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DIALOGUE

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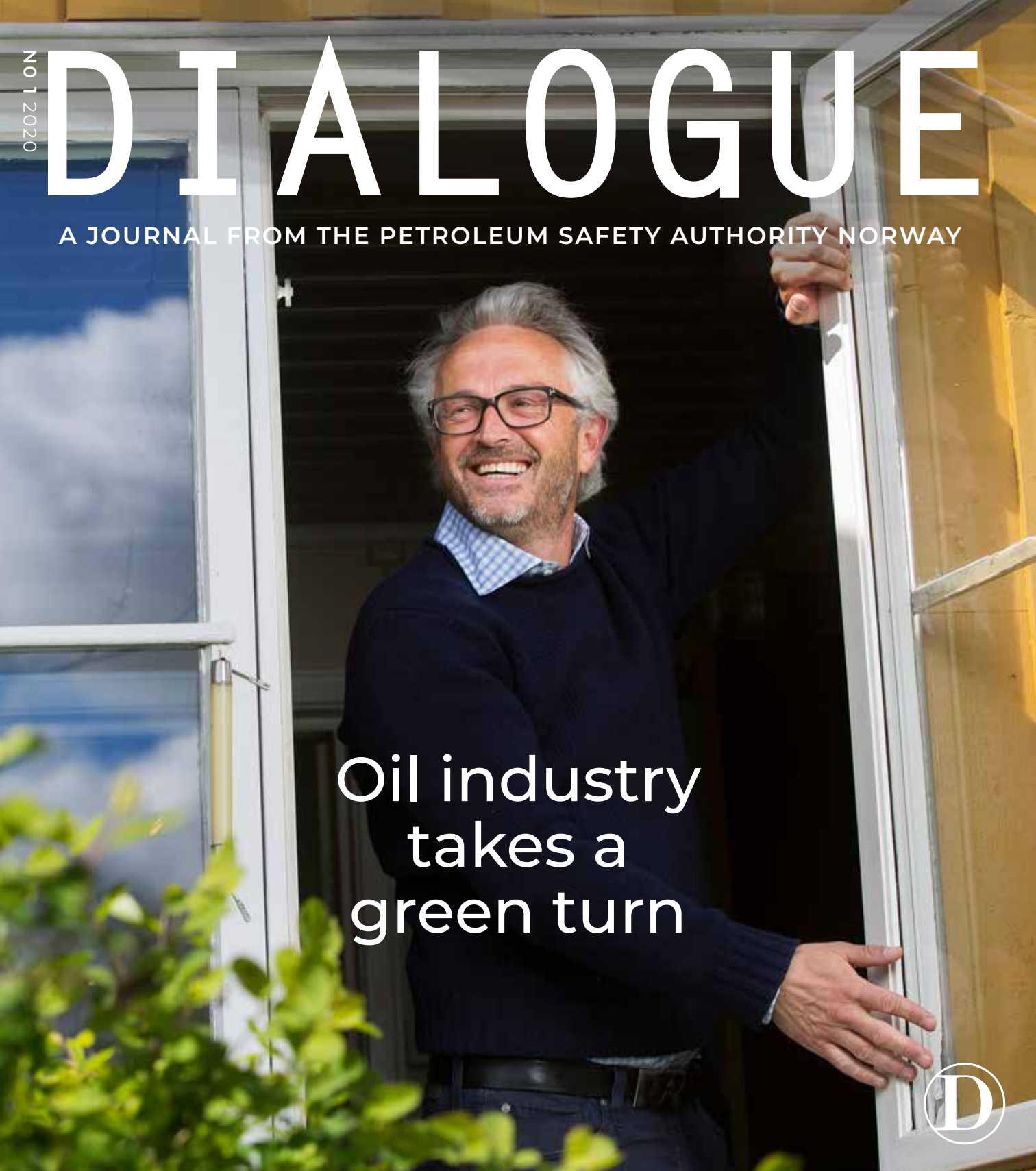

Oil industry takes a green turn

Going like the wind

Harnessing offshore wind power (OWP) has picked up speed over the past two decades, and the way has been opened on the NCS during 2020 for major developments in this sector.

The Utsira North and Southern North Sea II areas cover 3 600 square kilometres of the NCS between them, and could yield up to 4 500 megawatts (MW) of OWP. That would be enough to meet the needs of more than a million Norwegian homes.

Responsibility for the safety of OWP development and operation on the NCS has been allocated to the PSA. This is a new area for us, but we have both the specialists and the experience required.

This issue will look more closely at what OWP involves, what risks it poses, and how the new industry can be supervised.

We will also be looking at how the OWP sector itself is thinking about safety, and at why big oil companies are now making such a heavy commitment to green energy. Are they driven by pressure, politics or profit?

Enjoy
Øyvind Midttun
Editor

Front cover: Rapid growth in renewable energy is an important part of Equinor's climate plan, sustainability head Bjørn Otto Sverdrup reports in this issue of Dialogue. *(Photo: Sverre Chr Jarild)*

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BY ØYVIND MIDTTUN

Wind powers in place

The safety of renewable energy generation on the NCS has been added to the PSA's supervisory responsibilities by a government decision on 17 August 2020.

Photo: Ingimage

This means that the authority will be in charge of developing regulations for and supervising the development and operation of offshore wind turbines.

Director general Anne Myhrvold is gratified that new duties have thereby been delegated to the PSA – outside the petroleum sector.

"This represents recognition of our broad safety expertise," she comments. "Offshore wind power [OWP] has much in common with petroleum activities, and we'll ensure that good care is taken of its safety through effective regulation and supervision.

"Although OWP is a new field for us, we have long experience of following up industrial operations offshore and the technical expertise needed to monitor this sector in a good way."

Development The PSA has already been involved with OWP through Equinor's Hywind Tampen development in the northern North Sea, which ranks as the first project of its kind on the NCS.

Due to become operational in 2022, this scheme is intended to generate electricity for use on the nearby Snorre and Gullfaks oil fields.

Since Hywind Tampen is closely integrated with offshore operations on the NCS, the government has handled it in accordance with Norway's established petroleum regulations.

But it is recognised that a dedicated regulatory regime covering HSE in the OWP sector needs to be developed for future projects.

Experience This work is now under way and will build on experience from the oil and gas sector, reports Sigve Knudsen, director of legal and regulatory affairs at the PSA.

"Our starting point will be the HSE regulations for petroleum operations, with performance-based requirements and a risk-based approach," he explains. "But the content of an OWP regime will be different because other risk conditions apply.

"The experience we've gained with Hywind Tampen has shown that entrenching the regulations in specific risks for OWP works well. No major regulatory challenges have arisen in this process."

Knudsen observes that, although OWP is a relatively young business, it has made rapid progress and adopted important safety principles from more mature industries – such as petroleum.

