Fennovoima's year 2020

Contents

CEO's Review and Strategy


“We have a clear vision for the future and comprehensive plans for how we will proceed with the project.”

2020 – a year of steady progress

The Hanhikivi 1 project is picking up speed and progressing well. The year 2020 was significant for Fennovoima and the Hanhikivi 1 project as a whole. We achieved our goals and proceeded according to plan. Not even the coronavirus caused us any significant difficulties. If the nuclear power plant's construction had already been underway, the pandemic's effects would undoubtedly have been more prominent.

During the year, we almost completed the first review phase of the plant's basic design documentation. At this stage, we focused on plant safety and the plant's ability to generate the required amount of electricity. The work done shows that the plant's technical characteristics will provide us a safe and excellent power plant. During the current spring, the plant supplier RAOS Project, other parties involved in the plant design, and we will work heavily to achieve the level required by the construction license. At this stage, particular focus will be placed on design integrity and plant availability.

In addition, the licensing work aiming for the construction license progressed significantly during the year. By year-end, we submitted six out of a total of fifteen documentation batches to the Radiation and Nuclear Safety Authority (STUK). The most important of these was the documentation describing the plant's key safety functions.

We know that our goal to obtain the construction license by the end of 2021 is challenging. However, we have a clear vision for the future and comprehensive plans for how we will proceed with the project. Alongside the design work, we have turned our attention to the construction and operation of the plant. We are preparing for our role as a licensee and developing our capabilities to lead and take the project forward. Our team is motivated and has the necessary high-level technical expertise, so the prerequisites for success exist.

Construction readiness is crucial for the smooth construction of the Hanhikivi 1 plant. Thus, it is Fennovoima's principal target for the year 2021. All companies participating in the project must be able to implement the plans and monitor their implementation in accordance with Finnish requirements.

RAOS Project is part of Rosatom, the world's largest and highly competent nuclear power supplier. As always in all significant international deliveries, the challenge is to adapt the project and the facility to the local regulatory environment. One of the main obstacles to constructing facilities in the nuclear sector is that the industry has not been able to agree on a common approach and harmonize regulation internationally. This is also the reason why project costs are often rising. Therefore, it is paramount that we listen to each other with RAOS Project and look for solutions together. For the first time ever, Fennovoima and RAOS Project agreed on joint targets for 2021, driving even further the 'One Team' approach.

The Hanhikivi 1 project is continuously changing. As the project progresses, new challenges arise, and we need people with new kinds of skills. We need to be able to adapt and respond agilely to the needs of the different stages. The year 2021 will be even more challenging than previous years. Our focus is on three factors: obtaining the construction license, ensuring a high availability factor of the plant, and Fennovoima's readiness for safe and efficient construction.

We are taking the project forward in line with our strategy launched in 2019 that has proven successful. A warm thank you to Timo Okkonen, who, as our Chief Operational Officer, paved the way for Fennovoima and the entire Hanhikivi 1 project, whereas our new COO, Philippe Bordarier, will undoubtedly continue that way.

In the region where the site is located, the preparations for the construction phase have been on-going already for a long time. We have excellent and strong relationships with the local municipalities, and I felt welcome from the very first visit to the site area. I am very impressed with the high local support for the Hanhikivi 1 project in the Pyhäjoki region, where over 70% of the inhabitants support the project.

Lastly, I want to thank all the people of Fennovoima, our team. The Hanhikivi 1 project is a once-in-a-lifetime opportunity for us—the people working in the nuclear sector—regarding its social and environmental impact and our own professional development. The support, dedication, and passion of the whole team are needed to carry out this vast and challenging project.

Joachim Specht
CEO

Strategy and program

Fennovoima is focused on building and operating the Hanhikivi 1 nuclear power plant. We carry out our mission with a strategy and program that can be divided into four main dimensions:

1. **Plant design, construction, and operation**
2. **Project management, suppliers, and deliveries**
3. **People, leadership, tools, facilities, and support**
4. **Performance, risk factors, licensing, and financing**

Our plant forms our main focus. It is required to enable a very high level of safety in accordance with Finnish regulatory requirements and guidelines of STUK. In addition, our contract with the plant supplier RAOS Project requires the plant design and operational features to enable a high level of full power availability and a long plant lifetime.

We co-operate with the plant supplier to ensure the necessary design adjustments, and we control that the Hanhikivi 1 plant will fulfil the requirements. We ensure that our goals are met in terms of plant safety, construction readiness, implementation quality and operational readiness. In our criteria, we take into account the safety, operational reliability, lifetime and other risks of the matter in question.

Our project is huge. Our success depends on the capability of the plant supplier and all their partners and subcontractors to deliver on time and with the required quality. The main delivery scopes may be divided into engineering and licensing, procurement and supply chain, construction and installation, and commissioning and training. In the operational phase, we also need the nuclear fuel supply and other supporting services.

The supplier's capability to deliver requires constant and proactive attention from our side. We are interested in the delivery plans and contracts, work schedules and processes, products and services, as well as meeting the Finnish requirements and conditions.

Our people make things happen. Our success depends on each organizational unit having the necessary competence and resources, which depend on the specific phase of the project and the plant life cycle. We need to have clear roles and responsibilities at all organizational levels. Our management system and all our tools need to be set up to support every one of us in our work. Digitization will be the key to scaling up and remaining efficient in the daily flow of information and decisions.

All our processes and communications need to be aligned to ensure the right competence and resources, to apply the contract and requirements in a systematic way, to co-operate proactively with the suppliers, to control the deliveries for determining their acceptability, and to build a learning and developing culture. These are the core processes for executing our business up to the operational phase.

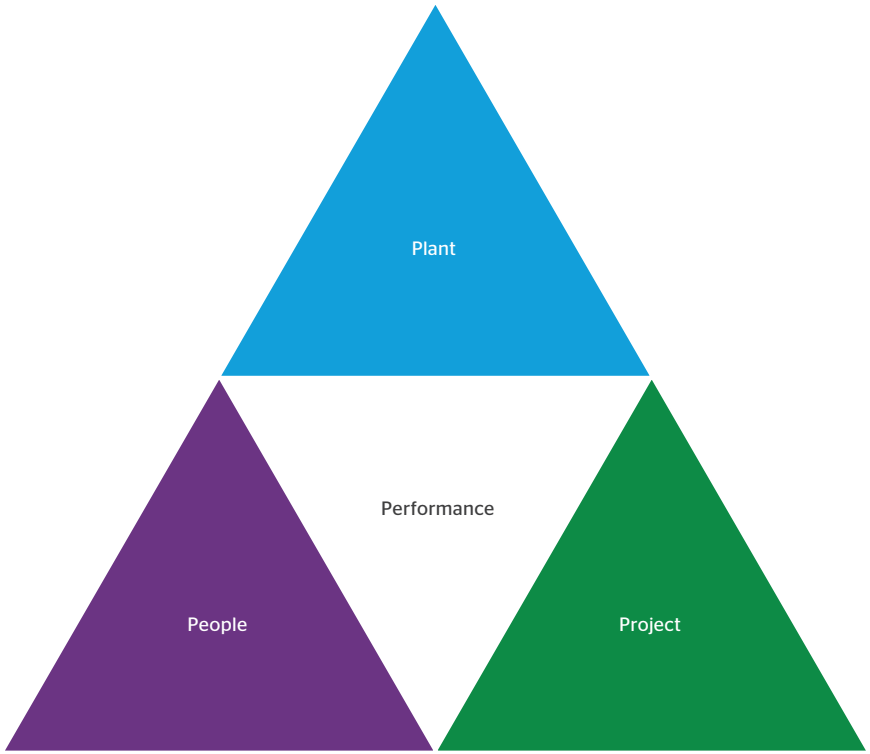
Our performance is measured in all of the aforementioned dimensions: plant performance, project progress, and people effectiveness. For

the main goal of operating the Hanhikivi plant, we will be assessed on the safe plant operation, responsible company operations, and shareholder value by the planned electricity price. We also need to pay attention to the "dark side of the moon", i.e., the risks involved. Also, the necessary regional and stakeholder activities are part of our risk management scope.

Licensing and financing efforts form the most important acid tests for our safety demonstration and risk management level. We want our board and shareholders to be well informed about our current performance and the possible risks in front of us.

Our strategy requires us to excel in both leadership and management in the different phases of the Hanhikivi 1 plant life cycle and our own organization. We are running operations that carry a high societal, economic, and ecological value. This makes us motivated and committed to work with our full heart. We are part of the sustainable energy solution and we are required to demonstrate our responsibility. This requires us to report and communicate well, both inside and outside.

We will not succeed with a strategy that only applies to Fennovoima. Our full program involves our plant supplier and their subcontracts, nuclear and other regulatory authorities, our shareholders and our people, municipalities and local services, and basically society as a whole. This is the reason why our strategy and plans need to be felt like the strategy that fits everyone involved in our endeavor. When we say "we", we mean all of us building up Fennovoima's operations and the Hanhikivi 1 plant!



Towards building the power plant

The Hanhikivi 1 project has progressed well over the last couple of years. By the end of 2020, we had reviewed almost all of the basic design and layout design of the plant and also made considerable progress in the reviews of the Preliminary Safety Analysis Report.

Together with RAOS Project, we have found solutions to the issues that were still open a year ago. For instance, the issues were related to the primary circuit, containment, and defense-in-depth. Based on experimental tests we have conducted, we also believe that the new passive residual heat removal systems for the containment will do their job well.

Indeed, we still have many things to resolve, but overall, the basic design of the Hanhikivi 1 plant is now steaming ahead. The design solutions are now mostly clear also for automation architecture, although the final verified architecture has not yet been finalized. During the 2021 spring, as we now have at our disposal the almost complete basic design documentation of the plant, we will move forward to review, for the first time, plant-level issues such as operability, operating costs, design integrity, and implementation feasibility. However, we can already say that the plant's design maturity has progressed significantly, and we do not expect any significant changes to the plant's concept.

As the design work progresses, the amount of information to be reviewed will increase at Fennovoima. We have refined our approach to design reviews. To ensure that we focus our reviews on the right things, we split the review into three areas: plant safety, operational economy, and feasibility. These areas have predefined criteria to fulfill for each stage of the project.

We have also started preparing Fennovoima's organizational unit plans that extend over the project life cycle. We define each unit's role at each stage of the project and the competencies and resources needed to accomplish the role. Unit planning enables us to plan personnel development, assess training needs, and plan career paths. As a result, our personnel will also have better visibility into their job and career development.

As the construction phase of the Hanhikivi 1 nuclear power plant approaches, preparations are imperative. We are evaluating Rosatom's traditional way of delivering facilities and clarifying expectations and requirements related to the Finnish environment in order to focus our development measures on the right things. For example, the plant implementation and implementation control plans and the construction phase's decision-making processes must be working and clear well before the start of construction.

We are also looking for opportunities to facilitate the progress of the project. For example, licensing high-quality components that are serially manufactured by well-known industry standards for safety-classified equipment can bring significant benefits to project implementation and plant operation.

The year 2021 will be busy, but we have a deliberate plan. I am very proud of our people in Fennovoima, who, in cooperation with Rosatom, have made great strides in the Hanhikivi 1 project. Similar perseverance, commitment, and decision-making ability are needed from all of us in the future as we continue towards the operation of the Hanhikivi 1 nuclear power plant.

Janne Liuko
Utility Operations Director

Plant safety

Nuclear safety lays the basis for our operations. The safety of the plant is ensured during the design phase.

We demonstrate the safety of the plant

During the past year, we have extensively reviewed the safety solutions of the Hanhikivi 1 nuclear power plant with the plant supplier and STUK. We have also systematically assessed the plant's systems, layout design, preliminary safety analysis report, and safety analyses from the safety perspective.

We are satisfied that we could approve the most important safety systems of the nuclear power plant and submitted the associated documentation to STUK for evaluation. According to our estimate, the safety systems description is sufficient for this stage of the project. In practice, the system design's safety has been demonstrated, and there are no significant open safety issues regarding the systems that could require substantial design changes later. STUK has been reviewing the documentation and issued some requests for clarification concerning, for example, containment isolation, hazard analyses, and safety classification. Many of STUK's requirements resulted from the fact that we have not yet submitted all the licensing documentation, which makes seeing the overall picture still hard at this point. However, requests for clarification, dialog with the authorities, and updating the documentation are a natural part of the licensing process to obtain a construction license for the plant.

At the end of the year, we approved the severe accident management strategy and the related bases. In our view, the design solutions for the containment and the severe accident management strategy guarantee plant safety also during severe accidents. The strategy describes how the leak-tightness and integrity of the containment are ensured in case of a severe accident to prevent any damage to people, the environment, or society from an accident. There are still some open details, but we do not expect them to cause any significant changes to the plant design. The open issues concern, for example, the isolation of smaller penetrations of the containment and missing hazard analyses, particularly regarding fires.

Various safety analyses are required to demonstrate the plant's safety, including thermohydraulic deterministic analyses, probabilistic risk assessments, hazard analyses, and failure tolerance analyses. We have received preliminary analyses from the plant supplier, and there was progress, especially concerning the plant supplier's hazard analyses and failure tolerance analyses in 2020. We use hazard analyses to ensure that the plant will be protected against external and internal threats, such as earthquakes, tornadoes, airplane crashes, and flooding and fires inside the plant. We have reviewed analyses already delivered to us and prepared a large number of our own independent deterministic safety analyses, which we will also use in the license applicant's own safety assessment. In general, our analyses also show that the plant will meet all safety requirements by significant margins.

In 2021, we intend to solve all open issues related to the plant's safety and submit the complete licensing documentation for the construction license application to STUK. We will engage in weekly dialog with STUK regarding the plant's safety and design solutions and update the licensing documentation as needed to fulfill the prerequisites for a positive safety assessment by the authorities and for granting a construction license for the plant.

