



Sustainability Report

| 2022



Research for a better future

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Introduction from the CEO

IFE's vision is 'research for a better future'. Since its establishment in 1948, IFE has played a leading role in the development of Norway as an energy nation. IFE's research in energy, the environment and digital systems is our most important contribution to a more sustainable society, in Norway and internationally.

Sustainability has always been an important and integral part of IFE's work, but we are more familiar with it being referred to as safety, safety culture, taking care of the surroundings, social responsibility, and being a good workplace for our employees.

Since 2022, we have been working in a structured manner with sustainability, and this has laid the foundation for our first sustainability report. The report shows that we are making a substantial

effort in sustainability, but that we also have a way to go. Our employees contribute every day towards sustainability for IFE and society through their research and operations, but IFE does not yet have adequate systems and methodology to quantify the impact. We will work to improve this in the years ahead.

The nature of sustainability has changed in recent years, partly because several factors are regulated by national and EU laws, directives, standards and reporting, as well as board and management requirements and expectations from customers, partners and employees. IFE supports this development and has chosen to look to the new European Sustainability Reporting Standards (ESRS) as a framework and guide for our improvement work within sustainability.



Nils Morten Huseby
President

Photo: Birgitte Aarebrodt

Executive summary

Sustainability has always been an important and integral part of IFE's work. IFE is not subject to the EU Corporate Sustainability Reporting Directive (CSDR), but is committed to conduct its sustainability work in accordance with best practice reporting standards. IFE has therefore, on a voluntarily basis, chosen to take inspiration from the disclosure requirements under the ESRS that are relevant for IFE. This report does not, and does not intend to, fulfil all requirements of the ESRS. IFE's board has approved the sustainability report along with the annual report.

IFE started working systematically with sustainability in 2022. We identified applicable Norwegian laws and recommendations, relevant EU directives and the UN's Sustainable Development Goals (SDGs). A materiality and risk analysis was conducted, and relevant standards for sustainability reporting were mapped. IFE prepared the first greenhouse gas accounts for 2022 according to the Greenhouse Gas Protocol, and we developed our first sustainability strategy, a policy for human rights and requirement specifications to comply with the Transparency Act. In the report, we provide information about the governance, risk management and control systems that are relevant for the ESRS reporting.

IFE's main purpose is research in energy, the environment and digital systems, and this is our main contribution to sustainability – although it is difficult to estimate the sustainability effect from the research. Research in developing more sustainable solutions comes with a footprint. We use gases, chemicals, oils and other input factors that have a negative impact on the environment.

Under "Environmental sustainability, we elaborate on our work on environmental sustainability, our footprint and our efforts to reduce the environmental impact from our operations. We present our first greenhouse gas accounts, which show high CO₂ emissions due to the use of the greenhouse gas SF₆ at one laboratory. Radioactive emissions are carefully monitored, and these are very low and cause no harm.

IFE's sustainability strategy states that the safety of our employees and surroundings is always a top priority for IFE. Under "Social sustainability" we report on our work on social sustainability, which includes promoting diversity, equality, involvement and the welfare of our employees. IFE has initiatives in place to prevent discrimination of any kind, and systems for reporting concerns and ethical dilemmas.

IFE is subject to the Transparency Act that came into effect on 1 July 2022. In 2022, we developed policies and procedures for integrity due diligence (IDD) in procurement for new suppliers and business partners. IFE's management decided to introduce similar requirements for new collaboration partners, which goes beyond the scope of the Transparency Act. No suppliers, business partners or collaboration partners were subject to IDD in 2022 as the new requirements only came into effect in 2023. The report covers our obligation to publish a statement according to the Transparency Act.

About this report

IFE reports and communicates its work on sustainability in view of, and inspired by, the European Sustainability Reporting Standards (ESRS). IFE is not subject to the EU Corporate Sustainability Reporting Directive (CSRD) but is committed to conduct its sustainability work in accordance with best practice reporting standards. IFE has therefore, on a voluntarily basis, chosen to base its report on the general reporting principles and take inspiration from the disclosure requirements under the ESRS that are relevant for IFE. This report does not, and does not intend to, fulfil all requirements of the ESRS.

This report is also prepared in view of the expectations and guidance in the Financial Supervisory Authority's mapping of Norwegian enterprises' sustainability reporting (2020), Euronext guidance on ESG reporting (2020), the Task Force on Climate-Related Financial Disclosures (TCFD), the UN Sustainable Development Goals (SDGs) and OECD's Guidelines for Multinational Enterprises.

This sustainability report covers IFE's obligation to publish a statement concerning IFE's due diligence processes in accordance with the Transparency Act Section 5, cf. the Accounting Act Section 3-5, and the Accounting Act Section 3-3 (c).

IFE's Director of Strategy, Sustainability and Communication (SSC) is responsible for our work on sustainability, and has written the sustainability report, with contributions from the entire organisation. The sustainability report was approved by IFE's board along with the annual report.

Governance

General governance

IFE is a research foundation whose objective is to undertake, on a not for profit-basis and for the benefit of society, research and development (R&D) within energy and other areas that are particularly suited to the foundation's expertise. In 2022, IFE was a multi-faceted and diverse organisation which, in addition to R&D, has activity in property, radiopharmaceuticals and nuclear operations and safety.

IFE's vision is 'Research for a better future'. Each of our business areas has established a set of values that reflect its unique operating environment.

The values for the R&D business area, including property and corporate staff are 'passion, creativity and integrity'. For nuclear operations and safety, the values are 'safe, credible and responsible', while radiopharmaceuticals' values are 'partnership, precision, safety, innovation and agility'.

IFE currently has two important social missions: 1) Research for a better future and value creation in Norway, and 2) Safe decommissioning of nuclear facilities and disposal of nuclear waste after 70 years of nuclear operations in Norway. When the nuclear activity is transferred to the State, research and value creation will continue to be IFE's social mission.



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Photo: Espen Solli

IFE established a new corporate structure in 2022 through the establishment of several separate companies under the IFE foundation, to better enable development and manage risks related to the diverse business areas. The corporate structure will continue to be developed further in the coming years.

The Norwegian Parliament has decided that IFE's nuclear facilities and organisation are to be transferred to the Norwegian Nuclear Decommissioning Authority (NND), a state agency. On 1 March 2023, the radiopharmaceuticals division was separated into a wholly owned subsidiary, Agilera Pharma AS. IFE's properties at Kjeller and Halden will be developed, new laboratories and production facilities will be built, and work is underway to establish a research and technology park at Kjeller. Together with the research institutes NILU and NIVA, IFE has established the NORIN research alliance, with the ambition to be a Nordic champion within the fields of energy, climate, environment, digitalisation and civil protection.

IFE's sustainability report covers all activities in the foundation, including the wholly owned subsidiary IFE Invest AS.

IFE is certified according to ISO 9001 and 14001, Achilles JSO and Utilities. Agilera Pharma is certified

according to GDP and GMP¹ from the European Medicines Agency, but is not ISO certified.

IFE started working systematically with sustainability in 2022, with the assistance of external legal and other advisors. The first step was identifying applicable Norwegian laws and recommendations, relevant EU directives and the UN's SDGs. As IFE is a multi-faceted organisation, there are a number of laws that encompass sustainability within the scope of IFE's work, including the Atomic Energy Act, the Radiation Protection Act, the Foundation Act, the Norwegian Public Limited Liability Companies Act, the Planning and Building Act, the Working Environment Act, the Pollution Control Act, the Nature Diversity Act, the Environmental Information Act, the Public Procurement Act,² the Transparency Act, the Equality and Anti-Discrimination Act, the Act on Ethics and Integrity in Research, the Personal Data Act, the Penal Code and the Marketing Control Act.

A materiality and risk analysis has been performed to identify areas where IFE potentially has the most negative impact on the environment, as well as the areas where the foundation has the best opportunity to have a positive impact. The risk mapping is based on social, environmental and governance issues.

1) Good Distribution Practice and Good Manufacturing Practice

2) The Public Procurement Act only applies to IFE's nuclear activities as this is financed with government funds allocated annually from the national budget.

Relevant standards for sustainability reporting have also been mapped. IFE has decided to draw up a sustainability report based on the European Sustainability Reporting Standards (ESRS) and adapt it to our business. The ESRS was chosen because it is considered crucial to the future sustainability work of many businesses in Norway and the EU, and the standard will provide guidance for improving our work on sustainability.

IFE has also undertaken work to prepare greenhouse gas accounts for 2022, which form part of the sustainability report. An internal working group was established consisting of around 10 people who have received training in preparing greenhouse gas accounts according to the GHG Protocol.³

IFE's employees, customers, collaboration partners and regulatory authorities all have expectations in terms of sustainability. Sustainability is an important motivation for working at IFE, and employees naturally expect sustainability standards to be high in all areas. Our customers and collaboration partners have the same expectations. IFE is also facing higher expectations for systematic work within sustainability from financial institutions such as banks, insurers, and investors.

IFE's customers and those who commission our work have a strong focus on sustainability. In research projects funded by the Research Council

of Norway or the EU, there is a growing demand for the projects to contribute to the green transition and digitalisation of society and to support the SDGs and the EU's strategic shift towards sustainability. IFE works closely with the Norwegian and international manufacturing sector on R&D projects, where we play a role in developing more sustainable technology and solutions within energy, the environment, and digital systems.

