McKinsey & Company

Report summary

Norway Tomorrow

Ten opportunities for Norway

Independent initiative

This report was developed by us in McKinsey on our own, independent initiative. It has not been conducted on behalf of, or by paid or unpaid assignment for, anyone else.

It is not the role of McKinsey to advise or comment on politics or policy. Our research is rather meant to provide an independent, non-biased fact base to inform decision-making of businesses, governments and other organizations.

We do name some companies in the report. These are included as we think they serve as good examples of companies that succeed in an opportunity industry. They have been chosen irrespective of whether McKinsey has previously carried out assignments for them. The majority of companies in this report have no assignment history with McKinsey.

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Summary

In the last fifty years, Norway has accumulated an enormous oil wealth. But the Norwegian oil age is nearing an end, as demand for oil and gas is expected to decrease. In the years ahead, Norway must develop new industries to secure the future for new generations, compensate for the loss in oil revenues and create a sustainable society.

The trends and changes facing both Norway and the world primarily represent great opportunities. This report features ten opportunity industries for Norway. Norway may not become a market leader in all these industries, and there are even more opportunities than those mentioned here. But what the industries in this report have in common, and what our analyses have indicated, is their potential for substantial contribution to future employment and value creation. The opportunity industries are hydrogen, offshore wind, batteries, carbon capture and storage, green maritime industry, industrial software, consumer platforms, circularity, aquaculture and tourism.

These ten forward-looking industries will in 2030 be able to create approximately 210,000 new jobs and generate about NOK 310 billion in increased gross national product, in addition to what we expect will occur "in any case" from industries that already contribute to Norwegian GDP. These 310 billion equal about 70 per cent of the 2020 contribution to GDP from oil and gas activities.

When analyzing the competitive landscape for the opportunity industries, it is clear there is every reason to act now. Norway has major geopolitical and natural advantages that give us, to borrow a term from Formula 1 racing, the "pole position" in many of these industries. Nevertheless, we spend considerable time on making decisions, whereas other countries are already accelerating at a rapid pace.

At the national level, there is therefore a set of key areas that must change if we are to equip Norway to meet the future. This involves the right knowledge and expertise, major investments in infrastructure development, the facilitation of investments and incentives, and specific objectives and strategies in each field.

Whereas Norway's export income has previously been driven to a large extent by oil and fish, we must now assert ourselves in many other disciplines in tough global competition. The Norwegian industries of the future therefore depend on making wise choices here at home in order to succeed abroad.

If we are to succeed tomorrow, we must make wise decisions today. This report is our contribution to good decisions today, for Norway tomorrow.

Important concepts

The contribution to value creation and employment

When we calculated the contributions of opportunity industries to increased gross national product (GDP) and employment, we made some simplified assumptions to ensure consistency and comparability. All this is described in a separate sub-chapter under each opportunity industry in the full version of the report.

We have defined contribution to value creation and employment in the following way:

- *Value creation (GDP):* We have calculated expected GDP contributions in 2030 based on the specific activities described for the ten industries. The main principle is that we only include the direct contribution to GDP. We have therefore excluded the effects from indirect (suppliers and sub-contractors) and induced impacts on GDP (government services and other industries). For certain industries, a few indirect effects have been included. For instance, portions of the supplier chain value for batteries have been included, because the processing of raw materials is part of the battery opportunity.
- *Employment (full-time equivalents):* The calculation of new jobs follows the same principles as the calculation of GDP contributions. Direct jobs – as the opportunity is described – are included. Indirect and induced employment effects are not included.

Turnover and GDP

Gross national product will always be lower than companies' turnover because foreign inputs are almost unavoidable. When calculating GDP, we often use the turnover of the companies in the industry. The general rule for this conversion is to look at historical ratios between turnover and gross national product for similar industries. The classification of industries and historical ratios are obtained from UNSTAT[1].

The effect of "pushing the button"

The figures for contribution to GDP growth and employment are in addition to what would have occurred "in any case". For both gross national product and jobs, our figures are an estimate of the actual effect of "pushing the button" for the opportunity industry. What separates the various industries is whether they currently contribute substantially to GDP:

- For industries that are virtually brand new, such as offshore wind and batteries, all growth between now and 2030 is included in the GDP increase leading up to 2030. This is because without extra effort, not much would not have occurred "in any case". In practice, we estimate GDP for these industries in 2020 as close to zero, which is a simplification.
- Opportunity industries that build upon already-established sectors, such as aquaculture, tourism, industrial software and consumer platforms, already have a substantial initial value in the GDP for Norway. For these opportunities, we have subtracted basic growth that is the result of inflation and general market growth from the current GDP. We have thus included only what is "added to" the current GDP as a result of major efforts. We have simultaneously highlighted the total increase in GDP for the respective sectors from 2020 to 2030, and we have distinguished what comes from underlying growth and what comes from the initiatives described in this report.

These analyses are intended to provide a sense of the magnitude and direction, but the figures are often associated with scenarios involving a great deal of uncertainty and should therefore be regarded as estimates.

2030 as milestone year

The choice of 2030 as a milestone year is a balancing of reliability in the analyses (achieved by specifying a shorter time horizon) and the opportunity to capture change (achieved by specifying a longer time horizon). With major investments in the ten opportunity industries, major economic effects will already take place in 2030.

[1] United Nations Statistics Division.

Introduction

What is our future livelihood?

When the Ekofisk field was opened on 9 June 1971, Prime Minister Trygve Bratteli said: "This may become a day to remember in Norway's economic history". Now, half a century later, we know this was a clear understatement. The oil and gas era has brought Norway enormous success.

The oil and gas adventure is not over just yet. Norway will continue to benefit from revenues generated by the industry for many years to come. Nonetheless, there is no doubt that we must renew ourselves. There will be less oil and gas in the future.

It is in the light of this realization that the work on this report began several months ago. Each day, McKinsey helps clients in various businesses and industries create growth for the future. The goal with this report, which has been given the name "Norway tomorrow", is to share more of this insight with a broader audience.

This is our contribution to the debate on the most important question of our time: What is our future livelihood?

We must have high ambitions for our country and for the prosperity and well-being of future generations. Therefore, we believe that Norway should become a global lighthouse for sustainable development. And Norway might never have been in a position where we can shape the future in the way we can right now. Nor has it ever been more important, perhaps, to make the right choices than now. The climate crisis is changing the world, and as an energy-producing nation Norway must change with it.

The paradoxes of the future

It is in many ways a paradox that most of the technologies that can help us achieve a zero-emission society are known to us, while the world's climate and energy challenges continue to seem unsolvable. In fact, technology required to achieve 85 per cent of the cuts needed to reach net zero in 2050 already exists. Yet the task remains difficult.

It is also a paradox that we have knowledge about industries in which Norway can become a market leader, while we continue to ask ourselves where our income will come from when we can no longer depend on oil. We have the knowledge and we know many of the solutions. The next step is to make decisions that will lead to changes and progress in new, unfamiliar areas. Decision makers at all levels must therefore be able to distinguish between visions and wishes on the one hand, and specific and actual opportunities on the other.

McKinsey would like the "Norway tomorrow" report to assist in clarifying this distinction, by highlighting specific and actual opportunities for Norway.

Major scope of opportunity

We have done this by identifying ten Norwegian opportunity industries. We have specified two main criteria for our selection. The first is that Norway is uniquely positioned to take a role as an international leader. The other is that the industry can provide

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a substantial contribution to national employment and value creation. For our ten opportunities industries, we have quantified both the contribution to GDP and the number of new jobs.

If Norway fully exploits the potential in these ten selected industries and acts on specific initiatives in this report, we will be able to create approximately 210,000 new jobs and increase Norway's annual contributions to GDP by more than 310 billion Norwegian kroner in 2030.

The increase in GDP and jobs would be an addition to what would have occurred "in any case". For industries that are virtually brand new, such as offshore wind, all increases between now and 2030 are included in the GDP increase leading up to 2030. This is because without any effort, nothing would have occurred "in any case". For opportunity industries that build upon already-established sectors, such as aquaculture and tourism, which already contribute significantly to Norway's GDP, we have not included the basic growth in current GDP that is the result of inflation and general market growth. We have only included what is "added" as a result of significant efforts. In other words, it could be said that for both GDP and jobs, our figures show the effect of "pushing the big button".

Based on these figures, the ten industries will in 2030 represent about 70 per cent of the current contribution to GDP from oil and gas activities[2]. The report also demonstrates that we to a large extent are able to compensate for the petroleum industry's contributions to the Norwegian economy and employment, also in the post-oil era.

Sustainability, for the economy and for the world

The ten industries and the scope of opportunity they entail is good news, because it means that we are still in a position where we strive for a sustainable future in terms of both the economy and the climate.

It is not certain whether Norway can or will become a leader in all these industries simultaneously, but the report highlights the scope of opportunity going forward. It is paramount to be crystal clear: There are other opportunities in addition to the ten addressed in this report. However, handling the major challenges of our time requires good leadership from all decision makers. If we can make wise and correct decisions today, we can sufficiently prepare ourselves for tomorrow.

Good leadership from all decision makers is essential if we are to solve the greatest challenges of our time. If we can make wise and correct decisions today, we can sufficiently prepare ourselves for tomorrow.

[2] The contribution from the oil and gas activities to the Norwegian economy is based on a five-year rolling average equivalent to NOK 447.5 billion.

Adequate access to green energy

The green transformation, and with it many of Norway's future opportunity industries, relies on access to sufficient amounts of green energy. In the discussion of several opportunity industries in this report, for instance batteries and hydrogen, we have emphasized adequate access to relatively inexpensive, green energy as a competitive advantage for Norway.

When this report was sent for printing, Norway was emerging from a winter of hefty discussions on the availability of energy and the price of electricity in Norway. Nevertheless, this report assumes that clean, inexpensive energy in the years ahead will remain a competitive advantage for Norway, provided that we can maintain the balance between electricity production and consumption through continued development of capacity. We expect that, even in an energy market where Norwegian prices are on the rise, domestic prices will on average be lower than in other European countries.

Energy balance is therefore a continuous task for Norwegian authorities in cooperation with stakeholders in the industry. In this report, we highlight offshore wind as an opportunity industry that will supply more green energy in the future. Discussions are also taking place on expanding the production of Norwegian hydroelectric energy to some degree, by improving efficiency at existing facilities and related tributaries at certain locations. Both initiatives can contribute to making the opportunity industries in this report a reality.

There is also an ongoing discussion with divergent opinions about other alternatives. In order to ensure access to power in the future, it is possible, and perhaps necessary, to consider developing more land-based wind energy. There is also a discussion on increasing export capacity, with net restrictions on export volume, in order to profit from surplus hydroelectric energy while still ensuring sufficient supply in cold and dry years. This report does not take an active position on developing land-based wind or an expansion of the export capacity for hydroelectric energy. Nevertheless, these are topics that will characterize the discussion about Norwegian green energy in the future.

Ten opportunity industries

What will our livelihood be in the post-oil era, and how can we ensure a green and sustainable transformation while at the same time maintaining Norwegian wealth and social welfare? This report presents ten industries that can respond to these challenges and equip Norway for the future.

Of course, there are more opportunities than the ten addressed here, and our report is not necessarily a recommendation on what Norway should not do. We will indicate the opportunities and let market dynamics determine who will be winners in the future. Nonetheless, we have great confidence in these ten opportunity industries.

