused by the Covid-19 oil demand destruction, the simultaneous increased supply by Russia and Opec, the production cuts onshore US and Canada, and the US diplomatic pressure for an Opec+ production cut agreement, has in combination demonstrated the global energy dependencies.

Many of the large, emerging economies such as China and India are big importers of petroleum, vulnerable to market fluctuations. This might be one of more drivers for such countries to increase their geopolitical influence, and also explain the desire for strategic energy investments domestically and globally.

4. MEGATRENDS

CHANGING SECURITY PARADIGM



Diversification of threats and actors is generating new challenges to the defense and security communities, as well as to society as a whole. The nature, scope and spectrum of conflicts and security are changing. The emerging security paradigm is framed by new asymmetrical warfare, increasingly easy access to increasingly powerful weapons, violent extremism, conflicting motivations, and a relatively chaotic organization of the parties involved.

The World Economic Forum Annual Meeting outline three main trends for the cyber security domain (WEF, 2020):

1. The east-west 'cyber cold war' is set to intensify
2. Emerging technologies could make us more vulnerable to cyberattack
3. Businesses will start to rethink their approach to the cloud

Security issues will become ever more important on the NCS. A heightened secure awareness should be built upon the world-class safety culture and performance of the Norwegian petroleum industry.

5. PESTEL-ANALYSIS OVERVIEW

Many of the external factors listed in the PESTEL-analysis below have been covered under the «Oil and gas fundamentals» section and the «Megatrends» section. External factors already discussed have been *highlighted in italic* and provided with links to relevant pages. The remaining factors are detailed out on the following pages.

Politics and policy:

- UN sustainability goals, [link](#)
- Ocean management plans, [link](#)
- *Climate change policy*, [link](#)
- *EU Green Deal*, [link](#)
- *Konkraft Road Map*, [link](#)

Economics:

- *NCS resources*, [link](#)
- *Investments - ESG concerns*, [link](#)
- *Players on the NCS*, [link](#)
- *Tax regime, exploration refund scheme, Covid-19 tax proposal*, [link](#)

Society:

- Industry reputation & society support, [link](#)
- Competence and access to talent, [link](#)
- *Security*, [link](#).

Technology:

- R&D trends N and EU, and global, [link](#)
- Energy transition, [link](#)
- *Digitalization, business models and data sharing*, [link](#)
- *Fuel switch (BEVs, FCEVs, etc.)*, [link](#)

Environment:

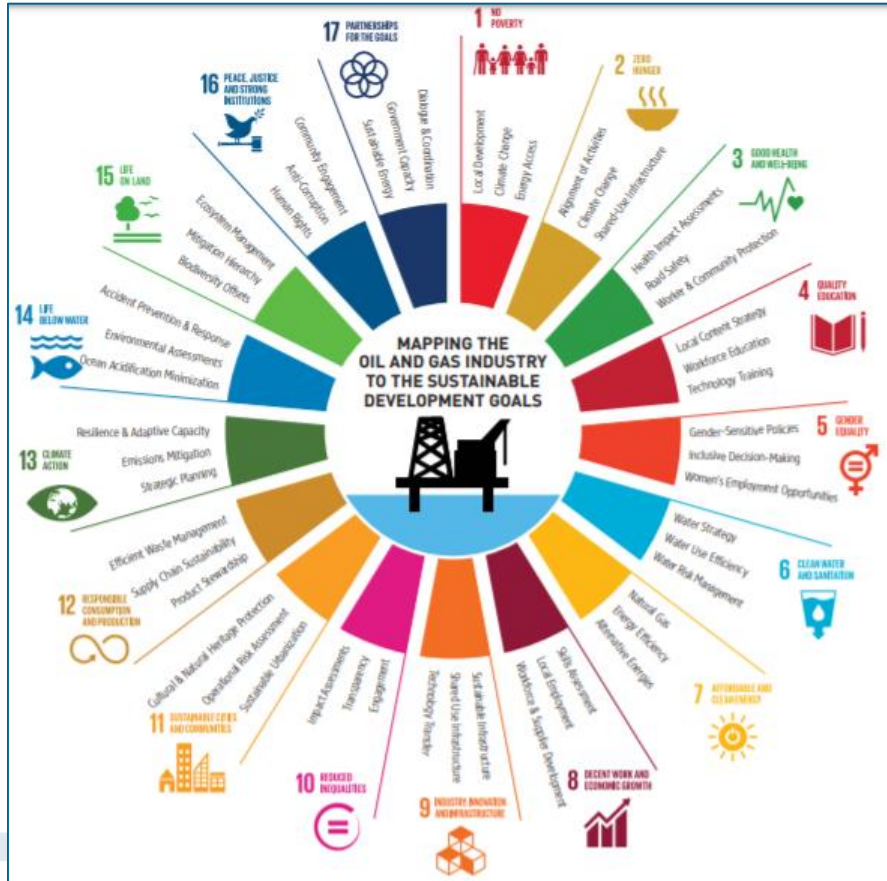
- *Climate change*, [link](#)
- *ESG responsibility full value chain*, [link](#)
- *Biodiversity (part of UN goals and ocean mngmt.plans)*, [link](#)
- *Oil spill preparedness (part of ocean mngmt.plans)*, [link](#)

