SINTEF supports the Sustainable Development Goals

Sustainability Report

SINTEF

Technology for a better society

September 2021

Letter from the CEO

Alexandra Bech Gjørv
President and CEO

2020 was a difficult year. The Covid-19 crisis highlighted vulnerabilities and global relationships that gave us new insights into the importance of successfully solving the challenges that lie behind the UN Sustainable Development Goals (SDGs).

SINTEF contributed to the emergency crisis response in several areas, including by supporting the US SLAC National Accelerator Laboratory with advanced sensors that helped us understand the structure of the virus. Research environments other than SINTEF have of course been on the frontline of this battle.

As an independent research institute, SINTEF has had two main priorities during the Covid-19 crisis: working to ensure that Norwegian society and business sustain the pace of change towards a more sustainable society, while systematically working to safeguard SINTEF's employees and our activities during these uncertain times. Hard work, good customer engagement and cooperation with the authorities and public support system have resulted in us successfully maintaining activities in 2020 and thus SINTEF's contributions to competitiveness and societal solutions. Our staff report high levels of motivation and team spirit, that we have got better at producing the best results together, and that even more of them feel their work is contributing to sustainable development. Such a capacity and willingness to change – in society and in SINTEF, will be crucial in the future.

Because when we look into the future, we can see the Covid-19 crisis persisting and, not least, that even greater crises lie ahead of us. We paid particular attention to the climate crisis in SINTEF's first sustainability report, which we published in autumn 2020. At that time we especially focused on our recent analysis of sustainability in our work with the oil and gas sector. The conclusion concerning this work was that we could vouch for our portfolio of assignments for this sector, but also that SINTEF should go even further in being a driving force behind the green transition.

In line with this, SINTEF has continued working on important climate initiatives. We have done this partly by responding strongly to the EU's Green Deal call and the Norwegian Green Platform. In addition, we have started and funded our own initiatives aimed at developing new climate-positive solutions, which will be required if the world is to achieve its climate goals. We have worked on the guidelines being issued through the EU's taxonomy, which means that business and society will have to take even greater account of climate, environmental and social conditions.

In our annual 'external analysis' in which we review the most important drivers behind research needs, we have now focused more intensely on the fact that the loss of biodiversity is a crisis with the potential to threaten the stability and sustainability of our society. In line with the global trend, we want to strengthen our efforts to promote comprehensive and integrated nature-based solutions in our projects and activities and prepare the ground for a strategic research-based approach to this. With ambitions in this area, it is satisfying that in an updated mapping of our project portfolio, we can see that more of our projects have now been tagged as also contributing to goal 15) Life on Land than before.

The response – both internal and external – to our commitment to the SDGs and the sustainability report we published last year was positive. We have found that the sustainability agenda expands the dialogue with customers and authorities to include new issues and opportunities. This is rewarding, and binding, including when we can see that we have to continue strengthening the work internally with respect to both reporting quality and integrating sustainability into everything we do.

Our long-standing vision, "Technology for a better society", continues to be an inspirational guiding star in our work.

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All figures in the report are from 2020, unless otherwise stated

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About SINTEF

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

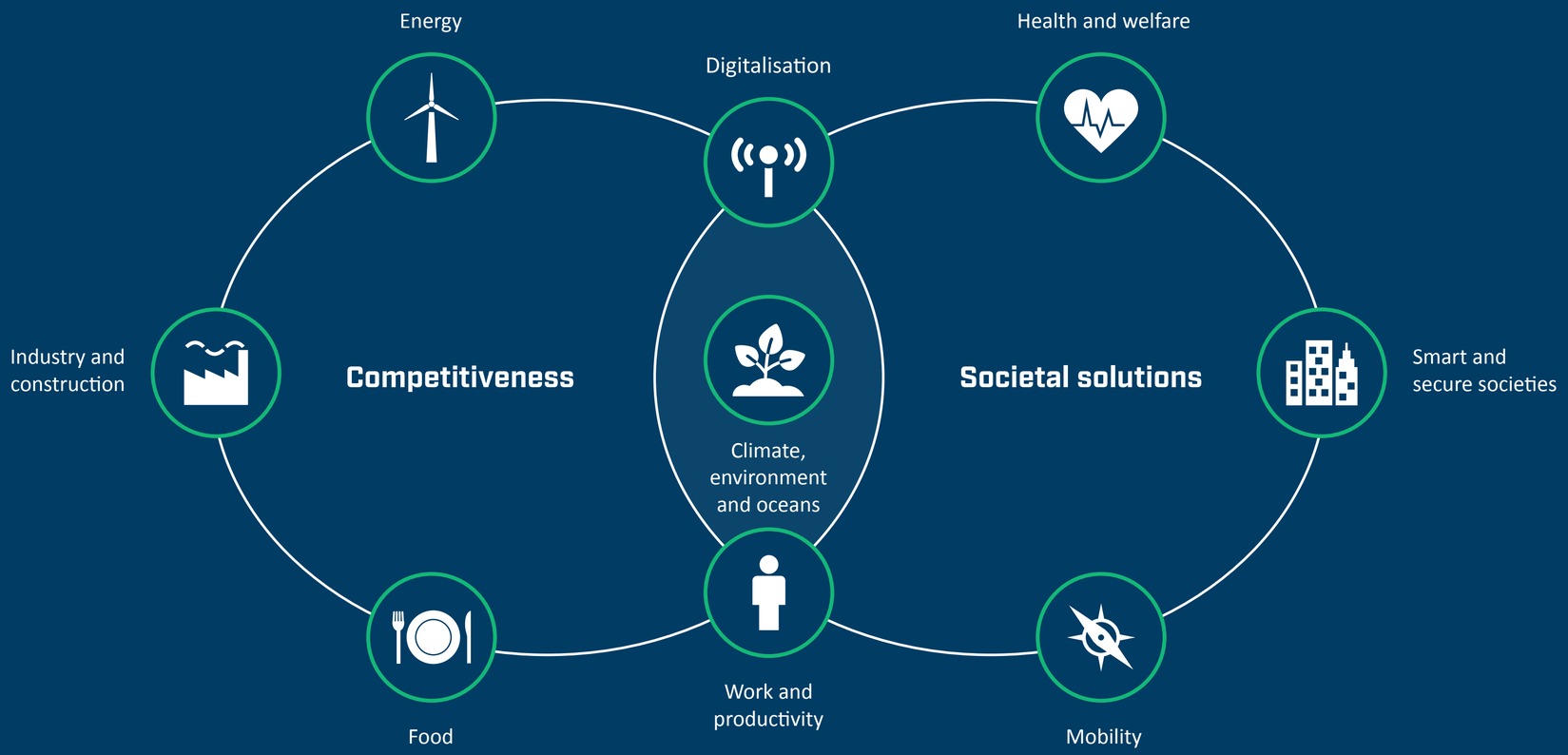
Our laboratories are closely involved in the research and, in addition, assist clients with their innovation and development work through test, prototype and verification projects.

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.

Cutting edge expertise from ocean space to outer space



Our general reputation in society testifies to the fact that we play a number of wide-ranging roles, not least within sustainability. SINTEF scores highly in national reputation surveys and the majority of respondents have a positive impression of SINTEF. We score the highest in environmental awareness, social responsibility and morality in various areas. SINTEF saw a strong improvement in its reputation in 2020 in the IPSOS profile survey of major Norwegian companies. The survey showed that a greater proportion now have a positive impression of us (62 per cent versus 53 per cent in 2019) and that the proportion that has not heard of SINTEF has fallen sharply. [1] A national profile survey conducted by Norfakta confirms widespread familiarity with SINTEF (82 per cent) and that SINTEF is perceived to be credible, an expert in our fields, and important for the development of sustainable solutions and for creating competitiveness for industry and business. [2] Our staff also believe that the work the organisation does is of societal significance.[3]

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

> *"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."[4]*

Jan Christian Vestre
CEO of the furniture company Vestre

> *"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."[5]*

Anne Borg
Rector NTNU

> *"Everything is now in place for SINTEF to take a leading role in Norwegian society as we continue the green transition."[6]*

Iselin Nybø
Norwegian Minister of Trade and Industry

[1] IPSOS profile survey, 2020.
[2] SINTEF/Norfakta brand tracker: Public knowledge and attitudes concerning SINTEF – 2020.
[3] Working environment survey in SINTEF, January 2021.
[4] Jan Christian Vestre at SINTEF's management seminar, 3 June 2020. [Translated from Norwegian]
[5] Anne Borg at SINTEF's management seminar, 3 June 2020. [Translated from Norwegian]
[6] Iselin Nybø at SINTEF's management seminar, 3 June 2020. [Translated from Norwegian]

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

2,000
employees

75
nationalities

3,400
clients

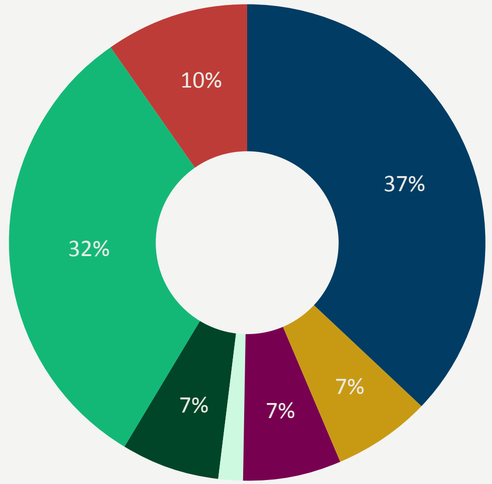
client satisfaction:

More than
8,000
items in
the media

With a total of **EUR 173 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 the business sector

Portfolio
funding 2020
3,4 BNOK



- Norwegian business sector
- International income
- Norwegian public sector
- Other sources of income
- Project income EU
- RCN project income
- RCN basic grant, incl. extraordinary 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 expands the obligations we have had as a member of the UN Global Compact since 2009. The 17 SDGs set out what we and the world have to achieve in the work on creating a better society.

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

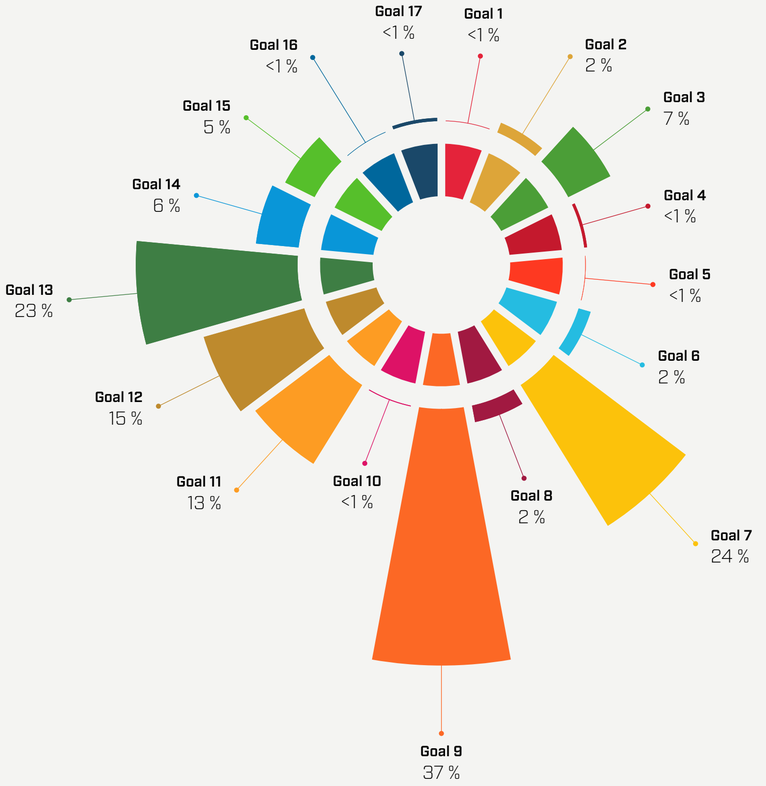
Many companies set clear priorities regarding which SDGs they particularly want to deliver on – often based on strategic considerations or on an assessment of where they can have the greatest societal impact.[7] As a research institute, SINTEF is involved in many value chains, industries and areas of 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 substantially more on some goals than others.

An analytical approach confirms this. The figure on the right shows an analysis of the research projects' relevance to the various SDGs, measured in terms of turnover in 2020.[8] We are systematically working to improve methodological weaknesses but believe that the figure provides a good visualisation of SINTEF's profile. It shows that in 2020 we carried out significant activities in relation to eight SDGs in particular, listed by the share of our turnover associated with each SDG in the project portfolio:

- Goal 9) Industry, Innovation, and Infrastructure
- Goal 7) Affordable and Clean Energy
- Goal 13) Climate Action
- Goal 12) Responsible Consumption and Production
- Goal 11) Sustainable Cities and Communities
- Goal 3) Good Health and Well-being
- Goal 14) Life Below Water
- Goal 15) Life on Land

We also have activities related to the other SDGs, but some are marginal, especially in relation to goal 5) Gender Equality and goal 16) Peace, Justice and Strong Institutions.

Gross turnover per Sustainable Development Goal



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

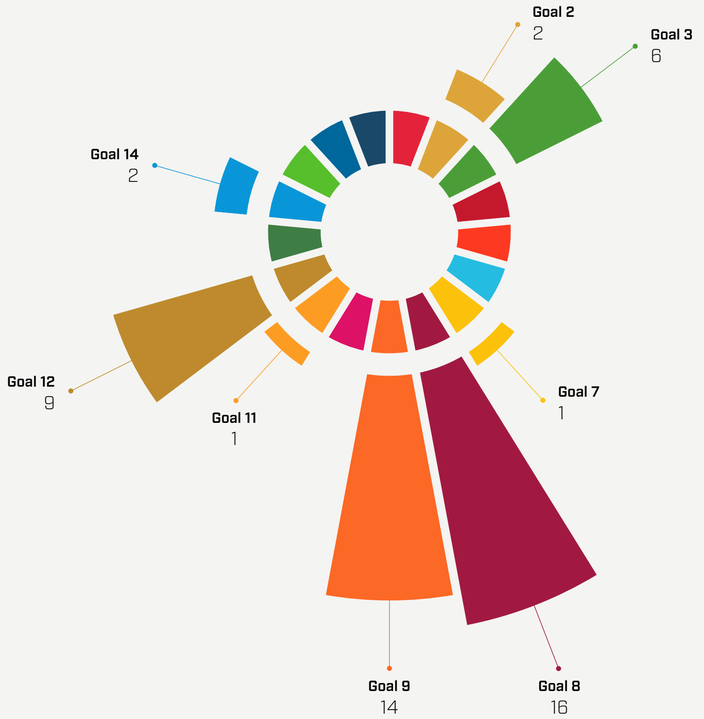
Source
SINTEF

[7] 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

[8] The model shows the share of gross turnover for research projects in SINTEF's six institutes in 2020 that contribute to the various SDGs, with up to three SDGs tagged per project. "Other/Outside" and the untagged portfolio (representing a total of around 9 per cent of the turnover) are not included in the model.

SINTEF's current portfolio of 17 research-based start-ups have also been evaluated in relation to the 17 SDGs. Most have been tagged with 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, 14) Life Below Water, and 2) Zero Hunger.

Start-ups per Sustainable Development Goal



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

Source
SINTEF

The process of continuously mapping the project profile is primarily a bottom-up one, where the quality depends on awareness, effort, and competence in SINTEF's research environments.

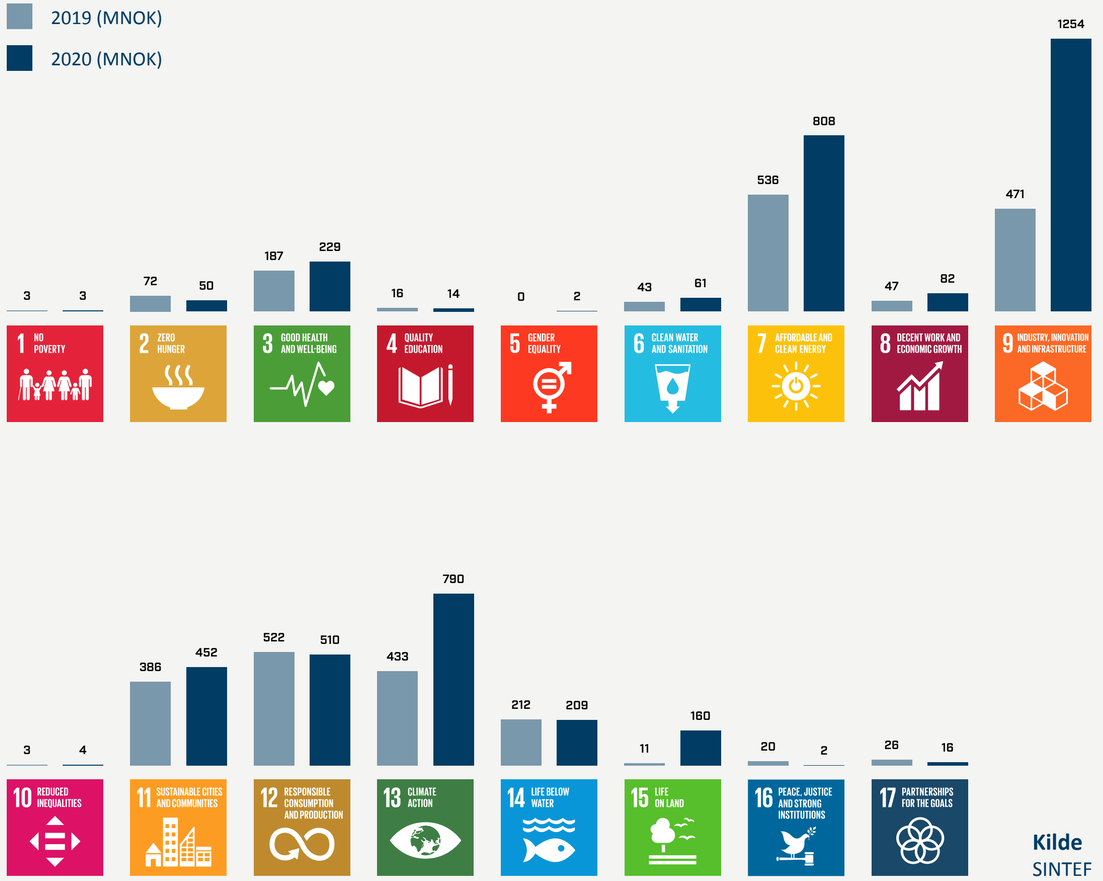
This year's report shows the results of the initial re-organisation of our mapping of the project portfolio. In last year's report we demonstrated the results by tagging each project with only one SDG. However, we saw that this method provided too little information about the interplay and dilemmas associated with the efforts to achieve all of the goals and a poorer basis for strategic decision-making than we had hoped. Since many of the solutions we develop both will and should contribute to achieving multiple SDGs at the same time, we have from this year onwards allowed our projects to be tagged with up to three SDGs per project.