"We see, for example, that a number of standards and best practices have been developed. These can be used as normative references in performance- and risk-based regulations."

Common OWP and the offshore petroleum sector share common features with regard to both technological and operational solutions, and for the various phases of these activities.

That includes design, construction, installation, operation, maintenance and removal, while the two industries also have a number of parallels in risk terms.

The biggest difference between them is that the dominant petroleum-related risk associated with handling large quantities of oil and gas under pressure is naturally absent from OWP.

This means in turn that major accident risk is substantially smaller for the latter. But OWP nevertheless has a potential for big incidents involving multiple fatalities.

Leaders Although OWP is a relatively new industry, it has made more progress in certain other countries. The UK, Germany, Denmark and the Netherlands are the European leaders by installed capacity.

HSE regulations vary between these countries, but a common denominator is that they have all placed regulatory authority with the same agency which supervises petroleum operations.

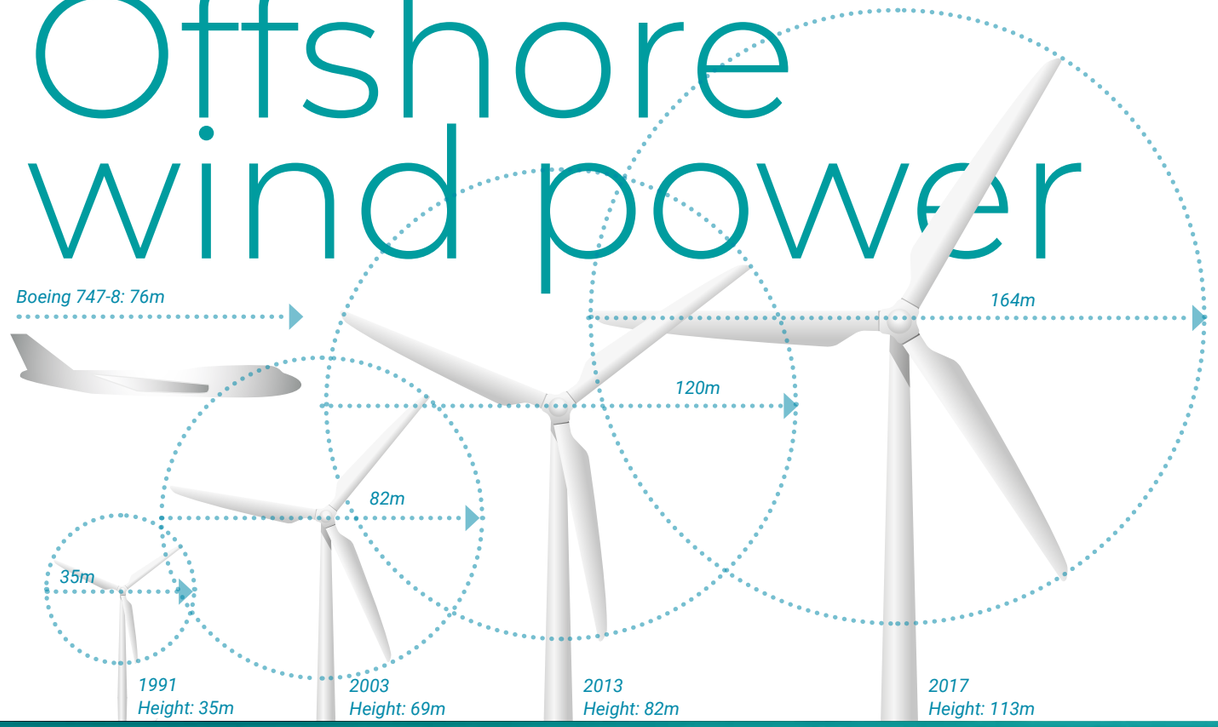
In the USA, too, OWP regulation has been allocated to the Bureau of Safety and Environmental Enforcement (BSEE) along with oil and gas supervision.

So Norway's allocation of responsibility for this sector is in line with the approach adopted by several other countries. *

OWP is a new field for the PSA, acknowledges director general Anne Myhrvold. "[But] we have long experience of following up industrial operations offshore and the technical expertise needed to monitor this sector in a good way."

BY ØYVIND MIDTTUN

Offshore wind power



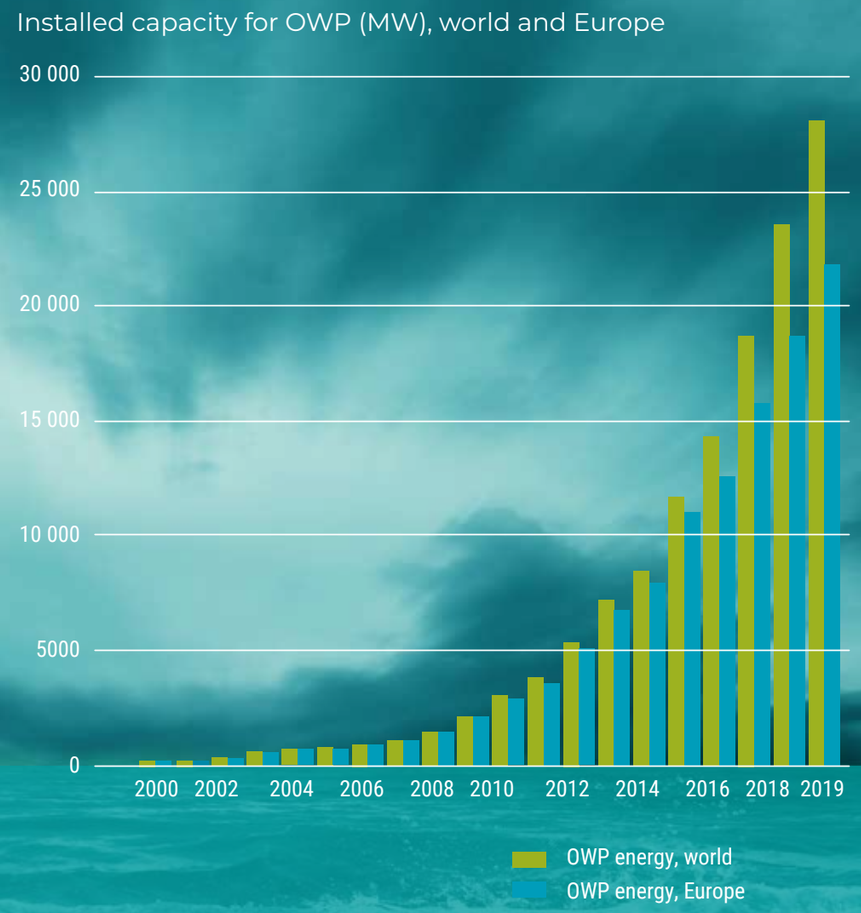
Wind-turbine dimensions are growing as the technology advances. The reason is simple – the longer the blades and the larger the area of rotation, the more energy is captured and the more electricity is generated. This diagram draws on information from Danish energy company Ørsted.