Juho Helander
Nuclear Safety Director

KEY SAFETY ASSESSMENTS

We have assessed the plant's systems and layout design systematically from the safety perspective, taking into account nuclear, radiation and occupational safety. Through our assessments, we ensure that the plant will be safe and that all the requirements set for it will be met. The most important assessments are summarized below.

Layout safety and design

We started the layout safety and design evaluation at the end of 2019. We are reviewing the layout against 31 assessment criteria. The criteria are associated with the following assessment areas: safety functions' allocation and classification, protection against hazards, ambient conditions, radiation safety, security and safeguards, operation, maintenance, availability and occupational safety, design integrity, fire safety and rescue, civil design, layout and architectural design, decommissioning and radioactive waste management.

In 2020, we evaluated the buildings that are critical or have a considerable significance to safety. In addition, we assessed those buildings and structures that are important for the operability of the plant. The evaluation was carried out based on the available first review stage basic design documentation, the plant's 3D model, concept-level documentation and technical architectures. Our central observations concerning nuclear and radiation safety were related to the reactor building, safety building, auxiliary building and one of the diesel generator buildings. The control building was excluded from the evaluation at this time, because its design was incomplete.

We shared our observations to the plant supplier. We will carry out the evaluation again once the basic design documentation, the plant's 3D model and the building descriptions of the preliminary safety analysis report have been completed and delivered to us. We will use the layout safety and design evaluation in the licensee's safety assessment, which is a part of the licensing documentation required for the construction license.

System safety evaluation

During 2020, we assessed the plant's systems from the safety perspective. We have completed the first review stage for nearly all systems, apart from the I&C systems. In 2020, we conditionally approved the systems regarding frontline safety features and diverse safety features, and turbine systems. We submitted the related documentation to the Finnish Radiation and Nuclear Safety Authority for review and approval.

SIGNIFICANT SAFETY IMPROVEMENTS

The control building was completely redesigned in 2020. This provided clearer separation of the safety systems and protection against external and internal hazards. The design of the control building now includes a structurally isolated protective shell that ensures the functioning of the systems and the control room in the event of a large commercial airplane crash. In addition, the systems are clearly separated in accordance with the separation principle.

FRACTURED ZONE AND THE PLANT LOCATION

There are significant fracture zones in the bedrock of the Hanhikivi nuclear power plant site. Possible slow movements of the bedrock due to land uplift after the last ice age and movements caused by seismic events in the fracture zones have been comprehensively studied since 2018. The conclusions of the studies state that the movements, if any, are insignificant in terms of nuclear safety and constructability.

Geological studies carried out in 2020 did not alter the earlier picture of the geological conditions of the area, but they refined it.

The current position of the plant on the Hanhikivi peninsula is safe and functional on the basis of all of the studies and investigations. We will monitor movements of the bedrock in the plant area throughout the plant's lifecycle in accordance with a monitoring program. In addition, the properties of the bedrock will be taken into account in the design of the buildings. The matter of the fracture zones and the positioning of the plant on the site will be discussed in the preliminary safety assessment.

Progress made in the key development areas identified in STUK's preliminary safety assessment

	Major topics	Progress 2020	Situation at the end of 2019 -> Situation at the end of 2020
1.	The design of nuclear power plant shall take the crash of a large commercial airliner into consideration as an external hazard.	In 2019, a diverse air-cooling residual heat removal system for reaching a safe state after a large commercial airplane crash was included in the design. During 2020, verification activities to demonstrate fulfillment of the requirements have continued, and the plant supplier has provided updated justification reports for safety assurance. Also, control building development has been on-going with consideration of airplane crash. Fennovoima has approved new safety systems, which are part of the airplane crash strategy, according to the requirements set for stage 1 basic design review.	
2.	System design shall apply the separation principle to ensure the implementation of the safety functions even in the event of a failure and during internal and external hazards.	Fennovoima's Layout and Safety Design group has conducted systematic reviews of applying the separation principle and adequacy of hazard protection in the reactor, critical and important buildings in 2020. Fennovoima's System Safety Evaluation group has also evaluated physical separation and hazard protection on system level for most safety systems. The hazard protection's adequacy will be confirmed in 2021 through hazard analyses currently under development.	
3.	Depressurization of the primary circuit in a severe accident.	The objective is to prevent the reactor core from melting through the pressure vessel's bottom under high-pressure conditions during a severe accident. The design provides a separate emergency pressure reduction system that is dedicated to managing severe accident conditions. The licensing documentation for the system has been received from the plant supplier in 2020. The severe accident analyses, which will be received in 2021, will justify its operation and capacity.	
4.	Experimental substantiation of passive heat removal systems (PHRS).	Fennovoima has reviewed the experimental and calculational justification for the passive heat removal systems of the containment building. Further experiments to demonstrate the functionality of the passive heat removal systems that have been carried out since 2019 in the test facility at Lappeenranta University of Technology are finalized. The report is under finalization. We sent the licensing documentation of the steam generator's passive heat removal system to STUK for approval in 2020. We will submit the documentation for the passive heat removal system of the containment to STUK for approval in 2021.	
5.	Detailed demonstration of compliance with the Finnish requirements in terms of the redundancy, separation, and diversity principles of the systems that ensure safety functions.	Fulfillment of the Finnish requirements in terms of the redundancy, separation, and diversity principles on a general level is justified in the licensing documentation reviewed and approved in Fennovoima in 2020 and sent to STUK for approval.	
6.	The effect that the material of the reactor pressure vessel has on the radiation embrittlement rate.	STUK has approved the supplier's justification of the reactor service life of 60 years with the requirement to perform an additional irradiation test program for reactor material and its welded joints. STUK has approved the irradiation test program (plan) with minor requirements related to the specimen sampling phase. The program has been updated to comply with STUK's requirements in 2020. Planning for the program execution is on-going. A surveillance program for reactor materials will be conducted during operation.	
7.	The effects that postulated, sudden pipe breaks of the primary coolant circuit have on the durability of the internal parts of the reactor as well as the implementation, inspection and radiation protection principles of the primary coolant circuit nozzles.	An analysis will be carried out in accordance with the YVL (regulatory guides on nuclear safety) requirements. The corresponding analyses of the reference plant have been submitted to STUK with positive results, and the Hanhikivi 1 design-specific analyses will be submitted to STUK in batch 2 of the pressure vessel structural design.	
8.	Design of penetrations in upper part of containment building and tendon system of inner containment.	For the penetrations in the top section of the containment, the main risk relates to how difficult they are to build. The constructability has been demonstrated in the second implementation phase of the reference plant. The leak-tightness of the penetrations is demonstrated in preliminary safety analysis as a structural requirement, and the fulfillment of the requirement is verified later with structural design.	

The status colors are the same from the 2019 report: all but one are either green or yellow, meaning that Fennovoima sees the issue has been solved, or it is clear where and how the matter will be solved. In 2021, it is expected that all these will turn green once Fennovoima can verify the solutions from complete design documentation. For more information, see STUK's preliminary safety assessment (2014).

- The matter has been resolved.
- There is a solution for the matter and it is known in which document and when the solution is presented.
- The matter is not resolved yet.

	Major topics	Progress 2020	Situation at the end of 2019 -> Situation at the end of 2020
9.	The suction strainers of the safety injection systems and experimental verification of their functionality.	The plant supplier has updated the justification reports for the emergency cooling water filter's functioning in 2020. The report will still be updated to consider additional debris sources. Further test with Hanhikivi 1 specific materials and cleaning approach is scheduled for the beginning of 2021 to show the reliable functioning of sump filters and, consequently, the cooling systems' functionality during accidents.	
10.	The technical solutions that are related to obtaining the cooling water for the systems that implement the diversity principle in residual heat removal for a 72-hour period.	The plant supplier's justification for the adequacy of water inventory was updated in 2020. It shows that residual heat removal can be continued without external supplies for a week.	
11.	Independence of the systems used to implement the severe accident management strategy (SAM).	All severe accident management systems meet the reguirements of independence. Also severe accident management strategy meets the Finnish requirements. We will submit the system descriptions and SAM strategy to STUK for approval in 2021.	
12.	A procedure and systems to reduce containment pressure to achieve a long-term safe state after a severe accident.	The systems and procedures to achieve a safe state after a severe accident are described in the severe accident management strategy as part of the preliminary safety assessment.	
13.	Realization of safety principles and objectives in the technical solutions of the plant with regard to I&C systems.	The I&C solutions will be designed to comply with the safety principles and requirements of the Hanhikivi 1 power plant. Conceptual planning and work with I&C architecture continued in 2020 and will also continue in 2021.	
14.	Separation principles for electrical systems.	The general principles for the separation of electrical systems are described in chapters 1.3 and 3.0 of the preliminary safety assessment, sent to STUK for approval in 2020. Solutions are described with mode detail in PSAR section 8, which will be sent to STUK in 2021. Electrical isolation solutions have been mostly finalized, and analyses including hazard analyses will be carried out to confirm their acceptability. However, there are several open items identified from layout and system safety evaluations.	
15.	Scope of the hardwired diverse I&C system.	The scope of the hardwired diverse I&C system will be described in the I&C architecture and in the chapter 7 of the PSAR that describes the automation systems. It will be sent to STUK in 2021.	
16.	Application of the diversity principle in the measurements of the reactor protection system and in activation of the protection.	Measurement sharing principles are defined and allocated to different systems. PSAR system descriptions of those systems have either been sent to STUK for approval in 2020 or will be sent in 2021. However, there are still open design issues related to the I&C.	
17.	Cooling of auxiliary and support systems and substantiation of a sufficient cooling water supply.	The design includes a cooling system for the safety systems ensuring its functionality in normal operating conditions and design basis accident conditions. System descriptions of these systems have either been submitted to STUK for approval in 2020 or will be submitted in 2021.	

External hazards are taken into consideration in the plant design

Nuclear safety design must be carried out systematically to ensure that the total risk for society is small. To ensure safety, different external hazards and phenomena that can be assumed to occur less frequently than once in a hundred thousand years are taken into account in the design values for a nuclear power plant. The probability of the phenomena occurring is thus less than 10^{-5} per year.

In the Finnish conditions and especially in the Hanhikivi headland area, phenomena to consider include variation in the sea water level, whirlwinds and downbursts, and weather phenomena potentially becoming more extreme as a result of climate change – in practice, the impact of storms and extreme conditions on plant safety.

When determining the design values for the plant, we have primarily used the observation history of the Finnish Meteorological Institute. However, observations have been recorded only for the last hundred years or so, depending on the phenomenon. Determining the probability of the phenomena recurring and the extreme values corresponding to them for a recurrence interval of up to 10 million years has required a lot of quantitative analysis and the utilization of expert knowledge. We have also taken the impact of climate change into account in the calculations in accordance with the different climate change scenarios of the Intergovernmental Panel on Climate Change (IPCC). This way, we have determined design values for the plant that cover the entire life cycle of the plant.

For example, according to our calculations, the sea water level of the plant area that corresponds to the probability of 10^{-7} per year is 308 cm. The power plant area has been raised to a level of 4.6 meters and the Hanhikivi 1 nuclear power plant will be watertight up to a level of 4.9 meters to ensure that among other things, the impact of climate change and waves are taken into account sufficiently in the plant design. In addition, the Hanhikivi 1 nuclear power plant will be able to withstand whirlwinds of the worst tornado category F5, and the sea water temperature rising to a tropical level of 32 °C will neither jeopardize the plant's safety.

Mikael Biese
Reliability Manager

NUCLEAR WASTE MANAGEMENT

Fennovoima carries the responsibility for the planning and construction of the nuclear waste management of the Hanhikivi 1 nuclear power plant, except for waste systems within the nuclear power plant, for which RAOS Project is responsible.

The key principle in nuclear waste management is that the waste or the processing of waste must not cause any radiation hazard to people, the environment, or property. Our aim is also to generate as little waste as possible from the operation, maintenance, and repairs of the Hanhikivi 1 nuclear power plant. The amount of waste is limited by, for example, optimizing the power plant's design and process parameters, using working methods that reduce waste, carefully planning the work, and providing training to the personnel.

In 2020, we reviewed the design documentation prepared by RAOS Project for the power plant's waste systems, that is also crucial for the plant's construction license. We conditionally approved the basic design of the systems and submitted the documents to STUK for review. Furthermore, we assessed the plant's layout design from the perspective of nuclear waste management using 3D modelling.

Spent nuclear fuel

In the final disposal of spent nuclear fuel, our goal is to engage in long-term cooperation with Posiva and the other Finnish companies currently operating under the nuclear waste management obligation (TVO and Fortum). According to a specified disposal schedule, the final disposal of spent fuel will begin after a cool-down period of some 45 years in the 2090s at the earliest.

In 2020, we have progressed with the design of the interim storage facility for spent nuclear fuel for the Hanhikivi 1 power plant. Fortum Oy is responsible for the design of the plant's interim storage facility. The interim storage will take place in pools of water at the Hanhikivi headland. There are similar facilities also at the Olkiluoto and Hästholmen nuclear power plant areas. We are applying for a construction license for the interim storage facility simultaneously with the plant's construction license. The interim storage facility will be needed seven years after the start of the operation of the Hanhikivi 1 power plant. The plan is to complete the facility a couple of years earlier, however.