The reason is because these ten opportunities originate from three "opportunity sources" that tie major, global megatrends to Norway's special strengths in a positive way:

- **Opportunities from the energy transformation:** These are new industries in the energy era which offer substantial, industrial opportunities when the energy of the future has to be obtained from new sources and no longer from coal, oil, and gas. Hydrogen, offshore wind, batteries, carbon capture, and storage and green maritime industry are promising opportunities here.
- **Opportunities from the digital transformation:** These are industries of the future where historically, Norway has not been among the front-runners, but where we recently have asserted ourselves on the global stage: On both consumer platforms and software for major industry, Norway has built a number of global winners, and the accelerating digital transformation has provided us with several opportunities.
- **Opportunities from the sustainability transformation (in addition to the energy industries):** These are opportunity industries that leverage Norwegian traditions, natural resources, and a strong focus on sustainability in all industries, including those not pertaining to the energy sector. Tourism, aquaculture, and circularity in general are opportunities here.

To arrive at these ten prioritized opportunities, we have considered a number of other sectors and initiatives. It cannot be denied that presenting a selection of ten industries that can consistently and unambiguously be compared to all other industries is a task close to impossible. This owes to the fact that certain opportunities are difficult to define and delimit in a consistent manner (for example, circularity represents a common topic across industries, whereas batteries are very specific), and because there is uncertainty related to estimating the potential for value creation and impact on employment.

What these ten opportunity industries have in common is that they all have high scores on the two key criteria we have applied: The potential for substantial economic value creation in terms of increased GDP and employment, and that Norway possesses competitive advantages that will enable us to succeed in these industries. The efforts of this report culminate in a list of ten opportunity industries in which Norway may thrive going forward. The list is, as noted, not exhaustive; there will be other industries that may also play important roles in shaping the future of Norway. Nor is it certain that Norway should focus on or will succeed with all of them.

In all of these industries we face competition from other countries with high ambitions. In order for Norway to succeed in a global setting, our starting point must be to cultivate the strategies and initiatives that play to our existing strengths, or where we have particularly strong prerequisites for success.

Within each of the ten industries, this report identifies a set of measures for seizing the opportunity.

10

opportunity industries aimed at 2030

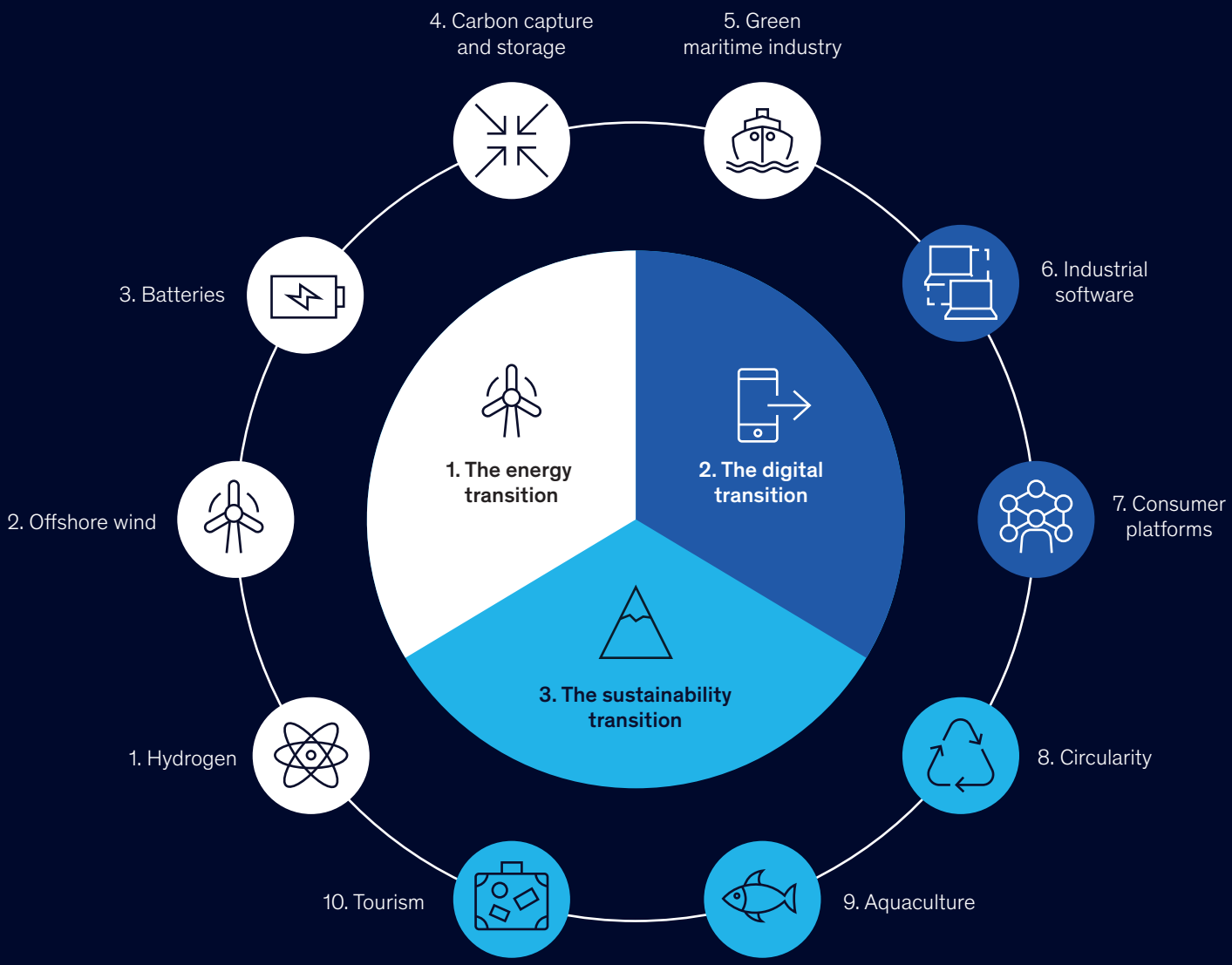
310

billion NOK

in increased value creation (GDP)

210 000

new jobs


4. Carbon capture and storage
5. Green maritime industry
6. Industrial software
7. Consumer platforms
8. Circularity
9. Aquaculture
10. Tourism
1. Hydrogen
2. Offshore wind
3. Batteries
1. The energy transition
2. The digital transition
3. The sustainability transition

	Contribution to value creation (GDP), billion Norwegian kroner			**Contribution to employment,** full-time equivalents
	Contribution from specific initiatives in this report	Underlying market growth	Total increase 2020-2030	Contribution from specific initiatives in this report
1. Hydrogen Become a leading nation for the production and export of hydrogen and hydrogen technology	71	N/A[1]	71	33 000
2. Offshore wind Take the position as Europe's leading offshore wind nation	24	N/A[1]	24	36 000
3. Batteries Put the entire country to use to create Europe's most sustainable and competitive battery value chain	40	N/A[1]	40	33 000
4. Carbon capture and storage Strengthen our leading position and become Europe's largest CO_2 bank	15	N/A[1]	15	15 000
5. Green maritime industry Secure our position as a leading green shipping nation	11	~4	15	10 000

[1] GDP contribution in 2020 is set to zero, because the industry is immature or completely new

	Contribution to value creation (GDP), billion Norwegian kroner			Contribution to employment, full-time equivalents
	Contribution from specific initiatives in this report	Underlying market growth	Total increase 2020-2030	Contribution from specific initiatives in this report
6. Industrial software Become the industry's answer to Silicon Valley	27	~5	32	26 000
7. Consumer platforms Build upon the Norwegian start-up boom on consumer platforms	11	~17	28	10 000
8. Circularity Create winners in the European circularity market across eco-systems, technologies and materials	46	N/A[1]	46	14 000
9. Aquaculture Develop the world's most sustainable aquaculture to enable radical growth	54	~29	83	18 000
10. Tourism Become the world's leading country in sustainable high-quality tourism	14	~31	45	17 000
Total	313	~86	399	212 000

Ten opportunities for Norway

1. Hydrogen

Hydrogen will be one of the world's most important solutions to the climate and energy crisis. Gas, water, and wind resources in Norway for energy production enable us to produce green and blue hydrogen less expensively than our competitors. We can develop an entirely new industry that will become a mainstay in the world's green transformation.

2. Offshore wind

Half the electricity Europe receives from offshore wind in 2050 can come from the North Sea. If we transfer expertise from the oil industry, offshore wind could become the next Norwegian industrial adventure in the North Sea.

3. Batteries

If we put the entire country to use to create Europe's most sustainable and competitive battery value chain, Norway can produce batteries for two million electric vehicles in 2030.

4. Carbon capture and storage

The time for frivolous lunar expeditions has passed, and now one of Norway's opportunities lie deep below the North Sea. There we can store just as much CO_2 as Europe is able to emit in the span of twenty-five years and thereby become one of the world's largest CO_2 banks.

5. Green maritime industry

When global greenhouse gas emissions from shipping are cut in half, it will be an advantage to already have the world's most decarbonised fleet. Norway can once again secure its position as a leading shipping nation.

6. Industrial software

The digital technology revolution that has changed the daily life for consumers around the globe is now hitting the world's industries. What Silicon Valley is for consumer technology, Norway can become for industrial software.

7. Consumer platforms

The value of the market for platform solutions will triple in the years leading up to 2025. Norway's supersonic speed in the start-up boom for technology companies creates opportunities to become a global winner. We just have to become as good as Sweden.

8. Circularity

Consumption must be replaced by recycling if we are to succeed with the green transformation. Without circularity, true sustainability cannot be achieved. There are considerable industrial opportunities for Norway from production, use, and recycling to recovery.

9. Aquaculture

The world needs more food which must be produced without increased greenhouse gas emissions. Because the solution can be found in the ocean, we should elevate the goals for one of Norway's great export successes. The time has come to introduce the world to a new species of Norwegian fish.

10. Tourism

Tales of Norway's natural beauty will not sell on their own. But if we make a choice to treat tourism as strategically and ambitiously as other industries, then high-quality tourism can become one answer to the question of our source of income after oil.

Hydrogen

Hydrogen in Norway in 2030

Value creation (GDP)

71 billion NOK

Contribution from specific initiatives in this report

71 billion NOK

Total increase 2020-2030

Employment (full-time equivalents)

33 000

Contribution from specific initiatives in this report

What is the opportunity?

Become the leading nation for the production and export of hydrogen and hydrogen technology

Hydrogen production for the green transformation in Norway

Produce hydrogen in order to increase the pace of the green transformation in more Norwegian industries, and to build new green industries

Hydrogen exports to Europe

Export substantial quantities of hydrogen to Europe

Supplier of hydrogen technology

Become a leading supplier of technology and infrastructure for the global hydrogen wave

Disclaimer

A comprehensive description of each opportunity industry, with analysis and detailed methodology, is available in the Norwegian full 200 page version of the report. What you are reading now is a short summary of each chapter

SUMMARY

Hydrogen will be one of the world's most important answers to the climate and energy crisis.

Hydrogen has many uses and a massive market potential.

There is nothing more abundant in the universe than hydrogen, as this element makes up three-fourths of the known mass of the universe. But even though this energy carrier surrounds us virtually everywhere, a great deal of technological expertise and infrastructure is needed to manage it. With experience from a hundred years of industrial hydrogen production, Norway fortunately has both. Therefore, we also have a unique opportunity to take a leading position in this industry.

Today hydrogen (from natural gas or coal) is mainly used in refineries and for the production of ammonia and methanol. In the future, hydrogen will have major potential as a replacement for fossil fuels in a number of industries that are difficult to decarbonise: in heavy transport (on both land and water), for heating and for storing electricity.