IFE's Technology & Properties Division finds that collaboration partners, tenants, the local community and financial players all have a strong focus on sustainability, and they are seeking solutions in relation to IT and property. The division has held user meetings with internal and external tenants in 2022 in order to obtain input for the ongoing work on strategy and sustainability.

IFE's nuclear division works closely with the government agency Norwegian Nuclear Decommissioning Authority (NND). The safe operation of nuclear facilities and management of nuclear waste is closely related to the environmental aspect of sustainability and ensuring safe working conditions for employees.

IFE's customers and collaboration partners in radiopharmacy have a significant focus on sustainability. IFE is a contract manufacturer of the cancer drug Xofigo for Bayer. The Bayer Group

³) Greenhouse Gas Protocol



IFE's properties at Kjeller and Halden will be developed, new laboratories and production facilities will be built, and work is underway to establish a research and technology park at Kjeller. Photo: Grape Architects

has a strong focus on sustainability and has set specific targets for reducing CO2 emissions, waste, and packaging, among other things. In 2022, IFE held several meetings and workshops with Bayer to work together on sustainability in the production of Xofigo and will continue the dialogue in 2023 to set shared goals going forward.

Governance, risk management and control

IFE's board consists of seven directors. Five members are external, appointed by the Ministry of Trade, Industry and Fisheries, and two are employee-elected members. IFE's strategic plan and sustainability strategy, code of conduct, annual goals and sustainability KPIs are all subject to approval by IFE's board, which is also responsible for approving sustainability reports.

IFE's group management consists of the managers of all business areas and support staff. The group management make strategic decisions covering the entire foundation, including sustainability. The status of sustainability goals and KPIs will be followed up quarterly in group management meetings from 2023.

The different business areas hold meetings for employees to prepare their own strategies, of which sustainability is a part, and set annual targets and KPIs for sustainability from 2023. These will be followed up in management meetings in the respective areas.

IFE's Ethics Committee is chaired by the Director of Strategy, Sustainability and Communication (SSC) and consists of five employees representing different parts of the business. Two of these representatives are elected by the trade unions. There are two external members with expertise in research ethics and law. The Ethics Committee deals with matters reported by managers or other employees, and gives advice to the CEO, managers and other employees on how to deal with ethical issues. The Ethics Committee will also handle issues relating to sustainability, in particular matters related to the Transparency Act.

IFE's Safety Committee is an advisory body for the CEO and the organisation whose role is to oversee IFE's nuclear safety requirements. The Safety Committee can deal with issues related to sustainability if it is relevant in relation to safety.

IFE has support staff who are responsible for Strategy, Sustainability and Communication (SSC). The head of the sector is part of group management and is responsible for drawing up IFE's sustainability policy, strategy and reporting, as well as managing, revising and developing governing documents, processes and tools.

IFE has support staff for Safety, Quality and Environment (SQE), which is central to the sustainability work in environmental, quality and governance factors. The support staff also manage internal auditing. The position of environmental director was vacant in 2022, and IFE therefore engaged an external consultancy firm to aid in the preparation of greenhouse gas accounts. The quality director organises reviews, systems and tools for risk management, and is responsible for the development of a new management system of which sustainability is an integral part.

IFE has central finance and procurement departments. In 2022, the procurement department played a key role in devising procedures for the Transparency Act and support tools for carrying out IDD. Going forward, the procurement department will be crucial to the implementation of the Transparency Act and IDD, particularly the follow-up of high-risk suppliers and trading partners. The finance department plays a key role in ensuring that IFE has the necessary tools and routines to prevent or identify financial irregularities.

In 2022, IFE had a document-based management system based on the requirements of the nuclear activity. IFE is currently developing a process-based management system, which will be introduced in 2023. In the management system, the overarching policy and strategies serve as a guide for the foundation and are incorporated into the work processes, in addition to supporting procedures and checklists. Sustainability is an integral part of the management system and entails the following:



Sustainability due diligence

In 2022, IFE focused on devising human rights policy and drawing up requirements specifications, procedures, and checklists for social sustainability in connection with the implementation of the Transparency Act. This work is discussed in "Social sustainability" and includes IDD and reporting according to the Transparency Act. In 2023, IFE will aim to introduce due diligence in relation to the climate and environment.

Strategies

IFE's Strategic Plan 2023–2028⁴ provides the overall direction and framework for the development of the foundation as we approach 2028 and the foundation's strategy vis-à-vis the business areas. The strategic direction for the next few years is to create value and opportunities as follows:

- Transfer nuclear activities to the State, in the form of the Norwegian Nuclear Decommissioning Authority (NND).
- Strengthen research activities by developing assets and opportunities in the business areas.
- Reduce risk for the foundation and the business areas.

- Healthy finances, safe and efficient operations.

IFE's sustainability strategy⁵ supplements the Strategic Plan and sets out strategic priorities and principles for sustainability. IFE shall promote sustainability in all its activities and priorities regarding social, environmental and governance issues. IFE's most important contribution to sustainability is research into energy, the environment and digital systems. Through its research, IFE is an important driving force for a robust, fair and sustainable society. We will continue our efforts to develop sustainable solutions to global and national challenges in partnership with those who commission our work.

Material impacts and risks

Risk mapping of sustainability within social, environmental and governance issues was carried out with external assistance. This work identified areas with the highest risk and areas where IFE has the greatest opportunity to make a positive impact. The risk mapping assessed the regulatory requirements that the foundation is subject to, as well as the legal risk.

⁴) Link to [IFE's strategy 2023–2028](#)

⁵) Link to [IFE Strategic Plan by CopyCat AS - Issuu](#)

The risk mapping showed that the business areas face different sustainability risks:

R&D:

- Emissions, environmental impact
- Energy consumption
- Waste
- Purchase
- Countries/regions/customers with a high risk profile
- Export control



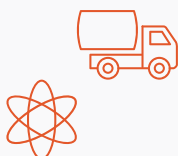
Technology & Property:

- Emissions, environmental impact
- Energy consumption
- Waste
- Purchase
- Use of materials



Nuclear:

- Emissions, environmental impact
- Energy consumption
- Waste
- Purchase
- Export control
- Purchase
- Fuel



Radiopharmaceuticals:

- Emissions, environmental impact
- Energy consumption
- Waste
- Purchase
- Packaging
- Transport



The risk mapping included recommendations for further development, and were as follows:

Area	Improvement
Environment	<ul style="list-style-type: none">- Map indirect footprints to a greater extent.- Improve the environmental aspect analyses.
Social	<ul style="list-style-type: none">- Provide a system for training managers and simplify the management system.- Continue the safety culture efforts in the organisation.- Devise practical processes for implementing sustainability in the supply chain and supplier controls in accordance with the requirements of the Transparency Act, as well as collaboration partners in research projects.
Governance	<ul style="list-style-type: none">- Training, raising awareness and setting out how sustainability is relevant for the individual employee and business areas.- Better coordination of various internal bodies with a view to implementing the sustainability ambition in the strategy. Clarify reporting responsibilities and roles.- Systematise the work in sustainability and contextualise with existing guidelines, routines and systems in order to ensure compliance and follow-up in the organisation.- Map and report sustainability in a way that is engaging for employees and gives the business concrete goals to strive for.- Improve how IFE communicates its contribution to increasing sustainability in society.

In 2022, priority has been given to tackling the risk areas and recommended measures, and this is explained in this report.

Prevention and detection of corruption or bribery

IFE works to promote healthy business practices and to prevent corruption and bribery. IFE's Code of Conduct applies to all employees, managers, contract workers and personnel involved in our research and teaching activities. The Code of Conduct sets out clear guidelines for good business practice and conduct, and violations of the Code of Conduct are subject to sanctions. There are separate guidelines for the use of agents and other intermediaries, which IFE uses to a very small extent. IFE has guidelines for giving and receiving gifts. IFE's Procurement Manual refers to the Code of Conduct, guidelines for gifts, and places particular emphasis on employee conduct in connection with the procurement process. The systems for procurement and the approval of invoices require two signatories with authorisation according to the authorisation matrix. Large procurements and investments require the preparation of a business case and approval by executive management, as well as the board if above certain thresholds.

IFE's Code of Conduct for business partners was drawn up in 2022 together with the ABC policy (Agreement on Responsible Business Conduct). The standard contracts were revised and the requirements for suppliers and trading partners in terms of ethics, sustainability and business operations were made clearer.

IFE facilitates a corporate culture in which employees are encouraged to report wrongdoing. An internal and external reporting channel has been established where wrongdoing can be reported

openly or anonymously. External parties can notify an external law firm via our website. The guidelines for reporting wrongdoing are set out in the internal Code of Conduct. In addition to the reporting of wrongdoing, IFE has experience in incident reporting and carrying out investigations that are internally and externally led.

