



SINTEF



SINTEF supports the Sustainable Development Goals

Sustainability Report SINTEF

Technology for a better society

November 2020



Letter from the CEO



Alexandra Bech Gjørv
President and CEO

We are on our way.

Since our inception as an applied research institute 70 years ago, we have sought to provide our clients and society with meaningful results from research and innovation. SINTEF's vision is 'Technology for a better society'. Our 2,000 employees hold our traditions and vision clear, and many come to work for us because they want to make a difference.

SINTEF's strategy, adopted in 2019, is guided by the UN Sustainable Development Goals (SDGs). This extends the obligations we have had as a member of UN Global Compact since 2009, which still apply. The 17 SDGs set out what we and the world have to achieve in order to create a better society. In this document we report on what we are doing to support the goals and strengthen our contribution to society, both through our research and innovation activities and in SINTEF's own organisation.

In this, our first sustainability report, we have decided to deep-dive into two themes in particular: The first is a discussion of SINTEF's energy and climate work, including our portfolio

of activities with the oil and gas sector in relation to sustainability; the second is a review of how SINTEF fulfils its role as a key resource in society's innovation system.

We are not alone in paying greater attention to sustainability. The EU has launched the 'European Green Deal', which aims to make Europe the world's first climate neutral continent by 2050. Among investors and companies, in Norway and abroad, systematically monitoring an organisation's environmental, social and governance (ESG) performance has quickly become commonplace.^[1] At the start of 2019, 85 of the 100 largest companies in Norway had defined one or more key performance indicators (KPIs) to measure their impact and progress within sustainability. Some 12 per cent had linked their business strategy to the company's environmental and social impact.^[2]

It turns out that producing a sustainability report for an organisation that works in as many arenas and on as many different issues as SINTEF does, is no easy task. Our diligent and knowledgeable researchers are the first to point out that the data

we have are far from perfect and that it takes a lot of effort and knowledge to evaluate the results of research in relation to an individual goal.

SINTEF takes sustainability seriously. Therefore, while highlighting results that benefit society, we also want to improve our reporting, specifically to be even more quantitative in how we document the impact our work has on society. At the same time, identifying good methods for measuring the impact of applied research is not straight forward. Among other things, it involves getting to grips with complex value chains involving many stakeholders and causal relationships. Research involves high-risk, long-term work with time lags between when research is conducted and impacts can be measured. But we want to do better!

Going forward, we will make even greater use of the SDGs in how we orient our portfolio and create new research projects and start-ups. We can see that our clearly set out ambition of contributing to sustainability has already helped us, as an organisation, to delve deeper into important issues.

[1] Harvard Business Review, "The Top Sustainability Stories of 2019." 30.12.2019. <https://hbr.org/2019/12/the-top-sustainability-stories-of-2019>.

[2] Hanne Løvstad, Magnus Young and Ulrik Hallén Øen, "Bærekraft 100" PwC (2019) <https://www.pwc.no/no/publikasjoner/Baerekraft100-2019.pdf>.

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1

About SINTEF

Cutting edge expertise from ocean space to outer space

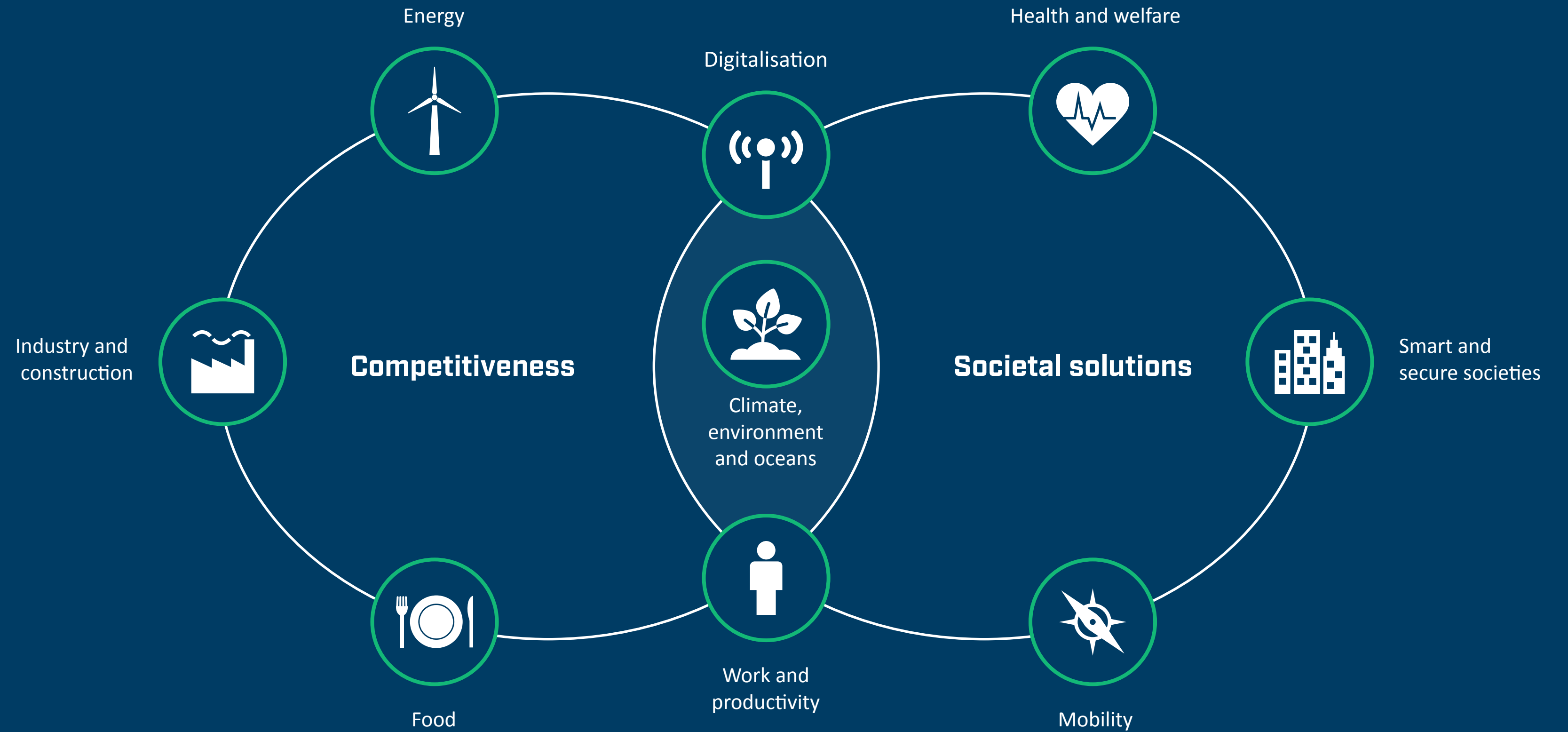
SINTEF's business model is primarily based on carrying out research and innovation projects.

Our laboratories are closely involved in the research and, in addition, assist clients with their innovation and development work through test, prototype and verification projects.

SINTEF also commercialises research results through licensing, selling technology, and start-up companies.

We contribute knowledge, ideas and recommendations to public debates and policymaking.

Our strategy is to move the research front and facilitate a transition towards a sustainable society, nationally and internationally. We want to produce good societal solutions and competitiveness for our partners that in turn have positive ripple effects for the general public and end-users of the technology.



Our general reputation in society testifies to the fact that we play a number of wide-ranging roles, not least within sustainability. The majority of respondents in reputation surveys have a positive perception of SINTEF. We score the highest in environmental awareness, social responsibility and morality among various areas.^[3] Our staff also believe that the organisation's work is important for sustainable development.^[4]

Key external stakeholders encourage us to play a role in the global transition:



“We are working on an exciting project with SINTEF and other partners involving using plastic from the oceans for new products and combining this with blockchain technology in order to maintain control over value chains and avoid the plastic re-entering the oceans.”^[5]

Jan Christian Vestre
CEO of the furniture company Vestre



“Everything is now in place for SINTEF to take a leading role in Norwegian society as we continue the green transition.”^[7]

Iselin Nybø
Norwegian Minister of Trade and Industry



“Today's SINTEF is a successful and internationally oriented research institute that occupies a key position in the Norwegian research landscape and is NTNU's most important research partner. Given its strong technology profile and broad expertise in technologies important for the green transition, SINTEF is an important actor within research and innovation for sustainable development in both a Norwegian and an international context.”^[6]

Anne Borg
Rector Norwegian University of Science and Technology (NTNU)

[3] IPSOS profile survey, 2019.

[4] Working environment survey in SINTEF, January 2020.

[5] Jan Christian Vestre at SINTEF's management gathering, 3 June 2020, translated from Norwegian.

[6] Anne Borg at SINTEF's management gathering, 3 June 2020, translated from Norwegian.

[7] Iselin Nybø at SINTEF's management gathering, 3 June 2020, translated from Norwegian.

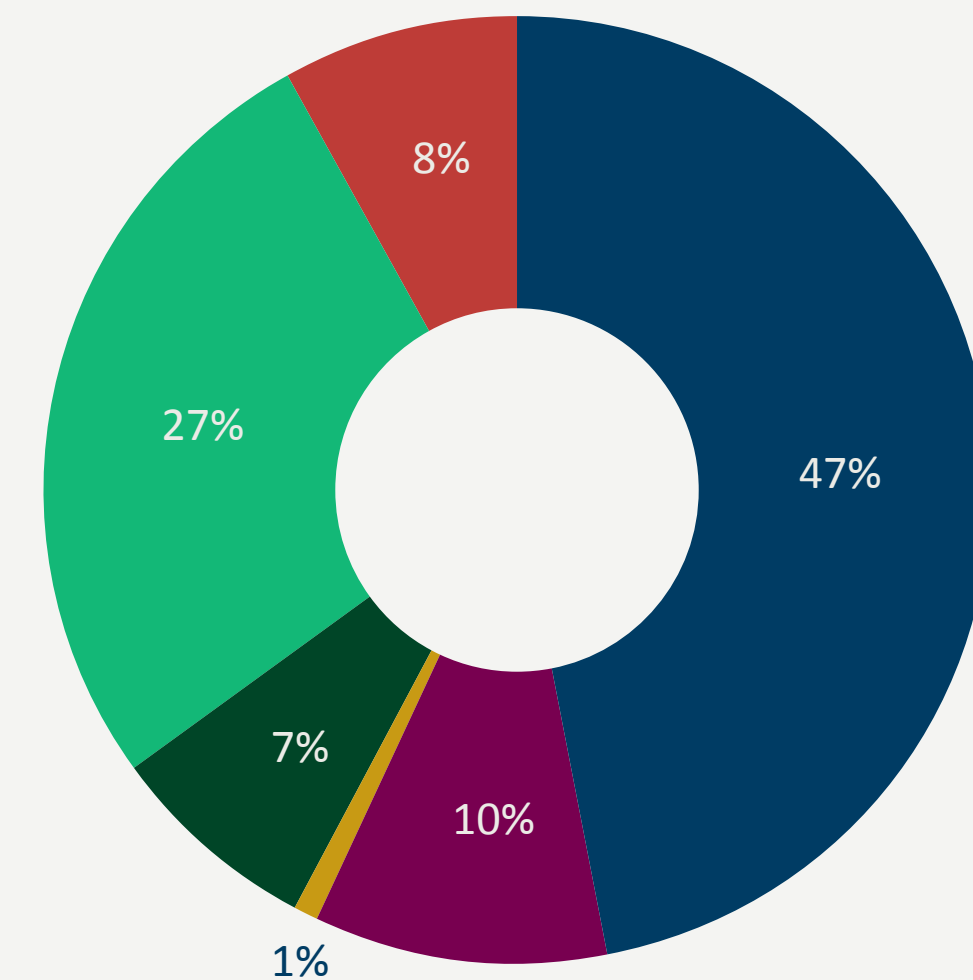
SINTEF is the largest research institute in Norway and one of the largest in Europe



With a total of **EUR 149 million** awarded, SINTEF is the largest contributor to Norway asserting itself in the EU's framework research programme, Horizon 2020

A broad portfolio with an emphasis on applied research with business and industry and other stakeholders

Portfolio funding 2019
NOK 3.5 billion



- Business and industry
- Other sources of income
- RCN project support
- Public sector
- EU
- RCN basic grant

Source
SINTEF

2

SINTEF's strategy and activities are guided by the UN Sustainable Development Goals

SINTEF's corporate strategy, adopted in 2019, is guided by the UN Sustainable Development Goals (SDGs). The goals refine SINTEF's vision. This extends beyond the obligations we have had as a member of UN Global Compact since 2009. The 17 SDGs set out what we and the world have to achieve in creating a better society.

SUSTAINABLE DEVELOPMENT GOALS



Many companies set clear priorities as regards which SDGs they particularly want to deliver on. This is often based on strategic considerations or on an assessment of where they can have the greatest societal impact.^[8] As a research institute, SINTEF is involved in many value chains, industries and areas of expertise – with an emphasis on sectors where technological solutions play an important role. This breadth means that we want to deliver on the entire sustainability agenda and have in our corporate strategy committed ourselves to all 17 SDGs. At the same time, SINTEF clearly delivers more on some goals than others.

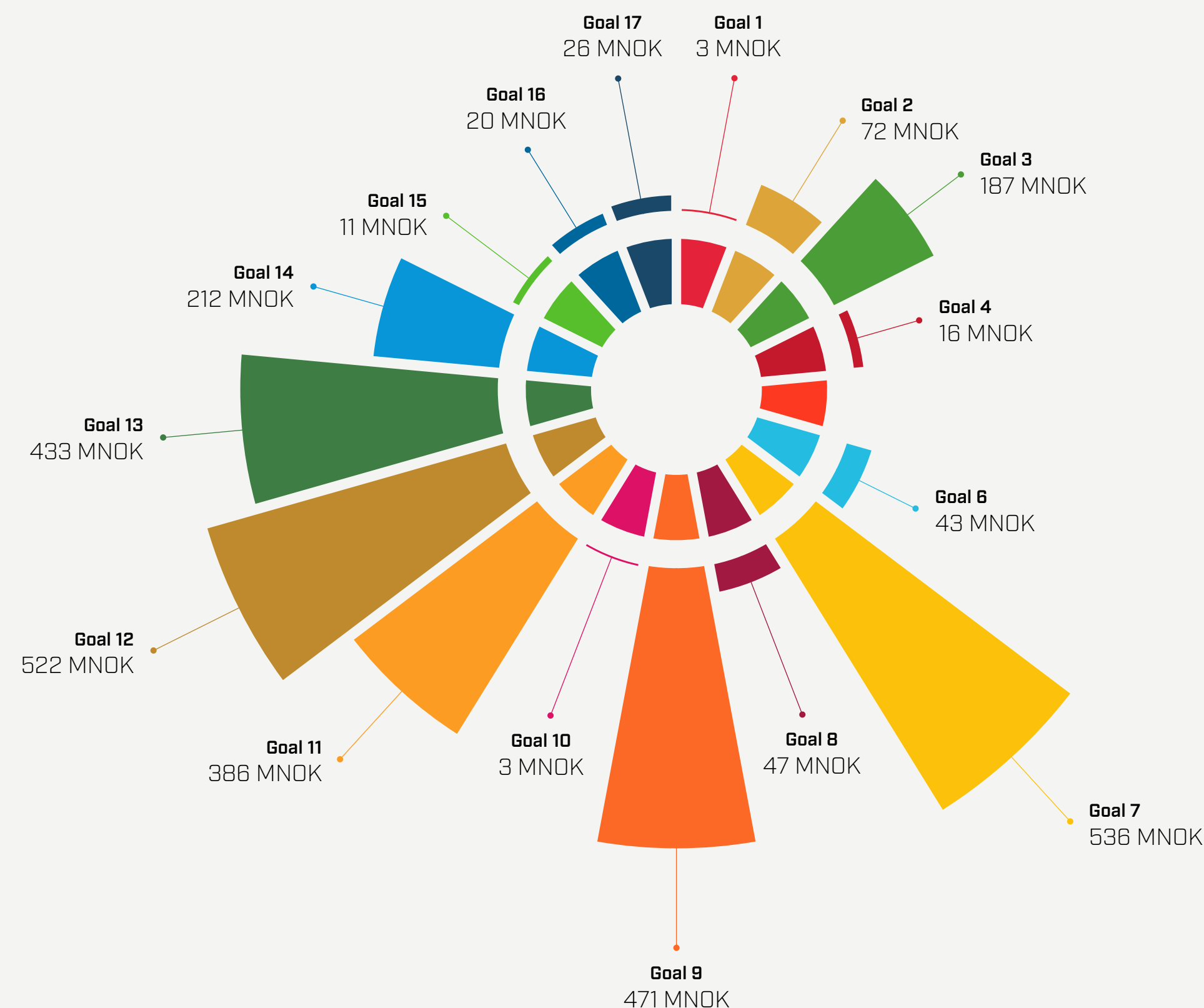
An analytical approach confirms this. The figure on the right shows our research projects' relevance to the various SDGs, measured in terms of turnover in 2019.^[9] The methodology is still being refined but

the current snapshot provides a good illustration of SINTEF's profile. It shows that in 2019 we carried out significant activities in relation to seven SDGs in particular, listed by the turnover associated with each SDG in our project portfolio:

- Goal 7) Affordable and Clean Energy
- Goal 12) Responsible Consumption and Production
- Goal 9) Industry, Innovation and Infrastructure
- Goal 13) Climate Action
- Goal 11) Sustainable Cities and Communities
- Goal 14) Life Below Water
- Goal 3) Good Health and Well-being

We also have activities related to the other SDGs, but these are marginal, especially in relation to goal 5) Gender Equality.

Gross turnover per Sustainable Development Goal



The full title of all of the goals is provided on page 9

Source
SINTEF

[8] World Business Council for Sustainable Development, "Reporting matters 2019" (2019) p. 20. <https://www.wbcsd.org/Programs/Redefining-Value/External-Disclosure/Reporting-matters/Resources/Reporting-matters-2019>

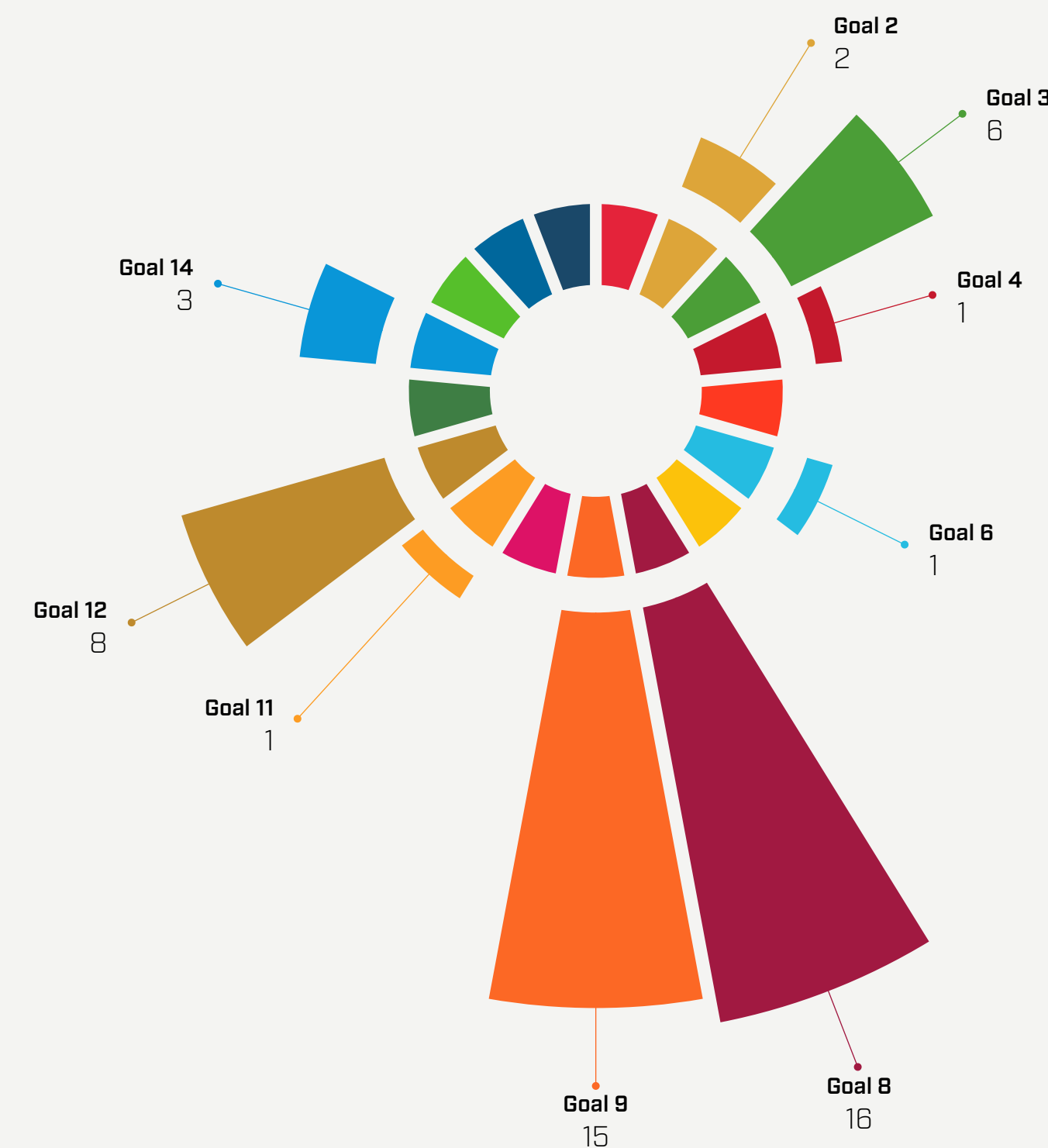
[9] The model shows gross turnover of the research projects in SINTEF's six institutes in 2019, with one goal tagged per project. "Other / Outside" and the untagged portfolio (representing a total of around 14% of the turnover) are not included in the model.

SINTEF's current portfolio of 16 research-based start-up companies have also been evaluated in relation to the 17 SDGs. Most of them have been tagged under goal 8) Decent Work and Economic Growth or goal 9) Industry, Innovation and Infrastructure. Many of these companies are involved in the application of key technologies within IT, biotechnology and nanotechnology that will enable a variety of products, services and value chains for sustainable innovation. In recent years, we have also seen a significant increase in start-ups targeting goal 3) Good Health and Well-being. Many companies also target goal 12) Responsible Consumption and Production and 14) Life Below Water.

It is satisfying to see that that no less than 79% of the Group's employees believe their work contributes to sustainable development.^[10]

At the same time, the work on this report has provided important lessons that will be used to further strengthen SINTEF's contributions to sustainability. We have chosen to develop the report in-house, without explicit links to existing suppliers' sustainability standards. Naturally, we understand the value of external guidance, and in the future we will consider strengthening the reporting with formal standards and audits. However, the process creating this report has been an important goal by itself. We have surveyed our activities. How the internal, external and multi-faceted activities with partners live up to our societal ambitions. By being transparent about this, we hope to build strength in our organisation and earn the trust of society at large.

Start-ups per Sustainable Development Goal



The full title of all of the goals is provided on page 9

Source
SINTEF

[10] SINTEF's working environment survey in January 2020, based on a total of 1,710 responses to the question: "I believe my work contributes to sustainable development".

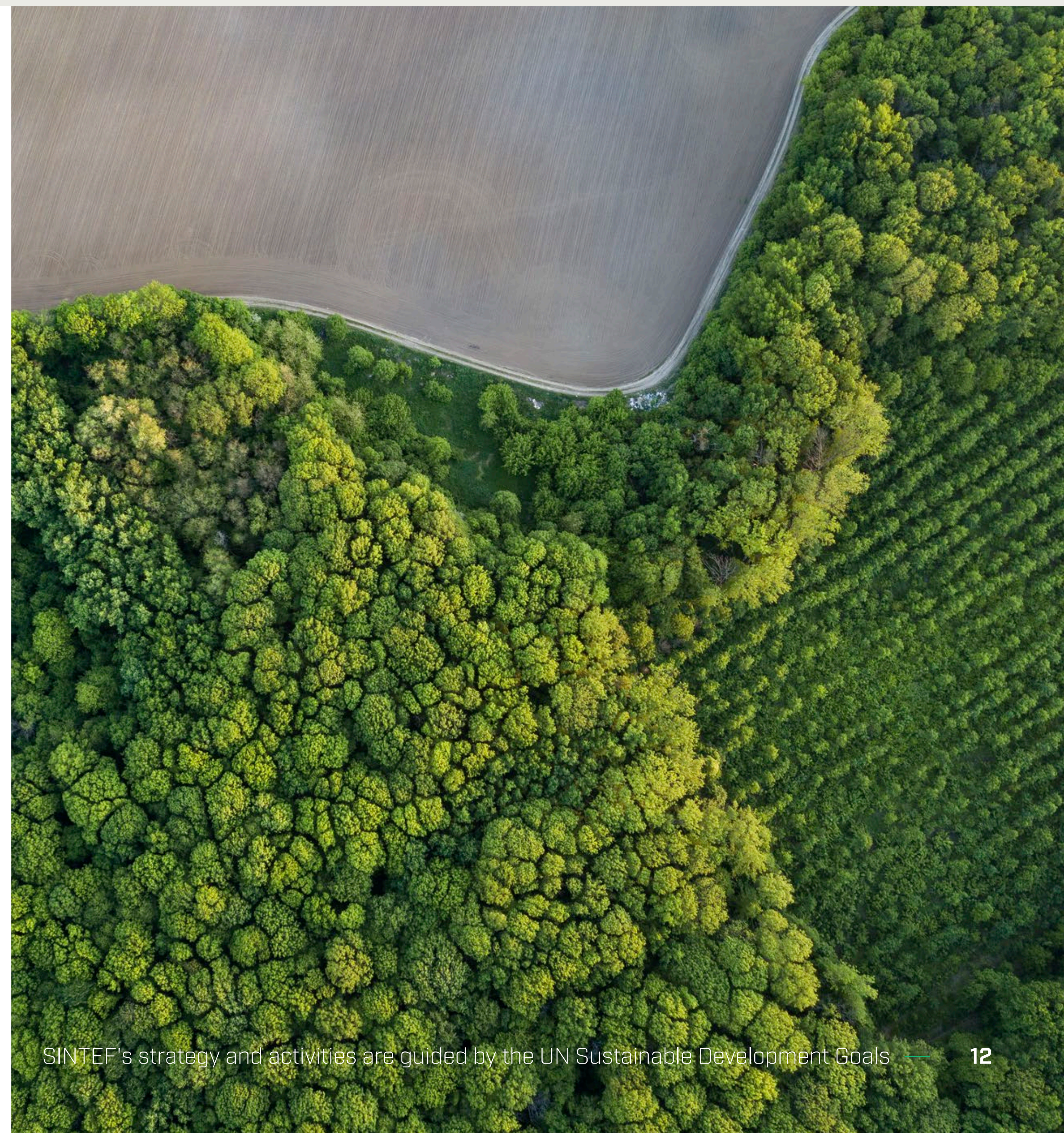
Reflections on our reporting towards the Sustainable Development Goals

When we started tagging our project portfolio, we wanted to match SINTEF's turnover to the SDGs. Therefore, a decision was made to only report on one SDG per project, even though we know that many projects contribute to realising multiple goals. Looking at the results for 2019, we can see that this method neither provides sufficient information about the interplay and dilemmas associated with the efforts to achieve the goals nor does it provide as rich a basis for strategic planning as we had hoped. We will change this for 2020 such that going forward projects can be tagged with up to three SDGs. The start up companies in our portfolio have been tagged with multiple SDGs from the start.

Below we look in more detail at how research and innovation in SINTEF contributes to the 17 goals. Since many of the goals, and the solutions we develop, are interconnected, we deal with some of them together.

The work on reporting on sustainability has given rise to two major debates in SINTEF and we illustrate these through two 'deep dives'. First of all, we look at the perceived dilemmas associated with goal 7) Affordable and Clean Energy and goal 13) Climate Action, where we have evaluated the correlation between SINTEF's work towards a green transition and work involving the oil and gas industry. Next, we look at how goal 9) Industry, Innovation and Infrastructure and goal 8) Decent Work and Economic Growth highlight SINTEF's role as an agent of innovation and our interaction with society at large, and also discuss this in detail.

We must also increasingly ask ourselves whether SINTEF, together with authorities and partners, is making a great enough effort with respect to the challenges faced by developing countries. The global balance between the North and the South is central to the sustainability agenda. An interrelated question, therefore, is also whether our framework conditions must be changed in order for such efforts to succeed.