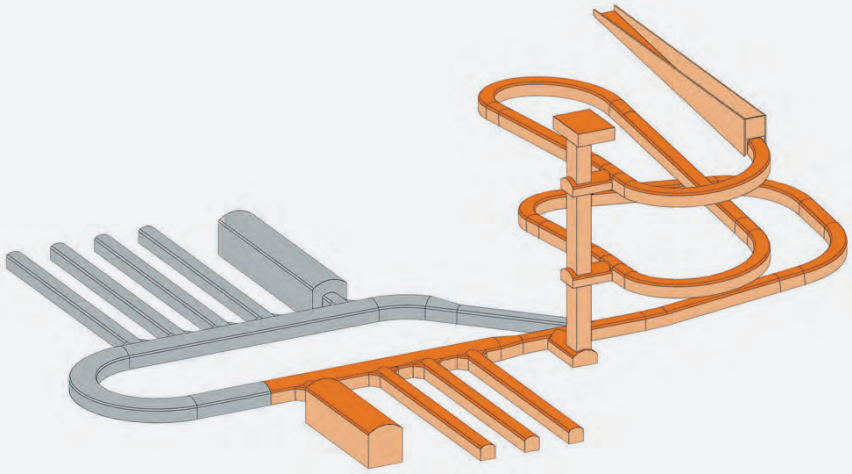
Operational waste

We also made progress in the planning of the final disposal of operational waste in 2020. The term "operational waste" refers to low and intermediate level waste, as well as very low-level waste generated during the operation of a nuclear power plant. Most of the low-level waste to be disposed of consists of waste generated during annual outages, such as protective clothing, gloves, replaced components, and devices. Intermediate level waste, on the other hand, consists of used ion exchange resin used in the treatment of process water, for example.

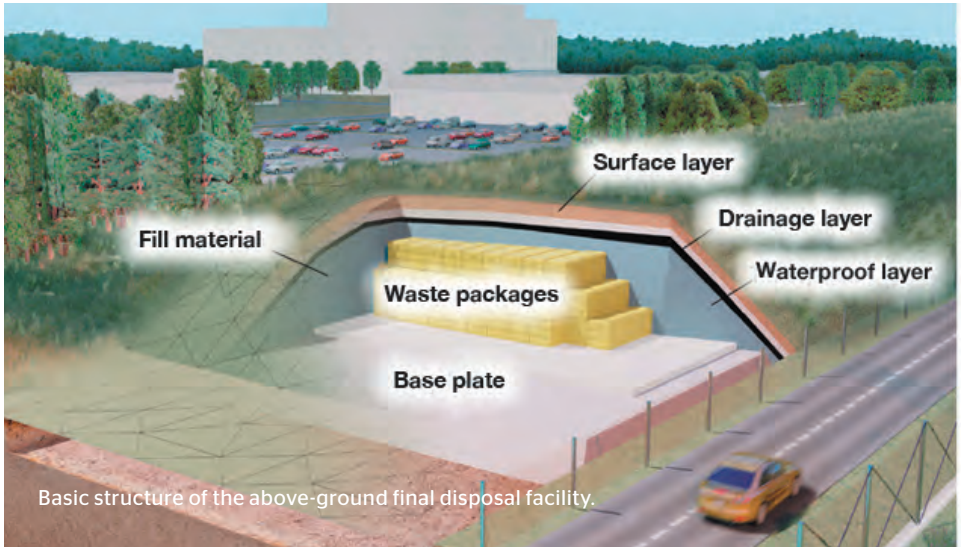
The final disposal facility for operational waste will be an underground facility at a depth of some 60–100 meters, but a decision on the final concept will not be made until at a later point in time based on the properties of the bedrock in the area. We have conducted field studies on the Hanhikivi headland in the area where the final disposal facility is to be constructed. We will start detailed studies once we have received the construction license for the nuclear power plant.

We will build an above-ground final disposal facility for very low-level waste. It will be insulated with care to prevent any leaks. The activity of the very low-level waste is so low that were it just a little less radioactive, it would be considered normal waste, which could be cleared from regulatory control and recycled like any other waste.

Waste generated during the decommissioning of the power plant's interim storage facility will also be taken into account in the nuclear waste management plans, and sufficient space will be reserved for it in the final disposal facilities.



Preliminary plans on the disposal facility for low and intermediate level waste. The facilities required for the final disposal of the waste generated during the decommissioning of the plant will be excavated at a later point in time (the area in gray in the image).



Basic structure of the above-ground final disposal facility.

Nuclear safeguards

The aim of safeguards operations implemented at nuclear power plants is to ensure the non-proliferation of nuclear weapons. The operations are based on the international nuclear non-proliferation treaty signed in 1970. It prohibits the acquisition of nuclear weapons, while allowing the signatory countries to use nuclear technology for peaceful purposes, such as energy production. The countries that have signed the treaty allow the International Atomic Energy Agency (IAEA) to monitor the use of nuclear material in their country. In practice, Finnish nuclear power companies engage in close cooperation with the Radiation and Nuclear Safety Authority (STUK), the European Commission and IAEA to ensure that Finland will not contribute to the spread of nuclear weapons under any conditions.

At the moment, we are making preparations to ensure that the Hanhikivi 1 nuclear power plant will meet the requirements set for monitoring procedures by IAEA, the European Commission and STUK and we will be able to do our part in nuclear safeguards. Under STUK's guidance, we are developing Fennovoima's control system for nuclear materials so that it will meet the needs during the construction phase, while also taking the requirements during the plant's operation into consideration.

Hanhikivi 1 is one of the first facilities where preparations are made for physical protection measures to ensure the non-proliferation of nuclear weapons as comprehensively as possible already during the plant's design phase. By taking the requirements related to nuclear safeguards into account well in advance, we save time, effort and money both for us and for parties supervising the operations: STUK, the European Commission and IAEA.

In plant design, we ensure that there are as few access routes to the reactor hall as possible. We also take the physical protection requirements into account when planning the storage and guarding of fuel and, for example, when designing the cable routes and data links for surveillance cameras. The reactor halls of plants must have camera surveillance that continuously sends a live video feed to IAEA. We are also making preparations for the nuclear safeguards needs in the plant's commissioning phase by preparing an accounting system in which all nuclear materials in Fennovoima's possession are recorded and their quantities and locations can be constantly monitored and regularly reported to the supervisory authorities.

At the moment, a central part of nuclear safeguards work consists of managing documents and various access rights, as well as reporting. The design documentation for the plant contains a lot of "nuclear dual-use items". This refers to documentation that could, in principle, be used not only to the peaceful construction of nuclear power but also for the wrong purposes. So, there is a theoretical possibility that someone could use the design documentation for making nuclear weapons. With document management procedures, we ensure that the documentation will not end up in the wrong hands, and that Fennovoima's employees know how to handle the documents with the required care. Rosatom is very strict about nuclear safeguards, and they carry out their international obligations diligently.

Kaisa Pellinen
Safeguards Manager

Construction readiness

Readiness to begin construction must be achieved well before the nuclear power plant construction license is granted to us, so that the plant construction work can commence promptly. Progress in technical design and supply chain readiness are key prerequisites for starting construction. The site preparations are well advanced and our practices in the project area are functional. We are preparing to the commencement of the plant construction together with the local stakeholders.

Fennovoima prepares for construction of the power plant

Construction readiness consists of many different aspects that all need to be sufficiently developed before the nuclear power plant's construction can begin. We have been preparing for the construction phase in multiple ways already for years and now, as we approach it, we focus on it even more. Currently, there are a lot of interconnected activities related to construction readiness going on in Fennovoima.

The most critical matter to achieve is the power plant's technical design which must be mature enough to acquire the construction license and proceed with the actual construction. In addition to the basic design, detailed design must advance to a stage that allows starting the construction of the buildings.

We must also ensure that our management system and processes are up-to-date and implemented effectively. We are making great progress in this and our renewed management system implementation is ongoing. One of the key requirements is our capabilities and processes to efficiently oversee and supervise the plant supplier and the complex supply chain. We are currently preparing our supervision model and will finalize and implement it in time. Furthermore, even though the Hanhikivi 1 construction site is well developed, many activities, such as the excavation of the main pit, must proceed before the power plant's construction can begin. For that, again, we must achieve adequate design maturity.

We began our own construction readiness self-assessment based on IAEA guidelines in 2020 to ensure that we have considered every aspect sufficiently and from the right perspectives. Even though we identified some gaps in our processes and data management tools, it reassured us that our organization's competencies are at the right level and we are focusing on the right things. In 2021, we will invite IAEA to perform a construction readiness review mission at Fennovoima. From the mission, we hope to get some recommendations to improve our readiness further.

All of us at Fennovoima contribute and add value to the company and the Hanhikivi 1 project. I am optimistic that we will be ready to proceed with constructing the power plant in a smooth and timely coordinated manner when we receive the construction license. We still have time to implement the required improvements, change our mindset, and get all project participants ready for the construction.

Vojtech Jansky
Project Manager
Nuclear Island Projects

Design progress

For the Hanhikivi 1 project, 2020 was a year of plant layout design. We knew already in advance that we would have plenty of difficult discussions with the plant supplier RAOS Project, and that the need to modify the proposed design solutions would arise. Designing a nuclear power plant and reviewing the design is a massive effort, but the work has proceeded fluently and reliably.

Us having received the expected design documentation from the plant supplier for review has been vital for the progress of the review work. The reorganization carried out by Fennovoima 18 months ago has also proven effective: responsibilities and ownerships are clear and the entire organization's decision-making capacity has improved.

Over the course of the year, we used a multidisciplinary team to assess all of the approximately 150 buildings included in the plant based on 3D modelling and technical drawings that give a view of the buildings from a variety of perspectives. We reviewed the layout design documentations building by building, highlighted deficiencies, and agreed with the necessary corrections with RAOS Project. We identified, among others, issues that required changes to ensure the ALARA (As Low As Reasonably Achievable) principle and issues that required changes to ensure the normal operation of the plant. For example, the locations of some pipelines and valves were changed to avoid an unnecessary radiation dose to the nuclear power plant's operating personnel. The plant's fire safety and evacuation routes were also further developed.

A little over a year ago, we stated that the design of the control room building did not meet our expectations. The building was completely redesigned in 2020, in compliance with clear-cut design principles. The building is quite massive: a couple of Finnish Parliament Houses could be fitted inside it. Its design is still somewhat lagging behind that of the other buildings. However, we are satisfied with the much clearer and straightforward final result.

Not everything went according to plan last year: the progress of Instrumentation and Control system (I&C) design has been regrettably slow. This influences the plant's technical design, its progress, and the review of the design documentation. I&C has already been taken into account in the building layout design, however, and the design includes the space reservations required for I&C and electrical equipment.

All in all, the functional and physical design of the plant has mostly been finalized, and no major changes are to be expected. We have good assurance of the appropriateness of the design. Now we will focus on ensuring integrity and faultlessness of the design and finalizing the document formalities. Careful finalization of the design documentation and performing the necessary assessments and analyses are essential tasks to ensure that there will be no problems with the plant's detailed design and component procurement at a later point in time.

We are gradually progressing via detailed design to the construction of the plant. For this reason, verifying the construction readiness of our own organization and the entire supply chain will be one of our key tasks in 2021.

Petri Jyrälä
Engineering Director

Progress in licensing

A Preliminary Safety Analysis Report (PSAR) approved by the Finnish Radiation and Nuclear Safety Authority (STUK) is a prerequisite for the Government to grant a construction license for the Hanhikivi 1 power plant. The PSAR comprises 80-90 percent of all the documentation required for the construction license, and it describes the plant's operation and safety features at a very detailed level.

We will deliver the PSAR documentation for STUK 's review in a total of fifteen batches. By the end of 2020, we had delivered six of these batches. For example, the system descriptions of the plant have progressed quite well, while there is still work to do with the I&C architecture and our own safety analyses. The preparation of the licensing documentation is the responsibility of the plant supplier's PSAR localization project, and our cooperation with them has been working well.

The review of the documentation and the preparation of Fennovoima's own justification memorandum include a considerable amount of work. Typically, before we deliver the documentation to STUK for approval, we send it back to the plant supplier a couple of times with requirements for additional clarifications or corrections, until we reach sufficient confidence in the accuracy of the design and the sufficiency of the documentation.

As with the approval process for the plant's basic design, we are proceeding with the PSAR process in stages. After we have received STUK's observations and requests for additional clarifications for the documentation we have delivered, we ensure that all the required changes are taken into account in the plant design and the PSAR is based on a consistent design. In the end, we hope that STUK will approve the PSAR as a whole.

I am very satisfied with my team and the way we made progress with the processing of the licensing documentation last year. We also developed our own processes considerably. Overall, I have very a positive feeling of what we achieved last year and that gives strength to continue forward. We strive to deliver the remaining nine documentation batches to STUK during the first half of 2021, which is a very challenging and ambitious goal. There is a lot of work to do, and the schedule is tight.

Juho Vierimaa
Head of Licensing

Preparatory construction work continued at the project site in Pyhäjoki

In the plant supplier's support functions area, construction work on the reinforcement workshop and the anticorrosion treatment workshop continued. In addition, the plant supplier began the construction of storage areas and workshops, which will be used for the storage of plant components.

In the sea area, the RAOS Project continued with the water construction work and dredging of the nuclear power plant's cooling water discharge channel, the cooling water intake structures, and the construction work of the harbor.

Staff facilities for a total of 2,500 people as well as a canteen have been built to the project site.

Lehto Group began the construction of Fennovoima's administration building in August 2020. The administration building is planned to be completed at the first half of 2022.

Safety culture in the project area

The COVID-19 pandemic caused extra challenges also for the safety culture work at the Hanhikivi 1 project area in 2020. Among other things, we were not able to continue normally with most work duties and events requiring face-to-face interaction, such as safety culture walks during which we observe and collect information about the safety culture at the construction site.

Regardless, we continued our close cooperation with RAOS Project and Titan-2 to develop the safety culture. We worked on improving processes at the project area and the transparency of decision-making, for example. Our goal is achieving a shared view of the operating methods in the project area in which all parties are committed, and a clear shared goal: a nuclear power plant that is safe and functional in all respects.

Finnish nuclear safety requirements are strict and demanding, which is also reflected in Fennovoima's quality and safety goals and requirements. This makes working in the project area more complicated than in traditional construction projects. It is of utmost importance that the parties in the project area work together with a mutual understanding and are able to cooperate. This enables achievement of the set goals and requirements and also ensures that the methods used to achieve them support smooth and safe operations by all the parties in the project area and the progress of the project.