Rules & regulations:

- *NCS licensing rounds (part of ocean management plans)*, [link](#)

5. PESTEL-ANALYSIS

POLITICS AND POLICY – UN SUSTAINABLE DEVELOPMENT GOALS



"The Sustainable Development Goals are a call for action by all countries to promote prosperity while protecting the planet. They recognize that ending poverty must go hand-in-hand with strategies that build economic growth and address a range of social needs including education, health, social protection, and job opportunities, while tackling climate change and environmental protection." (UN, 2020)

The global oil and gas industry association for advancing environmental and social performance (IPIECA), the United Nations Development Programme and the International Finance Corporation describe in their joint report, Mapping the oil and gas industry to the Sustainable Development Goals (SDGs), how the oil and gas industry can most effectively contribute to achieving the goals (IPIECA, 2017).

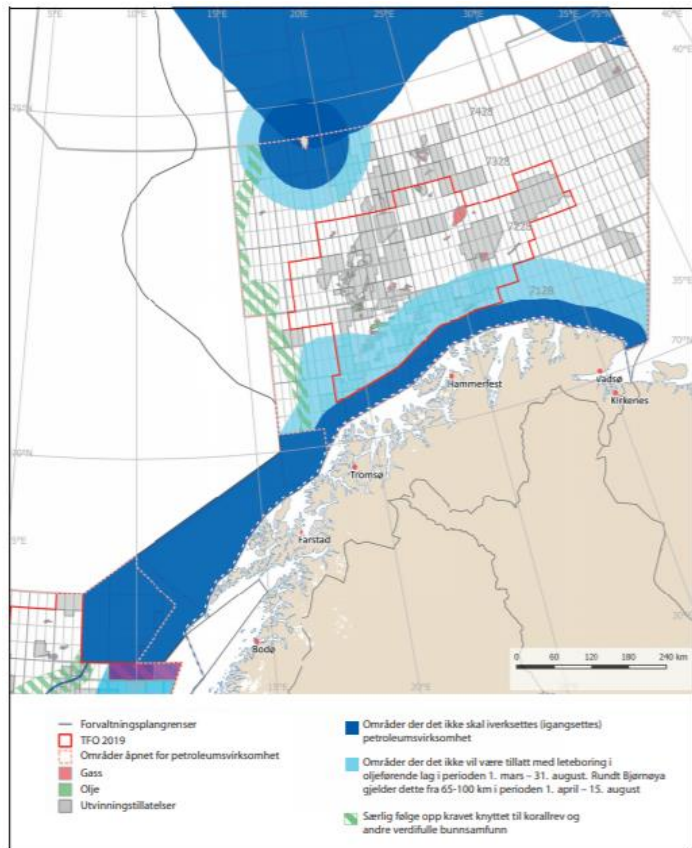
According to the report, the O&G industry has the opportunity to contribute to all SDGs, but the following appear as the most relevant:

- SDG 7 – Affordable and clean energy
- SDGs 13, 14 and 15: Climate action and life on land and in water
- SDGs 8 and 9: Economic development and innovation
- SDGs 3 and 6: Health and access to clean water

The SDGs illustrate that human prosperity and quality of life are depending on a variety of factors that are interwoven, and that none of the goals should be considered in isolation. For Norway and the NCS, the implications are that we should continue to deliver affordable petroleum to a growing global population, and at the same time work to reduce the environmental footprint associated with the NCS production and support efforts to de-carbonize the energy mix.