Employees are required to attend ethics training, and the Code of Conduct forms part of the training package for new employees. The intranet provides information on the Code of Conduct, reporting wrongdoing and the Ethics Committee. There is also extensive training material covering ethics, research ethics, reporting wrongdoing, corruption, and the safety and corporate cultures. The training material consists of videos, presentations, and a variety of dilemmas. IFE carried out an internal audit of the ethics training in the research divisions in 2022 and has followed up observed findings and deviations. The administration reports to the board on the ethics work every six months.

Only two cases were reported to the Ethics Committee in 2022, and no cases of wrongdoing were reported. In 2023, IFE's management decided to provide more information on the intranet, in townhall meetings, CEO and HR meetings with new employees, and other relevant arenas about how employees can report concerns.

Number of cases reported	Reported wrongdoing	Ethics Committee
2022	0	2

Sustainable removal of our hazardous legacy

Decommissioning is the process of safely removing and disposing of equipment and infrastructure that is no longer needed or operational. While decommissioning is often associated with the end of a project or the retirement of a piece of equipment, it can also contribute to a more sustainable society. At IFE, we research and spread awareness of best practices within decommissioning and waste management, often referred to as “Decom”.

Through our [DigiDECOM](#) initiative, we reach stakeholders in all aspects of operations and high-level government decision-makers. This has a direct positive influence on the way we responsibly removing our legacy of hazardous wastes without transferring the challenge to future generations. As we are also the only Norwegian member of several Euratom and other international initiatives within decommissioning, we learn valuable information on many important aspects of our national decommissioning programmes.

In the coming years and decades, both in the nuclear and the oil and gas sectors, we are looking at huge expenses for removing old reactors and platforms. This is a giant task in terms of finance, but also in relation to skills and technology. However, decommissioning can also support economic development.

Decommissioning in the nuclear sector is an important facilitator for AI, data and robotics technologies for ensuring the safety of people through increasingly remote and autonomous operations. Since such technologies apply to many aspects of modern life, this can support the growth of new industries and create jobs. This is also where IFE’s highly developed technology can make a major impact, such as 3D modelling and visualization-based digital support systems for safety-critical processes involving hazardous material/ conditions, combined with our hazard and risk management experience and smart robots equipped with various sensors.



*Decommissioning in the nuclear sector is an important facilitator for AI, data and robotics technologies for ensuring the safety of people through increasingly remote and autonomous operations.
Photo: Christer Nilssen*

Environmental sustainability

Introduction

IFE's main purpose is research. Since it was founded in 1948, IFE has served as a research partner for business and the public sector, both in Norway and abroad. In our projects, we develop innovative solutions that enable companies to develop or improve operations, products and services that make business more sustainable and safeguard competitiveness and market position. This creates value and jobs in Norway.

The environmental sustainability effect of IFE's research is difficult to estimate, and we will work to ensure more systematic documentation of this in the future. A small selection of examples of how our research increases environmental sustainability for society is presented in the report.

A key measure to strengthen our positive environmental impact is the establishment of the research alliance NORIN together with the environmental institutes NILU and NIVA. The ambition is to be a Nordic champion within the fields of energy, climate, environment, digitalisation and civil protection.

Research for developing more sustainable solutions comes with a footprint. We use gases, chemicals, oils and other input factors in research that have a negative impact on the environment. Laboratories and the business in general use energy and generate waste and emissions to air, soil and water. In our sustainability strategy we established a requirement

How IFE contributes to the SDGs in the areas of environment and climate



IFE works to reduce water consumption from operations. We work systematically to reduce emissions of chemicals, radioactivity and other substances into water.



IFE's most substantial positive contribution to sustainability and the SDGs is our energy research. IFE conducts research on the green transition and sustainable solutions within energy, energy systems and energy storage for actors in Norway and internationally.



Our research contributes to more environmentally friendly and sustainable industrial processes and transport solutions.



Research in energy, the environment and digital systems contributes to sustainable solutions in areas such as energy systems, transport systems and repositories.



IFE works actively to reduce our climate and environmental footprint through research activities, property activities and nuclear activities, and in our own operation.



IFE has systems to monitor and reduce emissions to water in order to minimise our pollution.



IFE's plans for the development of the Kjeller site include protecting biodiversity.

to set targets to reduce our direct climate footprint and actively work to reduce our indirect climate footprint by a proportional amount based on the level of activity. We also set a requirement that IFE should develop and implement sustainable solutions for its properties and buildings by using these as the test arena for the research activities. For 2022, we have not defined specific or measurable targets for reducing our direct or indirect climate footprint. We needed data from the greenhouse gas accounts, which will be developed for 2022. In addition, IFE needs to improve the collection of data on the indirect climate footprint.

The main findings of the materiality and risk analysis carried out in the first quarter of 2022 in relation to environmental sustainability are as follows:

- IFE's direct environmental footprint is well controlled, particularly in relation to radioactivity. However, the indirect climate and environmental footprint is not sufficiently being addressed. There is a need to map the indirect footprint to a greater extent.
- The reasons for a negative impact on the environment and climate vary between the different areas of activity. IFE's greatest environmental impact and highest emissions stem from gas and radioactive materials in connection with research, CO₂ emissions from transport and travel, energy consumption related to technology and data

processing, and energy consumption for property and operations.

- IFE has established reporting using environmental aspect analyses. The analyses have provided the areas of activity with important documentation for mapping their direct environmental footprint. The work has been followed up to varying degrees, and improvement is needed.

IFE is ISO 14001 certified and has incorporated the requirements of this certification into the management system. This is being followed up by the head of quality and management and through the management review. The business areas perform an annual environmental aspect analysis and are responsible for managing and reducing environmental risks in their respective areas. The SQE sector, in collaboration with the business areas, prepares an annual environmental report for the Norwegian Radiation and Nuclear Safety Authority (DSA) for emissions and pollution licences issued by the Authority.

IFE holds a permit for handling radioactive waste and emissions of radioactive contaminants. We comply with relevant requirements and have developed and implemented internal procedures for waste management and controlling release to the environment. IFE has guidelines for the safe use of hazardous substances, as well as instructions for handling gases, chemicals, solvents and oils. The documents are available in the management system and in the laboratories.

Batteries – the hub of the green transition

In many ways, batteries can be seen as the hub of the green transition, contributing directly and indirectly to the reduction of greenhouse gas emissions from, for instance, transport, construction sites and the power sector. The battery research at IFE helps to increase knowledge about batteries and to provide better battery solutions. This in turn will increase the competitiveness of batteries in various applications, which in turn reduces emissions and displaces fossil solutions.

Battery research at IFE covers large parts of the value chain for batteries in terms of more sustainable material choices, zero-emission transport solutions, as well as closing the value chain with reuse and recycling.

IFE heads several large international and national projects aimed at making more sustainable material choices. Research is carried out on bio-based anode materials, cobalt-free batteries as well as more sustainable material processes.

More sustainable materials

In SUMBAT (Sustainable Materials for the Battery Value Chain) the focus is on materials that are as sustainable as possible. To achieve this, all processes must be studied separately and as part of a coherent system. The entire value chain is evaluated, from raw materials to active materials, materials in cell production, as well as exploring recycled materials from used cells.

SUMBAT has received NOK 100 million in support through the National Green Platform initiative, granted by the Research Council of Norway. SUMBAT consists of a collaboration between leading industrial companies and research institutions.

2nd life and total impact of batteries

The national project '2ND LIFE', led by IFE, researches the value of second life batteries in the future energy system. In this project we look at both the possibilities of reusing batteries and the practical challenges of achieving this. By reusing batteries, it will be possible to save 178 kg CO₂/kWh compared to using new batteries in energy storage, in addition to the fact that there will be over 20 GWh of available battery capacity for energy storage in 2025 based on Norwegian electric cars. Therefore, 2ND LIFE will study the properties and possibilities of used Lithium-ion batteries, increase the understanding of safety vis-à-vis these batteries, further develop lifetime models, and design and optimise user projects for reused batteries. To ensure that the results are as sustainable as possible, LCA analyses are also a central part of this project, assuring that the total impact of these batteries can be quantified.

Zero-emission transport solutions with batteries

Transport accounts for approximately 15% of the world's greenhouse gas emissions, and battery-powered transport solutions can help to reduce these emissions on a large scale. At IFE we have worked with zero-emission transport solutions for over 10 years, for road transport, rail transport and maritime transport. FME MoZEES (Norwegian Research Center on Zero Emission Energy Systems for Transport), led by IFE, has been central to this research activity, where key actors representing all transportation systems have participated in the research. The maritime contribution has been particularly central, with important research on safety, degradation and optimisation of battery-electric operation of ships.

'Closing the loop' – reuse and recycling

In addition to its recycling activities, IFE also works to extend the lifetime of the batteries. This is closely linked to the activities on testing commercial battery cells, with degradation mechanisms and ageing processes as central parameters also in relation to the reuse of batteries in a new application.



IFE Battery laboratories.
Photo: Bo Mathisen

Climate change

In the materiality and risk analysis, use of gas in research activity, energy consumption and transport were identified as sources of greenhouse gas emissions. IFE did not have targets or KPIs for reducing greenhouse gas emissions in 2022. In the sustainability strategy, requirements were introduced for setting annual targets and KPIs for sustainability and for this to be included in the annual sustainability report.