Even though the current working methods and systems still require some development, as they have been perceived as inflexible, the companies working in the project area understand that systematic and accurately instructed processes are used in order to ensure a high level of nuclear safety. Nuclear safety is the most important principle guiding the work and its development, the implementation of which is influenced by each person and company operating in the project area. Strong occupational health and safety and environmental safety practices in the project area already support the achievement of a high level of nuclear safety.

Areas requiring significant development have been observed in the project area safety culture in the past years, and the different parties have worked hard to improve these areas. The progress continued also in 2020, and we are heading in the right direction. The work is also facilitated by the fact that Fennovoima, RAOS Project and Titan-2 project area safety culture managers share a common view on how we want to promote the safety culture.

Work on safety means continuous improvement. Even though you can achieve the target state and maintain it, the work is never done. Furthermore, it takes time to change the safety culture. Being willing to do the work is the most important thing. Such an attitude will bear fruit and lead to the desired results over time.

Jesse Hakala
Safety Culture Specialist

OCCUPATIONAL HEALTH AND SAFETY

Fennovoima's occupational health and safety (OHS) management system complies with ISO 45001 standard, and we received a certificate of this in January 2020. The system covers Fennovoima's operations in Helsinki and Pyhäjoki, as well as all of Fennovoima's operations at the Hanhikivi 1 project site. RAOS Project's OHS system for the Hanhikivi 1 project site also received an ISO 45001 certificate in October 2020. Titan-2's OHS system is OHSAS 18001 certified.

Occupational safety management and monitoring responsibilities are distributed among the different levels of Fennovoima's organization, from employees to the management team. The management team monitors how well occupational safety is realized on a monthly basis and carries out on-site occupational safety inspections at the Hanhikivi 1 project site twice a year. Fennovoima employees receive occupational safety training as part of the induction training that they receive at the beginning of their employment.

Occupational health and safety delegates are actively involved in the development of the wellbeing of Fennovoima's employees, and employees can participate in the development of wellbeing at work through occupational health and safety committees in Helsinki and Pyhäjoki.

We manage and monitor safety at the project site together with the plant supplier and worksite supervisors. Daily occupational safety practices at the site are well established.

Effective risk management prevents accidents

Extensive risk identification and management procedures and reporting of safety observations are an important part of preventive occupational safety measures. We assess occupational safety risks from the perspectives of risks to the employees, facilities and the Hanhikivi 1 project site four times a year.

At the project site, all contractors working within Fennovoima's scope of work follow the extensive risk assessment and management procedure that is based on Fennovoima's risk register. This ensures that risk assessments are carried out in a consistent manner and meet our requirements. The plant supplier RAOS Project and the main contractor Titan-2 follow similar risk assessment and management procedures.

Central risks at the project site include working at height, information sharing between various actors and working in winter conditions. A risk assessment is performed before each construction work. The identified risks are communicated to all contractors and builders active at the site. Everyone working for Fennovoima or at the Hanhikivi 1 project site has the right to refuse to perform unsafe work.

With the occupational safety training, we ensure that everyone working for Fennovoima or at the Hanhikivi 1 site has adequate knowledge and skills of the correct working methods and safety practices, and that everyone working at the construction site uses the required personal protective equipment.

During the pandemic, site supervision at the Hanhikivi 1 project area has been carried out with the required and sufficient resources at each given time.

Site inspections promote improvement of operations

We monitor occupational safety performance at two levels: procedures and practices. The monitoring aims at continuous development of working methods and the processing of observed deficiencies at an early stage, before any harm occurs.

Fennovoima's occupational health and safety management system was subjected to both internal and external audits in 2020. No deviations were discovered in the audits. Fennovoima also audited the occupational health and safety management systems of RAOS Project and Titan-2, and participated in inspections performed by the authorities at the construction site.

Fennovoima and RAOS Project together carried out an occupational safety inspection of the contractors at the construction site. Fennovoima also conducted targeted Hazard Hunt inspections that focus on one area at a time; examples include inspections of all lifting aids being used at the site, or the chemical storage facilities. Observations made during the inspections are recorded, and any required corrective actions are made clear to the contractors.

Safety violations are processed in accordance with the safety observation or accident investigation procedure. Fennovoima exercises zero tolerance on working under the influence of alcohol. Breathalyzer tests were carried out normally, several times a week, until March, at which time the testing was discontinued due to the pandemic.

OCCUPATIONAL ACCIDENTS

In 2020, a total of 66,8236.5 working hours were recorded at the construction site.
Six lost-time accidents occurred at the construction site during the year:

- An employee fell down in the yard, which resulted in a two-day absence from work.
- Wind tore open an entrance door with force, injuring an employee's hand, which resulted in a three-day absence from work.
- An employee tripped on an electric wire outdoors, injuring their back and foot, which resulted in a three-day absence from work.
- While walking about outdoors, an employee tripped and injured the ligaments in their ankle, resulting in a 21-day absence from work.
- An employee tripped and dislocated their knee, resulting in a 20-day absence from work.
- Telehandler leaned at the time when employee was attaching the load to the forks and the forks hit the employee in the back, resulting in a five-day absence from work.

Fennovoima's own employees were involved in one lost-time accident: a plank fell on an employee's foot in the storage area of a hardware store in Pyhäjoki when the employee was picking up goods. This accident resulted in a nine-day absence from work.

Occupational accidents at the Hanhikivi project site	2020	2019
Lost-time injuries*	6	0
Lost working days	54	0
Average severity of accidents (as lost days)	9	0
Lost time injury frequency rate (LTIFR)**	8.98	0
Fatalities	0	0
Severe accidents	0	
Investigation of accidents and near misses	Six accidents and one near miss, which were investigated according to set targets.	No accidents
High risk work	No	No

The table includes information about contractors working at the Hanhikivi project site (incl. the project areas of Fennovoima, RAOS Project, and Titan-2).

Occupational accidents, Fennovoima's own personnel	2020	2019
Lost-time injuries*	1	2
Lost working days	9	23
Average severity of accidents (as lost days)	9	11.5
Fatalities	0	0
Severe accidents	0	
Investigation of accidents and near misses	One accident, which was investigated according to set targets.	Two accidents, one of which was not investigated within the set time limit. Both investigations have been concluded.
High risk work	No	No

The table includes information about Fennovoima's offices in Helsinki, Pyhäjoki, and Oulu, and it covers both Fennovoima's employees and consultants working for Fennovoima.

* a) First-aid-level injuries are not included in the IR; b) fatalities are included in the IR; c) "lost day" indicates the loss of one full work shift; d) "days" means scheduled work days; e) count begins from the day after the accident (one full work shift). If the injured person is treated on the day of the accident and he/she returns to work on the next day, the injury is reported as a first-aid case.

** LTIFR is calculated by number of lost-time accidents per million hours worked. A lost-time accident is and accident that causes an absence from work of at least one work shift.

Advocate for all workers

Dozens of subcontractor companies and hundreds of people work in the Hanhikivi 1 project area. Oversight of the large construction site is a huge effort for the parties carrying the main responsibility for the project and also for the authorities.

As the joint shop steward and joint occupational safety delegate for the construction site, our duty is to offer guidance to and represent all the people working at the construction site, regardless of their job duties or employer. To succeed in this duty, we must maintain confidential relations with all workers, employers and authorities. In addition to official inspections, we tour the construction site daily and talk with the people, and we keep in close contact with the authorities, Fennovoima, and other parties active in the project area.

Sharing information is an important part of our work. There are plenty of foreign people from Estonia, Latvia, Lithuania, and Russia, among other countries, working at the construction site. Many of them are not familiar with the Finnish labor legislation and terms and conditions of employment, and the occupational safety and health requirements differ from the ones in their home countries. We strive to ensure that they know their rights.

Instances of misconduct in the project area are often caused by ignorance of the Finnish rules, and the situation can be reasonably easily corrected by communicating the correct information to the companies. Reports about the problem situations are included in the company data to ensure that Fennovoima's supply chain management team knows how the companies have fared here if they apply for new contracts in the Hanhikivi 1 project.

A personal site access permit is required for working in the Hanhikivi 1 project area. The fact that Fennovoima can revoke the access permit in case of problems makes our work much easier. It puts pressure on companies to do everything right. In addition, the data of all companies and workers is recorded in a site register so that it is easily available to us and the authorities.

We are impartial when working at the construction site, but we are backed by Fennovoima's strong support. Each person working at the construction site can easily see that Fennovoima aims to prevent misconduct and secure the rights of workers. The starting point for all companies and people coming to work at the Hanhikivi 1 construction site is that the rules do not bend here.

Jouni Karekivi
Joint Shop Steward

Mikko Lehtelä
Joint Occupational Safety Delegate

The joint occupational safety delegate ensures that employers comply with Finnish occupational health and safety regulations and legislation.

The joint shop steward of the Hanhikivi 1 construction site ensures compliance with the site agreement, the labor legislation, and Finnish terms and conditions of employment, as well as contributes to prevention of gray economy.

ENVIRONMENT

Once in operation, the Hanhikivi 1 nuclear power plant will produce electricity for decades without emissions detrimental to climate. Before commissioning, Fennovoima's direct environmental impact is mostly related to the construction work carried out at the plant site.

We ensure that all work on the Hanhikivi headland is carried out in accordance with environmental legislation and the permit conditions, and that the environment and the wellbeing of the local residents are respected during construction. Our ISO 14001 certified environmental management system is an important tool in this work. No non-conformances were observed in a recertification audit performed in late 2020. The work in the project area has proceeded normally regardless of the COVID-19 pandemic.

Management of the environmental impact at the Hanhikivi 1 construction site is based on proactive identification of environmental risks. We assess environmental risks for the Hanhikivi 1 project site as a whole from the perspectives of environmental impact, legislation, and permit conditions. At this stage of the construction project, important environmental risks include chemical and oil leaks, the spread of turbidity in the sea, and noise during blasting. We update our risk register four times a year.

All contractors working in the project area comply with a comprehensive risk assessment and risk management procedure. Furthermore, everyone working at the project site must be aware of the special characteristics of the Hanhikivi headland's natural environment, the access limitations in the area, as well as the environmental guidelines established for the construction site.

Project area is monitored with care

We monitor the progress of contracted work together with the plant supplier RAOS Project and main contractor Titan-2 during weekly site walkthroughs, assisting the contractors in better management of environmental matters. We also perform monthly targeted environmental inspections that focus on matters such as fuel storage, oil spill prevention preparedness, or dust prevention methods. In 2020, we continued to provide the contractors with instructions on the processing of waste and chemicals and the prevention of small oil leaks, and we emphasized the importance of preventing littering.

The authorities also carry out regular inspections of our procedures. As construction operations at the project site have remained small-scale and no significant deficiencies in environmental inspections have been detected, the authorities did not perform an official periodic inspection based on the environmental permit this year. They did visit the project site, however. In addition, we contacted the authorities regarding the need to update the environmental permit.

Permit matters

At the end of the year, the Finnish Safety and Chemicals Agency (Tukes) granted Fennovoima a permit for the handling and storage of large amounts of hazardous chemicals during the operation of the nuclear power plant. Hazardous chemicals are stored and used at the nuclear power plant for the management of water chemistry, for cleaning processes, for cooling of the generator and as fuel for the backup generators, for example.

Environmental requirements in plant design

There are approximately fifty environmental permit requirements for the plant. Some of them are extremely detailed, while others are more general in nature. The requirements involve water supply, emissions into the water and air, noise, the processing of waste, chemicals and chemical releases, as well as the monitoring of the environmental impact, for example. The thermal load from the cooling water in the immediate vicinity of the plant is the plant's most significant environmental impact. The practical management of environmental requirements is the combined effort of a large group of experts, and we are continuously developing our practices to ensure compliance.

Environmental impact management	2020	2019
Violations of permit conditions	Noice limit exceeded once.	No
Violations of environmental laws and decrees	One violation: disturbance of the natural water level of a gloe lake	Two violations: 1. disturbance of the natural water level of a gloe lake, 2. A leakage of waste water into the ground when canteen's broken waste container was lifted.

