VTT

Annual and sustainability report 2023

Challenging times highlight the importance of research

beyond the obvious

VTT in brief

VTT is a visionary research, development and innovation partner for companies and the society. We bring together people, business, science and technology to solve the biggest challenges of our time. We advance the utilisation and commercialisation of research and technology in commerce and society. This is how we create sustainable growth, jobs and wellbeing and bring exponential hope.

VTT is one of the leading technical research organisations in Europe, and we have over 80 years of experience in cutting-edge research and science-based results. Carbon neutral solutions, sustainable products and materials and digital technologies are in the core of our operations. Finland's national metrology institute and metrology laboratory MIKES is part of VTT.

Read more about VTT

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Crises in the operating environment clarify what we at VTT should focus on.

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With our new research investments, we take bold steps long into the future.

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Our customer satisfaction score was record high in 2023.

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We develop sustainable solutions and technologies for the use of our customers and society.

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Year 2023

Our cooperation with companies was more extensive than ever before despite the uncertainty in the markets. We made significant new research openings, strengthened the expertise of our stakeholders and our own, and took important steps in the development of key technologies.

Funding granted to VTT accelerates research and business development

The past year has shown that exceptional conditions have become the new normal. As the global political situation is getting increasingly tense, it will open up new areas where VTT's expertise can be utilised. A new era also means new opportunities.

Despite the geopolitical volatility, we are looking forward with optimism. The Finnish Government has granted VTT significant additional appropriations for the scaling of a quantum computer, multi-user devices for microelectronics and quantum technology, and research and development of small nuclear power plants. Therefore, I would like to thank the Finnish Government for these funding decisions. They promote not only technology infrastructures and R&D activities important for VTT and Finland, but also the scaling and development of companies and partners in a broader context.

The scope of VTT's operations grew to record levels last year. VTT also increased its work input by 160 person-years. New recruitments were made especially in growth projects, and they enable our renewal. In other words, in the coming year, VTT will continue to have excellent opportunities to create impact through its versatile offering and top research.

It is important that the investments we published in January 2023 will be realised and, in this way, enhance VTT's operations and impact. These investments promote the green transition, resource wisdom and security of supply, and accelerate the renewal and competitiveness of companies. In Espoo, we expanded our research environments and laboratory activities last year. We have other investment projects currently underway in Tampere and Espoo at Bioruukki and in Otaniemi. For example, at Bioruukki, we are building a clean energy piloting platform. The aim of the investments is to develop VTT's modern research capacity and capabilities and to improve occupational safety.

In 2024, we will focus especially on the development of operative activities and the results of scientific research and their impact. We also want to harness artificial intelligence more efficiently for the use of VTTers and to develop our own expertise in this respect. We are also preparing for ESG reporting, which will become obligatory for us in 2025, and for collecting the necessary data well in advance. We will also continue our efforts to improve the level of safety at VTT and to make heavy investments in improving our occupational safety culture. We want everyone at VTT to be aware of occupational safety risks and to take them into account in all their activities.

All development work done by us is supported by our reputation that has continued to develop in a positive direction. A positive trend in the results of the annual Reputation&Trust survey continued among our stakeholders. VTTers' satisfaction and trust in VTT as a workplace was also reflected in the survey, and the Board of Directors is very pleased about this development. Finally, I would like to thank both VTTers for the record year and our customers for the challenging assignments.

Chair of the Board
Pekka Tiitinen

The implementation of our investment projects plays a key role for VTT.

A volatile world does not discourage research

Crises clarify what we at VTT should focus on – long-term research aimed at addressing major challenges such as climate change and environmentally friendly food production.

In the light of the figures, the year 2023 went well at VTT, considering the weakened general economic outlook. The economic downturn has been reflected in our customers' capacity to invest. On the other hand, our operations have been accelerated by the competitive public research funding granted by Finland and the EU and the Finnish Government's strong investment in RDI activities.

Despite the crises in our operating environment, we at VTT keep an eye on the longer term and especially on the climate crisis and the need to find solutions to it. We believe that science and technology will play an important role in these efforts.

Based on our annual personnel survey, VTTers still find their work very important. However, we have identified challenges in how the workload of VTT employees is not evenly distributed, so we have continued to recruit new VTTers and develop our operations.

In 2023, the scientific impact and visibility of our articles in the scientific community increased. Another indication of the high level of research carried out at VTT is that Merja Penttilä, Research Professor for Biotechnology at VTT, was appointed Academician of Science on 19 January 2023. Still, the number of scientific articles and research papers published by VTT decreased from the previous year. We will pay attention to this in the future. Furthermore, the PhD and Postdoc programmes launched this year will make the publication of scientific articles easier.

One of our big success stories was the completion of Finland's second, 20-qubit quantum computer. The project, carried out together with IQM Quantum Computers, demonstrates our strong national technology competence, good cooperation between stakeholders in the sector and the growth potential offered by the sector.

During the year, we recruited almost 400 new VTTers, of whom international recruitment accounted for 101 persons. In the coming year, we want to allocate public funding granted to us to help companies invest in the green transition and renewable materials. We will also continue our journey towards VTT's own 2030 carbon-neutrality target.

Finally, I would like to thank all VTTers, our customers and our partners for the successful year! Let's continue our common journey in 2024.

President & CEO
Antti Vasara

We will look even further into the future and focus our efforts on resolving the planetary climate crisis.

VTT 2023 in figures

VTT brings together people, business, science and technology to solve the biggest challenges of our time, creating sustainable growth, jobs and wellbeing.

We need cooperation even more than before as the world situation has changed suddenly and fundamentally. In spite of everything, the changed environment offers opportunities for new business and the creation of technological breakthroughs to build a more sustainable and secure future.

Economic fluctuations have slightly reduced the demand for our services, but VTT is still highly valued by our customers.

Our excellence produces impact for society as a whole. In 2023, we took a significant leap in the development of quantum computers, for example.

The adjacent figures describe 2023 for VTT and our ability to create impact, resilience and exponential hope for the world transforming at an accelerating speed in a sustainable manner.

Operating income, EUR million

284

Number of employees

2,355

of which 306 are international employees

Doctors and licentiates

743

Scientific articles

488

Patent families

450

Invention disclosures

195

The figures are for the entire VTT Group.

Success stories in 2023

Merja Penttilä was awarded the title of Academician of Science

President of the Republic of Finland **Sauli Niinistö** awarded VTT's Research Professor for Biotechnology **Merja Penttilä** with the title of Academician of Science. Penttilä has cooperated very extensively with a number of national and international companies to develop industry-changing applications. Throughout her career, she has worked to foster dialogue and cooperation between academy and industry. Penttilä's key research area is the development of new production processes to replace fossil raw materials.

Read more

VTT became one of the most attractive workplaces

VTT gained an excellent ranking in Universum's annual survey of professionals' perceptions of different employers. VTT was one of the top climbers, moving to 6th place as the most attractive workplace among engineering professionals, up from 15th place last year. In the Universum survey, professionals in engineering considered that the respect for people in the workplace was important. This is something VTT has been investing in, and according to the latest employee survey, VTTers feel that their working community is equal and inclusive.

Read more

Ali Harlin awarded for fibre innovation

VTT Research Professor **Ali Harlin** was awarded the Blue Globe environmental award for developing and productising the textile fibre product Infinna. The award is a tribute to innovators who have succeeded in scaling up environmental actions to the extent that can change consumer behaviour.

Infinna solves problems related to textile waste, raises the awareness of the fashion industry and consumers about recycled materials and reduces the need for virgin cotton. It enables a new kind of industrial ecosystem based on recycling.

Read more

VTT was selected as the first NATO research partner in Finland

VTT was the first Finnish organisation to be approved by the NATO Communications and Information Agency (NCI Agency) as its research partner within the Not-For-Profit Framework (NFPF). The agreement provides VTT the opportunity to participate in NATO's research projects.

With the help of the arrangement, NCI Agency aims to enhance its research activities and bring new special expertise to the agency's use. VTT also has a long history of tackling some of the toughest challenges in information and communications technology, space, data and defence. The agreement shows that NCI Agency values VTT's expertise.

Read more

Second quantum computer completed, the first one deployed for business use

Finland's second quantum computer was released in October. The computing power of the machine developed jointly by the quantum computer company IQM and VTT is 20 qubits. It is a demonstration of strong Finnish technology expertise and ability to scale quantum computers and make them better. The aim is to upgrade the 20-qubit quantum computer to a 50-qubit computer by the end of 2024.

VTT also made the first five-qubit quantum computer available for Finnish and European companies in November. The computer allows companies to develop quantum algorithms and software, and to assess their suitability for solving practical computational problems.

Read more

Financial statements

VTT Technical Research Centre of Finland Ltd is a Finnish non-profit limited liability company owned by the state. The company falls within the mandate of the Ministry of Employment and the Economy. According to the law VTT is an independent and impartial research organization. VTT operates as a research, development and innovation partner to help the society and companies to grow through technological innovations.

VTT's operating income increased due to jointly-funded project activities. IPR revenues increased as well. The net turnover of commercial activities remained almost at the previous year's level, even though the global economic situation, high interest rates and inflation have made companies cautious and customers' decision-making has slowed down. The operating result of the parent company was positive but below last year's level due to the increase in costs caused by inflation, which was faster than the increase in income.

VTT is building Finland's first quantum computer, for which VTT was granted a 20.7 M€ government special grant (investment grant) for years 2020–2024. The phase two 20 qubit quantum computer was completed in August 2023, and the last phase of the project started with the goal of building a 50 qubit quantum computer. During the year five new significant research investments were launched. The idea is to promote green transition, resource wisdom and security of supply, and accelerate the renewal of companies and competitiveness.

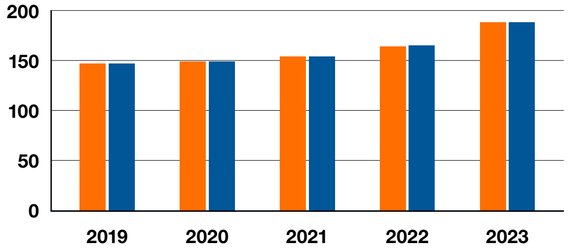
Key financial figures

VTT Technical Research Centre of Finland Ltd	VTT Group			Parent company		
	2023	2022	2021	2023	2022	2021
Net turnover (1,000 euros)	187,636	164,852	154,229	187,636	164,417	153,716
Other operating income (1,000 euros)	96,214	95,707	99,437	97,386	99,058	101,270
Government grant	87,100	83,841	83,579	87,100	83,841	83,579
Government special grant	2,022	1,327	1,493	2,022	1,327	1,493
Other	7,092	10,538	14,366	8,264	13,889	16,198
Operating result before special items* (1,000 euros) (operative, unaudited)	-681*	2,285*	7,257*	789*	6,484*	9,788*
Operating result (1,000 euros)	-1,131	4,856	13,966	340	9,056	16,498
Operating result (%)	-0.6	2.9	9.1	0.2	5.5	10.7
Result of the financial year (1,000 euros)	5,463	4,396	12,071	2,516	3,664	11,590
Return on equity (%)	3.0	2.5	7.2	1.8	3.4	8.6
Equity ratio (%)	74.7	70.2	69.5	70.5	68.1	68.5

VTT Technical Research Centre of Finland Ltd's net turnover consisted of 63% public sector revenue (Group 63%) and of 37% private sector revenue (Group 37%). The domestic revenue accounted for 55% (Group 55%) and foreign revenue for 45% (Group 45%) of the net turnover.

*Comparable operating result before special items does not include the additional provisions made for the decommissioning of FiR1 research reactor and restoration of the old hotcell facilities (2023: -0.4 M€, 2022: -0.4 M€), the government special grants for the decommissioning of FiR1 research reactor and restoration of hotcell facilities (2022: 0.5 M€, 2021: 0.5 M€), the revenue from partial derecognition of provisions for the restoration of old hotcell facilities and the Jules Horowitz reactor project included in Other operating income (2022: 2.5 M€) nor the revenue from the derecognition of debt due to the reduction of the nuclear waste management liability (2021: 7.6 M€).

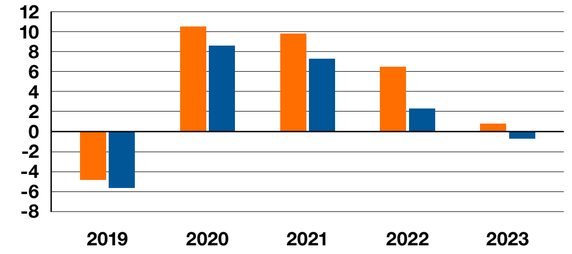
Net turnover M€



The parent company's **net turnover increased 14%** during the financial year especially due to higher income in the public sector.