IFE uses the GHG Protocol to calculate greenhouse gas emissions. This protocol is based on the Kyoto Protocol, which includes six gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆). Several of these are used in the research activity and the work to develop more sustainable solutions for customers. The use of alternative gases has been considered, but it is not always possible. We are therefore trying to reduce the use of greenhouse gases and the risk of accidental emissions.

Energy is consumed in the heating of buildings, office operations, the production of pharmaceuticals and research. In research, energy is consumed in the laboratories. For example, testing battery cells draws a lot of energy, as does data storage, and analysing large volumes of data using high

performance computing. In 2022, several measures were implemented to reduce energy consumption and obtain more detailed user data. In Halden, energy wells were installed, and electricity meters have been installed in all the buildings at Kjeller and Halden. At Kjeller, some of the buildings date back to the 1940s, 50s and 60s and they are not particularly energy efficient. As part of the maintenance and upgrading work, these will be isolated and solar panels will be installed on the roof.

The research activities involve a certain amount of travelling. A significant proportion of the journeys are by air, some of which is long-distance. In 2022, IFE did not have system data for greenhouse gas emissions from business trips, but we are working to ensure that this is in place in 2023. We also lack data on emissions from employees' travel to work and will consider including data on this in the report for 2023.

Radiopharmacy is responsible for receiving and controlling imports of radioactive pharmaceuticals, and then distributing them to hospitals throughout the country by road or air. In addition, Radiopharmacy is a contract manufacturer of radiopharmaceuticals. The production takes place at Kjeller and the pharmaceuticals are distributed globally by air from Gardermoen because of the

short half-life of the radioactive substances. We do not have an overview of the overall greenhouse gas emissions from Radiopharmacy's transport operations in 2022 but will endeavour to obtain more documentation in the future.

Radiopharmacy is working actively to reduce greenhouse gas emissions from transport by shifting from air to road where possible and ensuring

thorough logistics planning to increase the degree of shared transportation. The possibility of replacing diesel-powered vehicles with electric vehicles has been considered, but until now there have been no electric vehicles that meet the security and HSE requirements for transporting radioactive pharmaceuticals. When vehicles need to be replaced, Radiopharmacy will consider using electric vehicles if they meet the safety requirements.

Energy consumption and mix

Most of IFE's energy consumption comes from renewable sources, as shown in the table below.

Site	GHG Scope	Source	Volume	Unit	Emission (ton CO2 equivalent)
Halden, Os Allé	Scope 1	Biooil, BIO Caleo	49 420	Liter	87,31
Halden Reactor	Scope 1	Diesel, backup generator	740	Liter	0,07
Kjeller	Scope 2	Electricity	8 416 788	kWh	92,58
Kjeller Technology Park 8	Scope 2	Electricity	487 752	kWh	5,37
Kjeller Technology Park 8	Scope 2	Remote cooling	120 000	kWh	6,60
Kjeller Technology Park 10	Scope 2	Electricity	36 354	kWh	0,40
Kjeller	Scope 2	District heating, Kjeller	2 779 800	kWh	28,35
Halden, Os Allé	Scope 2	Electricity, Halden	74 429	kWh	0,82
Halden Reactor	Scope 2	Electricity, Halden Reactor	2 525 412	kWh	27,78
SUM					249,28

Towards a greener mineral and metal industry in Europe

The ALSiCal project, is an ambitious research and innovation project aimed at making the mineral and metal industry more sustainable and environmentally sound.

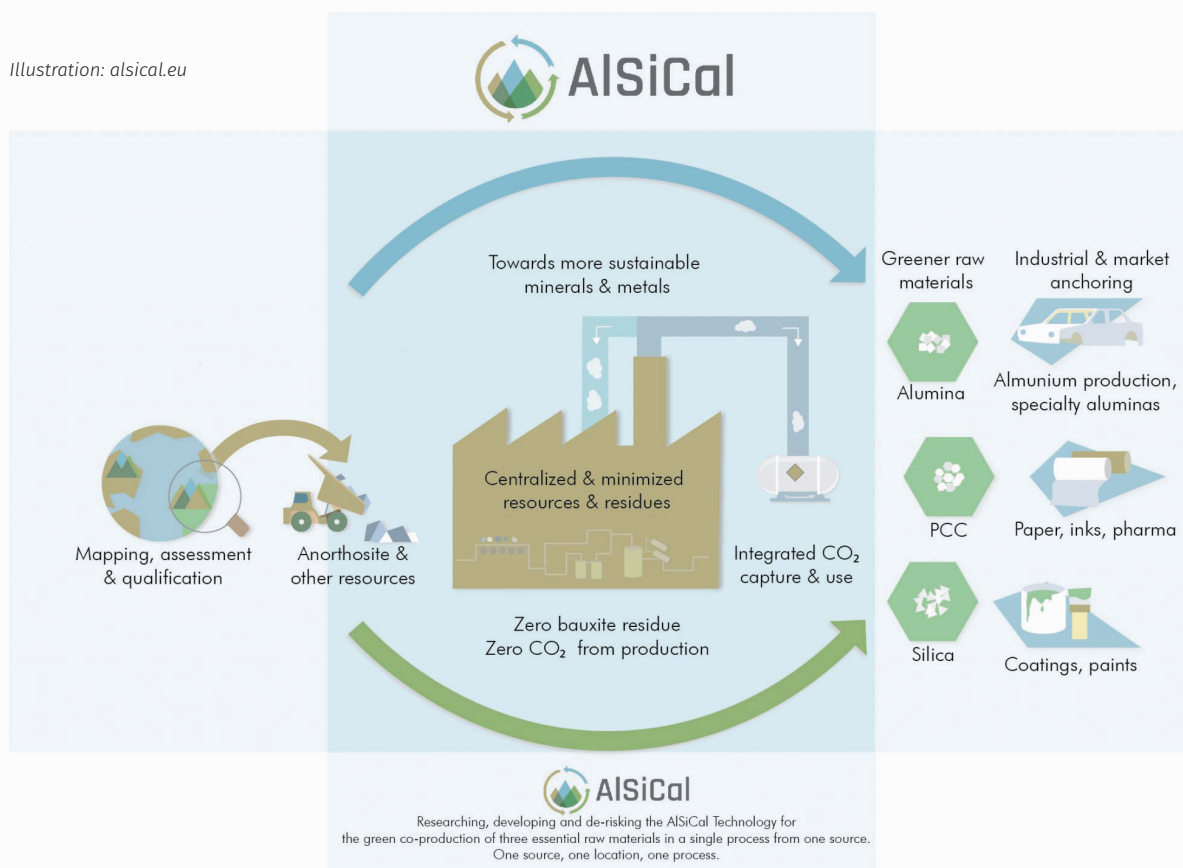
The ALSiCal project is led by IFE and includes 16 partners from 9 different countries representing the whole value chain in the mineral and metal industry. The project has received MNOK 60 funding from the European Union's Horizon 2020 research and innovation programme.

As part of the European [ALSiCal project](#), IFE has successfully developed a new technology for the complete transformation of an alternative mineral, anorthosite, into three highly sought-after raw materials: alumina, silica and precipitated calcium carbonate. An important benefit is that it does not generate bauxite residue (aka red mud).

The current aluminium industry processes bauxite using Bayer technology, generating three tons of red mud per ton of aluminium. IFE's technology uses anorthosite as the source mineral, without generating any harmful residue. The co-production of these raw materials from one only mineral brings additional environmental and business advantages. Strategically important, it allows full domestic production of these materials – from the mine to end products – with European resources. The technology is now at TRL5 for the first process step and at TRL4 for the two subsequent core steps.

More information about the project can be found at [ALSiCal - Towards a greener mineral and metal industry in Europe](#).

Illustration: alsical.eu



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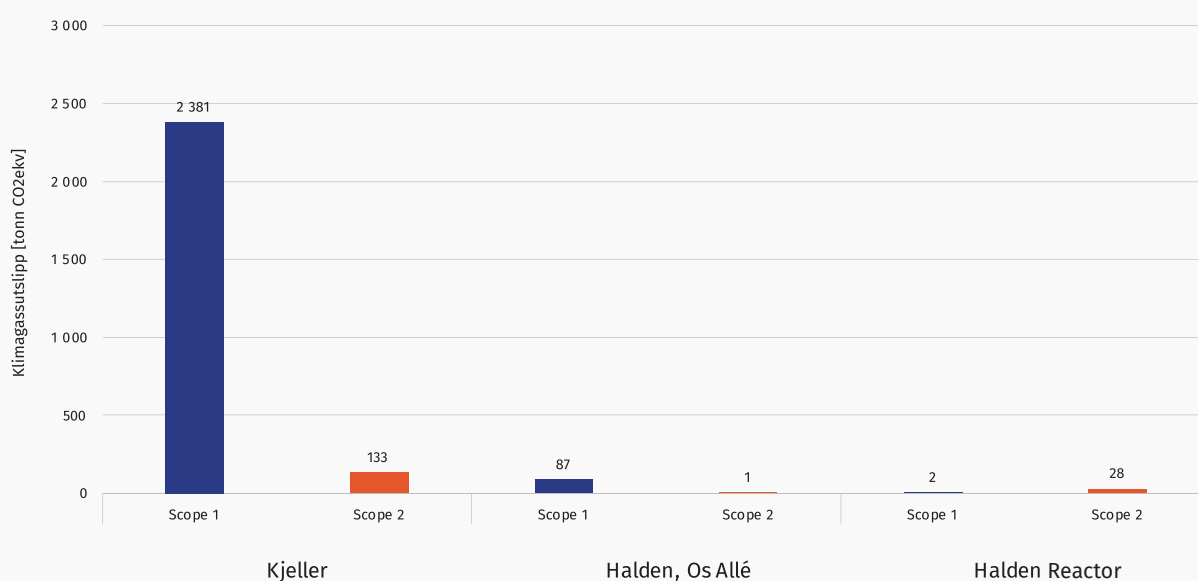
GHG emissions

For 2022, we have produced our first greenhouse gas accounts. Due to limited data, we have concentrated on scopes 1 and 2. Some data is not yet in place, like employees' transport to and from work and Radiopharmacy's distribution by air. We will establish a project for improving data and data

quality, and to report on the CO₂ footprint for the business areas and sites in more detail in the years to come.