ENERGY

Wind turbines generate electricity by converting the kinetic energy in moving air. The turbine blades capture this power for transfer via a drive shaft to the generator housed in the nacelle.

These blades can be adjusted to optimise utilisation of the available wind energy, depending on its direction and strength.

A modern wind turbine rotates when air speed at the rotor hub lies between three and 25 metres per second. Its output is normally highest with a wind strength of roughly 13 m/s.



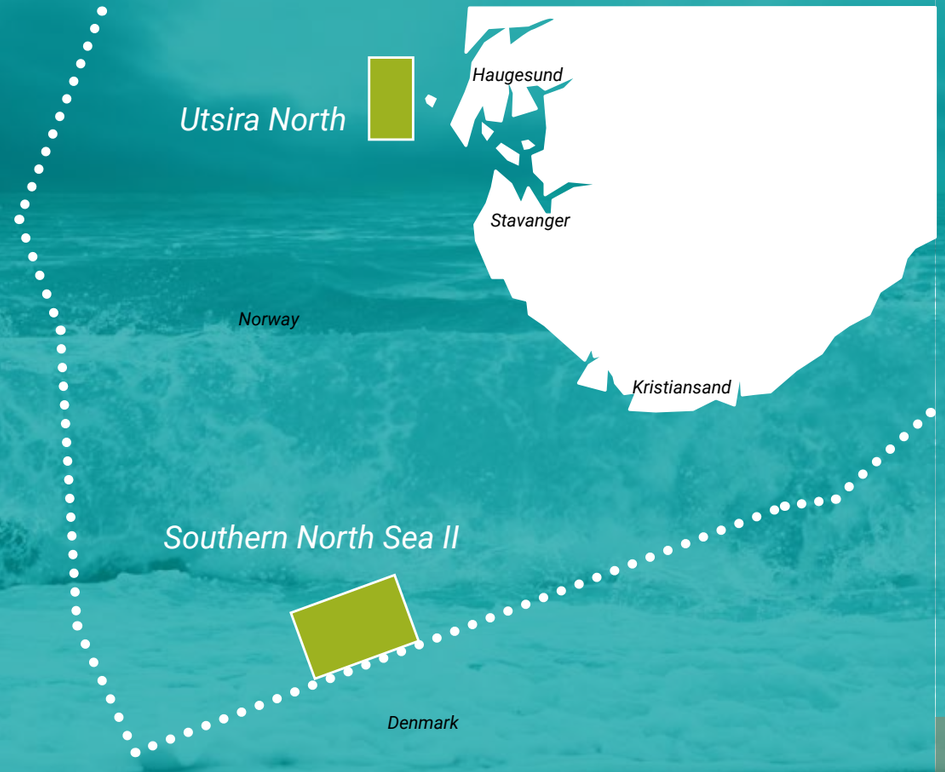
This graph illustrates how the expansion of OWP has gathered pace over the past two decades. Europe has so far dominated, accounting in 2019 for no less than 21 831 MW of 28 155 MW in total installed capacity worldwide. The figures come from the International Renewable Energy Agency (Irena).

OFFSHORE

Winds at sea are often stronger and more stable than on land.

The government has opened two areas of the NCS for wind power development – Utsira North, suitable for floating turbines, and Southern North Sea II, which is also appropriate for fixed units.

Water depths on the NCS mean that floating turbines offer the biggest potential for offshore wind power (OWP).

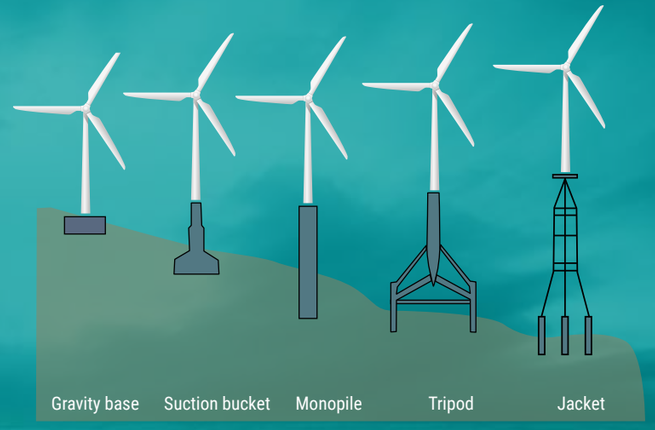


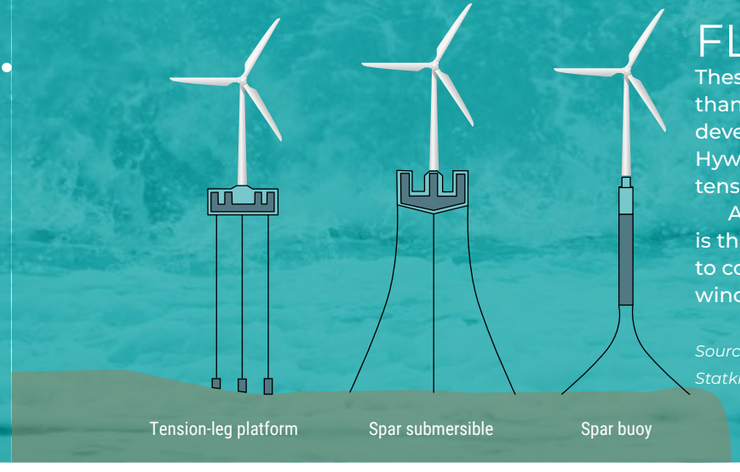
FIXED TURBINES

These can currently be installed in water depths down to 60 metres, and have so far accounted for the bulk of OWP capacity installed or under construction worldwide.

Many different types of foundations are available for such units, including jackets, suction buckets and gravity base structures (GBSs).

The choice of solution depends on the water depth and seabed conditions at the turbine installation site.





FLOATING TURBINES

These must be used today in waters deeper than 60 metres. Various technologies are under development, such as the spar buoy used for Hywind Tampen, semi-submersibles and tension-leg structures.

A common denominator for these solutions is that the floater must provide sufficient stability to cope with high waves, currents and challenging wind conditions.

Sources: Norwegian Water Resources and Energy Directorate, Statkraft, snl.no, Equinor and Ørsted.

BY ØYVIND MIDTTUN

Joining forces to stay safe

The offshore wind power (OWP) sector is making active efforts to improve its safety, and much of this work rests on principles already applied in the petroleum sector.

OWP presents many of the same safety challenges as oil and gas," explains Tove Lunde, chair of the Global Offshore Wind Health and Safety Organisation (G+).