Parent company
VTT Group

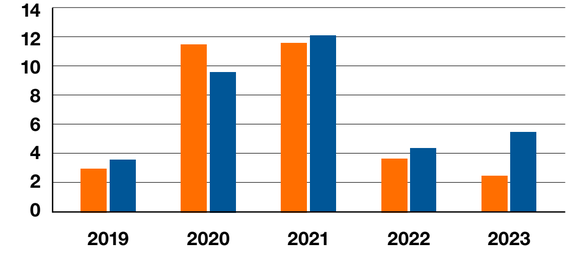
Comparable operating result M€



The comparable (adjusted) operating result* of the parent company **was positive.**

Parent company
VTT Group

Result of the financial year M€

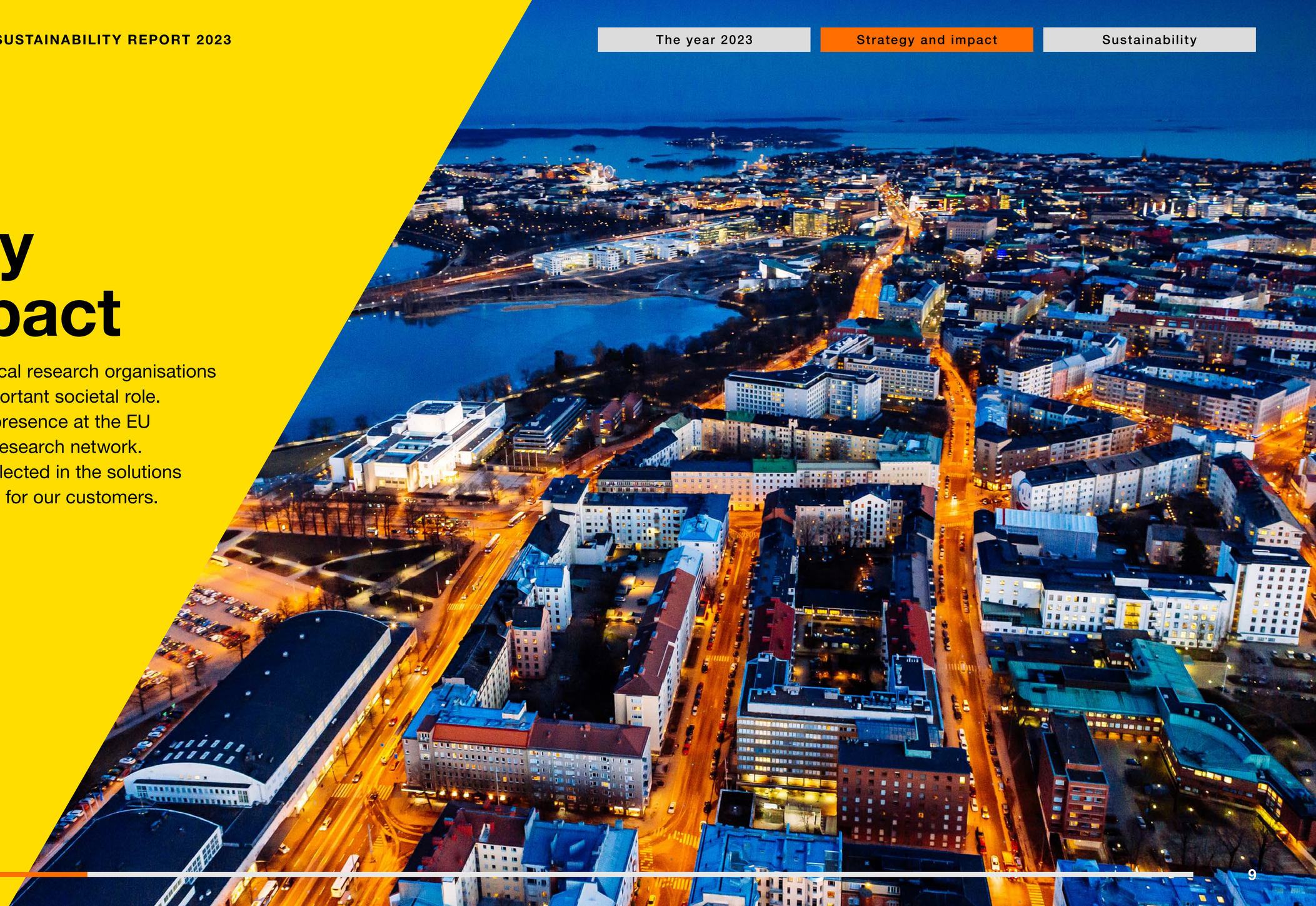


The parent company's and the Group's **result of the financial year were positive.**

Parent company
VTT Group

Strategy and impact

As one of the leading technical research organisations in Europe, VTT plays an important societal role. We also have an influential presence at the EU level and are part of global research network. Our greatest impacts are reflected in the solutions and technologies developed for our customers.



Impact is created through concrete solutions to global challenges

In 2023, we launched five major research investments, strengthened our strategic international partnerships and launched two programmes focusing on competence building.

Our aim is to find solutions in science and technology to global challenges. In our research, we focus on selected systemic and technological challenges to achieve maximum impact. We use new research investments to create expertise and infrastructures that enable our customers to achieve significant results that generate societal value.

At the beginning of the year, we announced five major research investments for the next three years. We will build a district heating reactor with Finnish operators and create new piloting platforms for the recycling of plastics and textiles, the development of sustainable fibre products, the product development of medical devices and the digital development of biomaterials. We will also promote a national initiative to build a piloting environment for microelectronics and quantum technology.

The purpose of the new research investments is to be bold with future-oriented progress. Through them we help companies renew themselves and create new conditions for the green transition. The openings were received with enthusiasm, and numerous Finnish and international companies actively joined our research themes. Our goal is to accelerate industry renewal in companies and attract more investments directly to them.

The focus areas of our research shift with the development of the operating environment and technology. In 2023, we raised energy technologies as a new key challenge area. The aim is to produce a driving force for a clean transition.

New international growth companies and ecosystems

VTT plays a special role in the renewal of the Finnish start-up and growth enterprise ecosystem. We have a wide range of customers, from large companies that shape the global market to start-ups that commercialise research expertise that serves global needs.

The goal of the VTT LaunchPad business incubator is to create high-quality spin-offs with solid funding and to propel them on a path of international growth, based on VTT-owned knowledge capital. In total, more than 50 spin-off companies have already emerged through VTT. They have accumulated nearly a tenth of the capital investment potential acquired by the Finnish start-up field.

An example of new spin-offs established in 2023 is Steady Energy, which aims to decouple heat intensive industries from fossil fuels. The conceptual development of small modular nuclear reactors took a big leap in 2023, when the company collected EUR 2 million in seed funding. Steady Energy intends to build a district heating plant based on small modular reactor technology in Finland by 2030.

It is crucial for the future of Finland that trade and industry can be bold and make investments in technological breakthroughs. We need innovation environments that enable strong and seamless cooperation between universities, research institutes and companies, while stimulating the emergence of new technologies, innovations and products.

Three main issues concerning VTT's strategy and impact

1. New research investments:
We launched significant new research openings and invested in piloting environments that promote the digital and green transitions and accelerate the renewal and competitiveness of companies.

2. We invest in competence:
We launched a new PhD programme and an internal innovation programme to understand systemic change. VTT's efforts generate more experts and expertise in society.

3. Internationality:
We strengthen global cooperation and customer relationships with trusted strategic partners.

”The purpose of the new research investments is to be bold with future-oriented progress. Through them we help companies renew themselves and create new conditions for the green transition.”

Laura Juvonen is Senior Vice President, Strategy at VTT.

National investments in the establishment of a piloting environment for microelectronics and quantum technology and the scale-up of a quantum computer support the existing strong Finnish expertise and ecosystem built around technologies. Kvanttinova, the joint piloting facility of VTT and its partners, makes it possible to make Finland one of Europe's most important RDI centres in the field. Scaling the quantum computer further towards 300 qubits enables the "effective quantum phase", i.e., achieving the real quantum computing benefits in the first practical quantum applications.

We aim for the future by developing concrete solutions to global challenges.

Strengthening international cooperation

VTT is Finland's largest actor in European networks and international research programmes. For example, in the European Union's Horizon funding programme for research and innovation, we ranked as one of the biggest recipients. Of all 12,600 organisations participating in the programme in 2023, we ranked 17th in terms of project funding.

We strengthened our strategic international partnerships and gained new customers, especially in North America. The cooperation focuses on cutting-edge technologies, such as quantum technology, in which Finland is one of the leading countries in the world.

New programmes enhance competence

Finland's national objective is to increase investments in research, development and innovation over the long term and to encourage the private sector to increase its R&D investments. This will strengthen cooperation between research and the business sector and provide conditions for creating new business based on high-level expertise. To achieve this goal, Finland needs more multidisciplinary expertise and an increasing number of RDI professionals.

VTT continuously invests in people and competence. In 2023, we launched the PhD and Postdoc programmes, which provide a more systematic way of multiplying the number of doctors specialising in industrial cooperation in Finland and at VTT and attracting international talents.

With the help of the internal iBEX innovation programme, we strive to gain a deeper understanding of systemic change and the multidisciplinary capabilities needed to generate socially sustainable innovations. For example, technological competence alone is not enough to solve the challenges of the energy transition. We also need a comprehensive understanding of the energy system and the entire operating environment.

Meaningfulness as strength

Our strength lies in the core mission of VTT's operations: people find creating solutions to global challenges to be meaningful work. We are making constant efforts to ensure that every VTTer concretely understands their role in our long-term vision and feels that working for common goals is meaningful and rewarding.

In internal short-term goal setting, we use the Objectives and Key Results (OKR) model. Dialogue is the key element of the OKR model. Each team recognises the objectives that play the central role in their own activities as well as the key results they are aiming at and regularly reflect on how they are progressing towards these goals. In 2023, all VTT team managers took part in OKR training, and we launched the OKR coaching activity to support our everyday work.

During the year, we also invested in improving occupational safety and cyber security.

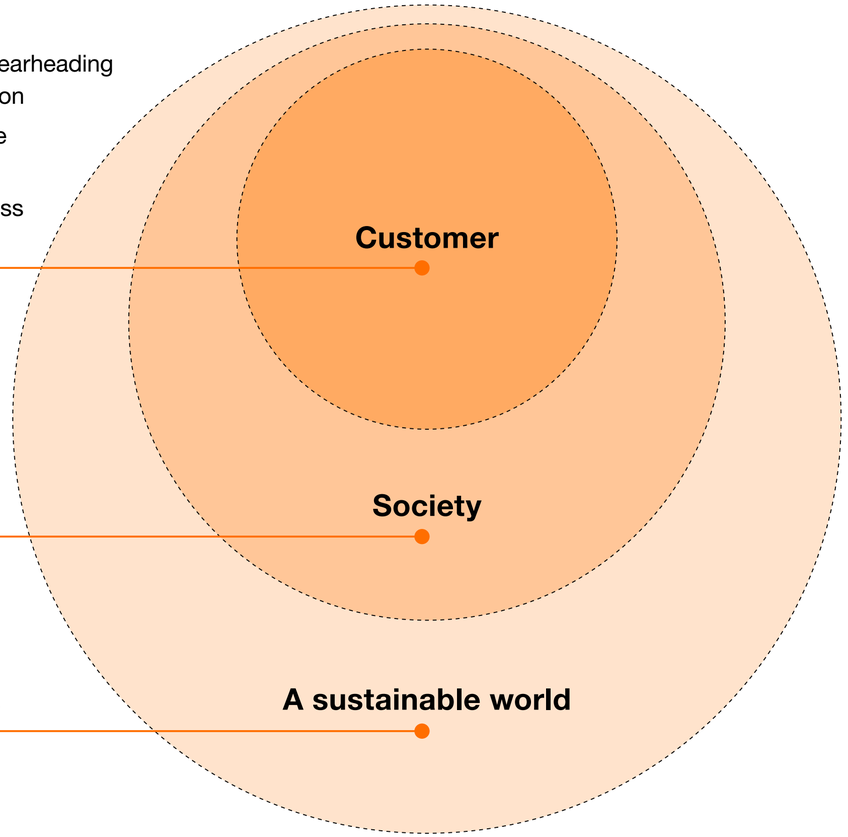
In 2024, the focus will be on promoting important research initiatives together with companies and our research partners. We also want to learn about the opportunities that artificial intelligence tools may open up for research and other everyday work.

We create impact together with our customers

1. Unique expertise and spearheading technologies for innovation
2. Faster and more scalable RDI projects
3. New international business opportunities

4. Sustainable renewal of industry
5. New international growth companies
6. Safe society utilizing technology

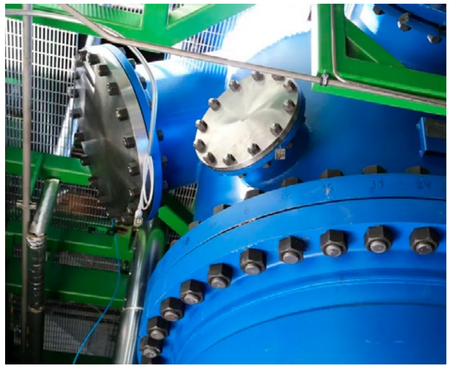
We bring together people, business, science and technology, to solve the world's biggest challenges.



In 2023–2025, VTT will invest in five research entities:

1. Pure and reliable heat in cities: domestic district heating reactor to be operational by 2030

The use of small modular nuclear energy can make district heating fossil free. The investment will continue the development of the small modular reactor (SMR) LDR-50 for district heating, which started in 2020. In addition to technical design, a network has been gathered around the project consisting of Finnish nuclear energy sector actors, energy end-users and companies. The aim is to commercialise the technology used in the district heating reactor by the end of this decade. This makes it possible to create a new industrial sector focusing on nuclear energy solutions in Finland.



2. New piloting platform bringing solutions for the recycling of plastics and textiles

Plastic packaging, mixed textiles and composite structures containing many different materials are difficult to recycle. They are almost always burned once discarded. The aim of the new piloting entity, to be built at VTT Bioruukki, is to significantly reduce carbon dioxide emissions by converting the components of composite materials into valuable raw materials for the process industry.

3. Pilot environment for fibre products: significant reduction of energy and water consumption in the forest industry and new product innovations

The market for different packaging and fibre-based products is growing strongly, but with the current methods, the production of fibre products consumes a lot of water and energy. VTT's investment will be used to develop a new virtually waterless forming technology, which significantly reduces the energy and water consumption of forest industry production lines. The technology also enables the manufacture of new innovative fibre-based products and lightweighting of fibre-based materials, which means that more products for consumer use can be produced from the same quantity of wood.

4. Digital development platform for biosynthetic materials: new materials by natural means 10 times faster

The development of new materials is essential for solving the global material challenge. Biotechnology and synthetic biology are expected to be one of the most important methods of material production in the future. The digital development platform to be built utilises data, AI, biotechnology and synthetic biology. It can be used to design and develop completely new materials with superior properties that are smart and responsive to different conditions up to ten times faster than before.