The tables below summarise the greenhouse gas accounting for 2022 broken down into scopes 1 and 2, and the locations Kjeller, Os Alle in Halden and the Halden Reactor:

Greenhouse gas emissions divided on scope and location



The greenhouse gas emission is 4,06 tons CO₂-equivalents per employee. Kjeller has the highest CO₂ emissions, mainly from the greenhouse gas, SF₆, which accounts for 2350 tons of emissions in CO₂ equivalents. If IFE had not used SF₆, the CO₂ emissions would have been 282 tons of CO₂ for scopes 1 and 2, which is 0,43 per employee. SF₆ is used in one laboratory, called 'Brønnsløyfa', where we conduct research in flow analysis for the petroleum industry. Consideration has been given to replacing the SF₆ gas, but this has not been done yet.

Through our research at IFE, we contribute to reduced CO₂ emissions for clients in Norway and internationally through the development of more environmentally friendly energy systems, energy production and storage. We also help to reduce CO₂ through more environmentally friendly solutions for the petroleum industry.

IFE works continuously to reduce the CO₂ footprint in its own operations. We replace gases and chemicals with less contaminated varieties as far as possible. We reuse furniture and materials, and we are working to put in place systems for

increased reuse of technical and digital equipment. When replacing vehicles, we seek to replace them with electric vehicles whenever possible. However, a number of improvement measures could be implemented, including energy-saving measures and campaigns to save electricity and for electronic documents to replace the need for printing. We can also place more stringent demands on suppliers to reduce their CO₂ footprint.

In 2022, IFE took significant steps towards reducing its carbon footprint by installing energy wells for its energy needs at Os Allé in Halden. The heat pumps deliver a total of 240 kW and provide over 700.000 kWh of heating and cooling per year. With the energy wells, IFE achieves a substantial energy saving of two-thirds, in addition to reduced emission and cost reduction.

IFEs PV Module Outdoor Test-site is a laboratory with several different system configurations and technologies are monitored, including ground-mounted, roof-mounted, wall-mounted and building-integrated. A bi-effect is solar power generation for IFEs activities at Kjeller.

Site	Scope	Activity	Volume	Unit	Emission (ton CO ₂ equivalent)
Kjeller	Scope 1	Co-transportation of pharmaceuticals	328 638	km	59,48
Kjeller	Scope 2	Solar Park	22 735	kWh	0,25
Halden, Os Allé	Scope 3	Energy Park	113 800	kWh	0,83

Research in nuclear technology

A number of analyses from the IPPC Panel on Climate Change and other recognised analysis agencies point out that reducing CO₂ emissions in order to reach the 1.5°C target cannot be achieved without nuclear power being a central part of the international energy mix. In Europe, the Ukraine war has intensified the need to ensure increased access to stable European power while reducing CO₂ emissions. This has led several countries to plan new nuclear power plants or extend the life of existing nuclear power plants. This reinforces the need for research in nuclear energy for many years to come.

IFE is Norway's nuclear research institute. For 75 years, we have worked with nuclear power through the construction and operation of four research reactors and research on nuclear technology.

IFE holds a unique position in research on nuclear technology in a national and international context. Since the 1950s, we have exported research in nuclear safety to the key nuclear power states internationally. The Halden Project is Norway's largest ever international research project, and has been ongoing continuously from 1958 to the present day. Around 100 member organisations from 20 countries participate in the promotion of nuclear safety. The member organisations are typically regulatory authorities, power plants, research centres and companies that build reactors. IFE hosts the project, which is under the auspices of OECD-NEA (Nuclear Energy Agency).

IFE initiated research activities on small modular reactors (SMR) as part of the Halden Reactor Project in 2018. The focus of this research was on understanding the operational side of SMRs:

- How will SMRs be operated, and how different will this be from conventional nuclear power plants?
- What/where are the risks for safety & human error?
- Could there be opportunities for new human errors?
- What effects could multi-unit operation, passive safety systems, higher levels of automation, etc. have on human performance and safety?
- How can safe operation be assured under all conditions?
- In 2024-2026, the research will include topics on cybersecurity, digital I&C, control room layout & design, decommissioning.

In 2022, IFE installed a full scope SMR Control Room Simulator, which is the only research simulator of its kind in the world. The simulator is capable of displaying between 1 to 12 independent SMR units. The first test study was performed in August 2022 with a team of licensed nuclear operators from the US.

Pollution

Parts of IFE's operations are at risk of generating pollution in the form of chemicals and oils, and radioactive contaminants to air and water. IFE is subject to a well-regulated regime and holds permits for emission of radioactive contaminants to air and water. As a result of the new group structure in 2022, separate permits are in the process of being sought from DSA for, respectively, the research activities, the radiopharmaceutical activities and the nuclear activities.

The R&D group is subject to legislation on emissions and environmental impact related to the use of chemicals and gases. In addition, some of the activities within R&D are regulated by DSA through permits. R&D's main sources of emissions and environmental impact are assumed to be mainly from the use of gases and chemicals. Some small pollution sources could be from radioactive waste.

Radiopharmacy is subject to strict rules for emissions and waste and is followed up by DSA as part of the permit conditions. Radiopharmacy's main sources of emissions and environmental impact are assumed to be radioactive releases and waste, biological waste, packaging and transport. The nuclear activity is subject to stringent requirements for emissions and environmental impact. The operation is based on the intention to avoid harming the environment. The ALARA (As Low As Reasonably Achievable) and BAT (Best Available

Technology) principles, and IAEA's Fundamental Safety Principles represent universal sustainability principles for nuclear activities. These principles are incorporated into existing guidelines, and we work to comply with these.

The biggest sources of negative impact on the environment and climate from nuclear activities are: (i) emissions from daily operations and (ii) handling waste and fuel. For (i), the greatest impact is assumed to be emissions of radioactive substances from daily operations and electricity consumption. This is confirmed by the environmental aspect analysis in which operation of the reactor facility and experimental circuits, including emissions of radioactive substances, use and emissions of environmentally harmful chemicals, emissions of hydrazine, and use of electricity are the most significant negative environmental aspects. For (ii), waste management is assumed to be the most important.

IFE's permit under the Pollution Control Act TU-13-38 for Himdalen covers the operation of the National Combined Disposal and Storage Facility for low- and medium-active waste (KLDRA) in Himdalen and intermediate storage of barrels with radioactive waste from IFE's previous barrel storage. Emissions to air and water from the plant are systematically monitored to capture any emissions of radioactive substances.

Actions and resources related to pollution

Because of the complex nature of activities at IFE, a wide range of methods have been implemented to reduce the release of radioactive material to a level that is as low as reasonably achievable. The methods listed below are described in more detail in IFE's annual report to the regulator, DSA.

Methods to reduce
release to air

- Use of particle filters and coal filters
- Delay systems and tanks for radioactive gas for decay
- Condensation of moisture in discharge lines from the primary circuit for tritium separation
- Automatic surveillance systems that shut down release valves if activity levels are above allowable levels

Methods to reduce
release to water

- Temporary storage of wastewater to allow for radioactive decay of short-lived radionuclides
- Evaporation of small amounts of wastewater to increase concentration/solidification of the waste in preparation for encapsulation
- Filtration of wastewater using particle filters and ion-exchange technology
- Distillation
- Sludge separation
- Sedimentation in tanks
- Processes to minimise contamination of protective clothing being washed
- Cleaning processes to minimise contamination of controlled areas
- Automatic surveillance systems that shut down release valves if activity levels are above allowable levels

Pollution to air, water, and soil

IFE is subject to stringent regulations on safety and emissions. Safety is thoroughly monitored both nationally and internationally. When it comes to emissions, DSA sets limits on how much IFE can release to air and water. The emissions licence sets specific emission limits, and limits have also been set for the maximum radiation dose that individuals in the most vulnerable population group can be exposed to. The limits are very low since this is about safety and environmental protection. Nevertheless, the resulting emissions are well below the limit thresholds.