3

How SINTEF's research and innovation contribute to the Sustainable Development Goals

Goal 7 Affordable and clean energy
Goal 13 Climate action



Goal 9 Industry, Innovation, and Infrastructure
Goal 8 Decent work and economic growth



Goal 12 Responsible consumption and production



Goal 11 Sustainable cities and communities



Goal 14 Life Below Water
Goal 6 Clean water and sanitation



Goal 3 Good Health and Well-Being



Other Sustainable Development Goals



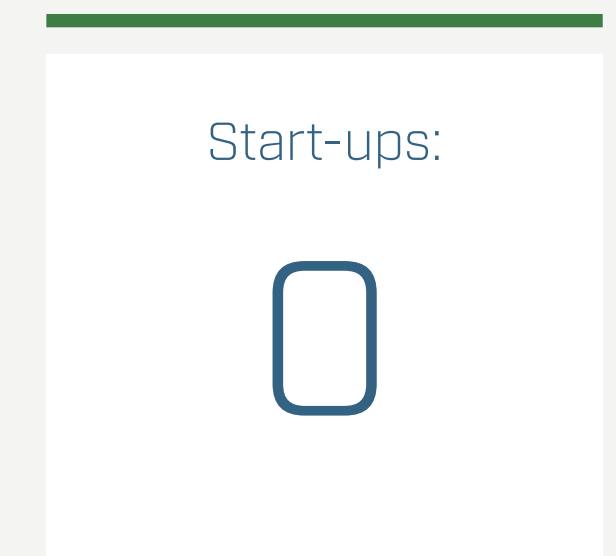
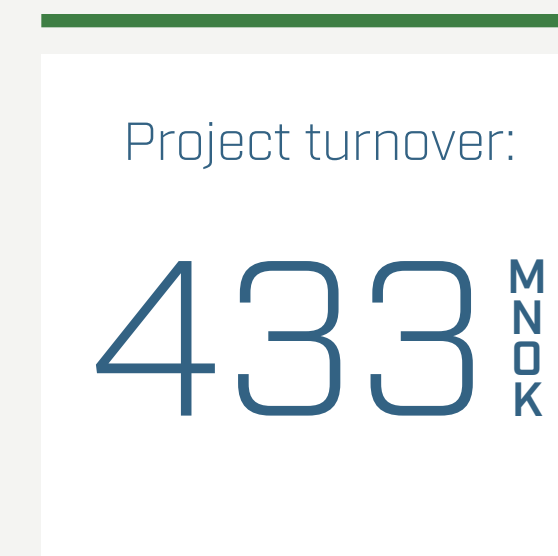
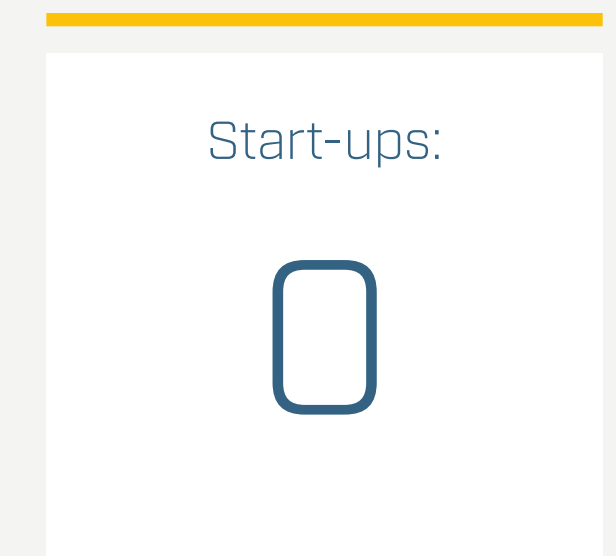
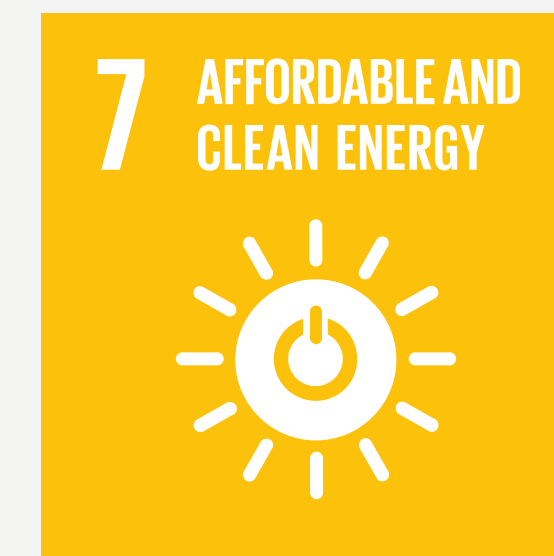
Affordable and clean energy and Climate action

The climate became an increasingly pressing issue in 2019 for all groups of stakeholders,^[11] including SINTEF. To avoid the catastrophic global consequences of climate change, the IPCC recommends limiting temperature rises to below 2°C, and preferably closer to 1.5°C, by the end of this century. Most countries have signed up to this target through the Paris Agreement. Norway has agreed to the EU's target from 2014 of cutting greenhouse gas emissions by 40 per cent by 2030, compared with 1990 levels. The government recently told the UN and the EU that Norway intends to increase its target to a 50-55 per cent cut in emissions by 2030.

The Paris Agreement's goal of limiting global warming to closer to 1.5°C means that Norway must achieve net zero greenhouse gas emissions in 2050. It will be a difficult path. This will mainly have to be achieved by 1) using energy and resources more efficiently; 2) more renewable energy; and 3) measures that eliminate and capture emissions from fossil energy.

The situation as per 2017 was that around 80 per cent of the world's energy supply came from fossil sources with corresponding emissions of CO₂.^[12] SINTEF's mission is to contribute with technology and innovation during the transition in the lead up to 2050, and we have activities related to all three of the main strategic approaches.

Goal 7) Affordable and Clean Energy complicates the picture because it means that a large proportion of the world's population needs more energy. As many of the most populous countries prioritise growing the prosperity of their populations over lower emissions, industrialised countries face a formidable challenge in helping to ensure that this energy is emissions free and economically accessible. The difficult part here is that technologies for producing zero-emission energy are expensive and require economic incentives at an early stage. The capacity of countries to deal with this market failure varies.



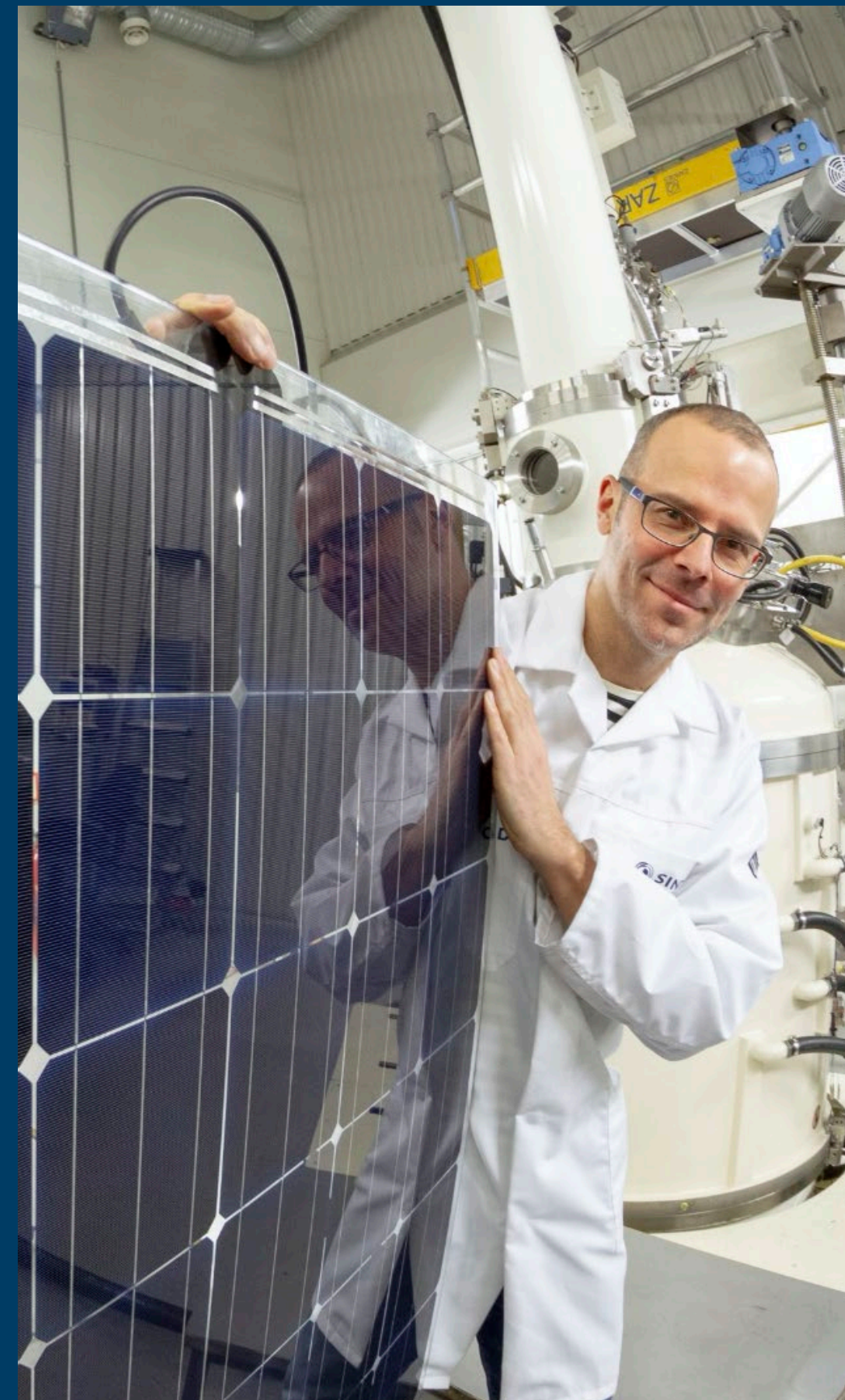
[11] Harvard Business Review, "The Top Sustainability Stories of 2019." 30.12.2019. <https://hbr.org/2019/12/the-top-sustainability-stories-of-2019>.

[12] IEA, "World Energy Balances" (2019).



Eco-Solar: greener solar power

The goal of the project is to make solar power even greener. The project has taken a systematic approach to reduce the consumption of valuable resources in manufacturing of solar panels, delivering the same performance as conventional panels. Eco-Solar has also developed a solar panel concept that allows the main components to be disassembled, recycled or reused. Overall, the innovations in the project have reduced the ecological footprint in manufacturing solar panels by 45 per cent, costs by 9 per cent, and the carbon footprint by around 20 per cent.

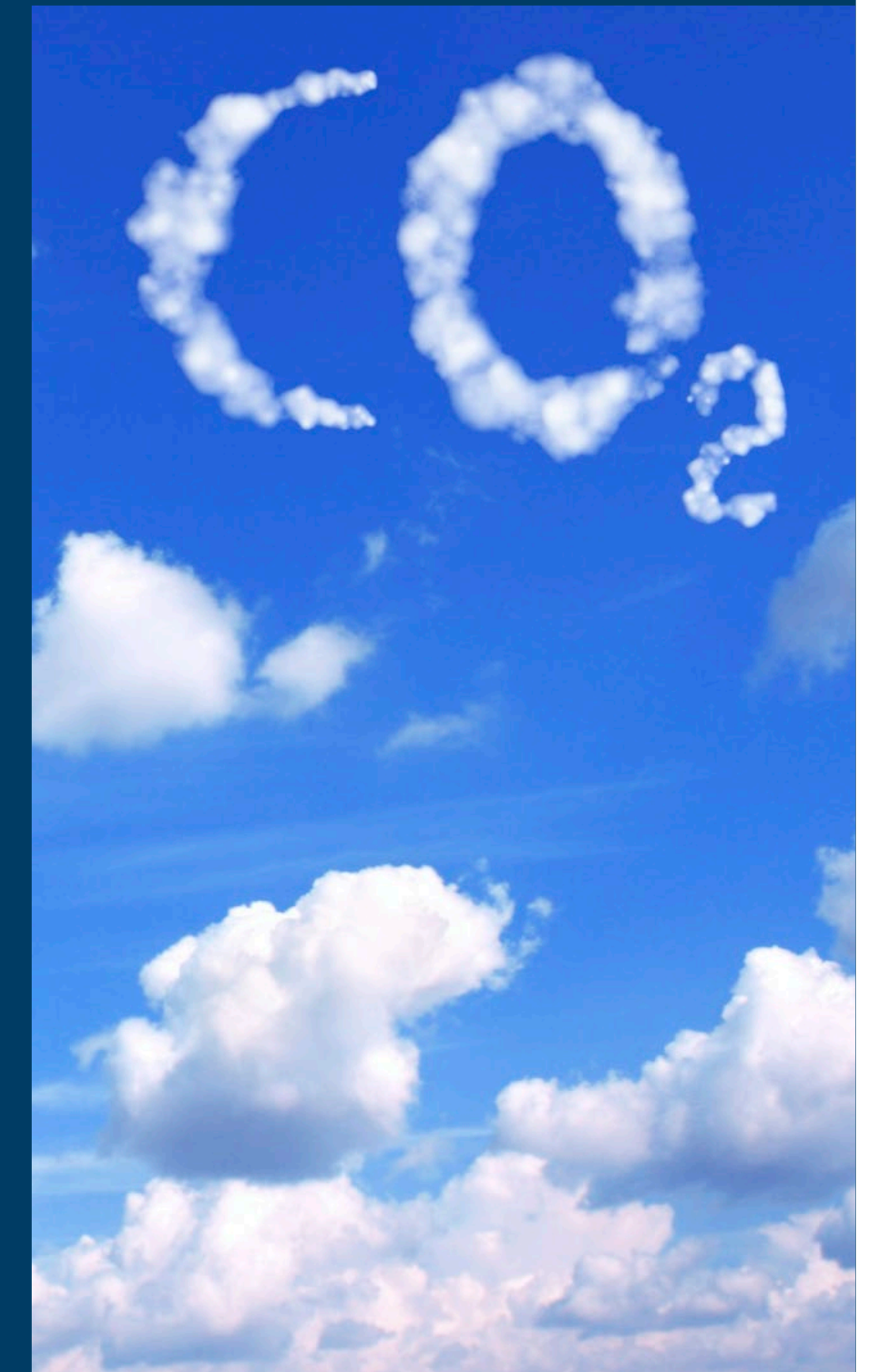


THE PROJECT ALSO CONTRIBUTES TO



NCCS: research into CO₂ capture, transport, and storage

NCCS is an internationally recognised research centre for eco-friendly energy led by SINTEF. The centre carries out research into various technologies for capturing, transporting, and permanently storing CO₂. CO₂ management technology facilitates competitive CO₂-free products, preserves the value of natural gas, and provides great opportunities for the maritime sector, including CO₂ transport via ship. CO₂ management may protect 200,000 Norwegian jobs and create 70,000 new ones by 2050 and is a tool for climate-positive solutions.



THE PROJECT ALSO CONTRIBUTES TO



SINTEF's work on the green transition

The green transition is partly about cutting greenhouse gas emissions, but also involves transforming into a less resource-intensive society. A summary of SINTEF's activities relating to the green transition is provided below. It is not exhaustive:

- The circular economy is a prerequisite for the green transition and is one of SINTEF's largest research areas. Our work relating to the circular economy is discussed under goal 12) Responsible Consumption and Production.
- SINTEF hosts three research centres for eco-friendly energy (FME centres) and is a strategic partner for the five other centres actively engaged in technology and one in social sciences. The FME centres are large (up to eight years) innovation and value creation-oriented collaborations between business, research environments and the public sector linked to targeted efforts within renewable energy, energy efficiency, CO₂ management, and social sciences.

Lower energy use and carbon neutral buildings and neighbourhoods are priority areas for the Zero-Emission Buildings and Zero-Emission Neighbourhoods (FME) centres. Other areas include low-emission concrete and replacing fossil raw materials with renewables in the development of materials. We are also working on CO₂ capture and storage from processes where renewable energy is not an alternative, such as emissions from chemical processes and waste incineration.

- SINTEF is working on energy efficient transport solutions and we have major initiatives within zero-emission technology relating to batteries, charging solutions, fuel cells, hydrogen from electrolysis, and biofuels. We also have major initiatives within autonomous and automated transport that will contribute to the efficient and safe performance of transport with the least possible use of resources. SINTEF hosts a centre for research-driven innovation (SFI centre), Smart

Maritime, which is developing the zero-emission and eco-friendly ships of the future, and is a key partner in SFI Autoship along with NTNU. We also have several large EU projects in all of the above-mentioned areas. We are working on further developing renewable forms of energy and electrification technology. We have particularly been instrumental in positioning Norwegian industry within solar and offshore wind, as well as the optimal utilisation of investments in the electricity grid and hydropower system. Hydrogen as a zero-emission energy carrier has also been a cornerstone of the mobilisation of Norwegian industry in relation to the EU.

- We are also helping to make society more resilient to global warming through climate adaptations and safeguarding society's infrastructure. SFI Klima 2050 is our most important research activity in this area and is also discussed under goal 9) Industry, Innovation, and Infrastructure.

- SINTEF has a broad focus on the bioeconomy of the future through the utilisation of sustainable renewable biomasses. Our efforts are directed at establishing climate-positive processes and the future biorefineries for processing biomass into bio-based chemicals and biomaterials, as well as bioenergy and advanced biofuels designed for long-haul and air transport.
- In addition to renewable energy, SINTEF is one of the world's leading environments within the development of zero-emission energy solutions as clean hydrogen produced from natural gas with carbon capture and storage, and hosts FME NCCS, one of the world's largest centres for CCS research. Fossil energy with CO₂ management, in the form of so-called 'blue hydrogen' or 'blue ammonia', may accelerate the transition to a zero-emission society.^[13]

[13] Blue hydrogen refers to hydrogen produced by converting natural gas into hydrogen and CO₂ with the subsequent or integrated CO₂ removal, transport and long-term storage. Blue ammonia is produced from blue hydrogen.

Removing carbon from the atmosphere

In addition to the measures described above, the IPCC points out that it may be necessary to remove the CO₂ already present in the atmosphere and oceans in order to limit global warming and achieve the goals of the Paris Agreement. This is because the world will be unable to cut emissions fast enough and because we have sectors where it is hard to envisage zero emissions, e.g. agriculture, parts of manufacturing and the transport sector (such as transcontinental air and maritime transport). Some estimates indicate a need in the range of 10-15 per cent of current emissions, which must be balanced by climate-positive solutions.^[14]

Atmospheric CO₂ is a problem that is the 'responsibility of everyone and no one' and there is no current business model for CO₂ removal measures, nor indeed for mobilising research into CO₂ removal. In 2019, SINTEF therefore decided to

establish a group-wide effort in this topic, called 'New climate-positive measures'. Our hypothesis is that as this area has not been in focus until now, there must be solutions that we can help to identify and develop together with the government and business. This group-wide effort will formulate academic hypotheses and a proposed work programme for the measures that would be most effective, both for the capture and the storage of CO₂. In 2020, the work will focus on idea generation and pave the way for research and innovation arenas for these solutions.

It would be natural to look at opportunities for capturing CO₂ in new biomass production in oceans and water, as well as on dry land, and by using chemical/mechanical solutions for capture from air or oceans. Given Norway's ambitions and advantages as an ocean nation, it would also be natural for us

to look particularly at the opportunities that exist in ocean spaces and in the boundary between blue and green value chains. As far as storage is concerned, binding carbon in new, valuable, and stable materials is one alternative, although large-scale storage in the form of either CCS or other methods may also be relevant. The carbon must be stored in a form and in a manner that means that it would be isolated from the atmosphere for a long time, and the solutions chosen must be environmentally and socially acceptable. Ideally, the carbon should be removed 'forever', but at least for several hundred years. Realistically, we may also have to include measures that store carbon for shorter periods of time. This will give us time to develop more permanent solutions.

Dedicated processes for the extraction and long-term storage of carbon is a relatively new field and the proposed solutions are mostly at the

laboratory stage, or at best in pilot scale. Therefore, there is a great need for research and innovation in relation to climate-positive solutions. Neither Norway nor the EU have a related research and development or innovation agenda, so this is a nascent market. The European Commission is drawing up proposals regarding incentives and regulations in order to accelerate the development of technology and use of climate-positive solutions. Therefore the group-wide effort is oriented towards both technical and market solutions, as well as creating an understanding of the need for these solutions in society and research policy. SINTEF can play a key role in the climate battle in this area and help to enable the authorities and business actors to realise concrete actions for the net removal of CO₂ from the atmosphere.

[14] Estimates based on the global need for climate-positive solutions depending on IPCC scenarios P1 to P4, assumed to be the same for Norway.

SINTEF's work with oil and gas in a climate and environmental context

After it was decided that SINTEF's corporate strategy would be guided by the UN SDGs, several employees asked whether our work for the oil and gas industry is compatible with our sustainability ambitions. We therefore reviewed this in the winter of 2019/2020, in consultation with external parties, SINTEF's governing bodies and our own organisation. We have sought to establish a knowledge-based approach to the dilemmas in order to plot the course ahead. A discussion paper was presented in-house for open debate among colleagues.

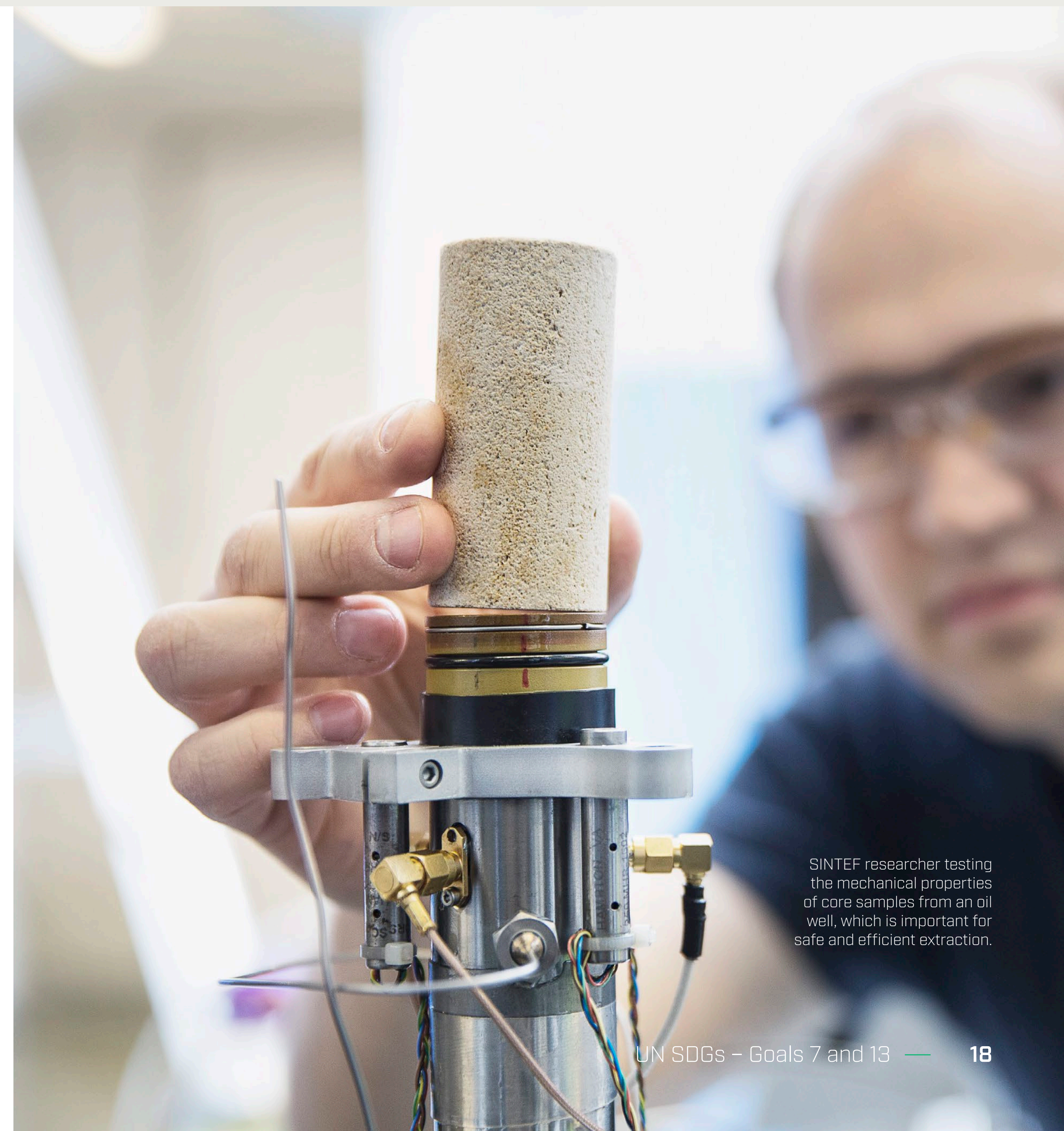
The starting point for the discussion was that the goals require an energy transition towards the 1.5°C scenario, which requires a society with net zero emissions of CO₂ by around the middle of this century. SINTEF's activities must, therefore, be guided by this.

Our review of various policy, market and risk scenarios shows that this transition will require a significantly more vigorous societal change towards the green transition than what we are currently

seeing. At the same time, there is a great deal of uncertainty surrounding what the demand will be going forward. Green alternatives are pushing their way through and the review concludes that SINTEF should further enhance its green transition efforts.

Another conclusion is that the transition is so comprehensive that even within the 1.5°C scenario, there will be a high level of demand for oil, and especially gas, including a need for replenishment with new fossil resources during a transition period.

Our main conclusion is that there is no moral contradiction between working towards a sustainable society and assisting the oil and gas industry as long as the work is based on a transition in line with the path set out for the 1.5°C scenario. We assume that this justifies exploration and field development near existing infrastructure, but probably not the development of new oil provinces, unless there is a fundamental breakthrough in the realisation of oil and gas decarbonisation.



SINTEF researcher testing the mechanical properties of core samples from an oil well, which is important for safe and efficient extraction.

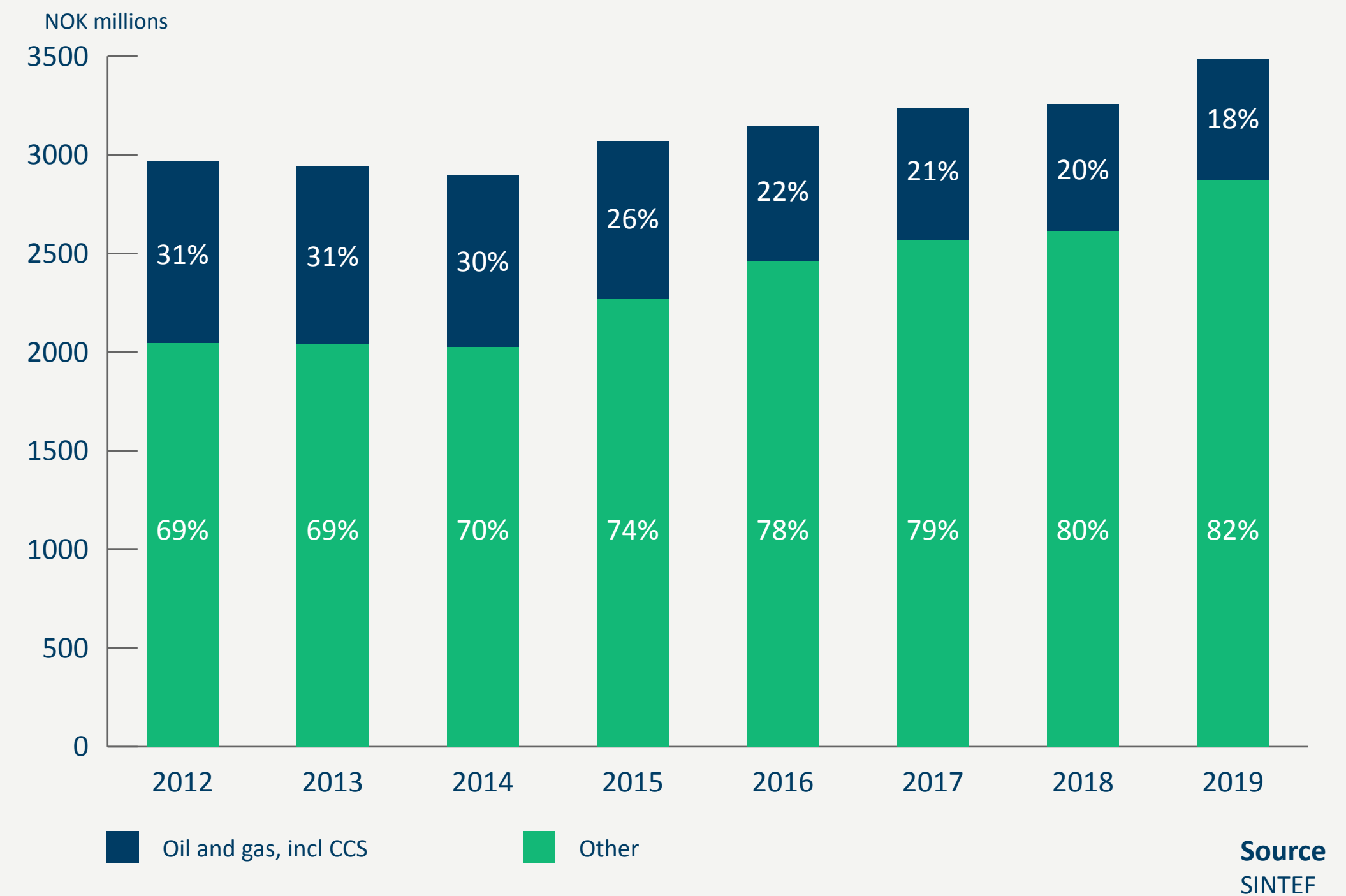
Despite the advances of the last 20 years within solar, wind and batteries indicating that the change could come about faster, and in more areas than even the most radical scenarios suggest, there are also new considerations that add new interests that must be balanced. Among these, we can see that more attention is being paid to biodiversity and conservation considerations, and that at times this gives rise to conflicts with renewable energy projects. Similarly, there are also challenges in relation to supplies of materials for batteries. Thus, our conclusion is that the energy transition will be very demanding and that it is, therefore, important not to just work on renewable energy, but also to develop zero-emission solutions in order to be able to utilise energy from petroleum resources in the form of hydrogen, ammonia and other solutions involving CCS as important contributions to the zero-emission society.