5. Pilot environment to accelerate the development of medical devices

The Western population is ageing and the need for health services is growing rapidly. The new generation of technology makes it possible to monitor the state of health and the risk of illness and to monitor the effectiveness of the selected treatment measures. The investment will be used to develop the research environment and manufacturing capabilities of VTT's Oulu office so that they enable the development of new innovative photonics-based medical devices and prototype manufacturing in a regulated manufacturing environment.

Our strategy 2021–2025: The path of exponential hope

OUR PEOPLE

Top professionals capable of systemic and technological breakthroughs that can bring about fundamental transformation.

The **choices** we make every day

OUR PURPOSE

We bring together people, business, science and technology, to solve the world's biggest challenges, creating sustainable growth, jobs and wellbeing.

1. Always aim for **impact**
2. Always create impact together with a **customer**
3. Always lead for **excellence**
4. Always drive **sustainable** business
5. Always build the world's most **meaningful** place to work

OUR AMBITION

We bring exponential hope to a world that needs to deal with the climate crisis, achieve resource sufficiency, drive industrial renewal, provide safety and security, and enable good life for all.

The choices are supported by our values:

- **Respect**
- **Together**
- **Passion**
- **Forerunner**

Generating sustainable growth by focusing on eight key challenges

We commit ourselves to focus all our energy and expertise on those systemic and technological challenges where we can make the biggest possible impact. Currently, we focus on the following challenges:

Systemic challenges

1. Carbon neutrality

Reaching a carbon-neutral economy in the coming decades

The mobility, construction, the industrial and energy sectors must become carbon neutral so that we can mitigate the most serious impacts of the climate crisis. Alongside reducing emissions, we must also create new economic activities that are based on low-carbon and carbon-negative technologies and carbon reuse. Working together with our customers, we are promoting the transition to a clean energy system and helping the world to free itself from fossil fuels.

2. Productivity leap

Achieving a 10-fold productivity leap

The need for sustainable materials and consumer goods is growing. The sufficiency of raw materials will be a major challenge facing the world. With effective solutions, renewable raw materials and the circular economy, we can ensure that there will be enough resources for everybody. Using new technologies, we can convert industrial by-products into valuable resources, recycle materials, introduce new production processes and create new renewable materials.

3. Societal resilience

Securing society's functions, fiscal sustainability and wellbeing while demographics shift

The environmental crisis, pandemics and other global challenges are making societies increasingly unstable. However, by using new technologies, we can anticipate and manage risks. Preparedness helps us to cope with emergencies, natural disasters and cyberattacks more quickly. Citizens can make decisions related to their wellbeing based on real-time health data. This also opens up opportunities for Finnish growth companies in the sector.

Technological challenges

4. Quantum leap

Bringing about the quantum leap in computing

A quantum leap means a fundamental change in computing. Quantum technologies and algorithms can help to speed up the development of materials and open new paths to combat the climate crisis. The benefits are already visible in the financial sector, the pharmaceutical industry and logistics. We ensure that quantum computing also benefits society at large. We develop quantum computing hardware and algorithms and help companies utilise quantum technology.

5. Super-performing materials

Creating superior-performing materials and shortening their design cycle by 50%

Materials science lies at the very heart of our future. It will help us ensure that there will be enough resources for the whole planet and replace fossil raw materials with renewable, carbon-neutral alternatives. We need new ways to design and produce materials. Synthetic biology and materials science provide tools to develop, for instance, sustainable biobased materials. Thanks to virtual material design, the duration of the development cycle can be halved.

6. Superior digital systems

Unleashing superior performance and sustainability in digital systems

Digitalisation has the potential to make most sectors more competitive and efficient. It requires redesigning processes by integrating ICT (such as 5G, data, artificial intelligence and sensors), robotics production and service environments. Electronics are, for example, integrated into structures or clothes. As the use of electronics increases, it makes us take better account of sustainable material solutions and recyclability and the need to minimise power consumption.

7. Synthetic biology

Matching nature's engineering skills through synthetic biology and bioinspired production

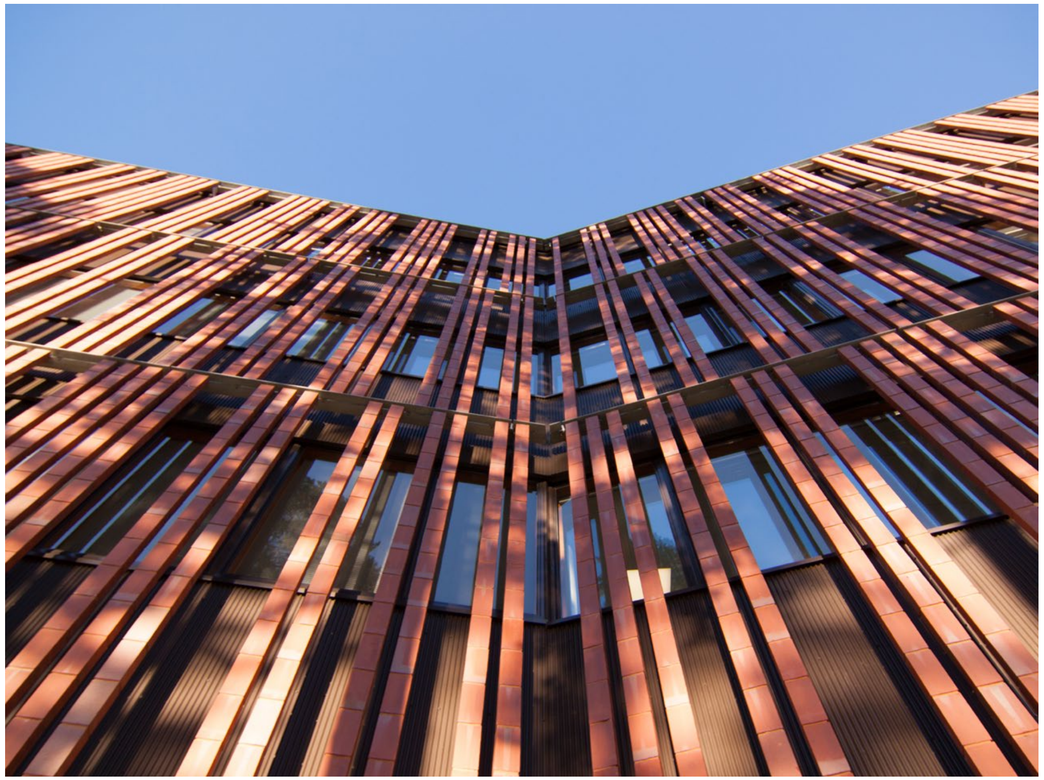
Synthetic biology is set to revolutionise biotechnology and replace some of the current production methods in the future. It can be used for producing durable materials, chemicals, pharmaceuticals and fuels. We can manufacture complex chemical compounds, smart materials and biological sensors. In a circular economy, we can utilise waste streams as food for microbes and use cell factories to deliver desired products to bioreactors.

8. Energy technologies

Powering up the clean transition

Hydrogen and nuclear energy offer carbon-neutral solutions for electricity and heat production. Hydrogen can enable carbon neutrality in challenging sectors, such as long-distance heavy traffic, maritime transport and the process industry. It can also help balance the supply and demand of renewable energy and its storage. Nuclear energy helps us achieve our carbon-neutrality goals in electricity and district heat production.

1. Carbon neutrality



Activities and strengths of VTT

We help to find the best solutions for making industrial processes carbon free or carbon negative.

In cooperation with industry, actors in the energy field and local governments, we are developing new models for different parts of the energy value chain. We are a partner in the energy system transformation in which smart power networks, solar and wind power as well as small modular reactors are assuming an increasingly important role.

We offer carbon capture solutions for the industrial, transport, power generation and heating as well as for agriculture and forestry sectors. Our emissions research services help the transport and logistics sectors to reduce their energy use and negative environmental impacts. We are an active player in many fields of applied battery research and in the development of biofuels and electrofuels.

By collaborating with companies, we are developing new models for different parts of the energy value chain.

We create solutions for the sustainable and smart design, construction, use and maintenance of buildings, infrastructure and cities. We support the transition towards a sustainable food system and health-enhancing nutritional solutions. We are partners in the development of plant biology, protein modification and food solutions.

Case

Tasty plant proteins can be produced using artificial intelligence

To build a sustainable food system, it is critical to change from high consumption of meat and animal-based products to more plant-based diets. The global plant-based food market is expected to grow to around EUR 160 billion by 2030.

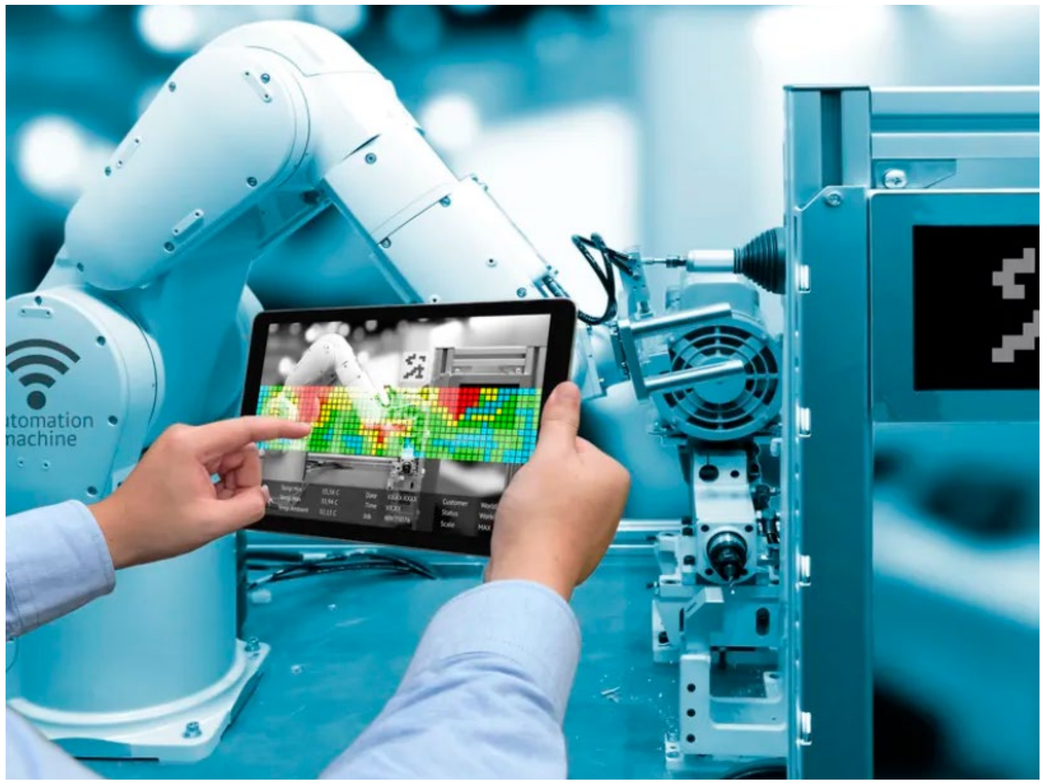
In 2023, VTT and the Finnish food industry joined forces to develop new plant protein value chains. The RETHINK consortium of VTT and food companies kicked off a series of projects to create competitive, tasty and healthy food solutions. This is done by using new plant protein production processes, boosted by machine learning and artificial intelligence.

The ingredient processes are optimised for maximal use of raw materials and minimal use of energy and other inputs. The use of local plants as food ingredients is taken into account in the development, which increases the security of supply. Solutions are systematically sought to improve the texture, taste and attractiveness of plant-based products.

Cost-efficient plant-based food ingredients generate income for both farmers and food manufacturers. The food ingredients can be used to produce plant-based foods that consumers are eager to buy and enjoy.

Read more >

2. Productivity leap



Activities and strengths of VTT

Key areas of research at VTT include developing durable and functional renewable materials, and recovering materials from challenging sources.

We are a research and innovation partner in the efficient recovery of valuable raw materials from side streams of industries and residential areas.

We help to find new business opportunities in the recycling of challenging materials, such as plastics and chemicals. Metals and minerals can be produced and recycled in a sustainable manner from sources such as ores. VTT has, for instance, developed a zero-waste concept for mines. We help our partners to increase

We help to create development projects and new bioeconomy solutions based on renewable materials in Finland.

the value added of forest industry products and thus to replace oil-based products.

We help to create development projects and new bioeconomy solutions based on renewable materials in Finland. With the business activities created around them, we are boosting the value of Finnish industrial exports. VTT studies the impacts of changes in industrial work. Robotics and increasingly advanced automation, and even autonomous operations in production, will affect the nature of future industrial work. The change is driven by the shortage of skilled labour experienced by companies and the means found for remedying the labour shortage.

Case

Board with unprecedented extensible limits may replace single-use plastics

VTT achieved unprecedented maximum limits for its highly extensible formable cellulose-based webs, used for rigid packaging applications. By utilising foam forming technology, VTT has now obtained up to 30% extensibility for formable boards. Earlier, typical extensibility for commercial boards has been between 3 to 18%.

This enables manufacturers to use rigid, formed cardboard-like packaging to serve consumers. Foam forming enables, for example, food brands producing cold cuts to increase cardboard-like package size from 75 grams up to 200–250 grams, which also reduces the use of fossil fuel-based materials.

For manufacturers, adopting the product as a substitute for plastic packaging is easy and can be implemented at low cost. For consumers, cardboard offers a more sustainable alternative to products packaged in single-use plastics.

The development work was conducted as part of a research programme where VTT, in cooperation with 54 companies and the Regional Council of Central Finland, has up-scaled promising alternatives for plastic products.

Read more >

3. Societal resilience

Activities and strengths of VTT

VTT boosts the resilience and cyber security of societies and organisations by helping them to use the necessary technologies.

We provide risk analyses and action plans that ensure the functional capacity of critical systems in exceptional and disruptive situations.