"The big difference is the absence of hydrocarbons, but we have lifting and marine operations, work in enclosed spaces, high voltages, dropped objects, hand tools and work at a height."

Originating in the UK, G+ was established after a period with several accidents and serious incidents in the wind power sector, both on land and offshore.

The industry and government therefore realised that a more structured approach to safety was required, along with closer collaboration between the companies.

"There was a definite need to join forces as an industry," Lunde reports. "Since we put incident reporting in place among our members in 2014, no fatal accidents have – touch wood – been reported from our operations."

The systematic approach and methods applied to safety work in G+ have a number of parallels with the petroleum sector, including mapping of risk and broad collaboration.

Similarly, experience transfer and learning from incidents occupy a key place alongside incident reporting in the wind power industry's work on safety.

Reporting The present commitment by G+ members to reporting undesirable incidents in their

The systematic approach and methods applied to safety work in the OWP industry has a number of parallels with the petroleum sector. (Photo: Scanpix)

operations makes it possible to see where these are concentrated and where safety efforts should be directed.

"Good data and statistics are a key focus," says Lunde. "That gives us the facts we need to produce good analyses and identify causes, understand problems and recommend action."

Harmonisation and quality assurance are important for drawing comparisons and conducting analyses, she adds.

"We've worked for a long time to harmonise across our members, and this is becoming good. We see that both quality and reporting are increasing. Reporting on near misses has also got better."

Information on incidents is used to produce annual statistics showing trends in the level of safety, she says. Incident reporting forms the basis for developing best-practice documents.

"The G+ collaboration also makes it possible for new and smaller players to secure guidelines, standards and requirements," Lunde explains.

"As a member, you're required to reflect the standards, and we thereby contribute to raising the overall level. That's an important goal for us."

Design One priority for G+ is to build health and safety into structures, with efforts made to identify improvements at the design stage for OWP projects. Various issues are attracting attention.

Both technical and organisational approaches are being pursued, and proposed improvements may concern specific changes to designs or amendments to standards, guidelines and best practice.

The goal is to reduce the number of incidents, improve efficiency and enhance the level of safety, and Lunde highlights lifting equipment as an example of innovative thinking.

"Davit cranes on the turbines are used to transfer equipment and tools from/to vessels. At one time, they were involved in many incidents such as crushed fingers and dropped objects.

"By taking a collective look at this, the companies have arrived at improved designs and operating procedures which mean fewer incidents from crane operation."

Crucial "Design is important, and getting involved at an early stage is crucial," Lunde emphasises. "If you're going to exert influence, it has to be during development work.

"The suppliers have traditionally been responsible for this with turbines. Once the design is chosen, less scope exists to make changes and you're more or less stuck with what you've got."

Turbine manufacturers occupy a key position in the industry, and play a central role in both designing their own equipment and in the development and operation of wind farms.

Increasing accountability and inclusion are thereby important arguments for getting the manufacturers to join G+. Siemens Gamesa is the first to have done so.

Learning Another priority is learning from incidents. G+ has opted for the Toolbox solution – originally developed by the oil and gas sector – for sharing experience and exchanging information.

This makes it possible for companies to search in work processes and to extract information which clarifies problem areas.

"Openness and sharing of knowledge and experience are important," Lunde emphasises, and notes that many players in the oil sector have very strong backgrounds.

"Equinor, my employer, has 50 years of petroleum experience, and our systems and way of working where safety is concerned are well established. We're taking this with us into the wind power sector and the G+ collaboration.

"OWP developments are also relatively complex, and we draw heavily here on our expertise and experience from oil and gas. We couldn't have done this without that knowledge."

Decline Figures from G+ show a steady decline in the number of registered personal injuries per million hours worked for the wind power sector between 2014 and 2018, from 6.2 to 4.5.

Unfortunately, Lunde reports, 2019 saw a rise to 5.5 – in part because the counting method was changed from the number of incidents to the number of injured people per incident.

"Combined with increased reporting, that explains a good deal of the negative trend – but not all," Lunde says. "So this is definitely something we'll be looking at more closely."

She believes that the most important job in the future will be to ensure that the level of safety is maintained and continuously improved.

Global European companies and wind farms dominate G+ at the moment. As its name indicates, however, the organisation's ambition is to become truly global.

The OWP sector is expanding rapidly in both Asia and North America, and G+ is currently establishing a presence in both these markets.

"It'll be crucial to maintain fundamental safety systems and build a culture for safety in these new regions as well," Lunde affirms.

Differences She also emphasises that, although OWP shares a number of common features with the petroleum industry, important differences exist in terms of both regime and economic preconditions.

"We must undoubtedly be willing to think a little differently. Health and safety is our top priority, but we must also develop our sector within prevailing parameters. That's tougher than for oil and gas – and to a greater extent margin-driven.

"But we'll be preserving what we've experienced and learnt about health and safety from the petroleum business – while also identifying cost drivers to get more safety for our money."★

FACTS

The biggest OWP risks

Figures from G+ show that incidents related to marine operations and to crane and lifting work make the biggest contributions to the risk picture for OWP.

The most serious injuries have the highest frequency on vessels (for personnel transport and accommodation, installation and so forth) and on the actual wind turbine.

G+ in brief

The Global Offshore Wind Health and Safety Organisation (G+) is a non-commercial interest body which works to improve health and safety in the OWP industry.

Equinor is the only Norwegian participant in the association, which comprises operators/owners of OWP farms, suppliers and grid owners.

While G+ is currently concentrated in Europe, it is now growing globally through a branch in Asia and has ambitions for a corresponding expansion in the USA.

The organisation's activities cover four main areas:

- reporting data on incidents
- guidance on good practice
- "safe by design" workshops
- learning from incidents.

"Health and safety is our top priority, but we must also develop our sector within prevailing parameters," says G+ chair Tove Lunde. "That's tougher than for oil and gas – and to a greater extent margin-driven."

BY ASTRI SIVERTSEN

Taking a three-lane road

Norway's biggest oil company has ratcheted up its own climate ambitions by several turns. And the goal of lower emissions and more renewable energy remains unchanged despite oil price cuts and the coronavirus crisis.

Sharp emission reductions, rapid growth in renewable energy and a lower carbon intensity are the key elements in Equinor's new climate plan. Sustainability head Bjørn Otto Sverdrup plays a key role in this work. (Photo: Sverre Chr Jarild)

Equinor presented an ambitious climate plan in February, setting targets for sharp emission reductions, rapid growth in renewable energy and a lower "carbon intensity".

Almost immediately afterwards, the world was hit by the coronavirus onslaught and oil prices went into free fall. But the climate strategy's goals are long-term and unchanged.

This assurance is provided by Bjørn Otto Sverdrup, senior vice president for sustainability at Equinor, despite the pandemic and lower revenues from the company's existing core business.