Hydrogen is expected to be able to meet about 22 per cent of humans' ultimate energy requirements and about 20 per cent of the world's carbon reduction requirements in 2050, according to the Hydrogen Council. The size of the global market in 2050 is estimated at USD 3 trillion across the value chain. This is the equivalent of more than 17 Norwegian national budgets.

However, the production method will be decisive in determining whether hydrogen can become part of the climate solution. *Brown hydrogen* is made with the aid of coal and generates 16 metric tonnes of CO_2 for each tonne of hydrogen. *Grey hydrogen*, which is reformulated with natural gas or oil, generates 9 metric tonnes of CO_2 for each tonne of hydrogen. Brown and grey hydrogen make up nearly all the hydrogen currently produced.

Blue hydrogen, in which CO_2 emissions are captured and stored (carbon capture and storage), has up to 98 per cent[1] lower emissions than grey hydrogen. *Green hydrogen*, on the other hand, which is produced through water electrolysis, is entirely emission-free as the electricity comes from renewable sources. The hydrogen mix will shift radically towards blue and green in coming years. In Europe, it is expected that up to 70 per cent of all hydrogen in 2030 will be green or blue.

The race is on to become a market leader in sustainable hydrogen.

Although Norsk Hydro produced green hydrogen at Vemork in Norway as early as 1929, the global green hydrogen industry is nonetheless still in the maturation phase nearly a hundred years later.

However, in the next ten years we will see an expanding and rapid development of hydrogen solutions worldwide. Norway has three unique opportunities to take a leading position in this race.

Hydrogen will represent an important part of the green transformation in Norwegian industries, and Norway will be able to produce green hydrogen for its own use. In addition, we can become a significant exporter of hydrogen, especially to the European market. Last, but not least, we can develop high-technology expertise and supply equipment and infrastructure to the global hydrogen industry.

A successful major investment in initiatives in this report for hydrogen can contribute NOK 71 billion in increased value creation (GDP) and 31,000 new jobs in 2030. The investment will also contribute with a reduction in emissions of 22 million metric tonnes of CO_2 in Norway and Europe.

22%

Hydrogen is expected to be able to meet about 22 per cent of humans' ultimate energy requirements and about 20 per cent of the world's carbon reduction requirements in 2050.

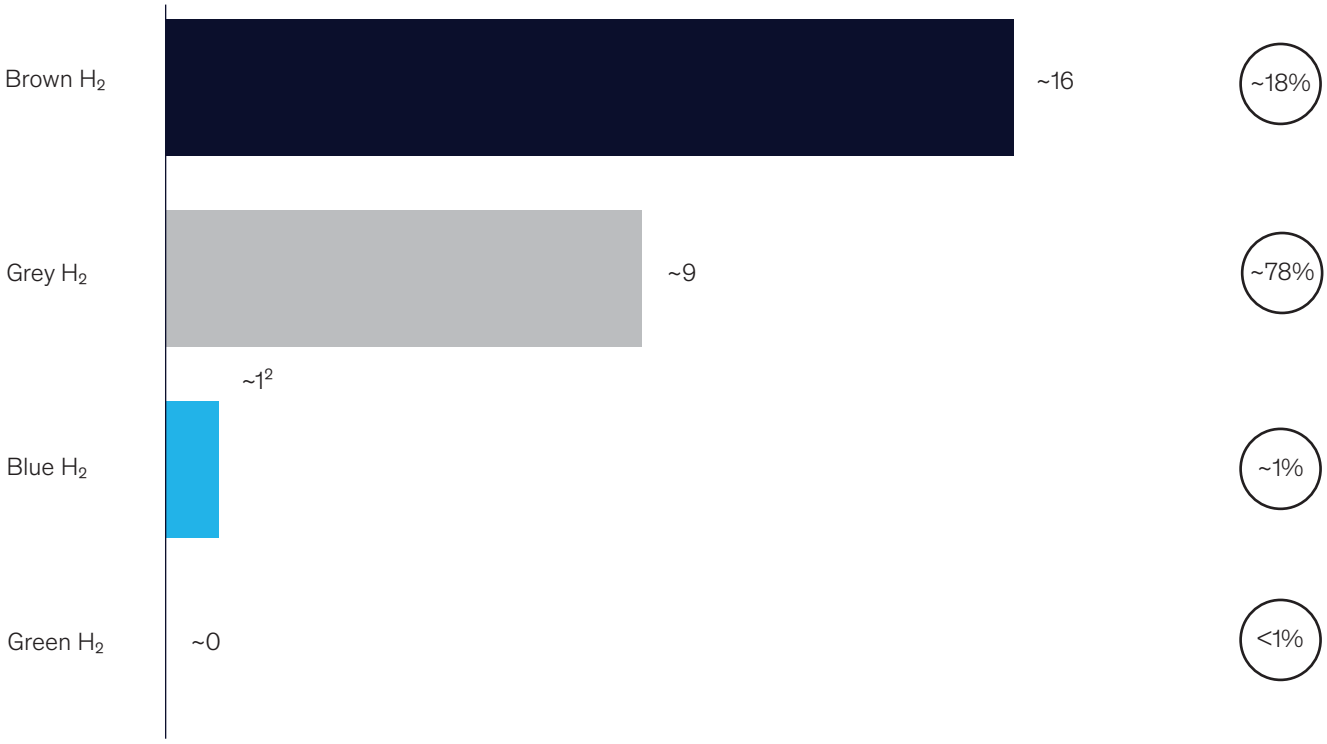
[1] Emissions from blue H^2 vary according to technology: Up to 90 per cent with newly developed Steam Methane Reforming (SMR) technology and up to 98 per cent with Auto-Thermal Reforming (ATR) technology

In Europe, it is expected that up to 70 per cent of all hydrogen in 2030 will be green or blue.

Today's production of hydrogen has significant negative environmental consequences

CO_2-emissions by type of hydrogen, tons of CO_2 per tons of hydrogen

Share of H_2-production 2021[1], per cent



[1] Share of H_2 production in 2021: 2-3% of today's H_2 production is a bi-product from other processes

[2] Emissions from blue H_2 varies by technology: Up to 90% with newly built SMR-technology (SMR: Steam Methane Reforming) and up to 98% with ATR-technology (ATR: Auto-Thermal Reforming)

Offshore wind

Offshore wind in Norway in 2030

Value creation (GDP)

24 billion NOK

Contribution from specific initiatives in this report

24 billion NOK

Total increase 2020-2030

Employment (full-time equivalents)

36 000

Contribution from specific initiatives in this report

What is the opportunity?

Take the position of Europe's leading offshore wind nation

Offshore wind farms in the North Sea

Install large offshore wind farms on the Norwegian continental shelf with up to 20 GW of capacity

Supplier industry for offshore wind

Develop a supplier industry for offshore wind for both floating and fixed technology and provide services to international offshore wind projects corresponding to 14 per cent of European offshore wind projects in 2030

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SUMMARY

Offshore wind could be the next adventure in the North Sea

The day before Christmas Eve 1969 marked the start of the Norwegian oil adventure in the North Sea. After a lengthy period of exploration, the American oil company Phillips finally reported the discovery of Ekofisk. The rest is history.

Today, more than fifty years of experience in producing offshore oil and gas has provided us with major advantages en route to the next blue-green adventure on the Norwegian continental shelf: Offshore wind.

In order to understand why the expertise transfer from oil platforms is so important, we need to consider the sheer size of offshore wind turbines. Today's largest wind turbines are approximately 264 metres high, with wing blades more than 118 metres long and a rotor diameter of 242 metres.[1]. Its height is the equivalent of more than two Oslo Plaza buildings on top of each other.

The turbines must be anchored in the seabed out in the open ocean or on a floating platform in a way that ensures their resilience in extreme weather conditions. It is here the advantage of having an industry with prior experience in constructing complex and technically advanced installations at sea comes into play. This experience with installations, and the associated infrastructure and supplier industry, is one of the building blocks that makes a major Norwegian investment in offshore wind possible.

In a world that demands far more renewable energy than what is currently available, the market opportunities in offshore wind are enormous. The EU's current strategy for offshore wind plans for more than 60 GW to be installed by 2030, more than double today's capacity. This is a conservative estimate compared to other sources which anticipate around 110 GW to be installed by 2030. Globally it is expected that around 270 GW of offshore wind will be installed by 2030, about 19 times as much as the currently installed capacity.

Nevertheless, the industry is still in an early growth phase. Today, offshore wind farms with fixed turbines are the most common. However, the full potential will not be realized until the number of floating offshore wind farms is increased, that is, turbines that are not anchored in the seabed. When ocean depth is no longer a constraint, the optimal ocean areas can be chosen based on wind conditions. Far out at sea, the wind is relatively strong and constant, and energy can be produced predictably and efficiently. An added benefit is that the placement is further away from both people and their neighborhoods.

Because this is an industry in which both expertise and natural conditions lay the basis for Norwegian success, we should stake out a course today in order to succeed tomorrow. However, in 2021 only two areas were opened by the authorities for offshore wind on the Norwegian continental shelf: Sørlig Nordsjø II and Utsira Nord. In total, a licence may only be granted for 4.5 GW. That is not enough. In the period leading up to 2030, Norway should announce licences to develop at least 20 GW of capacity on the Norwegian continental shelf. Such an announcement would immediately accelerate the mobilisation of both industry and investors and will be crucial for realising the Norwegian offshore wind potential.

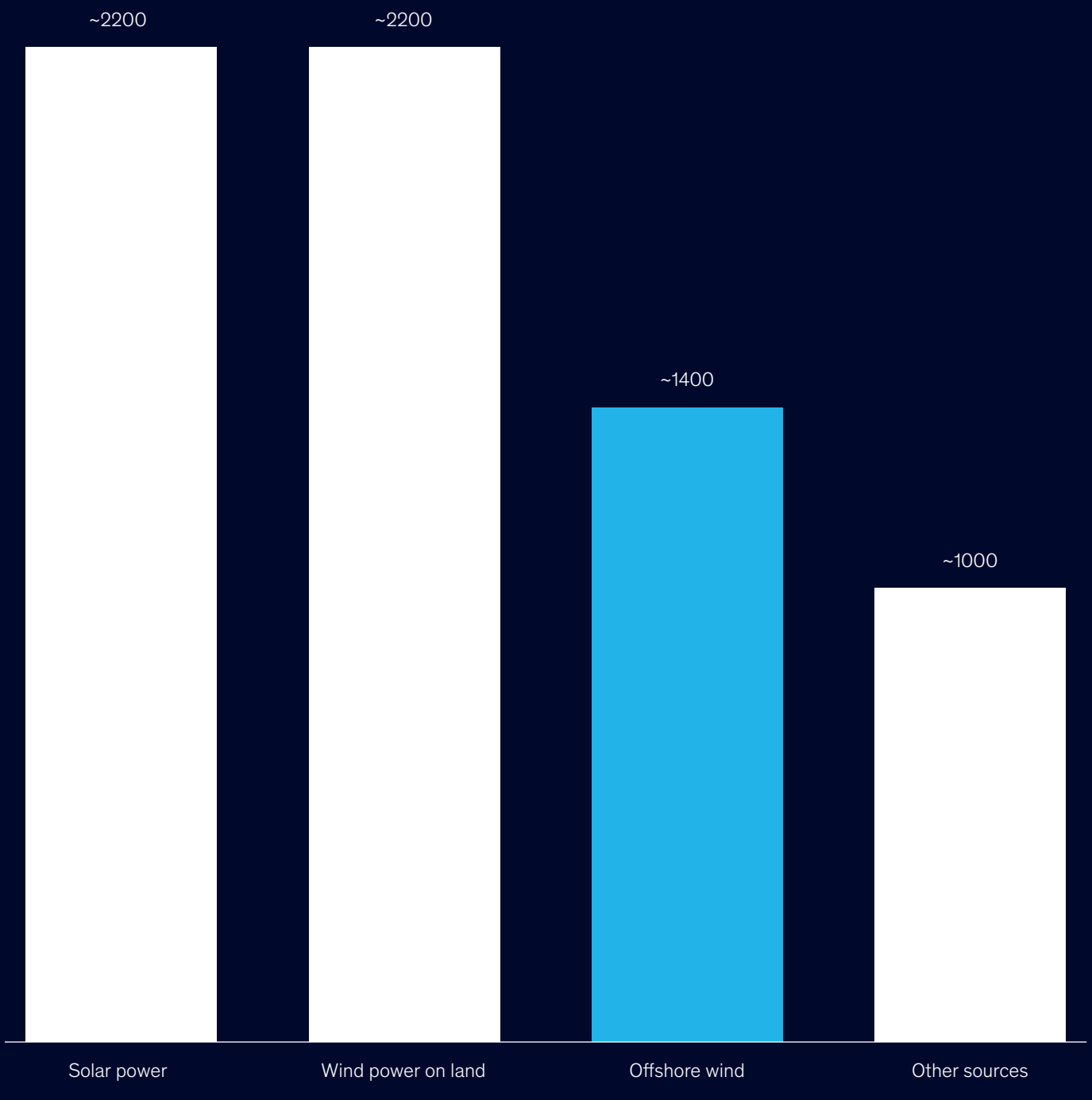
Globally it is expected that around 270 GW of offshore wind will be installed by 2030, around 19 times as much as the current installed capacity.