We design scalable cyber security development programmes and test environments. We provide solutions for acquiring, managing and sharing information so that citizens, companies and decision-makers can make the right decisions in changing circumstances. We safeguard the availability of critical natural resources, food and goods as well as their efficient and consistent distribution in emergency conditions.

We boost the resilience and cyber security of societies and organisations by helping them to use the necessary technologies.

We develop measurement technologies to enhance the wellbeing of citizens. Using them, we can help people to meet their personal wellbeing needs, help the health care system to move in the direction of preventive treatment and to evaluate the economic impacts of different technological solutions. Our services include smart health and wellness solutions, diagnostics technologies, health care technologies and wearable technology.

Case

Artificial intelligence solutions are needed to ensure cyber security of networks

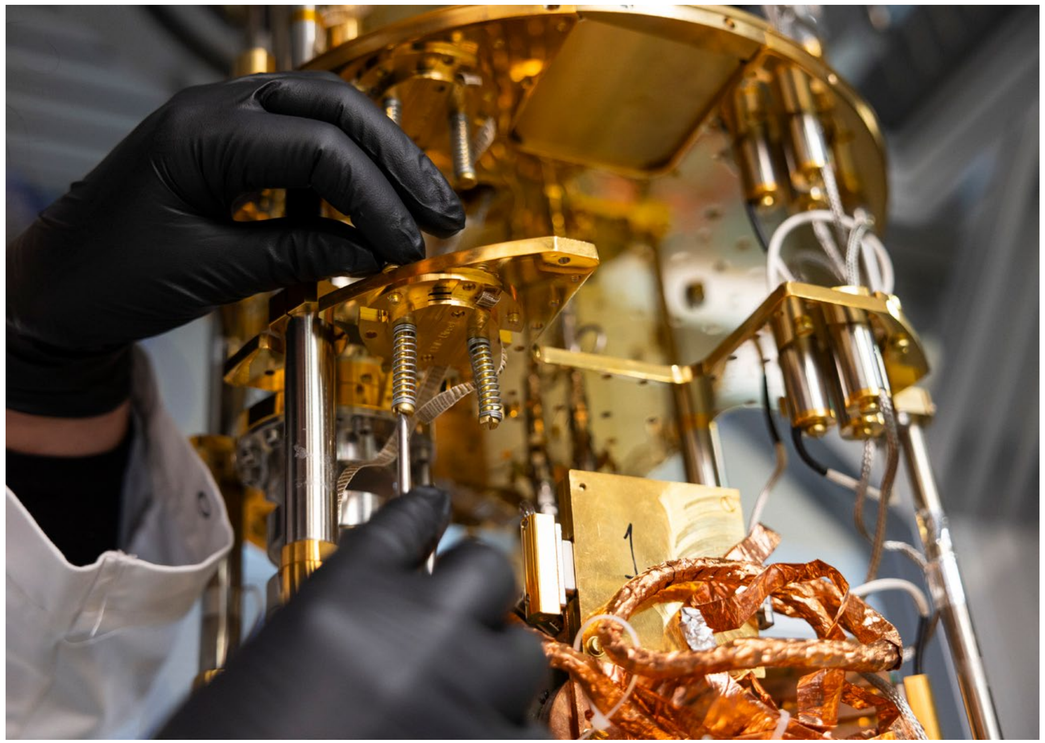
The development of information networks affects cyber security. Still, the communication of the authorities that are responsible for the safety and security of society – such as the police or border guard – must also be ensured in all circumstances. VTT coordinates the Finnish research consortium, which develops solutions to secure critical applications as part of the European AI-NET-ANTILLAS project.

In its own research, VTT focuses on how 5G and 6G networks can be attacked and how artificial intelligence can be utilised for cyber surveillance of the networks. We are also exploring ways to ensure the security and trustworthiness of AI algorithms, applications and platforms, and emerging solutions for field trials.

The research consortium has jointly developed several concepts that have been successfully tested. For example, we tested the use of low Earth orbit (LEO) satellite constellations in communications between authority users. The solutions were presented in May at the mid-term review of the project in Paris. The project involves partners from France and Germany. In Finland, it is funded by Business Finland.

Read more >

4. Quantum technology



Activities and strengths of VTT

VTT is a top expert in quantum technology, providing a full range of quantum technology services, such as quantum computing and quantum computing applications.

Our expertise covers superconductors, photonics and semiconductor platforms.

In cooperation with the Finnish quantum start-up IQM, VTT has built the first two fully functioning quantum computers in Finland. The latter of them, the 20-qubit quantum computer, was completed in autumn 2023. With the ecosystem built around the quantum computers and quantum expertise, VTT helps Finnish companies to prepare for the quantum era.

We help companies to adapt their offerings to the opportunities offered by quantum technologies and to create competitiveness.

VTT coordinates a large European infrastructure project in micro, nano and quantum technology.

We help organisations develop quantum technology in the scaling, integration and connection of the equipment. We supply components to companies building quantum computers and produce practical equipment and software solutions. We speed up quantum software development with our expertise in AI, machine learning and cryptography. We help companies to adapt their offerings to the opportunities offered by quantum technologies and to create competitive products and services for international markets.

Case

Finland's second quantum computer was completed

VTT and the Finnish company IQM Quantum Computers have completed Finland's second quantum computer. The technological advances made in the development of the 20-qubit quantum computer make it possible to scale quantum computers and to increase the number of qubits. This in turn increases the computing power and enables solving increasingly complex problems.

The quantum computer demonstrates the growth potential that the sector offers, the domestic technology excellence and strong cooperation in the field. The development of quantum technology generates export products and attracts international talents and investments. Finland is excellently positioned to create a new industrial sector around quantum technology. The intellectual property rights and tax revenues from the innovations would benefit Finland. The new quantum computer is located at VTT premises in Micronova, the national research infrastructure for micro and nanotechnology in Espoo, Otaniemi. The overall goal is to build a 50-qubit computer by the end of 2024. After that, the scaling of the quantum computer will continue towards 300 qubits with the additional appropriations granted by Finnish government.

Read more >

5. Super-performing materials

Activities and strengths of VTT

We are using AI to create new materials and significantly shorten the time required to develop them.

We possess top talent in the development of synthetic biology as well as of biobased, renewable and recyclable material innovations. We know how to manage materials challenges and produce cost-effective solutions.

We offer our customers services based on optimised materials planning and tribology, studying friction and wear. VTT ProperTune® is an Integrated Computational Materials Engineering (ICME) concept.

We utilise AI to create new materials and shorten the time required to develop materials.

Optimising materials planning with multiscale modelling can replace expensive and time-consuming testing. The more we can reduce the friction and wear of machines and equipment, the greater the savings of energy. Effective management of friction and wear can extend the useful lives of equipment and components and boost their performance. We can find the best solutions for individual customers and applications by means of experimental research and comprehensive tribo-analysis.

Case

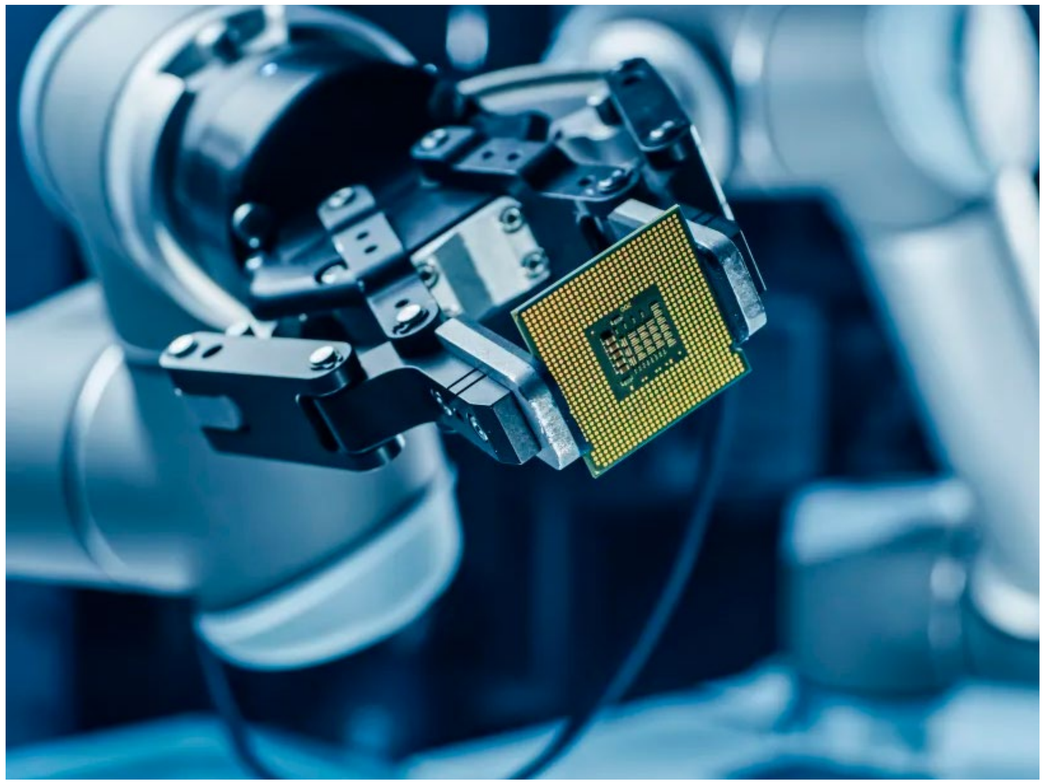
The transition to hydrogen economy requires expertise

Electrification and hydrogen will have a crucial role in propelling carbon neutrality. The hydrogen economy has huge potential. However, the introduction of hydrogen as a feedstock to industrial processes must be carefully planned to ensure a smooth transition. What changes or entirely new solutions are needed for companies to adjust their business operations and infrastructures to successfully adopt hydrogen-based solutions?

Whether companies are adapting their old processes or developing something entirely new, they need a profound understanding of materials performance and their conditions of use. In the future, hydrogen can function as a fuel, raw material or energy vector. Industry players must assess how their business models and production will be made ready for the hydrogen economy. VTT teams combine exceptional expertise in materials with multidisciplinary know-how. We also work with numerous industry partners, universities, and research institutes internationally to develop the best solutions for big systemic challenges as well as specific use cases. We help our customers introduce hydrogen-based production solutions and promote the development of hydrogen-based products with our customers.

Read more >

6. Superior digital systems



Activities and strengths of VTT

VTT develops integrated technologies for critical electronics and photonics systems.

The focus is on printed and flexible electronics applications in wearable and structural electronics. In photonics, we have developed measurement solutions that utilise edge computing for demanding measurements in the process industry, taking advantage of machine vision and spectroscopy.

The EU Chips Act aims to double the production of microchips in Europe by 2030. Our goal is to generate new business openings in Finland based on microsector, nanosector, quantum, photonics and printed intelligence technologies, create technology-based growth companies and to boost the competitiveness of existing companies. VTT offers growth companies pilot production lines and microelectronics manufacturing facilities.

We digitalise traditional industries and provide AI solutions to our customers.

We are digitalising traditional industries. We leverage environmentally friendly materials in electronics products and reduce e-waste. With the cross-disciplinary expertise possessed by VTT, challenges arising from digitalisation can be identified and customers can be provided with AI solutions tailored to their needs. Using VTT's equipment and methods, operators can determine how new technologies can be applied in their operations.

Case

Biodegradable ECG patch promotes more sustainable healthcare

VTT has developed a recyclable ECG patch made of biomaterials, which aims to reduce the carbon footprint of healthcare.

The biodegradable patch is made from VTT's new material, cellulose e-skin, a film which replaces traditional plastic in wearable applications. The new ECG patch consists of a reusable electronic component and a biodegradable single-use skin patch. The skin patch is made of nanocellulose and carbon. The film is strong, flexible, transparent, breathable and has good printability.

The global need for sustainable ECG patches is expected to grow rapidly as the population ages and the incidence of cardiovascular diseases rises. Regulations are also steering manufacturers from fossil-based approaches to more sustainable products. E-skin is a promising option that can be used in a wide array of wearable devices in the future.

Read more >

7. Synthetic biology

Activities and strengths of VTT

VTT has unique expertise in synthetic biology and the development of cell factories.

We use scientific breakthroughs to model DNA and create unprecedented biological organisms. This way we can revolutionise food production or create new biobased materials outperforming fossil-based alternatives. We provide technological solutions to produce chemicals from biobased raw materials and by-products. Modified microbes and plant cells, commonly called cell factories, can produce chemicals, polymers, proteins, materials and food.

We use scientific breakthroughs to model DNA and create unprecedented biological organisms.

We utilise both AI and robotics in the modelling of biomaterials and the design and construction of cell factories, significantly speeding up the development of solutions. VTT CellularFood service provides food sector actors with expert assistance and research platforms for developing new food solutions. We use the best production organisms, such as moulds that produce proteins, yeasts that are resistant to processing conditions and bacteria that get their energy from hydrogen.

We produce substitutes for plastics, as well as medically important molecules such as antibodies. We develop new food production methods that conserve both livestock and arable land, and biotechnical dyes for the textile industry.

Case

Fomes fungus helps develop strong and lightweight materials to replace plastics

A VTT research team has for the first time described the complex structural, chemical and mechanical features of Hoof fungus (Fomes fomentarius). The structure of Fomes is extraordinary because it can be modified. Minimal changes in the cell morphology and the extracellular polymeric composition result in diverse materials that surpass the properties of most natural or man-made materials in, for example, strength and lightness.

The complex architectural design of Fomes fungus could be mimicked and used to create new materials under laboratory conditions to replace plastics. Potential applications include impact-resistant implants, sports equipment, body armour, aircraft exoskeletons, electronics or surface coatings for windscreens.

The architectural design and biochemical principles of the Fomes fungus open new possibilities for material engineering, such as manufacturing ultra-lightweight technical structures or fabricating nanocomposites with enhanced mechanical properties.