Key clients are requesting assistance from SINTEF in the transition to zero-emissions in 2050.

Below, we provide a brief account of what SINTEF is currently doing for the oil and gas industry, and how this work interacts with our work on the green transition.

Despite a significant drop in turnover since 2014, oil and gas remains SINTEF's largest market area with an annual turnover of just over NOK 600 million in 2019. Of this, around NOK 140 million is linked to CCS, renewable energy and hydrogen-related projects for oil and gas companies. The figure shows SINTEF's gross turnover and highlights how we have successfully grown and developed a more diverse and less oil-dependent project portfolio.

SINTEF is growing and becoming more diverse



The diagram on the right distributes SINTEF's turnover in relation to the oil and gas value chain. Helping to streamline processes and lower costs have been consistent features of our oil and gas portfolio. We help to ensure clients' competitiveness, which also involves reducing environmental impact in the production and end-user phases, which includes greenhouse gas emissions.

A more detailed review of any individual area shows that SINTEF's activities are, to a great extent, based on a high level of generic expertise with many areas of application, which may contribute to achieving various SDGs in the longer or shorter term. The growth in green areas has largely been based on expertise that has been developed on behalf of the oil and gas industry, and which there is still a market for there.

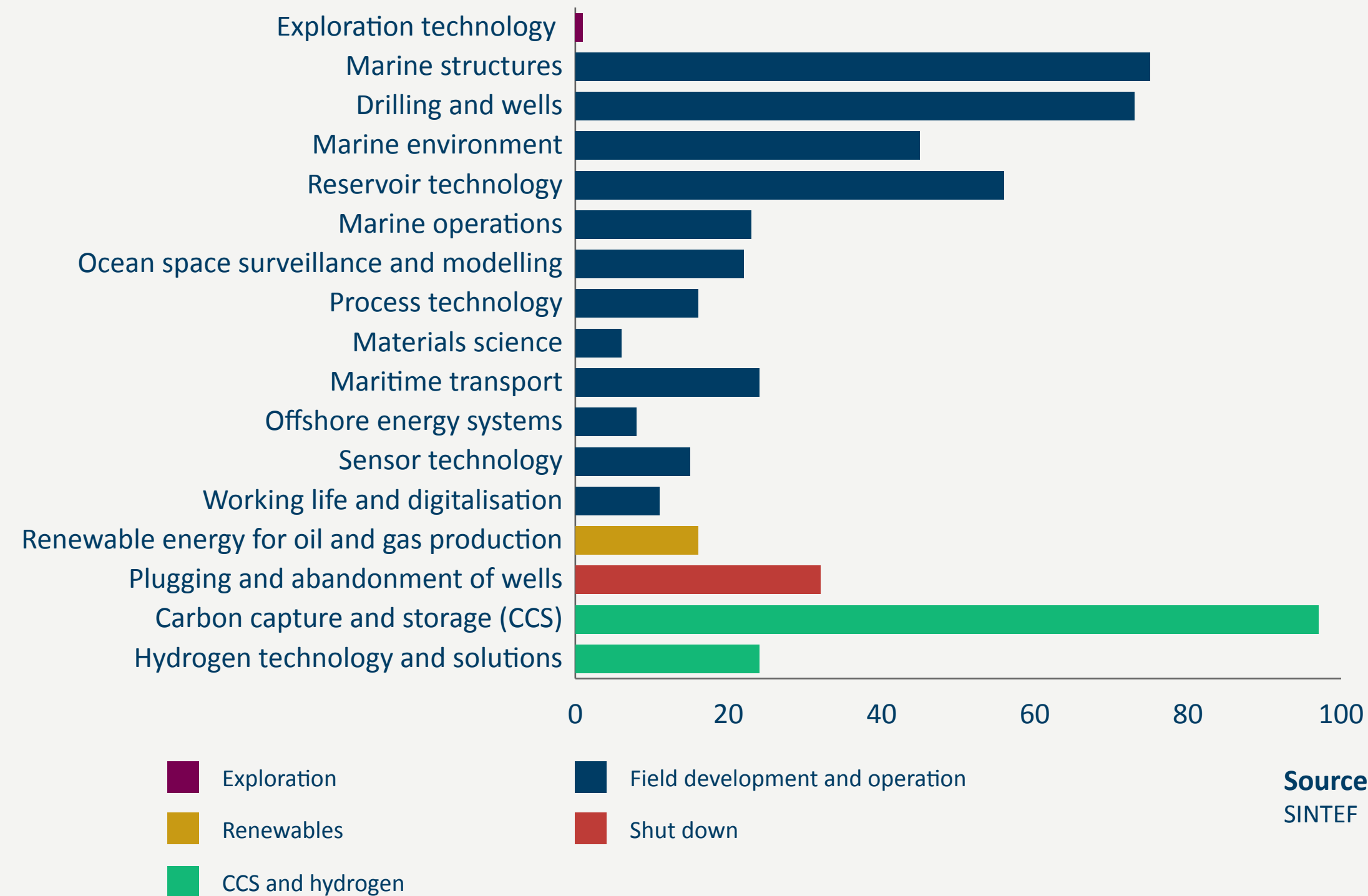
Carbon capture and storage, our largest market area in relation to the oil and gas industry, is in this context about eliminating emissions from the use or processing of gas into, for example, the raw materials for fish feed production. The same

expertise is also used to cut emissions from cement production, waste incineration and other industrial activities, and will be an important prerequisite for carbon removal/BioCCS and clean hydrogen.

The second largest market area, Marine structures, refers to Norway as a seafaring nation. We built up expertise in shipping, which gave us an advantage when we subsequently developed the offshore petroleum industry. Today, the same expertise is being used in relation to aquaculture and offshore wind.

Drilling and wells and Reservoir technology are two major areas of activity that involve technologies for automating and streamlining drilling operations, characterising, and modelling subterranean areas, understanding wells, safe drilling operations and reduced emissions to the environment. The same expertise, and some of the same projects, are contributing to the development of solutions for CO₂ storage, utilising geothermal energy and many other applications related to optimisation.

SINTEF's level of activity in oil and gas through the value chain [turnover in NOK millions]



The areas *Marine environment* and *Ocean space surveillance and modelling* both include environmental studies that monitor more than just oil spills. New technologies in these areas have many marine applications, for example in relation to the challenges of plastic littering of the oceans and the utilisation of low trophic level marine organisms.^[15]

A large proportion of the applications of *Marine operations* and *Maritime transport* are in shipping, which is also where both originate. Supply vessels, floating production and the automation of offshore operations, aimed at all ocean industries, fall under these categories.

The areas of *Process technology* and *Materials science* are based on generic knowledge within physics and chemistry, which is used here to find new and smarter solutions for oil and gas. They also have several other areas of application such as in the future bioeconomy through the utilisation of sustainable renewable biomass. Climate-positive processes and the future biorefineries for processing biomass into bio-based chemicals and biomaterials are being developed here, as are bioenergy and advanced biofuels designed for long-haul and air transport.

Sensor technology and *Working life and digitalisation* are both about introducing new, smarter and safer technology and work methods. These find their assignments out on the continental shelf, as well as in all forms of industry on land.

Offshore energy systems and *Renewable energy for oil and gas production* concern offshore energy supply, with the goal of lower emissions. This includes electrification of the continental shelf. These are key areas in the new Low-Emission Research Centre, funded by the Research Council of Norway for the development of new technologies and concepts within offshore energy systems, energy efficiency and the integration of renewable power production technology for use on the Norwegian continental shelf. This also includes areas of work linked to renewable energy at sea and other electrification challenges.

Plugging and abandonment of wells is the process of shutting down oil fields. In addition to shutting down fields, the area covers the secure plugging of reservoirs used for CO₂ storage.

Hydrogen technology and solutions will be important in transforming natural gas into a clean energy carrier, at the same time as the carbon is removed via CCS. Hydrogen and CCS could play important roles in cutting emissions during the transition phase up to 2050, and perhaps afterwards as well. Our research into hydrogen from gas is developing many solutions that are also relevant for hydrogen from renewable electricity.

We currently have almost no activities linked to *Exploration* for new oil and gas resources. The oil companies have chosen to keep the exploration work in-house in recent years. The expertise possessed by SINTEF's 'Exploration and reservoir' group has largely been refocused on safe and cost-effective CO₂ storage. The turnover linked to CO₂ storage is reported under CCS.

As the host of the Low-Emission Research Centre, SINTEF plays an important role in helping the petroleum industry deliver 40 per cent cuts in emissions by 2030 and zero emissions in 2050. Some are critical of this effort because cutting emissions on the continental shelf does not address the main problem, the emissions from using the

products. SINTEF's assessment is based on the fact that the petroleum industry accounts for 23 per cent of Norwegian emissions and that these emissions must be cut in order to fulfil Norway's obligations under the Paris Agreement. Compliance with the Paris Agreement is essential to ensure Norwegian legitimacy in international climate negotiations. At the same time, we cannot just settle for this, but must work to ensure that emissions from using oil and gas are also eliminated. We are doing this by both working on renewable alternatives and by ensuring that the energy from petroleum can be used without emissions.

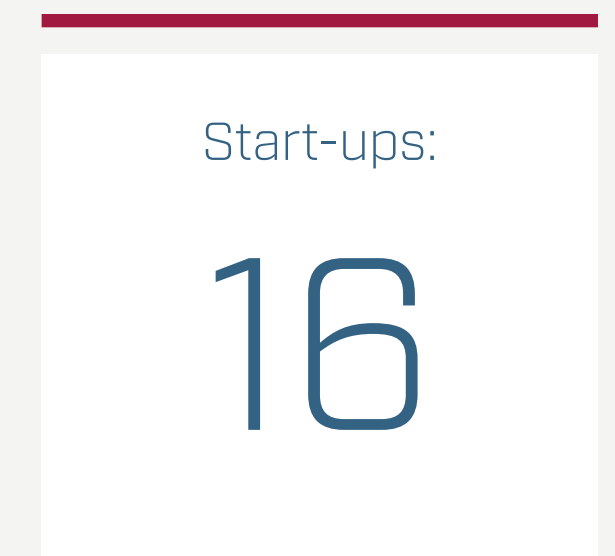
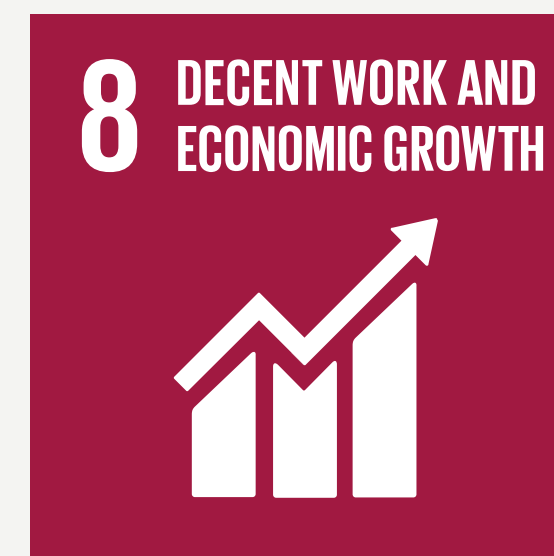
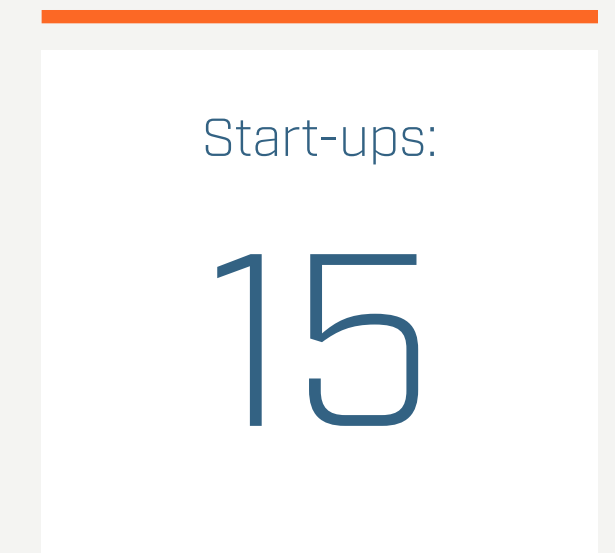
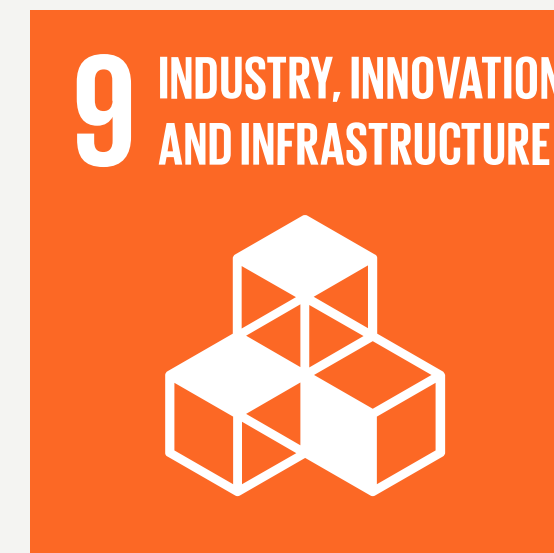
While we believe that the current portfolio is justifiable from a climate ethics perspective, asking whether there are projects that we could not justifiably take on is a legitimate question. SINTEF rejected projects linked to oil sands in Canada because we did not believe the activity was sustainable. Similarly, we must ask ourselves ethical questions when assessing whether or not we should take part in projects in new provinces or in projects with high CO₂ emissions or in especially vulnerable habitats.

[15] Low trophic level species are organisms at the lowest level of the food chain. At the lowest level we find primary producers (plants and algae) which utilise sunlight as energy and provide the basis for the food chain. The next level up are animals that live off these plants and algae, and further up come animals that eat animals. 90 per cent of the energy is lost between each level and it is therefore more advantageous to harvest and cultivate the low trophic level species than species further up the food chain.

Industry, innovation and infrastructure and Decent work and economic growth

The goal of SINTEF's corporate strategy is to produce competitiveness and societal solutions. It is, therefore, not surprising that we have significant activity aimed at the SDGs relating to innovation, infrastructure, and value creation.

In this deep dive we want to both show examples of projects and start-ups that are contributing to goals 8 and 9, and also look more closely at SINTEF's more overarching role in promoting innovation and value creation, in Norway and internationally.



Societal infrastructure research projects

The large volume of projects related to goal 9 reflects the fact that SINTEF has a substantial project portfolio linked to increasing the sustainability of society's infrastructure. Important research areas include road, rail, aviation, water supply, power supply, communications and computer systems, bridges, tunnels, underground systems, pipelines, satellites, ferries and others. Much of this research contributes to more area-specific goals and is discussed in other places in this report.

More generally, it can be said that the research helps to:

- Better utilise and maintain existing infrastructure, including the use of sensors, big data analytics, optimisation, traffic management and other planning tools.
- Analyse and assess the need for new or changed infrastructure, including for managing climate

change, population and behavioural changes, new mobility and energy supply needs, energy efficiency needs, changed environmental standards and for being able to exploit new technological solutions such as autonomy, electrification and other zero-emission solutions. Develop new standards, products, methods and trading platforms for materials and equipment for infrastructure development, especially in light of the need for cuts in emissions, the circular economy and increased productivity.

- Increase the safety and security of society's critical infrastructure, including new comprehensive risk analysis methods for complex structures, higher ICT and geopolitical threat levels, reduced biodiversity and more extreme weather.

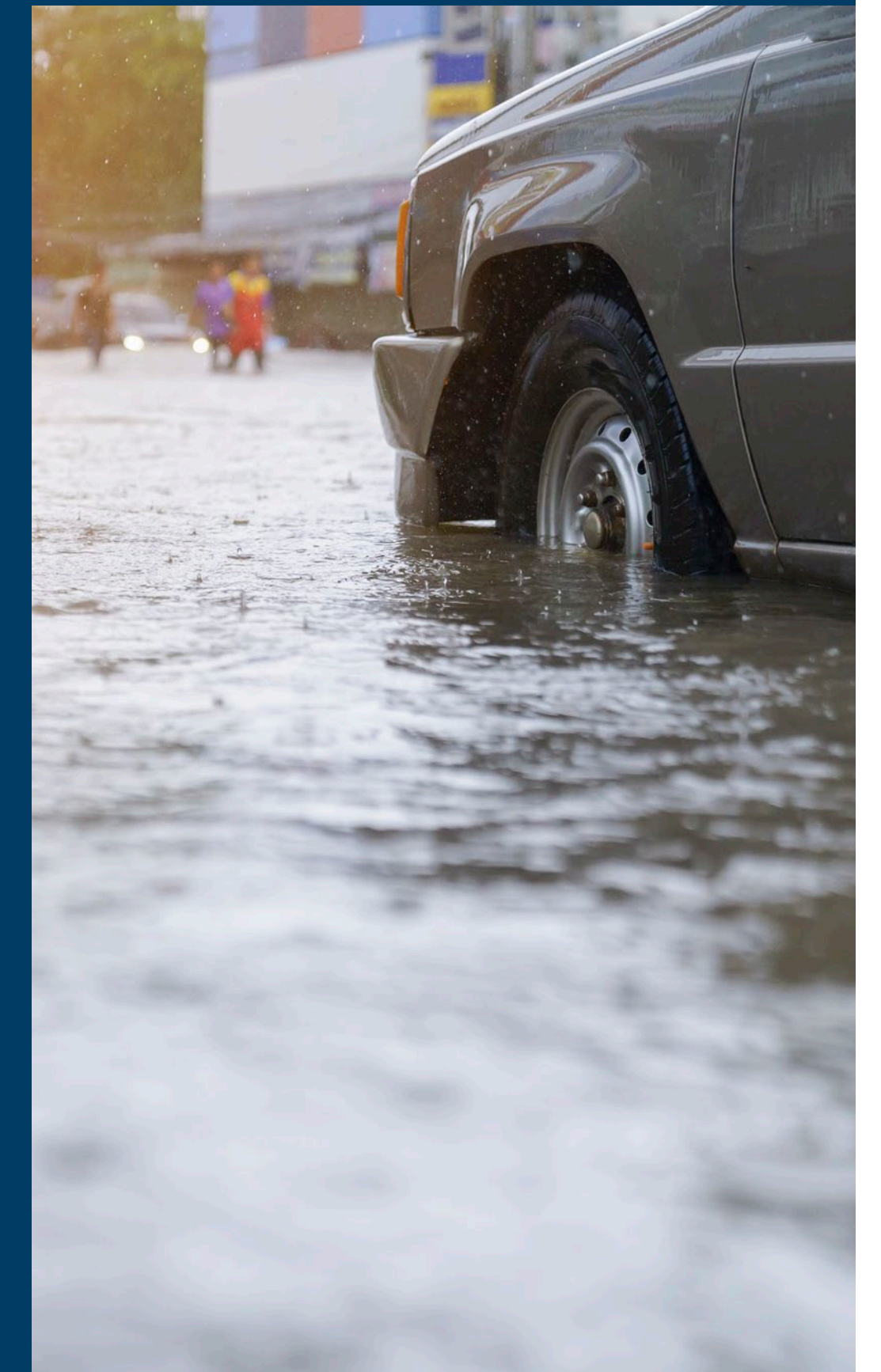
One concrete example of our work on protecting and improving infrastructure is the work taking place in SFI Klima 2050.



Klima 2050: research into the societal risks associated with climate change

Klima 2050 is a centre for research-based innovation that aims to mitigate the societal risks associated with climate change due to factors such as higher precipitation volumes and flooding. The centre, which is led by SINTEF, carries out research into risk mitigation solutions involving the climate adaptation of buildings and infrastructure, as well as solutions for strengthening the innovation capacity of companies. One pilot project at the centre is the climate adaptation network of the City of Trondheim and Trøndelag County Authority, which is contributing to the implementation of knowledge in all municipalities in the county.

THE PROJECT ALSO CONTRIBUTES TO



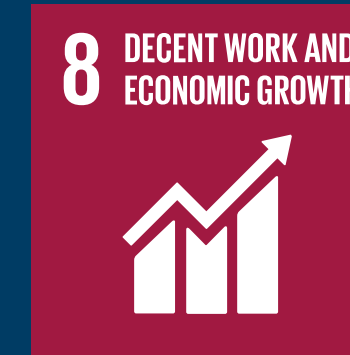
Research projects related to Decent Work and Economic Growth

SINTEF's project activities make a direct contribution to value creation and employment in society. Our research generally focuses on producing societal benefits and competitiveness, and from this perspective a large number of the projects contribute to the work on achieving goal 8) Decent Work and Economic Growth, although relatively few have been tagged with this as a (main) goal.

To ensure a safe and secure working environment, we work on tripartite cooperation and preventive working environment work and, especially recently, have

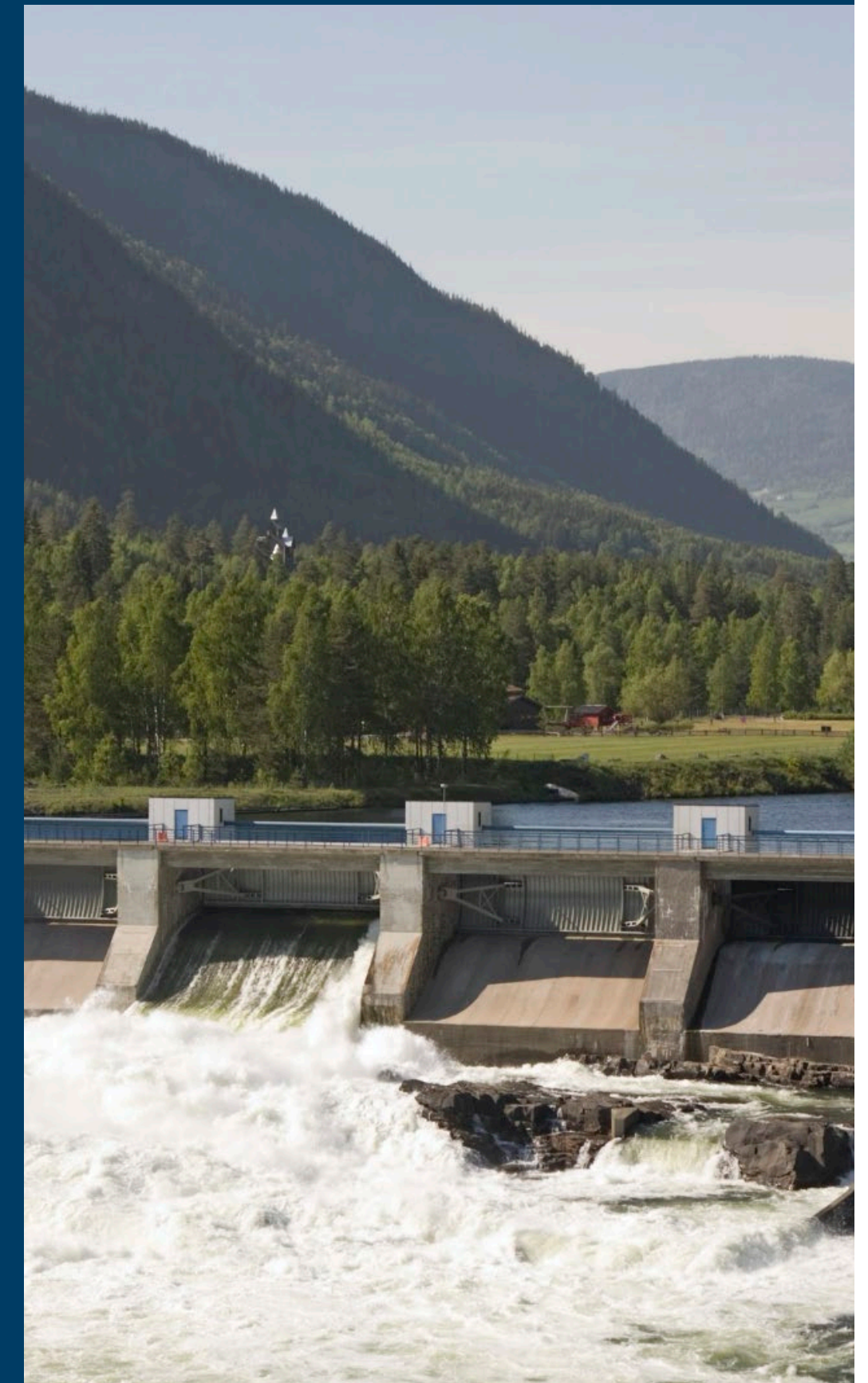
had projects related to the impact of digitalisation on working life. SINTEF also carries out extensive research related to HSE in the workplace, for example to mitigate the risks associated with working in fishing and aquaculture.

Economic benefits are often achieved through research-based improvements to the technologies and work processes on which products and services are based. One concrete example of this is a planning tool that we have developed over time for hydropower production:

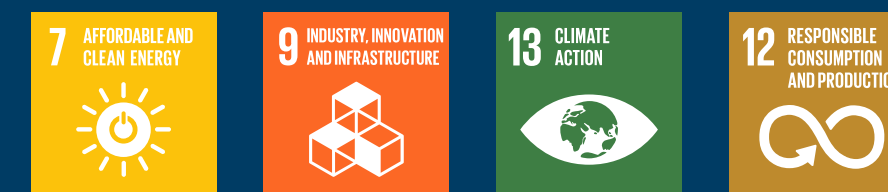


SHOP: a planning tool for hydropower

SHOP is a tool for planning hydropower production one to two weeks ahead to ensure the optimum use of resources. A study by Impello Management and Menon Economics shows that the planning tool has increased the value of the water in Norwegian power reservoirs by 2 per cent, which equates to NOK 6.8 billion over 10 years. SHOP can be used for different river systems and has recently undergone major changes as a consequence of an expanding user group with differing needs.



THE PROJECT ALSO CONTRIBUTES TO



SINTEF's role in the innovation system

SINTEF's research and innovation work is mainly carried out in collaboration with partners in the private and public sectors. This allows us to make sure that the research is relevant and has impact. Our expertise within research and innovation, as well as our infrastructure for research, verification and testing (laboratories), are important contributions to our partners. In this way, SINTEF itself, as an institution, represents infrastructure that enhances the innovative capacity of our society. UN Sustainable Development Goal 8) emphasises the need to increase economic productivity by, among other things, 'diversification, technological upgrading and innovation.' Goal 9) deals with, among other things, upgrading infrastructure and retrofitting industries, including 'enhanc[ing] scientific research and upgrad[ing] technological capabilities of industrial sectors in all countries.' Here, the SDGs are focusing on SINTEF's core tasks. Therefore, when reporting on these two goals, we believe it is of great relevance to describe how we work in partnerships.

Research institutes like SINTEF play a key role in the Norwegian research and innovation system. In the last five years, the institute sector has on average carried out 22 per cent of Norway's total research and development production, equivalent to NOK 13 billion per year.^[16] In many ways, the research institutes can be considered the business sector's research and development departments, or a supplement to these. SINTEF also plays an essential role in disseminating expertise to relevant industrial actors through publicly funded research.

A number of external evaluations of the institute sector has been carried out and was compiled into a synthesis report from the Research Council of Norway in 2018.^[17] The evaluations document that technical-industrial institutes are particularly important in ensuring the impact of research through value creation and restructuring. One of the studies in the evaluation estimates that the collaboration between industry and the technical-industrial institutes has helped to increase value creation in industry by NOK 800 billion over a 10-year period.^[18]

There is also a lot of evidence at the European level regarding the importance of the research institutes. A 'ripple effect' reported for nine European technical-industrial institutes (RTOs)^[19] shows that EUR 1 invested in RTOs yields a return of EUR 3.8 and that the nine institutes yield annual value creation of EUR 14 billion. SINTEF was one of the nine institutes studied.