A successful major investment in initiatives in this report for offshore wind can contribute 24 billion Norwegian kroner in increased value creation (GDP) and 36,000 new jobs by 2030. The value creation will be related to offshore wind projects in the North Sea, but there may also be substantial revenues if the Norwegian supplier industry becomes an important provider of services to the European and international offshore wind industry. The jobs created by offshore wind industry will to a large extent be a viable alternative in the future for individuals who currently work in oil and gas.

[1] The largest wind turbine on the world market is the MySE 16.0-242 from Mingyang Smart Energy Group

Offshore wind is expected to be the third greatest source of energy[1] in Europe in 2050

Power production EU-27 2050, TWh



[1] Measured in power production (TWh)

Source: McKinsey Net Zero 2050

Batteries

Batteries in Norway in 2030

Value creation (GDP)

40 billion NOK

Contribution from specific initiatives in this report

40 billion NOK

Total increase 2020-2030

Employment (full-time equivalents)

33 000

Contribution from specific initiatives in this report

What is the opportunity?

Put the entire country to use in order to create Europe's most sustainable and competitive battery value chain

Battery cell production of 200 GWh

Become one of Europe's largest battery cell producers with a production volume of 200 GWh

Pioneer in anode production

Become the European leader in anode production and take 20 per cent of the market for cathodes

Leading raw materials processor

Become Europe's leading raw materials processor and conduct research in the production and recycling of raw materials

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SUMMARY

The battery adventure is now or never

Put the entire country to use

It is typical of a Norwegian to appreciate good battery capacity. Just ask the owners of Norway's 500,000 electric vehicles, which altogether represent the highest market share for electric vehicles in the entire world.

Many of Norway's electric vehicle drivers have probably felt "range anxiety" now and then. This is one small part of the great battery challenge we face in the green, electric transformation. Whereas fossil energy sources have long provided us with flexibility, and in practice unlimited range, in the future we must rely on clean, storable electricity. Not until we have cost-effective storage without today's capacity constraints will we be able to use green energy when and where we want. This is why the world needs batteries.

In a few years, the demand for batteries will likely be far greater than the supply. At the climate summit in Glasgow in the autumn of 2021, a number of countries voluntarily committed to measures aimed at phasing out all fossil fuel-driven passenger vehicles by 2040. This comes at the same time as the EU is nearing a ban on new petrol and diesel vehicles by 2035. The decision significantly impacts the motor vehicle industry and consumers, and the anticipated demand for electric vehicles, which in turn drives about 80 per cent of the demand for batteries, could lead to an unmet need for batteries in Europe by about 20 per cent in 2030.

The most pressing bottlenecks for the battery industry are access to raw materials and competitive technology for European production of active materials in battery manufacturing. Norway can help mitigate both of these bottlenecks because we have an existing mining industry and ambitious industrial firms with a strong ability to innovate.

Although Norway has a fundamentally strong starting point through existing support industries and other natural advantages, such as access to clean electricity from renewable sources, the battery adventure is only achievable if we move quickly.

Battery manufacturing firms will only succeed if they have major, long-term agreements with the motor vehicle industry and other manufacturers that need battery technology. These agreements are being written now. In addition, Norway's main competitors, such as Sweden, Finland and Germany, already have a lead in the form of national strategies, high ambitions, and sound frameworks issued by the EU. For instance, the EU has approved aid to European battery firms equivalent to more than NOK 60 billion through two IPCEI (Important Projects of Common European Interest) rounds over the last five years.[1]. Norway did not partake in this grant. Therefore, we must act quickly and make every effort to seize our unique entry into the emerging battery industry.

In order to succeed, it is critical that Norway prepares a national ambition for the battery industry, based on a comprehensive cluster approach. This entails co-locating collaborating industrial firms in a sector within a limited geographic area[2]. Our analyses show that a cluster approach will be necessary in order to realize cost advantages through collaboration and co-location across the battery value chain's various links. In doing so, we can obtain a cost-leading position in Europe, with a 6 to 9 per cent cost advantage over Germany.

Norway's battery adventure also depends on strong political willingness to act. At the national level, expertise must be developed and licensing processes must move quickly. At an international level, sound trade agreements must be reached to ensure the basis for exports.

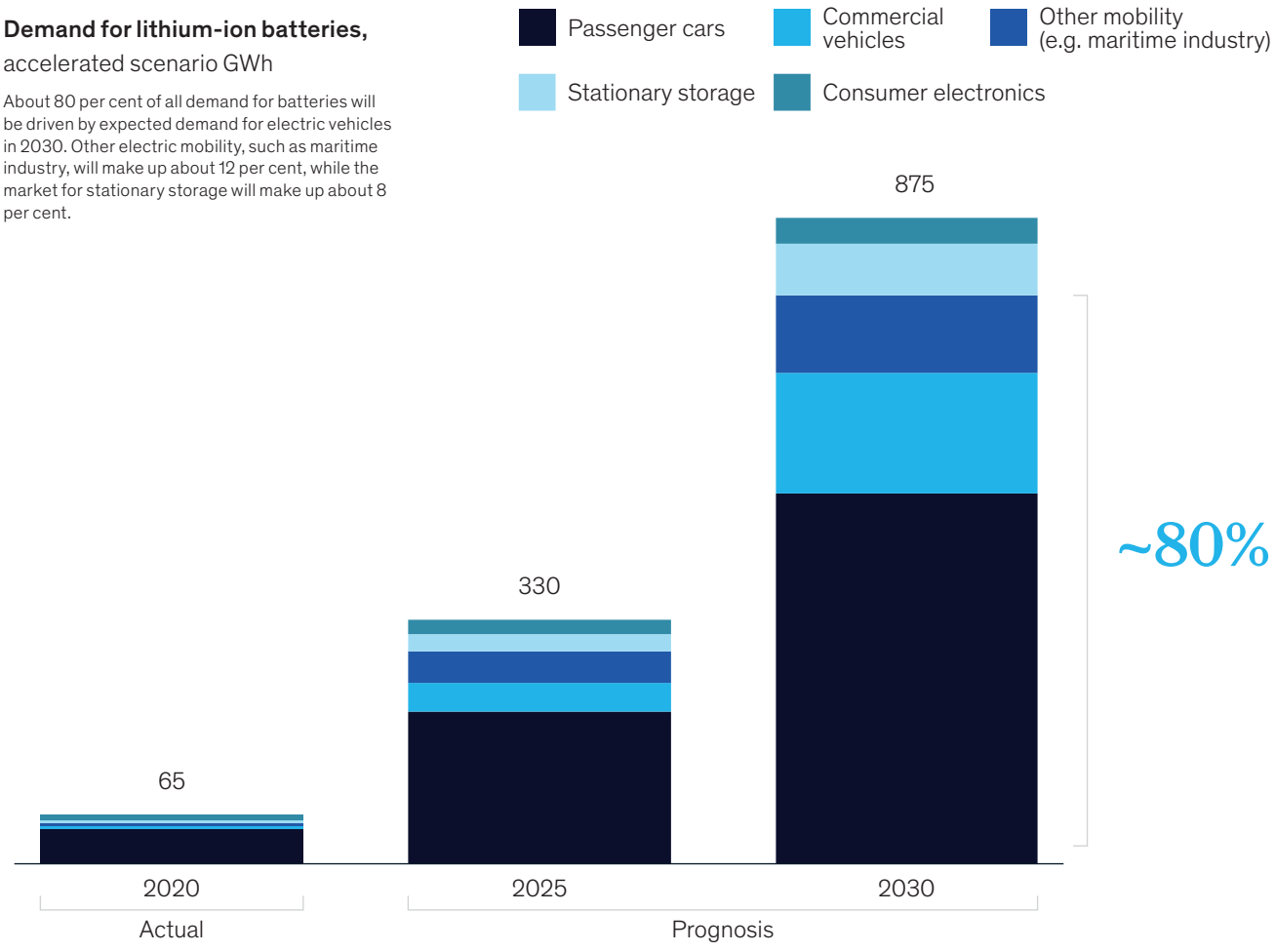
A successful major investment in the initiatives in this report can make Norway one of Europe's largest battery cell producers, with an attainable capacity of 200 GWh in 2030. This corresponds to the battery capacity of about two million electric cars. At the same time, the effort will contribute NOK 40 billion in increased value creation (GDP) and 33,000 new jobs in 2030. For Norway's part, many of the most important locations will be geographically dispersed, and in this way the battery industry will be an opportunity to put the entire country to use.

[1] The IPCEI scheme is administered by the European commission.
[2] Den Norske Akademis ordbok

Not until we have cost-effective storage without today's capacity constraints will we be able to use green energy when and where we want. This is why the world needs batteries.

Demand for lithium-ion batteries,
accelerated scenario GWh

About 80 per cent of all demand for batteries will be driven by expected demand for electric vehicles in 2030. Other electric mobility, such as maritime industry, will make up about 12 per cent, while the market for stationary storage will make up about 8 per cent.



Source: McKinsey Battery Demand Model 2021

Carbon capture and storage (CCS)

Carbon capture and storage in Norway in 2030

Value creation (GDP)

15 billion NOK

Contribution from specific initiatives in this report

15 billion NOK

Total increase 2020-2030

Employment (full-time equivalents)

15 000

Contribution from specific initiatives in this report

What is the opportunity?