"Today's oil prices mean that everyone has a little less money than before to invest in new things," he says. "But I don't think we have any plans to put the future on hold and say 'we'll get back to this'. It doesn't work like that here."

Roadmap Equinor has designated its current climate strategy a roadmap – the third in its history. Published in 2008, the first aimed to reduce and preferably avoid greenhouse gas (GHG) emissions from the company's operations on the NCS.

This was succeeded by a second roadmap in 2017, which also introduced an emphasis on increasing Equinor's output of renewable energy.

"Our latest version confirms and extends the first, reinforces the second and launches a new main element in our strategic thinking," Sverdrup explains.

In his view, the revised roadmap shows that Equinor is now taking a fundamentally different approach to tackling the climate issue.

Near-zero Getting emissions down is the first part of the strategy, with the actual amount of GHG released in Norway to be cut by 40 per cent in 2030 and 70 per cent in 2020, and to reach near-zero in 2050.

"That's a very ambitious goal, which means that we'll be lowering our emissions faster than the Norwegian government's Climate Cure programme, for example," says Sverdrup.

In addition to enhancing energy efficiency, these cuts will be pursued through extending the use of electricity to eliminate emissions from gas-fuelled turbines, compressors and generators.

Equinor is working to achieve this in the Utsira area of Norway's southern North Sea and on fields which will be producing for many years to come – such as Oseberg and Troll. Many of these projects are due to be implemented by 2030.

Power from shore will also be adopted on the Halten Bank in the Norwegian Sea and at the Snøhvit gas liquefaction plant outside Hammerfest, but this probably has a longer time frame.

"Because oil and gas contribute up to 10 per cent of the world's CO_2 emissions, it's incredibly important to produce them with the smallest possible climate footprint," says Sverdrup.

Renewable Expansion in renewable energy is the second key element in Equinor's climate strategy, with its output in this area due to reach 12-16 gigawatts over the next 10-15 years.

That compares with its current output of four-six GW from renewable sources, and represents an average annual increase of 30 per cent.

This will be achieved through the large-scale development of offshore wind power (OWP), and the company is already well under way here.

Its biggest investment so far is the Dogger Bank project in the UK North Sea, which will alone generate enough electricity to supply 4.5 million British households.

"That's not only our biggest renewable development, but also our largest investment overall in the North Sea," says Sverdrup. "It's actually equal to phase I of the Johan Sverdrup field."

He also calls attention to the Empire Wind scheme in the USA, where 60-80 wind turbines are planned to supply more than 500 000 New York homes from 2024.

In addition comes the Hywind Tampen project in the Norwegian North Sea, where 11 floating turbines will generate power for the Gullfaks and Snorre fields from 2022.

Role The new third element in this year's roadmap update is the corporate goal of playing a role in the transition to a low-emission society.

"We want to change the composition of our products in order to reduce the climate footprint per unit of energy we deliver over time," explains Sverdrup.

Put another way, Equinor aims to reduce its carbon intensity – which measures the emission of GHG per unit produced.

That will be achieved in practice with the aid of carbon capture and storage (CCS) and by producing hydrogen from natural gas.

The company will be helping to develop these new low-carbon industries, which Sverdrup believes will be important business areas within a few years.

"Our approach to climate is now fundamentally different," he emphasises. "That'll come to determine a lot of what we're going to be doing in the time to come.

"We're very concerned to work long-term, and try to be thorough and robust in everything we do. Overall, we believe today's energy system is unsustainable and needs to change."

He adds that, while petroleum will be required for many years to come, it is very important to produce the right oil and gas with the lowest cost and GHG emissions.

Equinor is convinced that its new strategy can improve its competitiveness, Sverdrup says.

"While cutting GHG emissions was earlier viewed perhaps as a cost, we now see it as providing a competitive edge – and a way to make our business more robust."

He explains that releasing CO_2 may become more expensive in the future, and that government regulation could get tough. A commitment to renewables will help to spread risk and better protect the company from price and demand fluctuations.

Profitability Both analysts and investors have questioned the profitability of Equinor's new course. Sverdrup notes that a petroleum project typically had a return of 10-20 per cent or more before the pandemic and slumping oil prices.

That is very high compared with other sectors. The return on the company's renewable energy portfolio is six-nine per cent, which it hopes to increase to 10-12 per cent.

"But when we talk about profitability, we need to look at both risk and return," Sverdrup observes, and notes that the oil sector is exposed to big price fluctuations.

"It also involves much greater geological and safety risks – major accidents, for example. That's another reason why renewable projects are interesting. They help to safeguard cash flow.

"We've never said that renewables can compete with super-profitable oil projects, but they're a very significant part of our portfolio."

He adds that some of the renewable projects "have very interesting profitability". Moreover, Equinor is working to learn how it can reduce costs.

"Some renewable projects are actually more profitable than oil developments after the coronavirus. Changes have been very abrupt, which shows that modelling future profitability is difficult.

"In any event, it's strategically important to be ahead of the energy transition. We and Norway's oil industry have a competitive edge here, and a lead over the rest of the world.

"We'd dealt with our emissions on the NCS a decade before other people began to be concerned about cutting them. And it's a long time since we began to transfer power from shore."

Exploit Sverdrup maintains that companies and the authorities should exploit this advantage to develop solutions which lead the way into a new energy future.