The OECD's country study of the Norwegian research and innovation system from 2017 also highlights the importance of the institutes, especially regarding increased competitiveness and innovation. 'One of the defining features of the Norwegian innovation system is the strong research institute sector' [...] 'Norway's research institutes, particularly the technical-industrial institutes, have a long history of supporting innovation in industry.'^[20]

[16] Regjeringen.no, "Strategi for helhetlig instituttpolitikk". 11.02.2020. <https://www.regjeringen.no/contentassets/980bb6529e194ddb970dc04b4d138af2/instituttstrategi.pdf>

[17] Research Council of Norway, "En målrettet og effektiv instituttpolitikk. En systematisk gjennomgang av Forskningsrådets evalueringer av forskningsinstitutter". Oslo: Research Council of Norway, 2018. <https://www.forskningsradet.no/contentassets/52963f9c837c464d86185e92f82e64c6/evaluering-forskningsinstitutter-synteserapport-.pdf>

[18] Research Council of Norway, "En målrettet og effektiv instituttpolitikk. En systematisk gjennomgang av Forskningsrådets evalueringer av forskningsinstitutter". Oslo: Research Council of Norway, 2018. <https://www.forskningsradet.no/contentassets/52963f9c837c464d86185e92f82e64c6/evaluering-forskningsinstitutter-synteserapport-.pdf>

[19] Valentijn Bilsen, Isabelle De Voldere, Miriam Van Hoed and Kleitia Zeqo, "Economic Footprint of Nine European RTOs in 2015-2016". Brussels: IDEA Consult, 2018. <https://www.earto.eu/wp-content/uploads/EARTO-Economic-Footprint-Study-Impact-of-9-RTOs-in-2015-2016-Final-Report.pdf>

[20] OECD, "OECD Reviews of Innovation Policy: Norway 2017", p. 30. Paris: OECD Publishing, 2017. https://read.oecd-ilibrary.org/science-and-technology/oecd-reviews-of-innovation-policy-norway-2017_9789264277960-en#page1

Research infrastructure and laboratories/'test beds'

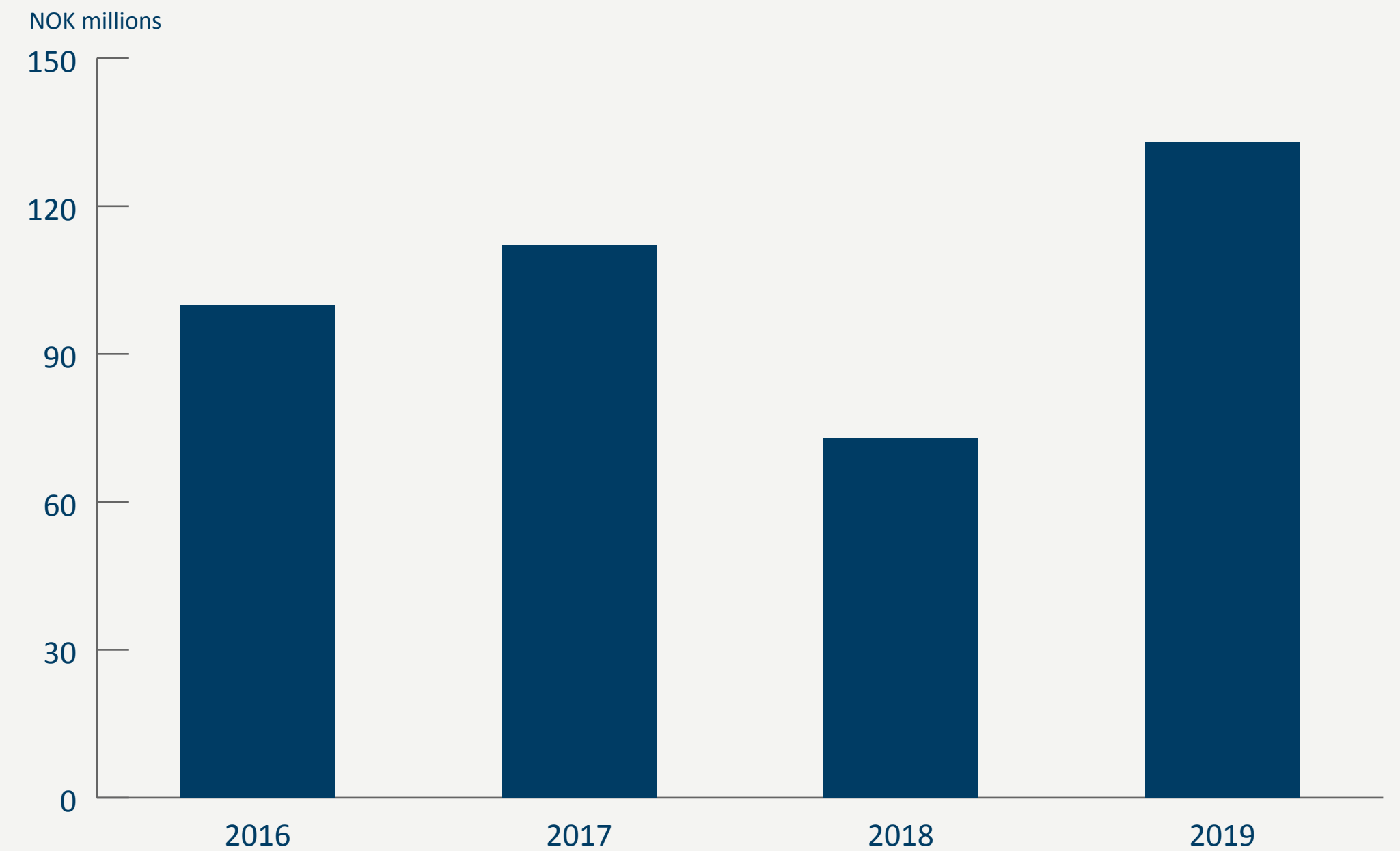
Research infrastructure plays an important role in how we can carry out projects for clients. Around 40 per cent of our turnover is linked to projects that make use of this type of infrastructure. This figure is somewhat higher for projects we carry out in collaboration with business. Access to advanced research laboratories is a prerequisite for succeeding as a world leading research institute. We are developing the infrastructure further through contributions from national and international infrastructure schemes and through our own investments. SINTEF has invested NOK 1.2 billion of its own funds in research infrastructure from its

surplus in the last 10 years. Co-funding from external sources, such as the Research Council of Norway and Innovation Norway, helps to 'gear up' our investments and expand opportunities for the companies and organisations with which we collaborate.

SINTEF has many laboratories, ranging in size from pilot scale, such as the ocean basin at Tyholt, to laboratories with equipment that measures distances on an atomic scale. Our research infrastructure represents the breadth of research carried out in SINTEF and the examples on the following pages describe some of our full-scale laboratories.

In total, SINTEF has more than 100 laboratories.

We are investing in new laboratories, scientific equipment, and other research production equipment



Source
SINTEF

Some of SINTEF's laboratories



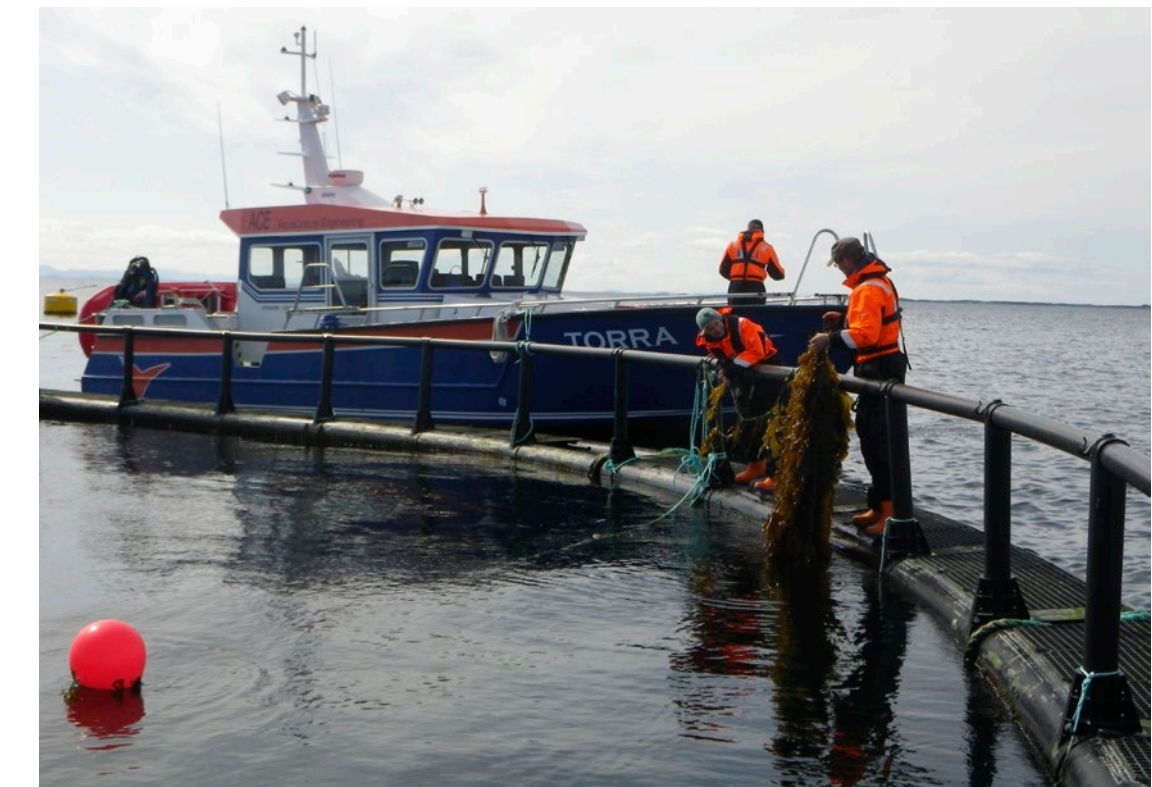
Manufacturing Technology Norwegian Catapult Centre

SIVA Manufacturing Technology Norwegian Catapult Centre develops and demonstrates production processes and enables technologies in mini-factories, in collaboration with industry, research and educational institutions, and its purpose is to shorten the time between research and development and results being put into production.



MiNaLab

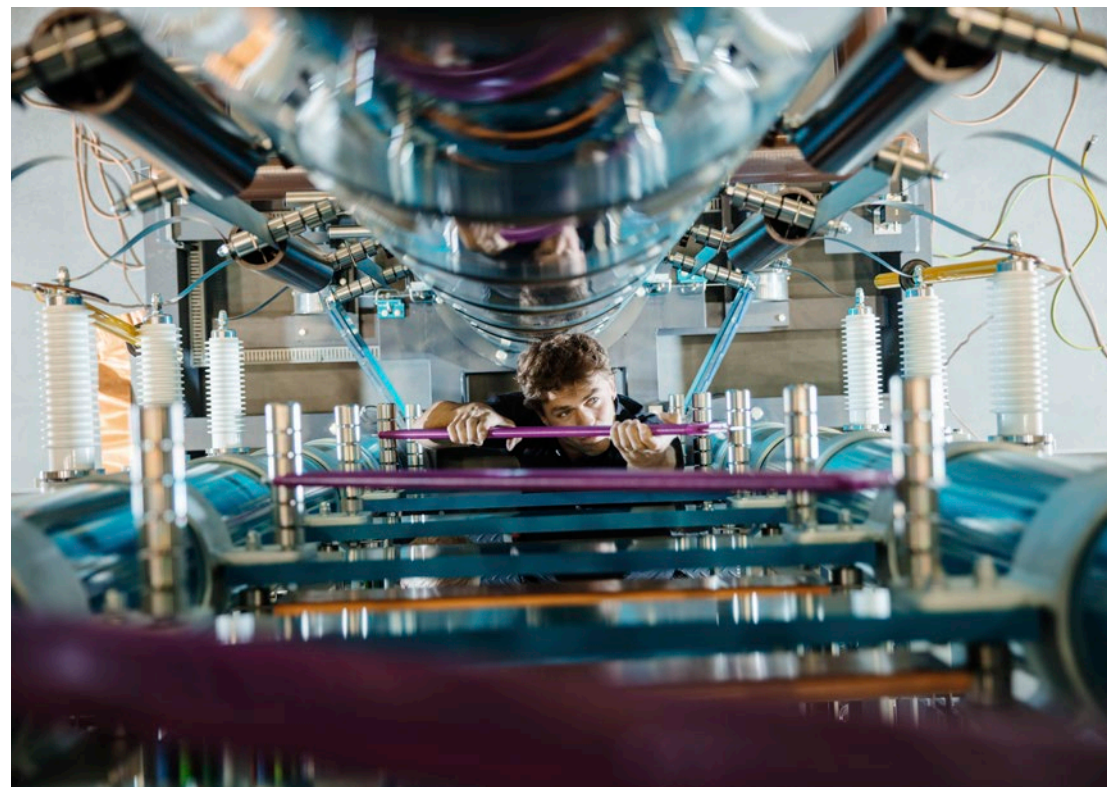
SINTEF MiNaLab is an advanced research facility for micro and nano fabrication of sensors and microsystems. It is the only complete, open access processing line in Norway and offers a broad range of services from concept development to small-scale production. It develops miniaturised components for applications within, among other areas, the processing industry, the aeronautical industry, medical technology, environmental surveillance, and the aerospace industry.



ACE – full-scale aquaculture laboratory

SINTEF ACE is a full-scale laboratory facility designed to develop and test new aquaculture technology. The research and experimental focus is mainly on technology for operational activities, as well as the surveillance of structures and the environment. This is based on interdisciplinary expertise in the interaction between biology and technology. Facility users are researchers and others who want to conduct practical experiments and tests under realistic conditions.

Some of SINTEF's laboratories



Electrotechnical laboratories

SINTEF carries out advanced experimental activities in both laboratories and the field for manufacturers, suppliers and users of electric power equipment related to materials, components and systems for the sustainable energy solutions and zero-emission mobility of the future. The electrotechnical laboratories consist of several different units, including high voltage laboratories, subsea laboratories, aging laboratories, chemistry laboratories, mechanical laboratories, power electronics laboratories and the smart grid laboratory.



CO₂-Lab Tiller

CO₂-Lab Tiller contains a pilot plant and infrastructure devoted to the development, testing and validation of CO₂ capture technologies for various emission sources. With a fully digitalised test facility, accurate measurements of many key process parameters can be carried out under industrial conditions for the Norwegian and international business sector.



The ZEB Laboratory

ZEB Laboratory is a laboratory for zero emission buildings (ZEB) – an arena where new and innovative materials and solutions are developed, investigated, tested and demonstrated in mutual interaction with people. The building form a living laboratory, i.e. a laboratory where people using it as an ordinary office building or for educational purposes become an experimental parameter giving variations in loads with their use of the premises.

Ocean Space Centre

A major infrastructure project we have worked extensively on in the last years, and especially in 2019, is the Ocean Space Centre (OSC)^[21], which the government granted funding for design planning in 2020 with the goal of reaching a decision on investment in 2021 and starting construction in 2022. Norway has been a great maritime power for generations, not least in combination with long-term thinking and technical marine knowledge and expertise. For decades, the maritime sector has benefited from the infrastructure in the large, hydro-dynamic laboratories at Tyholt in Trondheim, and the expertise at NTNU and SINTEF. The OSC's societal mission is to ensure continued value creation for Norway through competitive ocean space industries in line with the government's "New Growth, Proud History" strategy and the OECD's perspectives in the report, "The Ocean Economy in 2030".^[22] The OSC will contribute future-oriented infrastructure, both in the form of more functional laboratories with better instrumentation on land and in the form of digital infrastructure in the Trondheim Fjord, Hitra and Ålesund that supports strategic priority areas like energy, food, transport, and the environment into a more digital and greener future. The new infrastructure will result in better research and education, as well as a greater contribution to sustainable development in, for example,

ocean wind, aquaculture, fisheries, eco-friendly maritime transport, autonomous shipping, coastal infrastructure, deep sea mining, and more.

Collaboration with Norwegian policy agencies and research funding

With basic funding of only 8 per cent, SINTEF relies on successfully raising project funding in competitive arenas, nationally and in Europe. The business sector funds 47 per cent of the portfolio. We also collaborate with the public sector through direct projects and research collaborations with public research institutions. The projects we have with the Research Council of Norway or the EU programmes account for 34 per cent of the portfolio.

SINTEF's collaborative and contract research, partnering with business

To deliver on SINTEF's societal mission, we and our partners depend on a well-functioning public support system that mitigates the risk companies and other clients face in early and long-term development processes. The support system also allows investments to be made in research that may have major long-term effects but where no well-functioning market exists yet.

Almost all of SINTEF's research and innovation activities take place through active co-creation with clients and

often through consortia consisting of multiple clients with complex interests in a value chain. Nevertheless, we distinguish between contract research and what is referred to as collaborative research.

Put simply, in principle our contract research project portfolio consists of projects where companies have identified challenges or opportunities they want to explore, and they become the owner of the research results. In these projects, we meet their needs, challenge their technological perspective and our function is to work as the companies' research and development department. In many cases, the companies look for risk mitigation. SINTEF knows the different support schemes in Norway and in the EU and may suggest projects that can apply for support especially from the Research Council of Norway, Innovation Norway or SkatteFUNN, or from the framework programmes in the EU. This is how we trigger research investments in the business sector.

As far as collaborative research is concerned, in principle it is SINTEF itself that sees the opportunities provided by new knowledge or technology and then applies for public funding for the research associated with such opportunities. These projects often receive co-funding from partner companies. By inviting business and others to be partners, we trigger more fundamental innovation in the organisations, while

the results of the research belong to us and will be published openly.

We increase the expertise and pace of restructuring in companies and public organisations in both collaborative research and contract research. By partnering with companies in many different industries, we are spreading technological solutions across industries while simultaneously protecting our clients' intellectual property. Learning between industries is extremely important in particular in times of big shifts.

Since the oil crisis in 2014, we have seen a trend towards companies in Norway increasingly seeking risk mitigation from the public support system. Norway is thus approaching a model for research funding like those in other European countries. It is clear from our data that the share of projects with companies supported by government schemes is increasing. The growth in this portfolio from 2018 to 2019 was no less than 15 per cent. The growth in our contract research with no public support, is on the other hand marginal. The large increase in publicly supported business research is both in projects where we have applied for research funding while the companies are partners and co-funders, and in projects where the business sector has applied for funding, with us as R&D-partner.

[21] The laboratory project has been known as the Ocean Space Centre for years even though the concept alternative that was chosen and developed by the Norwegian Ministry of Trade, Industry and Fisheries was called Ocean Space Labs. The two names refer to the same project.

[22] Regjeringen.no, "The Norwegian Government's Ocean Strategy: New Growth, Proud History". 23.03.2017. https://www.regjeringen.no/contentassets/097c5ec1238d4c0ba32ef46965144467/nfd_havstrategi_uu.pdf, OECD. "The Ocean Economy in 2030". Paris: OECD Publishing, 2016. <https://www.oecd.org/environment/the-ocean-economy-in-2030-9789264251724-en.htm>

SINTEF's start-ups

SINTEF's start-ups emerge from our research activities and contribute to value creation and employment in society. The establishment of these companies testifies to the fact that not all new knowledge can be commercialised in collaboration with existing companies. Strong trends such as digitalisation and sustainability are driving a need for technologies that the current business sector has not always demanded through contract research. In our long-term research funded through our own and free funds, we attempt to develop technology that can contribute to creating a completely new business sector. These companies are highly competitive because their operations are based on expertise and leading technology. Together, these companies therefore represent a significant contribution to the renewal of the Norwegian business sector.

Since the middle of the 1980s, a total of 80 companies have emerged from SINTEF. Of these, 57 are still in operation as separate companies,

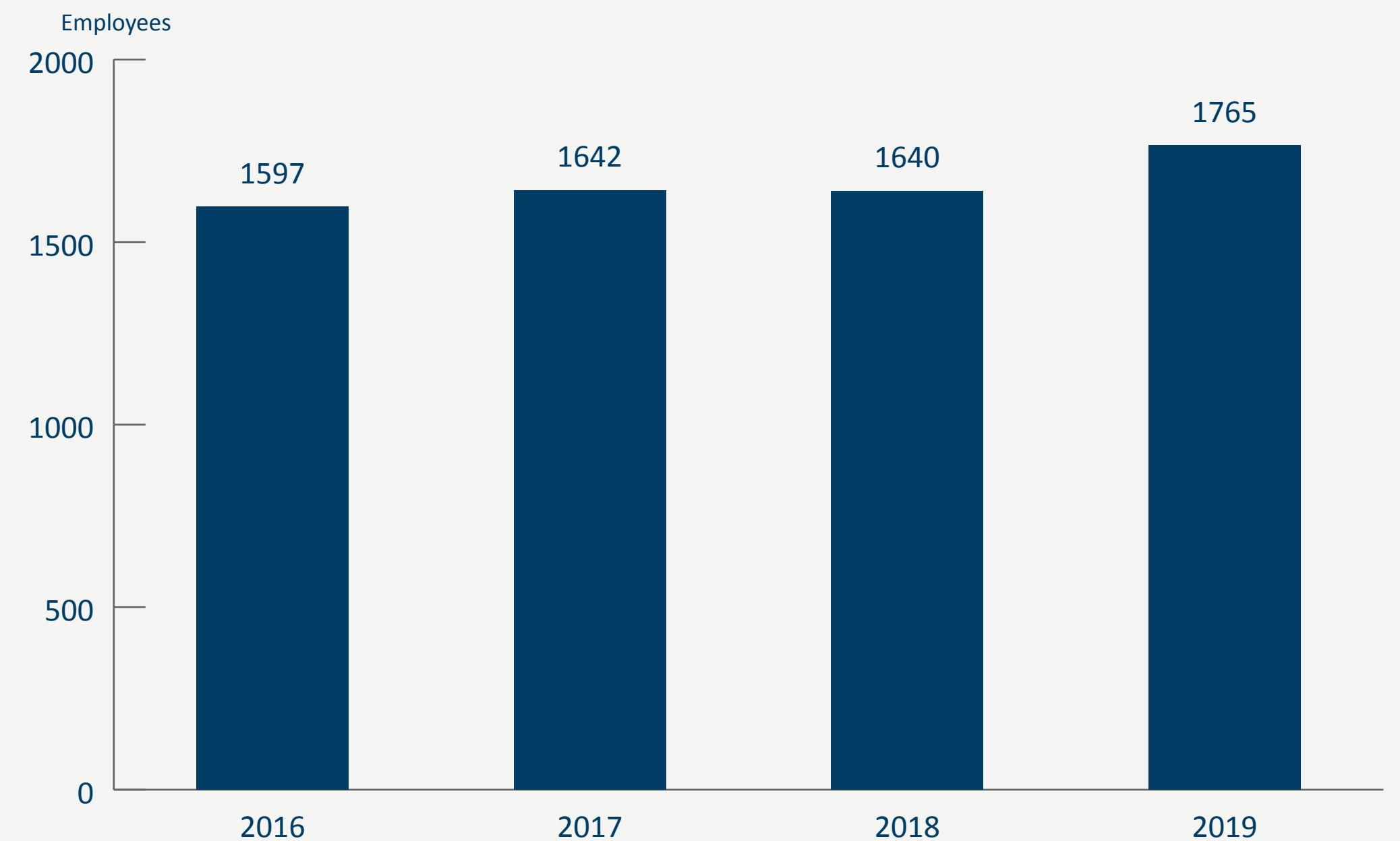
eight have merged with others and the rest have ceased trading. Some 67 of the 80 companies were established in the Trondheim region. The companies employ 1,765 people (2019) and generate around NOK 5.6 billion in earnings per year (2018).^[23]

SINTEF has achieved good results from these commercialisation activities. Selling stakes in companies established by us has resulted in both returns for owners and the companies developing well. The companies Nacre, GasSecure, Spermvital and Resman are good examples of this.

The diagrams on this and the following page provide a picture of SINTEF's commercialisation activities from 2003 to the present day.

One good example of a start-up that is contributing to goal 8) Decent Work and Economic Growth and goal 9) Industry, Innovation and Infrastructure is Zivid, which won the Research Council of Norway's innovation award in 2018.

We create jobs through start-ups



Cumulative overview of employees in companies that emerged from SINTEF

Source
The Impello Management Study 2019

[23] Data from the Impello Management Study 2019.

Ripple effects of SINTEF's commercialisation activities 2003-2019



591
ideas from
expert environments



114
projects
developed further



NOK 2 billion
in exit value



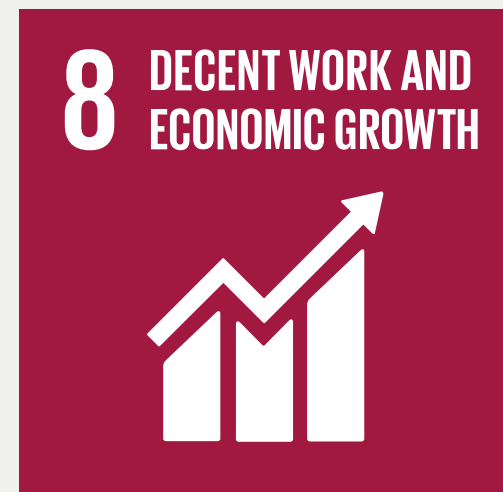
30
start-up
companies

15-20
per cent return
on funds

74
licences and
technology sales

NOK 1 billion
in portfolio value
per 2019

NOK 1,7 billion
in extra funding
triggered



8 DECENT WORK AND ECONOMIC GROWTH

THE COMPANY ALSO CONTRIBUTES TO



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Zivid

The world's most accurate 3D camera

Zivid AS is a spin-off company from SINTEF that has developed the world's most accurate 3D camera for industrial use. The camera gives robots 'eyesight' and enables them to discern colour, shape and distance. This has made it simpler to automate manual tasks in large parts of the manufacturing industry, including the electronics, furniture, car and food industries.

Impact for clients, users and society

This innovative camera technology developed by Zivid provides great potential for increased productivity and economic growth in several areas of manufacturing. In 2018, Zivid won the Research Council of Norway's innovation award. Since its founding in 2015, Zivid has already established sales offices in China, South Korea, and North America, as well as first-hand distributors in Canada, Japan, and the USA.



Links to more info

zivid.com
sintef.no

Application and scalability

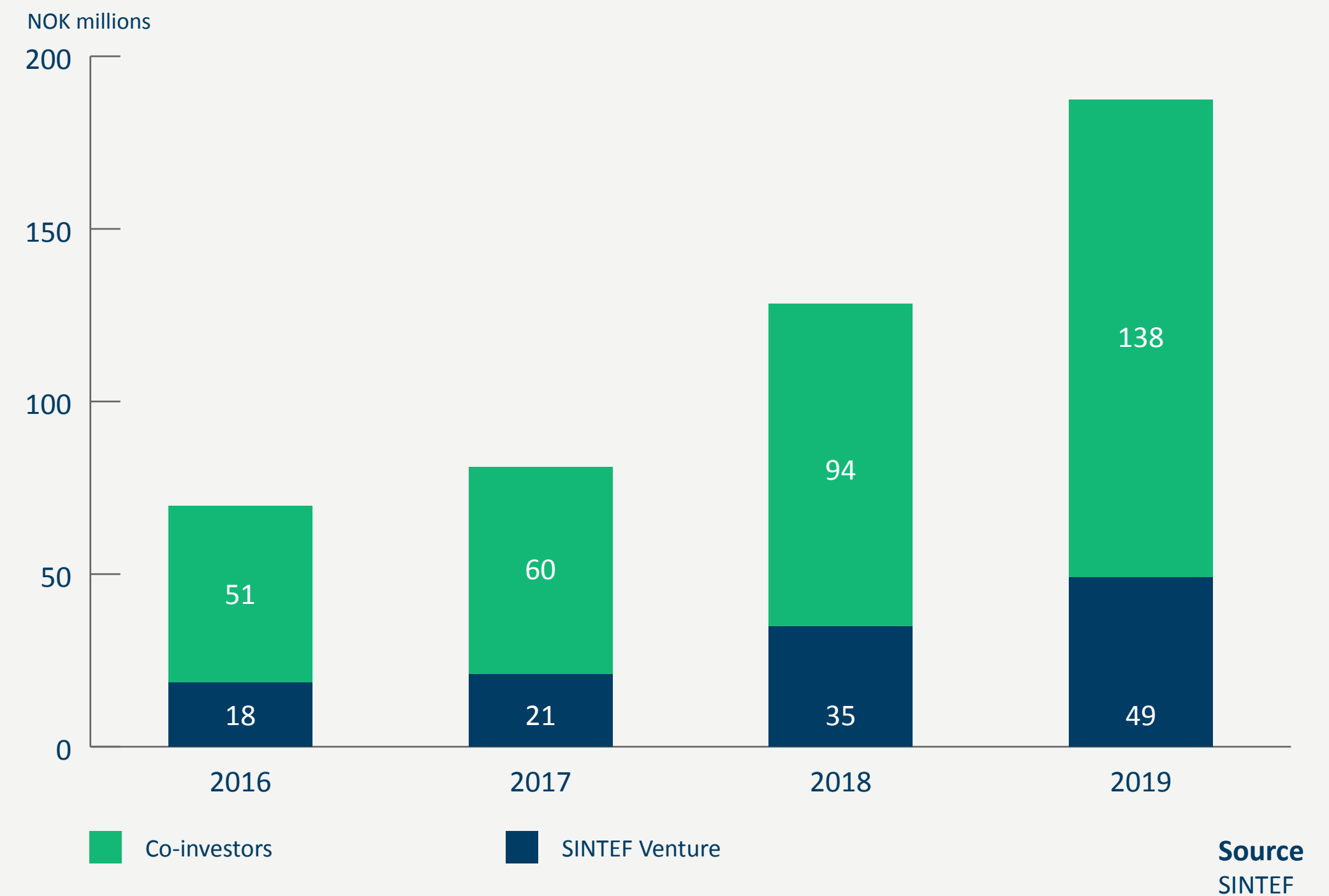
The technology developed by Zivid has wide-ranging potential applications in various sectors, including the health and care services sector. In the Intelli3D project, Zivid and SINTEF are partnering on using the camera technology in 'new' industries and small and medium-sized companies. If this goal is achieved, Zivid will become a key player in the global market and is expected to grow in value over the next seven years to more than EUR 400 million.