One disadvantage of this new method is that the sum of the project volume tagged exceeds SINTEF's turnover. However, given the reasons described above, we believe that the strategic value of a more complete footprint outweighs this disadvantage.

The results of the re-mapping are, therefore, partly illustrated by the fact that the profile is larger than the previous version and partly through some redistribution, especially via a greater role for goals 9) Industry, Innovation, and Infrastructure; 7) Affordable and Clean Energy; 13) Climate Action; and 15) Life on Land, than we could report last year. The new tagging scheme shows that goal 12) Responsible Consumption and Production assumes a relatively smaller role in SINTEF's portfolio, even though the project volume in terms of NOK was stable.

At the same time, we must be open about the fact that the extent to which the various research environments have had the capacity to expand their tagging from one to up to three SGDs per project varies significantly. Through long-term work on raising awareness and improving skills in relation to the sustainability agenda, and the projects' links to this, we hope to encourage further efforts and form a steadily more complete picture of SINTEF's contributions to society across all of our research areas.

Gross turnover per Sustainable Development Goal 2019-2020



Kilde
SINTEF

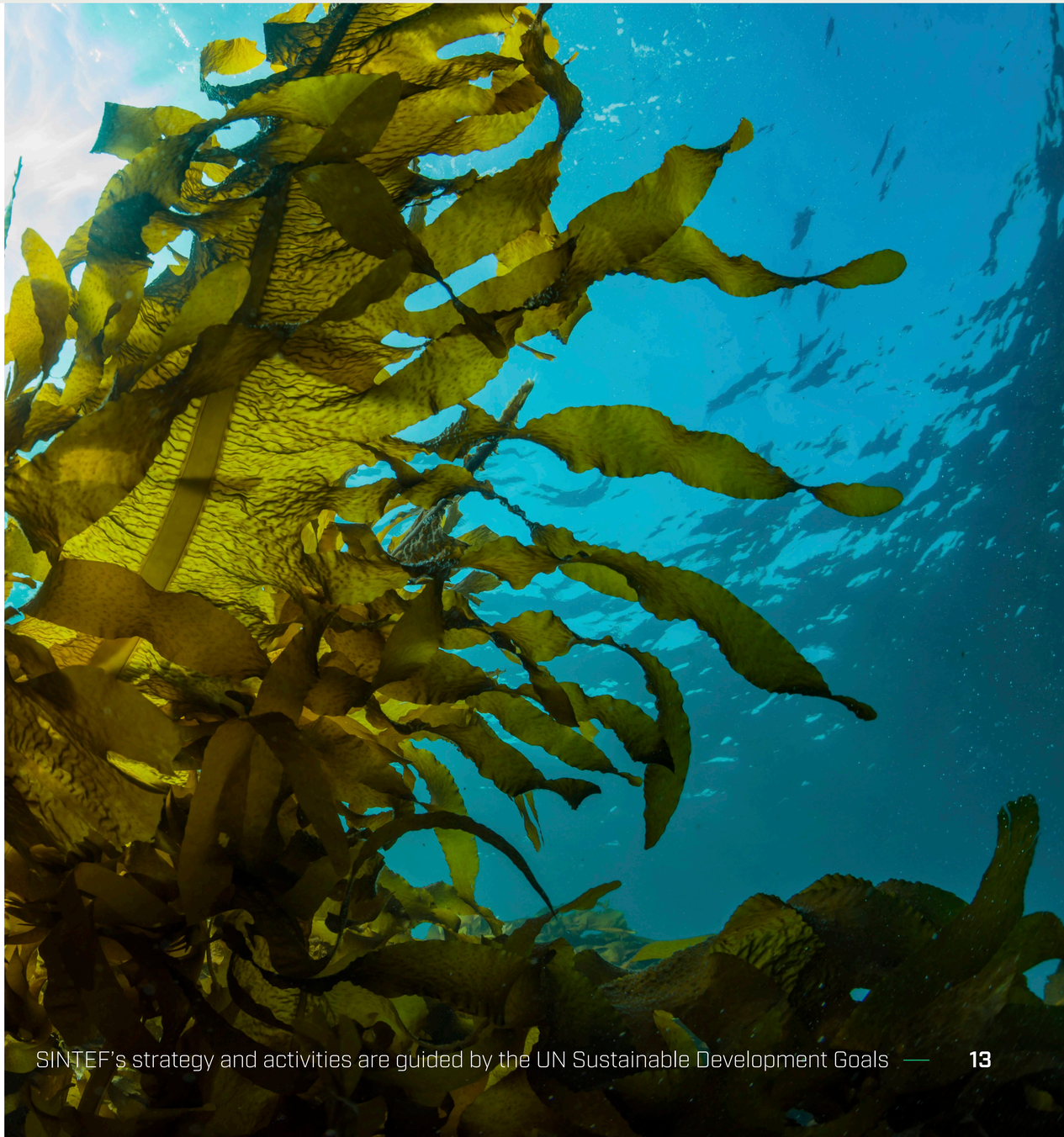
Given that we believe the SDGs represent a clarification of SINTEF's vision, it is pleasing that no less than 83 per cent of the Group's employees believe that their work is contributing to sustainable development and that this is a growing trend among our staff.[9]

At the same time, the work on sustainability reporting has provided important lessons that will improve SINTEF's future contributions to sustainability. We have chosen to develop the reporting in-house, without explicit links to existing suppliers' sustainability standards. Naturally, we understand the value of external guidance and will in the future consider strengthening the reporting with formal standards and assurance. However, the work has been an important development project in SINTEF's organisation from the very start, where the process has been a goal in itself. We have surveyed our activities – the external and multi-faceted activities within research and innovation together with partners – and our in-house operations – how our strategy and organisation live up to our societal ambitions. By being transparent about this, we hope to both strengthen our organisation and earn the trust of society at large.

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

As in the 2019 report, we have chosen to highlight two major discussions at SINTEF through two 'deep dives'. The first looks at the work on goals 7) Affordable and Clean Energy and 13) Climate Action, which we do a lot to realise. Next, we look at how goals 9) Industry, Innovation, and Infrastructure and 8) Decent Work and Economic Growth define SINTEF's role as an agent of innovation and our interaction with society at large, and also discuss this in detail.

[9] SINTEF's working environment survey in January 2021, based on a total of 1,768 responses to the question: "I believe my work contributes to sustainable development."



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

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 3 Good Health and Well-being

Goal 14 Life Below Water
Goal 6 Clean Water and Sanitation

Goal 15 Life on Land

Other Sustainable Development Goals

Affordable and Clean Energy and Climate Action

Despite the fact that the Covid-19 crisis gained the most attention in 2020, the crisis response has to a large extent also taken into consideration the pressing climate crisis. Both in Norway and the EU we see an opportunity to orient the instruments in crisis packages and stimulus schemes towards a green and digital future. Society has never had a greater opportunity to actually do something about the climate crisis and we can also see this in the EU's Green Deal announcements and the government's Green Platform initiative.

We can also see that both national and global emissions are decreasing during the pandemic. The reduction in relation to 2019 appears to be in the range of 5-6 per cent. The paradox though is how little this is in the big picture. This suggests that dealing with the climate crisis is about much more than just travelling less. We need to take a holistic approach through production, transport, end use and circularity. We are also learning which measures society is willing to accept in crises: the climate and natural world crisis are the largest underlying crises we can imagine.

Norway has reported new targets to the Paris Agreement of 50-55 per cent in relation to 1990 by 2030. We have also agreed to the EU's 2014 target of cutting greenhouse gas emissions by 40 per cent by 2030, compared with 1990 levels. This also includes an implementation commitment that was not included before. In January 2021, the government presented its climate White Paper [10] (White Paper No. 13 (2020-2021), which is also called the Climate Plan. This contains measures that the government will implement to achieve our climate targets. Two eye-catching features are a 45 per cent cut in emissions in the non-emissions trading system (ETS) sector by 2030 and a price indication of NOK 2,000 per tonne CO_2 in 2030. At the time of writing, the White Paper is being considered by the Norwegian parliament after the Committee on Energy and the Climate's recommendations were issued on 25 March 2021. The outcome is uncertain, although the debate clearly highlights the schism the political parties face with respect to existing jobs and the measures required to ensure that Norway also achieves its climate goals in a national and international context. It is not long until 2030, and there will be some lag between measures being implemented and their effects being felt, so time is getting shorter and shorter. In SINTEF's opinion, there has never been a better basis for getting to grips with this challenge and turning it into an advantage for the country, as has been done before with progressive environmental and climate legislation that subsequently proved to be highly

Project turnover:

808 MNOK

Start-ups:

1

Project turnover:

790 MNOK

Start-ups:

0

[10] The government, White Paper No 13 (2020-2021): Climate Plan for 2021-2030. 8 January 2021. https://www.regjeringen.no/no/dokumenter/meld.-st.-13-20202021/id2827405

advantageous. People speak a lot of the post-Covid-19 era but few talk about the post-climate crisis era. The long sprint has begun. The White Paper sends some interesting signals to the market. A quota price of NOK 2,000 per tonne CO_2 will make many measures profitable. Most of the measures in the "Climate Cure 2030" report[11] from the Norwegian Environment Agency will either cost less to implement or cost in the range of NOK 2,000 per tonne CO_2.

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 by around 2050. This will mainly have to be achieved by 1) using energy and resources more efficiently; 2) more renewable energy; 3) measures that eliminate and capture emissions from fossil energy; and 4) removing CO_2 from the cycle. There is a growing debate about whether net zero is good enough in relation to zero emissions from anthropogenic activities. This is a more radical direction and will require changes we currently cannot foresee. Elements of this can be seen in the EU's Green Deal where the pollution target has been increased to zero polluting emissions. Such a debate further strengthens the orientation towards zero emissions and a more holistic approach to a sustainable planet.

SINTEF's mission is to contribute technology and innovation in the transition up to 2050, and we have activities contributing to all of the four main strategies.

Goal 7) Affordable and Clean Energy is a prerequisite for the transition to a sustainable society. What clean energy actually means is interpreted differently in different environments, but as SINTEF understands it, this is energy the is produced sustainably and that enables sustainable energy. We have received a good reference in the EU's classification system for sustainable investments, the coming EU taxonomy.[12] This is a tool that in many ways measures sustainability. The taxonomy is research and fact-based and breaks down the Paris Agreement's goals in each sector and economic activity. It describes the limit values for the economic activity in order to contribute to the SDGs. This is quantified and does not just cover the climate, it also covers impacts on other SDGs linked to the circular economy, biodiversity, ocean and marine environments, and pollution, as well as respect for social standards.

Affordable and Clean Energy is progressing globally; steadily more people are gaining access to it. This is mostly due to increases in distribution, and price reductions, in solar and wind energy. We are proud that SINTEF is contributing, and has contributed, to the formidable reduction in price for solar panels and wind through our research over decades. Given the increasing need to realise the hydrogen economy and carbon capture and storage (CCS) we are, overall, well-equipped to contribute a wide range of soundly anchored, research-based approaches to the challenges. This includes substantial research and technology infrastructure that we can benefit from, often together with our university partners.

The global community is taking the climate crisis seriously, but action need to follow words. In poor countries, finding a balance between growing the population's prosperity and taking climate action at the same time, can be seen as challenging if, at the same time, one has few experts in this. Richer countries may face the same challenges but have better access to expertise and longer experience with this type of issue. International cooperation is needed in order to achieve good solutions, independent of demographic and social-economic development and previous experience.

[11] Norwegian Environment Agency, "Klimakur 2030". https://www.miljodirektoratet.no/klimakur
[12] The EU Commission, "EU taxonomy for sustainable activities". https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

OPWIND: affordable energy from offshore wind

OPWIND develops knowledge and tools for optimising the management of offshore wind parks. The basic idea is that managing the entire park as a whole will produce better results than managing each turbine individually. Holistic management takes account of how the wind conditions and turbines are mutually affected by each other. This can be quantified by measurements and calculations.

The challenge is to do this quickly and accurately enough to manage the entire park optimally. If the research is successful, its application will provide more and cheaper energy without an increased footprint or using more materials.

SDG:

7 AFFORDABLE AND CLEAN ENERGY

THE PROJECT ALSO CONTRIBUTES TO:

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

Floating solar: testing models for floating solar energy production

Offshore solar panel installations offer several advantages. Researchers in our test laboratories have constructed large-scale models for floating solar energy production and tested them in conditions that simulate wind, waves, and currents.

Data from the tests is used to identify areas where improvements can be made and to verify numerical models.

SDG:

7 AFFORDABLE AND CLEAN ENERGY

THE PROJECT ALSO CONTRIBUTES TO:

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

SDG:

13 CLIMATE ACTION

TACT: climate-positive removal of CO_2

In collaboration with Drax and C-Capture, this project is intended to help Drax's power plant in North Yorkshire in the UK become the world's first power plant with negative emissions thanks to it removing the greenhouse gas carbon dioxide (CO_2) from the atmosphere at the same time as it produces electricity.

The technology can contribute to negative CO_2 emissions by capturing CO_2 from chimney smoke produced from biomass. This is something the world will need if it is to reduce atmospheric CO_2 concentrations.

New gases for GIS: alternatives to the world's strongest greenhouse gas

Gas insulated switchgear (GIS equipment) are an essential component of the power system. GIS equipment is used in hubs, such as substations, and contains switches that control the current in the grid.

SF6 is used in GIS because of its good electrical insulation properties. Unfortunately, SF6 is the strongest greenhouse gas we know and more than 23,000 times worse than CO_2. Environmental footprints could be reduced sharply by finding a good substitute for SF6. The goal is to contribute to a robust and sustainable power grid by researching alternatives to SF6 for distribution and transmission grids from a long-term perspective.

SDG:

13 CLIMATE ACTION

THE PROJECT ALSO CONTRIBUTES TO:

7 AFFORDABLE AND CLEAN ENERGY

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

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 research and innovation 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 a significant research area for SINTEF. 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, as well as a partner in a social science FME centre. 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, CO_2 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 CO_2 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, clean hydrogen, 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.

- SINTEF has a broad focus on the bioeconomy of the future through the utilisation of sustainable renewable biomasses. Our efforts are directed at establishing new technology and climate-positive processes and the future processing of biomass into bio-based chemicals, biomaterials, as well as bioenergy and advanced biofuels designed for long-haul and air transport.

- SINTEF is working with the food industry to develop new processes and technologies that will increase utilisation and value creation for various types of bio-raw materials used as an ingredient in feed or as food. The focus is on developing new products in a circular interaction between bio-raw materials from the sea, land, and forest. SINTEF is contributing solutions that can reduce greenhouse gas emissions from meat production and improve the utilisation of residual raw materials via 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.

- In addition to renewable energy, SINTEF is one of the world's leading environments within the development of zero-emission energy solutions from natural gas with carbon capture and storage, and hosts FME NCCS, one of the world's largest centres for CCS research. Reforming and removing CO_2 from natural gas can produce clean hydrogen, sometimes referred to as 'blue' hydrogen. Blue hydrogen or 'blue ammonia' could accelerate the transition to the zero-emission society.[13]

- SINTEF is also a leader within social science research into sustainable transformation. We are developing new knowledge about the relationships between technological and social change processes, with an emphasis on how public and private decision-makers can contribute to systemic changes through new strategies, cooperation models and tools for sustainable innovation. This is taking place in, for example, FME NTRANS (energy transition) and in the research centre INTRANSIT, which focuses on innovation policies for green and smart transition.

[13] Blue hydrogen refers to hydrogen produced by converting natural gas into hydrogen and CO_2 with the subsequent or integrated CO_2 removal, transport, and long-term storage. Blue ammonia is produced from blue hydrogen.

Removing carbon dioxide from the atmosphere

In addition to the measures described above, the IPCC points out that it will be necessary to remove the CO_2 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 CO_2 is a problem that is the 'responsibility of everyone and no one' and there is no current business model for CO_2 removal measures, nor indeed for mobilising the necessary research into CO_2 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. In 2020, the work focused on idea generation and paving the way for research and innovation arenas for these solutions.

It would be natural to look at opportunities for capturing CO_2 in new biomass production in oceans and water, as well as on land, and by using chemical/mechanical solutions for capture from air or water. 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 space 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 will be the prevalent form of storage. 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.

Dedicated processes for the removal of CO_2 is a relatively new field, and the proposed solutions are mostly at the laboratory stage, or at best in small scale. Therefore, there is a great need for research and innovation in relation to climate-positive solutions.

In 2020, SINTEF initiated five projects ranging from CO_2 capture from water to the long-term storage of carbon through cultivating sea grass or other algae production. Recarbonising concrete is another alternative, as is the long-term storage of carbon through following the life cycle of wood. These are areas where successfully developing such solutions could have a major impact globally.

Neither Norway nor the EU have a related research and development or innovation agenda in this area, 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. This is why 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 has taken a central role here by setting aside funds for research into this important area and allowing external contributions to counter market failure for climate positive solutions. We want to help authorities and business actors to realise concrete actions for the net removal of CO_2 from the atmosphere.

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

Industry, Innovation and Infrastructure and Decent Work and Economic Growth

The goal of SINTEF's corporate strategy is to produce competitiveness and good societal solutions. It is, therefore, unsurprising that a lot of our activity is oriented towards the SDGs relating to innovation, infrastructure and value creation.

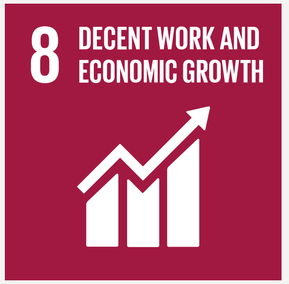
In this deep dive we want to both show examples of projects and start-ups that are contributing to goals 8 and 9, and also look more closely at SINTEF's more over-arching role in promoting innovation and value creation, in Norway and internationally.

Project turnover:

1254 MNOK

Start-ups:

14



Project turnover:

82 MNOK

Start-ups:

16

Research projects related to society's infrastructure

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, buildings, and others. Much of this research contributes to more area-specific goals and is discussed in other places in this report.

Research and development (R&D) is a necessary and affordable 'insurance premium' linked to enormous investments in infrastructure, including to ensure future-oriented development, avoid incorrect investments, and develop Norwegian industry.