5. PESTEL-ANALYSIS

POLITICS AND POLICY – MANAGEMENT PLANS NORWEGIAN WATERS



The holistic and eco-system based management plans for Norwegian waters have been updated in a recent white paper from the Government, Meld. St. 20 (2019–2020). The purpose of the management plans is to coordinate and prioritize economic activities, and facilitate co-existence between industries. The latest revisions of the plans have put special emphasis on climate and the effects of climate changes.

The management plans state that established practices and requirements for licensing rounds will be continued, e.g.: subject to public hearings; the latest available knowledge on environmental impacts from petroleum activities will be applied; due concerns to coral reefs and sea bottom life; strive for reduced impacts from seismic.

In addition, the management plans provide details on the licensing of new acreage specific to each part of the NCS, i.e. the North Sea, the Norwegian Sea and the Barents Sea.

As described in the section on petroleum resources on the NCS, the Barents Sea is believed to hold two thirds of the estimated undiscovered resources on the NCS, and the area is therefore important for the long-term activity on the NCS. The revised management plan introduces a new definition of the ice edge zone. No petroleum activity is allowed from this zone Northwards. Another change is the extension of restriction zones for exploration drilling in the period March 1st – August 31st, increasing from 65 to 100 km from shore.

The ice edge zone and other areas closed or with restrictions for petroleum activities, are shown on the map to the left. Areas outside Lofoten, Vesterålen and Senja are closed also for consequence assessments until year-end 2021.

Implications for the petroleum industry: The management plans continue established practices for licensing of acreage with environmental assessments and concerns as central elements.

5. PESTEL-ANALYSIS

SOCIETY – SUPPORT FOR THE O&G INDUSTRY UNDER PRESSURE

KLASSEKAMPEN Venstresidas dagsavis **PRØV AVISA GRATIS I 1 UKE!**

Forsida Innenriks Utenriks Kultur og medier Meninger Biblioteket Dagens

Mandag 30. desember 2019

Vi er fortsatt oljetørste, viser undersøkelse:

De yngste vil bore mer

Facebook Tweet Skriv ut

FAKTA

Olje-Norges framtid:

- 49 prosent, og et klart flertall, mener Norge bør fortsette å bore etter olje og gass.
- Det framkommer i en spørreundersøkelse gjort at Sentio Research på oppdrag fra Klassekampen.
- Spørsmålet er: «Bør Norge åpne nye områder for olje- og gassvirksomhet?»
- 27,7 prosent av de spurte svarte «nei» og 23 prosent svarte «vet ikke».
- Undersøkelsen er gjennomført fra 13. til 19. desember blant 1004 respondenter.

alderssegmentene, men klart høyest blant de spurte mellom 18 og 22 år med hele 58 prosent.

FLERTALL: Halvparten av oss mener Norge bør åpne nye områder for olje- og gassvirksomhet. Størst flertall finner man blant de yngste.

MÅLING

2019 var året der hundretusener av ungdom verden over streiket for klimaet med svenske Greta Thunberg i spissen. Likevel mener et stort flertall av de yngste at Norge bør åpne for mer olje- og gassvirksomhet. Det viser en fersk spørreundersøkelse fra Sentio Research på oppdrag for Klassekampen.