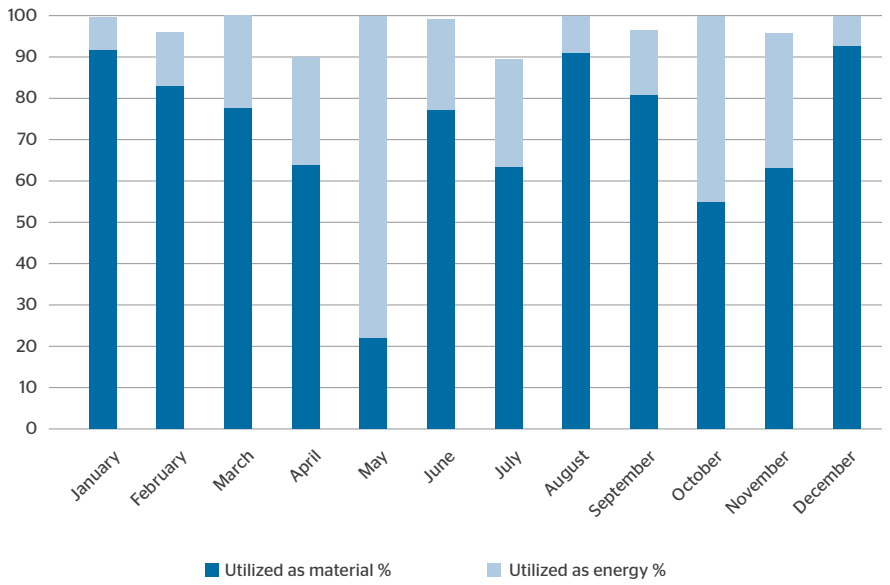
Object	Results in 2020	Monitoring method
Environmental monitoring		
Air quality	No increased volume of dust outside the project area. We monitor the air quality, especially in close proximity to nature conservation areas.	Six monitoring points. We added one new monitoring point due to rock crushing.
Noise	One case of noise limit being exceeded.	Seven measuring points; the one closest to residential areas is approximately 1 km from the closest home.
Seawater quality	No changes in water samples caused by construction activities..	Monitored five times a year with water samples taken from ten measuring points.
Turbidity	Increased turbidity caused by heavy rainfall and storms were detected again during monitoring activities. The values exceeded twelve times the limit where work must be interrupted, but no water construction work was in progress at the time. Breakwaters and a protective embankment built in the sea area limit the spreading of turbidity from the construction site.	Monitored by means of continuous measurements. There are five measuring points around the Hanhikivi headland and two in the marine spoil area.
Fish stock	The monitoring covered the fry production of whitefish, vendace, and Baltic herring. No changes that were clearly caused by water construction work could be detected in the collected fry production data.	Follow-up study
Oil and chemical leaks	Four oil spills that were considered significant took place in the project area. The term "significant oil spill" refers to an incident that would have caused damage to the environment had the correct preventive actions not been performed.	Subcontractors report all accidents to Fennovoima or RAOS Project in accordance with the construction site responsibilities.
Protected species and nature conservation areas		
Seashore meadows	No follow-up monitoring of seashore meadows took place in 2020. However, more specific monitoring of Siberian primrose, a plant growing in seashore meadows, took place. It was observed that there were fewer plants at certain locations but more in others, and that Siberian primrose had naturally spread to new areas.	Follow-up study
Gloe lakes	The security measures taken during studies on the settling pond failed, which caused the water level of the western gloe lake to rise above the normal level.	Annual follow-up
Species relocated based on a permit requirement	No significant changes were detected during the studies. There are still moor frogs in the project area. The transfer of yellow iris to a new habitat has been successful and the plants have already started to mix with the naturally occurring yellow irises.	Annual follow-up

Environmental impact monitoring

On the Hanhikivi headland, there are extensive protected seashore meadows, overgrowing shallow bays, and gloe lakes, which have become isolated from the sea. There is a Natura 2000 conservation area approximately two kilometers from the plant area. Areas of high natural value were excluded from the plant area already at the construction planning phase.

We monitor the state of the environment together with RAOS Project in accordance with a jointly agreed environmental monitoring program. In addition to the environmental monitoring required by the permit conditions, we also carry out voluntary monitoring of the environmental impact.

Utilization of construction waste as material or energy in 2020



Waste generated in the Hanhikivi 1 project area	2020 Metric tons (t) % of waste	2019 Metric tons (t) % of waste
Construction waste, of which	**428 (54 %)**	**217 (75 %)**
Wood waste	82 (19 %)	52 (24 %)
Energy waste	25 (6 %)	53 (24 %)
Concrete and brick waste	69 (16 %)	19 (9 %)
Bitumen	95 (22 %)	31 (14 %)
Mixed construction waste	20 (5 %)	16 (7 %)
Combustible waste*	7 (2 %)	10 (5 %)
Other waste**	131 (31 %)	36 (16 %)
Hazardous waste* **	**372 (46 %)**	**71 (25 %)**
Total	**780 (100 %)**	**287 (100 %)**

Our target is that 70% of the construction waste is utilized as material and altogether 90% of the construction waste is utilized as material or energy. We reached the overall target we had set for the utilization of waste (total annual utilization rate of 97%) and the material utilization rate target (material utilization rate 72%).

Most of the waste generated at the construction site is regular construction waste: metal, wood, concrete, rocks, biowaste, paper, cardboard, glass, or electrical and electronic waste. Our partner Remeo is in charge of transporting the waste from the site and appropriately processing it. The fluctuation in the annual waste volumes is due to changes in the ongoing construction work. * Combustible waste includes all combustible materials that cannot be utilized as material or energy fuel, such as rubber, leather, and aluminum packaging. ** The "other waste" category includes other waste types that can be utilized as materials: metal, paper, cardboard, glass, and biowaste. *** Hazardous waste includes 367 t of removed contaminated soil, waste oil, filters, batteries, and electrical and electronic waste, for example.

Construction waste is utilized as energy or material

Efficient sorting and recycling, as well as appropriate processing, are important parts of the management of the environmental impact of the waste generated on site.

Our goal is to utilize at least 70% of our construction waste as materials and a total of 90% of our construction waste either as materials or in energy production. The recycling of materials saves natural resources and reduces the waste load caused by the use of the materials. Recycled fuel made from energy waste, on the other hand, is utilized as fuel in industrial and power plants.

Contractors must sort the waste in their own work areas before transporting it to the project area's sorting stations. Contractors must also manage the processing and storage of hazardous waste in accordance with the applicable regulations. Contractors have mainly been diligent in the processing and sorting of waste.

Recycling construction waste

Environmentally sustainable construction requires, among other things, that as much of the waste that is inevitably generated during construction is either reused or utilized as energy. Recycling is also cost-effective. At the Hanhikivi 1 construction site, we strive to consider any opportunities to utilize waste as well as possible during all construction stages.

Around 7,500 cubic meters (m^3) of tree stumps were collected from the Hanhikivi 1 plant area during land clearance. Our partner Lakeuden BioPower Oy turned the stumps into around 3,000 m^3 of wood chips that were used to produce heat at Oulun Energia Oy's Laanila power plant. The wood chips generated some 2,100 MWh of energy, which is enough to heat seven apartment buildings or 100 detached houses for one year.

Mud-covered stumps and logging waste that could not be utilized to produce energy were composted at the Hanhikivi headland. In a few months, they will turn into soil that can be used as soil enrichment when landscaping the green areas at the plant site, for example. The approximately 500 m^3 of soil generated in this manner offers an excellent substrate and adding chemical fertilizers will not be necessary.

Crushed rock and soil from excavation, dredging, and blasting will also be utilized. The plant area lies fairly close to sea level, and crushed rock has been used to level out the ground in the plant area and to raise it to the elevation required for nuclear construction. Excess crushed rock and soil from the construction site have been utilized to level and fill the ground in Matinsaari, a new residential area currently under construction close to downtown Pyhäjoki.

All in all, 97% of the construction waste generated at the Hanhikivi 1 project area in 2020 was utilized as material or energy.

LOCAL IMPACT OF THE HANHIKIVI 1 PROJECT

The Hanhikivi 1 project has an impact on the living environment and everyday life in Pyhäjoki and in the neighboring municipalities. Active participation in regional development together with public, private and third sector improves the area's capabilities to prepare the region for changes brought about by the project, including the increased number of residents and the volume of services needed.

The construction of the new nuclear power plant has a significant impact on the regional economy and employment rate. The construction project generates new investments, creates jobs in the region, and increases tax revenue. With the increasing number of residents and stable municipal economy, the selection and availability of public and private services in the region improves, which benefits all local residents.

The construction work also has some negative effects on the living environment, such as increased volumes of heavy traffic and temporary turbidity in the seawater caused by water construction work. Some of these negative impacts cannot be avoided, but we openly communicate about the work in progress and any disturbances that it is expected to cause.

Strong support for the project

The project has strong support in Pyhäjoki and the surrounding area. According to the survey, 74.2 percent of Pyhäjoki residents support the project. In the entire study area, 69.1 percent of the residents are positive about the construction of the power plant.

In Pyhäjoki, the readings have decreased by 2.3 percentage points from the previous year, when the local support for Hanhikivi 1 project reached an all-time high: 76.5 percent of the residents of Pyhäjoki welcomed the power plant project.

Across the study area, the support for the project has fallen by two percentage points from the previous year's peak reading, which was 71.1 percent. On the other hand, the number of those who have a negative attitude towards the project has decreased by 1.1 percentage points across the study area.

During the construction phase, the Hanhikivi 1 construction site will employ more than **20,000** professionals. At the most **4,000** of these people will be working simultaneously.

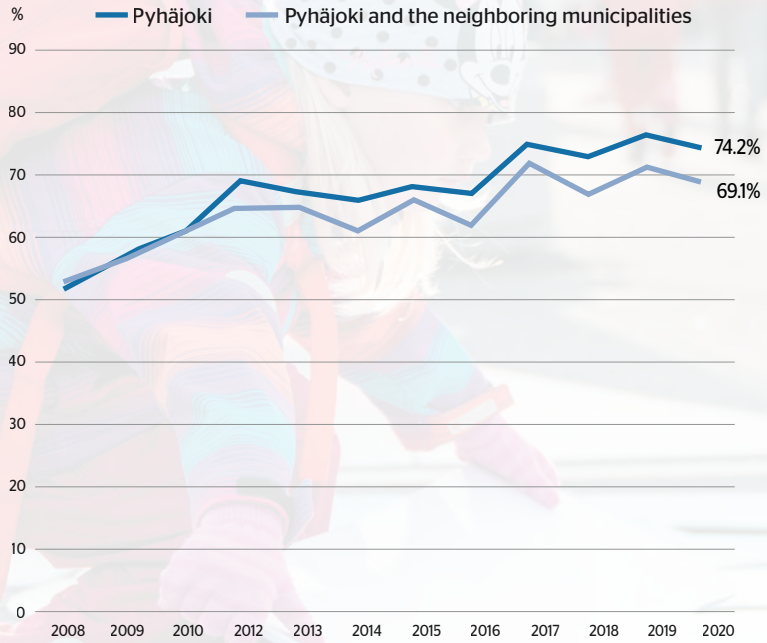
Once in operation, the nuclear power plant will directly employ some **500** people. When taking into account the indirect impact (the cascade effect)*, approximately **2,600** jobs will be created.

*More jobs in several industries will be created due to the cascade effect from direct jobs, such as service- and education-related jobs.

Different types of direct and indirect taxes will be paid a total of **70 million** EUR during the construction of the infrastructure and **342-564 million** EUR during the construction of the nuclear power plant. Furthermore **49 million** EUR per year during the operation of the nuclear power plant.

Source: Northern Ostrobothnia Regional Resource flows study (Northern Ostrobothnia Association and Raahe Region Business Services, 2018). The domestic content used in the assessment of impact ranged from 25 to 40 percent.

Local support for the project



Development of support for the project in 2008-2020 in Pyhäjoki, and in Pyhäjoki and the neighboring municipalities (Norstat Finland Oy).

Implementation quality

By high-quality implementation of the nuclear power plant, we mean that the plant is safe, complies with Finnish legislation, regulations and the plant supply contract and produces the agreed volume of electricity. Supply chain readiness is one of the key factors in ensuring high-quality construction of the plant.

Towards high-quality construction of the plant

When the COVID-19 pandemic started, Fennovoima switched to remote work quite flexibly. The pandemic has made development work and creating new ideas more difficult, as well as hampered integrating new people into the work community, but overall, there have been no major problems. The impact of the pandemic on the project has been surprisingly small.

Technical design of the nuclear power plant proceeded well in 2020, except for I&C design. Technical design for Instrumentation and Control (I&C) system is still at a very early stage, and there is some schedule pressure in its progress. In addition, the project organization responsible for the I&C delivery is not yet fully formed. There must be swift progress with the I&C design to ensure that it will be sufficiently advanced for the plant's licensing.

We are actively preparing for the plant's construction phase. In 2020, we carried out a lot of preparatory work to develop supply chain monitoring and quality control, as well as to build Fennovoima's own supervision organization, among other things. For Fennovoima, quality control means in practice that we participate in inspections and, above all, ensure that the quality inspections of RAOS Project and its supply chain work well, feedback is transmitted and corrective action is taken in accordance with the observations.

The Finnish regulatory environment is challenging, and therefore we find it necessary to support the plant supplier and the supply chain in their preparations for it. We do not do the work for them, but support and guide them.

RAOS Project is also preparing for the construction phase and planning related measures. In 2020, RAOS Project and Fennovoima worked together to produce the implementation plan for the construction phase, which includes examples of typical delivery sequences and information on how the different functions and parties are linked and interact with each other in the Finnish operating environment. The plan supports the schedule for the project's implementation phase and is very important to us.
The main contractor Titan-2 is also making progress with the development of construction readiness. The construction readiness plan delivered by the main contractor describes their responsibilities and the development of their organization from the present moment to the casting of the reactor building base slab, as well as a detailed construction plan for the reactor building. Overall, the plan increases the transparency of preparations and supports Titan-2's credibility as the main contractor for the Hanhikivi 1 plant.

Successful and timely deliveries of equipment with long lead times are essential for the progress of the project. Our goal is to have the manufacturing of components related to the reactor and primary circuit started during 2021. Starting the manufacturing of the reactor pressure vessel is the most critical of these, as it takes so long to make. Before starting the manufacture, we need to have the manufacturing materials and plans approved by STUK.

Jouni Takakarhu
Project Director

SUPPLY CHAIN MANAGEMENT

The most important aspect of a nuclear power project's supply chain management is ensuring safety. Deliveries that are important for safety are subject to a higher number of requirements that are also stricter than the requirements set for deliveries which have no nuclear safety significance. For these deliveries, only such suppliers can be approved that have the necessary prerequisites for operations that meet the statutory safety requirements and that have adopted audited quality management and quality assurance processes.

The processes are verified with valid certificates and through audits carried out by Fennovoima and RAOS Project. The approvals of suppliers approved for manufacturing components relevant to nuclear safety are valid for a limited period of time, typically three or five years, depending on the safety class of the approval. The validity period of the approval will be shorter if the supplier fails to meet all the requirements.

Evaluating construction readiness

During 2020, we focused on ensuring in cooperation with RAOS Project that the supply chain and its management will be ready for starting the construction phase at the scheduled time. We implemented a detailed gap analysis focusing on reviewing the performance of the most important suppliers in terms of nuclear safety in 2020. Based on the findings, we defined operational targets linked to the project's milestones and a development plan for areas requiring development for each key supplier. With these operational assessments, we help RAOS Project identify the areas in which the suppliers' performance does not meet the requirements of Fennovoima and the Finnish nuclear energy act, decrees and additional guidelines.