SINTEF has increased the number of start-ups after attracting co-investors into its commercialisation activities in 2014 through SINTEF Venture IV, a NOK 209 million fund, NOK 109 million of which came from investors other than SINTEF. In 2018, we established a new NOK 500 million fund, SINTEF Venture V. SINTEF has invested NOK 110 million of its own money in the fund. SINTEF's commercialisation activities primarily focus on the pre-seed and seed phases. These are important activities when it comes to realising SINTEF's vision of producing 'technology for a better society'. The potential return on investments in these phases is high, but so is the risk. The risk is particularly related to whether the technologies will be attractive in the market, and whether the companies will be able to sell solutions based on

the technologies. In 2019, the SINTEF Venture funds invested NOK 49 million in the company portfolio, which in turn triggered NOK 138 million in investments from others and are contributing to these companies' growth and development.

Considering this, SINTEF's returns on its investments are regarded as very good. The commercialisation concept is operated by SINTEF TTO, which both carries out technology transfers from SINTEF and manages SINTEF's investment fund with the mission of creating commercial value and exiting. The concept is based on close collaboration with SINTEF's expert environments and competent financial and industrial partners. There is a good supply of high-quality projects.

Internal and external capital supplied to create new companies



SINTEF's contribution to regional innovation in Norway

SINTEF's projects contribute to competitiveness and societal solutions throughout Norway. We lack geographical data on where all the institutes' projects are carried out, but this map shows where SINTEF Energy Research's clients are, which we believe is relatively comparable to the other institutes. The map does not completely correspond with some official statistics which largely reflects head office addresses. The map shows where the research actually finds its area of application.

SINTEF has also actively focused on strengthening innovation capacity in regional industrial environments, partly through collaboration with clusters and partly through business establishment and mergers in many parts of the country, as shown on the map on the next page. The green spots show SINTEF's office locations, the red spots are the Innovation Norway clusters we partner with, and the yellow spot show our cluster-like collaborations with the companies in Røros.

Having such a presence has enabled us to bolster our expertise and take the initiative to establish development projects in these environments as a supplement to our ordinary project collaborations in the large research environments in SINTEF, where Trondheim and Oslo are centres of gravity. This presence contributes to value creation and is, in many cases, strongly contributing to a green transition in these industrial environments.

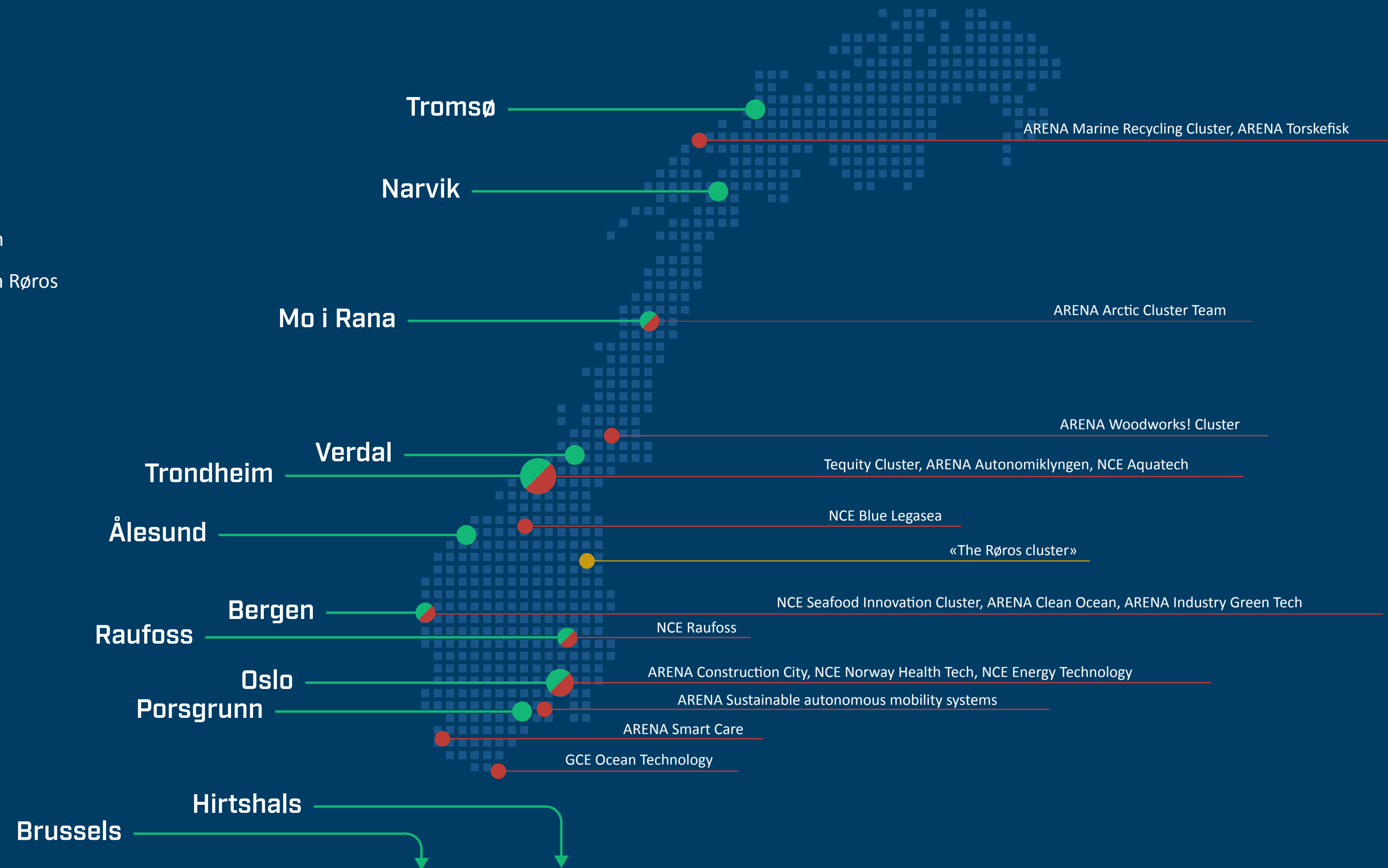
As an example, in 2019 SINTEF decided to establish a permanent office in the industrial park in Verdal to strengthen the collaboration with business in the region. SINTEF's collaboration with the industrial park in Verdal prior to the establishment of the office was vital for the development of a well-functioning regional innovation ecosystem. This is based, not least, on a multi-year collaboration with the business development company Proneo, Verdal Business Forum and Verdal Upper Secondary School, supported by Verdal Municipality, Trøndelag County Authority and SpareBank 1 SMN. The collaboration has resulted in a portfolio of industrial research and development projects with a total budget of more than NOK 250 million.

Client locations SINTEF Energy Research



Proximity to customers through regional presence and cluster collaboration

- SINTEF's offices
- Innovation Norway clusters we collaborate with
- Cluster-like collaboration with the companies in Røros



SINTEF's engagement in EU research

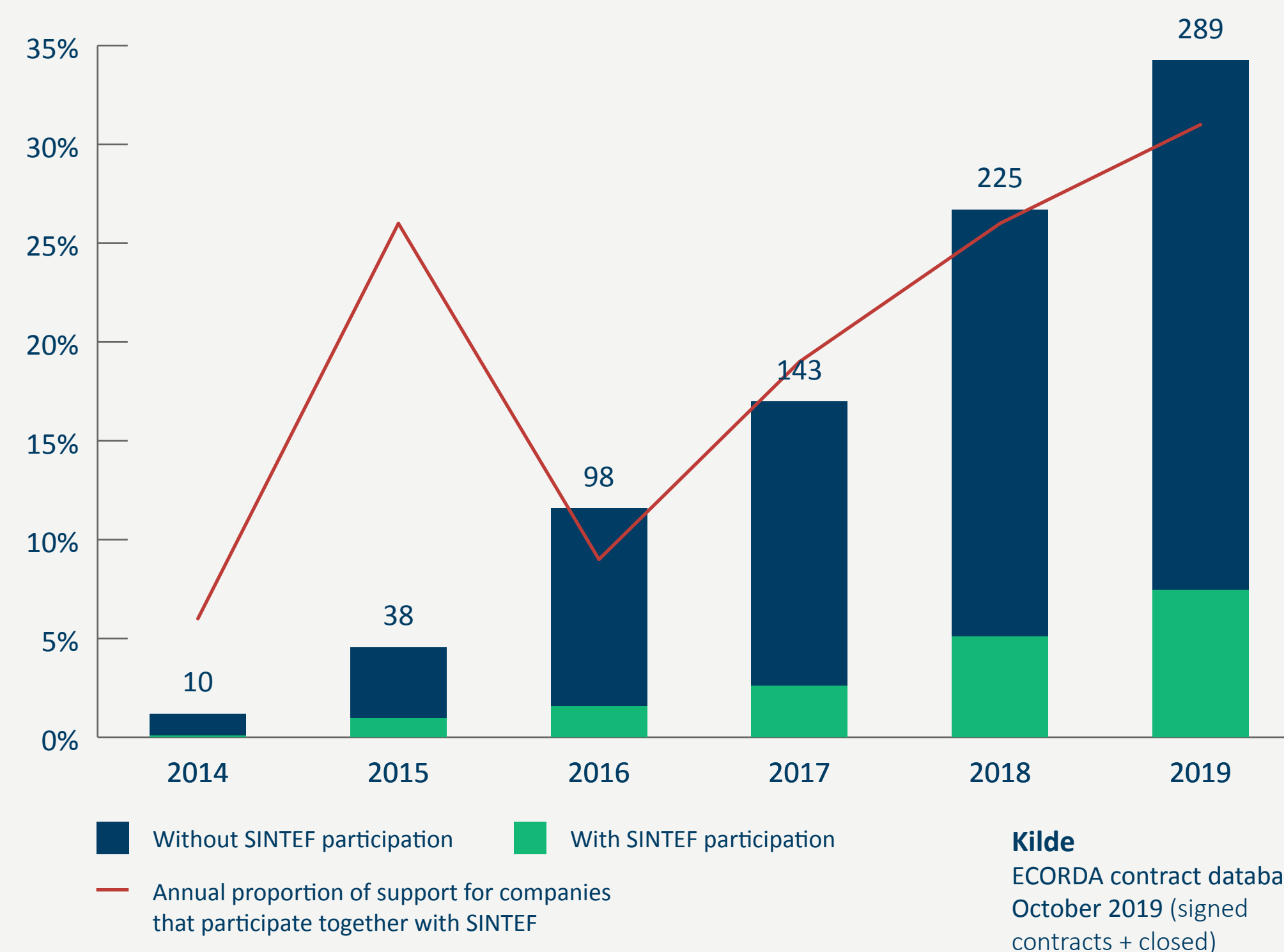
SINTEF's main strength, bringing partners from business and the public sector together in commercially-oriented research projects, has proved a good starting point for bringing home funding from the EU and thereby ensuring that Norwegian actors build competitiveness by taking part in the international research front in key technologies like ICT, biotechnology, energy, nanotechnology and materials science. Professional updates from EU projects are invaluable in maintaining SINTEF's leading position and competitiveness.

In 2014, the EU merged its research and innovation programmes into what is the world's largest research programme worth around EUR 70 billion, Horizon 2020 (H2020). At the same time, the focus was shifted to resolving global challenges. The EU's research programme is an important contributor to the development of EU policies and regulations.

As of May 2020, SINTEF is the Norwegian actor that has won the most projects in H2020 with EUR 149 million in research and innovation funding. The Norwegian government contributes around 2.7 per cent of the current framework programme's budget and has a target of a 2 per cent return share. SINTEF's H2020 activities account for more than one tenth of the government's ambitions regarding the total return of funds to Norway. The projects we take part in receive a total of 2.9 per cent of the funds in H2020, distributed across the various national and international partners.

More than 30 per cent of Norwegian companies that obtain research and development funding from the EU do so in collaboration with SINTEF, as per October 2019. The figure shows how we trigger activity in the Norwegian business sector that brings the companies into partnerships with clients and other companies in the research front at an EU level, accumulated through the period.

We help companies secure R&D funding in the EU (figures in EUR millions)



H2020 is based around three pillars: societal challenges, industrial leadership, and excellent science. SINTEF's biggest contributions to EU research are within societal challenges and industrial leadership. The three largest areas for SINTEF are: secure, clean, and efficient energy, advanced manufacturing and processing, and ICT research.

The research programmes are one of the EU's most important tools for achieving the goal of becoming the world's first climate neutral continent by 2050. Research and innovation in areas like health, the digital society, preparedness and safety, constitute key parts of the next EU framework programme, Horizon Europe, where the EU's proposed budget is more than EUR 80 billion for the period 2021 to 2027.

SINTEF's goal is to double our turnover in relation to the EU during the upcoming framework programme up to 2027, assuming that the economic framework conditions for our participation do not deteriorate. The ambitions are based on the European arena helping to give our clients access to unique networks and innovation power, and give SINTEF's researchers a unique platform for developing and presenting results, getting feedback on the quality of deliverables and obtaining inspiration and knowledge from working with leading European actors. EU research is an important aspect of our ambitions regarding carrying out world-leading research.



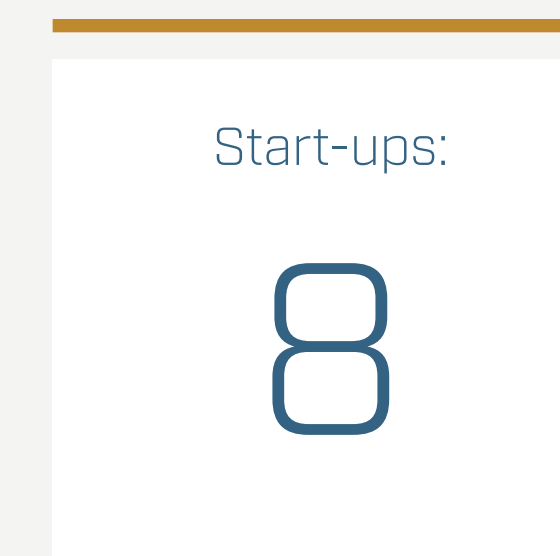
Responsible consumption and production

The world's resources are today under heavy pressure. The growing scarcity of raw materials and increasing volumes of waste and pollution make the development of sustainable consumption and production patterns an important goal. SINTEF is working in an interdisciplinary and cross-sectoral manner with more than 100 business clients on developing solutions for more responsible consumption and production.

SINTEF has strategically focused on the circular economy since 2016 with a vision of “challenging and supporting Norway in the circular transition.” The transformation to a circular society will be complex, and business and the public sector needs insights into the effects of a circular economic model and support with developing new business models, processes, and products. We spend a significant part of the Research Council of Norway's basic grant on delivering basic knowledge about the importance and potential of a Norwegian circular economy. SINTEF hosts the annual Norwegian Circular Economy Conference and contributes heavily to

dissemination in the public debate on how we will achieve responsible consumption and production.

SINTEF contributes to efficient resource use via innovative processes and the development of materials that reduce the use of raw materials in production. For example, together with Skanska, we are realising the waste-free construction site by developing process tools that support cooperation between partners in planning, procurement and logistical activities related to construction sites. We are also contributing to developing technology and bioprocesses for reducing loss and waste and increasing the utilisation of raw materials in the value chain for marine and land-based food production. Among other things, we are working on a project that will increase the utilisation rate for, and value creation from, residual raw materials from white fish. This means developing solutions for onboard handling, logistics and processing ingredients from residual raw materials from sea fishing. Reducing consumer food loss and waste is another relevant topic where facilitating good solutions is important.



We develop solutions for keeping products and waste-free construction site resources in circular material silos through prevention, reduction, recovery, and reuse. Important research topics include life cycle analyses, the reuse of materials and optimisation models that combine technological opportunities with economic and environmental effects. SINTEF coordinates several major EU projects within the circular economy, including in relation to the recovery of electronic components and the utilisation of waste streams for valuable products.

Together with Norwegian Plastic Recycling and others, we are facilitating a sustainable value chain for plastic waste from the Norwegian aquaculture industry. Another example is the Smart Sustainable Composite Products (CompDetect) project. The project owner, Hexagon Ragasco, has set a clear goal

of contributing to a more circular economy through the gas cylinders they produce. SINTEF contributes research expertise to the project within recovery technology, product condition detection, life cycle analysis for documenting environmental impact and the strategic development of more circular business models. SINTEF has worked closely with Tomra for a long time on separation technology for the return of beverage containers, and with Hydro on increasing the recycling of aluminium alloys.

SINTEF contributes to knowledge building to reduce emissions of chemicals and waste into the environment. Several of Norway's largest actors in the textile industry are collaborating on the MICROFIBRE project in order to understand and mitigate the environmental impact of pollution from microfibres discharged from textiles during washing.



ConZerW: expertise in waste free construction sites

ConZerW is an innovation project that aims to develop expertise in order to create waste free construction sites. This will be done through process tools that can support professionals in the various phases of the construction process. The tool will contribute to good planning before materials are ordered and efficient assembly in the construction projects of the future. Methods and models will also be developed for analysing material streams and value chains in a flexible manner.



THE PROJECT ALSO CONTRIBUTES TO



Sustainable cities and communities

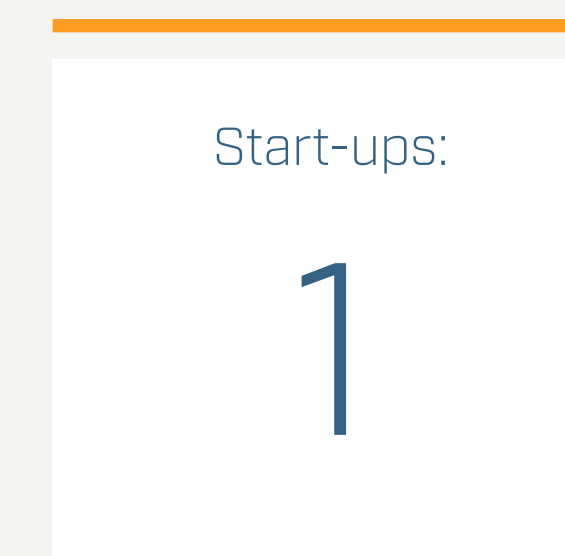
With a turnover of NOK 386 million, SINTEF has a broad project portfolio related to goal 11 Sustainable Cities and Communities. In this area we have, together with partners from research, the public sector, and the organisation and business sectors, succeeded in getting major, multi-year research centres established and funded, like FME ZEN (Zero Emission Neighbourhoods in Smart Cities), SFI Klima 2050 (Risk reduction through climate adaptation of buildings and infrastructure) and FME CINELDI (Centre for Intelligent Electricity Distribution). Behind these spearheads lie a wide range of projects linked to disciplines such as building, infrastructure and neighbourhood development, zero-emission mobility, sustainable infrastructure and autonomous transport systems, the circular economy, energy systems, digitalisation, and innovation in the public sector.

Sustainable cities and communities largely involves seeing issues from an overarching perspective and creating solutions across sectors.

This is a big challenge that SINTEF wants to contribute to resolving through our group-wide

project, Smart Societies. The project portfolio currently reflects great thematic breadth but needs to develop strong links across sectors.

In the UniverCity3.0 project, SINTEF is monitoring the interaction between NTNU and City of Trondheim in their collaboration on University City TRD3.0, which is looking at the effects of collaborations across sectors, the innovative use of technology and the development of the city as a living laboratory and learning community. Norwegian municipalities are important for facilitating interaction between members of the public, business, and the public sector. Through partnership agreements with forward-leaning Norwegian municipalities, SINTEF contributes to the development of local communities and local and national businesses. The intermunicipal 'Gode Sirkler' [Good Circles] initiative is one example of how three neighbouring municipalities, in collaboration with SINTEF, have over many years created an innovative partnership for sustainable social development within expertise-driven business development, education and location development.



In its report from 2020, the Expert Committee for Data Sharing in Business (Ekspertutvalget for datadeling i næringslivet) points out that there is a lot of value in sharing data and we have already seen international examples of urban and rural development based on Open Data Platforms. SINTEF has oriented its project development towards sharing data across four selected sectors: buildings, energy, mobility, and health. These are sectors in which we already find open data, although the data quality, sharing platforms and pace of innovation are deficient.

Mobility is an important element of sustainable cities and communities. The ambition behind our group-wide focus on mobility is to create sustainable solutions that realise a much-needed transition in the transport sector. For example, the GeoSum innovation project is developing geofencing solutions

designed to contribute to traffic management and information in urban areas. The pilot projects will establish speed limit zones around schools to adjust the speed of vehicles, as well as low-emission zones where hybrid vehicles are switched to electric propulsion. Sustainable transport is one of the most important factors in achieving a number of the SDGs, and could contribute to better health, food for all, access to clean energy, responsible consumption, innovation, lower climate emissions and the development of sustainable cities and communities. The UN Secretary-General's High-Level Advisory Board has defined sustainable transport as safe, affordable, accessible, efficient, resilient, and having minimal CO₂ and other emissions that have an adverse impact on the climate and environment. Knowledge, technology, and innovations must be developed and implemented on a large scale to ensure rapid adaptations in society to achieve this.



FME ZEN: Research Centre on Zero Emission Neighbourhoods in Smart Cities

The goal of the FME ZEN research centre, which SINTEF is part of, is to develop knowledge, solutions, and competitive products. These should contribute to the realisation of sustainable buildings and neighbourhoods with zero greenhouse gas emissions related to construction, operation, and transformation. The centre currently has nine pilot projects spread across Norway. The research conducted in FME ZEN and FME ZEB (Zero Emission Buildings) has demonstrated potential energy savings in the lead up to 2040 of 30 TWh through the active implementation of zero-emission buildings. This is equal to the expected increase in demand for electricity.



THE PROJECT ALSO CONTRIBUTES TO



Life below water and Clean water and sanitation

Global systems and all life on earth depend on the oceans and it is therefore vital that these are managed in a sustainable manner. Environmental considerations are becoming an increasingly important factor in the sustainable development of ocean-based industries. Clean oceans are productive oceans and SINTEF is especially interested in making use of our interdisciplinary expertise to solve challenges and create value for our clients. We are focusing on issues linked to marine littering and pollution and contributing to solutions to mitigate the environmental risk from emissions from industrial activities in the oceans.

SINTEF is developing and using models for mapping and managing environmental risk for the sustainable harvesting and production of marine resources. The modelling tools SINMOD (hydrodynamic ocean model), DREAM (dispersal model for chemicals and particles) and OSCAR

(dispersal model for oil spills) are used by the industry to support decision-making in relation to mitigating environmental risks from its activities and evaluating impacts on external environmental parameters in its operations. The modelling tools are updated constantly by including data and new knowledge from our own and international research in fields related to the impact of pollutants on marine organisms. Key fields included in the modelling tools are hydrodynamics, ecotoxicology, microbiology, and analytical chemistry, which are crucial factors in understanding the decomposition, effects, and life cycles of components of pollution (chemicals, microplastics, etc.) in ecosystems. We are developing technologies and systems that make use of digitalisation and autonomy within ocean industries and which provide businesses and the authorities with better conditions for sustainably managing industries and the ocean environment.



Project turnover:

212 M NOK

Start-ups:

3



Project turnover:

43 M NOK

Start-ups:

1

The research portfolio includes development projects aimed at the growing domestic aquaculture industry that focus on better fish health, lower emissions, impacts on the external environment and optimised production. Our research and technology development for cultivating kelp and other low trophic level species on an industrial scale is creating growth in a sustainable blue economy. Expertise in microbial water quality, living feed and automation is providing sustainable value creation through robust fry production. SINTEF is focusing on producing Norwegian raw materials for feed production that can replace soya imports and prevent further destruction of the rainforests in Brazil.

Many of our activities are aimed at optimising the harvesting of important marine resources, nationally and internationally. Optimised capture technology helps to ensure correct extraction while also preventing bycatch, equipment losses and extensive ghost fishing, which is what happens when lost equipment continues to trap fish after being left in the sea. There is huge potential for greater value creation through ensuring further

optimisation of harvesting levels, harvesting at a lower trophic level, protecting spawning and nursery areas, clean oceans, and the best possible quality throughout the entire value chain.

SINTEF has significant infrastructure with some of the world's most modern and specialised maritime laboratories, which are used across projects. We are responsible for the operation of full-scale aquaculture research facilities, have world leading laboratories for research into the life cycles and impacts of industrial emissions, have a national centre for research into marine plankton and are in the process of establishing a national centre for digitalisation and autonomy (full-scale laboratory) in the fjord and coastal region of Central Norway. Our researchers are working closely with industry actors and the environmental authorities to create a common understanding and basis for the sustainable utilisation of resources that are created in the ecosystems and life below water.

Life Below Water is an important goal for SINTEF's start-ups. Ocean Space Acoustics and C-Feed are good examples of this.



Knowledge and methods to prevent escape of fish

The Prevent Escape research project was initiated to establish the causes of escape incidents at Norwegian aquaculture facilities, develop methods for investigation of incidents, and provide targeted preventative measures for reducing escape of farmed fish. The project has categorized the causes of all escape incidents during 2010-2018, and the knowledge is used to prevent future escape incidents. A website, www.hindreromming.no, has been established to disseminate the results, including short articles, animations and research reports. Fish farmers and employees in the aquaculture industry is the main target group.

THE PROJECT ALSO CONTRIBUTES TO





THE COMPANY ALSO CONTRIBUTES TO



Ocean Space Acoustics

PingMe™ locates hazardous waste

Lost fishing gear are a major challenge to marine life and makes up the majority of large plastic pollution in the oceans. More than 640,000 metric tons of lost and discarded fishing gear end up in the world's oceans every year. The phenomenon of ghost fishing is a threat to living species in the ocean, harms the reputation of the fishing industry and has major economic consequences for fishermen in the form of lost gear and catches. Fishing gear is the most harmful type of marine waste for life below water, since lost equipment can continue to trap fish for periods of up to 30 years.

Impact for clients, users and society

PingMe™ helps fishermen locate and identify lost fishing gear below water, down to 2 000 metres depth. Fishermen can register information about lost and found gear in a cloud solution. In the future, the service may be integrated into public databases. PingMe™ is being commercialised by SINTEF's start up company, Ocean Space Acoustics AS. PingMe will be tested by pilot clients in 2021.



Links to more info

osac.no
sintef.no

Application and scalability

PingMe™ can also be useful for other applications, including locating offshore anchoring systems, sea cables and pipelines for offshore wind power, aquaculture, and oil operations.



THE COMPANY ALSO CONTRIBUTES TO



C-Feed

Copepods for commercial use

In 2016, the company C-Feed opened the world's first commercial copepod production facility. The company is based on more than 15 years of research and development in SINTEF. Today, C-Feed offers eggs and live copepods to marine hatcheries, aquariums, and researchers around the world. Copepods are mainly used for fry feed due to their high levels of fatty acids and proteins in the cell tissue. A container of copepod eggs can produce more than 100 million copepods that can be kept alive for long-term storage in fish tanks.

Impact for clients, users and society

One major problem in fish farming is that a large proportion of the fry die in the first phase of the farming process. Copepods have proved to be highly suitable as feed for fish, including tuna, halibut, lobster and ballan wrasse, and have in many ways revolutionised the farming of these species. The use of copepods as feed thus increases efficiency in industrial fish farming by improving the survival rate, quality, and weight of the fish. Using copepods also improves water quality and the production environment in the facility.



Links to more info

cfeed.no
sintef.no

Application and scalability

C-Feed's products can be used as starter feed for a large number of farmed fish species around the world. The company's total market potential is estimated to be around NOK 3.5 billion.

Clean water and sanitation also require new solutions, and these must be secured for the sake of the world's entire population. One of the consequences of climate change that we are experiencing today is large variations in precipitation. The frequency and intensity of precipitation has increased dramatically in the North, while water shortages are causing enormous tragedies in many countries (droughts, fires and more). Water quality in Norway has also deteriorated as a direct consequence of climate change. Further, there are growing concerns about new emerging pathogens and micropollutants in water, such as medicine residues, hormones, cosmetics, and industrial activities, which may constitute a danger to people and ecosystems.