Read more >

8. Energy technologies

We scale up hydrogen production using renewable energy and produce equipment solutions for hydrogen production. We help Finland meet its emissions targets with hydrogen-based technologies. We contribute to the emergence of the exports of hydrogen economy products based on Finnish expertise.

Next-generation nuclear reactors, small modular reactor solutions (SMR) and traditional large nuclear power plants help our society achieve its carbon-neutrality goals, make its energy system more self-sufficient and secure its energy supply.

We accelerate the clean transition and promote hydrogen economy exports and the achievement of Finland's emission targets.

Activities and strengths of VTT

VTT accelerates the clean transition through carbon-neutral energy technologies.

Case

Small nuclear reactors can heat our homes in the future

The VTT spin-out Steady Energy will build a district heating plant powered by a small nuclear reactor in Finland. The modular LDR-50 district heating reactor has a heat output of 50 MW. It is designed to operate at around 150 degrees Celsius and below 10 bar. The pressure required by the reactor is comparable to the pressure in a household espresso machine.

The operating conditions of small reactors are less demanding than those of conventional reactors, which simplifies the technical solutions needed. The system does not rely on any mechanical moving parts, which could fail and prevent the cooling function. Therefore, it meets the very high safety standards applied in the nuclear industry.

Small nuclear reactors could contribute to decarbonising residential heating and significantly reducing greenhouse gas emissions. In Europe alone, the small nuclear energy market has a growth potential of hundreds of billions of euros.

Steady Energy has been part of the VTT LaunchPad spin-off incubator. The incubator brings together VTT researchers and IPR, business expertise and investors. It helps to transform VTT's intellectual property rights into fundable spin-off companies.

Read more >

2023: A year of increasingly extensive customer cooperation

We had more extensive cooperation with corporate partners than ever before in both domestic and EU-level joint projects. Customer satisfaction rose to a record level.

In 2023, we helped our customers build future business in numerous large projects. Companies that consider new technological solutions to be the prerequisite of their success benefited from VTT's extensive know-how.

However, the uncertainty in the markets was reflected in some particular traditional industries where international conflicts, inflation and rising interest rates reduced the willingness to invest in research and innovation.

Nevertheless, we succeeded excellently in the field of competitive research funding. The international projects implemented through the EU's Horizon Europe programme, as well as Business Finland's leading company projects, were of particular interest to both companies and VTT. Active international cooperation and targeted customer work also brought results such as completely new openings.

For example, solutions related to the energy transition, sustainable development and health have proven to be essential choices for companies when investing in the future. Therefore, we had more extensive cooperation with corporate partners than ever before in both Finland and at the EU level. We also targeted more of our communications, marketing and customer work to the North American market.

In 2023, the number of our commercial projects was slightly smaller than in the previous year. As a whole, however, our turnover increased when the joint project funding is included. The increase in the number

Customers, total

1,135

Domestic companies, private sector

635

Foreign companies, private sector

310

VTT's net promoter score (NPS)*

~75

The overall assessment given by VTT's customers of the project execution (on a scale of 1 to 5)**

4.3

How easy it was to work with VTT, rate seen by customers (CES)* (on a scale of 1 to 5)

4.6

*NPS and CES are based on a customer feedback survey.
**The score is based on the customer impact survey.

Case

Fazer studies cellular agriculture for sustainable food production

Could Fazer make its chocolate from cell-cultured cocoa? This is one of the issues that VTT and its Finnish partner companies are investigating in a joint CERAFIM project that aims to achieve sustainable food production through biotechnology.

Cellular agriculture is based on the production of food and materials in bioreactors, without fields or animal farming. Biotechnology methods make it possible to produce proteins, lipids or microbial biomass that can be safely used for food.

In the project, Fazer is studying the potential of using cellular agriculture for cocoa beans. The aim is to develop more sustainable and equal solutions for food production.

"The environmental impacts of cellular agriculture are estimated to be significantly smaller than those of traditional food production. Cellular agriculture could also offer a new approach to creating fair and transparent supply chains," says **Annika Porr**, Senior Manager of the Forward Lab, the innovation and research unit of Fazer Confectionery.

Read more >

of projects in new areas strengthens our positions with a view to the future. There was growth in research themes such as material development, packaging materials and technologies, and national defence and security. Interest in the benefits provided by quantum technology will continue to grow, as will energy-related technologies such as green hydrogen.

Seeking a growth leap together

We discussed with companies with a stronger strategic focus than before to find the most effective ways to promote impact and growth. We aim to identify companies with a strong will to grow by investing in the future. Together we seek a growth leap through either new or existing technologies.

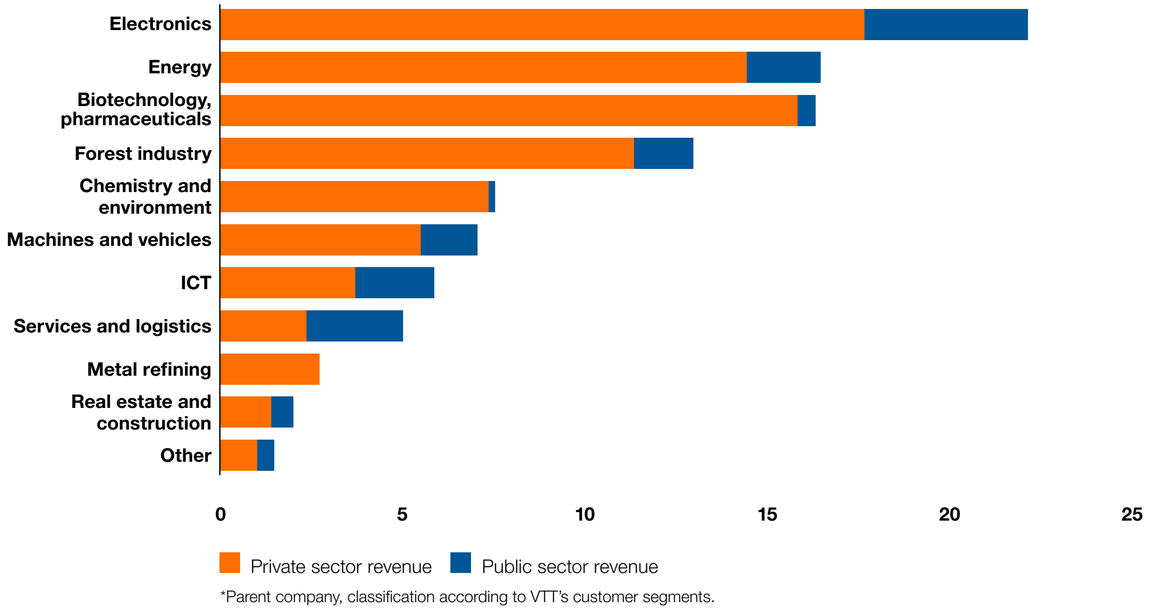
In addition to technological development, we can also offer world-class expertise in ensuring scalability. VTT provides its customers with unique expertise and the latest technologies for their own innovation work. Our impact will become more concrete when companies put innovations generated in research cooperation to their own use.

Our customer satisfaction and customer impact ratings improved clearly: the net promoter score (NPS) reached a record level, almost 75 (in 2022: 70). VTT is a relevant, long-term partner for its customers in the creation of innovations and business renewal. According to the results of the annual Reputation&Trust survey, VTT's reputation also developed positively in the eyes of the general public. The results of VTT's 2023 customer impact survey also showed that we have excellent capacity to respond to the expectation our customers most often mentioned in the survey: strengthening the organisations' own knowledge base and competence. 76% of the respondents sought to strengthen their knowledge base and competence, and 97% of them achieved this goal.

The impact of VTT's work is created through companies.

We will continue our active customer work and seek strategic discussions and large entities. Through them, we aim to build our impact even more efficiently than before – together with companies. At the same time, our own expertise and understanding of the companies' future needs will develop. This will help to keep our research portfolio relevant with a view to the needs of companies and society in the future as well.

Customer solutions sales revenue* (%)



*Parent company, classification according to VTT's customer segments.

Commercialisation of technologies and IPR protection

In 2023, VTT technology generated added value for customers: The revenue from IPR licensing was EUR 5.3 million, and IPR worth EUR 1.5 million was invested in growth companies. Furthermore, 63 new inventions were patented to increase future business.

195

invention disclosures

450

patent families in the patent portfolio

5.3

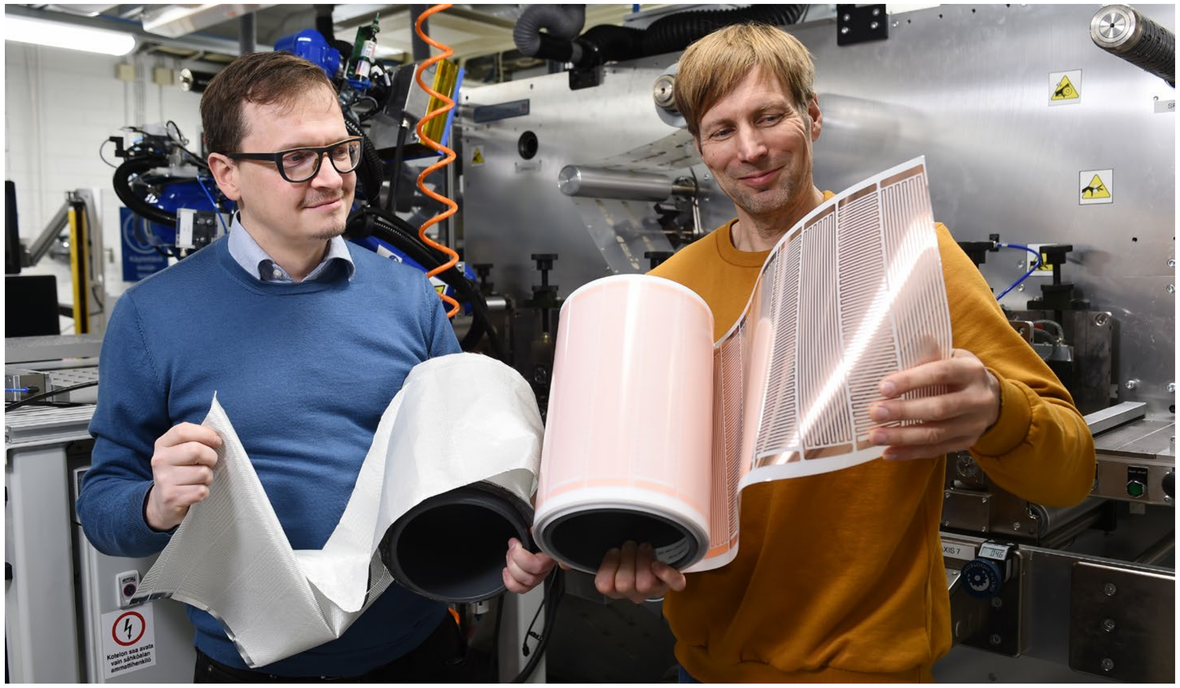
EUR million in IPR revenue

Future business with a strong IPR portfolio

VTT's invention and patenting activity picked up from the previous year: VTT received 195 invention disclosures and submitted 63 priority patent applications. VTT's patent portfolio contains a total of 450 patent families in which we invested EUR 2.2 million in 2023. We are committed to ensuring that high-standard IPR would provide our customers with new opportunities to develop their business.

We create growth potential for our customers

Licensing of technology generated a record-breaking revenue of EUR 5.3 million. In addition, IPR investments as contributions in kind to growth companies amounted to EUR 1.5 million. The key commercialised technologies included microelectronics, biotechnology, health technology and process simulation software.



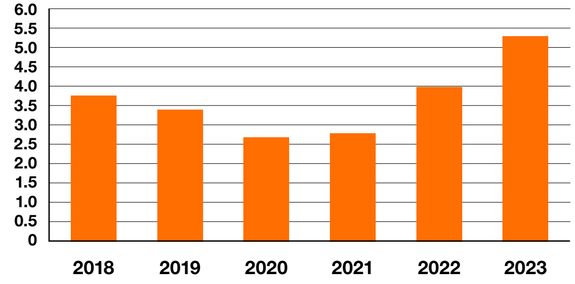
We serve our customers in a comprehensive manner by offering research projects and environments combined with IPR.

IPR sales development increases impact and utilization

We invested in IPR sales, its development and continued to clarify VTT's IPR offering. For our customers, the seamless development of VTT's research, business and IPR means added value. In addition, we created IP plans for VTT's strategic priorities and enhanced the visibility and significance of IPR in internal communication.

In 2023, licensing of technology produced a record-breaking revenue of EUR 5.3 million.

VTT's IPR revenue, MEUR



Cooperation is in our DNA

In 2023, we continued effective networking at the national and EU level. We played an important role in various projects, initiatives and expert groups.

Cooperation lies at the core of VTT's activities. Working with VTT impacts our customers' ability to create and scale up new, radical innovations and to grow their businesses and international networks. We engage in RDI activities in close collaboration with the private sector and other research organisations. We also actively cooperate with public actors, offering extensive expertise on the development of new technologies and the systemic challenges associated with them to support decision-making.

In 2023, we created scenarios for national carbon neutrality measures and a sustainable energy economy (the PEIKKO project) and, together with more than 400 actors, drafted a national metaverse initiative. We produce expert opinions on issues related to, for example, the annual climate report, energy and climate targets, renewable fuels and critical raw materials. In addition, VTT representatives were invited to several expert groups, such as the steering group preparing the industrial policy strategy and the steering group for promoting Finnish food production. VTT was also consulted in government programme negotiations when our experts were invited to give introductions on various topics.