Totalt mener 49 prosent av de spurte mellom 18 og 80 år at Norge ikke bør la olja ligge. Bare 27,7 prosent vil ha en slutt på oljeeventyret. Andelen av dem som er for mer olje- og gassutvinning, er høy i alle de fire

There is an on-going debate in Norway about the future of the domestic oil and gas industry. Topics that receive attention include:

- Licensing of new acreage, both in numbered rounds and APA rounds
- Definition of the ice edge in the Barents Sea
- Permanent closure of LoVeSe for petroleum activities
- Defining a set close-down year for Norwegian petroleum production

Traditionally the debate related to NCS activities were related to pollution risks and coexistence with industry, especially the fisheries. Over the last decade GHG emissions and Norway's contribution to climate change have come to dominate the discussions, even for those topics where it previously would be logical that potential local effects cause concerns.

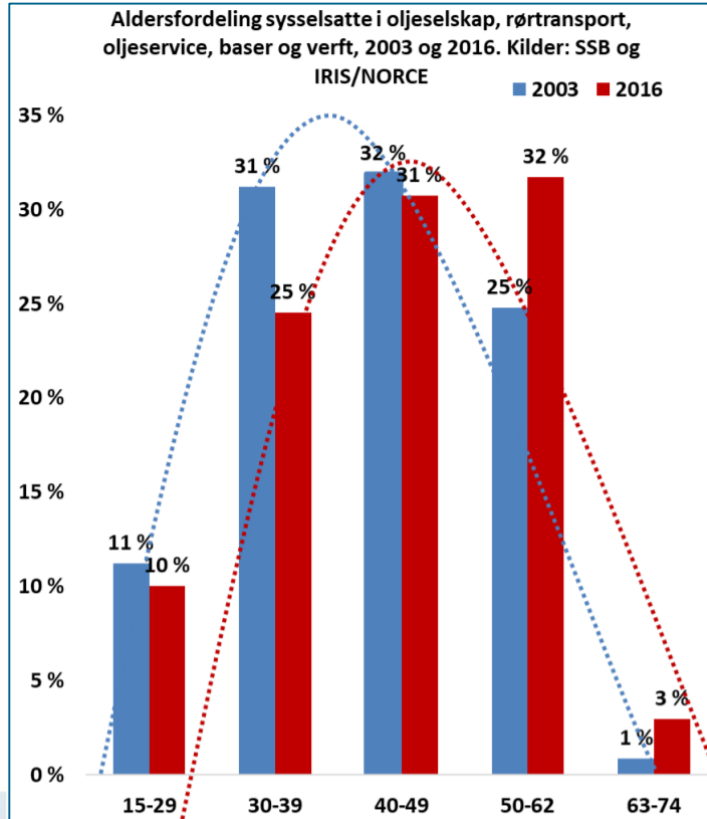
There is still considerable support for opening up new areas for oil activities among Norwegians. A poll in in December 2019, conducted for Klassekampen, revealed that 49% of the people interviewed supported the opening of new areas, whereas 28% were against. 23% had not decided. Among the 18-22 year age group, 58% supported the opening up of new areas. A similar poll conducted by Klassekampen in 2018 suggested the same level of support in general for opening up new areas, but with less support from younger people. A study from Cicero (2019) suggests that 30% of Norway's population wants to reduce the oil production, whereas 40% are against reducing the production.

At the same time, the majority (~70%) of the Norwegian population believes that humans are responsible for climate change, and 35% are to either some extent or to a high extent concerned (Cicero, 2019).

Implications for the O&G industry in Norway: Expect reduced support for petroleum activities in the population as concern for climate change increases.