Strengthen our leading position and become Europe's largest CO_2 bank

Carbon capture technologies

Develop carbon capture technology to cover more point source emissions

Blue hydrogen with the aid of CCS

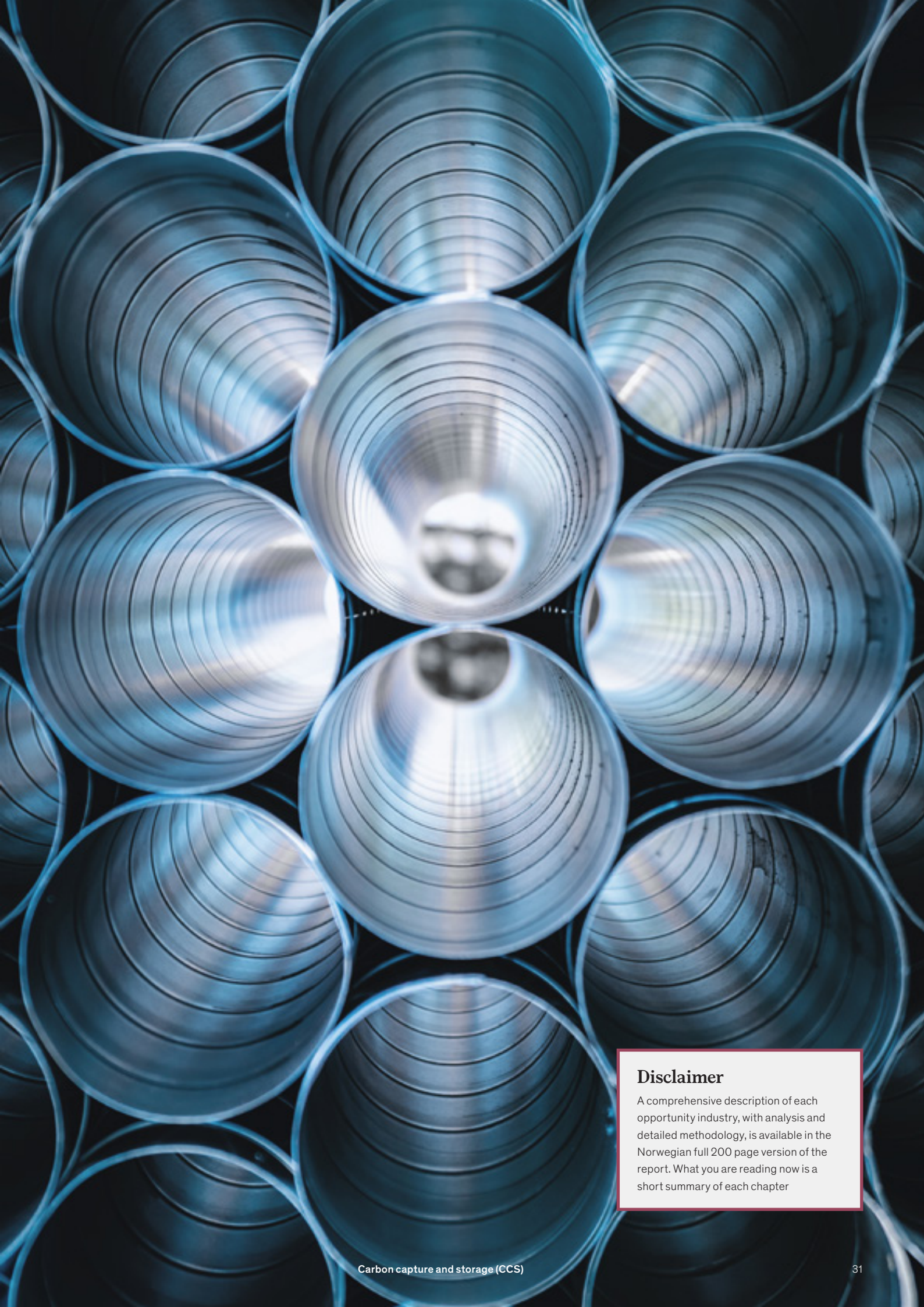
Use carbon capture solutions to make blue hydrogen possible

CO_2 storage

Become Europe's carbon bank by storing CO_2 in the North Sea

Infrastructure for transporting CO_2

Develop infrastructure that facilitates capture and storage



Disclaimer

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SUMMARY

Unwanted, but fundamentally important

Carbon capture and storage (CCS) is an industry that the world in many ways does not really want. Emission-free and renewable energy sources would ideally be efficient and widespread enough that there would be no CO_2 to capture and store, but unfortunately that is not the case.

Even if we replaced all fossil fuel energy sources with power from water, sun, or wind, we would still have considerable CO_2 emissions from several industrial processes. The cement industry, which currently is responsible for about five per cent of the world's emissions, is a good example. Making cement involves burning limestone, which leads to the release of large quantities of CO_2 (two-thirds of the emissions from cement production occur through burning of limestone).

Making this process carbon-neutral therefore requires carbon capture and storage. Emissions from cement production and other industrial processes that cannot become climate neutral without CCS make up between 5 and 10 per cent[1] of the EU's total CO_2 emissions in 2020.

In addition to being an irreplaceable solution for certain types of CO_2 emissions, CCS is also a necessary, temporary solution in the years leading up to 2050 because it will take time to develop renewable energy sources. McKinsey's calculations show that up to 15–20 per cent[2] of the EU's total emissions in 2020 must be handled with the aid of CCS, if the goal is the most cost-effective route to climate neutrality by 2050.

Stated briefly: For Europe there is no route to climate neutrality in 2050 that does not include significant amounts of carbon capture and storage.

This is reflected in the anticipated size of the European market for CCS. Depending on carbon price, the value along the entire value chain – from capture, via transport and to storage – will be somewhere between NOK 50 and 400 billion in 2030.[3]. The large interval shows that there is still some uncertainty about how large the market will be in eight years.

Norway has an opportunity to take a leading position in carbon capture and storage. Few, if any, countries have better conditions for becoming Europe's carbon bank. Norway has a large number of empty oil and gas reservoirs in the North Sea, which combined have the capacity to store CO_2 corresponding to 1,000 years of annual Norwegian emissions. This storage capacity can be used for storing CO_2 captured from point source emissions and CO_2 from production of blue hydrogen with natural gas.

With specialized expertise from the oil and gas industry, Norway possesses unique knowledge in carbon capture and storage. In fact, for more than a quarter of a century, Norway demonstrated to the world that CO_2 can safely be captured and stored on an industrial scale. As early as October 1996, Equinor (then Statoil) began to pump CO_2 from natural gas back into the ground under the Sleipner Field off Stavanger. Now about one million metric tonnes of CO_2 is stored here annually, a reduction in emissions that corresponds to the annual emissions from 220,000 passenger vehicles.[4].

[1] ERTR- European Pollution Emission Register
[2] McKinsey Net-Zero Europe Report
[3] Depending on carbon price, CO_2 demand and greenhouse gas regulation. Estimated volume between 100-200 million metric tonnes of CO_2, with a CO_2 price between EUR 50-200 per metric tonnes.
[4] Equinor, Carbon Capture and Storage

Stated briefly: For Europe there is no route to climate neutrality in 2050 that does not include a substantial amount of carbon capture and storage

Separating and capturing CO_2 from emissions is energy-intensive, but Norway is well positioned to carry out carbon capture without generating additional emissions, as nearly 100 per cent of the electricity in this country comes from renewable hydroelectric power. This is a clear competitive advantage over the rest of the EU, where only 34 per cent[5] of the electricity comes from a green source in 2019.

A successful major investment in the initiatives in this report for carbon capture and storage can contribute NOK 15 billion in increased value creation (GDP) and 15,000 new jobs in 2030.

Green maritime industry

Green maritime industry in Norway in 2030

Value creation (GDP)

11 billion NOK
Contribution from specific initiatives in this report

4 billion NOK
Underlying market growth

15 billion NOK
Total increase 2020-2030

Employment (full-time equivalents)

10 000
Contribution from specific initiatives in this report

What is the opportunity?

Secure our position as a leading green shipping nation

High-technology ships

Develop a robust and leading value chain for green high-technology ships

Optimization systems

Develop optimization and ship systems and systems for maritime logistics

Green fuel

Produce green maritime fuel

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SUMMARY

Blue legacy, green future

In the 1920s and 30s – before Norway became an oil-producing nation – the world's demand for oil was on the rise. Norwegian shipowners invested in tankers that made Norway a key player. Not only was the Norwegian fleet the world's fourth largest before the Second World War – it was also, with a motorized share of 60 per cent, the world's most modern fleet.

Nearly a hundred years later, Norway is still a leader in the modernization of shipping. No country in the world has a fleet with greater elements of CO_2-reducing measures than us. This bodes well when the blue industry is to become green.

Today, shipping is problematic for the climate. About three per cent of global greenhouse gas emissions come from shipping.[1]. For Norway, the emissions are even higher. Shipping (including shipping related to fishing) is responsible for up to seven per cent[2] of our total greenhouse gas emissions, equivalent to 24 per cent of Norwegian transport emissions.

Now more stakeholders are imposing stricter requirements. Emission reductions from maritime industry are high on the agenda of both the United Nations International Maritime Organization (IMO) and Norwegian authorities. The IMO's objective is for emissions from shipping to be reduced by 50 per cent by 2050.

In addition, the capital market and consumers are imposing stricter requirements on the industry to reduce its greenhouse gas emissions.

In this regard, Norway is in the lead. With a merchant fleet that has the greatest carbon reduction in the world, Norway is currently a leader in green shipping. Norway's vessel fleet has up to ten times more carbon-reducing measures than the global average (13 per cent versus 1.5 per cent).[3]

But we must nevertheless take steps to invest for the future. Other sectors and industries will likely implement the green transformation faster than the maritime sector, as vessels have a long lifespan and it is costly and complicated to reduce emissions. Therefore, Norway cannot rely on global growth, which in turn creates a challenge: We must be willing to invest while others continue to wait, and we must act proactively in order to create the green maritime industry of the future.

A successful major investment in the initiatives in this report for green maritime industry can contribute NOK 11 billion in increased value creation (GDP) and 10,000 new jobs in 2030. This does not include existing contributions to GDP, jobs from green maritime industry in 2020, or underlying growth from this in the period leading up to 2030.

1 McKinsey Net Zero Europe
2 Statistics Norway - Statistikkbanken
3 McKinsey

We must dare to invest while others continue to wait, and we must act proactively in order to create the green maritime industry of the future.

Industrial software

Industrial software in Norway in 2030

Value creation (GDP)

27 billion NOK
Contribution from specific initiatives in this report

5 billion NOK
Underlying market growth

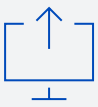
32 billion NOK
Total increase 2020-2030

Employment (full-time equivalents)

26 000
Contribution from specific initiatives in this report

What is the opportunity?

Become the industry's answer to Silicon Valley

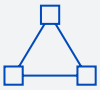


Applications

Utilize a strong domestic market to develop applications for industrial use

Data

Develop and build data companies that take advantage of the scaling effect of data



Platform solutions

Utilize the interaction between software applications by developing platform solutions

Industrial equipment

Design and develop equipment at the intersection between industry and software

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SUMMARY

Norway can become the industry's answer to Silicon Valley

5/7

Today five of the seven most successful companies in the world are consumer platform companies.

80%

Approximately 80 per cent of all devices connected to the internet in 2025 are expected to be IOT devices.

If you're not reading this text on a smartphone, you almost certainly have one nearby. What that phone can do for you today, compared to what the phone you had at the end of the last millennium could do, does in many ways summarize twenty years of technological revolution for consumers.

We have gone from physical encyclopedias to Google, from land line phones to smartphones, and from letters to social media. As a result, today five of the seven[1] most successful companies in the world are consumer platform companies.

The same progress that has changed our everyday lives as consumers will hit the world's industries in the next ten years.

The changes we will see in all industries are made possible by technological progress and driven by a handful of global main trends. The world is facing strengthened demand for efficiency because of a growing population with higher requirements for prosperity, and we are becoming increasingly dependent on the efficient use of resources in order to respond to the demands imposed by the green transformation.

This paves the way for industrial software as a future industry.