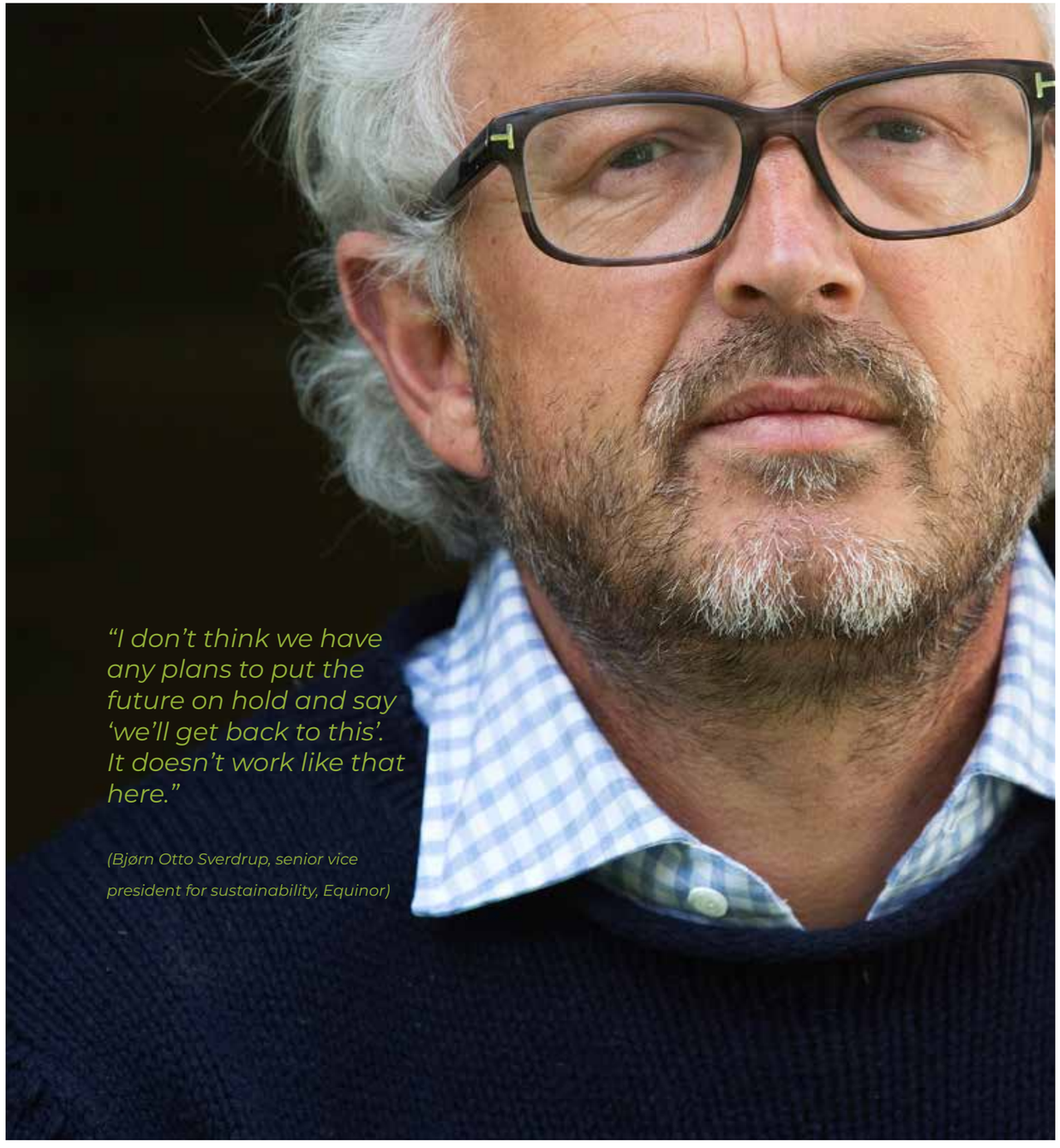
"That can by all means take the form of a public-private partnership, like Hywind Tampen and the Northern Lights CCS project."

In his view, the fact that such developments need to receive government support does not present any obstacles to getting on with them.

"The oil industry has yielded several thousand billion kroner in revenues to society. We now have to stake out new paths and apply the knowledge we've acquired to building a new industry." ★

SUSTAINABILITY This word is used in many different contexts today, but goes back to the final report of the UN's World Commission on Environment and Development in 1987.

That defined sustainable development as "[meeting] the needs of the present without compromising the ability of future generations to meet their own needs".



"I don't think we have any plans to put the future on hold and say 'we'll get back to this'. It doesn't work like that here."

(Bjørn Otto Sverdrup, senior vice president for sustainability, Equinor)

BY ASTRI SIVERTSEN

Harmonising commerce and climate

Demands for emission cuts mean that a number of oil companies are now making a commitment to renewable energy. But can offshore wind power (OWP) ever be as profitable as petroleum?

"Pressure on the industry is constantly increasing, with investing in it viewed as risky," Wood Mackenzie analyst Valentina Kretzschmar observes. "By comparison, renewable projects offer clear advantages." (Photo: Wood Mackenzie)

The petroleum industry has long been having a rough time of it, even before the coronavirus pandemic caused oil prices to tumble.

Governments and owners are calling for CO_2 emission cuts, investors are withdrawing their money, and newspapers are refusing to accept fossil-fuel advertisements.

At the same time, artists are turning down grants from oil companies while young people demonstrate in the streets and call for an end to all petroleum operations.

"The companies are being leaned on heavily from a number of quarters," agrees Valentina Kretzschmar, vice president for corporate research at global analyst Wood Mackenzie.

"Pressure from institutional investors has grown so much in the past couple of years that you can no longer operate as a big European oil company without a strategy for cutting emissions. That's quite new."

This trend particularly affects the big European players, whose governments want them to take account of society and the environment, and not just shareholders.

Clear goals for reducing greenhouse gas (GHG) emissions have also been set by these countries, while consumers are turning their fire on the companies when such targets fail to be met.

Some oil companies are responding by investing more in renewable energy, some are pulling out of petroleum altogether – and others are continuing as before.

Return Kretzschmar maintained in 2019 that it was almost impossible for oil companies to expand renewable energy operations if these had to compete with much higher returns from petroleum projects.

"That was true when oil fetched USD 60 per barrel, but not if the price is down to USD 35," she now says. "At this level, renewables can give the same return as oil and gas developments."

A report she issued in March asked if clean energy could be the winner in the oil price war, and concluded that the pandemic and low oil demand had speeded the transition to renewables.

"What we'd expected, on the basis of our models, to happen 10-15 years into the future is now playing out right in front of our eyes," Kretzschmar says.

Even if oil prices rise again, which Wood Mackenzie expects to see from next year, petroleum is no longer as attractive as it used to be.

"Pressure on the industry is constantly increasing, with investing in it viewed as risky," Kretzschmar observes. "Big price fluctuations also create uncertainty, and oil projects cost a lot.

"By comparison, renewable projects offer clear advantages, with less risk, lower CO_2 emissions and smaller costs. Many oil companies therefore appreciate that it pays to diversify."

She has also noted an internal change of attitude in some of the oil companies.

"The great majority prefer to react to external pressure. But we're now starting to see some actually taking responsibility for reducing the damage caused by climate change."

Kretzschmar includes Equinor among the big European players and sees the company making a strong commitment to OWP. It has been joined by others, including Shell and Total.

In her view, OWP fits extremely well with the core competence of these companies and allows them to transfer knowledge and skills.

"They can use these capabilities to develop this new growth sector. We actually believe that OWP could deliver returns and cash flows familiar from petroleum projects."

Pace According to Hildegunn T Blindheim, director for climate and the environment at the Norwegian Oil and Gas Association, the change of pace on renewables can be dated to December 2018.

That was when the EU published *A clean planet for all* – a strategy document which recommended moving to net zero emissions by 2050.

Two months earlier, the UN intergovernmental panel on climate change (IPCC) had published its assessment of the difference between global temperature rises of 1.5°C and 2°C.

"The seriousness of climate change is indisputable," Blindheim notes. "A clear course was set by the EU, and we understood the need to raise our game and define new and more ambitious goals."

Measures in the EU have largely concentrated on developing renewable energy, but the emission problems cannot be resolved by increased use of clean electricity alone.