5. PESTEL-ANALYSIS

SOCIETY – COMPETENCE, HUMAN CAPACITY AND ACCESS TO TALENT



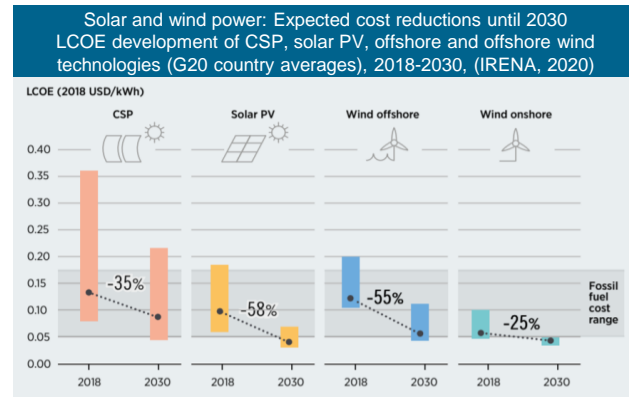
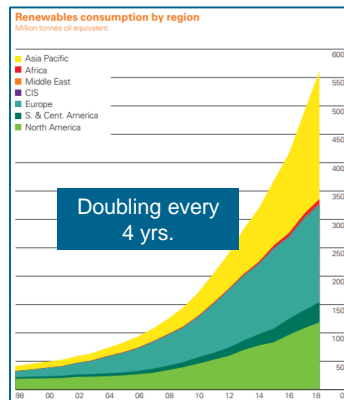
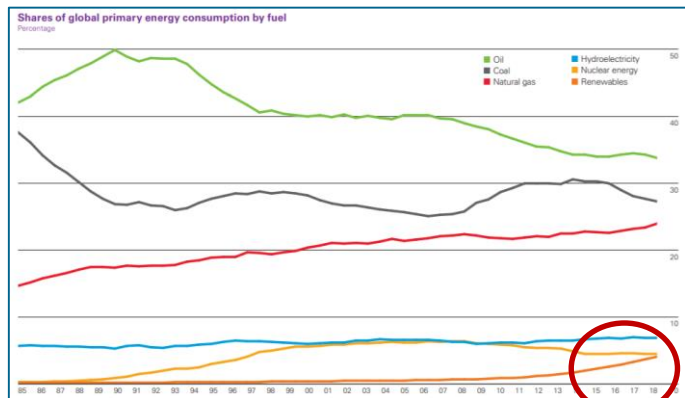
The average age of people working in the Norwegian oil industry is increasing. In 2016, 35% of the workforce was above 50 years old as compared to 26% 12 years earlier (NORCE, 2018).

Low applications over time to petroleum studies indicate a reduced attractiveness of the industry to young people. The underlying cause is probably a combination of a perception of a polluting sunset industry and uncertainty about job security.

However, most new hires to the oil and gas industry come from other disciplines like STEM, economics and legal. The talent pool is plentiful, but the future access to new talent might be dependent upon an improved reputation as well as positive employment signals from the industry. Delivering on the new Konkraft roadmap for reducing CO₂-emissions will hopefully contribute to improving the industry's reputation. Regarding employment signals, rapid downsizing as a response to low-cycles as most recently with the Covid-19 situation may please investors with quarterly perspectives, but will hurt the long-term competitiveness and profitability of the industry.

5. PESTEL-ANALYSIS

TECHNOLOGY – ENERGY TRANSITION HAPPENS FAST



The energy transition towards renewables is driven not only by a de-carbonization pressure from governments, investors and the public, but also more and more by project economics. Until recently growth in renewables such as solar and wind required subsidies to prove profitable. Renewable projects have become profitable w/o subsidies, and with further scale-up effects, could become even more competitive with fossil fuel projects (IRENA, 2020).

The growth of renewables, excluding hydropower, has been exponential over the last decade with a doubling rate of 4 yrs. (BP, 2019). Current renewables consumption equals a modest 1.5 mmboe/d, but if the current trend continues, the consumption could reach an equivalent of 12 mmboe/d in 2030 and close to 50 mmboe/d by 2040. By comparison, the current oil demand for fuel to light vehicles is around 23 mmboe/d.

European oil companies are becoming energy companies by taking large positions also in renewables. Total is the largest in renewables today, followed by BP, Shell, GALP and Equinor. Looking a few years ahead Equinor has the most ambitious plans, followed by Shell. US based oil companies are so far virtually non-existent in this domain (Rystad Energy, 2020).

NCS implications: Long-term downward pressure on oil and gas prices as a result of substitution with renewables. Need to de-carbonize gas value chain.

5. PESTEL-ANALYSIS

TECHNOLOGY: ATTRACTIVE FRAME CONDITIONS STIMULATE R&D



Illustration: NTNU/Sintef Ocean Space Center



R&D and the resulting competence and technology has been key to the successful development of the NCS and the development of a globally competitive Norwegian supplier industry. It holds the promise of continuing to unlock vast value and also reduce environmental impact in the decades to come (Rystad Energy, 2020b). A close collaboration between academia and the industry is important. It ensures that the research is relevant for the industry and it provides the industry access to state of the art knowledge.