The strength in industry data

The world has enormous quantities of collected industry data. In fact, the quantity of stored industry data now exceeds that of consumer data. Across the entire planet, processes and results are being recorded and stored by enterprises and sectors. But in contrast to consumer data, these are not analyzed to the same extent across silos. Nor are they combined and augmented in cloud solutions. Until now.

About 80 per cent[2] of all devices connected to the internet in 2025 are expected to become part of the IoT ("Internet of Things"). The IoT is a network of physical objects equipped with sensors, software, and various meters that can be connected to the internet and generate data. A key point in this regard is that large parts of the world's industrial data are still unused. As much as 90 per cent[3] of these data may be deemed "non-IoT". Whoever occupies the best position when the world's industrial data connects to the IoT may become the industry's equivalent to Silicon Valley.

Just as Apple and Microsoft have become giant companies because they were far-sighted pioneers, similar processes will likely occur in the imminent digitalization of industry: A few pioneers will dominate the market.

It is a long way from Silicon Valley in California to Kongsberg Technology Park in Viken county in Norway. However, the software that Kongsberg Digital supplies to its customers from here, along with the platform that Cognite is developing at Fornebu in Bærum, is evidence that Norwegian companies already are part of shaping the digital advance.

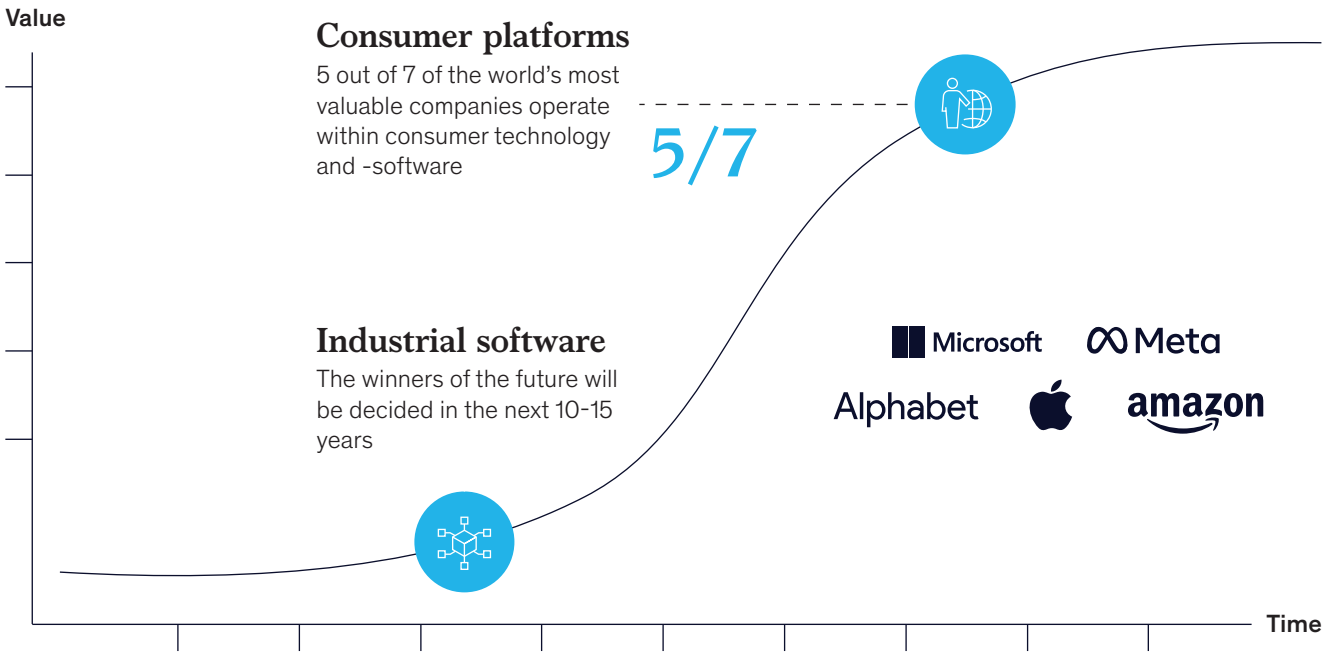
Norway can lead the way in development

Not only can Norway be part of shaping the digitalization of industry, but we can also lead the development. Good examples of how digitalization and a new industry can reinforce each other can be found in the ten industries highlighted in this report. Industrial software connects the digital with the physical.

This promising business area will only be an opportunity if there are industries

[1] Apple, Microsoft, Alphabet (Google), Saudi Aramco, Amazon, Tesla, and Meta (Facebook)
[2] IoT Analytics – Cellular IoT & LPWA Connectivity Market Tracker 2010-2025
[3] IDF Global DataSphere

The world is facing a new S-curve of innovation and value creation



Source: Mckinsey

to supply software to. Industry-leading companies with a high willingness to digitalize – be it in offshore wind, batteries or hydrogen – will therefore be crucial if Norway is to succeed in establishing industrial software as an important industry.

The power that is released when entrepreneurs can try their hand at the most challenging and valuable industrial problems can be enormous. If Norway actively uses its industrial expertise, its engineers, and its customer base to develop new companies, we can take a pioneering position in industrial software and create Norway's next big export product.

Norwegian investments in industrial software are fundamentally attractive because this is an efficient use of capital in solutions that are extremely scalable. It also has the advantageous "double effect" of building a new export industry while at the same time strengthening the competitiveness of existing Norwegian industries.

In the end, it is the ability to convert the Norwegian urge for new adventures to business entrepreneurship that will decide whether or not we succeed. Even though the opportunity to develop industrial software into a new industrial adventure depends to a large extent on the willingness of Norwegian entrepreneurs to take action, there are measures that can increase our chance of succeeding. Industry expertise, talent, and risk capital are three key areas.

A successful major investment in initiatives in this report for industrial software can contribute NOK 27 billion in increased value creation (GDP) and 26,000 new jobs in 2030. This does not include existing contributions to GDP, jobs from industrial software in 2020, or underlying growth from this in the period leading up to 2030.

Consumer platforms

Consumer platforms in Norway in 2030

Value creation (GDP)

11 billion NOK
Contribution from specific initiatives in this report

17 billion NOK
Underlying market growth

28 billion NOK
Total increase 2020-2030

Employment (full-time equivalents)

10 000
Contribution from specific initiatives in this report

What is the opportunity?

Build upon the Norwegian start-up boom on consumer platforms

Digital platforms

Develop and scale digital platforms that create value by facilitating the of goods, services, solutions or social currency

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SUMMARY

Norwegian platform technology – from “start up” to “scale up”

Things are flourishing in Norway.

The vast majority of people in Norway enjoy beating Sweden in competitions. But when it comes to the number of successful technology companies and consumer platforms, we are the ones who are being outperformed. Sweden is one of the countries in Europe with the largest number of technology companies, and when adjusting for population, only Silicon Valley has more unicorns – companies with more than USD 1 billion in valuation – than the Swedes. Sweden invests five times more capital in start-up companies than Norway. They also invest differently by maintaining a greater investment pressure throughout the growth phase of the companies. This means that Norwegian start-up companies cannot grow as rapidly.

Norway’s goal should be to become at least as good as our neighbors in platform technology and other digital solutions. The most important reason for this is the enormous value creation that will occur in this area in the future. It is estimated that the global market for digital consumer platforms will triple in five years – from NOK 4.5 trillion in 2020 to NOK 15.3 trillion [1] in 2025. There is substantial revenue potential in taking a larger share of this market. In addition, consumer platforms contribute by changing and usually simplifying the customer journey, which in turn has contributed to positive externalities in society. The payment solution Vipps, for example, has simplified payment processes for consumers, companies and voluntary organizations.

A consumer platform enables consumers and companies to digitally interact for the purpose of exchanging goods, services, solutions or social currency. International examples of such platforms include Facebook and Airbnb, two of the world’s best-known brands. We find Norwegian examples in Norway’s largest marketplace, Finn.no, the game-based learning platform Kahoot!, the printing and production platform Gelato, and Tise, a marketplace for buying and selling second-hand clothes and items.

Even though the consumer platform industry is a global market exposed to competition, with established structures and players, we still believe that Norway has the potential to succeed.

This is because the development of a digital platform is most likely to succeed when the solution is quickly iterated in a test market before it is scaled rapidly on a global basis. The communications tool Slack is an example of such a process. Slack saw the light of day in a start-up company that had actually developed a computer game but was later scaled globally. After just eight months, the company achieved unicorn status, with a valuation of more than one billion U.S. dollars.

Both Gelato and Kahoot! are companies that have achieved unicorn status. They prove that Norway can also succeed with global platform solutions. There are several aspects of Norway as a country indicating that these success stories should not be viewed as random luck. Instead, they should be regarded as the result of a number of societal features that can be systematized, and thus make consumer platforms a prosperous future industry for Norway.

Norwegians tend to quickly adopt new digital solutions, and in Europe, no one uses the internet more than us. More than 90 per cent of the population uses public sector digital services or has contact with the public

[1] McKinsey

30%

The annual salary of a Norwegian software developer is on average 30 per cent lower than for comparable positions in California.

20%

The annual salary of a Norwegian user experience designer is on average 20 per cent lower than for comparable positions in California.

sector through digital channels.[2]. Another crucial element is that we have a high level of trust in each other and in public institutions. In this area, Norway has the third highest score in the world, ranking below Denmark and Finland. In addition, we have access to competitive developer expertise. The annual salary of a Norwegian software developer is on average 30 per cent lower, and 20 per cent[3] lower for user experience developers, than for equivalent positions in California. This means that Norway is a good test market for new digital business models and consumer platforms.

A promising technology ecosystem is in the process of germinating. We see signs of a an extremely promising and obvious Norwegian momentum in the start-up environment for platform technology. Over the last ten years, there has been robust growth in new technology companies – from 97 start-ups in 2010 to 370 start-ups in 2020[4]. Kahoot!, Hyre, Vipps, and Tise are just a few examples indicating that Norway is already accelerating in this area.

Norway has an opportunity to achieve enormous success in the sector if we utilize and strengthen the momentum we have built. We must also succeed in scaling internationally and ensure that the investor landscape secures adequate investments throughout the entire journey – from the starting capital phase to the late growth phase.

To put it in "entrepreneurese": In Norway, we are ready to go from being good at "start-ups" to becoming good at "scale ups".

A successful major investment in initiatives in this report for consumer platforms can contribute NOK 11 billion in increased value creation (GDP) and 10,000 new jobs in 2030. This does not include existing contributions to GDP, jobs from consumer platforms in 2020, or underlying growth from this in the period leading up to 2030.

2 Government of Norway
3 Government of Norway
4 Pitchbook, September 2021

Circularity

Circularity in Norway in 2030

Value creation (GDP)

46 billion NOK

Contribution from specific initiatives in this report

46 billion NOK

Total increase 2020-2030

Employment (full-time equivalents)

14 000

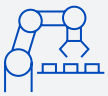
Contribution from specific initiatives in this report

What is the opportunity?