As part of our expert role, we are active in setting the direction for the national RDI policy. We continued to work on the themes of the Parliamentary Working Group on Research, Development and Innovation. We maintained active dialogue with various stakeholders, decision-makers and actors in the field of business and research. At the beginning of the year, collaborating with the Ownership Steering Department of the Prime Minister's Office, we organised a seminar under the theme "Sustainable growth and wellbeing in Finland through RDI" for the management of all state-owned companies. In addition, we organised with CSC an RDI-themed event for members of Parliament. At the end of the year, we organised a joint TechDay 2023 event with Business Finland, Academic Engineers and Architects in Finland TEK and Technology Industries of Finland. The seminar highlighted the importance of innovations, investments and expertise for building a sustainable and competitive Finland. Towards the end of the year, the Government appointed a new Research and Innovation Council, in which Antti Vasara serves as a member.

We are actively involved in setting the direction for the national RDI policy.

Cooperation with VTT promotes sustainable renewal of trade and industry

We collaborate with companies in projects aimed at sustainably renewing the industry and creating new

The creation of Kvanttinova is an excellent example of cooperation between research actors and companies.

business opportunities for companies. An important part of the national innovation infrastructure is based on VTT's technology infrastructures. These infrastructures allow businesses to scale up their products and solutions. In 2023, VTT's infrastructural development continued with the quantum computer. The completion of Finland's second quantum computer was announced in October. This 20-qubit quantum computer was co-created with the company IQM Quantum Computers. The 20-qubit quantum computer demonstrates the high level of Finnish technology expertise and strong cooperation between actors in the field.

In 2023, we also launched five new research investments to promote the green transition, resource wisdom and security of supply, and accelerate the renewal of companies and competitiveness. In addition, VTT has played an important role in creating Kvanttinova, the national pilot environment for microelectronics and quantum technology.

VTT is a professional in networking

In addition to national networks, we are also members of many European and international innovation communities. At the EU level, VTT representatives belong to more than 100 different expert groups and organisations. For instance, we are actively involved in the work of European public-private partnership technology communities and in the innovation clusters of the European Institute of Innovation and Technology (EIT). As an active member of European Association of Research and Technology Organisations (EARTO), we are well-placed to influence the European research and innovation policy. In 2023, we participated actively in the creation of new Horizon Europe partnerships, such as a partnership focused on the virtual world and a partnership focused on advanced materials and textiles. We also joined the New European Bauhaus initiative. Furthermore, we were selected into the European Commission's Science Diplomacy Working Group and the expert group on the interim evaluation of Horizon Europe.

VTT plays a key role in promoting the networking of Finnish companies, universities and other actors and involving them in EU Framework Programme projects. Our strong role in the EU Framework Programme for Research and Innovation, the biggest of its kind in the world, reflects the extent and international impact of the cooperation done. VTT is the single largest recipient of EU research funding through Horizon Europe (HE) in Finland. VTT has won almost 15% of all HE funding that Finland has received. We accounted for almost 19% of the HE funding that Finland received through joint consortium projects (Business Finland: Summary of Finland's participation in Horizon Europe programme 9/2023). All in all, VTT has had more than a thousand partners in Horizon Europe projects. We are also Finland's most active player in European Defence Fund (EDF) projects.

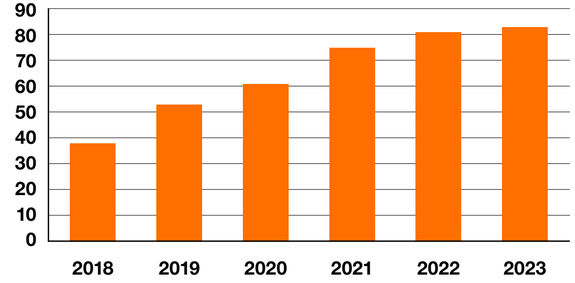
Through our strong networks, our partners can benefit from international research and expertise.

Diverse research cooperation and high-quality of publications play a key role

In its research work, VTT seeks answers to global challenges. As a result of the research done, VTTers write more than one thousand scientific articles and other publications on different topics each year. In 2023, 488 peer-reviewed scientific articles were written, of which 40% were published in international top journals of different fields. The share of articles published in top journals increased from the previous year. We also published conference presentations, books, and articles in trade journals. 80% of the scientific publications were produced in cooperation with VTT's partners and 45% in cooperation with international partners. It is also characteristic of VTT that nearly one fifth of the publications are produced in collaboration with companies every year. This is a significant share even by international standards.

The share of universally accessible publications of VTT's scientific publications increases year by year.

Share of Open Access articles (%)

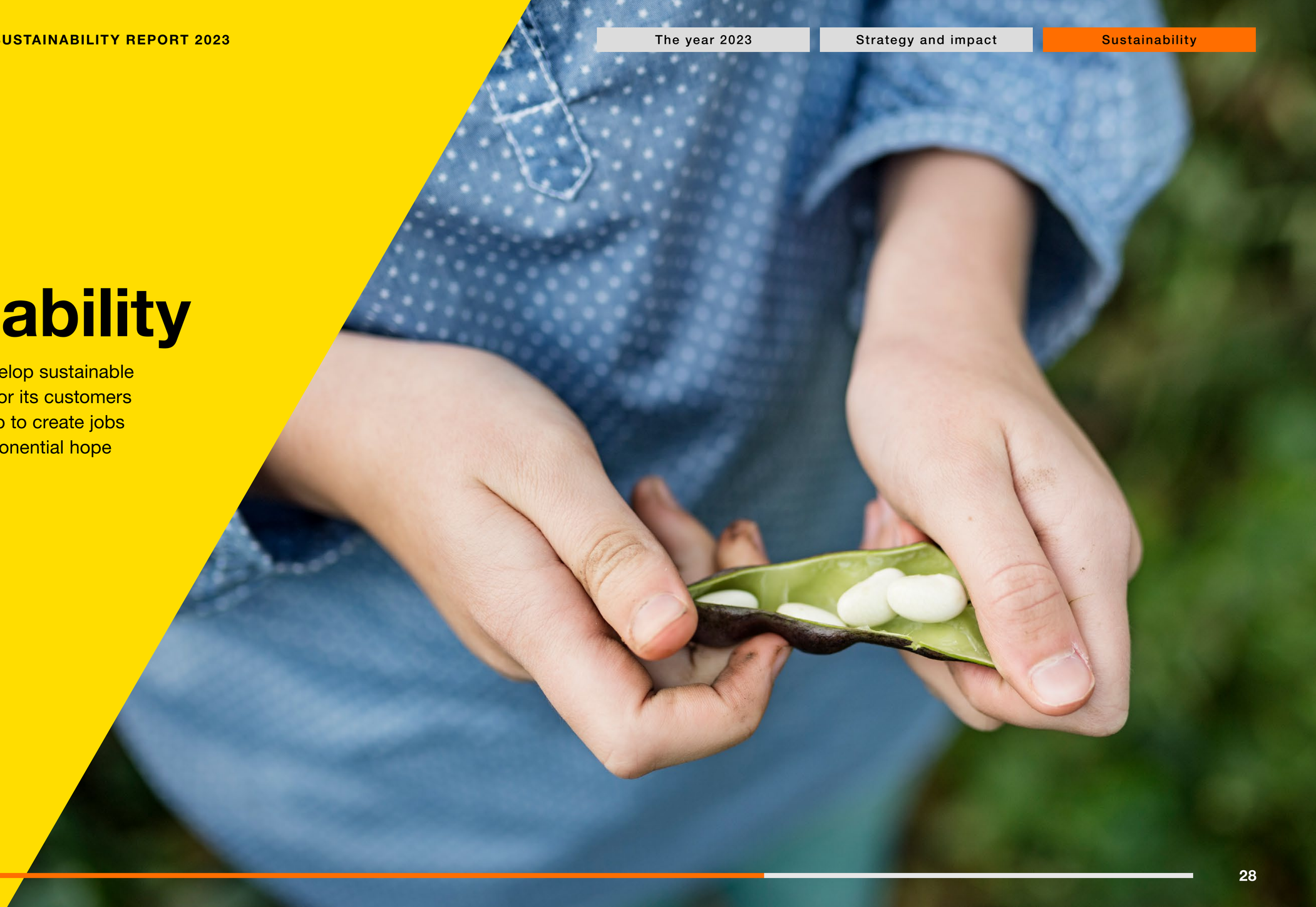


Open science and open access make publicly funded top science universally available. The proportion of universally accessible publications is also growing each year. In 2023, about 84% of all scientific articles published by VTT were universally accessible (in 2022, the figure was 81%).

VTT's Research Information Portal contains the details of all the publications produced by VTTers. VTT experts, their areas of expertise and cooperation networks can be found in the system by topic and, for example, divided according to UN Sustainable Development Goals.

Sustainability

VTT's core mission is to develop sustainable solutions and technologies for its customers and society at large. We help to create jobs and wellbeing and bring exponential hope to the world.



Collaborating sustainably with stakeholders to reach results

Our key sustainability goals are to reach sustainable impact through research and a positive carbon handprint. Today, we monitor how sustainability is implemented not only in our own and jointly funded projects but also in the customer projects.

Collaborating with stakeholders to reach sustainable results

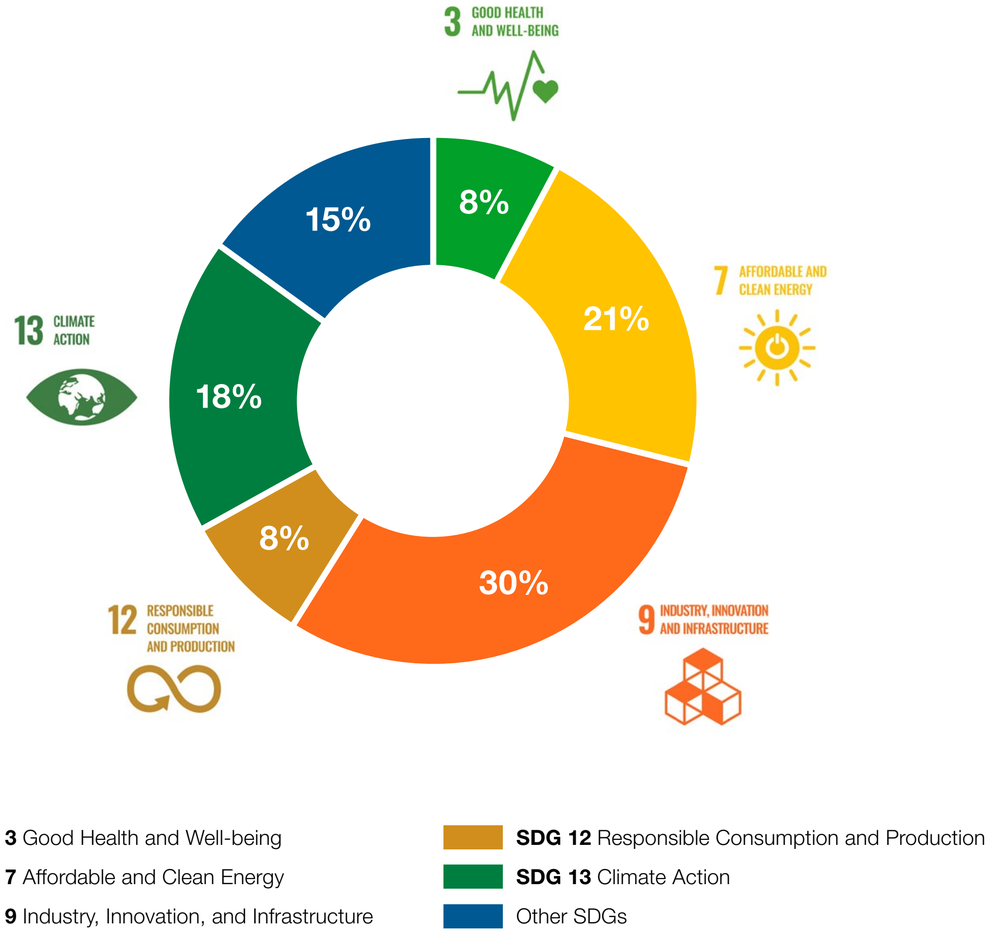
Sustainability is an important part of our strategy: one of our five strategic choices is to “Always drive sustainable business”. VTT’s key sustainability goal is to reach sustainable impact through research, i.e., to leave a positive carbon handprint. In this effort, it is crucial to focus our sustainability measures on the greatest challenges of our time. In 2015, the UN member states agreed to commit themselves to the Sustainable Development Goals (SDGs), which will help in their efforts to address global challenges by 2030. The UN 2030 Agenda contains 17 global goals for sustainable development and 169 targets concerning the environment, people and the economy. In our research activities, we assess how our projects are targeted towards these goals.

In 2023, we expanded the operating model for monitoring the implementation of sustainability goals to also include our commercial projects. The self-funded and jointly funded projects have been within the scope of the operating model since 2022. In addition, we have piloted calculating the carbon handprint in a few research projects. In its research activities, VTT focused particularly strongly on five goals: SDG 9: Sustainable industry, innovation and infrastructure; SDG 13: Climate action; SDG 7: Affordable and clean energy; SDG 12: Responsible consumption and production; and SDG 11: Sustainable cities and communities.

We also support sustainability in societal decision-making by providing researched information in the form of expert opinions (reports, involvement in working groups and committee hearings) as a basis for decisions.

We brought our customers and stakeholders together to VTT’s VVV seminar (Vahva, Vahvempi, Vastuullinen; Strong, Stronger, Responsible) to discuss sustainability issues. At the event, the participants considered whether it is possible to achieve the SDGs by 2030 and the role of research and innovations in enabling the achievement of the goals.

We integrated ensuring sustainability of our customer projects as part of the project preparation, by using our sustainability criteria. We take the perspective of sustainability strongly into account when examining both the sectoral risks and country risks arising from the customer’s domicile. At VTT, operating in very high-risk areas and sectors is either prohibited or requires a separate risk decision and reasoning by business management.



Occupational safety at VTT

VTTers are at the core of our operations, and they are taken care of in many ways. In our daily work, we pay special attention to safety. In accordance with our occupational safety programme, a good level of safety is the minimum requirement in all our activities.