Europe has industries which must reduce the amounts they emit. Steel mills and cement plants consume too much current and heat for this energy to be replaced by sun and wind.

When gas-fired power stations cannot be used as a reserve and swing producer, other solutions are required – with hydrogen as an example.

"Burning hydrogen rather than natural gas would provide a power station which functions as a massive emission-free battery for various forms of renewable energy," says Blindheim.

Carbon capture and storage (CCS) facilities are also required in order to sequester emissions, and on such a scale that they can eventually become profitable.

"The technology is mature, after all, but we must get it built and rolled out in order to bring down its cost," says Blindheim.

Strategy She has headed work on a revised climate roadmap for Norway's petroleum industry, which led to a report on *The energy industry of tomorrow on the Norwegian continental shelf. Climate strategy towards 2030 and 2050.*

Issued by the Konkraft partnership in March, this commits the Norwegian oil sector to cut its GHG emissions in 2030 by 40 per cent compared with 2005, and in 2050 to near-zero.

"The absolute amount of GHG released remains virtually unchanged from year to year even though the industry is taking measures to cut the level," Blindheim observes.

"Although we're starting to see the contours of a decline in NCS emissions, they'll be stable or rise a little for two-three more years because new fields are coming on stream.

"When the industry decided on its latest climate goals, it also saw that new reporting and follow-up systems had to be put in place.

"These would make it possible to determine the status of cuts along the way and ensure that measures are implemented. Plans call for them to be in place during the present year."

She explains that the oil sector has matured during recent years. Instead of going on the defensive when attacked as a problem, it now recognises that it can perhaps overcome many of the challenges facing the world.

"This is an industry which has crossed the deep Norwegian Trench and developed horizontal drilling," Blindheim points out. "We possess a lot of technological expertise.

"That includes not least the ability to implement the big, demanding industrial projects required if Europe is to reach its climate goals."

"The seriousness of climate change is indisputable," says Hildegunn T Blindheim at Norwegian Oil and Gas. "A clear course was set by the EU, and we understood the need to raise our game and define new and more ambitious goals." (Photo: Norwegian Oil and Gas)

"If we were to shut down all emission sources in this country, it wouldn't make a jot of difference to the climate battle," emphasises Frode Alfheim at Industry Energy. "Quite the opposite – we'd increase global CO_2 emissions." (Photo: Marie von Krogh)

United Employees and employers in Norway's oil and gas industry are united over its climate goals and agree on the methods to be used, emphasises Frode Alfheim.

As president of the Norwegian Union of Industry and Energy Workers (Industry Energy), he was involved in drawing up the new climate roadmap.

He says that this is a matter of developing technology which can reduce emissions in the petroleum sector even further, while building up new industries such as OWP, hydrogen and CCS.

"After all, we're mining a non-renewable resource. At some point or another, the reservoirs will begin to empty or the resources will become harder and harder to recover."

Jobs in the oil and gas sector have to be replaced, but Alfheim says that this will take several decades and that Norway must build on what it has.

"As far as I'm concerned, those people in Norway who talk about ceasing oil production in 2030 are living on a distant planet.

"If we were to shut down all emission sources in this country, it wouldn't make a jot of difference to the climate battle. Quite the opposite – we'd increase global CO_2 emissions."

Shale oil production in the USA releases 57 times as much CO_2 per unit produced as crude output from the NCS, he points out, and believes people are too focused on equating oil with petrol.

Alfheim observes that petroleum provides feedstock for a number of industries and is incorporated in countless products people depend on – from plastics to medicines and textiles.

Such applications account today for only 11 per cent of annual world consumption of oil and gas, but he believes that this proportion is set to rise in coming years.

"The pandemic and the oil price slump may encourage a greater commitment to OWP, but energy consumption – and thereby demand for petroleum – is likely to rise again as soon as economies recover."

Oil and gas will remain the most important source of jobs and incomes for Norway Ltd, Alfheim maintains, and notes that OWP and other industries depend on grants and subsidies to show a profit.

"A subsidised industry can't sustain the welfare state," he asserts. "I believe most Norwegians understand, more than ever, how important it is that we have the oil sector. And that we've been so wise that we nationalised its ownership."*

Conversion in practice

Hi-tech equipment for the oil sector has been IKM Technology's bread and butter. But the industry's commitment to offshore wind power (OWP) is opening new markets for this company.

Saeid Bekit Yassin at IKM Technology in Bryne winds high-voltage motors. Their applications include powering subsea equipment. (Photo: Jonas Haarr Friestad)

BY: ASTRI SIVERTSEN

We don't need to reinvent the wheel, but we can repurpose it for other applications," observes CEO Jostein H Reinsnos at IKM Technology.

Based at Bryne south of Stavanger, his company recently delivered motors to a Dutch client for a subsea trencher. This is now in full swing burying power cables from OWP installations to land somewhere in Europe.

"This machine was originally developed for use on the NCS," says Reinsnos. "After a little conversion and testing, however, it's now found a completely new market."

He provides the following explanation of why his company exists: "The deeper the water, the more the offshore petroleum sector has wanted to eliminate people working subsea.

"That's been one driver for developing advanced underwater technology. The other, which has become increasingly important, is the desire to cut environmental burdens and energy consumption."

The oil industry's constant need to improve equipment, procedures and methods has prompted it to develop new technology – which Reinsnos says can find applications in many other areas.

Electrical The bulk of IKM Technology's revenues derive from electrical subsea equipment, and it became a specialist in this field at an early stage.

"Such solutions require less energy and involve substantially lower CO_2 emissions," Reinsnos explains. "They also pose less risk of environmental harm than hydraulic equipment, which can cause unwelcome oil leaks to the sea."

He has devoted almost 35 years to working with subsea technology, and has seen how customers increasingly want more environment-friendly equipment.

According to Reinsnos, IKM Technology is the first commercial company in the world to deliver an electrically driven remotely operated vehicle (ROV) which can sit permanently on the seabed.

This is positioned beneath the Snorre B platform in the Norwegian North Sea to do maintenance and repair work as well as to monitor the condition of seabed connections and equipment.

That work is directed from the control room on the first floor of the company's grey building in Bryne, where two pilots operate the Snorre B ROV and another based on Visund further north.

Each of these units has five cameras on its chassis and one on the front-mounted manipulator

CEO Jostein Reinsnos at IKM Technology (right) and IKM group divisional vice president Øystein Stjern in the control room at the company's Bryne base. Advanced vehicles are remotely operated in the depths of the North Sea from here. (Photo: Jonas Haarr Friestad)

arm. They transmit information which appears on the big screens in Bryne.

These data include figures and graphs as well as directly transmitted images of swimming fish. Reinsnos describes such ROVs as both caretakers and repair workers under water.

"On land, a company can call in a mechanic or an electrician when something needs to be fixed. Offshore, ROVs do all that. They replace divers and do their jobs in all kinds of weather."