Water supply and wastewater facilities are critical infrastructure. Other driving forces that impact buildings and infrastructure are urbanisation, safety, less economic room for action, rapid advances in technology and digitalisation. In Norway, the population growth is primarily expected to occur in small and medium-sized towns. In many of these towns, there is a huge need to increase the rehabilitation rate of existing infrastructure, and safety, vulnerability and preparedness routines are not always satisfactory. Digitalisation of the water and wastewater industry opens the door to many exciting opportunities, although it also presents challenges with regard to IT security.



STOP-IT: risk assessments and protection of water supplies

The STOP-IT project is looking at how water supplies can be protected from physical threats and cyberattacks. STOP-IT is contributing with an integrated, scalable, and flexible technological platform that has been developed up to at least a level seven on the technology readiness level (TRL) scale. The solutions that are being developed will help operators prioritise risk, develop a realistic approach and plan how to strengthen the protection of physical and digital infrastructure. In the future, this will contribute to secure operational control systems in European waterworks.



THE PROJECT ALSO CONTRIBUTES TO



Environmental protection and a greater focus on resource optimisation are also important drivers, both for the public sector and for the Norwegian industry. The requirements of the Water Framework Directive regarding chemically and ecologically unaffected water bodies must be complied with and stricter regulations are expected for sewage sludge and wastewater (municipal, industrial and stormwater).

A large proportion of these challenges are owned by public authorities and the municipalities. In these cases, there is no commercial motivation, but rather a strong sense of social responsibility. In other cases, the challenges are owned by the private sector.

SINTEF contributes expertise in areas such as:

- Integrated water management, which combines knowledge about water resources, water management infrastructure, economics, and society to develop sustainable solutions throughout the water cycle. These include solutions for the optimal utilisation of resources for various purposes, solutions for infrastructure for hydropower, water supplies, stormwater management and wastewater treatment, and methods and tools that allow solutions to be evaluated in relation to the SDGs.
- SINTEF has expertise that can help dealing with the consequences of climate change in the form of stormwater management, use of reservoirs for flood alleviation, nature-based solutions, not just for stormwater but also for improving quality, purification, reuse, landslide prediction, and urban drainage systems. Since climate change also impacts water quality, especially colour, organic content and microbiology, water treatment needs to be re-evaluated to deal with these changes sustainably.
- The digitalisation of the water industry, where there is a continuous need to upgrade processes for water treatment; a need that is increasing with climate change and higher pollution loads on raw water sources. Artificial intelligence and machine learning can also be used here, including in analyses of climate data and the effect of climate change on water and wastewater resources. The water industry is transitioning from analogue to digital solutions for processes and systems. This is providing opportunities to improve existing technology and working methods ('digital maintenance') and to develop new solutions for controlling water quality and security of supply.
- Safe and sustainable water treatment and resource recovery, which must safeguard public health and maintain a good environment/recipient quality from a sustainability perspective, while conserving resources and minimising emissions and waste. This applies to drinking water, wastewater from municipal and industrial uses and rainwater.

Good health and well-being

SINTEF aims to contribute to better and more coherent healthcare, increased productivity in the national health service and growth in the health industry. Together, this will result in a healthier population, a more sustainable welfare state, more jobs and increased export income. Our ambition is to increase our contribution to achieving the health-related SDGs in low-income countries, where access to healthcare for the most vulnerable in society, the development of medicines and vaccines, and using technology to increase capacity in the healthcare sector, are particularly important. Changing demographics with more elderly and relatively fewer in the labour force will be

challenging for many countries in the coming years. Therefore, technologies and solutions that can help us deal with these challenges in a way that ensures the sustainability of healthcare and welfare services must be developed.

SINTEF supports good health and well-being through research and development in all phases of patient pathways: health promotion and preventing diseases and injuries, diagnosis, treatment, rehabilitation, and follow-up. This is being done in partnership with employers and the education sector, the national health services, patient and user organisations, and business.



Project turnover:

187 M NOK

Start-ups:

6

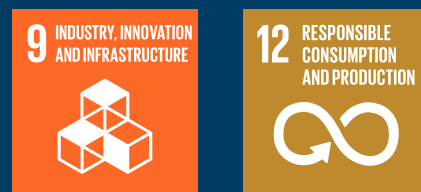


MEDPROT: production of Antibodies

MEDPROT aims to establish production of therapeutic proteins in Norway. The project is focusing on monoclonal antibodies that can be used in treatment of, for example, cancer. The production takes place in cell cultures and the goal of the project is to understand and develop this process in order to improve product yield and quality. Producing antibodies better, faster, and cheaper will help to make this type of medicine available to a larger proportion of the world's population.

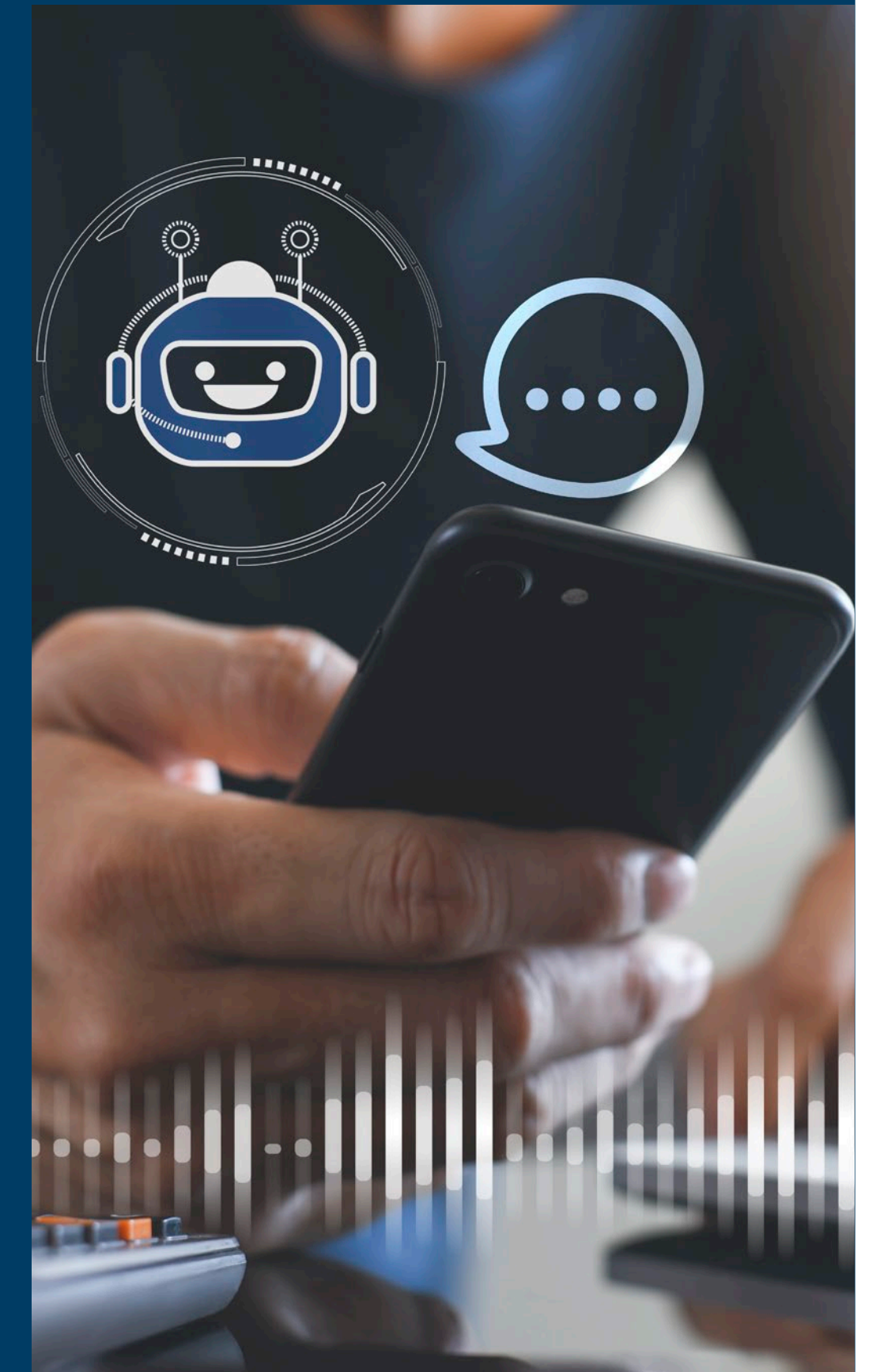


THE PROJECT ALSO CONTRIBUTES TO



Social Health Bots: for an effective health service for young people

The concept behind Social Health Bots is that web-based chatbots will lower the threshold for young people to ask questions and seek help in relation to their mental health. This will improve young people's access to reliable information and support, and thus contribute to more effective services. The services may also be a gateway to more comprehensive healthcare services. Evaluations of current prototypes have produced promising results and show that young people benefit from healthcare chatbots.



THE PROJECT ALSO CONTRIBUTES TO



Health and quality of life are experienced at a personal level, and user participation is, therefore, key in our approach to contribute to improved health and care services. We are actively working to enable data sharing in all parts of, and between, the various actors in the national e-health service. We are using our knowledge of physiology, sensors and materials in partnership with Norwegian and international industry to develop procedures and protective equipment that prevent accidents and hazards at work and in leisure time. SINTEF has developed roadmaps, procedures and solutions for the health authorities to improve the treatment and follow-up of large patient groups such as people with rheumatism, dementia, asthma and COPD, children and young people with mental disorders, and people living at home with complex medical conditions.

To increase both quality and productivity in the healthcare sector, we are developing completely new ways of providing healthcare and tools to improve the efficiency of work processes. Our research and development within digitally

supported healthcare like welfare technology and e-health, the use of health data and more flexible and efficient pharmaceutical manufacturing is helping to lower costs and improve the quality of care. We are using our expertise in biotechnology, nanotechnology and imaging technology to develop better diagnostic processes and treatments for cancer and stroke patients.

SINTEF's work within global health in the last 25 years has included research and development that is directly relevant to many of the SDGs: goal 1) No Poverty; goal 4) Quality Education; goal 5) Gender Equality; goal 10) Reduced Inequality; and goal 3) Good Health and Well-being. This research and development work involves extensive collaboration with national authorities and the civil society in many sub-Saharan countries, as well as in the Middle East and Asia.

The research and development activities have concentrated on living conditions, health, and healthcare for people with disabilities and other

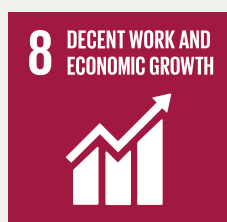
particularly vulnerable groups. SINTEF has worked on this by contributing to scientific data on vulnerable groups, through research into specific services and through service development. The data is used by the World Health Organisation (WHO), the UN Development Programme (UNDP) and other international organisations, as well as on a national level for policy development. Special studies have helped to turn the spotlight on specific areas, like the access of disabled people to tuberculosis prevention and treatment, the abuse of women and discrimination against people with disabilities by health professionals. SINTEF has also played a leading role in developing provisions such as technical aids and hearing services, as well as using technology to make specialised healthcare services more accessible (see project descriptions for I Hear You and LOREWO pp. 57-58). This has even greater potential going forward because the use of mobile phones is now common in all countries.

Our work on more efficient and flexible pharmaceutical manufacturing can contribute to increased accessibility to new and more targeted medicines for the world's poor as well. The partnership with international organisations, national authorities, civil society and other stakeholders has been a deliberate strategy aimed at obtaining more data about lower priority groups, and has increased the ability to influence policies and practices. Over time, this has resulted in an extensive network of contacts that can provide new opportunities both for further research into health and healthcare, and act as a good gateway for other specialist environments in SINTEF that want to, and can help to strengthen the work on achieving the goal of good health and well-being for all.

Good health is also an important goal for the start-ups in SINTEF where six of the 16 companies are working on relevant solutions. Tellu and Minuendo are two good examples.



THE COMPANY ALSO CONTRIBUTES TO



Tellu

E-health for remote follow-up, etc.

Tellu is contributing to the development of the e-health market in the intersection between healthcare and technology. At the core of the company's activities lies a cloud-based platform that serves as an integration layer between various third-party or self-developed services, sensors, professional systems in home services, alarm services and patient records. The cloud solution is based on open standards, and it is possible to integrate advanced medical equipment, which opens the door to, for example, remote medical follow-up and 'hospital at home' solutions in a safe and proper manner.

Impact for clients, users and society

Taking care of people is Tellu's core mission. The company's solutions make it easier and safer to take good care of people in vulnerable phases of their lives. Research into the implementation of the company's solutions shows a clear increase in the quality of care that can be given to the users, and at the same time significant savings for clients and improved working conditions for employees. For society, the large-scale introduction of the type of solutions Tellu delivers will provide big savings and enable society to deliver better services with fewer resources.



Links to more info

tellucloud.com
sintef.no

Application and scalability

Following the merger with Telenor E-health, Tellu has budgeted for a turnover of NOK 77 million in 2020 and they have taken a position in the home market that makes rapid scaling in new markets possible. The company's solutions have been noticed in several EU countries, and as a pure software-as-a-service (SaaS) provider it will be possible to scale the business rapidly, alone or together with local partners.



THE COMPANY ALSO CONTRIBUTES TO



Minuendo

Intelligent hearing protection

Minuendo is developing intelligent hearing protection based on technology from SINTEF. Minuendo's solution is the first of its kind in the world, which protects hearing without degrading the sound quality. This product will notify the user of dangerous noise levels and prevent hearing damage, as well as reproduce sound in environments with varying background noise levels. Minuendo's first product was launched in 2020 and is an earplug for musicians and concert participants with stepless variable attenuation between 7-25dB. The earplug includes a tuneable high-fidelity acoustic filter yielding natural sound reproduction at any attenuation level.

Impact for clients, users and society

According to the European Commission, hearing loss is the most serious occupational work-related injury in Europe. The hearing protection from Minuendo aims to reduce the number of people developing hearing damage at work.



Application and scalability

High noise levels and hearing damage are a problem for many occupational groups, including the music and construction industries. Minuendo's products will, therefore, be important for many different industries and contribute to better hearing protection.

Links to more info

minuendo.com
sintef.no

Other sustainable development goals

Our analysis shows that SINTEF also has research activities aimed at other SDGs.

Listed by the size of turnover in relation to each SDG, this applies to:

- Goal 2) Zero Hunger
- Goal 17) Partnerships for the Goals
- Goal 16) Peace, Justice and Strong Institutions
- Goal 4) Quality Education
- Goal 15) Life on Land
- Goal 1) No Poverty
- Goal 10) Reduced Inequality
- Goal 5) Gender Equality

Together, this portfolio of projects was worth around NOK 151 million in turnover in 2019.

For example, we have raised the theme of sustainable food to the highest level in SINTEF's

corporate strategy and are, therefore, focusing the spotlight on goal 2) Zero Hunger. The distribution of the world's food resources is clearly skewed. The challenge is related to the paradox that while more than 800 million people in world are still undernourished, on average we eat a third more calories than in 1961 and twice as much vegetable oil and meat. Two billion people are overweight and suffer from obesity. Around 25-30 per cent of all the food produced for people is not eaten. It is expected that by 2050, the planet will be home to around 10 billion people. Demand for food, materials and energy will increase. Therefore, we have to look for new sources, both on land and in water, of healthy, nutritious food to meet the world's needs. We also have to reduce greenhouse gas emissions dramatically if we are to meet the UN's climate goals. In the period 2007-2016, agriculture, forestry and land-use changes accounted for around 23 per cent of total net manmade greenhouse gas emissions.



SINTEF's work on food from the sea represents significant activities relating to SDG 2. Cultivation in the sea, by developing the Norwegian salmon industry and by contributing to the profitable, sustainable production of other species, will form an important part of future sources of food, energy, and raw materials. The production of new species from the sea will be vital for feeding the world's population. In SINTEF, we are focusing on the interaction between technology and biology to develop solutions that result in good fish welfare. To ensure a high-quality product, we must understand how technology influences quality throughout the entire value chain, from catching to cultivating the finished product.

The total utilisation of all raw materials is a prerequisite for sustainable growth. The report, Value Creation Based on Productive Oceans in 2050, looks at the opportunities for achieving growth in bio-based industries towards 2050.^[24] It points to six areas in particular as having significant growth potential: the fishing industry, the salmon industry, the supply industry, the marine ingredients industry, seaweed and kelp production and low trophic level production.

SINTEF's research and innovation is relevant to all of these areas and seeks to contribute to the responsible utilisation of resources and value creation.

In 2017, SINTEF established the group-wide Food and Agri project to contribute to the more efficient, profitable, and climate-friendly production and processing of raw materials, not just from the sea, but also from fields and forests. We can see that interacting with technology providers and the transfer of knowledge from other industries are prerequisites for a successful green transition in these industries. SINTEF is contributing solutions that can reduce greenhouse gas emissions from meat production and improve the utilisation of residual raw materials by more automated solutions and establishing new processes. Solutions for carbon capture in agriculture and forestry are also being developed. The development of Norwegian ingredients for fish feed is a special priority area where we are promoting interaction between agriculture and the marine sector.

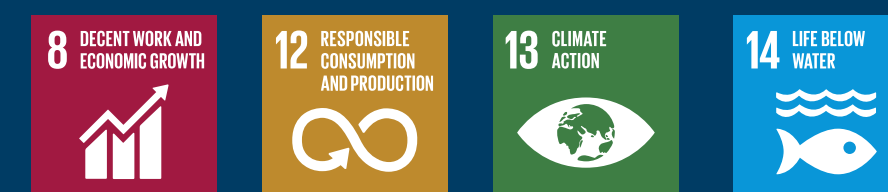


ProSeaFood: Kelp on a plate

Global food production faces major technological and environmental challenges that must be resolved to become sustainable. The ProSeaFood project is developing prototypes of food products containing processed kelp. The products are being evaluated based on their sensory properties, nutritional content and health promoting effects. The project is also working on methods for processing kelp into food ingredients on an industrial scale. Long-term efforts are being made to launch new products in the Spanish and Norwegian markets.



THE PROJECT ALSO CONTRIBUTES TO



[24] "Verdiskaping basert på productive hav i 2050", report from a working group appointed by the Royal Norwegian Society of Sciences and Letters (DKNVS) and the Norwegian Academy of Technological Sciences (NTVA). 16.08.2012. <https://www.sintef.no/siste-nytt/verdiskaping-basert-pa-produktive-hav-i-2050/>

Similarly, we have also raised the topic of smart and secure communities to the highest level in SINTEF's corporate strategy and are, therefore, also focusing on goal 16) Peace, Justice and Strong Institutions. Our research into secure societies is about reinforcing society's ability to protect itself from, and deal with, events that threaten fundamental values and functions and put lives and health at risk. These could be events triggered by nature, technical or human error, or even deliberate malicious actions, events that can occur both locally and globally. SINTEF is carrying out research into critical societal systems and infrastructure. We are also developing new knowledge that helps to improve coordination between the actors responsible for public security and knowledge that enables us to map and handle the risks inherent in the dependencies between systems and infrastructures. SINTEF's work on secure societies has garnered both national and international recognition. Nationally thanks to the establishment of the Gemini Centre – Resilient Critical Infrastructures and Societies, and internationally thanks to the EU's research programme, including the DARWIN project co-ordinated by SINTEF being mentioned as one of only 10 projects in the EU's own midway evaluation of the framework programme Horizon 2020.

Furthermore, SINTEF had the role as Scientific Officer in the EU's SmartResilience project, which developed an advanced method, based on indicators, for scoring the resilience of infrastructures. Infrastructure owners in Norway are already interested in implementing this method in their work with risk analysis. In total, through the EU's research programme for "Secure Societies: Protecting freedom and security of Europe and its citizens", SINTEF has brought home project funding worth EUR 7.1 million.

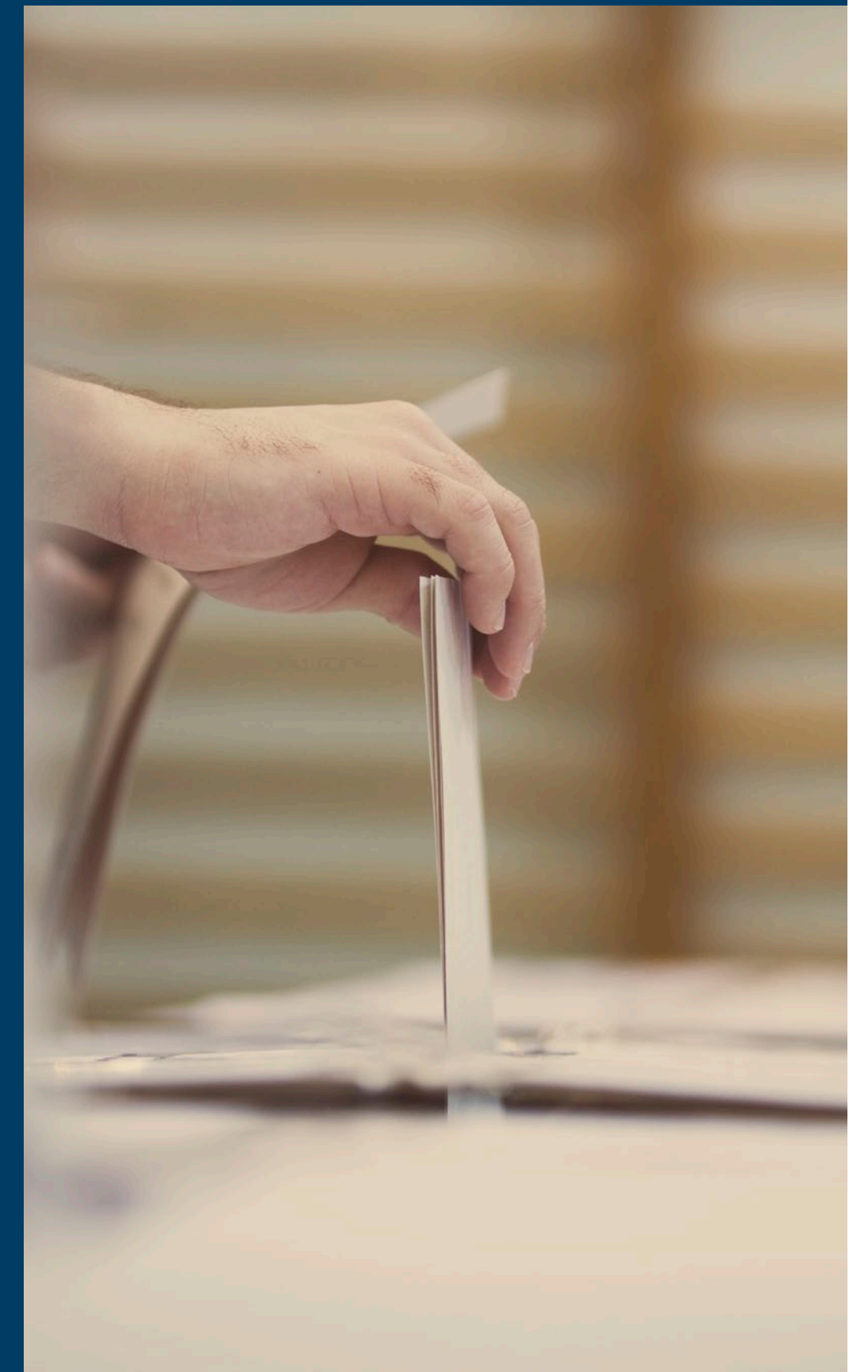
In the wake of the coronavirus crisis, the group-wide Secure Societies project took the initiative to bring many of the national scientific research institutions together in order to join forces on a common effort in which everyone contributed to coordinating, sharing and producing new knowledge related to the crisis. One of the products of this common effort was a virtual national conference "What did we learn from the Covid-19 pandemic?", where 20 different informative talks were given and discussed during a four-hour digital session.

We also have activities aimed at the remaining SDGs. Some examples are provided on the following pages.



Information influence activities in the 2019 Norwegian elections

The project investigated whether attempts were made by foreign actors to influence information in connection with the municipal council and county authority elections in 2019. The method is both a quantitative and qualitative analysis of user-generated content from a range of social media and websites that represent political actors, traditional media and 'alternative media'. The materials were also analysed with a view to the dissemination of known 'fake news'. Conspicuous and, to some extent, suspicious communication patterns were detected, although links to foreign actors could not be shown. The entire process rests on advanced 'scraping' (the systematic collection of comments from social media) combined with surveys by Faktisk.no and foreign analyses.



17 PARTNERSHIPS FOR THE GOALS

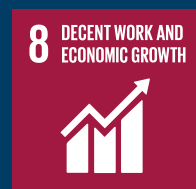


Research project on impacts of decarbonisation strategies

The project is part of a partnership between the International Labour Organisation (ILO) and the Inter-American Development Bank (IDB). SINTEF is a member of the ILO's Green Jobs Assessment Institutions Network (GAIN) and contributes to improving skills in this type of analysis. SINTEF has investigated the degree to which jobs are affected by different decarbonisation strategies. The project has helped to provide insights into, and knowledge about, jobs and carbon emissions in different sectors in 20 countries in the Latin America and Caribbean region. **The numbers** relate to sectors and emissions today and in 70 different possible scenarios for 2030 and 2050.



THE PROJECT ALSO CONTRIBUTES TO

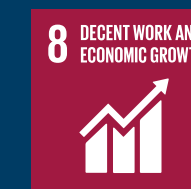


BOOST: A school approach to promote mental health and well-being

The goal of the BOOST project is to create good inclusive school environments to prevent school dropout and ultimately social exclusion. BOOST is working on developing a flexible and preventive school approach that promotes good mental health and can be sustainably integrated into school environments. The approach will be implemented and tested in Norway, Spain, and Poland. The goal is to make an approach which is relevant both nationally and internationally.



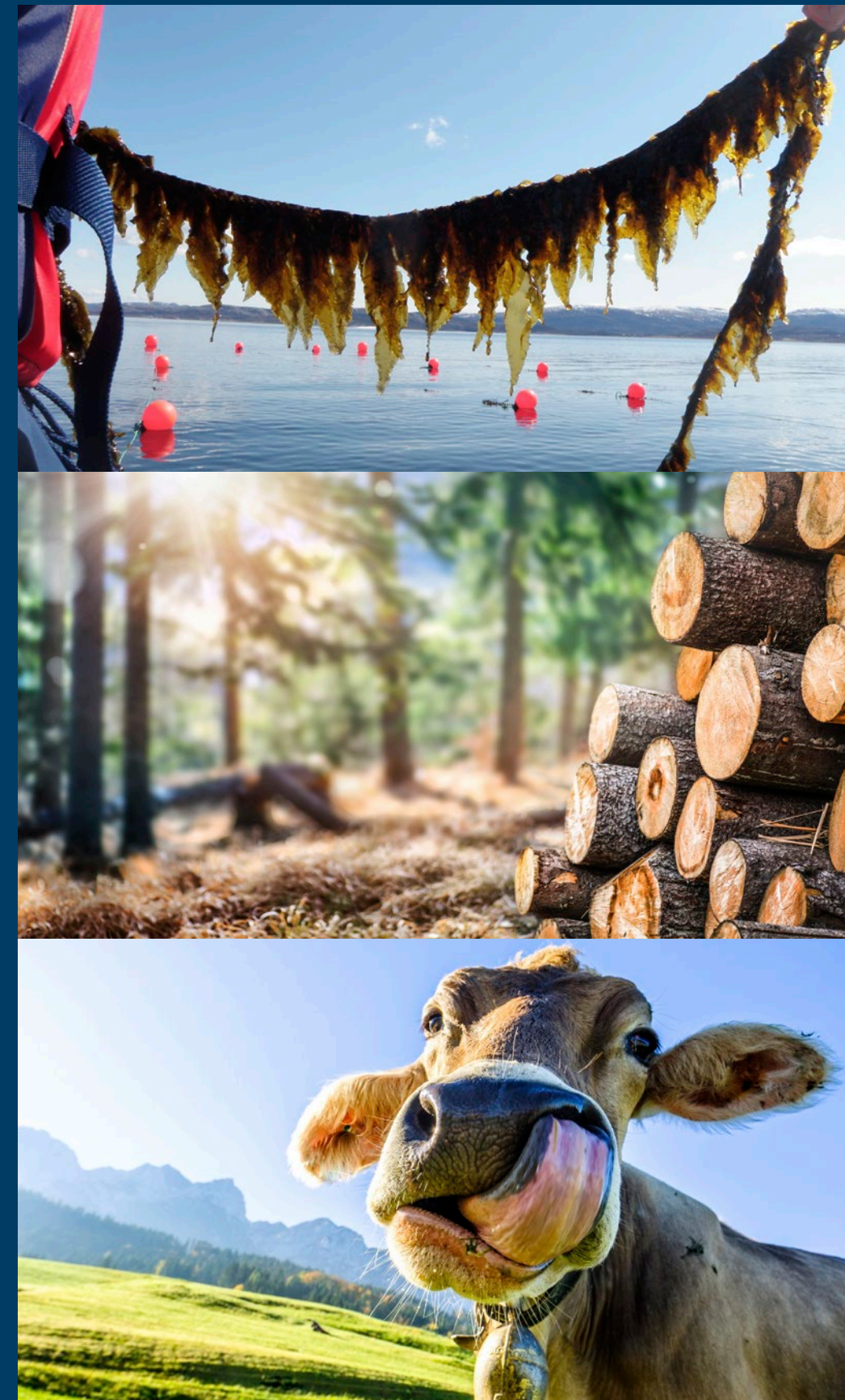
THE PROJECT ALSO CONTRIBUTES TO





Value creation through increased cooperation between the ocean, agriculture and forest industries

On behalf of Trøndelag County Council, the project has mapped supply volumes and investigated how greater value can be realised from regional bioresources by utilising residual raw materials across the ocean, agriculture, and forestry industries in the region. The work has concentrated on the potential represented by bioprospecting, biorefining, feed production for aquaculture and bioenergy, and the impact new technology can have on the development of new business models. It has identified priority areas that will strengthen business development, employment and contribute to the establishment of green, valuable industry in the region.