Create winners in the European circularity market across ecosystems, technologies, and materials

Ecosystem for maintenance, recycling and sharing

Build platform companies that facilitate maintenance, recycling, and sharing and thus extend a product's useful life

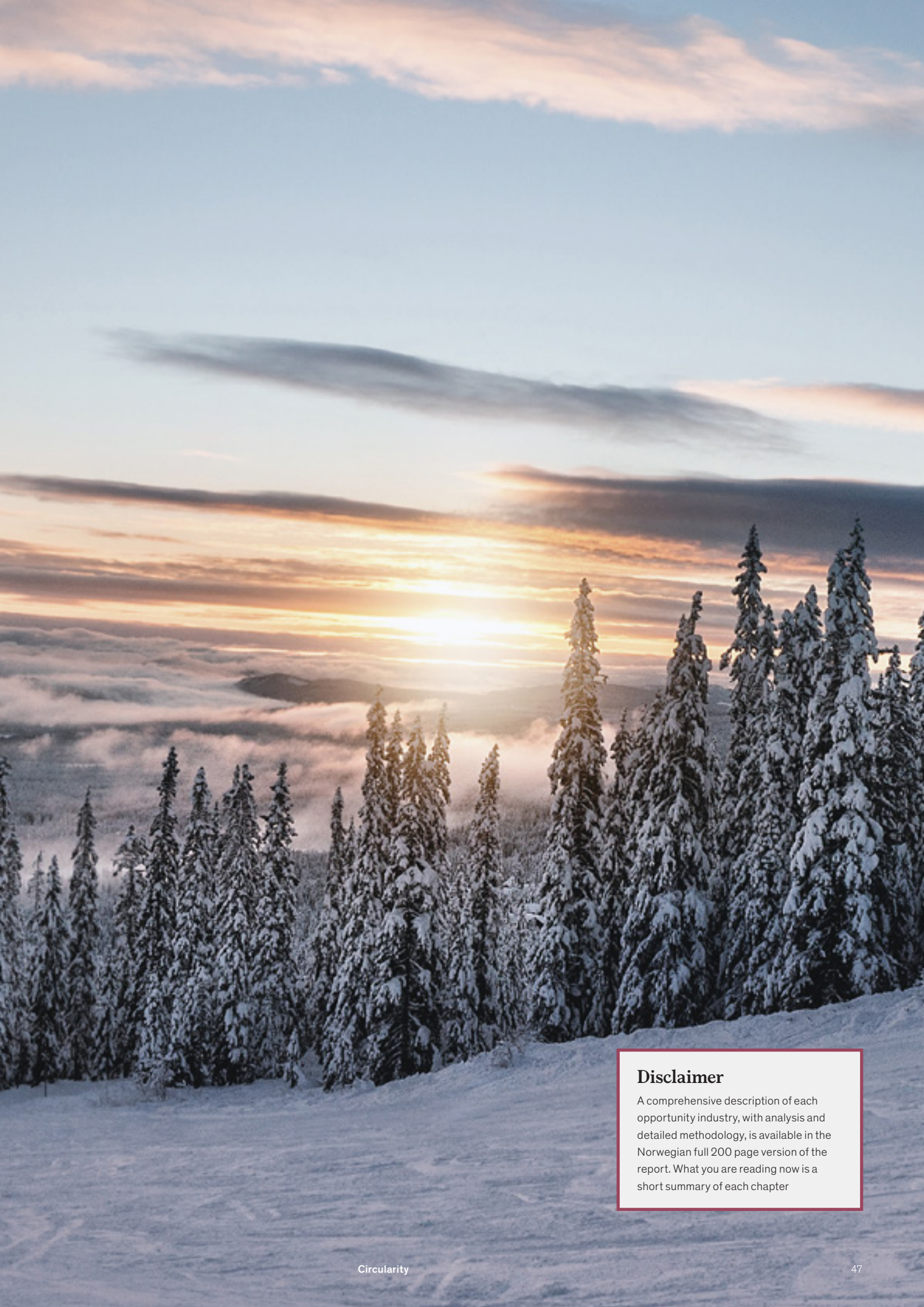


Recovery technology

Export technology that is required for an efficient and smart recovery of materials

Better utilization of materials

Become a pioneer in using both buildings and materials better, and focus heavily on utilizing inputs from the bio industries



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SUMMARY

Circularity is working its way into all industries

Circularity is not just a trendy concept, it is also profitable.

If everyone on Earth lived as Norwegians do, we would need resources equivalent to three and a half planets. It is obvious, therefore, that those of us who reside in this part of the world must reduce our own consumption if we want to contribute to a sustainable planet.

When the growth in wealth worldwide means that the global middle class with purchasing power will increase by close to two billion people by 2030, this means that the planet's resources will be subjected to even greater pressure in the next decade. Naturally, most people will want to consume as much as we do.

This will likely result in regulatory requirements from authorities worldwide, who will be forced to think in a circular fashion in order to protect the planet's common raw material resources.

In this sense, circularity comprises the entire value chain for physical goods: Raw material processing, production, use, collecting, sorting, and recycling. It is this holistic context circularity can help us maintain our standard of living while simultaneously reducing our consumption.

It is that same holistic understanding – not just the recycling phase, which we often talk about – that makes circularity a possible winner if optimize all links in the value chain.

The fact that we have started early is an advantage for Norway. Among other things, we have widespread ownership of what for many is the very symbol of circularity – reverse vending of bottles. The Norwegian firm TOMRA has a global market share of an impressive 80 per cent in reverse vending machines. Norsk Gjenvinning, which gives new life to waste products from construction sites, and Norsk Hydro, which has the market's most advanced sorting technology for recycling of aluminum, are other examples indicating that Norway has the leading products, recovery technology, and expertise that the world needs.

More products must become more attractive throughout their entire lifespan for demanding consumers. Norway has also come a long way in this area with sound technological solutions and good customer understanding. Hyre's car sharing and Tise's platform for second-hand clothing are examples of that. This type of consumption must be adopted if we are to get more out of every vehicle, bicycle, or jacket in 2030.

Norway's expertise and products could help create a more circular world. However, we may also benefit ourselves, and the results can become visible in our national budget. If we succeed with circularity, we will enhance our competitiveness as a nation – not only because we will get more from less, and thereby be able to reinvest the savings in Norwegian industry, but also because we will benefit from increased demand for our circular products and services.

The circular economy is heavily reliant on our attitude as consumers. It is not until we, as residents and consumers, change our patterns of consumption into a more sustainable one that we create the revenue basis that makes circularity an industry of the future.

Circularity is not an industry in itself, but an economic mindset that must pervade all sectors. However, the economic potential is on par with several of the other industries in this report.

A successful major investment in the initiatives mentioned in this chapter can contribute NOK 46 billion in increased value creation (GDP) and 14,000 new jobs in 2030. This does not include existing contributions to GDP or jobs from circularity in 2020, overlapping value, and jobs created through circular business models in other industries mentioned in this report, or underlying growth from this in the period leading up to 2030.

If everyone on Earth lived as Norwegians do, we would need resources equivalent to three and a half planets.

Aquaculture

Aquaculture in Norway in 2030

Value creation (GDP)

54 billion NOK
Contribution from specific initiatives in this report

29 billion NOK
Underlying market growth

83 billion NOK
Total increase 2020-2030

Employment (full-time equivalents)

18 000
Contribution from specific initiatives in this report

What is the opportunity?

Develop the world's most sustainable aquaculture to enable radical growth

Sustainable fish farming solutions

Become the leading aquaculture nation in sustainable fish farming solutions

New fish farming technology

Secure our position as a leading nation in new fish farming technology

New species

Establish Norway as the global market leader for new species (such as cod)

Domestic manufacturing process

Bring the processing of Norwegian fish back home

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SUMMARY

The seafood adventure is not over

We should not be content with just being the world's leading seafood nation.

Norwegian salmon on the menus of some of the world's most exclusive restaurants is just one of many examples of Norway's success as an aquaculture nation.

In 2020, Norway exported 2,700,000 metric tonnes of seafood products worth NOK 105.7 billion, equivalent to 37[1] million meals each day for an entire year. Norwegian seafood was responsible for about 10 per cent of Norway's total export earnings in 2020[2].

In other words, the Norwegian aquaculture industry distinguishes itself from a number of the other industries in this report because it already is a strong, established industry, with existing jobs and earnings.

Aquaculture is nonetheless categorized as an opportunity industry, owing to the great growth opportunities that exist in the industry. Given a global market with an increased appetite for fish, combined with a unique value chain in the Norwegian aquaculture industry, Norway should think big when we plan for the future.

The potential for the Norwegian aquaculture industry can be illustrated by viewing Norwegian salmon as an ideal export model. In the year 2000, Norway exported about 383,000 metric tonnes of farmed salmon and trout, for a combined value of NOK 11.1 billion.[3]. Twenty years later, exported volumes had increased to 1,400,000 metric tonnes, corresponding to values of NOK 74 billion.

The aquaculture industry has multiplied its turnover seven times over the last twenty years. The volume has nearly quadrupled. This adventure can be recreated. Once the salmon has blazed a trail, the scene is set for other Norwegian fish species to follow suit. The salmon has become our "red gold". Could cod and other species perhaps become our "white gold"?

What makes the Norwegian value chain unique is that it is more or less complete. It is characterized by comprehensive regulations, research, and education. This ensures that we have the necessary biological expertise on everything from breeding and fry to feed and high-technology fish farming facilities early in the process. At subsequent stages in the value chain, modern slaughterhouses, efficient infrastructure, and targeted marketing contribute to maximizing the value of Norwegian fish on foreign dinner plates.

With such a solid foundation on which to grow further, Norway Is suited to make major investments in aquaculture.

We should not be content with being the world's leading seafood nation, but instead seize the chance to develop the world's most sustainable aquaculture and make radical growth possible. The opportunities extend beyond growth in existing salmon farming: Norway can become a global supplier of new fish species, develop new fish farming technologies, and bring the processing of Norwegian fish back home.

A successful major investment in initiatives in this report for Norwegian aquaculture will make radical growth in volume possible, contribute NOK 54 billion in increased value creation (GDP), and provide 18,000 new jobs in 2030. This does not include existing contributions to GDP, jobs from the aquaculture industry in 2020, or underlying growth from this in the period leading up to 2030.

We must develop the world's most sustainable aquaculture to make radical growth possible.

1 Norwegian Directorate of Fisheries
2 Menon Economics
3 Norwegian Directorate of Fisheries

10%

Norwegian seafood was responsible for about 10 per cent of Norway's total export earnings in 2020

37 million

In 2020, Norway exported 2,700,000 metric tonnes of seafood products worth NOK 105.7 billion, equivalent to 37 million meals each day for an entire year.

The aquaculture industry has multiplied its turnover seven times over the last twenty years. The volume has nearly quadrupled. This adventure can be recreated.

Tourism

Tourism in Norway in 2030

Value creation (GDP)

14 billion NOK
Contribution from specific initiatives in this report

31 billion NOK
Underlying market growth

45 billion NOK
Total increase 2020-2030

Employment (full-time equivalents)

17 000
Contribution from specific initiatives in this report

What is the opportunity?

Become the world's leading country in sustainable high-quality tourism

Powerhouse for distribution

Develop tourism flagships that can grow abroad and link to larger networks and brands

Destination for high-quality tourism

Become an attractive destination for tourists willing to pay for high-quality experiences

Sustainable tourism

Become the world's leading destination for sustainable tourism

Disclaimer

A comprehensive description of each opportunity industry, with analysis and detailed methodology, is available in the Norwegian full 200 page version of the report. What you are reading now is a short summary of each chapter

SUMMARY

The time has come to industrialize Norwegian tourism.

It is not uncommon to underestimate tourism as an industry of the future when discussing what Norway's livelihood will be in the future. Holidays, travel, and experiences may seem trivial compared to other Norwegian industries mentioned in this report.

However, with around ten per cent of the global gross national product before the pandemic, or about three times as much as agriculture, tourism is in reality a global mega-industry. Here in Norway, however, this industry lives in the shadow of other natural resource-based industries and is currently characterized by considerable fragmentation and low margins.