In comparison, the average Norwegian receives an effective dose in the order of 5200 μSv per year from naturally occurring radiation (ground, cosmic, food, etc.), historical fallout (nuclear testing, nuclear accidents, etc.) and medical use of radiation. The effective dose from a dental x-ray examination is typically 1.5 μSv .

IFE has wide-ranging expertise in radiation protection, radioecology and radioactive waste, and is part of Norway's nuclear accident emergency preparedness organisation. We provide industry, the health service, the authorities and research institutions with expertise in radiation protection, originating from IFEs in-house activities. IFE has laboratories for measuring radioactivity in a variety of sample types and for calibration of radiation protection instruments, in addition to its own electronics laboratory. Our internal radiation protection service ensures that all use of radiation sources and radioactive material is in accordance with national laws, regulations and guidelines. It also assesses and follows up recommendations from international organisations. The aim is to limit and reduce any radiation doses for employees, and to check that emissions during normal operation are within the specified limit.

Site	Emission and unit	2022
Halden	Collective dose to workers, mmanSv	39.9
	Average dose to workers, mSV	0.35
	Total release to atmosphere, μSv	0.046
	Total release to water, μSv	0.0001
Kjeller	Collective dose to workers, mmanSv	40.5
	Average dose to workers, mSV	0.2
	Total release to atmosphere, μSv	0.01
	Total release to water, μSv	0.00017

The environmental monitoring programmes at Kjeller and Halden ensure that we have a full overview of our footprint with respect to releases of radioactivity. The environmental monitoring service regularly collects and analyses samples

from the area surrounding the facilities at Halden and Kjeller to monitor the radioactivity in the close environment, which is known as ‘recipient monitoring’.

Environmental monitoring programme at Kjeller

- Dosimeters outside the plant areas to measure external radiation within a 5 km radius of the site.
- Air filter stations within IFE’s site in continuous operation, as well as five sampling stations that collect rainfall.
- Regular grass samples in the summer months.
- Milk samples collected every week from two nearby farms and analysed for radioactivity.
- Agricultural products collected once a year in the autumn and analysed for radioactivity.
- Collect and analyse samples of water, sediments, aquatic plants and fish from fixed sampling sites in the Nitelva river.

Environmental monitoring programme in Halden

- Area dosimeters located outside the plant area to measure the external radiation within a 5 km radius of the site.
- Rainfall collected at two locations near the plant and analysed regularly.
- Samples of drinking water are analysed for radioactivity.
- Grass samples at two different places twice a year.
- Water samples in the Tista river from three different places twice a year.
- Samples of sand from four different beaches in the Iddefjord once a year.
- Fish analysed annually.
- Samples of the sediment in the Tista river at three different places twice a year.

Substances of concern and substances of very high concern

We refer to the sections on radioactive substances.

Biodiversity and ecosystems

At Kjeller, IFE has property covering approximately 38 acres, which is to be developed into a research and technology park. IFE has drawn up a detailed zoning plan as a basis for developing the property at Kjeller, which was submitted to Lillestrøm local authority at the end of 2022 for consideration.

The plan corresponds to the master plan for the area, which has three central and comprehensive strategic priority areas: sustainability; safety and preparedness; digitalisation.

The area is made up of cultivated land, unused agricultural areas and areas with lawns/grass that have been prepared for use as a research and technology park. The site is host to a rich diversity of flora and fauna, including a bee species with red list status. In the master plan, the goal is to preserve and further develop the area into a green campus that strengthens local biodiversity and biology with, for example, wildflower meadows, diverse plant species and a focus on plants that are particularly attractive to pollinators.

In 2022, meetings were held with stakeholders for the area, and in 2023 formal input processes will be carried out prior to the local authority's processing of the detailed zoning plan.

Waste

The waste is complex and consists of chemicals, food waste, wood, cardboard and paper, glass, steel, iron and aluminium. Kjeller's radiopharmaceutical activity also produces waste that is classified as clinical waste. The waste is managed by Norsk Gjenvinning, who also segregates the residual waste.

Site	Kjeller	Halden
Total amount, in kilo	150 400	58 158
Source segregated, in kilo	113 155	43 857
Residual waste, in kilo	37 245	14 301
Recovery rate	75	76

Radioactive waste

IFE was commissioned by the authorities to handle radioactive waste in Norway. In addition to IFE's waste, radioactive waste is also produced by the military, hospitals, industry and fire detectors. The waste is processed in facilities at Kjeller, and low- and medium-active waste is deposited at KLDRA in

Himdalen. In 2022, no waste was deposited at KLDRA – everything was stored at Kjeller.

	Number of deliveries	Percentage
External radioactive waste	86	86
IFE radioactive waste	14	14

Norway has been conducting nuclear safety research since 1958, including research on fuels to make nuclear power plants safer. The research activity has generated 16.5 tons of spent nuclear fuel, which is a small amount of nuclear waste in an international context. However, the Norwegian nuclear waste is special because it is derived from research on various types of fuel that have been subject to several different experiments with a range of methods. The complex and varied waste creates several challenges for the clean-up and decommissioning of nuclear facilities.

The fuel storage facilities at Kjeller and Halden were built in the 1950s and 60s, and do not meet today's international or national requirements. For this reason, IFE has in recent years initiated several assessments and measures to improve the

safety of the storage facilities. In 2022, IFE spent 17.782 man-hours and NOK 37.6 million on handling and securing the nuclear waste, as well as work on solutions for new storage facilities. We work closely with NND on this, and IFE is part of an extensive ongoing process with DSA regarding necessary permits for upgrading storage conditions and new storage facilities.

Since Norway has so many different types of nuclear waste, but in relatively small quantities, it will be very challenging and costly to build national facilities and infrastructure, and to develop expertise to treat the waste before it can be deposited. IFE and NND have worked to find solutions with various other countries, which have expertise in and facilities for special types of waste. This is ground-breaking work that involves numerous actors and authorities, and requires the development of new technological solutions. In 2021, IFE signed a contract with Studsvik Waste Management Technology AB and Studsvik Nuclear AB in Sweden for inspection and mechanical pre-treatment in Studsvik's facilities. Approval by the DSA and national agreement on the return of the fuel are required before the work can be carried out. Norway signed a memorandum of understanding with the United States in 2021 to eliminate highly

enriched uranium. Norway is one of 22 countries that have highly enriched uranium in the civilian sector. A particular challenge is that the Norwegian uranium contains thorium, which makes the treatment more complex. The uranium will be blended in a new US-developed facility. For the agreement to be implemented, further technical investigations must be carried out and permits must be granted by regulatory authorities in Norway and the United States. IFE has applied to DSA for approval to carry out a pilot project for verification of the process.

In 2021, IFE signed an agreement with Springfields Fuels Limited, whereby 960 kg of unirradiated uranium fuel is shipped to the UK instead of being treated as waste, stored and disposed of in Norway. The Ministry of Foreign Affairs has granted an export licence for unirradiated uranium to the UK. Approval from the DSA is required to move the material to Springfield.

The KLDRA facility in Himdalen is the Norwegian national facility for the storage and disposal of low- and medium-active waste. The facility is owned by Statsbygg and operated by IFE on behalf of the Ministry of Trade, Industry and Fisheries, which finances the operation. KLDRA was planned, designed and built under the auspices of the Norwegian government in the 1990s, and opened in 1999. In the period 2021-2022, IFE and NND, with assistance from external international expertise, carried out a comprehensive study of all aspects of KLDRA. The conclusion of the study is that KLDRA is safe and poses no danger to the environment or people, but that further investigation is needed to assess the condition of the plant in the long term – i.e. several hundred years from now.



Through our research at IFE, we contribute to reduced CO2 emissions for clients in Norway and internationally through the development of more environmentally friendly energy systems, energy production and storage. Photo: Mostphotos



Solar power – a major green energy source assuring flexibility, non-intrusiveness and supply security

IFE has the leading national research group on solar energy technology and solar power systems. IFE is also hosting FME SuSolTech (Sustainable Solar Cell Technology), a Research Centre for Environment-friendly Energy Research. The centre has been a significant contributor to Norwegian growth in solar power by conducting research aimed at cost reduction, solar cell efficiency increases and sustainability through innovation along the full value chain of production.

In order to accelerate the transition to a sustainable energy system, renewable power needs to expand significantly. Solar power plants are expected to constitute the largest share of power production capacity within the next two decades. The solar power researchers at IFE perform research and development related to utility-scale solar parks, floating solar systems and the integration of solar solutions in the Nordic area. We cooperate closely with Norwegian and international partners to support the development and implementation of various solar power technologies like solar parks, floating photovoltaics and building-integrated photovoltaics.


The IFE team of researchers in solar power are also involved in the development of sustainable innovation with skilled and innovative Norwegian industry partners, such as Over Easy, Ocean Sun, Glint Solar, SunlitSea, Equinor, Statkraft, Scatec and TGS Prediktor.

Hydro sun and hybrid power plants

IFE contributes to the HydroSun project to support the realisation of full-scale, integrated hybrid power plants. By combining two or more renewable electricity production technologies, energy storage and digital control systems, this type of power plant aims to deliver predictable and controllable power to the grid on multiple timescales.