The identified areas for development include knowledge of European norms and requirements and safety culture. RAOS Project also needs to manage and control the subcontracting network and its own resources in a more systematic way.

Fennovoima's scope of supply	2020	2019	2018
Subcontractors in total	455	329	273
Of whom Finnish	84%	82%	83%

RAOS Project's scope of supply	2020	2019	2018
Subcontractors in total	1102	904	754
Of whom Finnish	81%	80%	80%

The tables include all subcontractors approved for the supply chains by the end of 2020.

We have also required a separate development plan from some suppliers, in addition to the supplier-specific development plan based on the gap analysis mentioned above. For example, the main contractor Titan-2 has provided us with a development plan for construction readiness.

Titan-2 has developed its operations and safety culture during 2020. We require them to continue the systematic development of their operations. We extended the supplier approval of Titan-2 by two years.

Supply chain development in 2020

The manufacturing of the turbine generator rotor forging was completed by Japan Steelworks and approved after the final inspection in Japan. The part will be transported for machining at the GE Steam Power (previously called GE Alstom) factory in Belfort, France.

The manufacturing of the reactor pressure vessel forgings will start in 2021.

Ethical requirements apply to all suppliers of the Hanhikivi 1 project

Socially significant ethical requirements related to the supply chain, such as anti-corruption, human rights obligations, and environmental management are instructed through contractual terms, verified with audits, and taken into account in project planning. All the key participants in the project must also have an environmental management system compliant with ISO 14001, and an occupational health and safety management system that meets the requirements of OHSAS 18001 or ISO 45001 standard.

Rosatom Group signed the UN Global Compact initiative on social responsibility and

Lessons learned from inspections

Our task in quality control is to independently assure that the manufactured components fulfil all the necessary standards to ensure high quality and nuclear safety. External circumstances, such as schedule pressure, cannot compromise quality.

The first steps of main component manufacturing have been taken. The turbine rotor forging was finalized in Japan at the end of last year. The forging was accepted in our final inspection.

Conducting the inspections on the other side of the world during the COVID-19 pandemic was a challenge. We could not travel to Japan to inspect the product ourselves because of the traveling restrictions. Instead, we hired a local Japanese inspector to conduct the inspections and trained them to work according to our management system processes. We faced some cultural and communication challenges, but those did not prevent the inspections from taking place as required. The forging has now been transported to France, where the machining will take place. There it will be easier for us to run the inspections despite the COVID-19 restrictions.

The fact that the forging was the first component manufacturing that we were inspecting was an opportunity to test our processes in a real-life situation and correct them where necessary. The main lesson we learned is that we must clarify our internal responsibilities, improve our internal communication concerning quality inspections, and communication with RAOS Project. Also, RAOS Project must develop their quality control and supply chain management capabilities to be ready to supervise the large-scale manufacturing of components and the construction of the power plant itself.

We have developed our capabilities a lot during 2020 and will continue doing so. Our team will also grow heavily over the following years. We will be ready to begin wide-scale inspections when the manufacture of components speeds up and the power plant construction begins.

Julien Henry
Quality Control Specialist

Manufacturing of the power plant's equipment

Long-lead items always lay on the Hanhikivi 1 project's critical path or very close to it because a delay in their manufacturing and delivery to site for installation can have a significant impact on the project's progress. The manufacturing of these components takes years, includes heavy testing in several stages, and require a complex supply chain.

One of our most noteworthy achievements in 2020 was that we were able to elaborate and approve the irradiation embrittlement program for the reactor pressure vessel 60-year lifetime justification that we developed in cooperation with the plant supplier RAOS Project. Also, the Finnish radiation and nuclear safety authority STUK approved the testing program.

The turbine generator rotor forging was finalized in Japan in 2020 and moved to France for machining. Besides that, the reactor pressure vessel forgings will be some of the first long-lead items entering material manufacturing. The work should begin in the second half of 2021.

Even though most of the equipment manufacturing will only begin after we have received the power plant's construction license, we need to be ready for the manufacturing well ahead of that. In 2021, one of our most critical tasks is to ensure that the manufacturers of the long-lead items and their processes are qualified. The manufacturers have proven experience and manufacturing references, but their processes need to be qualified to be in-line with the European and Finnish regulations and requirements and our expectations. We will support and supervise RAOS Project in the work. Overall, the cooperation with RAOS Project concerning the long-lead items is active and works well.

The supply chain for manufacturing the materials and the equipment involves companies in several countries. When the COVID-19 pandemic hit, we were afraid that it would significantly affect the progress of the work. It has been a small miracle that the work has progressed rather fluently after all.

Vladimir Szabó
Nuclear Island Director

sustainable development in October 2020. By signing, Rosatom committed itself to upholding and supporting the ten principles concerning human rights, labor, the environment and anti-corruption activities in its strategy and daily operations. Fennovoima signed the Global Compact commitment in January 2017.

Safety culture in the supply chain

We continuously monitor the level of safety culture in the supply chain. Overall, safety culture within the supply chain has developed in the desired direction, even though the COVID-19 pandemic has slowed down the development. The safety culture of the project's main contractor Titan-2 has been monitored with special care during the past few years. Titan-2 has clearly improved its actions to develop the safety culture and an open atmosphere at the project site. Cooperation between Fennovoima, RAOS Project and Titan-2 also increased in 2019–2020. Changes in the safety culture always take time. Because of this, we require that Titan-2 continues to develop the safety culture and improve the supervision of the project area's safety culture.

In addition to Titan-2, we audited the safety culture at main component supplier Atomenergomash and JSC Rusatom Automated Control Systems (JSC RASU) last year. Because of the COVID-19 pandemic, a significant part of the activities related to the monitoring of the safety culture, including audits, were implemented remotely.

Supply chain readiness will be achieved in time

In the Hanhikivi 1 project, the readiness of the supply chain is twofold. On the one hand, it includes the readiness to acquire equipment and, on the other hand, the readiness to start construction. Overall, the supply chain comprises several thousand companies.

Supply chain readiness for construction and equipment procurement are being prepared side by side. We have developed our procedures and prepared a plan for how we will be able to manage the enormous number of companies and suppliers in the supply chain at all levels. The primary responsibility for supply chain management lies with RAOS Project. Still, we at Fennovoima must also have good visibility throughout the supply chain to the last person and product or even a part of the product.

Construction readiness must be achieved in the supply chain first, during 2021. Companies working in the Hanhikivi 1 project area form a sound basis for starting construction. All companies already operating in the area are audited and approved and have the capability to deliver services to the project. The supply chain already includes several hundred companies.

In terms of equipment manufacturing, the supply chain has a little more time to prepare. For my part, I am responsible for the technical specifications of the standard non-long-lead item equipment on which the technical procurement is based. For this equipment, I think RAOS Project and we are a little ahead of schedule, so I believe RAOS Project will be ready to purchase and deliver the equipment in time.

The Hanhikivi 1 project is highly complex. That is why we must have a good plan for how we proceed. However, a strategy is never complete and all-encompassing. We will complete and continuously improve our plan as we gain experience. I am sure that both the power plant construction and equipment manufacturing supply chains will meet the requirements and achieve readiness to proceed at full power. We have identified supply chain risks and bottlenecks, and, most importantly, we also know how to address them.

Matous Zivotek
Balance of Plant Manager

Operational readiness

We will be ready for the operation of the plant once the plant itself and the operating organization are ready for safe, cost-effective, and efficient operation of the plant.

Preparing for the 60-year operation of the plant

Operational readiness is achieved when the Hanhikivi 1 nuclear power plant and the organization operating it are ready for the plant's safe, cost-effective and efficient operation. Over the past year, we have mapped the needs and development areas related to Fennovoima's operational phase and defined a roadmap as the basis for Fennovoima's operational readiness development work. The roadmap creates a clear picture of all key objectives and tasks.

At the plant design phase, we ensure that the power plant meets the technical and safety requirements set for it. In addition, we make sure that it is easy to use and maintain and produces the agreed amount of electricity.

Founded in early 2020, Fennovoima's operational readiness unit focuses primarily on organizational readiness, which has been continuously developed during the project. We have begun to define the functions of the plant's operating organization and related goals in cooperation with Fennovoima's various units. In 2021, we will continue to develop the operational phase organizational model, including new functions and a plan for how to operate the Hanhikivi 1 plant.

Besides structural matters, an organization's readiness consists above all of the right competencies as well as functional processes and tools. The organization's expertise is continuously developed during the project so that the organization's operational readiness is achieved well in advance of the nuclear power plant's initial fuel loading.

According to the plant delivery EPC contract, RAOS Project is responsible for the technical training of Fennovoima's personnel. For several years, however, we have seen language and cultural challenges in identifying training needs and implementing the training. We have studied the experiences of other nuclear power projects in a similar situation around the world and found that cultural and linguistic challenges have often led to the failure of training activities. That is why we are now supporting the plant supplier more than planned in the development of training.

We have started defining a long-term training program that not only covers the project organization's training needs at different stages of the project but also the operational organization's training needs. For example, the training of licensed operators in charge of the plant operation is long, and it must begin several years before the plant's planned commissioning.

At the beginning of 2021, we launched a technical training program specifically for experts evaluating the plant design. The program initially covers themes related to plant safety, design, quality, and plant operation in a normal situation. The training primarily supports the second stage of the basic design and its review. In addition, the training will help Fennovoima's organization prepare for the plant's 60-year operating phase in the future.

Kim Stålhandske
Operational Readiness Manager

PLANT AVAILABILITY

Capacity factor is a figure which indicates the amount of time during a specific review period for which a plant or a component is capable of performing the required action. In the case of a nuclear power plant, the capacity factor refers to the plant's ability to produce electricity to the grid. The review period is usually one year. Every per cent in the capacity factor is valuable, and the savings potential may even amount to billions during the 60-year life cycle of the plant.

During the plant's design phase, we examine availability in proportion to time, i.e. for how long during the review period is the plant capable of producing electricity to the grid at 100% capacity. Factors affecting availability also include planned annual outages, unplanned shutdowns, plant modernizations, and any major repairs that were not taken into account when preparing the maintenance schedule. In addition, the degree to which the plant is automated has an impact on its availability.

The agreed amount of electricity as a minimum

Traditionally, VVER plants in Russia have not achieved capacity factors similar to that required from Hanhikivi 1. We will ensure that Hanhikivi 1 will produce at least the amount of electricity agreed in the plant supply contract.

We have received the first design-phase estimate on the current capacity factor of the Hanhikivi 1 nuclear power plant, and at the end of the year, we also received the first official availability calculation for the whole plant. We will evaluate the accuracy of the availability estimate while reviewing the basic design documentation for the nuclear island. The actual Hanhikivi 1-specific availability calculation can only be made once the detailed design of the plant is complete.

Verifying the availability

In 2020, we focused on ensuring that the plant's layout design does not include any factors hindering availability that would be extremely difficult or impossible to correct through design modifications later. RAOS Project and the main designer Atomproekt demonstrated to us the maintainability of buildings important to availability and safety.

During the second stage of basic design in 2021, we will process nearly all buildings in the plant area room by room at the system level. We will gradually proceed to examining smaller entities all the way to the optimization of component-specific maintenance.

We have also analyzed the schedule for the planned outages of the nuclear island, which will define the annual cycle of the whole plant, i.e. the duration of planned outages. The plant supplier has proposed some improvements that would have an impact on the duration of planned outages, such as changes to the refueling machine's speeds, advanced tools for opening the pressure vessel and changes to the maintenance cycles of the reactor coolant pumps. The work to verify the effects of the changes will last until the spring of 2021.

In 2021, RAOS Project will deliver the schedules for planned outages that concern the whole plant for us to review. Information based on operating experience from the LAES-2 reference plant regarding planned maintenance would also be very important to us when we estimate the durations of the planned outages of the Hanhikivi 1 plant. In addition, we will receive for our examination availability analyses for different component types, such as heat exchangers, cooling systems and steam systems, so that we will also be able to evaluate the availability of the components separately.

Some words about maintenance

Fennovoima's maintenance team is currently focusing on ensuring that maintenance matters are taken into account in the design of the Hanhikivi 1 plant and that the plant's availability is in line with what was agreed in the plant supply contract.

Since last summer, plant supplier RAOS Project has demonstrated to us the maintainability of the Hanhikivi 1 plant using 3D modelling and design documentation. In the first stage of the basic design, we have reviewed the layout design of the plant's thirty most important buildings floor by floor. In practice, we have selected a piece of equipment from each floor that is difficult to move due to its size or some other characteristic and checked whether the buildings' design allows for equipment maintenance and inspections.

The demonstration meetings have speeded up the basic design review, but we have also identified some design modification needs. For example, we have located equipment that is not interchangeable and found places in the design where we want to have elevators. We discuss the findings with the plant supplier, and many issues have already been resolved.

In the second review stage in the spring of 2021, we will look in more detail at the maintainability of various buildings, systems, and equipment. We will also focus on practical issues. For example, we will check that the equipment can be separated from the process during maintenance operations and that there is enough space around it to allow maintenance personnel to carry out maintenance work and inspections.

We will also analyze with the plant supplier the operability and, in particular, the lengths of the planned outages. The length of the planned outages has a significant effect on the plant's availability factor, i.e., how much electricity the plant produces per year. So far, we have not been able to ascertain whether the current plant design allows for the downtime agreed in the plant supply contract. We will review the grounds for the proposed outages with the plant supplier to ensure that the downtime is achieved in accordance with the plant supply contract.

We are also shifting the focus of our work to the development of maintenance organization and processes and other matters related to preparing for maintenance, but we will continue to evaluate plant design alongside development work.