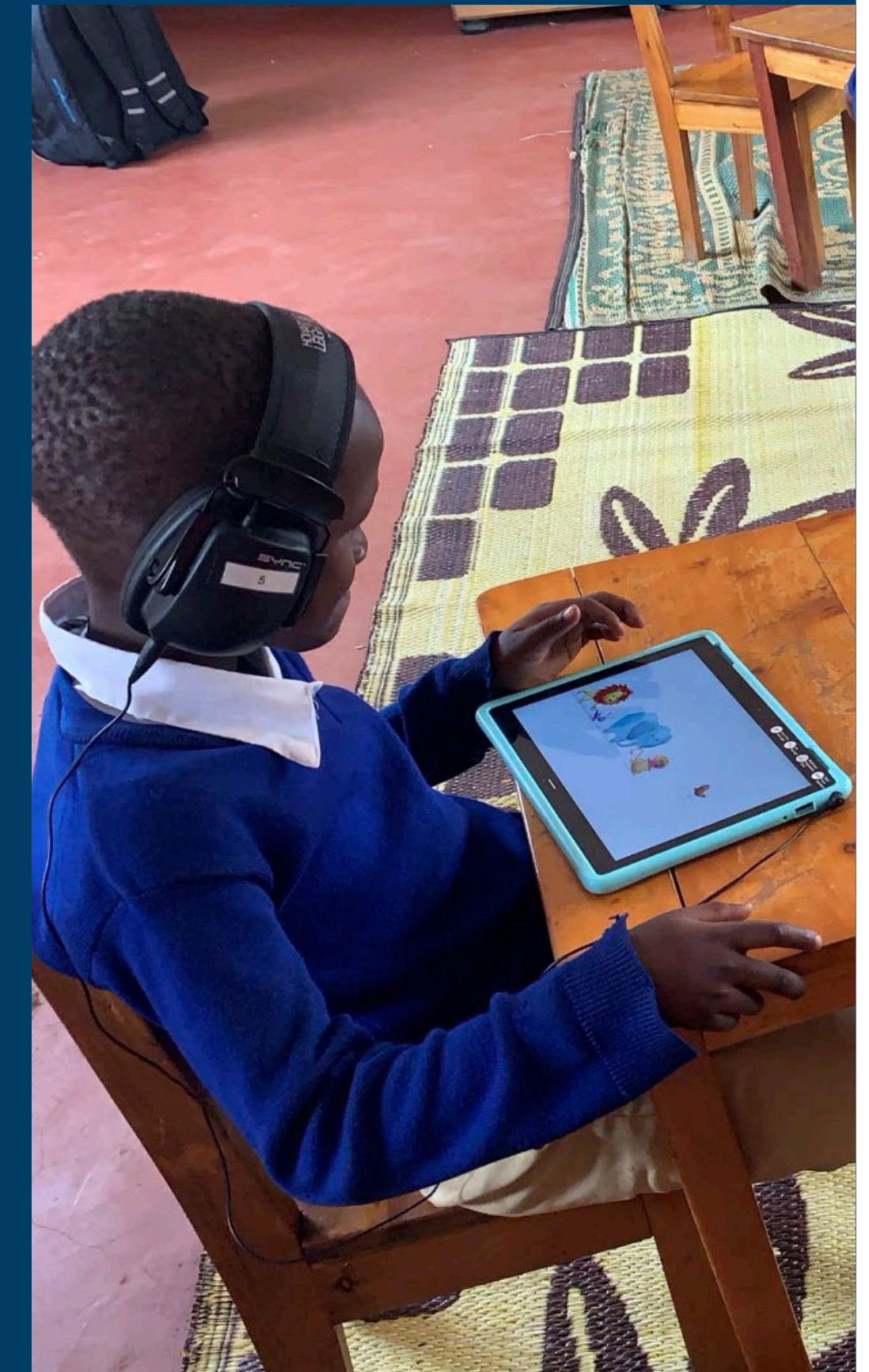


THE PROJECT ALSO CONTRIBUTES TO



I Hear You: Gaming technology for testing children's hearing

Using gaming technology, tablets, and headphones, the I Hear You project has developed new tools for testing of children's hearing in schools in Tanzania. The aim is to include children with hearing loss in school and education, and thereby reduce poverty. The project has screened children from three primary schools. The prevalence of hearing loss varied between 7-16 per cent, and the most common causes of hearing loss were earwax and otitis. If hearing loss is detected early, it might be treated with preventive measures and proper medical follow up, thus reducing the number of children dropping out of school.



THE PROJECT ALSO CONTRIBUTES TO





LOREWO: Local rehabilitation workshops in Namibia and Zimbabwe

The project is creating jobs, facilitating inclusion and empowering people with disabilities to live independent lives. LOREWO provides wheelchairs and services in Namibia and Zimbabwe. Annually more than 1,000 people with disabilities and their families receive assistive technology, training, follow-up, as well as repair of broken assistive technology. The project is based on experience from Norwegian assistive technology centres adapted to local contexts in low-income countries. LOREWO strive to ensure 'no one is left behind'.



THE PROJECT ALSO CONTRIBUTES TO



Insight work for Ung.no

The project involves analysing almost 300,000 questions asked by adolescents using the information and communication channel, Ung.no. The insights obtained from the research work may contribute to a better understanding of what adolescents really are interested in and wondering about. One particularly important finding is that boys seek help far less than girls. This has contributed to Ung.no now focusing more on gender and gender equality, and has raised awareness among the panel members who answer the adolescent's questions.



THE PROJECT ALSO CONTRIBUTES TO



4

SINTEF's operations and management are based on sustainable principles

A not-for-profit research institute tasked with realising the Foundation's purpose

As a foundation, SINTEF has no owners, but it does have a responsibility to fulfil its purpose and social mission. No dividends can be paid out and our entire surplus is used to boost the organisation's financial strength and innovation capacity through improving expertise and investing in infrastructure and strategic priorities.

As a not-for-profit research institute with a board and council, we have involved important groups of stakeholders in our formal corporate governance. For example, SINTEF's Council is chaired by

NTNU's rector and includes employees, individuals from business, NTNU and the University of Oslo, employer and employee organisations, and people with a background from the public sector.

The SINTEF Foundation's articles of association describe its purpose and overarching management principles. The Board produces a report describing SINTEF's corporate governance every year. Our annual report describes our financial results and our HSE report provides further information about our HSE work.



Sustainability as part of management and organisation

Integrating sustainability into the core of how we work is not only important for our business areas. It is also about how we manage and organise ourselves.

The formal organisation of the group management team confirms the importance sustainability has on SINTEF's agenda. SINTEF established the position of Executive Vice President (EVP) Sustainability in 2015 as an expansion of the position of Climate Director (2012-2015), formerly known as the Climate Technology Director (2008-2012). SINTEF was one of the first to establish such positions in Norway, separate from HSE and HR. However, in line with SINTEF's unique position, the role of SINTEF's EVP Sustainability has largely prioritised proactive engagement with clients, the authorities, industry organisations and other decision makers in order to develop understanding, demand and good framework conditions for research and innovation that contribute to sustainable development. The

position has been part of the group management team since 2008.

Historically, SINTEF's reporting on its internal sustainability performance has not been prioritised equally high. In 2019, we started a more ambitious project developing a more comprehensive set of management information, which includes externally and societally oriented key performance indicators (KPIs). These apply to, for example, the projects' contributions to the SDGs and our organisation's CO₂ emissions.

Our sustainability profile is also being strengthened in SINTEF's portfolio of start-ups. When new companies are established, SINTEF requires them to organise and manage themselves in line with the same principles as SINTEF, with the UN Global Compact's principles acting as guidance. In our experience, investors include sustainability in their investment criteria both because they want to

contribute, but also because they want to assess and price risk. In 2020, SINTEF will ask all start-ups to report on their activities within sustainability and societal impact.

In-house 'Green Teams' (environmental working groups) have been established at institute and group levels with responsibility for our own green transition and eco-friendly operations.

The basis for SINTEF's work includes formal certifications. SINTEF must always strive to ensure that the requirements and expectations of our clients and other partners are properly met. SINTEF's management system is certified in accordance with the internationally recognised standards, ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018. SINTEF's certificates were renewed for a new three-year period in 2019. This means that we have a management system designed to ensure that SINTEF delivers products and services

of the agreed quality, takes account of the external environment, and works systematically on its working environment and safety.

SINTEF conducts ongoing client satisfaction surveys. The survey is sent to contact people in private and public organisations after projects are completed and amounts to around 500 responses annually. The 2019 survey shows a satisfaction score of 4.49 measured on a scale from 1 to 5. Our score has developed positively since 2017 and the average for 2019 was the highest since the survey started in 2013. Projects which receive a low evaluation score (1 or 2) are followed up directly with the client in line with the management system. The survey is used to increase value creation in future projects and identify areas with improvement potential. The results are shown on the following page.

Since 2017, all clients have also been asked to evaluate the contribution the activities make to innovation and the external environment. The clients confirm the positive results here too, although as the figure shows at a slightly lower level than the average for questions in the survey. We think this is due to the fact that many clients do not view innovation and the environment as key factors for the given projects and many mark these categories as 'not relevant'. We are assessing the possibility of improving and clarifying the questions in order to facilitate a better dialogue and a clearer evaluation on how the partnership with SINTEF is contributing, or could contribute, to better competitiveness and good societal solutions in line with the SDGs and our strategy.

We are also paying greater attention to sustainability in our work with suppliers. This is reflected in requests for tenders sent out by SINTEF and in documentation following procurements. Today, we use SINTEF's declaration on social responsibility and business ethics when we enter into contracts and when sending out requests for tenders for contracts under the direction of the Group. We also apply procedures for the procurement of goods

and services that establish that all procurements must comply with SINTEF's code of conduct. An evaluation of the supplier is conducted for all procurements above NOK 300,000. The evaluation covers all technical areas such as social responsibility, economics, IT, quality, HSE, subcontractors, and ethics. We also always check whether or not the business concerned has documented its compliance with human rights principles and the ILO convention, and that it has implemented the principles of recognised standards or guidelines for ethics and social responsibility, such as the UN Global Compact, GRI, SA 8000 and ETI.

In our experience, sustainability is very important to our employees, clients, and suppliers. The key figures included in supplier follow-up highlight our focus on sustainability and cover factors such as food waste, carbon footprint, ecology, and fair trade, as well as employee satisfaction. One example where many of these are relevant is the new supplier agreement we have concluded for the procurement of furniture. The agreement focuses on the reuse, repair, maintenance, sustainable manufacturing, and transport of the furniture. The circular economy therefore has a key position in the agreement.

Our clients are satisfied and confirm that SINTEF contributes to innovation and the external environment (scale from 1 to 5)



SINTEF wants to reduce its climate footprint

SINTEF's environmental policy dictates how we are to operate our buildings and conduct our research activities. By systematically working to reduce SINTEF's impact on the environment we are seeking to fulfil our societal responsibility and meet clients' expectations.

Energy, properties, water, and waste

SINTEF's environmental action plan contains several measures aimed at more energy efficient operations and better waste management. For 2019, the information about our energy-related CO₂ emissions covers buildings owned by SINTEF in Trondheim. Information about our buildings in Oslo will be included in 2020. A significant proportion of our building stock consists of laboratories that require continuous 24/7 operation, which means that they cannot be compared with ordinary office buildings. Nevertheless, SINTEF is working to improve and reduce energy use in areas where this is possible. In 2019, we worked on the rehabilitation and efficiency of heating systems, installation of combined cooling and heat pumps, eliminating oil boilers and replacing all light sources with LED. We have also established an agreement with an energy adviser

concerning an energy monitoring system. SINTEF's water consumption varies greatly in the different buildings and reflects the proportion of the space which is used for laboratories. Measures carried out in 2019 for monitoring water consumption included installing water meters connected to the energy monitoring system and establishing non-return valves on all water intake points. SINTEF has implemented measures to reduce water consumption, including the elimination of mains water for cooling and the replacement of older toilets.

SINTEF, in partnership with our suppliers, is continuously working to improve source separation routines for waste. To date, we have established a source separation system with separate waste fractions for household plastic and food waste linked to canteen operations, but the supplier does not have a reception system for the fractions. This has not been part of the government's mandatory source separation requirements for business waste. A decision has also been made to eliminate single-use plastics associated with meals. We have increased our focus on this and will be working on several measures aimed at improving our source separation rate. We

are in particular working with the suppliers in Oslo to make correct source separation simpler.

SINTEF is working on developing its premises and aims to ensure that all investments in new buildings satisfy the BREEAM-NOR Excellent standard. BREEAM-NOR is a Norwegian adaptation of BREEAM – Norway's most widespread environmental certification for all types of buildings. Several rehabilitation projects are being planned, where the modernisation of our premises in Forskningsveien 1 in Oslo is closest to completion. In the case of rehabilitation, the standard being strived for is BREEAM-NOR Very Good.

	2016	2017	2018	2019	Goal (KPI)
Total energy GWh	28,58	28,65	26,96	25,95	24,35 in 2021
Reduction (from 2017) in energy consumption			Reduction of 5,7 %	Reduction of 9,2 %	>15% Reduction in 2021 measured in relation to 2017 ^[25]
Metric tons of CO ₂ from energy in buildings owned in Trondheim				2588	None
Source separation rate Trondheim	24	33	37	47	>60
Source separation rate Oslo	42	42	37	29	>60
Mains water consumption in millions of litres				31	None

[25] In SINTEF's building operations by the end of 2021, measured in relation to 2017. The reduction is an estimate.

Travel

SINTEF seeks to reduce emissions of CO₂. The organisation is geographically dispersed, with clients and partners across Norway and the world. Some travel activity is necessary, to develop and maintain important relations, to cooperate and work efficiently together, and also to produce societally beneficial results. The table below summarises emissions from domestic and international air travels in SINTEF.

After some reduction in previous years, CO₂ emissions per FTE (full-time equivalent) from domestic air travel increased by no less than 42 per cent, and international air travel by 7 per cent, in 2019, according to measurements by our travel agency.

These figures surprised the management team, not least because the general perception has been that we have looked critically at our travel activity.

Also, a great deal of work has gone into establishing satisfactory video facilities and improving solutions for Skype, Teams and videoconferencing to make the services more user-friendly. The use of videoconferencing solutions increased during 2019, gradually but significantly, from 2,230 conference hours in January to a peak of 4,210 hours in October.

By comparing the increase in emissions from travel with travel costs, it is obvious that there was a real increase in the number of journeys from 2018 to 2019, but a significantly lower one than what the CO₂-emission data show. A comparison of travel expenses from 2018 to 2019 indicates an increase of 11 per cent for domestic air travel. If we also compare the number of kilometres travelled and the number of journeys completed in the data from the travel agency, the increase is more moderate, around 15 per cent. This means that there is some

uncertainty surrounding the emission figures and we will continue working on improving and verifying calculation methods. In any case, we believe it is urgent that we work even harder to ensure that the organisation knows the alternative options and is aware of the need to reduce travel activities.

Therefore, a decision has been made to ensure that all departments must keep regular discussions about their emissions history and the need for travel activity. The aim is to ensure that decisions about travelling are properly considered so that we all contribute to achieving the shared goal of reducing emissions. Based on our experience from 2019, we have decided not to set new targets for CO₂ emissions from travel before all departments have analysed their travel pattern more thoroughly. This will provide us with a better factual basis when setting a target for 2021.

Experience from the coronavirus crisis in spring 2020, shows that we have good capacity for interacting through digital solutions. The crisis may accelerate the transition to digital solutions with permanent effects. Together with internal and external data sharing, and regular discussions, we hope the opportunities and incentives for reducing emissions will be significantly improved.

Climate neutrality

SINTEF's activities will produce greenhouse gas emissions, including from travel activities, for the foreseeable future. Therefore, we have given some consideration to whether or not we should purchase climate quotas or implement other compensatory measures outside the organisation in order to help SINTEF become climate neutral. Companies such as Amazon, Microsoft, Starbucks, and Bosch have a goal of climate neutrality and they do this. However, in our opinion, the most effective contribution SINTEF could make to climate neutrality would be to invest the funds we would otherwise have spent on quotas in our research on major and time-critical climate improvements for which there is currently no functional market. Specifically, we believe that such a compensation scheme could fund research into technologies and solutions that will result in the net removal of greenhouse gases from the atmosphere. We want to develop a simple, operational model for calculating the impact of such research. Through this, we will hopefully be able to offer a corresponding opportunity to contribute to correcting this market failure, including to other companies, and thereby contribute to climate neutrality beyond our own activities.

	2016	2017	2018	2019
Kg CO ₂ per FTE from domestic air travel	446 ^[26]	444 ^[26]	427	607
Kg CO ₂ per FTE from international air travel	839 ^[26]	784 ^[26]	792	849
Total metric tons of CO ₂ from air travel	2342 ^[26]	2219 ^[26]	2244	2534

Source: SINTEF

[26] Our supplier of travel statistics changed its method for calculating emissions between 2018 and 2019, and the data are not directly comparable but do provide an indication of the trend.

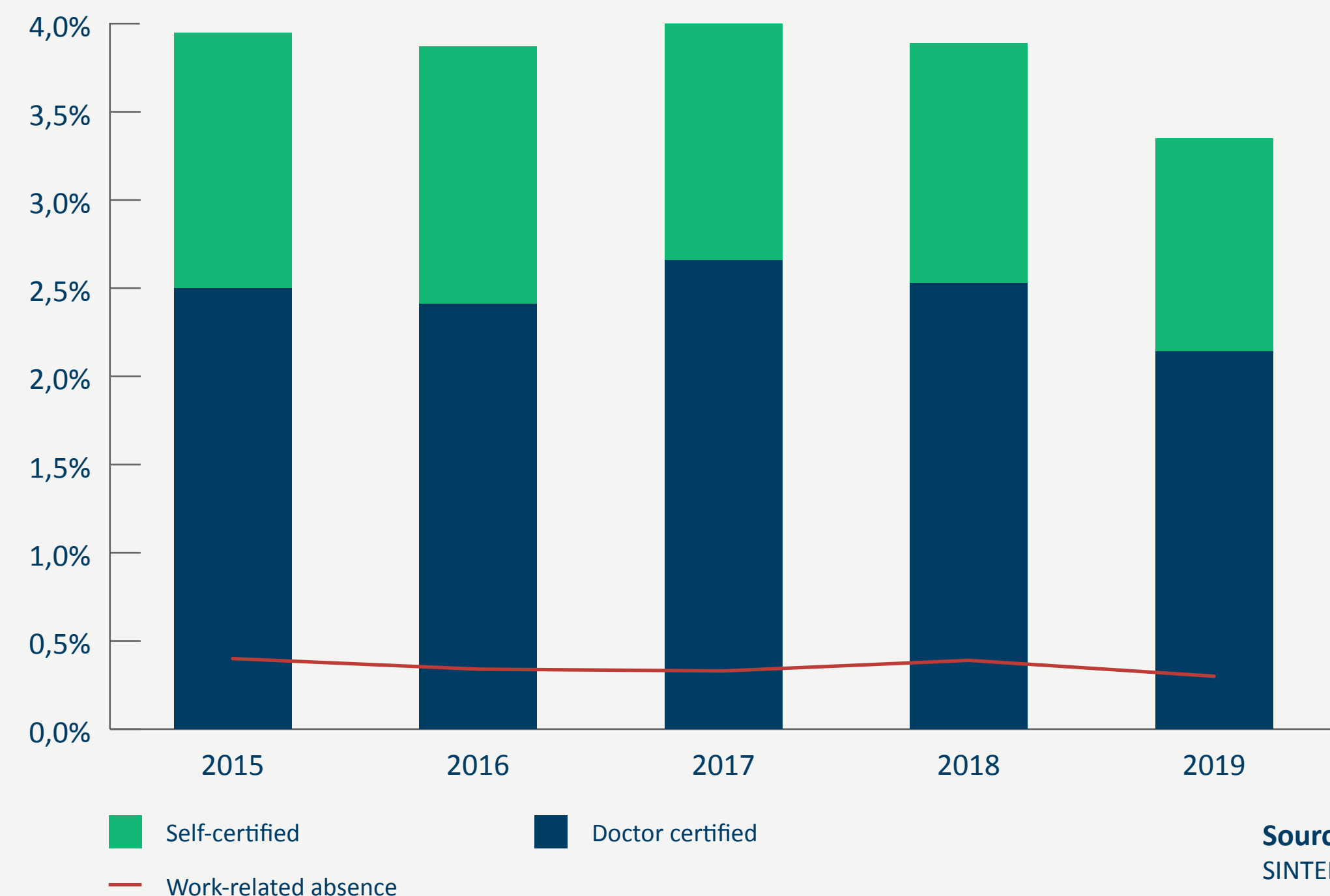
HSE is the top priority in SINTEF

HSE is the top priority in SINTEF. This means that we strive to ensure that the working environment is safe and promotes personal development, well-being, and good health. We take a systematic approach to addressing our employees' safety and working environment, and our HSE standard is consistent with our strategy, policy, and goals for the area of HSE.

In 2019, SINTEF's sick leave rate was 3.3 per cent.^[27] All sick leave is followed up by the institutes. This is particularly true for absences due to occupational illnesses, which in 2019 was 0.3 per cent. The follow-up involves close contact with the person on sick leave, in order to provide optimal condition for a good recovery and timely return to the workplace. SINTEF has a target of zero personnel injuries and constantly and systematically works to put in place preventive measures to achieve this. A total of 35 personnel injuries were registered in 2019. This represents an increase of 24 compared with 2018. Of the injuries in 2019, 12 required medical treatment

and 23 were registered as requiring first aid. Five of the injuries resulted in sick leave. Several of the incidents were connected to the use of chemicals. An assessment of the HSE incidents shows that prioritising the work on handling chemicals and checking equipment is important. Today, the institutes carry out local training to protect the employees' safety in laboratories and workshops, and the corporate health service carries out regular, targeted health dialogues with employees whose work could potentially result in hazardous exposure. Despite this, the institutes believe that there should be a greater focus on training and understanding the possible risks associated with the work being done, and we are now working systematically to improve this. In 2019, an internal survey was conducted on the life cycles of chemicals in the organisation. The survey included around 540 employees. These were project owners, project managers, project workers, laboratory managers, room managers and chemicals managers. The response rate was 84 per cent.

Sick leave



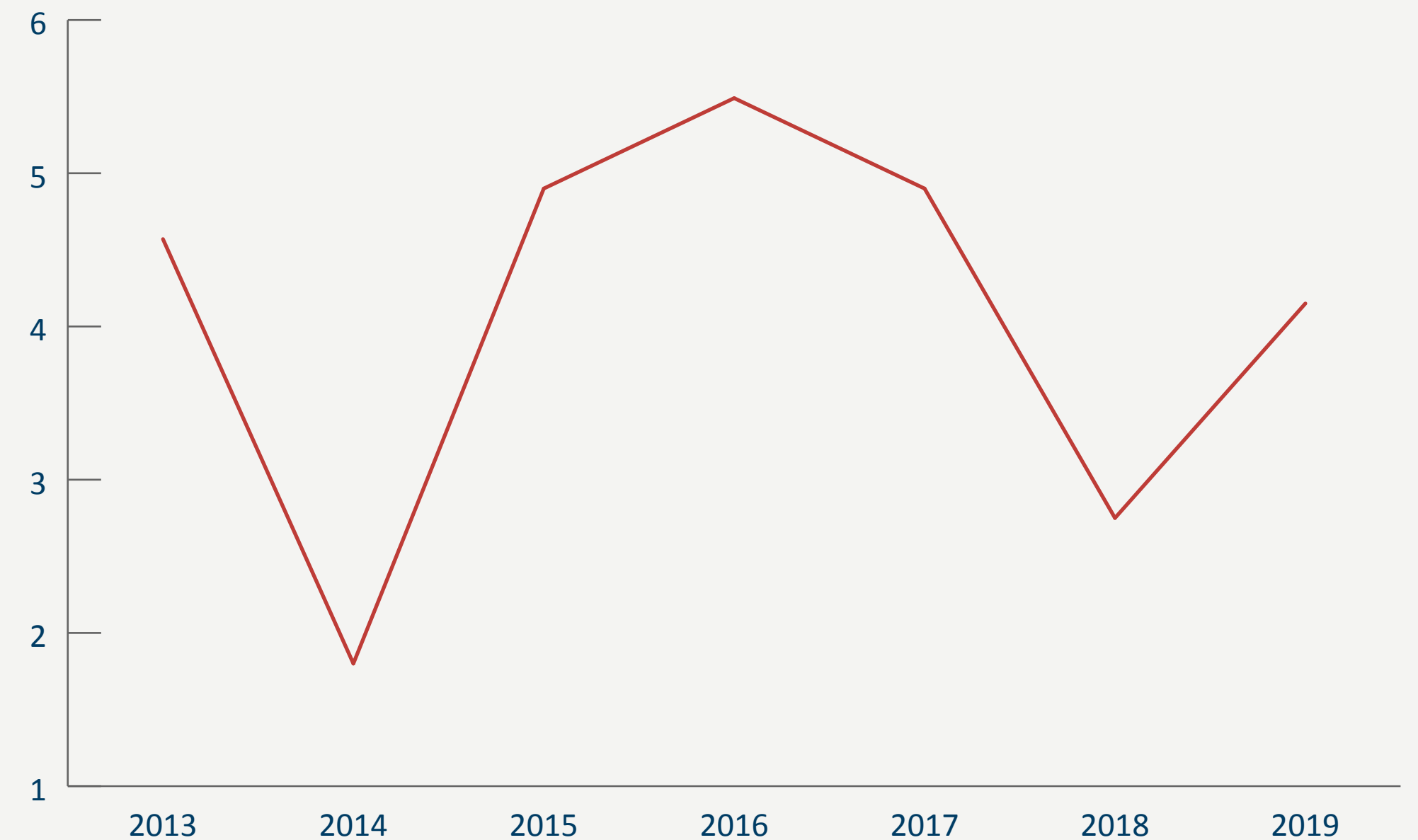
[27] New calculation method from 2019 based on guidelines from Statistics Norway.

In short, the survey showed that respondents generally think we have good routines for handling chemicals. It also showed that we must do more work on training, and using risk assessment methods in projects to ensure better support in the handling of chemicals. The survey provided input for improvement work that will form the basis for new priority areas in 2020.

All registered HSE incidents are reported to the group management team on a weekly basis. Of the around 600 HSE reports in 2019, 50 were accidents and 58 were near accidents, which represent a small increase compared with 2018. There was a small reduction in the number of hazardous situations reported, from 29 per 100 FTEs in 2018 to 27 per 100 FTEs in 2019. Even though this is not a statistically significant change, the reduction has inspired further measures for increasing the number of reported hazardous situations/

observations. These are important to reduce accidents. We believe that sharing experiences and cooperation are important for increasing the safety of SINTEF's employees and partners. We produce 'HSE one pagers' to encourage learning after incidents, near accidents and reported hazardous situations. These contain a brief description of the causes and provide learning points. The HSE one pagers are shared in the organisation and used in many contexts, such as management meetings, department meetings, working environment committee meetings and external meetings. SINTEF shares many premises with NTNU and good cooperation and coordination on safety is a necessity. We are working to improve coordination, especially with a focus on sharing experiences from incidents. In 2019, a new coordination agreement template was agreed. This simplifies follow-up and clarifies the requirements for the cooperation.

Total recordable injuries frequency (TRIF value)



Total recordable injuries frequency (TRIF value) = the sum of the number of injuries resulting in absences and other personal injuries (excluding injuries requiring first aid) per million hours worked

Source
SINTEF

SINTEF's employees – human rights, labour rights, gender equality and diversity

SINTEF is an attractive place to work. In the Career Barometer's survey of the workplaces students find attractive, SINTEF came first in the ranking by 4,600 respondents in 2019.^[28] In the 2020 Universum ranking of attractive workplaces, SINTEF was ranked number six by Norwegian university and university college students within technical and natural sciences.^[29] However, recruitment of the most talented people in a number of fields is demanding and, for example, we are not satisfied with being in 30th place among the ICT students in Universum.