Multiple hybrid power plants based on various combinations of power production and storage are being developed by the project partners, all of which are supported by the HydroSun project. The HydroSun project has a particular emphasis on hybrid power plants that combine hydropower, floating solar (PV) power and battery energy storage systems (BESS).

In the HydroSun project, we are developing new processes and tools for simultaneous planning, dimensioning and design of hybrid power plants, the world's first integrated control system for a hybrid PV-hydropower plant and new technology for floating PV power plants, with a view to increasing power production and reducing costs.



Solar power plants are expected to constitute the largest share of power production capacity within the next two decades. Photo: Mostphotos

Social sustainability

Introduction

IFE's sustainability strategy emphasises that the safety of our employees and surroundings is always the top priority for IFE, and that we must respect diversity and work actively to prevent discrimination in all areas. Social sustainability also entails playing an important role in our local community as a decent and responsible employer, trading

partner, creator of value and contributor to local green communities. We endeavour to implement sustainability in all activities and daily operations, respect basic human rights and decent working conditions throughout the value chain, and provide a good working environment for all our employees. Improvements are made on an ongoing basis.

IFE's board and management have overall responsibility for safeguarding social sustainability. HR is responsible for arranging policy and systems for social sustainability in relation to IFE's own staff, while SSC is responsible for policy and procedures that safeguard human rights in supply chains with trading partners and collaboration partners. Employees are responsible for following the guidelines, reporting relevant matters to the Ethics Committee, or reporting wrongdoing to HR. IFE has a well-established practice for involving employees in the operation and development of activities in accordance with Norwegian law and the agreements with trade unions.

IFE's board includes two employee representatives and their deputies. The Cooperation Committee consists of the trade union leaders at Kjeller and Halden as well as IFE management. Five regular meetings are held each year in addition to extraordinary meetings when necessary, and these entail a mutual exchange of information in addition to formal discussions. The Working Environment Committee consists of the chief

How IFE contributes to the SDGs for social sustainability



IFE's employees provide teaching within our areas of expertise at schools and universities, we offer summer jobs to students, have institute scholarships, and provide supervision for master's and PhD students.



IFE endeavours to ensure gender equality and equal opportunities in career development and employee benefits.



IFE works to safeguard human rights and decent working conditions in its own operations and in the supply chain, including through our work vis-à-vis the Transparency Act.



IFE works actively to reduce our climate and environmental footprint. The work is described in more detail under Environmental sustainability.

safety representatives and representatives for the trade unions and IFE management in addition to the occupational health service. AKAN contacts at Halden and Kjeller assist managers and other employees with the prevention and management of substance abuse problems.

Social sustainability is also about employees' physical and mental well-being, job satisfaction and work-life balance. IFE has a Welfare Committee that allocates annual welfare funds, and company sports teams at Halden and Kjeller organise various activities.

Many of our new employees are from other countries and different parts of Norway. We aim to include and integrate employees in the workplace and help ensure that they have a social network outside of work. At Halden, Lego and board game evenings are held, among other arrangements, for employees and their families. At Kjeller, we established 'Young at IFE' in 2022, which organises social meetings and activities for our younger employees to get to know each other better and build a social network both at work and outside of work.

IFE is a major employer in Halden and Lillestrøm, and our activities and procurements generate economic ripple effects in the region. In choosing a new canteen supplier at Kjeller in 2022, we entered into an agreement with Norasonde, which focuses

on responsible consumption by investing in local producers and resources, in addition to providing work experience for people who are out of work or at risk of losing their job or unable to take education.

Own workforce

The working environment at IFE is regarded as good. IFE conducts an annual survey of employee satisfaction. The results from the survey in 2022 show generally good scores for team spirit and management, and the results are generally at the same level as in 2021. This is positive considering the extensive changes IFE has undergone in recent years and which are still ongoing.

Total sick leave in 2022 was 3.3 per cent, which is lower than in 2021. Individual adaptations to the workplace and duties are undertaken as part of the close follow-up of employees on sick leave to ensure a timely return to work. Eight injuries were reported in 2022, six of which were minor injuries. In 2022, IFE initiated measures to reduce the number of injuries and extended reporting to the board.

	2022
Sickness leave	3,3
H1 (incl subcontractor)	3,1
H2 (incl subcontractor)	3,8
Injuries	8

National Insurance Scheme. All employees retain their normal salary during the leave period. Based on a risk assessment, pregnant women who work with radioactive substances and ionising radiation are transferred to duties that do not involve exposure for the remainder of the pregnancy.

Gender equality and anti-discrimination

IFE seeks to achieve full gender equality. The foundation has set up a multi-party group to analyse issues related to gender equality and discrimination. The group consists of HR representatives, chief safety representatives and trade union representatives. The group reports to IFE's board and the Working Environment Committee. For IFE's reporting on the status of gender equality, the description of the gender equality and anti-discrimination efforts, as well as the action plan, we refer to the report 'IFE's work on equality', which is published on our website.⁶ IFE also has a 'Gender Equality Plan' to promote gender equality in research.⁷

Under IFE's Code of Conduct, employees must help to safeguard a fair and inclusive working environment that does not discriminate based on ethnicity, gender, race, religion, political orientation or social background. Diversity at IFE is safeguarded through our recruitment process, which

Total number 2022	Women	Men
649 permanent employees	247	402
66 temporary employees	16	50
28 part-time employees	13	15
9 members of IFE's executive management team	3	6
9 members of IFE's board of directors	3	6
4 members of IFE Invest's board of directors	0	4

is needs-based and subject to objective criteria that should not be influenced by the candidate's gender, pregnancy, maternity or adoption leave, care responsibilities, ethnicity, religion, worldview, disability, sexual orientation, gender identity or gender expression. In 2022, IFE composed a diversity statement, which is included in all our job advertisements.

IFE has an international environment with employees from 38 different nations. In order to make our employees feel included, information on our website and in the Employee Handbook is in Norwegian and English. The CEO and HR hold introductory meetings with all new employees in Norwegian and English.

6) [ifes-arbeid-for-likestilling-2022.pdf](#)

7) [ife-gender-equality-plan-2022.pdf](#)

IFE's working environment survey also covers discrimination and unfair differential treatment in the organisation. The results of the survey are presented to IFE's entire line management. Based on this, action plans are drawn up at departmental level to address any non-conformance and design improvement measures. The results of these are assessed in a midway evaluation and subsequently a final evaluation.

IFE has established internal and external channels for reporting wrongdoing. No issues were reported in 2022, either in the internal or the external channel. The working environment survey has uncovered cases of bullying and harassment at IFE. IFE takes this very seriously and has initiated preventive measures in 2023, including training on how managers and other employees should deal with the reporting of wrongdoing, bullying and harassment.

IFE seeks to achieve full gender equality. The foundation has set up a multi-party group to analyse issues related to gender equality and discrimination. Photo: Mostphotos



Future scenarios for de-carbonising, electrification and long-term decision-making

An energy system entails relationships between energy carriers, energy generation technologies, energy storage, energy transport options and end-use sectors. Understanding energy system dynamics is necessary for an affordable future development with a low carbon footprint and for ensuring energy security. At IFE, a team of researchers dedicated to Energy System Analysis applies and develops mathematical models in order to increase the knowledge base of future energy systems. The analysis focuses on technology learning, new technologies, behaviour aspects, flexibility solutions, new energy carriers, energy storage, sector couplings and political measures.

The IFE Energy System Analysis group develops and uses scenarios to explore possible future paths as well as mapping relevant uncertainties. Our regional scope covers local energy systems, national systems (Norway) as well as Europe and global outlooks. We have a widespread collaboration with experts in national/local authorities, organisations, the private sector (energy and industry) and technology experts.

IFE Energy System Analysis is also actively contributing to the international development of analytical tools through the Energy Technology Systems Analysis Programme (IEA-ETSAP) – one of the longest running Technological Collaboration Programmes of the International Energy Agency (IEA) – which includes partners from 21 countries.

DataArena

The DataArena project is developing a simulation service that makes it easier for grid customers to connect to the power grid, see available capacity and explore alternatives to the local expansion of grid capacity. The simulation service aims to serve as early-phase guidance for new customers that want to connect to the grid. The major benefits of the project lie in the use of new data for faster and better decisions for the development and strengthening of the power grid. The solution also helps developers get a better overview of the network capacity in the power system and provides the opportunity to optimise location in terms of connection costs. The project was initiated by IFE project partner Glitre Nett.



Reporting according to the Transparency Act

IFE is subject to the act relating to enterprises' transparency and work on fundamental human rights and decent working conditions (the **Transparency Act**). IFE conducts IDD of suppliers and other partners in accordance with UN's Guiding Principles for Business and Human Rights and the OECD Procedure for Multinational Enterprises.

Each year, IFE buys goods and services from suppliers in Norway and abroad for approximately NOK 400 million. In the materiality and risk analysis, procurement was considered one of the areas where IFE is at the greatest risk in terms of social sustainability. This relates to purchases from countries that are considered 'high risk' due to the risk of contraventions of human rights and decent working conditions. In the materiality and risk analysis, insufficient management documents and routines for control of the supply chain and follow-up of suppliers were identified as the main risk for IFE.