Our safety objective is that our staff comes to, and leaves work healthy. This is crystallised in three principles:

- VTT offers meaningful work that factors in the capabilities, resources and needs for development of individuals (physical, psychological and social stress).
- VTT provides a healthy and safe working environment.
- VTT forbids taking risks, deviating from safe procedures and ignoring instructions.

We are a member of the Zero Accidents Forum. For us, the Zero Accident policy is not just about injuries but also about the following:

- Zero occupational illnesses
- Zero tolerance for bullying and harassment
- Zero unaddressed incidents of violence and harassment
- Zero sick days resulting from work
- Zero burnouts
- Zero managers and employees who are unfamiliar with occupational safety issues.

Anyone working in VTT's research premises must have a valid occupational safety card. In accordance with our common workplace safety practices, the policy applies to both VTT employees and anyone representing our partners. The requirement applies to all work, except for work in offices and at computer terminals.

In 2023, when calculated using the method of the Finnish Workers' Compensation Center, the lost time injuries frequency rate (LTI3, three-day absence) stood at 1.2 per million hours worked. Taking into account all injuries that caused costs at the workplace or at work, the Total Recordable Incident Frequency (TRIF) was 4.2 injuries per million hours worked. The most common reason for injuries and incidents requiring first aid was an employee hurting themselves on an object of some kind. During the year, there was one serious occupational accident among VTT's own personnel. We are also investigating one suspected case of occupational illness on which no decision has been made yet. Our KPI for the seriousness of workplace injury was 76.2 sick days per accident. This represents a significant increase compared to 2022 (6.5 sick leave days/injury).

1.2 workplace injuries / million hours worked

We have invested in our safety culture and encouraged our personnel to make safety observations. In 2023, we made nearly five times as many observations as in 2022 (4.8-fold increase): 4,300 safety observations, or approximately 2 observations per person.

Rewarding the safety observation of the month with a small prize improves the visibility of safety observations and encourages employees to remain aware of safety. A significant observation or several observations of the same issue are considered in the procedure. Awarded

safety observations were made on issues such as hearing protection, charging of an electric car, personal protective equipment, emergency exits and winter cycling.

At VTT, safety is integrated into everyday activities and provides a sustainable basis for responsible operations. We want to take care of our personnel and stakeholders. The ISO 45001 certificate for the occupational health and safety operating system granted to VTT shows that we have successfully reached that goal.

The strong foundation of our sustainability

We observe the Finnish Corporate Governance Code with certain exceptions, which are described in our own Corporate Governance document.

In 2023, we defined VTT's sustainability governance model. The governance model describes the roles, responsibilities and obligations of VTT's Board of Directors, senior management and operative sustainability actors. Sustainability is led by an Executive Leadership Team member appointed to supervise sustainability matters. The measures are coordinated by a cross-organisational sustainability team, which meets regularly around different ESG themes. In addition, the QEHS team is responsible for ensuring that our management systems and operations comply with ISO 9001, ISO 14001 and ISO 45001 standards.

We are responsible with our tax policy, and we report on our tax footprint in a transparent manner as part of our financial statements.

The EU's Corporate Sustainability Reporting Directive (CSRD) will oblige VTT as of 2026, when we will have to report our sustainability data for 2025 in accordance with the European Sustainability Reporting Standards (ESRS). The double materiality analysis approved by VTT's Board of Directors was completed in January 2023. During the year, we prepared a reform of the reporting system based on the results of the double materiality analysis.

The double materiality analysis took into account the views of several external stakeholders, employees, experts and management. The sustainability team analyses and visualises the results. The double materiality analysis covers the company's impacts on the environment and society (impact materiality) as well as financial risks and opportunities in relation to corporate responsibility (financial materiality). It also examines the interconnection between the two concepts. A description of the analysis can be found on our website. The key topics for VTT are climate, biodiversity, own personnel, resource use and the circular economy, employees in the value chain and, outside the ESRS standards, research ethics.

During 2023, we were also preparing a reform of our sustainability indicators, goals and policies to meet the requirements of the CSRD directive.

Sustainability in our everyday operations

VTT is also involved in the UN Global Compact initiative on corporate sustainability. We are a member of FIBS's corporate responsibility network, the Climate Leadership Coalition and the Climate Partners. VTT actively networks with other European research organisations in theme areas related to sustainability.

We observe the Responsible Conduct of Research (RCR) guidelines of the Finnish National Board on Research Integrity. Each VTTer is committed to the ethical principles of impartiality, reliability, integrity and responsibility. We continued the workshops on research ethics, safety and DEI (Diversity, Equity and Inclusion) that we launched in the research teams in 2022, focusing on the special issues of the team and the research area in each theme. For those engaged in research work, a course on research ethics is mandatory. We have also invested in the provision and visibility of information on responsible research and innovation activities (RRI) in the form of video presentations available on the intranet.

During the year, we invested in creating a diverse, equal and inclusive culture. The teams could participate in training on building an inclusive team. We also trained VTTers interested in the team's topic to promote it in their own networks. We defined VTT's DEI principles and targets to take steps towards a more inclusive work environment.

We also emphasised issues of everyday responsibility visible to the whole personnel, for example, by updating our travel guidelines with an aim to reduce unnecessary travel and the resulting emissions.

To ensure the sustainability of supply chains, we introduced sustainability criteria for key procurement areas. The assessment helps us identify risks related to responsibility and determine the appropriate sustainability criteria for different acquisitions. In addition, suppliers must approve VTT's Supplier Code of Conduct.

VTT's sustainability priorities

VTT's sustainability priorities have been selected on the basis of stakeholder consultations and a materiality analysis.

Sustainability is at the core of our strategy. VTT is a research institute and in accordance with this, its core mission is to develop sustainable solutions and technologies for its customers and society at large.

VTT's sustainability priorities are a sustainable foundation, thriving professionals, empowered customers and a resilient society. The sustainability priorities have been selected on the basis of a materiality analysis and stakeholder interviews. VTT's sustainability programme, launched at the end of 2021 and updated at the beginning of 2023, is built around these focus areas.

In 2023, key areas of action in the sustainability programme included uncompromising ethics, sustainable supply chains, promotion of the UN Sustainable Development Goals, renewal of sustainability reporting, sustainable customer choices, and safety of staff, as well as diversity, equity and inclusion.

VTT's value chain

Upstream

Supply chain

- **Human capital**
- **Funding**
- **Research infrastructure, equipment and materials**
- **General office material and ICT procurement**
- **Office and laboratory spaces, heating, electricity and water and building maintenance**
- **Other outsourced support services**

Own processes

VTT's own activities

Research, innovation and development activities in scientific and commercial projects

Iterative knowledge production and technologial innovations in national and international virtual and on-site collaboration:

- customer, partner and ecosystem encounters
- seminars and events

In-house support services

- Commercial Operations
- Finance and Business Support
- Strategy
- Human Resources
- Other in-house support services

Products and services

- Scientific knowledge
- Technological innovations
- Incubator, piloting and testing services
- Practical tools

Downstream

Distribution

National and international distribution in virtual and physical channels

- Scientific and popular publishing
- Customer, partner and ecosystem encounters
- Participation and presentations in seminars, conferences and other events

Benefits for stakeholders

VTT's customers
Unique expertise, faster and more scalable RDI projects, new business opportunities

Broader society
Sustainable renewal of industry, spin-offs and new national and international growth companies, increase in talent and number of experts

A sustainable world
Sustainable solutions to the world's biggest challenges

Management of actual and potential negative impacts

(GHG emissions, working conditions, research ethics, data security)

An inspiring workplace community that puts the wellbeing of top talent first

VTT is an expert organisation where we encourage and inspire our talents by improving wellbeing and communality and giving them opportunities for continuous learning. Our success is based on the excellence we nurture with these things.

Developing VTT's culture through emotional agency and management

The cornerstones of VTT culture are joy, courage and curiosity. Our goal is to build the most meaningful workplace in the world and strengthen the communality, employee experience and interaction.

At the beginning of the year, we launched VTT's hybrid work model. Everyone is welcome to the workplace every day, and three days a week can be remote work. The model was created based on the feedback and open comments of 637 VTTers, and a discussion basis was created for the teams to agree on their own practices. According to the feedback, VTTers felt the model was successful and consider meetings with colleagues to be significant.

We invested in developing our leadership skills. The means used included mapping the development needs of leaders and reforming the coaching offering for new leaders. Based on the leadership competence model, we conceptualised the basic leadership training and put it out to tender. The training will be launched in spring 2024.

At the end of the year, we carried out a Navigator personnel survey, which reached a record-breaking response rate of 91%. Its overall results remained at an excellent level for the third year running. The upward trend in the development of the net promoter score (NPS) continued. We took steps to address the workload challenge identified in the previous survey, and the work done was already positively reflected in the survey. This work will continue, and other development measures will be developed further in teams.

Learning, development and career opportunities emerged as important themes.

Continuous development of competence and personnel experience

Learning, development and career opportunities emerged as important themes during the year. We planned and launched the PhD and Postdoc programmes. The PhD programme promotes goal-oriented dissertation work in VTT's strategic research choices. The first 51 participants were appointed to the programme in October. The Postdoc programme creates new career paths from universities to VTT. During the autumn, almost 20 new postdoc positions were opened in research on the clean energy transition.

The situations that most affect the development of competence arise from the work tasks. We continued to encourage our employees to practice reflection in different situations. We supported the culture of learning by integrating the Learning Buddy practice into various coaching programmes. In the target and development discussions last autumn, a development plan was prepared for every VTTer. The plans were supported by, for example, Learning Lab events and new support materials to inspire thinking. This year, the theme of the annual Leadership Day was learning. We launched three new career coaching groups to promote the internal labour market and the personal development of VTTers.

We continued to offer a wide array of induction events and coaching. They were attended by 278 VTTers. Active provision of project management coaching continued, and it was attended by 106 VTTers. Furthermore, 24 people acquired IPMA certification. 57 VTTers were involved in mentoring groups, and, in the autumn, we launched support material for independent mentoring. We supported the AI competence of VTTers by means of, for example, a series of coaching sessions under the heading "Artificial intelligence for all." We supported the integration of our international employees into Finland and the work community through language training with a total of 116 participants.

Strengthening the sense of community by means of wellbeing

At the beginning of the year, we focused on strengthening the sense of community and employee wellbeing by organising recreational club info sessions in different locations. The VTT-sponsored clubs offer versatile activities from physical exercise to arts for all VTTers.

We organised traditional local morning health checks to support the physical wellbeing of VTTers. In the events, staff members could have their blood sugar level, blood pressure, mobility, grip strength and body composition measured. In addition, before the summer holidays, we launched a step challenge. Within the four weeks the challenge continued, the 100 participating VTTers collected an impressive number of steps, 27.7 million. We also arranged gym groups in different locations under the guidance of gym instructors and physiotherapists. We encouraged staff members to stay physically active with a break exercise application. It can also be used for mindfulness exercises.

It was still possible to get a bicycle as an employee benefit. Over the year, 79 VTTers already took advantage of the benefit. In addition, a total of 2,372 VTTers used the sports, massage and cultural services provided by Smartum. A significant share, 60%, of the benefits, were used for sports services.

We organised webinars on mental wellbeing themes, such as cognitive ergonomics, stress and recovery. The pension information sessions held with pension providers gave information on the details of retirement.

In the autumn, we offered flu vaccinations for our employees in four localities, and they were taken by 1,288 VTTers. At the end of the year, a VTT researcher gave lectures on nutrition, focusing on the importance of food in promoting wellbeing.

In addition, we regularly bring our staff together at our VTT Townhall events. They give VTTers an opportunity to present their research or discuss other topical issues related to the company's strategy or culture or any other matters that concern all VTTers.

Towards an improved employer brand by means of human-centred storytelling

VTT is an encouraging and inspiring workplace community for top talent. We focus on wellbeing.

In 2023, we recruited almost 400 new VTTers, including trainees, of whom 101 were international recruitments. Currently, VTTers represent 59 nationalities. In employer branding, we focused on human-centred storytelling in a multi-channel approach in accordance with our employer brand strategy. We organised and participated in dozens of events where VTTers were able to share their own experiences and stories with our target groups. We created new employee-centred content and content series for social and digital media.

To celebrate the Postdoc researcher programme launched in the autumn, we organised a Clean Energy recruitment campaign in November 2023. The campaign raised wide interest in both social and digital media. The campaign website attracted over 25,000 visits and almost 1,000 applications for clean energy positions.

The VTT summer job campaign, Summer of Changemakers, also achieved excellent results. The campaign received more than 2 million views on social and digital media. We received a record number of summer job applications: more than 3,200. We hired over 100 summer trainees through the programme.

In the employer image survey that Universum carried out among students in the spring, we were ranked 14th among natural science students and 24th among engineering students. In the survey of professionals' perceptions of different employers in the autumn, VTT was ranked as the 6th most attractive workplace by engineering professionals. This made us one of the biggest risers in the sector. Among natural sciences professionals, we were ranked 12th.

Different forms of rewarding

Rewarding at VTT comprises financial rewards, support for wellbeing at work, corporate culture and the development of expertise. Rewarding helps us to implement our strategy and to achieve our goals. Most of the financial rewards are granted as recognition rewards in which the focus is on sustainability, promoting excellence and boosting impact.

In 2023, a total of 395 VTTers received recognition rewards. The Customer Excellence award which encourages teams to achieve excellence in customer work is also an important form of reward. The award was granted to six teams (42 people). The Leadership Excellence Reward is intended for management members, and its criteria comprise company-level, business area-level, and personal targets.