Diversity and a good gender balance are essential for delivering on major societal challenges. This is because diverse experiences, approaches and perspectives are required to succeed as a research institute. SINTEF's strategy for people states that diversity and a good gender balance are important, and that we will achieve these through seeking

for diversity in scientific expertise, gender, age, nationality, cultural background, and personal characteristics. The diversity work is anchored in SINTEF's Board and the group management team. SINTEF's managers are responsible for building, developing, and using the resources that diversity and gender balance represent within their areas. Managers are also given responsibility for allocating pay, development opportunities and other benefits in a manner that ensures equality between men and women. Diversity leadership is an important theme in the SINTEF Academy's management development programme. The strategy for people also states that all employees are expected to contribute to diversity by complying with SINTEF's core values, honesty, generosity, courage and solidarity, by contributing what they have to offer and appreciating the particular contributions and competencies of others.

International employees provide SINTEF with access to valuable scientific and cultural competence. Some 26 per cent of all of SINTEF's employees in 2019 came from countries other than Norway. Together, these people were from 74 different countries, with the largest groups from Germany and France. This shows that SINTEF is an attractive place to work for international researchers, and that we are contributing to recruiting highly qualified labour to Norway.

SINTEF has established an integration programme for foreign employees and their families to ensure foreign employees are followed up in a proper manner. The programme offers expat services, free Norwegian language courses and teaching in English in the SINTEF Academy. The working environment survey has documented that foreign employees enjoy working at SINTEF.

Diversity based on country of birth

	2016	2017	2018	2019
No. of countries excl. Norway	74	75	72	74
Proportion of foreign employees	22 %	23 %	24 %	26 %
No. of foreign employees	432	436	469	518

Source: SINTEF

[28] KarriereStart.no, "Dette er de mest attraktive arbeidsgiverne blant ingeniør- og teknologistudentene." 20.05.2020. <https://karrierestart.no/karrierebarometeret/2660-karrierebarometeret-2020-mest-attraktive-arbeidsgivere-blant-ingeniorstudenter>

[29] Universum, "Norway." Retrieved 25.06.2020. <https://universumglobal.com/rankings/norway/>

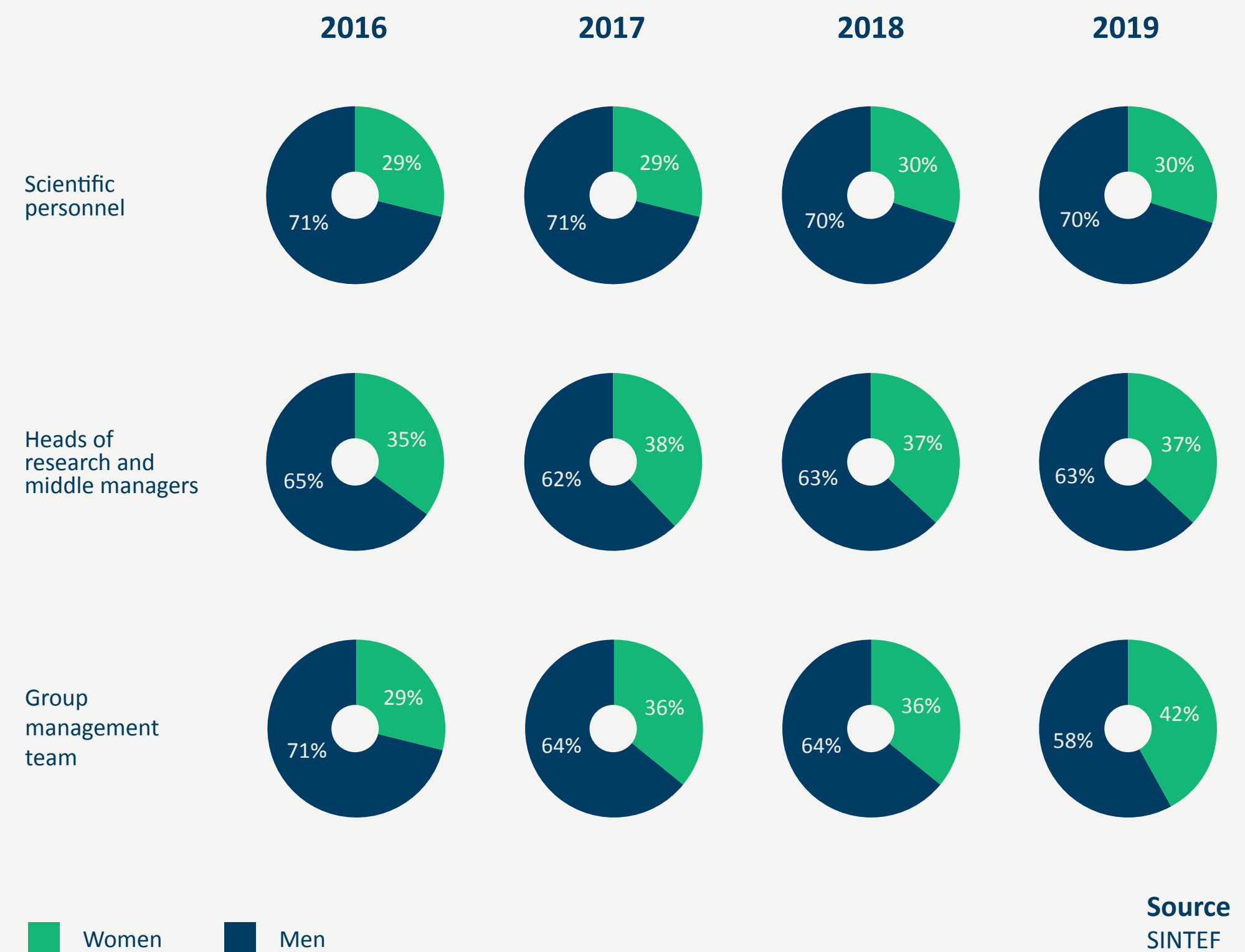
SINTEF's CEO is a woman and of the six institute heads, three are women and three are men. Despite this, structural disparities in SINTEF mirror those also found in the recruitment base from the educational institutions. Our goal is to increase the proportion of women among our researchers and managers. Therefore, we attach great importance to recruiting women when hiring, and developing female managers from our own ranks.

Because of the high degree of diversity, we are aware that our employees have different needs. SINTEF therefore facilitates flexible solutions to meet the needs of individuals. Wherever possible, we make adaptations for employees who develop or have disabilities, and during recruitment we focus on skills, and not on limitations due to a disability. Another important area requiring facilitation is employees with children. In practice, all employees

have flexible working hours, with core hours between 09:00-15:00 when one is expected to be present, and flex time periods between 07:00-09:00 and 15:00-17:00. This is practised liberally, and most employees are able to make use of flex time within core hours as well. Employees who have been on parental leave for more than three months in the last year, receive an average pay rise. This may only be deviated from with reasonable cause, which cannot be the parental leave.

SINTEF has a good, well-regulated relationship with the trade unions, and full freedom of association is practised. A trade union representative attends all courses for new SINTEF employees, both Norwegian and foreign employees. The representative informs them about the work of the trade union, what it is and why it is important. Around 70 per cent of SINTEF's employees are members of a trade union.

Gender distribution – scientific personnel and managers



We also want to offer employees benefits, relevant across different life situations. SINTEF has a modern hybrid pension scheme with a maximum rate for contributions. An extra contribution is paid for women due to their higher life expectancy. Our insurance schemes are also very good. We emphasise having coverage that is as similar as possible at work and in leisure time, and we only have exceptions where legislative restrictions exist. If employees become ill or are taking parental leave, SINTEF covers the difference between the amount paid by the public (up to a maximum of six times the national insurance basic amount (G)), and the full salary of the employee.

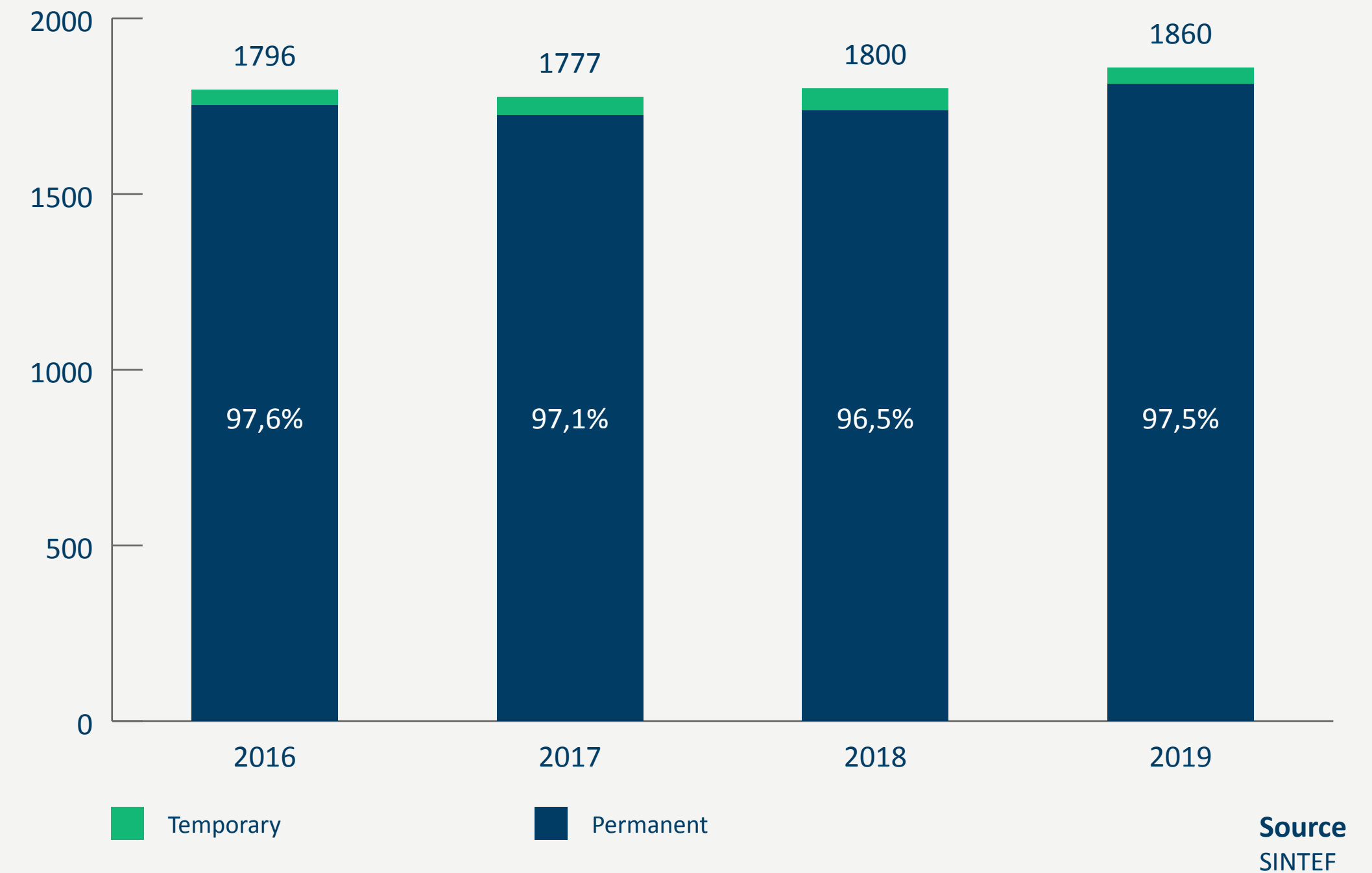
According to SINTEF's code of conduct, we need to work to achieve a good working environment characterised by equality and opportunities. SINTEF's working environment surveys are a good

indicator of whether we are achieving this goal. The response rate to working environment surveys is usually very high, and in January 2020 it was 94 per cent. We want SINTEF to be an attractive place to work, with unique development opportunities, and the working environment survey indicates so. This is a consequence of the fact that we have done good work on developing SINTEF's working environment over time.

SINTEF has contributed funds to the annual TV fundraising campaign since 2007, and in 2019 the employees' Christmas present went to the Church City Mission.

We employed around 2,000 people (1,860 full-time equivalents (FTEs)) at the end of 2019. Some 59 per cent of SINTEF's researchers hold a PhD.

FTEs per December



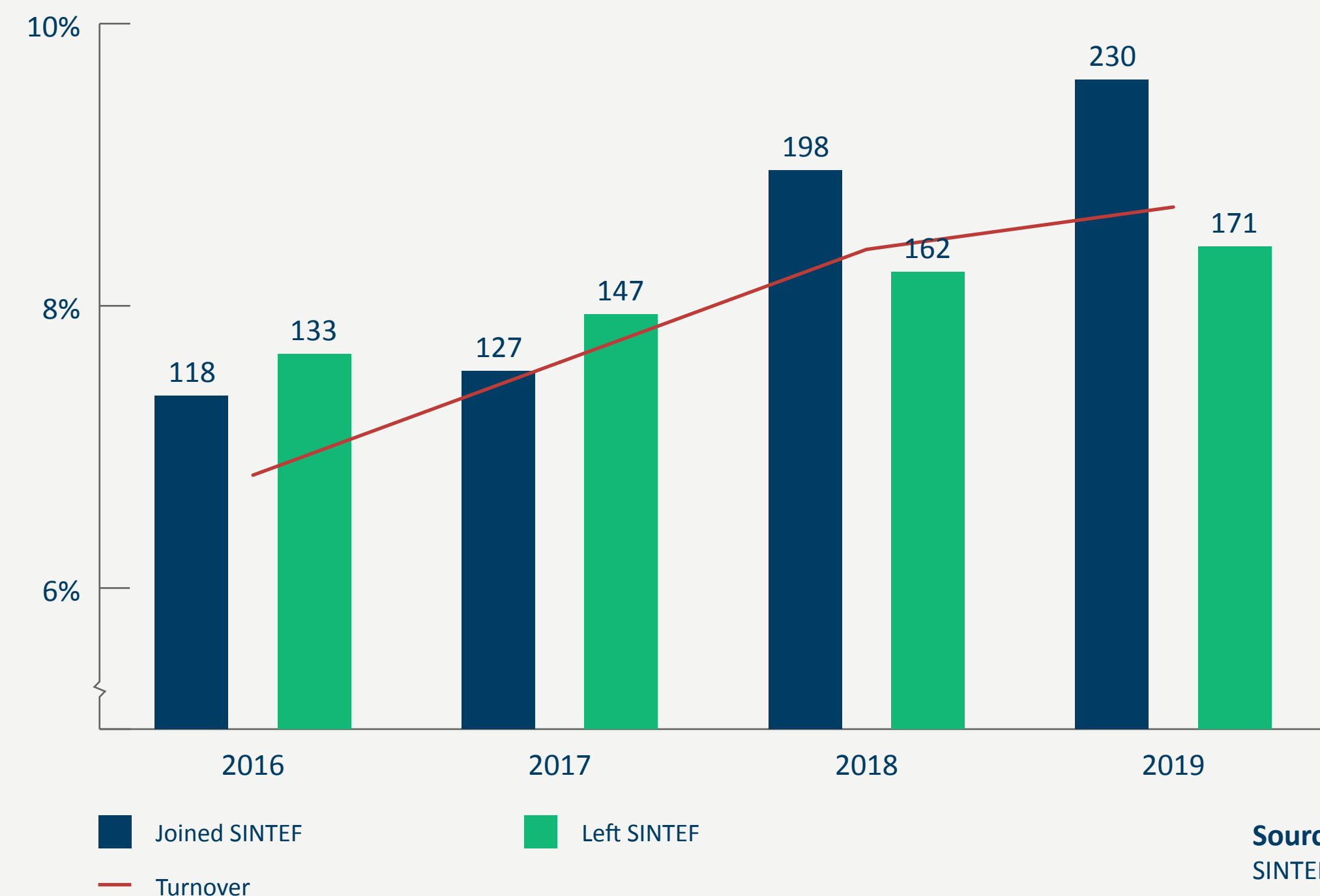
Most jobs in SINTEF are permanent positions. To the extent that temporary positions are used in SINTEF, this is done in specific cases, such as temporary posts and to bring in particular expertise in individual projects. In 2019, 2.5 per cent of the workforce were temporary employees. We believe that offering permanent positions makes us an attractive employer and partner.

Both attracting and retaining the right expertise are crucial to SINTEF's success. Over the last four years, there has been an increase in new recruitment, and we are experiencing a good supply of qualified applicants within most fields. At the same time, we view it as positive, and part of our societal mission, that, through their work, employees of SINTEF are developing insights and skills that

represent attractive competencies for business and other organisations, and thereby contributing to strengthening their capacity for innovation.

The SINTEF Academy is a strategically important tool for developing employees and the organisation. Our overarching goal is to provide employees and managers with the knowledge they need to be successful in their work and for SINTEF to achieve its strategic goals. In 2019, 1,445 course days were completed in SINTEF, 400 of which were for new employees' participation in the three-day 'Welcome to SINTEF' course. Our digital academy made an important new addition to competence building with introductory and detailed training within machine learning and optimisation.

Employees and turnover



Ethics, anti-corruption and good governance are prerequisites for our activities

Ethics constitute an integral part of SINTEF's strategy and apply to all employees. The group management team frequently discusses ethical dilemmas relating to our business and organisation.

SINTEF has a clear ethical platform, which is also set out in our ethical compass.

Ethics training was provided in four different courses run by the SINTEF Academy in 2019. Six project manager courses and one course in research methodology and social responsibility were completed with a special module on ethics. A special course module on ethics and management has been produced for each of the management training courses: 'The Manager Platform' and 'Good Management in SINTEF', with an emphasis on the ethical responsibilities of managers and training through ethics exercises. A total of three management courses including ethics training were carried out in 2019. Work on a plan for an e-learning ethics module also started in 2019. This will be completed in 2020. Four training modules in ethics, which form part of the SINTEF Academy, have been continued: (1) 'Course on Research Methodology', (2) 'New

Project Manager course', (3) ethics module for 'The Manager Platform', and (4) ethics module in 'Good Management in SINTEF'.

Our research ethics are based on the guidelines from national research ethics committees, the principles promoted by the European Group of Ethics in Science and New Technologies, as well as international conventions and Norwegian law. Our business ethics, relationship ethics and research ethics are well aligned with SINTEF's vision, values, goals, and societal mission.

The ethics ombudsman in SINTEF also received several questions about ethics from employees in 2019. These were largely about research ethics, including publication rules, project manager responsibilities and describing ethics in EU proposals. The ethics ombudsman took part in a range of departmental meetings, management meetings and meetings of the group management team in which the topic of ethics was discussed in 2019.

A new routine for in-house whistleblowing was drawn up in SINTEF in 2019, in compliance with

the amended Norwegian Working Environment Act (1 January 2020). The routine states that SINTEF puts great importance in ensuring a good climate for freedom of expression in the organisation where employees are encouraged to report wrongdoing. The routine describes what is meant by wrongdoing, the content of the whistleblowing procedure, the administrative procedures in whistleblowing cases, as well as the protection of whistleblowers and follow-up of whistleblowing cases. Two whistleblowing cases were reported in 2019 and were considered by a whistleblowing committee established in line with the new routine for whistleblowing. It concluded in favour of the whistleblower in one case. In the other case, the report was considered to be without merit.

Transparency, audits, and internal audits continue to be considered important. SINTEF conducts advance checks of foreign companies through the RDC due diligence database to obtain information about whether a company has previously been found guilty of corruption or other irregularities such as bribery, price fixing or child labour. Such checks must be carried out before project work or partnerships

are commenced with foreign companies so that a careful assessment can be made of whether SINTEF should collaborate with the given company. SINTEF makes use of Transparency International's corruption index database and the associated social analysis for each country. SINTEF's third important source is information from the Norwegian Ministry of Foreign Affairs. SINTEF is a member of Transparency international, follows their annual corruption conferences and receives information about corruption and ongoing anti-corruption work.

SINTEF's management system includes a requirement regarding the proper management of ethics and social responsibility, and this is reflected in our code of conduct and in the 15 overarching policy documents. One important management policy in this context is SINTEF's policy on defence-related research and development, which provides principles for performing research activities for military purposes and describes our attitudes and ethics principles related to the dilemmas that arise within these types of research activities.

5

Lessons learned from our first sustainability report and strategic questions for the future

Given SINTEF's many roles in society, the work on sustainability reporting is demanding and complex. We are working on identifying good indicators and descriptions for our approach. Not least, we are looking at the need to use the data to strengthen our actual contributions to sustainable development. This chapter looks beyond the reporting to the strategic measures that we want to take to strengthen SINTEF's total contribution to society.

One concrete area with potential for improvement is the relatively new marking of projects in relation to the SDGs. Following our initial effort, we can see that we should have allowed projects to be tagged with multiple goals. We will change this in our future reporting. The SDGs are not achieved

separately. It will only be when all the goals have been achieved that the sustainability agenda will have successfully been addressed.

Some tensions also exist between the goals. Should all the SDGs be assigned equal value or are some more important than others? For example, climate change may be perceived as more fundamental than economic progress. At the same time, many people believe that combatting poverty will require the use of fossil energy sources. SINTEF takes a knowledge-based approach to such questions, at the same time as we have committed ourselves to contribute to the achievement of all the goals. Our hope is that when SINTEF, as a wide-ranging research and innovation institute, works on the breadth of societal challenges, the tensions between the goals will challenge us to think in

radical new ways and thereby create solutions that achieve several of the goals at the same time.

We are working on how we can use our project SDG mapping as active management information and a basis for prioritising future focus areas. Among other things, we are discussing whether contributions to sustainability should be a formal criterion for the use of the basic grant and for investments, in line with our vision. We want to encourage our own researchers and partners to let project ideas erupt directly from the major societal challenges SINTEF is meant to help solving.

We also acknowledge that the mapping indicates how much clients, the authorities and SINTEF invest in each SDG through our research and innovation projects. This is and will be rather superficial

information. The work on this report has clarified the need to continue working on measuring the impact of research. This is difficult because the effects do not only occur at our clients, but also far out in value chains and at end-users. Some examples of concrete individual projects in SINTEF whose effects have been evaluated/estimated/quantified in relation to sustainable development, are described in detail in this report.^[30] Nevertheless, we see that we still ought to develop methods that allow us to be clearer about the aggregated effects of our activities. In this context, climate effects and value creation are two key areas. Further quantification of our reporting is a clear ambition for subsequent sustainability reports.

[30] As far as energy research is concerned, there is an impact report from 2018 in which, among others, the effects of SHOP, referred to as an example case in the report under goal 8 (page 24), are assessed. Impello Management AS, "Effekter av energiforskningen". 28.12.2018. <https://impello.no/en/referanse/forskningsradet/>

One new and exciting field of research we are developing in SINTEF assesses the impact of new technologies and solutions on sustainability. This is expertise that we will offer to our clients and that we will also use in our own projects to estimate the effects of technological development pathways we are working on.

SINTEF wants to motivate researchers and decision makers in the public and private sectors to take into account their influence on the SDGs and assist with analysing this. Based on this, we started developing “systematic assessments of sustainability impacts” at SINTEF in 2019/2020 to assess the impact technology has on society in relation to the SDGs

and indicators. The idea is then to develop a platform for assessing the societal impact of new technologies and structural changes based on the UN's indicators for sustainable development. This system could be used by clients who want to analyse the impact they are having on society, or internally in SINTEF to estimate the effects of our research. We want to develop new methods and combine existing modelling tools and different data sources and data for sustainability analysis. This is especially important since SINTEF is involved in the development of technologies and products from an early stage where there is still room for making decisions and different approaches are assessed.

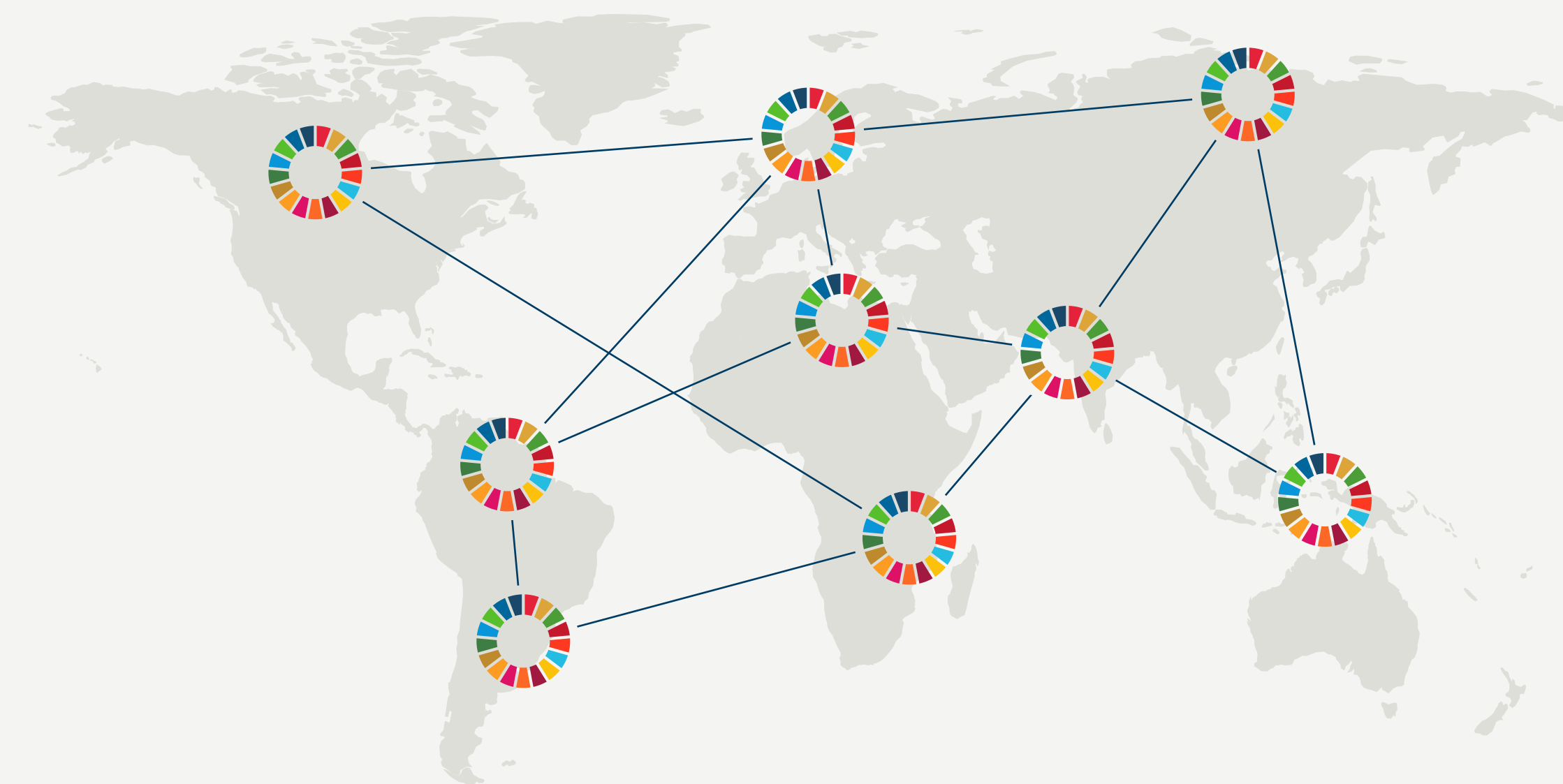


Illustration of how technology and product development and implementation impact global value chains and have effects in relation to the SDGs around the world.

The work on the sustainability report has also shown us the general limitations of the SDGs. The goals have been set for 2030 but many of the themes require measures and solutions with a significantly longer horizon. This is true, not least, in relation to climate issues, where it is the need for changes by 2050 that in reality provide the most inspiring and important information.

We can also see that the applicability of the SDGs is not always good fit in relation to Norwegian issues. The specific targets may address challenges that we no longer face in Norway. This is why we interpret the main goals more broadly. For example, in Norway we have to work to promote good health and well-being beyond the minimum agenda the global community has agreed for the SDGs, and we are working together with partners on solutions that promote the life situations of boys, and not just girls, when, for example, one gender is underrepresented in the use of healthcare.

The balance between the North and the South is another challenge. Many of the goals deal with how we should contribute to sustainable development in countries in the South and enhance capacity building for this. While we also have projects in SINTEF that contribute to development in the South (see the description and examples under the sections on the goal of good health and well-being and 'other SDGs'), we think that the capacity building, partnerships and funding for such work should be on the agenda of Norway and the EU. World leading solutions that help all countries, require collaborations between business, governments and research actors in well-developed countries, cf. goal 17) Partnerships for the Goals.

We must also strive for a balanced development with skills enhancement and capacity building in all sectors and regions in Norway.



Sources:

- References to external resources are provided in footnotes/graphs.
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