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

- Better utilise, develop, and maintain existing infrastructure, including through the use of sensors, big data analytics, optimisation, risk and vulnerability analyses, 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 due to electrification, energy efficiency needs, changed environmental standards and for being able to exploit new technological solutions such as autonomy, digitalisation, and zero-emission solutions.
- Develop new standards, products, methods and trading platforms for materials, equipment, and services for infrastructure development, especially in light of the need for cuts in emissions, the circular economy and increased productivity.
- Increase the security of ciritical infrastructure in society, including in light of new comprehensive risk analysis methods for complex structures, higher ICT, and geopolitical threat levels, reduced biodiversity and more extreme weather.

Specific examples of our work on protecting and improving infrastructure include:

- KlimaDigital: digital warnings that can reduce the risk of harm from landslides, as described on the right.
- Various aspects of nature-based solutions for local stormwater management are themes in projects linked to SFI Klima 2050.
- SFI Norwegian Centre for Cybersecurity in Critical Sectors, where SINTEF bears special responsibility for the energy sector.
- FME CINELDI- Centre for Intelligent Electricity Distribution, where SINTEF is the host organisation.

KlimaDigital: digital warnings can reduce risk of harm from landslides

Climate change will result in more extreme precipitation and snow melt, which often trigger landslides. At the same time, the proportion of people and infrastructure exposed to water-triggered landslides will increase due to population growth.

Early warning systems using digital technologies may significantly reduce the risk of harm. Monitoring and warning systems can provide more reliable landslide warnings based on data about risk factors such as precipitation and variations in groundwater levels. The project is examining how the risk of harm can be managed via various risk management strategies.

THE PROJECT ALSO CONTRIBUTES TO:

SDG:

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.

In order to ensure safe and secure working environments, we have research activities aimed at tripartite cooperation and preventive activities for the working environment. In particular, recent projects have looked at 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 and/or the basis for new jobs are often realised through research-based improvements to the technologies and work processes on which products and services are based.

Examples of realised and potential value creation from SINTEF's activities in the field of energy are well described in the Impact Study. [15]

Input-output analysis: the effects of climate policy

SINTEF is developing a tool for analysing emissions, employment and value creation along global value chains based on a global input-output database. We are analysing how new technologies or climate and environmental policies in Europe or other countries are changing international trade, and the effects this is having on employment, emissions, and other sustainability indicators around the world.

We have also developed an input-output model with a focus on Norway, which we have used to analyse the effects on value creation and employment of transitioning to a circular economy. Despite lower new output, a circular economy would meet our needs as well as we are used to. Recycling, recovery, repair, leasing, and second-hand sales are more labour-intensive than the jobs they would replace in mines and factories. Therefore, the number of jobs will go up, not down. In the scenario we based our calculations on, circular measures will increase the number of jobs by 2.5 per cent by 2030, compared with 'business-as-usual'.

SDG:

THE PROJECT ALSO CONTRIBUTES TO:

[15] Impello, "Effekter av energiforskningen", 2019. https://www.regjeringen.no/no/aktuelt/ny-side/id2625970

SINTEF's role in the innovation system

SINTEF's research and innovation work is mainly carried out in collaborations with partners in the private and public sectors. This allows us to make sure that the research is relevant and contributes to innovation in practice. We contribute research and innovation expertise to the collaboration, as well as research, verification and test infrastructure, which we often refer to as 'laboratories'. In this way, SINTEF itself, as an institution, represents infrastructure that enhances the innovative capacity of society.

UN Sustainable Development Goal 8) emphasises the need to increase economic productivity via, among other things, "diversification, technological progress and innovation." Goal 9) deals with, among other things, upgrading infrastructure and retrofitting industries, and includes a target that aims to "enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries." In our opinion, the SDGs are focusing on SINTEF's core tasks here. Therefore, when reporting on these two goals, we believe it is relevant to describe how we work in partnerships.

Research institutes like SINTEF play a key role in the Norwegian research and innovation system. In the five-year period up to 2020, the institute sector carried out an average of 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 have been carried out and collated in a synthesis report from the Research Council of Norway from 2018.[17] The evaluations document that technical-industrial institutes are particularly important for ensuring that research has an impact 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' report 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 looked at in the study.

The latest country study of the Norwegian research and innovation system from OECD also highlights the importance of the institutes, especially with regard to 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 February 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'

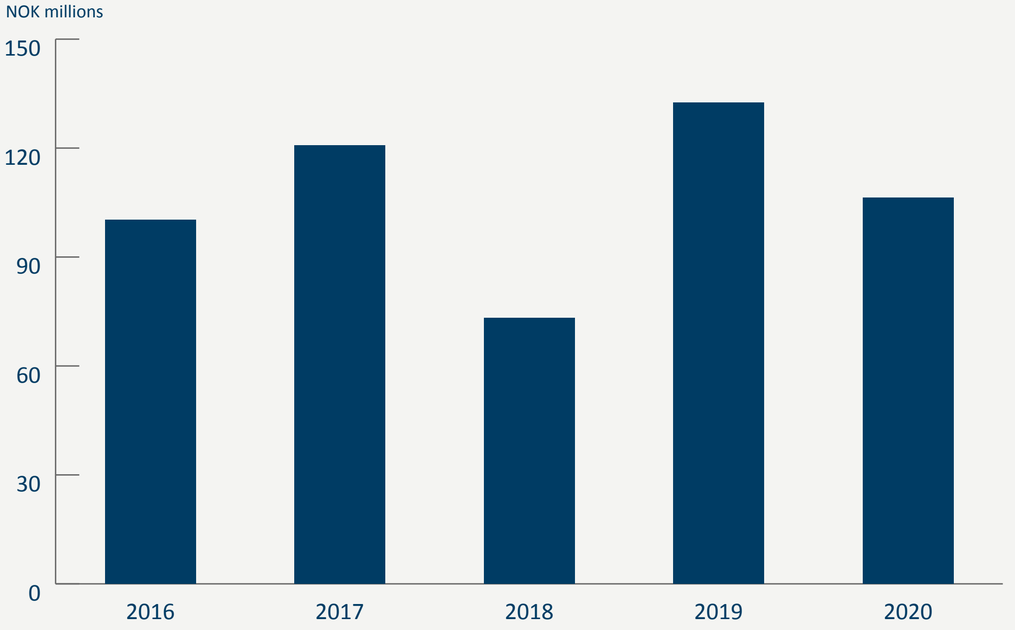
Research infrastructure plays an important role in how we can carry out projects for clients. Around 40 per cent of our turnover is linked to projects that make use of this type of infrastructure. This figure is somewhat higher for projects we carry out in collaboration with business. Access to advanced 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 SIVA, 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.

CO_2-Lab Tiller

CO_2-Lab Tiller contains a pilot plant and infrastructure devoted to the development, testing and validation of CO_2 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

The ZEB Laboratory is a zero-emission building laboratory and was opened in March 2021. The building forms a living laboratory in which people that use it as a normal office building, or for educational purposes, become part of the experiments. The laboratory is an arena in which new and innovative materials and solutions are developed, investigated, tested, and demonstrated in mutual interaction with people.

Ocean Space Centre

A major infrastructure project we have worked extensively on in recent years is the Ocean Space Centre (OSC)[21], which the government granted design funding for in 2020 with the goal of reaching a decision on investment in 2021 and starting construction in 2022. Norway has been a leading 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, hydrodynamic 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 in the quest for a greener and more digital 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 normally 8 per cent, SINTEF relies on successfully raising project funding in competitive arenas, nationally and in Europe. 44 per cent of the income comes from business through direct contract research and co-funding from business in publicly supported development projects. We have direct assignments from the public sector, in addition to research funded by the public support system. Together with companies and other partners, SINTEF obtained 39 per cent of its income from projects in the EU and the Research Council of Norway.

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 what we call contract research and what is referred to as collaborative research.

Put simply, in principle our contract research portfolio consists of projects where companies that 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 and function as the companies' research and development department. However, it is also the case that in many of the projects the clients are looking for risk mitigation, with support especially from the Research Council of Norway, Innovation Norway or SkatteFUNN. SINTEF often takes the initiative in relation to companies when we see opportunities for projects for which the companies should apply for support. 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 afforded by new knowledge or technology and then applies for public funding for the research associated with such opportunities. These projects usually receive co-funding from partner companies. By asking the business community and others to become partners, we achieve at least three things. We trigger more basic innovation in the activities in areas that may in the long term be important breakthroughs for them. We build up expertise and develop technology that provides a basis for radical innovations, often across multiple areas of application. The results of the research are also made available through publication, meaning that we are contributing to national and international efforts to solve basic challenges.

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 that we own while simultaneously protecting our clients' property.

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. During the crisis year 2020, we saw a strengthening of the trend in which we are experiencing a significant reduction in contract research without support from the support system. However, we are managing to sustain our pace of research and innovation through publicly co-funded research. Strengthening our EU portfolio, ongoing announcements of innovation projects (IPN) in the Research Council of Norway, as well as an extraordinary basic grant for the technical-industrial institutes, were especially important for promoting green and digital transitions during the crisis year.

[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 Laboratories. The two names refer to the same thing.

[22] Regjeringen.no, "The Norwegian Government's Ocean Strategy: New Growth, Proud History". 23 March 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 83 companies have emerged from SINTEF. Of these, 60 are still in operation as separate companies, eight have merged with others and the rest have ceased trading. Some 60 of the 80 companies were established in the Trondheim region. The companies employ 1,858 people (2020) and have an annual turnover of NOK 6.2 billion (2019).[23]

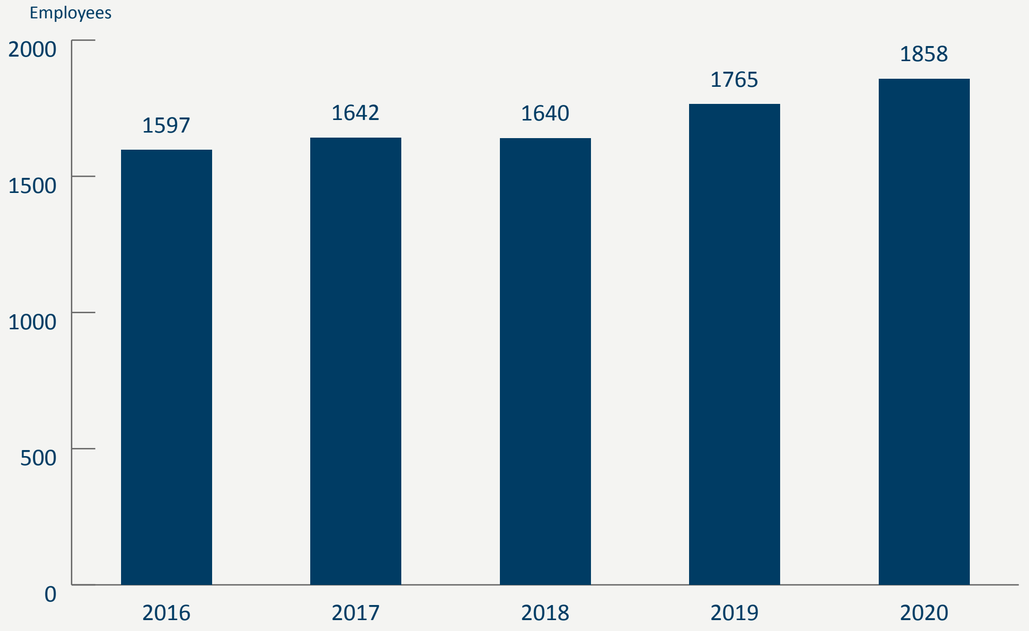
SINTEF has a strong track record from its commercialisation activities. Successful exits of start-ups established by SINTEF, have been profitable for investors and have also helped companies with further development and expansion of their business.

The diagrams on this and the following page provide a picture of SINTEF's commercialisation activities from 2002 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.

[23] Data from the Impello Management Study 2020.

We create jobs through start-ups



Cumulative overview of employees in companies that emerged from SINTEF

Source
The Impello Management Study 2020

Total commercialisation activities 2002-2020

771
Ideas from research institutes in SINTEF

101
Commercialisations through start-ups, licenses and technology sales

3,5 BNOK
in exit value

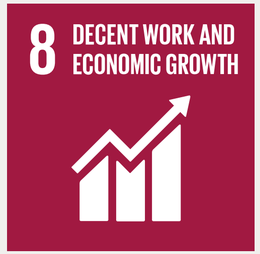
Portfolio of start-ups as of 2020

17
Start-up companies

256,4 MNOK
Total investment by co-investors

43,3 MNOK
Total investment by SINTEF Venture funds

Source
SINTEF



THE COMPANY ALSO CONTRIBUTES TO

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 use in industry. The camera gives robots 'eyes' and enables them to discern colour, shape and distance. This has made it simpler to robotise and 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

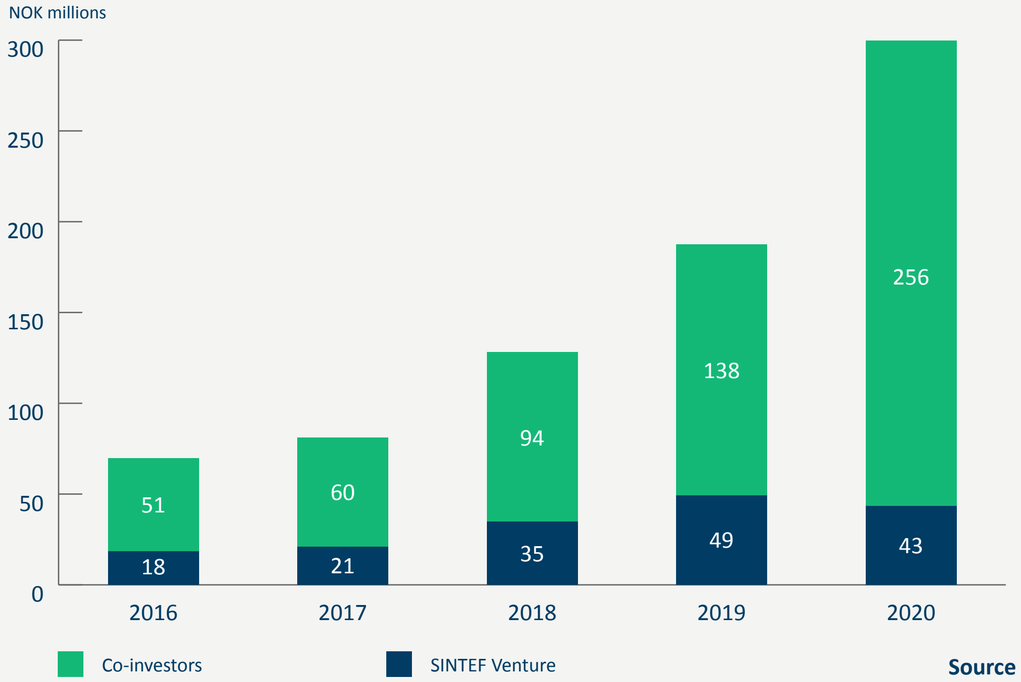
Application and scalability

The technology developed by Zivid has wide-ranging potential applications in various sectors, including the health care services sector. In the Intelli3D project, Zivid and SINTEF are partnering on using the camera technology in 'new' industries. If this goal is achieved, Zivid will become a key player in a global market that 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 2020, the SINTEF Venture funds invested NOK 43.3 million in the company portfolio, which in turn triggered NOK 256.4 million in investments from others and are contributing to these companies' growth and development.

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



Source
SINTEF

SINTEF's contribution to regional innovative power in Norway

SINTEF's projects contribute to competitiveness and societal solutions throughout Norway. We lack geographical data on where all of 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 because it largely reflects head office addresses while the map shows where the research actually finds it area of application.

SINTEF has also actively focused on strengthening innovation capacity in regional industrial environments, partly through collaboration with clusters and partly through its own start-ups 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 ones are the Innovation Norway clusters we partner with, and the yellow ones show our cluster-like collaborations with the companies in Røros.

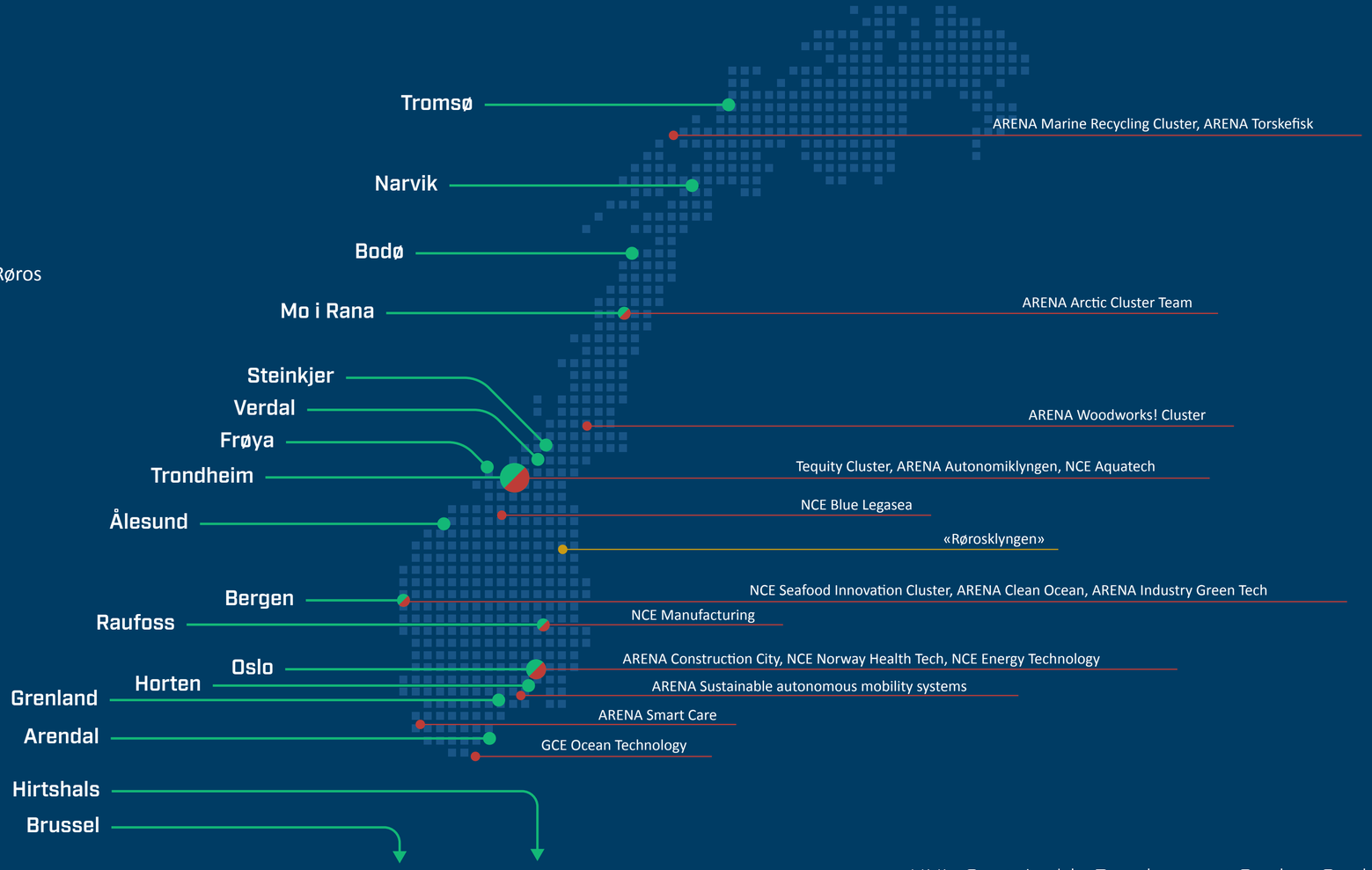
Having such a presence has enabled us to bolster expertise and take the initiative to establish development projects in these environments as a supplement to our ordinary project collaborations anchored in the large research environments in SINTEF, where Trondheim and Oslo are centres of gravity. This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

One example of this is that 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, in particular, the innovation 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 335 million as of November 2020.