Miika Hyvärinen
Maintenance Manager

Human factors contributing to the safety of the nuclear power plant

Around 80% of all incidents or accidents are either caused or significantly contributed to by human performance. Our task in the human factors engineering (HFE) team is to ensure that we design the plant in such a way that the plant can be operated successfully in every foreseeable operating condition, from normal day-to-day operation and outages to severe accident management. We approach the question systematically and consider the human role in delivering plant performance in all of those conditions over the whole operation phase and into decommissioning.

In practice, we are interested in the things that affect human performance. We apply scientifically based assumptions about how people are able to perform in their work and look at several factors behind that. For example, we look at staffing, training, competence within job roles, and the design of the organization. We also consider matters such as the impact of stress on human performance and the design's inclusiveness. After testing the assumptions, we implement it all in the design to ensure that the plant is designed in such a way that the operators, maintainers, and security staff can do their jobs reliably every day.

Adapting human factor engineering requirements to the practical conditions of the project has been challenging, but the situation is improving. Over the past couple of years, we have set the foundations of an effective and compliant human factors program that supports the plant's safety, availability, and compliance with regulations and requirements. We have developed clear expectations for both RAOS Project and Fennovoima to achieve the overall goal of human factors contributing to safety. We still have challenges integrating human factors across the design, both in the supplier scope and owner scope. However, we now have a solid technical foundation for the work.

The design decisions we make today fundamentally affect how safely and effectively the Hanhikivi 1 nuclear power plant can be operated by our workforce in the future.

Pernilla Allwin
HFE specialist

Aerial picture of the Hanhikivi 1 project area in February 2020.

People and competence

Committed and competent personnel is a prerequisite for the success of the Hanhikivi 1 project. Fennovoima's organization and its competencies must meet the statutory requirements set for each project phase. Our strengths in the global competition for nuclear power professionals are the interesting and challenging work, the opportunity to get involved in developing new nuclear power company operations and grow as a professional in a caring and encouraging work community.

The COVID-19 pandemic that started in the spring of 2020 has impacted work in Fennovoima too. Our entire organization switched to working from home in March, and majority of our employees have been taking care of most of their work duties remotely ever since. We have regularly updated our instructions regarding the pandemic based on the currently valid national guidelines and the current status of the pandemic.

Our organization's attitude towards remote work is positive. According to a supervisor survey carried out in May, 85% of the supervisors who replied the survey (n=50) had not noticed any change in the performance of their team after the switch to working from home, and 86% of the supervisors were confident of their ability to effectively lead their team remotely.

Recruitment and personnel changes

Joachim Specht started work as Fennovoima's President and CEO in June. He came to the company from PreussenElektra (formerly E.ON Kernkraft), where he served as Senior Vice President and Head of Nuclear Engineering and Consultancy. Specht holds a master's degree in metallurgy and materials science, and has an almost thirty years of experience from the nuclear industry.

Timo Okkonen, Fennovoima's acting CEO, switched back to his role as the COO at the end of May and left Fennovoima in January 2021. Okkonen was responsible for the implementation of Fennovoima's comprehensive development program, and continues to act as a management consultant for the company.

In 2020, we fine-tuned our organizational model, which was renewed in 2019. Most recruitments to new supervisory positions were made from within our own organization. Janne Liuko, M.Sc. (Tech.), was appointed Utility Operations Director and a member of the management team in September. He was formerly Fennovoima's Nuclear Safety Director. Juho Helander, M.Sc. (Tech.), is now the head of the Nuclear Safety department.

Personnel commitment and retention continued to improve from 2019 by five percentage points. The voluntary staff turnover rate was 5.4% in 2020. The average number of personnel over the course of the year was 359 people.

Our recruitment needs for 2020 were moderate, and the focus was on longstanding nuclear power expertise in technical and project management positions. All recruitment processes were discontinued in the spring due to the pandemic but were restarted during the summer. Travel restrictions hampered recruitment from abroad in particular. Regardless, 58 new employees – including 12 interns or summer trainees – started work in Fennovoima over the course of the year. The employment of summer trainees who were selected in the spring before the restrictions due to the pandemic entered into force were realized according to plan, although mostly remotely.

We strive to hire new personnel who can start their work directly at the Hanhikivi 1 project site. We will provide all our employees with flexible ways of working in Pyhäjoki. We have worked in close cooperation with the region's municipalities for several years to ensure that the transfer of our personnel and their families to the new region will be as smooth as possible.

Fennovoima employees 370
In Helsinki 296, in Pyhäjoki 74

Female 29% Male 71%

Average age of the employees 43 years

Personnel total, including internal consultants 441

New permanent employees 46
Growth of the organization at the end of the year 25 people

Outgoing employees 20
Voluntary employee turnover 5.4%
(2019: 10.4% ja 2018: 13.5%)

Average training hours 26
(2019: 43 hours)

We rewarded a total of 27 employees for their excellent work with a sum corresponding to their salary for one month.

LEARNING ORGANIZATION

In 2020, we focused particularly on reviewing the competences and resources of the different units in our organization, as well as on planning in both the long and short term. This work will be continued in the years to come, as it supports the company's long-term planning and the development of personal competence. Fennovoima's competence model sets the framework for the planning. It describes Fennovoima's key competence areas at each project phase.

We believe that the career paths of experts and managers are equally important. We have developed a career path model to support development planning and management. The model is based a competence rating of the duties in Fennovoima, which was updated in 2020. The model is used when planning the career path and training needs during personal development discussions and in internal recruitment, for example.

The planning and development of training is based on a systematic approach to training (SAT). It is a well-known five-tier method recommended by the international nuclear industry organizations WANO and IAEA. It allows us to ensure that the training we offer is properly targeted and of high quality, and that it corresponds to the needs of the organization and the employees.

We have developed digital and remote learning solutions for our training, and will continue their development in the years to come. Early in the year, we introduced a new content creation tool. In the fall, we launched several e-learning material packages in cooperation with our trainers. Our flexible and varied training solutions meet the needs of the Hanhikivi 1 project and our employees.

We offer a comprehensive induction training program for all our new employees at the beginning of their employment. It consists of a training course for all employees and task-specific training courses.

HIGH PERSONNEL WELLBEING

By investing in wellbeing at work and a good working atmosphere, we also support productivity, commitment, and motivation. A functional organizational structure, high-quality management practices, and opportunities for professional development, among other similar factors, are the key to a prosperous workplace community.

Due to COVID-19, we have focused especially on the significance of psychosocial wellbeing. We have highlighted occupational health care services that support wellbeing at work and offered our employees a variety of lectures and online exercising programs to assist them in coping with working from home.

The next survey on wellbeing at work will be carried out in 2021.

Flexible working hour model

TWe offer our employees the opportunity to do their work flexibly, and we support location-independent work. In 2020, we introduced Fennovoima's new working hour model in stages. It provides the maximum working hour flexibility allowed by working hour legislation and the collective labor agreement: for instance, we further extended our flextime and shortened the permanent working hours. Furthermore, work done outside the workplace is included in the working hours in full.

The more freedom the employees have to make decisions regarding their own working hours, the better they can take care of their own wellbeing. That is why we instruct supervisors to pay special attention to their own wellbeing and the wellbeing of their employees.

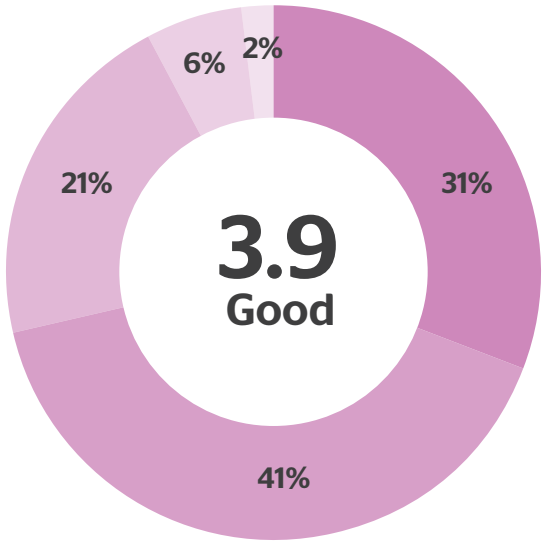
Leadership quality

In November, we carried out an extensive survey on leadership quality. Almost 78% of the employees (279 respondents) replied to the survey. The employees assessed the capability of their immediate supervisors in six aspects of leadership.

The company's overall score for leadership quality was 3.9 on a scale of one to five, which is a good result. Our strengths include listening to the employees and taking into account different views and feedback. Clear communication and supervisors' role in cooperation with the authorities and the media were also praised. The development areas we identified

include the ability of supervisors to address performance challenges and their ability to consider the employees' career and development opportunities during their leadership work.

In addition to the survey, supervisors were given an opportunity to complete a self-assessment and compare its results with the assessments and feedback provided by their teams. We support supervisors in developing their leadership skills based on their unique needs.



Leadership quality

- Excellent 4.1–5
- Good 3.8–4
- Satisfactory 3.3–3.7
- Poor 2.5–3.2
- Very poor 1–2.4

N/A 1%

Fennovoima's organization grows even during the pandemic

Fennovoima's operation unit has grown rapidly in recent months. Since a year ago, we have doubled the number of people on the team and added more international color to our ranks. The operation and maintenance department's most extensive growth period comes after the construction license decision. During the operation phase of the plant, our department employs about 200 people. In addition to reviewing and evaluating plant design, we are increasingly focusing on planning the department's operations for the operational phase.

The newest entrant in our operations unit is operation planning engineer Sarah Don. She joined our team at the turn of the year. Finding and hiring a new employee during the COVID-19 pandemic has not differed much from the normal at Fennovoima. However, we received three times the number of applications compared to previous recruitments.

Due to the pandemic, Fennovoima's organization works mainly remotely, and Sarah also started her work and orientation period remotely. So far, we have only met face to face once. The situation is not ideal, but the other team members and I set aside time to keep in touch so we can guide Sarah and get to know each other.

Antti Lammela
Operation Manager

I applied to Fennovoima as soon as I got acquainted with the Hanhikivi 1 project. My first impression of Fennovoima is that it is energetic, practical, and focused on collaboration and cooperation. The people working at the company seem equally enthusiastic about working together to build a new nuclear power plant as I am.

I previously worked as the Operations Manager at a research reactor at the Massachusetts Institute of Technology (MIT) in the United States. Despite the pandemic situation, the recruitment process for Fennovoima did not differ from my previous experiences except that I could not meet the team in person beforehand. The interviews took place over a video connection, and I got answers to all my questions. A colleague also shared his experiences working at Fennovoima and living in Finland before being offered the job which was beneficial in decision making.

Fennovoima's induction training has been helpful. The program is versatile, and all activities can be attended remotely. However, starting a new job in a remote situation requires more initiative than joining a company requires usually. For example, when learning how to use new information systems and programs, it would be great to lean over to a colleague and ask for help. It also requires more intention with getting to know new co-workers when there are no everyday encounters in the office.

Although I haven't met many of my new co-workers face to face yet, I already feel like I have friends and support in Finland. My team and all the Fennovoima people I have met have welcomed me very warmly.

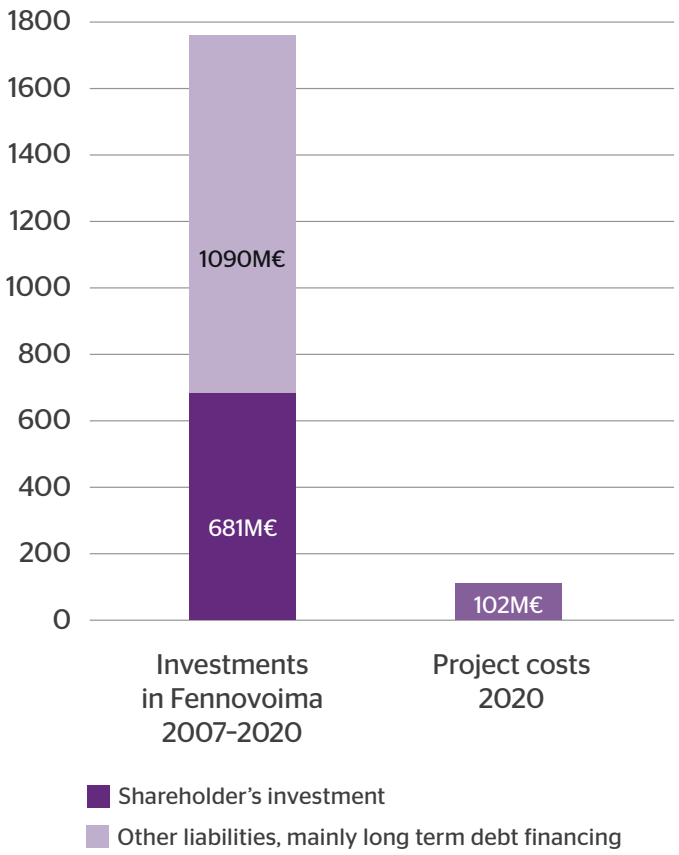
Sarah Don
Operation Planning Engineer

Financial status and governance

For us, economic responsibility means producing value for shareholders over the long term and generating a positive impact on the Finnish national economy. We protect our operations from risks and secure our ability to operate in the Finnish society by complying with the laws, regulations and our Code of Conduct in all our activities.

Financial figures 2020

INVESTMENTS IN FENNOVOIMA



KEY FIGURES 2020

Balance sheet total **1 701M€**

Equity ratio **32.2%**

Liquidity position **Good**

Average number of personnel **359**

Personnel expenses **29.9M€**

Payment to the State Nuclear Waste Fund **1.8M€**

The company does not have any turnover before the start of electricity generation, which is estimated for late 2028. Until then, the company is estimated to make small losses.