Important elements of the petroleum R&D system in Norway are:

- FOT (the “Research and Technology” arrangement) - a tax deduction arrangement for oil and gas companies.
- Direct public funding of R&D through the RCN programs Petromaks2, Demo2000 and Petrocenters.
- SkatteFunn – a tax deduction arrangement for industry enterprises.

The FOT-arrangement follows cycles in the oil market, and low oil prices therefore have immediate effects on oil companies R&D investments. Research institutes get a significant part of their funding directly from the industry, and are therefore especially vulnerable. The Norwegian Government has shown willingness to counteract the cyclicity through R&D stimulus packages in 2016-17 and recently in the Covid-19 package.

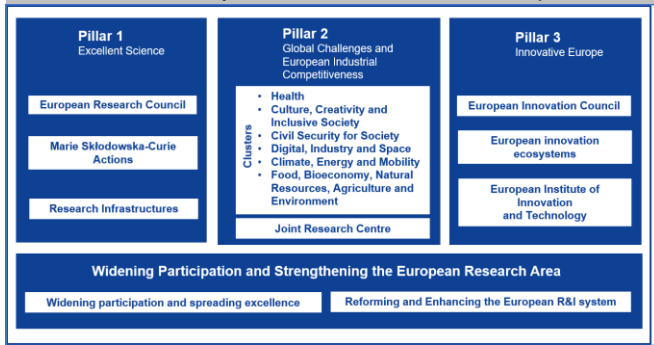
R&D frame conditions are important to convince industry enterprises to invest their resources and time in Norway, since also other petroleum provinces in the world are competing for the attention and investments of industry enterprises. Brazil, Canada and the UK all have attractive programs and co-funding schemes in place. For example, Brazil has introduced a requirement that 1% of the oil companies' sales revenues have to be used for R&D, of which 50% would have to be spent on services from academia and the other 50% on R&D conducted by the oil company and its partners (including suppliers). It is a requirement that the R&D is primarily carried out in Brazil.

Implications for Norway and the NCS: There is a global competition for industry R&D, and the R&D frame conditions have to be attractive.

5. PESTEL-ANALYSIS

TECHNOLOGY: EU R&D PROGRAMS OFFER OPPORTUNITIES AND IDEAS

Preliminary structure of Horizon Europe



Horizon Europe's 5 mission areas:

1. Adaptation to climate change including societal transformation
2. Cancer
3. Climate-neutral and smart cities
4. Healthy oceans, seas, coastal and inland waters
5. Soil health and food

The EU Research and Innovation program Horizon 2020 (H2020) has committed nearly €73 billion of funding over the years 2014 to 2020. Norwegian R&D players have been awarded 2.2% of the available funds, which is above the target of 2%. The cost-benefit ratio has been evaluated as positive (SA & Technopolis, 2020).

Petroleum R&D has not been part of the scope for H2020, but according to the RCN, several research areas covered by the program have been relevant to the petroleum sector. Statistics on how much petroleum related R&D funding Norwegian enterprises have obtained through H2020 has not been collected, but anecdotes suggest that oil companies as well as oil sector suppliers have been successful in obtaining funding.

A new EU R&D program, Horizon Europe, is in the making. The European Parliament and the Council of the EU reached in April 2019 a provisional agreement, and the Commission has begun a strategic planning process. Horizon Europe will start in 2021.

Implications for Norway, the NCS and OG21: It is at this point in time hard to identify specific opportunities for petroleum relevant R&D in Horizon Europe. As for H2020, petroleum R&D does not seem to be part of the scope directly, but relevant opportunities embedded in other areas should be identified and pursued.

Horizon Europe differs from H2020 in a “Missions” approach rather than a system approach. Missions are defined as specific challenges that need to be solved within a certain time frame and budget. OG21 should investigate if elements of such an approach also could be used in the up-coming OG21 strategy revision.

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