Client locations SINTEF Energy Research

Proximity to clients 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 the EU's research collaboration

SINTEF's main strength, which is bringing partners from business and the public sector together in commercially oriented research projects, has proved to be a good basis for success in relation to the EU's research programmes. This ensures that Norwegian players can strengthen their competitiveness by participating in the international research front in key technologies such as ICT, biotechnology, energy, nanotechnology and materials science. Research from EU projects are invaluable in maintaining SINTEF's leading position and competitiveness.

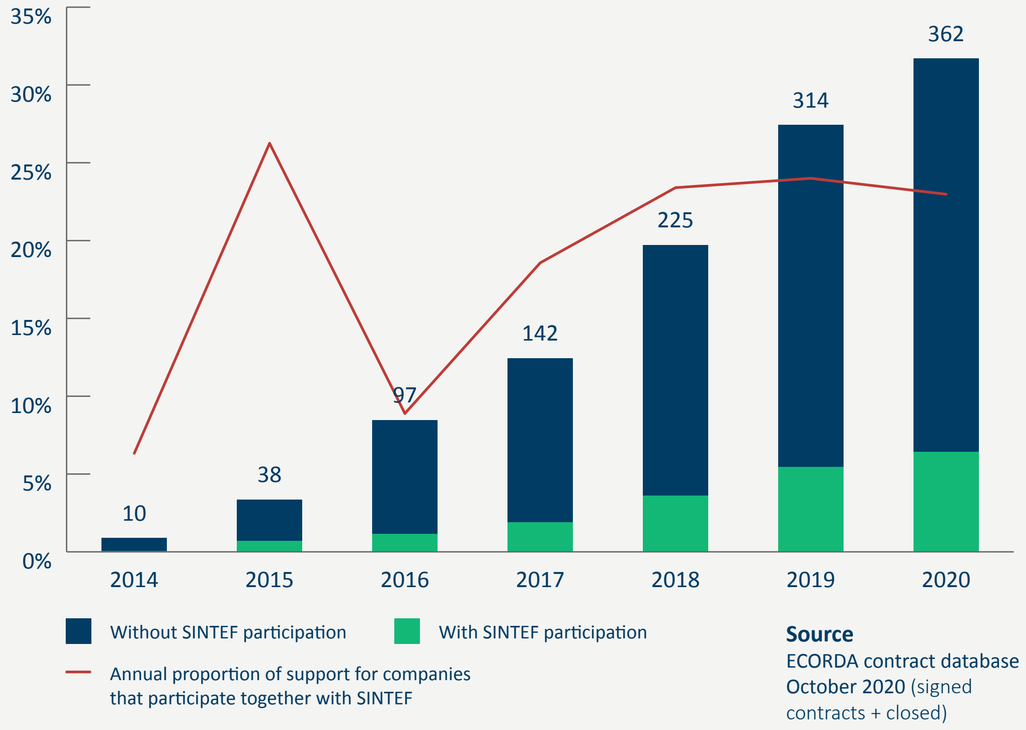
In 2020, the EU approved a total budget of EUR 95 billion for Horizon Europe, which will run from 2021 to 2027. With contributions from associated countries such as Norway, the UK and others, the total sum will be well in excess of EUR 100 billion, with Norway's contribution amounting to around 2.7 per cent. New elements in Horizon Europe are a greater emphasis on effects within five areas called 'missions', where importance is attached to impacts in the form of value creation, instruments, jobs and upscaling. The task of missions is to define 'moonshot' goals for the areas of i) cancer; ii) adaptation to climate change; iii) climate-neutral and smart cities; iv) healthy oceans, seas coastal and inland waters and v) soil health and food. The EU research programme is a premise provider for the development of EU policies and regulations.

The research programmes are also one of the EU's most important tools for achieving the goal in the EU's Green Deal of becoming the world's first climate neutral continent by 2050. Research and innovation in areas like health, the digital society, and preparedness and safety also constitute key parts of the EU framework programme, Horizon Europe.

As of October 2020, SINTEF is the leading Norwegian actor in Horizon 2020 (H2020), the current framework programme, with EUR 173.2 million in research and innovation funding. Our research efforts are greatest in the applied research programmes. The Norwegian government contributed around 2.7 per cent of the current H2020 budget with a target of a 2 per cent share of the return. SINTEF's participation in H2020 accounts for more than 13 per cent of 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 23 per cent of Norwegian companies that obtain research and development funding from the EU do so in collaboration with SINTEF, as per October 2020. 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)



Source
ECORDA contract database
October 2020 (signed contracts + closed)

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

SINTEF's goal is to double the scope of EU projects during the next 7 years of Horizon Europe, assuming that the conditions for our participation are financially sustainable. 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 an important 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 crucial for our ambitions regarding doing world-leading research.

Responsible Consumption and Production

The world's resources are today coming 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 transition 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 the Research Council of Norway's basic grant on delivering basic knowledge about the importance and potential of a Norwegian circular economy for value creation, employment and cutting emissions. SINTEF hosts the annual Norwegian Circular Economy Conference, which attracts more than 1,600 participants and contributes heavily to dissemination in the public debate on how we will achieve responsible consumption and production, for example through developing "10 circular principles for Norwegian business".

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, in the EU project WIDER UPTAKE, we are helping to optimise water use, resource recovery and energy use through the wider adoption of water-smart solutions that take into account technological, organisational, regulatory, social, and economic barriers. The project is creating a roadmap for the widespread implementation of symbiotic water-smart solutions for reusing wastewater and resource recovery based on circular economy principles.

Project turnover:

510 MNOK

Start-ups:

9

Through prevention, reduction, recovery and reuse we are developing solutions for keeping products and resources in circular material silos. Important research topics include life cycle analyses, the reuse of materials and optimisation models that combine technological opportunities with economic and environmental effects. SINTEF is working with the bed manufacturer Wonderland on the project WONDerful Circular REST, which is intended to half the eco-footprint of a bed via sustainable design, innovative business models and circular value chains, as presented in the case example.

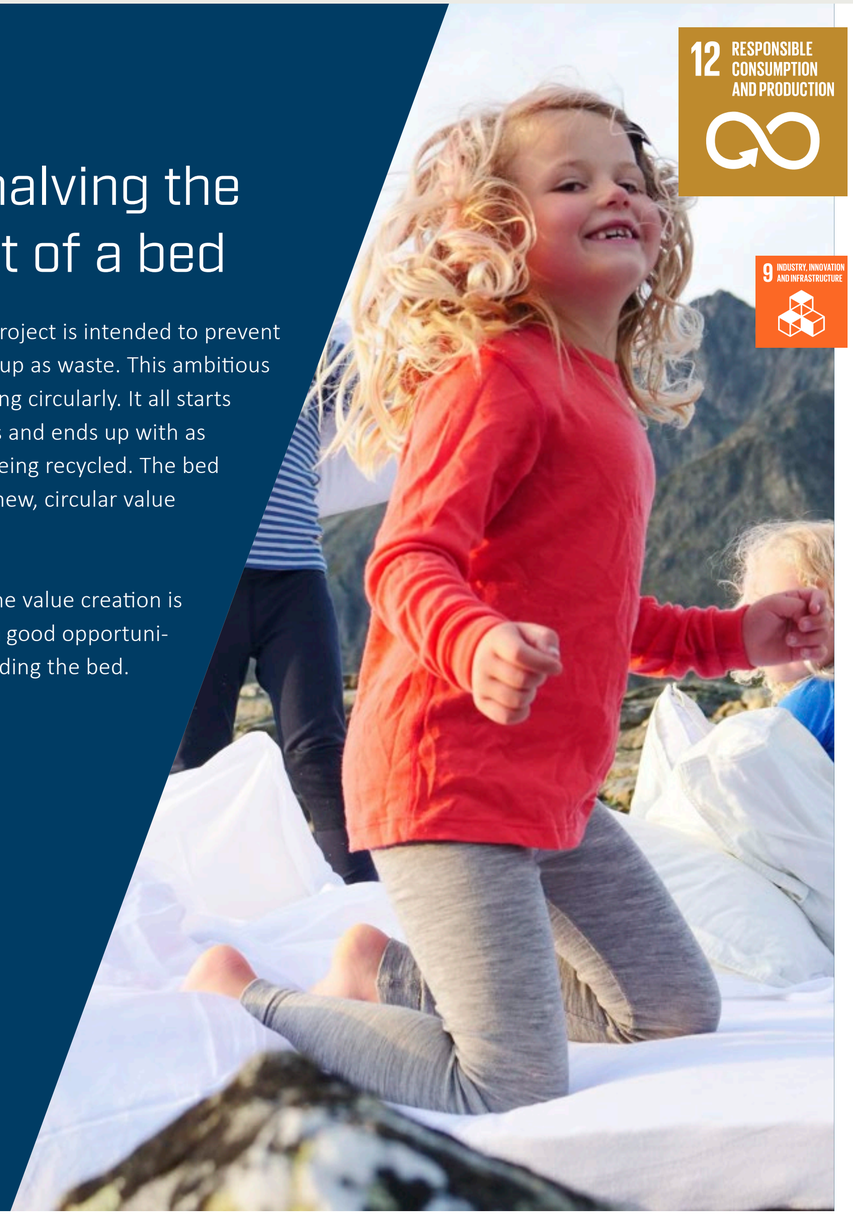
SINTEF contributes research expertise to the project within recovery technology, product condition detection, life cycle analyses for documenting environmental impact and the strategic development of more circular business models. SINTEF is working with Hydro, Metallco, Kavli, Infinitum, Norsk Metallgjenvinning and NTNU on the project Alpakka, which is aiming to establish a Norwegian flagship demonstrator of the circular economy in practice. This will increase aluminium packaging circularity in Norway based on value chain cooperation between collectors, food producers/packaging designers and aluminium recyclers, as well as by engaging consumers. The goal of the project is to prevent 40,000 tonnes of aluminium ending up in waste incineration each year, which is equivalent to more than 1.5 TWh of energy savings and cuts of several hundred thousand tonnes of CO_2.

SINTEF contributes to knowledge building in order to reduce emissions of chemicals and waste into the environment. In the EU project InNoPlastic, we are developing collection robots, apps and filter technologies that will remove marine pollution from the oceans in Europe and the Caribbean. The project is also meant to ensure that collected plastic is retained in the system and recovered as part of the European circular economy strategy.

WondRest: halving the eco-footprint of a bed

The WondRest sustainability project is intended to prevent the beds of the future ending up as waste. This ambitious goal will be achieved by thinking circularly. It all starts with sustainable raw materials and ends up with as much of the bed as possible being recycled. The bed would thus become part of a new, circular value chain.

The framework surrounding the value creation is a circular business model with good opportunities for maintaining and upgrading the bed.



SDG:

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

THE PROJECT ALSO CONTRIBUTES TO:

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Sustainable Cities and Communities

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 (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 construction and neighbourhood development (architecture, construction processes, energy efficiency, energy and indoor climates, as well as climate adaptation), transport and infrastructure (zero-emission mobility, sustainable infrastructure and autonomous transport systems), energy systems, digitalisation and innovation in the public sector, and the circular economy within sectors such as construction, civil engineering and industry.

Smart and 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 Sirklar' [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.

Project turnover:

452 MNOK

Start-ups:

1

In its report from 2020,[24] 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 shift 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 a key factor in realising a number of the SDGs. For example, sustainable transport would contribute to better health, innovation in infrastructure, the development of sustainable cities and communities and to stopping climate change. The UN Secretary-General's High-Level Advisory Board has defined sustainable transport as safe, affordable, accessible, efficient, resilient, and having minimal CO_2 and other emissions that have an adverse impact on the climate and environment. Knowledge, technology, and innovation must be developed and implemented on a large scale to ensure rapid adaptations in society to achieve this.

Syn.ikia: increasing the share of sustainable neighbourhoods

We need to develop and integrate solutions for local energy storage and sharing in order to create plus energy neighbourhoods and over time urban districts. The goal of this EU project is to find smart solutions for exploiting the potential for energy efficiency and flexibility.

The project is intended to provide new technology at a neighbourhood level, while also safeguarding user interests, good architectonic solutions, and spatial qualities.

By facilitating smart technology combined with public engagement, which can help to ensure that apartment buildings generate more than they consume, plus energy neighbourhoods may become a reality.

SDG:

THE PROJECT ALSO CONTRIBUTES TO:

11 SUSTAINABLE CITIES AND COMMUNITIES

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

17 PARTNERSHIPS FOR THE GOALS

[24] Report from the Expert Committee for Data Sharing in Business, 2020. https://www.regjeringen.no/contentassets/c98cce6745b0486c-948c269dc80335c8/rapport-fra-datadelingsutvalget2.pdf

Good Health and Well-being

SINTEF aims to contribute to healthy living, better and more coherent healthcare, increased productivity in the national health service and growth in the healthcare industry. Together, this will result in better health care for the individual, a healthier population, a more sustainable welfare state, more jobs and increased export income. One aspect of this ambition is to increase our contribution to achieving the health-related UN 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 a challenge 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 into healthy living, as well as preventing disease and injury in all phases of patient pathways: diagnosis, treatment, and follow-up. This is being done in partnership with employers and the education sector, the national health service, patient and user organisations and business. Working to create good health and well-being is an area in which researchers with a health, technical or social science background must work together to create good solutions. We are prioritising some key multidisciplinary research topics because we can see that the necessary cooperation will not happen without proactive efforts. These efforts include:

- Digital patients and health services, where we are building up expertise on how we can develop and use new digital solutions for the benefit of the public, patients, and healthcare workers. Better quality and better resource utilisation are important goals for the work.
- Aging-friendly societies, which is about building up knowledge about how to create a society that is better adapted to a larger proportion of older citizens in the future and ensuring that they live with the best possible life quality and with good opportunities for getting help to live independently.
- Future medicine production, which is about how Norway will be able to develop knowledge and produce medicines and other pharmaceuticals in the future in competitive and sustainable ways.
- Technology and global heath, which is based on SINTEF's long tradition of research into living conditions in developing countries. In the future, we want to work harder to ensure that the introduction of technological solutions will help to raise living standards and ensure the countries' sustainability.

Project turnover:

229 MNOK

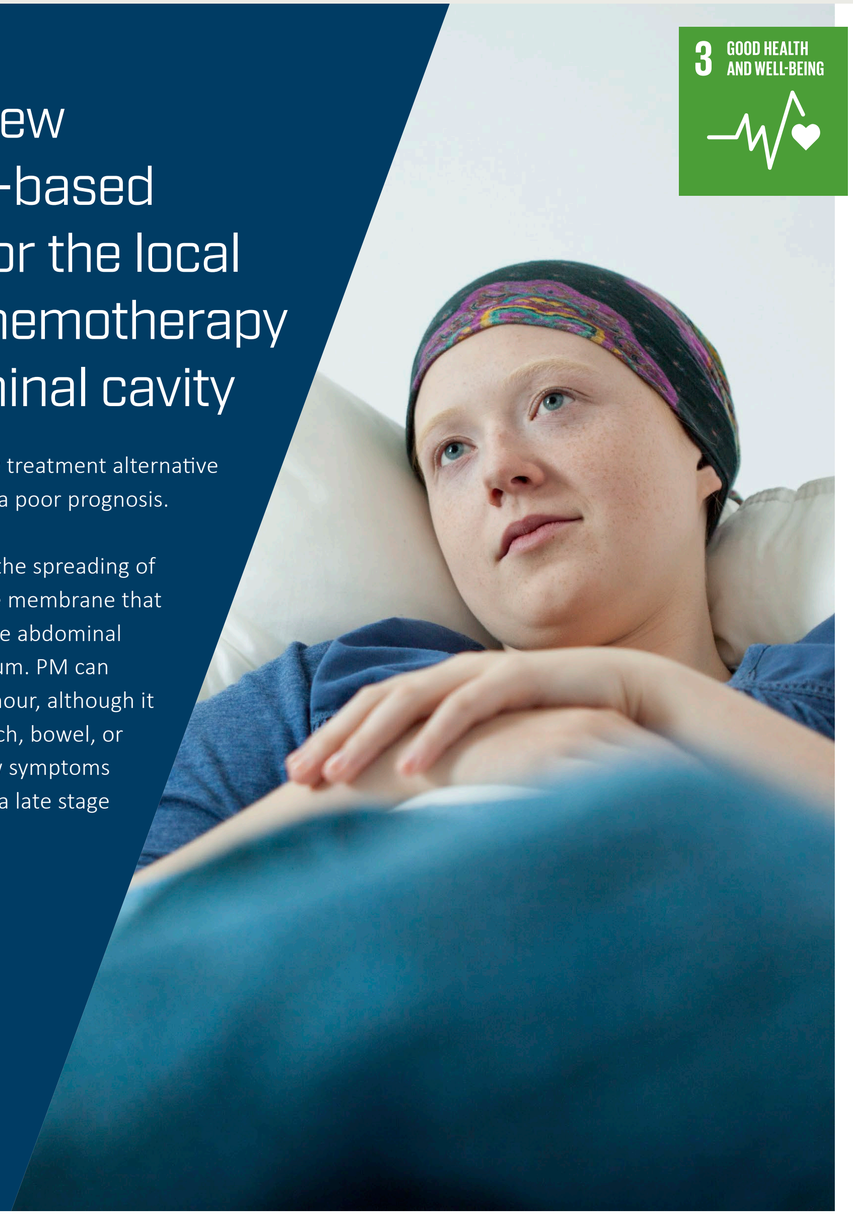
Start-ups:

6

ENPERITO: new nanoparticle-based technology for the local delivery of chemotherapy to the abdominal cavity

SDG:

3 GOOD HEALTH AND WELL-BEING



Enperito may represent a new treatment alternative for a large patient group with a poor prognosis.