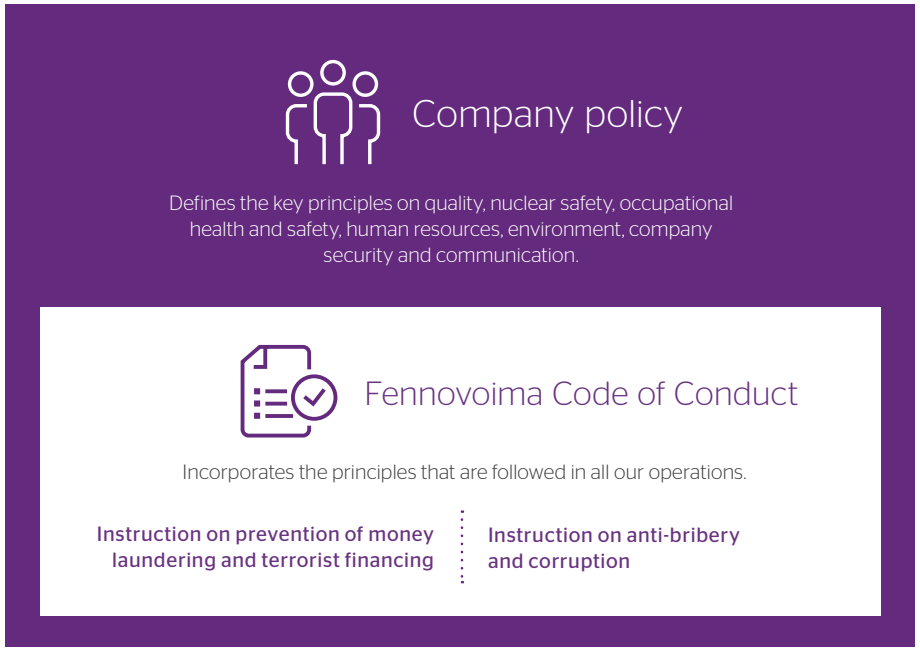
Causes	Consequences	Project costs	Project delays	Plant performance	Operational costs
Plant	Nuclear & radiological safety			Safety issues	Necessary upgrades
	Design & specifications			Availability issues	Unplanned shutdowns
	Implementation & quality			Lifetime issues	Unplanned maintenance
	Operation & maintenance			Operational issues	Additional resource needs
Deliveries	Engineering & licensing	Additional resources	Delayed deliveries		
	Procurement & supply chain				
	Construction & installations				
	Commissioning & training				
Enablers	Management & leadership		Delayed work		
	Competence & resources		Delayed operation		
	Partners & advisors		Lagging support	Lacking support	
	Platforms & tools	Low productivity	Missing information		
External	Financing		Financing delays		Interest rates
	Authorities		Authority delays		
	Shareholders			Financial pressure	
	Regional aspects		Local challenges		
	Impact of international politics		Delayed project		

RISK OVERVIEW

Large and complex investment projects, like the Hanhikivi 1 project, involve risks and uncertainties. Some of the risks have already materialized during the project period. The planned starting date of commercial operation was postponed from 2024 to 2028. Delays increase expenses from Fennovoima's own operations, while the nuclear power plant supply contract signed with RAOS Project Oy is a fixed-price contract. Fennovoima's risk management supports the achievement of the set goals and prevents negative impacts on the operations. We strive to identify risks as early as possible and by actively implementing corrective and preventive measures. With efficient risk management, we strengthen:

- Nuclear safety, quality and safety and security of the operations
- Safety and security of personnel
- Economic value creation and minimization of potential economic loss
- Responsible operations
- Cooperation and dialogue with stakeholders

The focus of risk management is on identified risks related to plant performance, progress of the project, and efficiency of work. In addition, the project's impact locally and stakeholder relations are a central part of our risk management. As Fennovoima's plant project is very extensive and multinational, we also monitor risks involving international politics and their potential impact on the project. In terms of project management, in addition to the project's schedule, quality, and technical risks, risk management in 2020 strongly focused on financial risks and modelling of the financial impact of potential risks. The key risks in terms of schedule, quality, and technical risks in the short term involve preparation for construction in the entire supply chain.



Our Company Policy and the Code of Conduct follow the principles of the UN Global Compact responsibility initiative.

RESPONSIBLE BUSINESS PRACTICES

Compliance with laws, regulations and our Code of Conduct secures our ability to operate in the Finnish society. All Fennovoima employees carry the responsibility for following the law, protecting human rights and promoting justice. We operate with absolute integrity and honesty..

Compliance management

The identified key risks associated with business ethics for Fennovoima are

- Corruption
- Unjust influence and conflicts of interests
- Risks related to the supply chain
- Risks related to the neglect of legal requirements.

Fennovoima's Compliance & Ethics Program places special emphasis on these risk areas.

The Compliance & Ethics Program has been approved by Fennovoima's Board of Directors, and the CEO carries the responsibility for its implementation. In practice, the Compliance unit is in charge of the development and follow-up of the Program, processing of concerns, and providing instructions and training to the personnel. The Compliance unit also processes suspected violations and non-conformities and implements the necessary actions.

Compliance & Ethics training

Successful operation in the nuclear industry requires that all the personnel are familiar with the applicable laws and regulations and is committed to compliance with them and with the nuclear safety principles, company policy and ethical principles that steer the organization's operations.

In 2020, 82% of our own personnel and 27% of internal consultants (total: 66%) had completed the mandatory training on our Code of Conduct within the set time limit of six months. In 2019, the combined completion percentage was 86. In addition, we introduced an online training course to be completed every other year to support and maintain our employees' understanding of ethical issues.

Reporting concerns

We encourage our employees to report any suspected violations of laws, our Code of Conduct and internal regulations. These should

be reported primarily to the supervisor or to the Compliance team. Fennovoima also has a so-called whistleblowing tool that allows anonymous reporting of all compliance-related observations. The tool is available to all Fennovoima employees.

The reporting tool has also been available to external stakeholders since fall 2020. A link to the tool and instructions on how to submit reports are available for external stakeholders on our website.

In 2020, we received one report via the reporting tool regarding the archiving of files containing personal data in Fennovoima. The report resulted in an update of the archiving practice for files containing personal data. Absolute confidentiality is applied to all communications related to expressing concerns, and we do not tolerate any countermeasures, harassment or discrimination of persons who have submitted reports. Even an attempt of a countermeasure will lead to disciplinary action and may even lead to the termination of employment.

Anti-corruption

Fennovoima has versatile tools to prevent corruption. These include written Code of Conduct, instructions to prevent corruption and money laundering, which are always available to personnel online, compulsory training on prevention of corruption (as part of the Compliance & Ethics training for employees and internal consultants) and procedures for the processing of suspected and observed incidences. Any offer, promise, grant or gift must comply with applicable laws and Fennovoima's instructions.

In 2020, Fennovoima detected one case where one of its own employees had repeatedly ignored a potential conflict of interest in their own work. Instructions on what to do in future were provided, and the employee was given a written warning. Fennovoima illustrates what situations are deemed conflicts of interest during its Compliance and Ethics training to ensure that the rules are clear to all and any ambiguity is eliminated.

Companies included in the supply chain have committed to complying with Fennovoima's Code of Conduct or similar ethical principles. Fennovoima has established contractual obligations for supply chain companies to prevent corruption in their own organizations and in their supply chains, and to comply with Finnish legislation when operating at the Hanhikivi 1 project area.

Ethical requirements apply to all suppliers

Socially significant ethical issues involving the supply chain, such as anti-corruption, human rights obligations, and the management of environmental matters are guided by means of contractual terms, verified by means of audits, and also taken into account in project planning. All the key participants in the project must also have an environmental management system compliant with ISO 14001, and an occupational health and safety management system that meets the requirements of OHSAS 18001 or ISO 45001.

We conduct a preliminary assessment of ethical conduct as part of the subcontractor pre-selection process for companies who wish to be part of Fennovoima's direct supply chain. For the assessment, we collect information about the policies of any contractual partners, codes of conduct, oversight procedures, and violations with regard to matters such as management of corruption, safeguarding human rights as well as the management of occupational health and safety and environmental matters. RAOS Project Oy is responsible for the supervision of its own supply chain.

Significant non-compliances with laws and legal requirements and confirmed cases of corruption	2020	2019	2018
Fines or non-monetary sanctions for non-compliances	0	0	0
Confirmed cases of corruption	0	0	0

Reporting principles

This Fennovoima report contains information on the progress of the Hanhikivi 1 project and on the focus areas of corporate responsibility. The report covers the year 2020. The information on the progress of the project is based on our internal evaluations and the views of Fennovoima's experts. For sustainability reporting purposes, we apply disclosures of GRI Standards and Fennovoima's own disclosures that we have defined as essential to our corporate responsibility.

When defining what matters to us in terms of corporate responsibility, we have taken into account the expectations and requirements of both our own organization and external stakeholders, in accordance with the materiality matrix shown on the next page. More information on the definition of materiality and our sustainability targets can be found at: **www.fennovoima.fi/en/responsibility.**

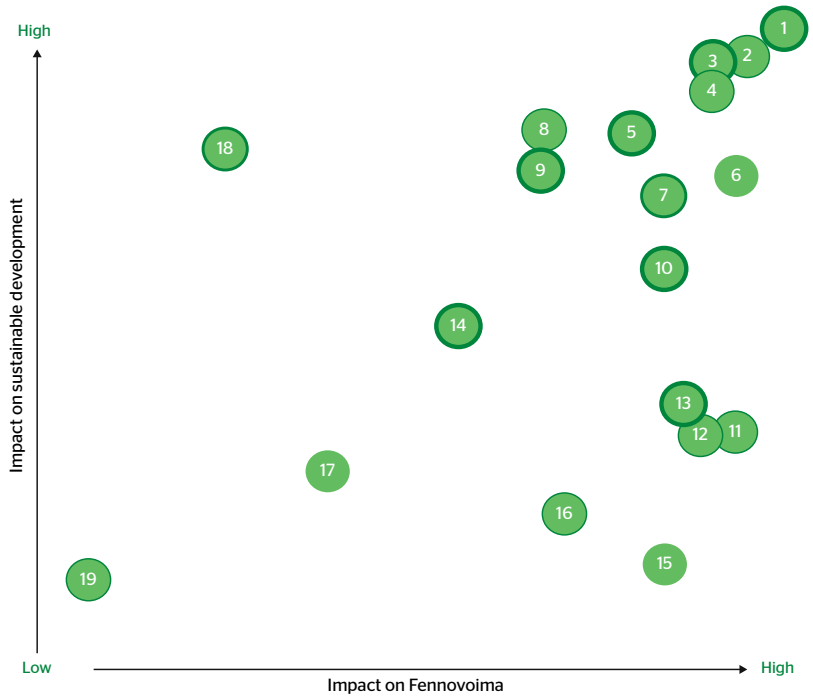
The sustainability indicator index is available at: **www.fennovoima.fi/en/reports-and-assurance**

Data boundaries and information sources
The data presented in this report covers Fennovoima Oy's functions in Helsinki and Pyhäjoki and in the Hanhikivi 1 nuclear power plant project site, if not otherwise stated. Fennovoima's subsidiary Fennovoima RUS is not included in the scope of the report as it has only one employee. To cover the material aspects of the Hanhikivi 1 project site operations, the matters that relate directly to the material aspects of Fennovoima's corporate responsibility, also regarding the plant supplier RAOS Project and main contractor Titan-2, are included in this report.

The financial data presented in the document is from Fennovoima's audited financial statement. Supply chain data includes information from the Fennovoima Management System (FMS) and the Hanhikivi 1 site register. EPC (engineering, procurement and construction) scope related supply chain data is supplied by RAOS Project Oy. The environmental data provided in this report covers the Hanhikivi 1 project site. The information is collected from the management system, monthly reports and from independent experts' studies conducted in the plant site area. The construction waste data is from Fennovoima's own systems and from Fennovoima's waste management partner Remeo Oy. Human resources related data in this report covers Fennovoima's organization in Helsinki and Pyhäjoki. Occupational health and safety data describes the Hanhikivi 1 construction site and Fennovoima's offices in Helsinki and Pyhäjoki.

Global Compact Communication on Progress
Fennovoima supports the ten principles of the United Nations' Global Compact sustainability initiative. We respect and promote these principles throughout our operations, and report on our progress in this report.

Material topics of corporate responsibility



SAFETY
1 Nuclear and radiation safety, emergency preparedness
4 Nuclear fuel life cycle and responsible nuclear waste management
15 Data privacy and security
18 Energy security & energy self-sufficiency of Finland

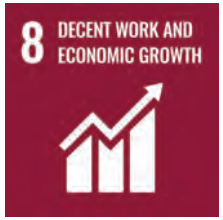
ECONOMIC RESPONSIBILITY
2 Plant availability & economic benefits to the shareholders
5 Supply chain management
8 Impact on local economy and employment
18 Energy security & energy self-sufficiency of Finland

SOCIAL RESPONSIBILITY
5 Supply chain management: labour practices, supply chain transparency, respecting human rights in the value chain
6 Acceptability of nuclear power
10 Occupational health and safety
11 Competence developement and retention
12 Employee engagement and satisfaction
14 Engaging with local stakeholders
16 Personnel and workplace wellbeing
17 Co-operation with educational institutions
19 Supporting good causes, volunteering

ENVIRONMENTAL RESPONSIBILITY
3 Climate change mitigation & reducing fossil dependency
9 Environmental impact management

RESPONSIBLE BUSINESS PRACTICES
7 Business ethics
13 Openness and transparency

The topics in the upper right corner of the matrix are considered most relevant to our corporate responsibility but all the topics presented are important. Topics that are important to external stakeholders are encircled. The weight of the line indicates the importance of the topic to our external stakeholders.



We promote the UN Sustainable Development Goals in our activities. We have identified the four goals presented on this page as most material for our operations. In addition, we have a particular impact on the goals: 12. Responsible consumption and production, 14. Life below water and 15. Life on land.

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