The pandemic's travel restrictions are the root cause of a few extremely tough years for the tourism industry. The shutdown has led to new conditions and several bankruptcies, but has also accelerated transformation. As Norwegian and international tourism in the period leading up to 2023 are anticipated to reach previous activity levels, and value creation during this period is forecasted to increase by about 50 per cent compared to 2019 levels, the industry faces a paradigm shift.

A modern, professionalized, and sustainable tourism industry must be raised from the ashes. If Norway is to succeed in developing a competitive tourism economy in the period leading up to 2030, we must treat tourism just as strategically as other industries.

The product Norway is a scarce and underpriced commodity

Norway's fjords, mountains, and waterfalls are scarce commodities that have attracted, and will continue to attract, foreign tourists. Aided by a global middle class with new preferences, greater demands, and strong wanderlust, Norway should adopt a visionary mindset when planning for the future.

Norway's travel adventure depends on strong private and public willingness to act. First, we need to gather the actors in a fragmented Norwegian travel sector. In the period leading up to 2030, we must dare to build flagships that can grow internationally and connect with larger networks and brands. This will ensure control over the distribution of Norwegian tourism, so that value is retained in Norway and not in the hands of foreign actors.

At the same time, we must become more conscious of how we approach attractive target groups who are curious about Norway as a travel destination. This will raise the price level and ensure that we reclaim the potential for tourism to create value on par with our Nordic neighbors. For instance, foreign tourists on average leave behind 50 per cent more money in Finland than in Norway.

At the same time, the opportunities extend well beyond professionalizing existing activities. As a pioneering country for green infrastructure, we should not be content with only our natural advantages. The status as a pioneering country for sustainable tourism will be grounds for increased growth.

A successful major investment in initiatives in this report for Norwegian tourism can contribute NOK 14 billion in increased value creation (GDP) and 17,000 new jobs in 2030. This does not include existing contributions to GDP or jobs from the Norwegian tourism economy in 2019 or underlying growth from this in the period leading up to 2030.

The product Norway is a scarce and underpriced commodity

From words to action

Why we must invest now

Norway is one of the world's richest and most prosperous countries. An oil fund of more than NOK 12 trillion is perhaps the most visible evidence of that. From an outside-in perspective, there may seem to be a lack of compelling reasons for countries of such wealth to change course. That is why it is a useful exercise to remove the oil and gas earnings from the equation, in order to get a sense of how healthy and sustainable the Norwegian economy actually is.

In doing so, the picture quickly changes. The Norwegian Government's budget for 2022 would have had a structural oil-corrected deficit of NOK 322 billion. The Norwegian balance of trade, that is, the sum of everything we export and import, would run at a substantial deficit, if foreign countries did not purchase our oil and gas.

Norway's untapped oil and gas deposits are limited, and the earnings from the sector will decline. At the same time, the world must significantly reduce the use of fossil fuel energy if we are to limit global warming. However, declining oil prices is not the only trend impacting us.

Four trends that compel us to act

Certain trends in our time recognize no national boundaries, while others pertain Norway more specifically. What they have in common is that they affect our direction. There are four trends in particular that stand out:

- Firstly, Norway faces a major demographic shift with fewer employees behind each retiree, while earnings from oil and gas are expected to decline. This threatens the economic sustainability of our welfare state. **It forces us to develop additional new jobs.**
- Secondly, the world is facing a climate and energy crisis. Norway's response to this is to commit to the reduction of greenhouse gas emissions by 50 to 55 per cent from the 1990 level by 2030. These are obligations we have not only imposed on ourselves, but the rest of the world as well. **It forces us to think green.**
- Thirdly, the world is in the midst of a digital transformation that is changing the way we work, consume and live. This threatens many traditional business models, but it also facilitates entirely new ways of developing, scaling, and optimizing industries. **It forces us to think digitally.**
- Fourthly, our opportunities to create positive transformation for Norway and the world depend on the natural and competitive advantages we already have. But we will not remain in the "pole position" forever. Geographic advantages have given us oil wealth. The industries of the future do not recognize national boundaries to the same extent, and other countries are investing massively in order to become market leaders. **It forces us to make good decisions more quickly.**

Whereas during the oil era we could succeed by merely being one of the best in one field, the new era means that we must assert ourselves among global competitors in ten different industries, or more.

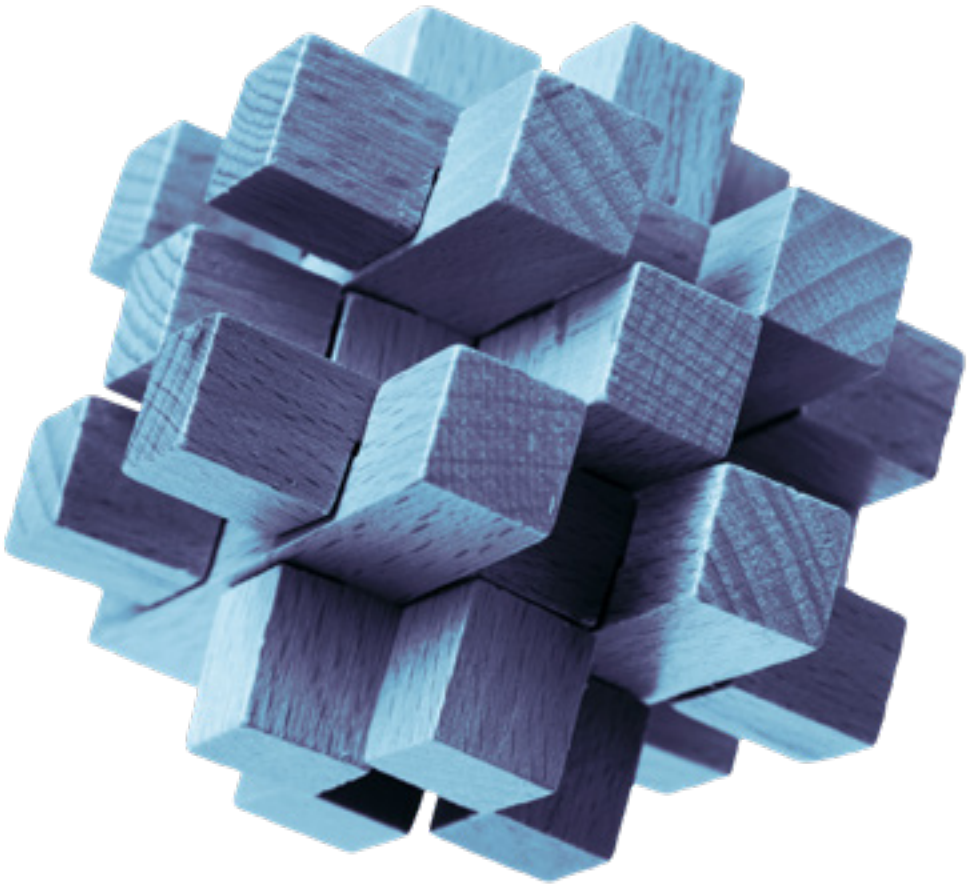
This competition does not start tomorrow. It is underway now. Just look at how Germany and Sweden are investing in batteries, while Denmark has clear ambitions for offshore wind, and Japan, Chile, and the Netherlands are investing heavily in hydrogen.

If we are to assert ourselves in these competitive contexts, we must not only think and act smart, we must also be willing to make the necessary investments and put in the work that is required. There is a great deal of focus on transformation. The next step is for us to make the right decisions for success.

Seven changes for success

Individual industries will have specific and individual problems that must be solved. We have discussed these in a detailed manner in each opportunity chapter. For example, the battery industry depends on trade agreements and international cooperation, while industrial software cannot become a foundational industry until we educate more developers here at home.

What the ten industries and Norway's ability to transform itself have in common are seven overarching areas of improvement. If we can move faster, become more efficient, and make more targeted efforts in these areas, we have a better chance of succeeding with our industries of the future.



1. Specific strategies and plans at the business community, regional and national levels

Norway needs national strategies with clear time frames and ambitious, specific goals. This may, for instance, include deadlines for zero emissions at an industry level, or specifications of capacity expansions.

The most important aspect of strategies in this context is the specific goals they set. Only then can internal and external forces be mobilized to become part of a collective journey. There are few such strategies in the ten opportunity industries today.

2. Knowledge and expertise

When we set out to develop the industries of the future, we also need the expertise of the future. At the moment, we are not educating enough people with the expertise we need. Given the current trend, we must update and renew curricula, increase the number of admissions to the most vital study programs, and continue developing research environments that can attract international talent.

In the individual sub-chapters, we have calculated how many new graduates that are needed in the various industries in order to succeed. We also point out an opportunity for private stakeholders to finance new study programs together with the public institutions, in order to quickly establish the paths to expertise that are required.

3. Investments

Norwegian private investors must recognize their opportunities, and society must encourage them. Sweden invests five times as much in tech start-up companies as Norway, and we must rise to a corresponding level.

Across all investor levels, whether it is starting capital, risk capital, or growth capital, the access to capital for the Norwegian business community must be significantly increased. Greater pressure to invest throughout the investment phase makes it possible for more companies to scale.

4. Infrastructure

In order to *build the country*, the country must actually be built. Norway's ability to transform itself depends on how adept we are at the logistics surrounding raw materials and products. The global competition requires us to create this as seamlessly as possible.

Through private-public cooperation, we must facilitate, invest in and develop the necessary infrastructure for our ten industries of the future. This may, for example, be pipelines for hydrogen and carbon capture, or power cable connections to Europe to export electricity from offshore wind.

5. Legislation and regulation

In tough global competition, Norwegian legislation and regulations must promote Norwegian competitiveness. This must be developed to promote innovation and mobility within knowledge-intensive industries, although not at the cost of ethics of security. One idea, in order to succeed with circularity as an overarching opportunity, is to review current volume regulation on various types of material that are currently regarded as waste (and which have a volume limit) that can curtail major investments in some sectors.

For industries of the future, more single points of contact must be established for certain areas.

6. Bilateral cooperation and trade agreements

Because we will rely on more exports to other countries in several new industries, we will also need sound bilateral and international agreements. For example, transport and storage of CO_2 from European carbon capture on the Norwegian continental shelf can be problematic due to international regulations.

7. Good ownership as a means

Succeeding with the ten opportunity industries will require a willingness to take on risk, a high level of ambition, and long-term decisions. Willingness to invest is required of both domestic and foreign investors. What is crucial for developing the industries of the future is not whether the ownership is private or public but that the ownership is advantageous.

A goal-oriented and constructive governmental ownership is a tool that should be used whenever appropriate. It is sensible for Norwegian authorities now to review the role that the state as an owner can play in various industries, both established and potential sectors. The state as an owner should not select individual winners, however, it may be essential for larger and broader efforts within an industry as a whole.

Four measures for Norwegian executives that should be implemented immediately

- Executives in private companies and public enterprises should, by the summer of 2022, develop clear road maps for the measures they want to implement to become carbon-neutral by 2040.
- Private stakeholders and educational institutions should work together to realize, renew, and adapt educational programs in programming and technical subjects, so that they can be offered as early as the autumn of 2023. Public-private collaboration can co-finance new study programs in necessary expertise (such as battery engineers and programmers). This includes continuing education at the upper secondary, university college, and university levels, so that oil and gas operators, for instance, can receive further training to become battery operators in the mainstream educational system.
- Norwegian private investors should establish Norwegian development and investment funds, in which they actively use their networks to recruit international investors as well. The funds must invest primarily in Norwegian companies within the opportunity industries.
- For industries that are crucial for Norway's ability to transform and compete, a "fast track" case processing scheme must be established through one contact point with a maximum fourteen days for issues involving digital or physical infrastructure.