Peritoneal metastasis (PM) is the spreading of tumour cells to and within the membrane that covers the entire surface of the abdominal cavity, known as the peritoneum. PM can originate from almost any tumour, although it usually originates from stomach, bowel, or ovarian cancer. PM causes few symptoms and is therefore diagnosed at a late stage and has a high mortality rate.

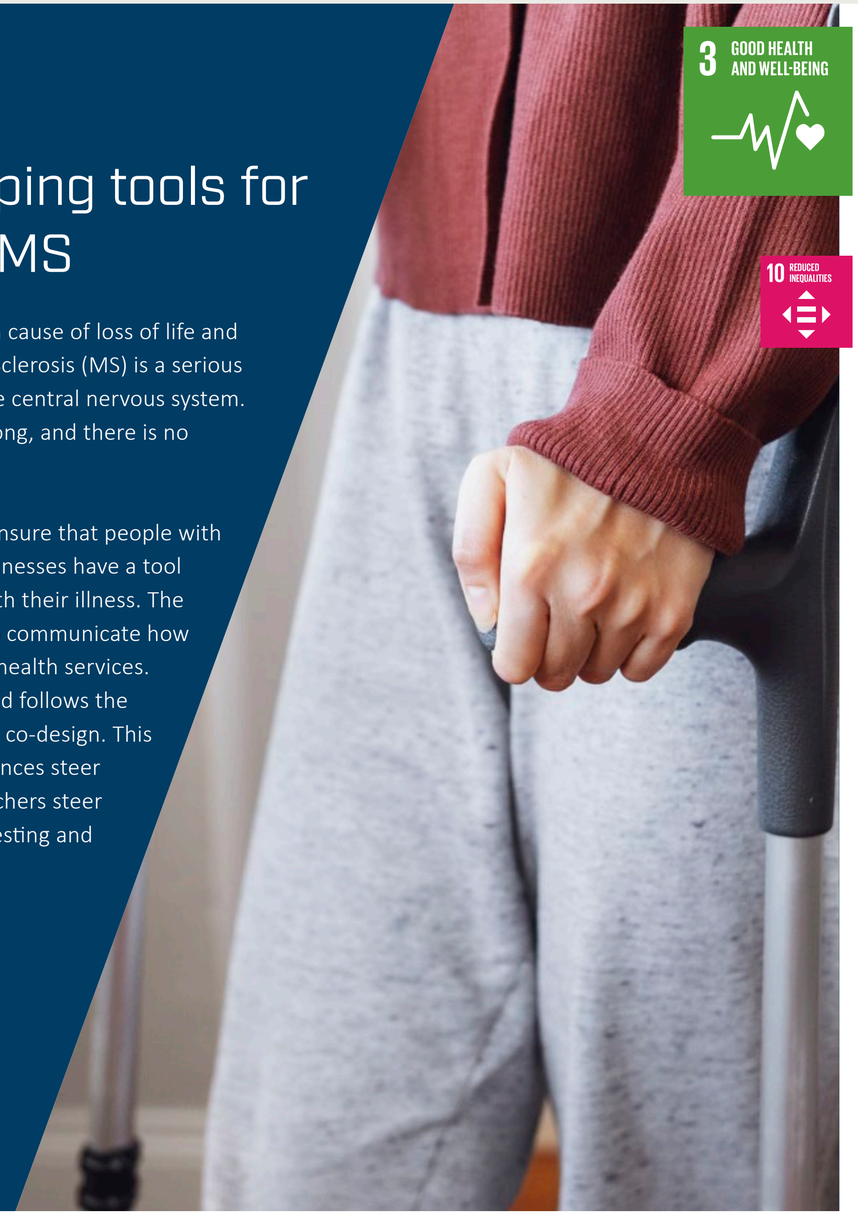
EgenMS: coping tools for people with MS

SDG:

3 GOOD HEALTH AND WELL-BEING

THE PROJECT ALSO CONTRIBUTES TO:

10 REDUCED INEQUALITIES



Chronic illnesses are the main cause of loss of life and well-being globally. Multiple Sclerosis (MS) is a serious chronic illness that attacks the central nervous system. It strikes young adults, is lifelong, and there is no medicinal cure.

The goal of the project is to ensure that people with MS and others with chronic illnesses have a tool that makes it easier to live with their illness. The tool will also make it easier to communicate how they feel to relatives and the health services. The project is user-steered and follows the principles for user insight and co-design. This ensures that patients' preferences steer the content, while the researchers steer the choice of methodology, testing and implementation.

Health and quality of life are experienced at a personal level. User participation is, therefore, key in our work on contributing to patient healthcare services and helping people cope with their health conditions, as the example EgenMS shows. We are actively working to make patient data available in all parts of, and between, the various actors in the national 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 multiple diagnoses.

To increase both quality and productivity in the healthcare services, we are developing completely new ways of providing healthcare and tools to improve the efficiency of work processes. Our research and development within domains such as gerontechnology and e-health, the use of health data and approaches to realize more flexible and efficient pharmaceutical manufacturing are all contributing to lower costs and improve the quality of healthcare for those who need it. We are using our expertise in biotechnology, microtechnology, nanotechnology and imaging technology to develop better diagnosis processes and treatments for cancer and stroke patients.

SINTEF's activities within global health in the last 25 years has included research and development that is of direct relevance for many of the SDGs, primarily goal 3) Good Health and Well-being, although goals 1) No Poverty; 4) Quality Education; 5) Gender Equality; and 10) Reduced Inequality are also prerequisites for Good Health and Well-being. This research and development work involves extensive collaboration with national authorities and 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 better source data on vulnerable groups, through research into specific services and through service development. The source data are 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. 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 and quality of life are also important goals for the start-ups in SINTEF where six of the 17 companies are working on health related solutions. These include Tellu, which develops new e-health services and Minuendo, which is developing a new type of hearing protection.

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 better 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 a budgeted revenue of MNOK 100 in 2021 and a position in its home market that makes rapid scaling in new markets credible. 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 develops, manufactures, and sells intelligent hearing protection designed to monitor harmful noise and alert the user to prevent hearing damage. Minuendo's solution is the first of its kind in the world because it protects hearing without degrading the reproduction of the sound. Minuendo's first product, Music™, was launched in 2020 and is an earplug that permits stepless variable attenuation by the user. The earplug includes a tuneable high-fidelity acoustic filter that yields natural sound reproduction at any attenuation level – a technology developed at SINTEF.

Impact for clients, users, and society

Hearing damage is the most frequent type of occupational injury in the EU today. Helped by hearing protection from Minuendo, the aim is to reduce the number of people who develop hearing damage at work.

Links to more info

minuendo.com
sintef.no

Application and scalability

High noise levels leading to hearing damage is a problem for many occupational groups, including mucisians and construction workers. Minuendo's products will contribute to better hearing protection in a variety of industries.

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 in order to mitigate the environmental risk from emissions from industrial activities in 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:

209 MNOK

Start-ups:

2

Project turnover:

61 MNOK

Start-ups:

0

The research portfolio includes development projects aimed at the growing domestic aquaculture industry that focus on better fish health, preventing escapes, lower emissions, impacts on the external environment and optimised production. Our research and technology development for cultivating kelp and other low-trophic level species[25] 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 catch 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. This also includes social science projects such as POCOplast, where we are looking at how to reduce pollution and develop new value chains based on recycling used hard plastics from the aquaculture industry.

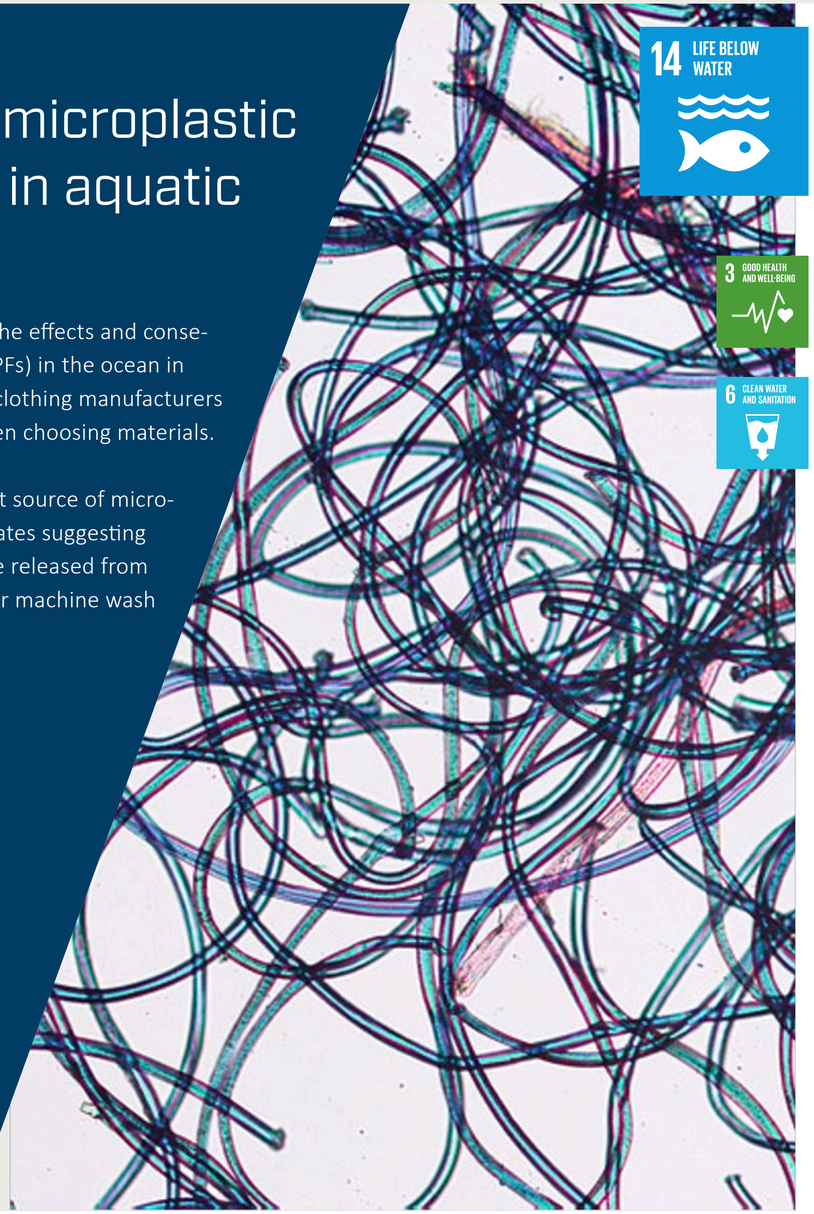
Life Below Water is an important goal for SINTEF's start-ups. Ocean Space Acoustics and C-Feed are examples of this.

[25] 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.

MICROFIBRE: microplastic fibre pollution in aquatic environments

MICROFIBRE aims to understand the effects and consequences of microplastic fibres (MPFs) in the ocean in order to develop tools that allow clothing manufacturers to make sustainable decisions when choosing materials.

MPFs are often the most abundant source of microplastic pollution, with some estimates suggesting that upwards of 700,000 fibres are released from synthetic textiles in a single regular machine wash cycle.



SDG:

THE PROJECT ALSO CONTRIBUTES TO:

THE COMPANY ALSO CONTRIBUTES TO

Ocean Space Acoustics

PingMe™ locates hazardous waste

Lost fishing gear, nets and lobster pots are a major challenge. Around 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 gear 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 and makes fishing more efficient. Fishermen can register information about gear they have lost and found in a cloud solution. In the future, the service may be integrated into public databases. PingMe™ is being commercialised in SINTEF's own spin-off company Ocean Space Acoustics AS, which is supported by Norwegian investors, the Research Council of Norway, and the EU.

Links to more info

osac.no

sintef.no

Application and scalability

The technology behind PingMe™ also has potential in other sectors, including when it comes to 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 polyunsaturated fatty acids and proteins in the cell tissue. A one-litre 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 aquaculture 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.

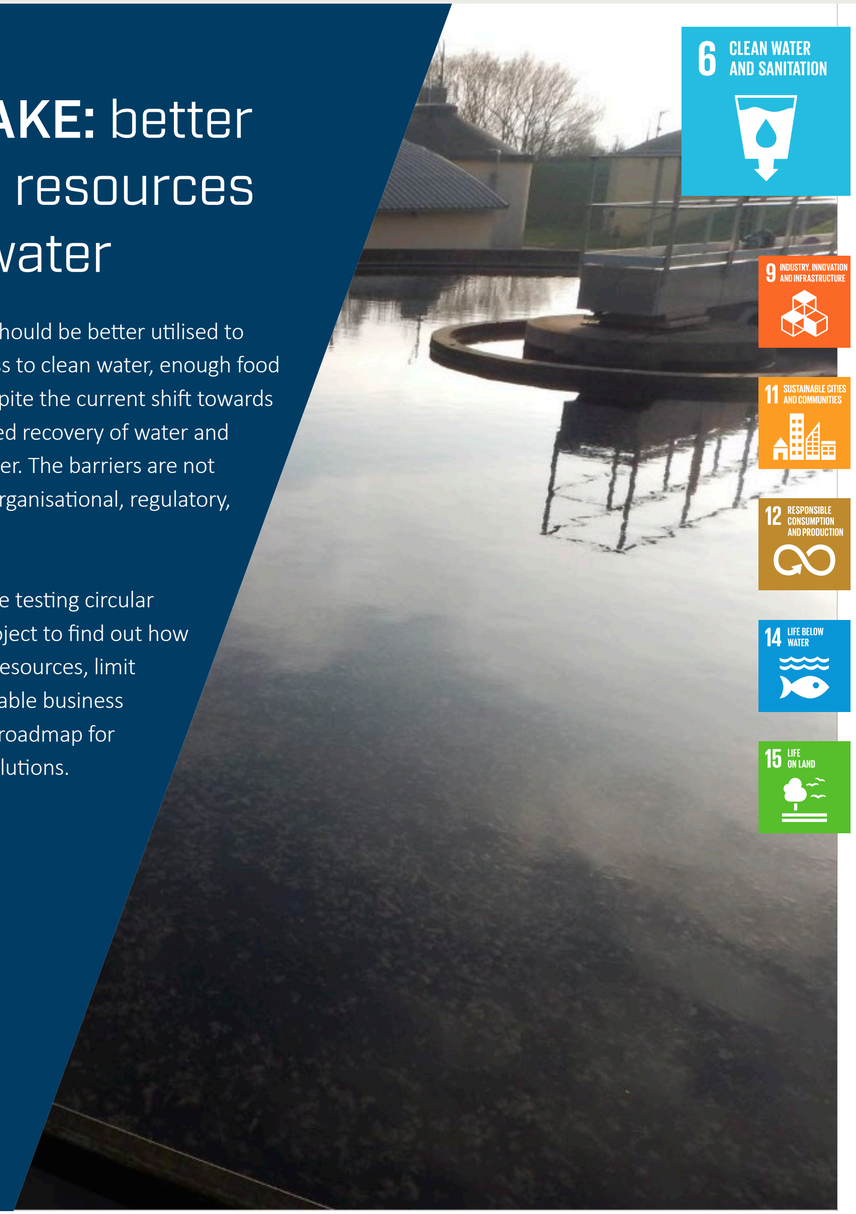
Clean water and sanitation also require new solutions, and these must be secured for the sake of the world's entire population. One of the consequences of climate change that we are experiencing today is large variations in precipitation. The frequency and intensity of precipitation has increased dramatically 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. In addition to this, there are concerns about emerging new 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 public 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, the maintenance lag with regard to existing infrastructure is huge, 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.

WIDER UPTAKE: better utilisation of resources from wastewater

Resources in the water sector should be better utilised to ensure that everyone has access to clean water, enough food and good living conditions. Despite the current shift towards circular economy, there is limited recovery of water and other resources from wastewater. The barriers are not only technological but also of organisational, regulatory, social and economic character.

Researchers in five countries are testing circular economy solutions in an EU project to find out how to make the best use of water resources, limit discharges and develop sustainable business models. The final outcome is a roadmap for wider uptake of water-smart solutions.



SDG:

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 Norwegian industry. The requirements of the Water Framework Directive 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, rather there is a strong sense of social responsibility. In other cases, the challenges are owned by business.

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 optimum 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 deal with the consequences of climate change in the form of stormwater management, use of reservoirs for flood protection, 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 in order 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.

Life on Land

The UN's Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), which launched its latest report[26] in 2019, points out that biodiversity and nature-based solutions, i.e. solutions that are developed on nature's premises, will be crucial in avoiding what they refer to as ecocide, ecological suicide.

The services that the ecosystems provides in our society are often perceived as underlying automatic and free services. Modern society poses an increasing threat to these services and our knowledge of nature's carrying capacity is quite limited. For example, it is only recently that the importance of insects and their dramatic decline has gained attention. We do not really have any good alternatives to bees, flies, butterflies, and bats for such purposes.

In SINTEF we have grown our attention to the inextricable links between climate, biodiversity and human futures. As IPBES points out, we need to see these as a whole and suboptimal solutions must be avoided. In our strategy review in 2020, we have therefore decided to strengthen our efforts to take greater account of life on land.

We view critical conditions in nature as fundamental for our activities. We work towards increasing our contributions to sustainability through cooperation with other research groups that work with natural systems and ecosystem services and diversity.

In total for 2020, 5 per cent of our turnover was linked to the goal Life on Land. We assume that the activity is greater, and this will be addressed in our future work on tagging projects.

We can also see that it is not always the case that one has to choose between the climate and life on land. Many of our projects contribute to both Life on Land (including freshwater) and Climate Action simultaneously. We see that the EU sustainable finance taxonomy can also be applied to our project portfolios and the 'do no significant harm' criterion will have an automatic effect on our contribution to a sustainable world. Biodiversity thus becomes much more concrete in our approach through research. Natural risk has become clearer in recent years and is a framework condition for all human activity.

Project turnover:

160 MNOK

Start-ups:

0

[26] IPBES, "Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services", 2019. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn, Germany. https://www.ipbes.net/global-assessment

In 2017, SINTEF established the group-wide initiative Food and Agri, which has strong links to solutions that address Life on Land. The forestry industry has been included in the initiative in order to contribute to greater efficiency, profitability and climate-friendly production and processing of raw materials.