IKM Technology is building a new and similar control room alongside its existing facility, and may install a third.

Worldwide The company manufactures and maintains its equipment on the ground floor of the building, and delivers not just in Norway and Europe but worldwide.

On the day I visit, for example, a grey container holds a low-head generator ready for shipment to provide power for an isolated indigenous community in Alaska.

This ranks as the second unit of its kind, following one installed in the summer of 2019. Reinsnos reports that the latter has functioned very well.

Adjacent to the container stands a large yellow buoyancy tank capable of lifting 1.5 tonnes from the seabed in order to replace the use of surface cranes.

A development of one of the company's own inventions, this device can be used by every industry which does work under water – including fish farming as well as petroleum and OWP.

Two mechanics are making adjustments to the tank after yesterday's test in the small pool, which will be followed up with testing in a larger basin before delivery offshore.

Further inside the workshop, an electrician is assembling an earthing box for high-voltage connections. Reinsnos says this was also developed in-house and is sold to all types of customers.

A few metres away, three men are winding electrical motors used to power such subsea equipment as pumps and propellers, and the CEO explains that this must be done by hand.

The production process is completely different from motors for surface use, which can be up to six times larger and call for a lot of cooling.

Several kilometres of cabling in copper and other materials are stored on shelves behind the winders. The company produces 50-70 motors per year and also maintains such devices.

Drones Another growth business is the development of drones – remotely operated vehicles which can be used both in the air and under water.

IKM Technology already has experience in using machines of this kind on offshore facilities for inspection without the need for rope access technicians.

Drones are now finding a big market in OWP, reports Øystein Stjern, the divisional vice president responsible for subsea and renewables in the IKM group.

"They're examples of the way equipment developed for use in the offshore petroleum industry can be transferred directly to the renewable energy sector," he says.

Reusing solutions both saves money and benefits the environment, Stjern maintains. "Ending up in a technology race where we constantly develop and scrap would be unfortunate.

"Why can't we instead look at the equipment we already have, combine it with new technology and adapt it to other applications? That would give big savings in investment and operating costs." ★

Mechanics Ola Reve (left) and Krystian Jakubiak at IKM Technology make adjustments to a buoyancy tank which can replace surface cranes offshore. (Photo: Jonas Haarr Friestad)

Carbon control

BY ØYVIND MIDTTUN

Supervising safety and the working environment when CO_2 gets transported and injected on the NCS is among the PSA's duties, and regulations for such activities were adopted in February.

These provisions will govern, for example, the government's full-scale demonstration project on capturing and transporting CO_2 for injection in geological structures beneath the NCS.

Responsibility for the transport and injection part of this programme rests with the Northern Lights consortium established by oil companies Equinor, Norske Shell and Total.

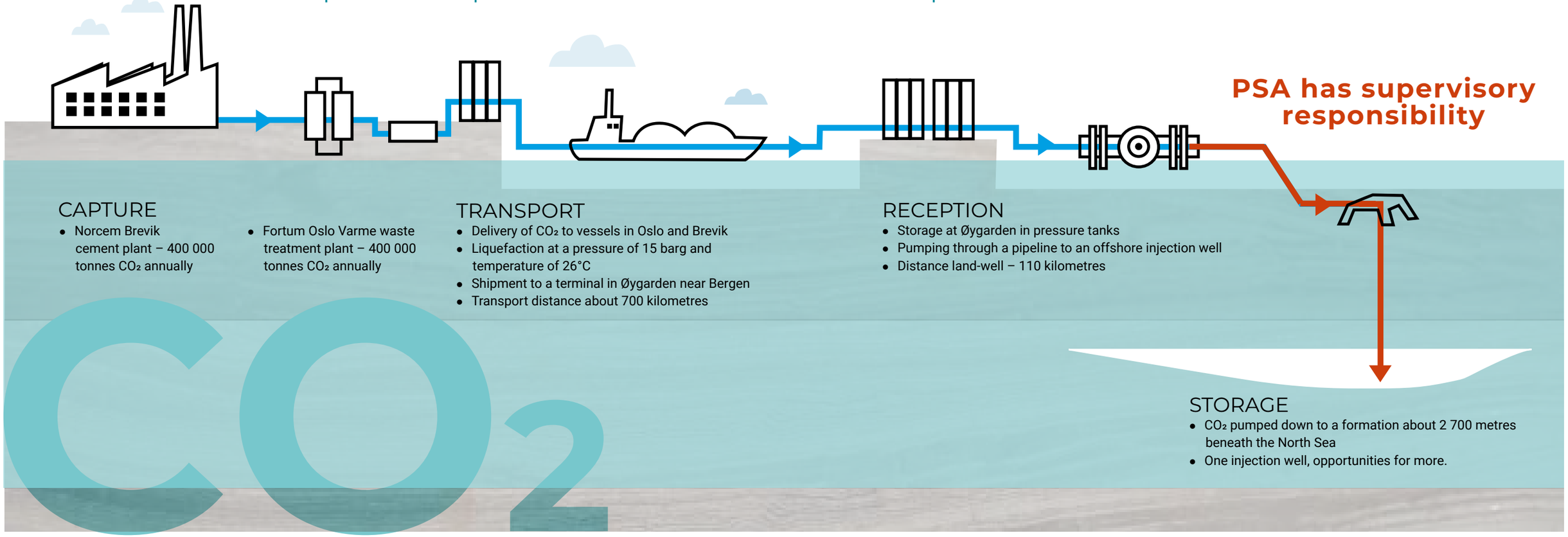
In addition to pipeline transport and injection, the government's CO_2 management project covers capture facilities with storage tanks, ship transport and intermediate storage.

The regulations governing the activities on the NCS deal with the equipment and systems required to operate and maintain the necessary pipelines.

In addition, they cover solutions for monitoring injection wells as well as emergency and safety systems related to pipelines and wells. ★

The Norcem Brevik cement plant in southern Norway is part of a major demonstration project to capture and transport CO_2 for storage beneath the North Sea. CCS offers an important measure for reducing GHG emissions, and Norway has been working for a number of years to achieve a cost-efficient solution for full-scale CO_2 management. (Photo: Scanpix/VG/Janne Møller-Hansen)

Norway's full-scale CO_2 project includes the capture of this gas from two industrial companies in eastern Norway and its shipment in liquefied form to a terminal on the west coast. In addition comes pipeline transport out to the NCS and injection for permanent storage deep beneath the North Sea.



The PSA has established regulations governing safety and the working environment for CO_2 transport and injection on the NCS.

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GHG: Greenhouse gases
HSE: Health, safety and the environment
NCS: Norwegian continental shelf
NPD: Norwegian Petroleum Directorate
OWP: Offshore wind power
PSA: Petroleum Safety Authority Norway

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