IFE can make a positive contribution by choosing suppliers and trading partners who incorporate sustainability into their social and environmental conditions, and by setting requirements for those we work with.

In 2022, IFE developed policies and guidelines to implement the Transparency Act into the procurement process. As IFE has around 1600 suppliers registered in the procurement register,

we have started by introducing the routines for new suppliers from 2023. Suppliers are then categorised in the register based on risk level. IFE is trying to reduce the number of suppliers, and aims to particularly reduce the number of high-risk ones.

If it is difficult to remove or replace high-risk suppliers and trading partners, IDD will be performed and the results presented to IFE management, who will then decide whether the risk is manageable and acceptable. If we choose to retain high-risk suppliers and trading partners, annual assessments will be required. When negotiating and entering into contracts, suppliers and trading partners must sign IFE's ABC policy, in which they undertake to comply with IFE's Code of Conduct. Any breaches of this may lead to the contract being revoked.

In addition to introducing new requirements and procedures for suppliers and trading partners, IFE management decided to introduce similar procedures for collaboration partners. This goes beyond the scope of the Transparency Act, but it is crucial to ensuring that our collaboration partners protect human rights and maintain decent working conditions.

Employees who procure goods or services or enter into collaborations are responsible for complying with the new policies and procedures introduced in conjunction with the Transparency Act.

The procurement department is assisting with the implementation of the Transparency Act vis-à-vis suppliers and business partners, and SSC is providing assistance in relation to collaboration partners. Employees can seek advice from the Ethics Committee and escalate matters to the division management or IFE's executive management.

Integrity due diligence process for IFE's suppliers

Suppliers and business partners are subject to IDD in relation to the procurement of goods and services. New suppliers and business partners are assessed to clarify whether they are high or low risk, and the results are documented in the supplier register. High-risk partners are either located in countries that score below 70 in the Transparency International Corruption Index, and/or below 70 in the Freedom House ranking, and/or appear on the 'red flag' list. If it is decided to proceed with a high-risk partner, the person responsible for the procurement must screen the supplier in a compliance database that IFE has access to, and carry out an IDD for those with a score below 50 in the aforementioned index and ranking.

The procurement department is responsible for assessing whether the result of the IDD indicates whether a contract can be entered into, or the process must be terminated, and can escalate the

matter to the Ethics Committee or IFE's executive management. If the decision is made to proceed, there is an established routine for the annual follow-up of high-risk partners that the employee using the supplier/partner is responsible for. According to this routine, IFE will follow up the high-risk supplier with a set of measures, such as:

- Yearly declaration of conformity
- Yearly reporting of ethical and social conditions
- Audits
- Periodic review of invoices and services performed
- Updated IDD, screening and/or questionnaire

The routine also includes IFE giving consideration to whether the current supplementary mitigating measures are sufficient, or if the risk may be resolved through communication with the supplier, and/or affected local communities and NGOs. If the risk increases, the matter must be escalated to the procurement department, which will implement risk-reducing measures or decide whether there is a need to terminate the relationship.

IFE's Code of Conduct and ABC policy form part of negotiations and contracts with a value of more than NOK 100 000, and these must be signed. IFE's standard contracts were revised in 2022 in order to comply with the new requirements and procedures.

Integrity due diligence process for IFE's partners

IFE has collaboration partners who are not classified as suppliers or business partners, for example, businesses, individuals, research groups or business clusters, where they collaborate on the exchange of data, guest researchers, students, infrastructure, etc. The Transparency Act does not cover collaboration partners, but IFE has decided to introduce corresponding requirements and procedures for collaboration partners who are considered high-risk.⁸

High-risk collaboration partners are either located in countries that score below 70 in the Transparency International Corruption Index, and/or below 70 in the Freedom House ranking, and/or appear on the 'red flag' list. If it is decided to proceed with a high-risk collaboration partner, the person responsible for the project must screen the supplier in a compliance database that IFE has access to, and carry out an IDD for those with a score below 50 in the aforementioned index and ranking.

The division management is responsible for assessing whether the result of the IDD indicates whether a partnership can be entered into or if the process must be terminated, and can escalate the matter to the Ethics Committee or IFE's executive

management. If it is decided to proceed, there is an established routine for the annual follow-up of high-risk collaboration partners for whom the project manager is responsible. According to this routine, IFE will follow up the high-risk partner with a set of measures, such as:

- Yearly declaration of conformity
- Yearly reporting of ethical and social conditions
- Audits
- Periodic review of invoices and services performed
- Updated IDD, screening and/or questionnaire

If the risk increases, the matter must be escalated to division management, who will implement risk-reducing measures or decide whether there is a need to terminate the relationship.

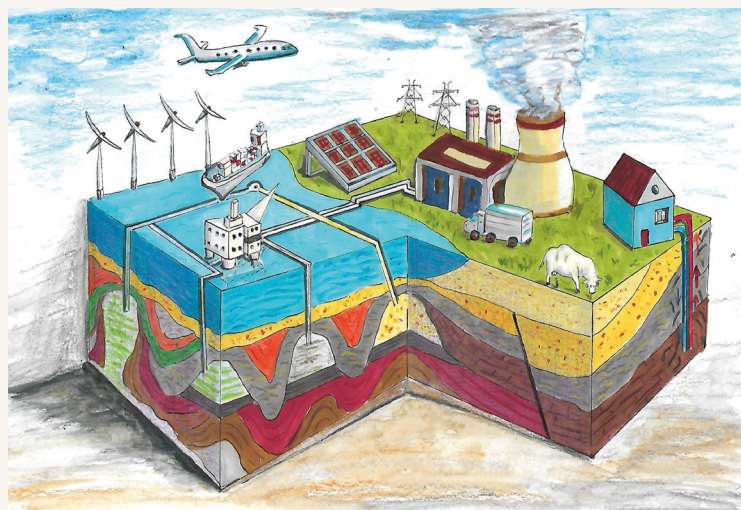
Results from IFE's IDD process

New requirements and procedures for compliance with the Transparency Act were drawn up in 2022 and will be implemented in 2023. No suppliers, business partners or collaboration partners were subject to IDD in 2022.

8) The requirement does not apply to collaboration partners in research projects that are funded by the Halden Project, the Research Council of Norway or the EU, as research partners in such projects are subject to an approval's procedure. However, in establishing consortia or negotiations with research partners who want to participate in such projects, IFE can apply the requirements and routines to assess whether we want to work with them.

Sustainable development on the Norwegian continental shelf

The IFE team of researchers from the Reservoir and Tracer departments is working on the development of new technologies to reduce the environmental and health impacts of human activities. This includes laboratory and numerical studies of geomechanical, geochemical and fluid flow processes. We perform chemical characterisation of geological formations for a wide spectrum of surface and subsurface applications, and trace pollution and contamination in ecological systems, landfills and industrial sites.



An essential step in the energy transition towards net-zero emissions is combining fossil and renewable energy sources. The energy mix scenario is based on clean H2 production combined with large-scale CCS and underground H2 storage. Illustration: Anna Mironova

Geological CO2 storage

We contribute actively to developing geological CO2 storage, which is an important part of the solution for reducing global emissions. We are working on many flow and geomechanical issues arising in existing CO2 pilot projects, such as surface uplift, induced seismicity and fluid leakage. We are coordinating a European project, Development and testing of novel cement designs for enhanced CCS well integrity, in which academic and industrial partners from three countries are working together to improve wellbore cement quality. A new international project, Permanent sequestration of gigatons of CO2 in continental margin basalt deposits, with partners from Norway, the United States, India and Germany, was launched in 2022. The project aims to provide detailed solutions for reservoir selection, CO2 transport, injection, and monitoring to pave the way to commercialising CO2 storage in offshore basalt complexes.

Sustainable utilisation of the norwegian continental shelf

As part of the National Centre for Sustainable Subsurface Utilization of the Norwegian Continental Shelf (NCS2030), we aim to develop solutions that maximise the value creation of energy resources on the Norwegian continental shelf, whilst also achieving the net zero emission goals. The University of Stavanger, NORCE, the University of Bergen and IFE are the main research partners in the research centre, which will be operational from 2022 to 2029. The industry partners include operators on the Norwegian continental shelf, technology suppliers and innovation companies that will ensure high relevance and societal benefits.

The centre will work on four main research: subsurface energy systems, net-zero emission production, digitalisation and society. Transitioning the NCS into the future Sustainable Subsurface Value Chain requires a new way of thinking across disciplines. Increased understanding of the subsurface for hydrogen and CCS and geothermal energy, in addition to efficient hydrocarbon production, are elements that the centre will focus on to achieve the goal.

The Sustainability Report is approved and electronically signed by the Board of Directors

Kjeller, 27. April 2023

Nils Morten Huseby
President

Olav Fjell
Chairman of the Board

Jo Døhl
Board Member

Katrine Trovik
Board Member

Sven Sigfred Ordeus
Board Member

Ingvill Heskestad Mykland
Board Member

Josefine Helene Krogh Selj
Board Member

Marinus Isaac Hoffmann
Board Member



IFE will continue our efforts to develop sustainable solutions to global and national challenges in partnership with those who commission our work.



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