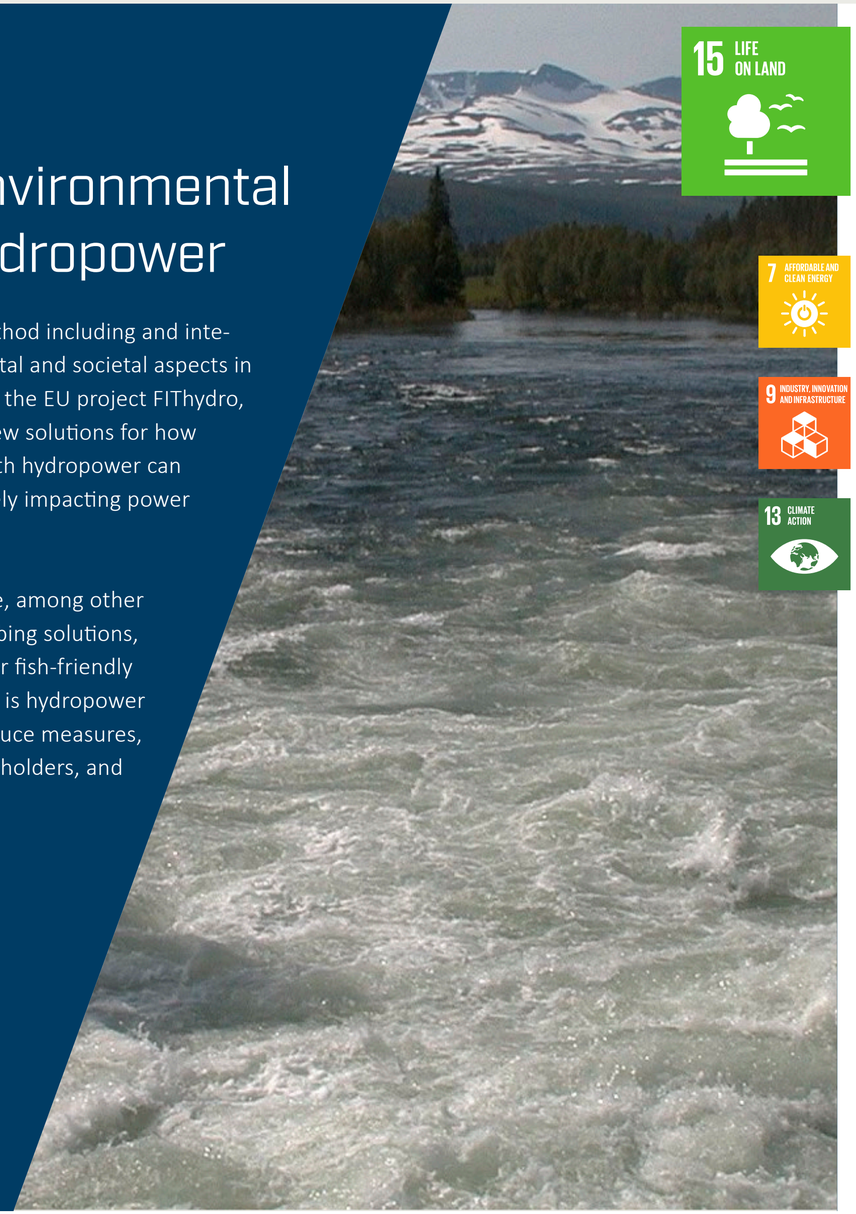
SINTEF's work for the goal of Life on Land is linked to a number of activities and areas of expertise such as:

- Integrating economic, technological, social, and environmental impacts in the work on environmental design of hydropower and other renewable energies, as the example on the right shows. This includes good solutions for life in freshwater.
- Sustainable management of water resources that protects life in freshwater at the same time as ecosystem services and other services contribute to societal development.
- Sustainable harvesting of terrestrial biomass for energy purposes.
- Technology and process development for the full utilisation of bioresources.
- Production of biochar using bioresources from the oceans and land.
- Energy optimisation and the development of new solutions using renewable energy in food production.
- Digitalisation of food production, which in many cases has contributed to better animal welfare, biodiversity, and less use of herbicides.
- New technology and processes for using residual biomass from the ocean, with biomass from soil and forestry, together with sustainable assessments of biobased products in a circular economy context.

FIThydro: environmental design of hydropower

Environmental design is a method including and integrating technical, environmental and societal aspects in renewable energy projects. In the EU project FIThydro, researchers are developing new solutions for how conditions for fish in rivers with hydropower can be improved without negatively impacting power production.

Researchers from SINTEF have, among other things, launched a wiki describing solutions, methods, tools and devices for fish-friendly hydropower. The target group is hydropower producers who want to introduce measures, consultants, authorities, stakeholders, and researchers.



THE PROJECT ALSO CONTRIBUTES TO:

SDG:

15 LIFE ON LAND

7 AFFORDABLE AND CLEAN ENERGY

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

13 CLIMATE ACTION

Other Sustainable Development Goals

The project mapping shows that SINTEF has research activities aimed at other SDGs as well.

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 4) Quality Education
- Goal 10) Reduced Inequality
- Goal 1) No Poverty
- Goal 5) Gender Equality
- Goal 16) Peace, Justice and Strong Institutions

Together, this portfolio of projects was worth around NOK 91 million in turnover, or almost 3 per cent of turnover in 2020.

For example, we have elevated the topic of sustainable food to the highest level in SINTEF's corporate strategy, and therefore also focus 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.

Project turnover:

91 MNOK

Start-ups:

2

SINTEF's work on developing new solutions for more efficient and sustainable food production onshore and offshore means it has significant activities relating to food. 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. Good interaction between the agricultural and marine sectors will be crucial in feeding the world's growing population. In SINTEF, we are focusing on the interaction between technology and biology in order to develop solutions that result in good animal welfare. To ensure a high-quality end product, we have to understand how technology influences quality throughout the entire value chain, from production to the finished product.

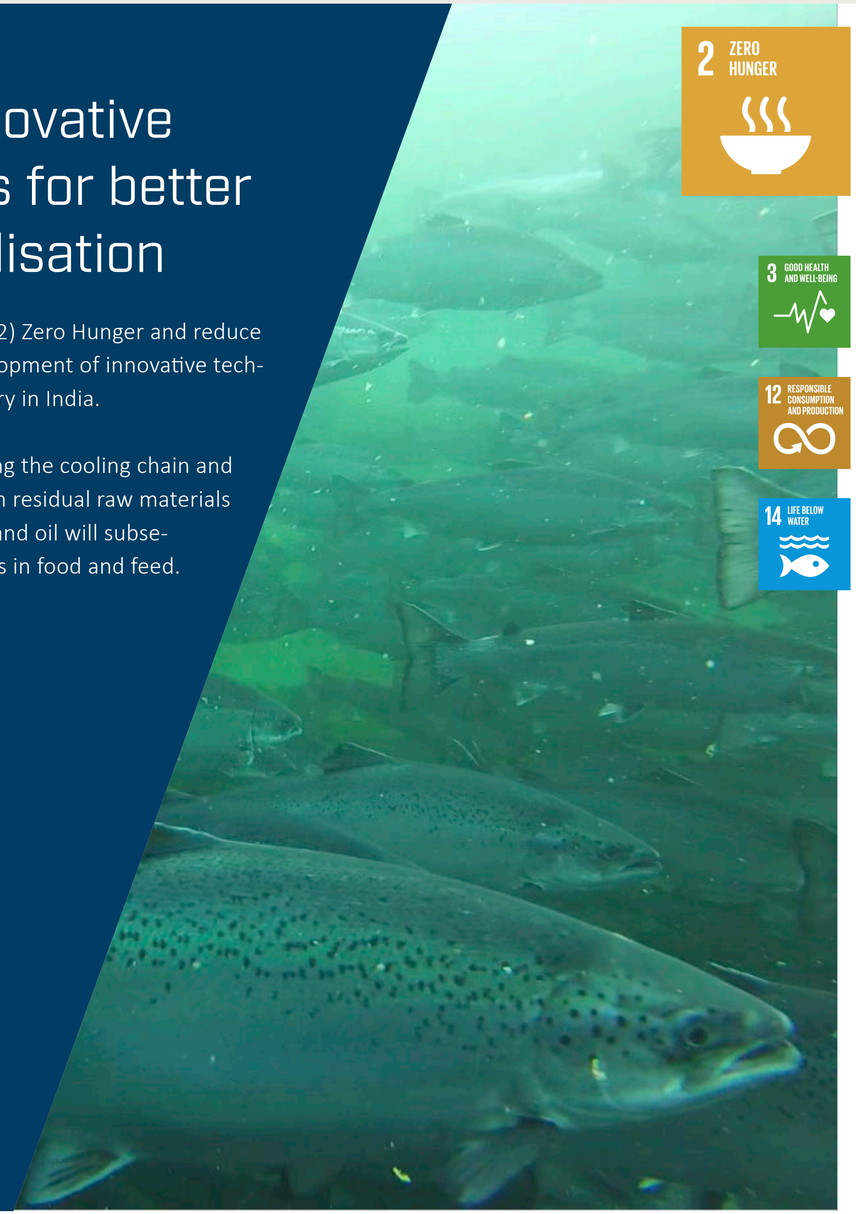
The total utilisation of all raw materials is a prerequisite for sustainable growth. The report, Value Creation Based on Productive Oceans in 2050, looks at the opportunities for achieving growth in bio-based industries in the lead up to 2050.[27] It points to six areas in particular as having significant 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 are relevant to all of these areas and seeks to contribute to the responsible utilisation of resources and value creation. The report "Value creation through increased cooperation between aquaculture, agriculture and forestry in Trøndelag" identifies areas where interaction between the marine and agricultural sectors can create sustainable growth in the circular bioeconomy.

The group-wide Food and Agri project aims to contribute to more efficient , profitable, and climate-friendly production and processing of raw materials, not just from the sea but also from fields and forests, as described, for example, under goal 13) Climate Action.

ReValue: innovative technologies for better resource utilisation

ReValue aims to achieve goal 2) Zero Hunger and reduce food waste through the development of innovative technologies for the Surimi industry in India.

The method involves improving the cooling chain and extracting protein and oil from residual raw materials and wastewater. The protein and oil will subsequently be used as ingredients in food and feed.



SDG:

THE PROJECT ALSO CONTRIBUTES TO:

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

14 LIFE BELOW WATER

[27] "Value Creation Based on Productive Oceans in 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 August 2012. https://www.sintef.no/siste-nytt/verdiskaping-basert-pa-produktive-hav-i-2050/

Similarly, SINTEF's corporate strategy has also elevated the topic of smart and secure communities to the highest level. Much of this work therefore also focuses on goal 16) Peace, Justice and Strong Institutions, even though few of our research projects are tagged with this goal.

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 functions, 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. National thanks to the establishment of the Gemini Centre – Resilient Critical Infrastructures and Societies, and international thanks to the EU's research programme, including through the DARWIN project coordinated by SINTEF being mentioned as one of only 10 projects in the EU's own midway evaluation of the framework programme, Horizon 2020. SINTEF also bore technical responsibility in the EU's SmartResilience project, which developed an advanced method, based on indicators, for scoring the resilience of infrastructure. In total, through the EU's research programme for "Secure Societies: Protecting freedom and security of Europe and its citizens", SINTEF has raised project funding worth EUR 10.5 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 a joint effort in which everyone will contribute to coordinating, sharing, and producing new knowledge related to the crisis. One of the products of this joint 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 show an example of SINTEF's work on goal 16) Peace, Justice and Strong Institutions on the next page, followed by descriptions of activities within other SDGs.

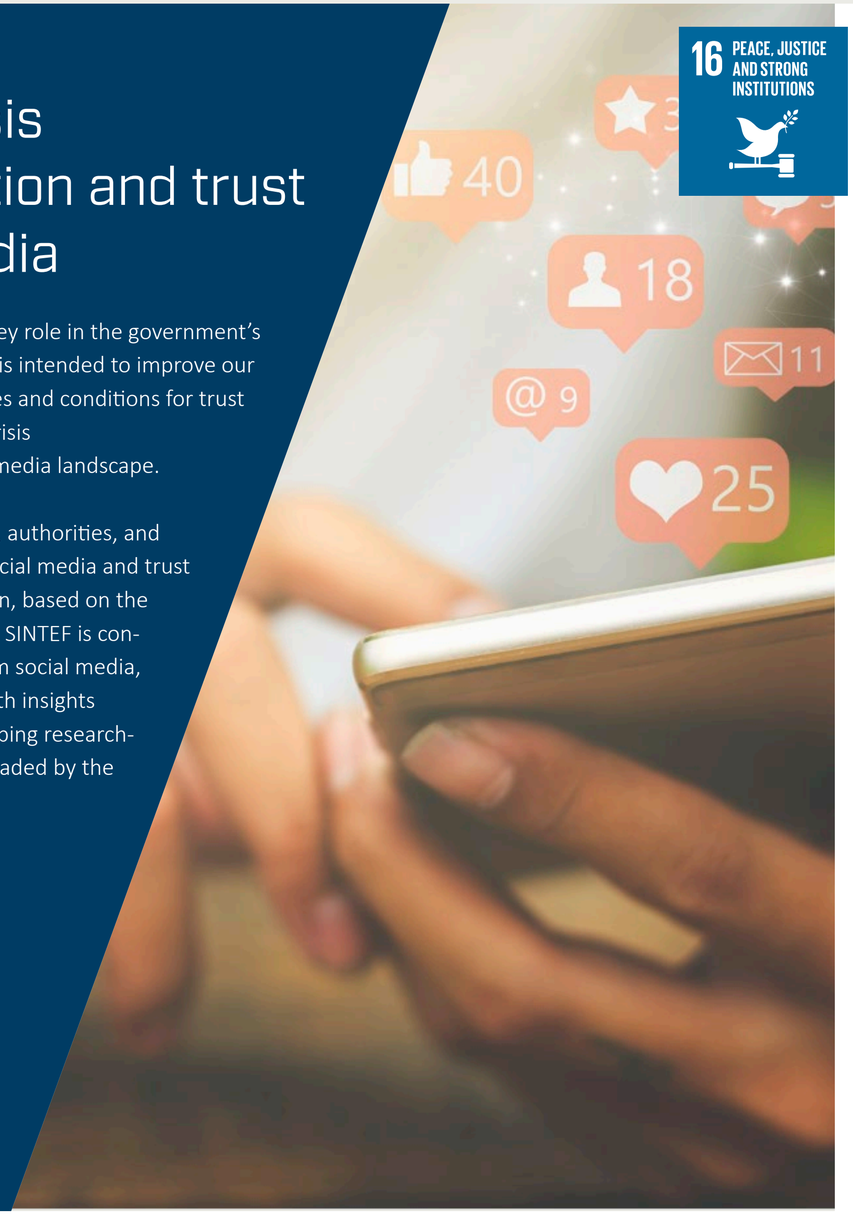
PAR-TS: crisis communication and trust in social media

Language and rhetoric play a key role in the government's handling of crises. The project is intended to improve our understanding of the challenges and conditions for trust and building trust in risk and crisis communication in a changing media landscape.

The aim is to advise the media, authorities, and public on the importance of social media and trust in risk and crisis communication, based on the handling of the Covid-19 crisis. SINTEF is contributing by analysing data from social media, facilitating combining these with insights from opinion polls, and developing research-based advice. The project is headed by the University of Oslo (UiO).

SDG:

16 PEACE, JUSTICE AND STRONG INSTITUTIONS



KiDiCoTi: Kids' digital lives in COVID-19 times

The world is facing a pandemic that has presented major social challenges. In the project, we have looked at how changes in the educational situation, leisure time and home activities have impacted children and young people and their families' lives. The theme of the study is related to children and young people's online activities in relation to education and homeschooling, communication and social interaction, leisure and leisure activities, and well-being and health.

The project is a community effort involving researchers from 15 countries led by the European Commission. The Norwegian part is a collaboration between NTNU (project manager), SINTEF and UiO.

SDG:

4 QUALITY EDUCATION

THE PROJECT ALSO CONTRIBUTES TO:

3 GOOD HEALTH AND WELL-BEING

5 GENDER EQUALITY

11 SUSTAINABLE CITIES AND COMMUNITIES

17 PARTNERSHIPS FOR THE GOALS

rAPID Assistive Technology Assessment: health for the whole world

An inclusive society is a prerequisite for achieving the SDGs. Without technical aids that improve accessibility to schools, workplaces and services, people with disabilities are at risk of living a life in poverty. The World Health Organisation (WHO) estimates that one billion people need technical aids, while only one in ten in low and middle-income countries have their needs met.

SINTEF is heading a global data collection for the WHO, where the purpose is to obtain an overview of the use and unmet need for assistive technology and the barriers that exist. Results from the study will be included in the Global Report on Assistive Technology, to be launched in 2022 by WHO and United Nations International Children's Emergency Fund (UNICEF).

SDG:

THE PROJECT ALSO CONTRIBUTES TO:

1 NO POVERTY

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

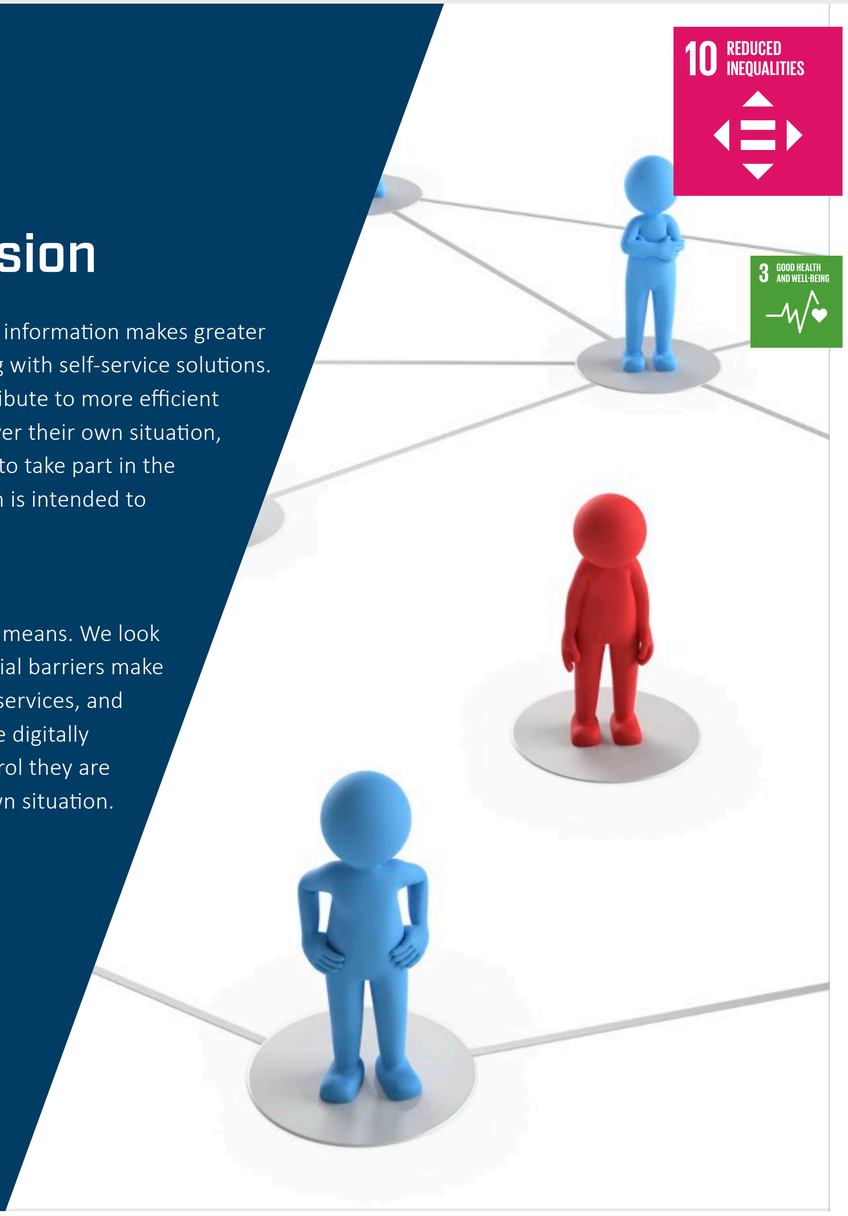
4 QUALITY EDUCATION

8 DECENT WORK AND ECONOMIC GROWTH

Digital exclusion

Digitalising public services and information makes greater demands of the public's coping with self-service solutions. For many, such solutions contribute to more efficient services and greater control over their own situation, however, not everyone is able to take part in the expected benefits digitalisation is intended to provide.