59

different nationalities

Almost

400

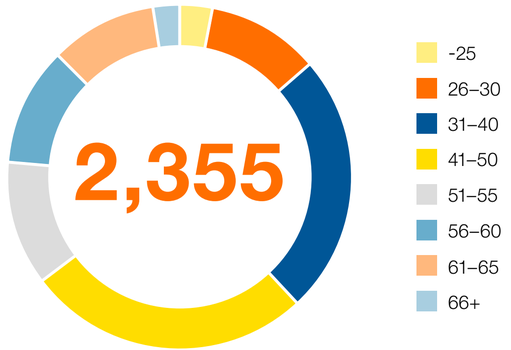
new VTTers

395

VTTers received recognition rewards

We strengthened our sense of community by promoting wellbeing.

Employees by age



VTT's stakeholders' expectation

VTT is engaged in a continuous dialogue with its key stakeholders. Customers, personnel, financiers, owners and the research community are our most important stakeholders.

In addition to engaging in direct communication and discussions with our stakeholders, we also collect information about their views in surveys and interviews, such as customer satisfaction, customer impact, and personnel satisfaction surveys, by taking part in the Reputation&Trust survey and collecting feedback on ownership steering.

Stakeholder group	Customers	Owner	Financiers	Personnel	Research community
Expectations	• VTT helps its customers to boost their own expertise and capabilities • VTT supports the identification and evaluation of new opportunities and accelerates research and product development • Excellent customer service and smooth, flexible, and data-secure operating methods in projects • Working with VTT helps customers to establish networks in research and innovation ecosystems	• VTT is a limited liability company owned by the state, whose ownership steering is under the responsibility of the Ministry of Economic Affairs and Employment • In accordance with the government program, the steering document describes the owner's expectations for VTT's operations and its societal impact	• Identifying the opportunities arising from global challenges • Mission and sustainability/ESG-based approach • EU regulation-based, measurable, and comparable sustainability reporting • Impeccable research ethics	• Interesting work content • Meaningful work • Professional development and the opportunity to develop • Competitive pay and other benefits • Good working conditions, good management, and good balance between work and leisure • Fair and just treatment	• Research cooperation in which the expertise and capabilities of the parties involved complement each other in an innovative manner • Cooperation in the use and development of research infrastructure • Research cooperation in innovation ecosystems and research projects • Ethical research activities • Focusing on projects that promote sustainability and responsibility • Promotion of open science
VTT's response in 2023	• Customer satisfaction with our projects remained high (NPS 75) • According to our customer impact survey, 42% of the projects carried out in cooperation with VTT helped customers to integrate into international networks • VTT promoted customers' responsibility and corporate responsibility (in 56% of the projects where responsibility is relevant)	• Contributed to strengthening the competitiveness of Finnish business and industry by developing solutions for the needs of a sustainable and developing society in various projects • Enabled customers to utilise VTT's wide-ranging and multidisciplinary expertise and networks, for example, in EU projects • Transferred the developed technology and intellectual property rights to the businesses • VTT spun SemiQon Technologies Oy, which manufactures semiconductor processors for quantum computers • Conducted expertise and development activities in selected fields; for example, VTT established a new PhD programme to increase the number of experts and promote the quality of research • VTT's own finances are on a sustainable basis	• Providing solutions to systemic challenges, developing technology breakthroughs, and supporting society in the challenges it faces • Bringing experts together to produce effective solutions to the climate crisis, resource sufficiency, industrial renewal, safety and security, and good life • VTT's research agenda is in line with the UN's Sustainable Development Goals	• We continuously provide our leaders and managers the opportunity to further develop their skills and competence in leading people • In goal and development discussions, teams and individuals agree on their goals and development plans • In The Navigator personnel survey, we hear employees' views and opinions on their work and working community: The results in 2023 were at an excellent level • By offering meaningful work, we provide opportunities for all employees to grow professionally • By investing in comprehensive physical and mental wellbeing and creating an extensive wellbeing programme, we help our employees to succeed at work and achieve a good work-life balance • With its reward policy, VTT aims to ensure a fair, transparent, and competitive approach to total rewards	• Joint research projects and research collaboration with international research communities, organisations and companies • Joint scientific publications • Visiting researchers and professors • Partnership cooperation • Participation in international research seminars • Providing PhD candidates and postdocs research opportunities
Channels and frequence	• Customer survey for every project • Customer impact survey annually • Direct discussion with the customer in daily project work • Dedicated personnel for key accounts	• Regular meeting with the steering Ministry	• Feedback about projects • Responses to funding applications	• Annual personnel survey • Goal and development discussions with each individual 3 times a year • Several channels for feedback and ideas (development proposals, safety observations, Whistlerblower, etc.)	• Participation in common projects, forums, and associations with other RTOs and other members of the research community

VTT and the environment

Our emissions related to purchased energy decreased, but total emissions increased from the previous year. The greatest challenge to our carbon neutrality goal is posed by indirect emissions, especially those related to travel and procurement.

Greenhouse gas emission trends

In 2023, VTT's projected greenhouse gas emissions increased by 16% from the previous year. The main reasons for the increase in greenhouse gas emissions were increased travel, new emission categories included in the calculation and updates to input data. Compared to previous years during the coronavirus pandemic, the number of flights, kilometres driven in private cars and work-related travel by train all increased.

The increase in direct (Scope 1) emissions was due to more accurate emission calculations. In 2023, emissions from fuel used in research have been included for the first time. Despite the significant increase, direct emissions still only accounted for a relatively small share (7%) of VTT's total emissions.

In 2023, Scope 2 emissions decreased by 22%, accounting for less than a quarter (21%) of VTT's estimated total emissions. A significant reduction in energy-related emissions was achieved by switching to green district heating at the Jyväskylä and Bioruukki sites. During the year, we also switched to using fossil-free electricity granted a certificate of origin according to the government's electricity security portfolio, which in 2023 included nuclear (85.6%), wind (9.4%), bioenergy (3.8%), solar (0.9%) and hydro (0.3%) (according to the preliminary production profile).

An increase in emissions from air travel

The most significant increase in other indirect emissions (Scope 3) was due to increased air travel. In addition to increased flight kilometres, a significant change was caused by updates to the input data on aviation fuel production. Other indirect emissions were increased by emissions from the manufacture of purchased IT equipment and the production of fuels consumed in research, which were added to the calculation as new emission categories. Indirect emissions from wastewater treatment also increased slightly due to increased water consumption and increased amount of waste. On the other hand, the change in the electricity production profile reduced emissions associated with the upstream end of electricity production, which contributed to curbing the growth of other indirect emissions. In 2023, other indirect emissions accounted for the majority (71%) of VTT's total estimated emissions.

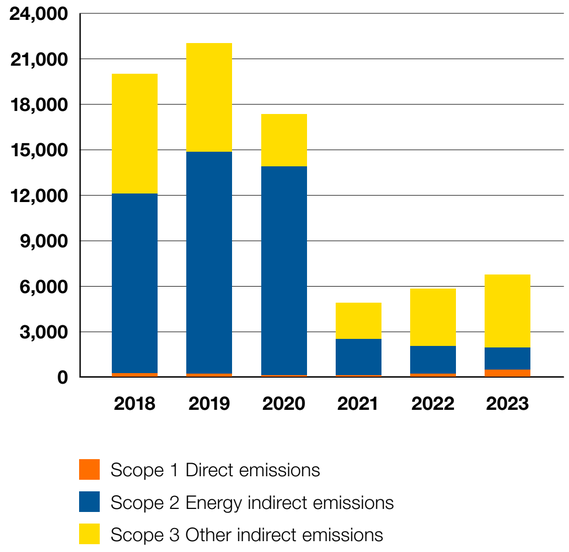
The biggest challenge for future emission reduction targets is related to cutting down the increased indirect emissions which will require a range of measures.

Preparing for the Sustainability Reporting Directive

As climate change is a key sustainability issue for VTT, we have defined indicators in line with the European sustainability reporting standards, which we will move to in 2024–2025, and started collecting the sustainability data needed for these indicators. In 2024, we will further define the new base year for sustainability reporting, which will be used as the basis for a short-term (5–10 years) plan to reduce emissions by 2030.

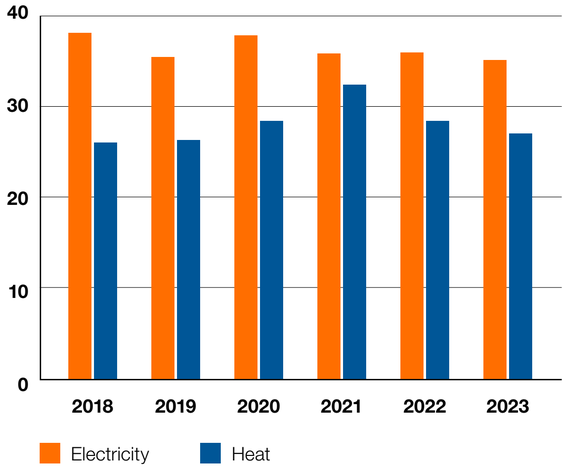
We set reduction targets in line with the Science Based Target initiative's (SBTi) short-term target, covering both direct and indirect greenhouse gas emissions (Scope 1–3).

VTT's estimated GHG emissions (as tonnes of CO_2 eq)*



*VTT's estimated GHG emissions (as tonnes of CO_2 eq) from years 2018–2023. Emissions from 2021 are reported with corrected information. Assessment was conducted according to the main principles of ISO14641-1 and the GHG Protocol.

Consumption of eletricity and heat, GWh



We switched to green district heating at our Jyväskylä and Bioruukki sites.

GRI index

GRI Standards disclosure		Location
GRI 2: General disclosures (2021)		
Organizational profile		
2-1	Organizational details	VTT as a company Key facts of VTT Contact details
2-2	Entities included in the organization's sustainability reporting	Management approach
2-3	Reporting period, frequency and contact point	Reporting period 1.1.2023-31.12.2023. Publication date 28.3.2023. Frequency: Annually. Contact point: kirjaamo@vtt.fi
2-4	Restatements of information	No major changes
2-5	External assurance	No external assurance
Activities and workers		
2-6	Activities, value chain and other business relationships	VTT as a company
2-7	Employees	Employees by contract types
Governance		
2-9	Governance structure and composition	VTT's Board has audit and remuneration committees VTT's corporate governance Tax footprint, management and control 2023 annex VTT Board
2-10	Nomination and selection of the highest governance body	VTT Board
2-11	Chair of the highest governance body	VTT Board
2-15	Conflicts of interest	Tax footprint, management and control 2023 annex
2-19	Remuneration policies	Tax footprint, management and control 2023 annex
2-20	Process to determine remuneration	Tax footprint, management and control 2023 annex
Strategy, policies and practices		
2-22	Statement on sustainable development strategy	Annual report, pp. 10–12
2-23	Policy commitments	Code of Conduct Management approach Operating system Administration Gender equality plan
2-24	Embedding policy commitments	Code of Conduct
2-25	Processes to remediate negative impacts	Whistleblowing channel Tax footprint, management and control 2023 annex
2-26	Mechanisms for seeking advice and raising concerns	Whistleblowing channel
2-27	Compliance with laws and regulations	No compliance breaches have been identified
2-28	Membership associations	Annual report, pp. 27 & 29–30 VTT is also a member of Palta ry

GRI Standards disclosure		Location
Stakeholder engagement		
2-29	Approach to stakeholder engagement	Annual report, p. 36
2-30	Collective bargaining agreements	100%, only top management is outside collective bargaining agreements
GRI 3: Material Topics (2021)		
3-1	Process to determine material topics	Management approach Double materiality assessment
3-2	List of material topics	Double materiality assessment
ECONOMIC STANDARDS		
GRI 201: Economic performance (2016)		
201-1	Direct economic value generated and distributed	Annual report, p. 8
201-4	Financial assistance received from government	Annual report, p. 8
GRI 205: Anti-corruption (2016)		
205-2	Communication and training about anti-corruption policies and procedures	Anti-corruption is part of mandatory Code of Conduct e-training for all employees
205-3	Confirmed incidents of corruption and actions taken	No confirmed incidents
GRI 207: Tax (2019)		
207-1	Approach to tax	Tax footprint, management and control 2023 annex
ENVIRONMENTAL STANDARDS		
GRI 302: Energy (2016)		
302-1	Energy consumption within the organization	Consumption of electricity Consumption of heat
GRI 303: Water and Effluents (2018)		
303-5	Water consumption	Water consumption
GRI 305: Emissions (2016)		
305-1	Direct (Scope 1) GHG emissions	GHG emissions
305-2	Energy indirect (Scope 2) GHG emissions	GHG emissions
305-3	Other indirect (Scope 3) GHG emissions	GHG emissions
GRI 306: Waste (2020)		
306-3	Waste generated	Amount of waste

GRI Standards disclosure		Location
SOCIAL STANDARDS		
GRI 401: Employment (2016)		
401-1	New employee hires and employee turnover	New employee hires
401-3	Parental leave	Parental leave
GRI 403: Occupational health and safety (2018)		
403-1	Occupational health and safety management system	Management approach
403-2	Hazard identification, risk assessment, and incident investigation	Management approach
403-3	Occupational health services	Management approach
403-4	Worker participation, consultation, and communication on occupational health and safety	Management approach
403-5	Worker training on occupational health and safety	Management approach
403-6	Promotion of worker health	Management approach Annual report, pp. 30 & 34–35
403-7	Prevention and mitigation of occupational health and safety impacts directly linked by business relationships	Management approach
403-8	Workers covered by an occupational health and safety management system	Whole VTT Group personnel are within OHS managment system
403-9	Work-related injuries	Work-related injuries
GRI 404: Training and education (2016)		
404-1	Average hours of training per year per employee	Training expenses and days
GRI 405: Diversity and equal opportunity (2016)		
405-1	Diversity of governance bodies and employees	Age structure and gender distribution Share of men and women In VTT's Board there are 3 women and 4 men
GRI 406: Non-discrimination (2016)		
406-1	Incidents of discrimination and corrective actions taken	1 reported incident in 2023, No longer subject to action
GRI 415: Public policy (2016)		
415-1	Political contributions	No contributions have been rendered

VTT

beyond

the obvious

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