The project explores what the concept of digital vulnerability means. We look at what health-related and social barriers make it difficult to use public digital services, and whether these services provide digitally vulnerable users with the control they are supposed to gain over their own situation.



SDG:

THE PROJECT ALSO CONTRIBUTES TO:

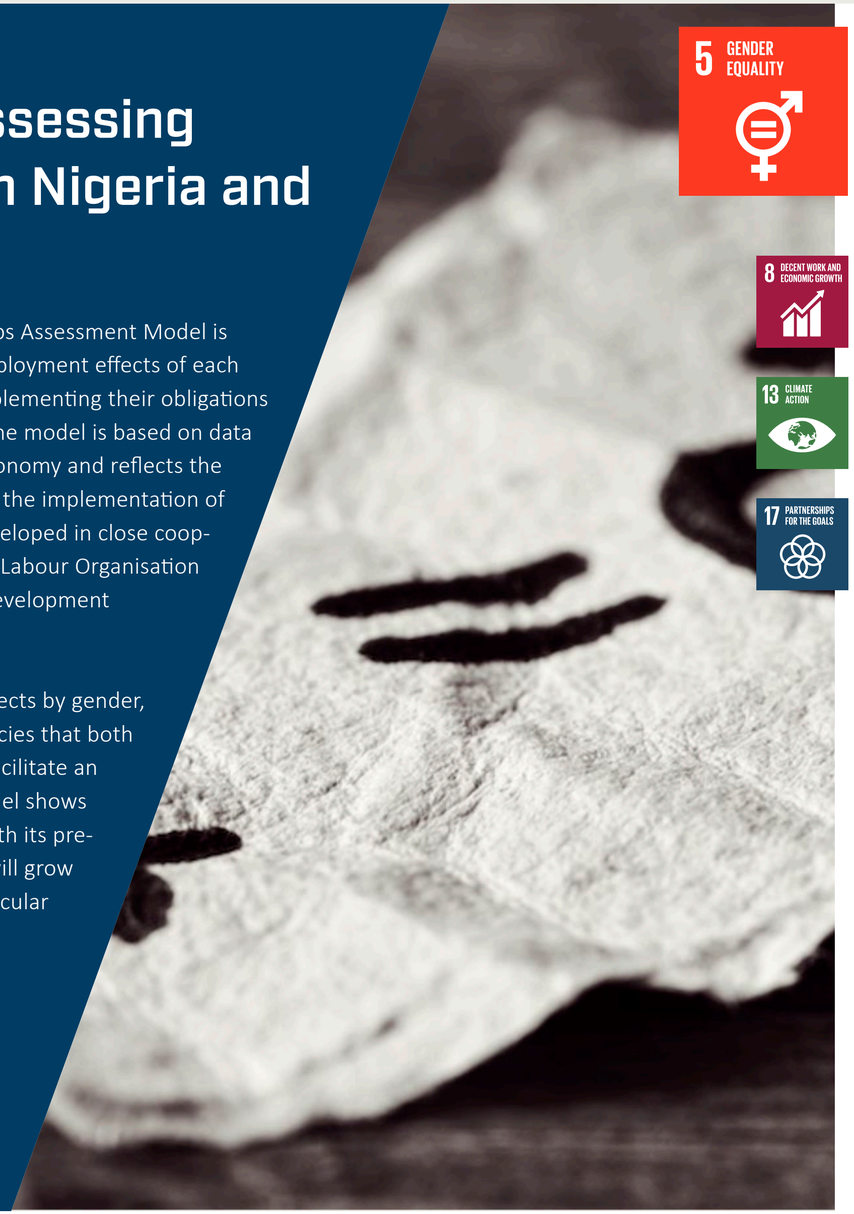
10 REDUCED INEQUALITIES

3 GOOD HEALTH AND WELL-BEING

Model for assessing green jobs in Nigeria and Zimbabwe

The objective of the Green Jobs Assessment Model is to measure the social and employment effects of each country's local policies for implementing their obligations under the Paris Agreement. The model is based on data on the individual country's economy and reflects the structural changes that follow the implementation of measures. The model was developed in close cooperation with the International Labour Organisation (ILO) and is used by the UN Development Programme.

By describing employment effects by gender, one will be able to design policies that both address climate change and facilitate an equal labour market. The model shows that it is the service sector, with its preponderance of women, that will grow with the transition to more circular production regimes.



SDG:

5 GENDER EQUALITY

THE PROJECT ALSO CONTRIBUTES TO:

8 DECENT WORK AND ECONOMIC GROWTH

13 CLIMATE ACTION

17 PARTNERSHIPS FOR THE GOALS

SmartFab: transforming Norwegian commodity producers into smart and green lighthouses

The project is developing innovative solutions to transform Norwegian small and medium-sized (SME) factories and their value chains into smart and sustainable lighthouses in the national and international market.

By collaborating with SINTEF, SMEs gain access to research-based methods for developing circular business models, sustainable products, production logistics systems and digital twins for real-time monitoring and management.

SDG:

17 PARTNERSHIPS FOR THE GOALS

THE PROJECT ALSO CONTRIBUTES TO:

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

8 DECENT WORK AND ECONOMIC GROWTH

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

4

SINTEF's operations and management are based on sustainable principles

A non-profit research group tasked with realising the Foundation's purposes

As a foundation, SINTEF has no owners, but it does have a responsibility to fulfil its purpose and societal 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 non-profit foundation 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, businesspeople, experts from 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 presents our financial results.

SINTEF's operations and management are based on sustainable principles

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 in SINTEF's agenda. SINTEF established the position of EVP Sustainability in 2015 as an expansion of the position of Climate Director (2012-2015), formerly known as the Climate Technology Director (2008-2012). The position has been part of the group management team since 2008.

Historically, SINTEF's reporting on its internal sustainability performance has not been as high a priority. We are now working systematically on the development of balanced management goals and performance indicators to ensure follow-up, results and continuous improvement.

The EU action plan for sustainable finance and the associated taxonomy are highly relevant for SINTEF's work on sustainability. This is a completely new EU regulatory framework that is under construction with the aim of promoting sustainable investment, and which has gained a lot of attention. The regulations are recognition that the EU states will not achieve their climate targets without setting clear and strict guidelines for the financial sector, such that private capital is channelled in a green and sustainable direction. At the heart of the taxonomy lies the role of research and innovation, which will help companies and the public sector achieve the EU's climate targets. SINTEF has started to assess ongoing and future projects in relation to the taxonomy; not only to ensure that our own activities are compatible with the regulations, but also to build up knowledge we can share with future customers and partners.

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-house 'Green Teams' have been established (environmental working groups) at institute and group levels with responsibility for our 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 systems are 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.

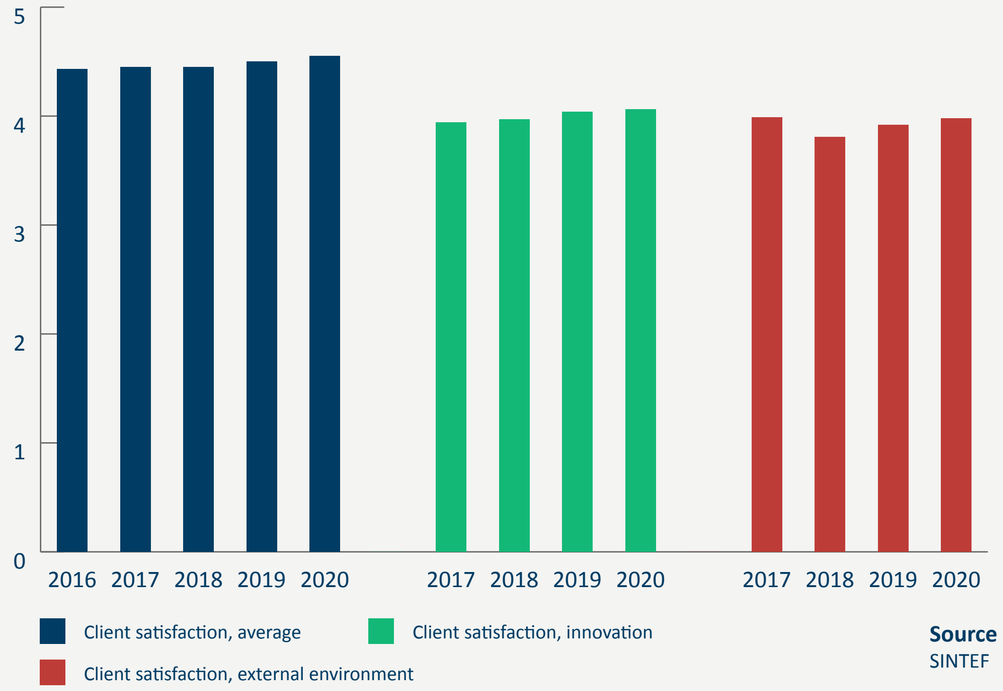
SINTEF conducts ongoing client satisfaction surveys. The survey is sent to contact people in private and public organisations after projects are completed and we receive around 500 responses annually. The 2020 survey shows a satisfaction score of 4.55 measured on a scale from 1 to 5. Our score has developed positively since 2017 and the average for 2020 was the highest since the survey started in 2013. Projects that 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 of our 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 believe this is due to many clients not viewing innovation and the environment as key factors in many of the projects they take part in, and we can also see that many mark these categories as 'not relevant'. We are assessing the possibility of improving and clarifying the questions in order to facilitate more engagement and clearer evaluations on the part of the client of how the partnership with SINTEF is contributing, or could contribute, to greater 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. The supplier is subject to an evaluation in all procurements worth more than 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 signed 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)



Source
SINTEF

SINTEF wants to reduce its climate footprint

SINTEF's environmental policy governs how we should 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 social 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 2020, the information on our energy-related CO_2 emissions includes buildings managed by SINTEF Eiendom and owned by the SINTEF Foundation. 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. Nonetheless, SINTEF is working to improve and reduce energy use in areas where this is possible. In 2020, we continued to work on the rehabilitation and efficiency of heating systems, installation of combined cooling and heat pumps, and replacing all light sources with LED. SINTEF's water consumption varies greatly in the different buildings and reflects the proportion of the space used for laboratories. In 2020, we strived to achieve a stable basis for reporting from our water metres in relation to our energy monitoring system. This work will continue in 2021.

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 all 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. In particular, we are 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. Modernisation of our premises in Forskningsveien 1 in Oslo started in 2020 with a budget of NOK 165 million. The project was supported by ENOVA because it is innovative and will, among other things, result in energy efficiency gains of 1,550,000 kWh per year and have a direct climate impact in Norway of 9,672,000 kg CO_2e per year. In the case of property rehabilitation, the standard being strived for is BREEAM-NOR ***Very Good***.

	2016	2017	2018	2019	2020	KPI
Total energy GWh	28.58	28.65	26.96	25.95	25.23	24.35 in 2021
Reduction (from 2017) in energy consumption			Reduction of 5.7%	Reduction of 9.2%	Reduction of 11.9%	>15% reduction in 2021 measured in relation to 2017[28]
Metric tons of CO_2 from energy in owned/managed buildings				2,588[29]	2,517	None
Source separation rate Trondheim	24	33	37	47	43	>60
Source separation rate Oslo	42	42	37	29	35	>60
Mains water consumption in millions of litres				31	29	None

[28] In SINTEF's building operations by the end of 2021, measured in relation to 2017. The reduction is an estimate.
[29] In 2019, the emissions were incorrectly reported as relating to Trondheim only, but they actually covered all owned/managed buildings.

Travel

SINTEF's ambition is to be a world-leading research institute. At the same time, we want to reduce our climate footprint from travel. Some travel activity will be required when an organisation, its customers and its partners are based in different locations across Norway and the rest of the world. This must be taken into consideration when assessing which travels to conduct.

The table below summarises emissions from SINTEF's business flights, which is the travel activity we measure in relation to CO_2 emissions.

The Covid-19 pandemic resulted in significantly less travel in SINTEF in 2020 and CO_2 emissions from business flights were cut by approximately 80 per cent from 2019 to 2020. During this year of minimal travel, we learned that we are quite capable of interacting via digital solutions. We can build good relationships and produce results that are important for society, even when we are not present in person. This has helped increase our motivation to reduce our travel activities and eight out of ten employees in SINTEF say that it is possible to travel less than we did prior to the Covid-19 crisis.

	2016	2017	2018	2019	2020
Kg CO_2 per FTE from domestic flights	446[30]	444[30]	427[30]	607	135
Kg CO_2 per FTE from international flights	839[30]	784[30]	792[30]	849	146
Total metric tons of CO_2 from flights	2342[30]	2219[30]	2244[30]	2534	519

Source: SINTEF

The experiences from this period have provided a good basis for discussions in the organisation about our history of emissions and the need for travel going forward. Despite the fact that we expect the need to travel to increase when the Covid-19 restrictions no longer apply, all of the institutes believe that they can reduce their travel activities compared with the last normal year, 2019. We are currently working on detailed guidelines and targets for the organisation as a whole.

SINTEF's aim is to ensure that decisions about when travel is necessary are properly thought through so that we all contribute to achieving our shared ambition of reducing emissions.

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 want to achieve climate neutrality and aim to do so through both direct action in their own operations and compensatory measures. 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. In the coming years, we will spend NOK 7 million annually on such a compensation scheme, which will 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.

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

HSE is a top priority in SINTEF

HSE is a top priority in SINTEF. This means that we will 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.

Our goal is zero injuries and accidents, and we are always trying to improve preventive measures. A total of 13 personal injuries were registered in 2020. This represents a reduction of 35 compared with 2019. Of the injuries sustained in 2020, five required medical treatment while eight required first aid. None of the injuries resulted in sick leave. This results in lost time injuries (LTI) and total recordable injuries frequency (TRIF) values of 0 and 1.7, respectively.

In 2020, SINTEF's sick leave rate was 3.1 per cent, with work-related sick leave at 0.2 per cent.[31] All sick leave is followed up by the institutes. The line manager stays in close contact with the person on sick leave. To prevent sick leave, line managers are to follow SINTEF's management principles.

Handling chemicals is an important topic in SINTEF's risk matrix. In 2020, this was included as a priority area in the continuous HSE improvement process in SINTEF. A survey has been conducted among approx. 540 employees with different roles linked to the life cycle of chemicals. Overall, the survey shows that chemicals are handled correctly, but some areas for improvement were identified. There is a need to strengthen safety and good practices, which is also shown by audits and reported HSE cases. We will continue to improve the quality of risk assessment for chemical handling in projects, ensure chemicals are properly labelled and stored, and make sure that employees are using the exposure register as required. Various measures to raise competence is essential and this will, amongst others, include an internal campaign.

Sick leave

Source
SINTEF

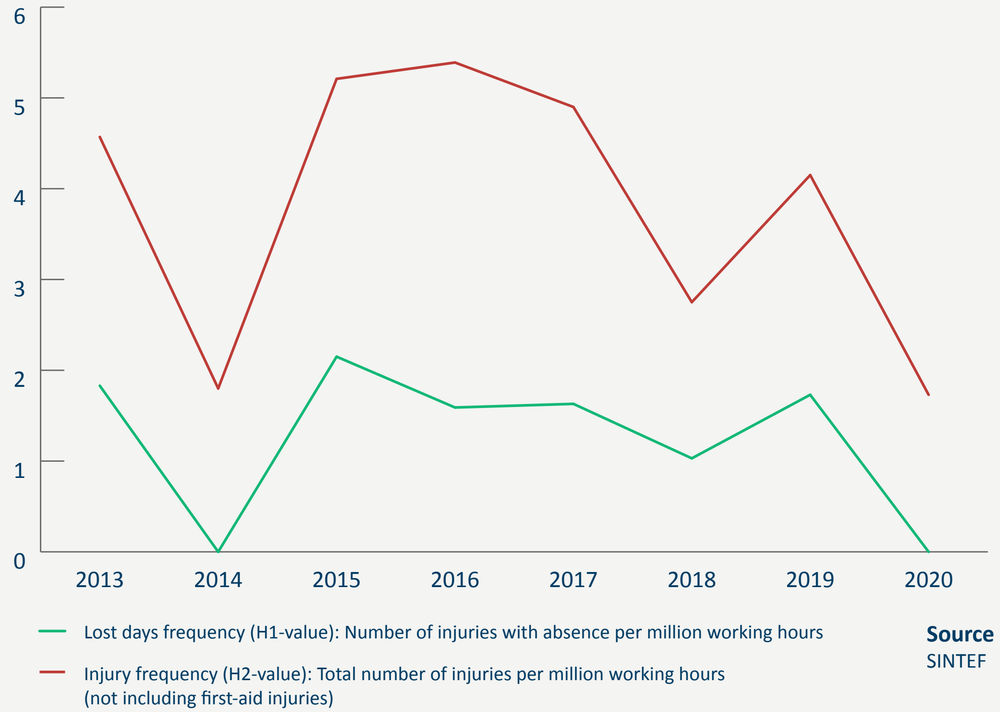
[31] New calculation method from 2019 based on guidelines from Statistics Norway.

All HSE reports are reported to the group management team on a weekly basis. Of the around 320 HSE reports in 2020, 24 were accidents and 14 were near accidents, which represents a significant decrease compared with 2019. The number of hazardous situations reported per 100 FTEs was reduced from 27 in 2019 to 15 in 2020. One possible reason for the decrease is that fewer employees have been physically present in the workplace due to the pandemic, although at the same time SINTEF's laboratories have been fully operational the entire time. Reported hazardous situations and observations provide key information to improvement work, and it is thus necessary to focus on increasing reporting.

Cooperation and sharing of experiences are important for increasing the safety of employees and partners. We produce 'HSE one pagers' to encourage learning after incidents, near accidents and reported hazardous situations. These one-pagers contain a brief description of the causes and provide learning points from the incident. These are shared in the organisation and used in many contexts, such as management meetings, departmental meetings, working environment committee meetings and external meetings.

SINTEF has coordinated operations with several organisations, such as NTNU and UiO. Good cooperation on safety is important and focusing on sharing experiences from incidents is especially important.

Total recordable injuries frequency (H1- and H2-value)



Source
SINTEF

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

SINTEF remains a very attractive place to work. This is demonstrated by, among other things, the substantial increase we saw in applicants for our advertised positions in 2020. Another sign of this is the Career Barometer's survey of which employers students find attractive. This ranked SINTEF in first place for the fourth year in a row.[32] In the major Universum ranking of attractive employers in 2020, SINTEF is ranked as number six by Norwegian university and university college students taking technical and natural science subjects.[33] When we look behind the figures, we can see that nationally we are the second choice of women in this group and the eighth choice of men. The surveys also show that we are an overall second choice among students from NTNU. This is an improvement from isf on fifth place in 2019. SINTEF is also number two at UiO, an improvement of one place from 2019. This shows that our results-oriented employer branding work targeted at these institutions and others has borne fruit. However, we cannot rest on our laurels. Recruiting the most talented people remains demanding in a number of fields and we are not satisfied with being ranked 30th by ICT students in the Universum survey. As far as surveys among working professionals within natural science and engineering subjects are concerned, we are in a pleasing third place. We are number one among women and number five among men.

When the survey respondents were asked why they would choose SINTEF the answers were fairly unambiguous: an inspiring purpose, opportunities to have an impact, social responsibility, sustainability, and a good, creative, and dynamic working environment.

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 broad 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. SINTEF's strategy for people also states that all employees are expected to contribute to diversity through 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 28 per cent of all of SINTEF's employees in 2020 came from countries other than Norway. In total, they represent 74 different countries with the largest groups with international backgrounds coming from Germany, France, Italy, and Sweden. This shows that SINTEF is an attractive place to work for international researchers and that we are helping to recruit highly qualified labour to Norway. SINTEF has established an integration programme for international employees and their families to ensure international employees are properly looked after. The programme offers expat services, free Norwegian language courses and teaching in English in the SINTEF Academy. The working environment survey has documented that international employees enjoy working at SINTEF.

Diversity based on country of birth

	2016	2017	2018	2019	2020
No. of countries excl. Norway	74	75	72	74	74
Proportion of international employees	22 %	23 %	24 %	26 %	28%
No. of international employees	432	436	469	518	571

Source: SINTEF

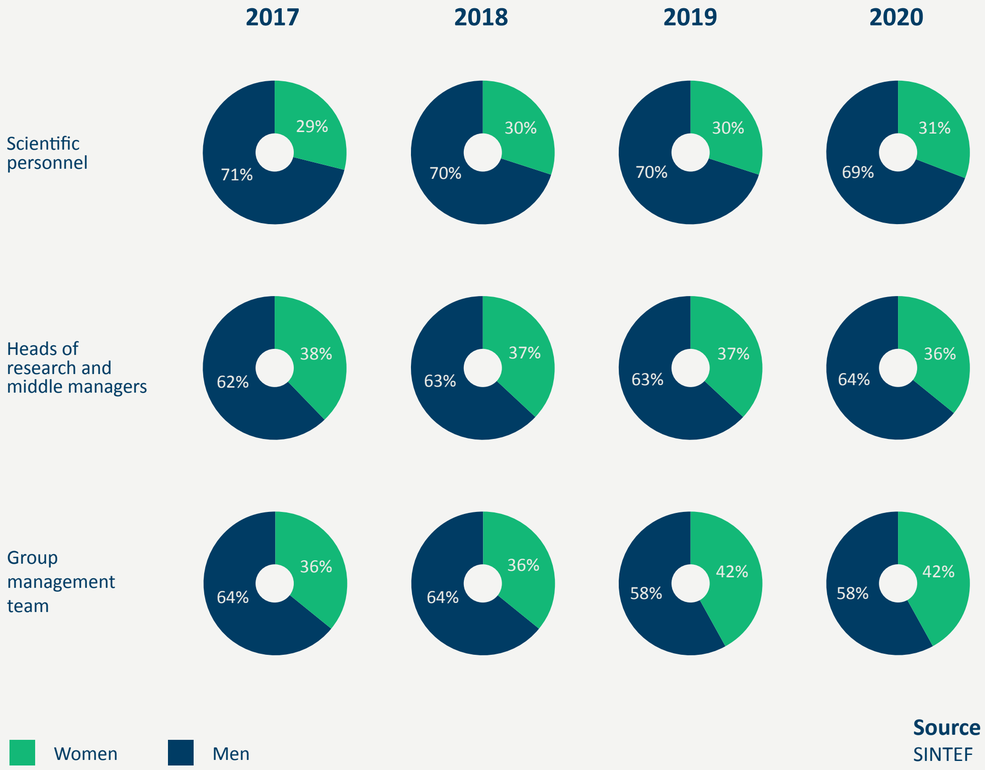
[32] KarriereStart.no, "Dette er de mest attraktive arbeidsgiverne blant ingeniør- og teknologistudentene." https://karrierestart.no/karrierebarometeret/2660-karrierebarometeret-2020-mest-attraktive-arbeidsgivere-blant-ingeniorstudenter
[33] Universum, "Norway." https://universumglobal.com/rankings/norway/

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. We are currently working on action plans to strengthen equal opportunities and diversity in SINTEF.

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 recruiting we focus on competencies, not 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 flexitime periods between 07:00-09:00 and 15:00-17:00. This is practised liberally, and most employees are able to make use of flexitime within core hours as well. Employees who have been on parental leave for more than three months in the last year receive at least 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 on a par with other Norwegian companies. A trade union representative attends all courses for new employees of SINTEF, both Norwegian and international employees. The representative informs the new employees 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



Source
SINTEF

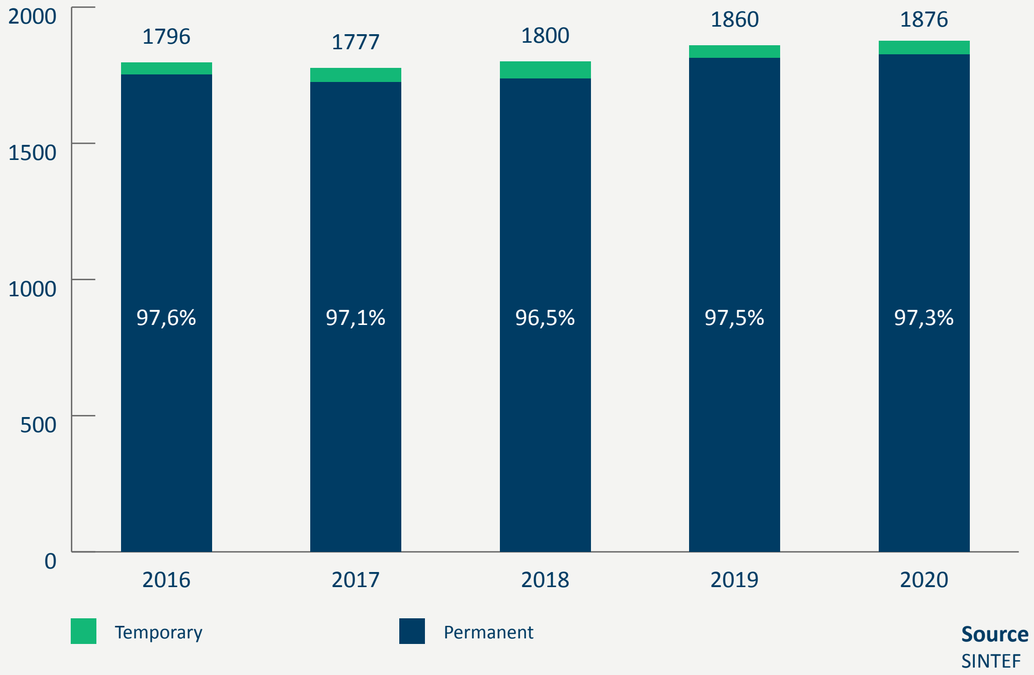
We also want to offer employees good conditions, across different life situations. SINTEF has a modern hybrid pension scheme with a maximum rate for contributions. An extra contribution is paid for women due to their higher life expectancy. Our insurance schemes are also very good. We emphasise having coverage that is as similar as possible at work and in leisure time, and we only make 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 purse, which is 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 high and in January 2021 it was 94 per cent. We want SINTEF to be an attractive place to work with unique development opportunities, which the working environment survey indicates it is. This is a consequence of the fact that we have done good work on developing SINTEF's working environment over time.

SINTEF has donated to the annual TV fundraising campaign since 2007, and in addition to a well-deserved Christmas gift for the employees, SINTEF also donated to NepaliMed Norway in 2020. The Christmas donation from SINTEF of NOK 100,000 will go towards buying protective equipment for healthcare workers in Nepal.

We employed around 2,000 people (1,876 full-time equivalents- FTEs) at the end of 2020. Some 62 per cent of SINTEF's researchers hold a PhD.

FTEs per December



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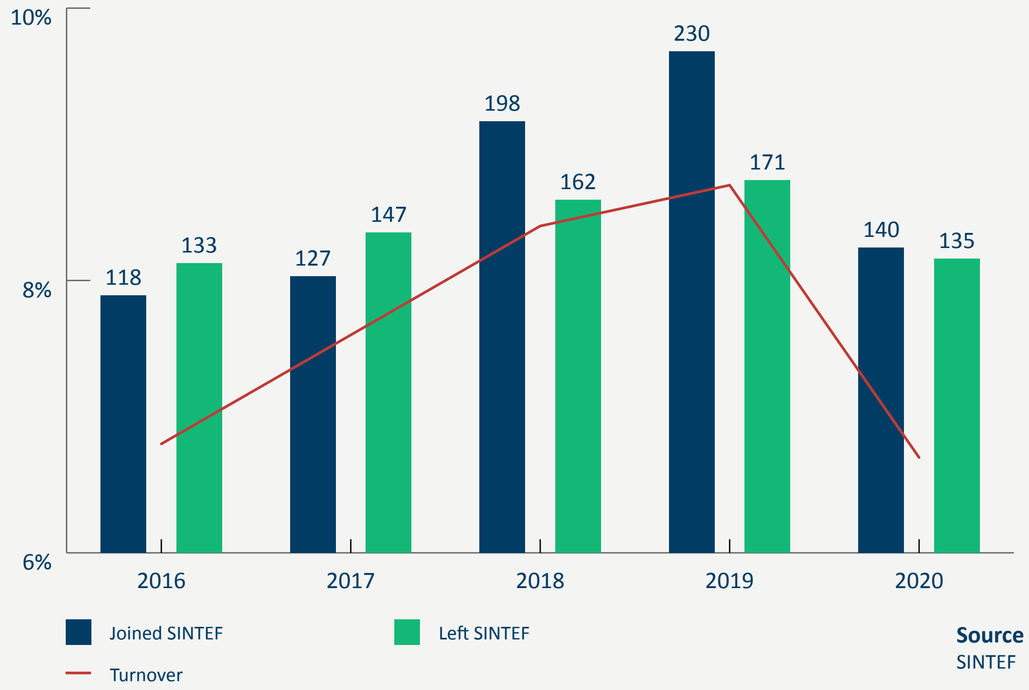
SINTEF

Most jobs in SINTEF are permanent positions. To the extent that temporary positions are used in SINTEF, this is done in special cases, such as temporary posts and to bring in particular expertise in individual projects. In 2020, 2.7 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 2020, 840 course days were completed in SINTEF, 300 of which were for new employees' participation in the two-day 'Welcome to SINTEF' course. Management programmes, project management training, and our digital academy with introductions and detailed training within machine learning and optimisation are also key parts of our training provision.

Employees and turnover



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SINTEF

Ethics, anti-corruption, and good management 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 SINTEF's operations.

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 2020. Nine project manager courses were completed with a dedicated module on ethics. A special course module on ethics and management has been produced for each of the management development programmes: '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 two management courses including ethics training were carried out in 2020. Work on a plan for an e-learning ethics module started in 2020 and will be completed in 2021. 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.

SINTEF's ethics ombudsman also received several questions about ethics from employees in 2020. These were largely about research ethics, including publication rules, line manager and project manager responsibilities and describing ethics in EU proposals. The ethics ombudsman took part in a range of departmental meetings, management meetings and meeting of the group management team in which the topic of ethics was discussed in 2020.

A new routine for in-house whistleblowing was drawn up in SINTEF in 2020, in compliance with the amended Norwegian Working Environment Act (1 January 2020). The routine states that SINTEF believes it is very important to ensure there is a good climate of freedom of expression in the organisation where employees are encouraged to report wrongdoing. The routine describes what is meant by wrongdoing, the whistleblowing procedure, the administrative procedures in whistleblowing cases, as well as the protection of whistleblowers and follow-up of whistleblowing cases. Three whistleblowing cases were reported in 2020 and were considered by a whistleblowing committee established in line with the new routine for whistleblowing. It found in favour of the whistleblower in one case. In the other case, the report was considered to be without merit. The third case will reach a conclusion in 2021.

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 particular 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 the work on our sustainability reporting and strategic questions for the future

SINTEF's diversity and role in society serves as good motivation for the work on sustainability reporting. 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 specific area we have continued to work on since the last report is the mapping of projects against the SDGs. We can see that projects need to be tagged with more goals; the SDGs are not achieved separately. It will only be when all of the goals have been achieved that the sustainability agenda will have successfully been achieved.

We are also working on clarifying our contributions within solutions that completely integrate biodiversity. It is pleasing to see that the registered activity towards achieving goal 15) Life on Land has increased in parallel with such ambitions. Nevertheless, there is still some to go. In the same way as we have strengthened our efforts in relation to the climate crisis in recent years, long-term solutions must be built that are resilient in relation to the crisis in nature in order to safeguard the biodiversity on which the planet and society depend.

We are working on how we can use our project SDG mapping as active management information and a basis for prioritising future focus areas. In 2020 and early 2021, we have worked on updating SINTEF's strategic objectives. Societal impact and our contribution to the UN SDGs are at the top of the hierarchy of objectives and will influence internal priorities and follow-up in the organisation. Among other things, we will continue 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, to an even greater degree, let project ideas spring directly from the major societal challenges SINTEF is meant to help solve.

We also acknowledge that the mapping indicates how much clients, the authorities and SINTEF invest in each SDG through our research and innovation projects, although this does not fully show "how much sustainability SINTEF produces." Work on the reporting, as well as our engagement with customers and the support system, has clarified the need to continue the work on measuring the effects of the 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. We will continue to work on methods that more clearly show the aggregated effects of our activities. In this context, effects on climate and value creation are two key areas. Further quantification of our reporting is a clear ambition for subsequent sustainability reports. Similarly, we will assess ties to external standards and assurance.

Given the need to evaluate effects, we have high hopes for a new and exciting field of research we are developing in SINTEF where we assess the impact of new technologies and alternative 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 assessing this. Taking this as our starting point we have initiated a major project aimed at developing 'systematic assessments of sustainability impact' in SINTEF in 2019/2020 in order to model the scaling up of new technologies, how they affect and change global value chains, and what long-term effects these changes to the value chains and the new technologies will have with respect to sustainability. The effects will be measured and assessed with the aid of the 17 UN SDGs and their indicators. This framework could be used by clients who want to analyse the impact they are having on society, or internally in SINTEF to estimate the effects related to our research projects. It can also be used to analyse the effects of various policies going forward, or other future scenarios. We are developing new methods and combine existing modelling tools and different data sources and data to carry out this 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.

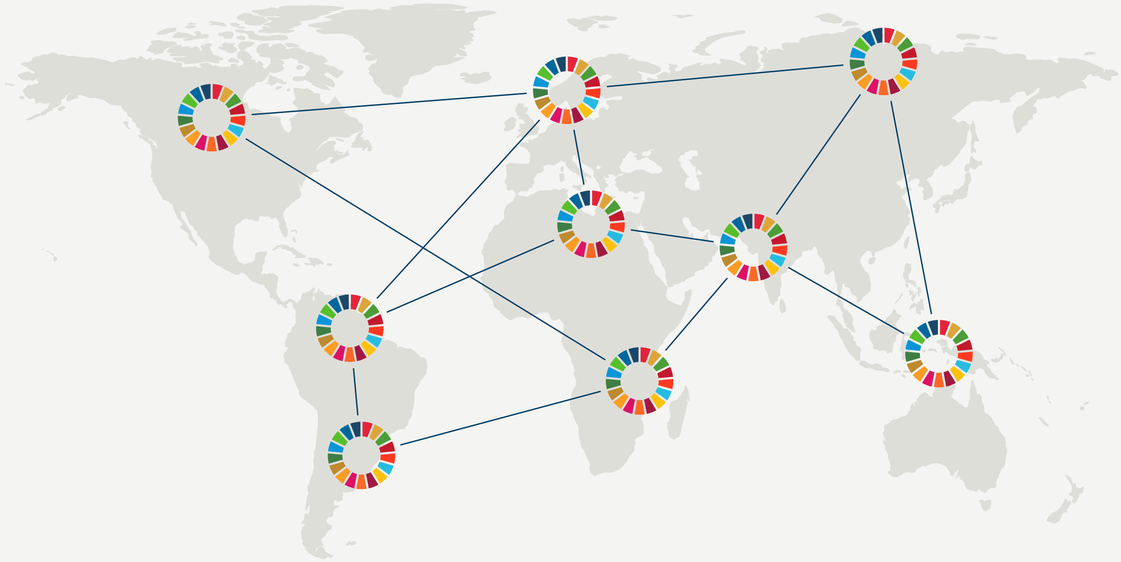

Illustration of how technology and product development and implementation impact global value chains and have effects in relation to the SDGs around the world.

The work on the sustainability reporting 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 management 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 also 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. We also have projects in SINTEF that contribute to development in the South (as demonstrated in various project examples). At the same time, we feel that capacity building, partnerships and the funding of such work must be on the agenda in 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/figures.
- Other use of SINTEF's data and content from, among other places, Sintef.no and Gemini.no.

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