

A winter landscape featuring a snow-covered hillside with several power line towers and cables stretching across the scene. The trees are heavily laden with snow, and the sky is a clear, pale blue. The overall atmosphere is serene and cold.

**FINGRID**

ANNUAL REPORT 2022

# Business Review

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An open, fair, efficient and responsible work community

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Excellent results for Fingrid in reputation surveys



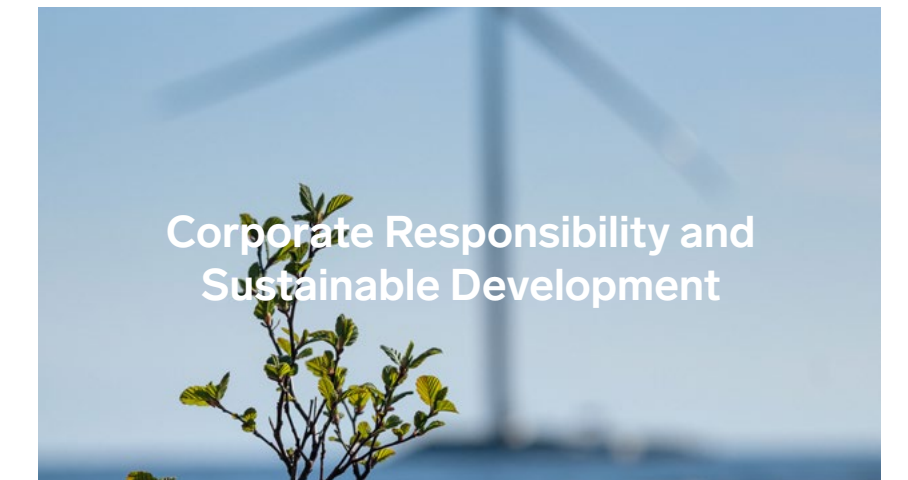
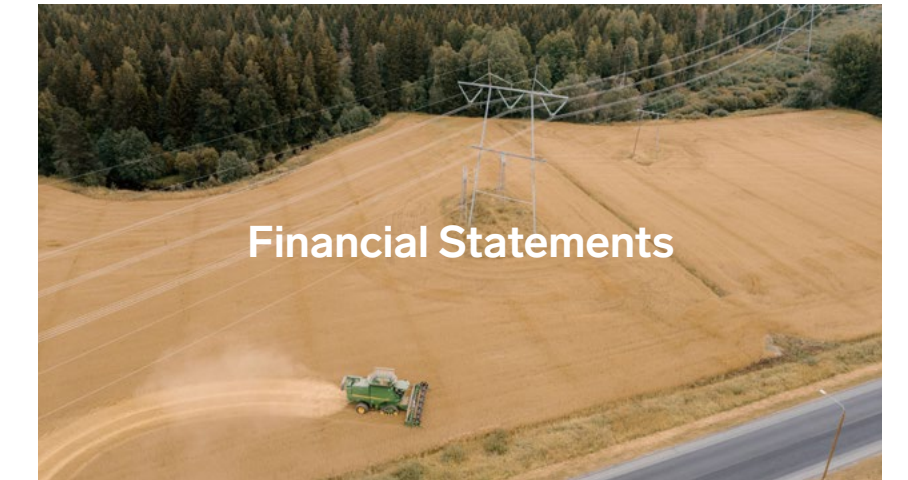
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## Business Review 2022

Fingrid's Annual Report for 2022 consists of six sub-reports: the Business Review, Report of the Board of Directors, Consolidated Group and parent company's Financial Statements and key figures, Corporate Governance Statement, Remuneration Report, and Corporate Responsibility Report.

Fingrid draws up the Consolidated Financial Statements and the half-year report in accordance with the international IFRS reporting standards accepted by the European Union and in accordance with the Finnish Securities Market Act. The Consolidated Financial Statements include the parent company Fingrid Oyj and its wholly owned subsidiaries Finextra Oy and Fingrid Datahub Oy. The Group additionally has a 25% holding in two associated companies – eSett Oy and Nordic RCC A/S. The Report of the Board of Directors and the financial statements of Fingrid Group's parent company and its subsidiaries are prepared in accordance with the Finnish Accounting Act and the guidelines and statements of the Finnish Accounting Board.



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# 01

## Review by the President & CEO

### Sights set on the future in the midst of an energy war

In 2022, the European energy markets faced a new reality after Russia launched a war of aggression against Ukraine. The market mechanism binds natural gas and electricity together, which meant in the scarcity situation, the prices of both gas and electricity rose sharply everywhere in the EU.

The price of gas started to rise already in autumn 2021 and steeply increased at the end of 2021. The exceptional circumstances were further intensified when Russia invaded Ukraine in February 2022. Europe's efforts to end its dependence on Russian energy kept the price of gas high. The gas scarcity caused electricity prices to spike throughout Europe. In Finland, the price of electricity remained somewhat lower than more southern areas of

Europe, thanks to low-carbon electricity generation. As a result of Western sanctions, Finland's electricity imports from Russia ended in May 2022. Imports from Russia have played an important role in Finland's electricity procurement in past decades. Finland's long cooperation with its neighbour came to an end. Finland's electricity system coped well with the exceptional situation.

The energy crisis and the end of Russian electricity imports increased uncertainty related to the availability of electricity during winter 2022/2023. We exceptionally published our first estimate of the adequacy of electricity already in August. At the time, the adequacy of the electricity supply was considered to be affected by three main factors: The completion of the Olkiluoto 3 nuclear power plant, the situation in Finland's neighbouring



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countries, and winter temperatures and wind conditions. The message was clear: as a result of major uncertainty, Finns had reason to anticipate possible power outages caused by electricity shortages and to be prepared to take electricity-saving measures. In addition to the adequacy of electricity, citizens were also very concerned about the extremely high price of electricity. Our message was well received in Finnish society, which quickly employed various measures to prepare for the worst-case scenarios.

At the same time as we were managing the crisis, we had our sights set firmly on the future. Despite the difficult situation, we successfully rolled out our investment programme. We were able to make progress on demanding transmission line and substation projects as planned – on schedule and on budget. We had a record number of projects in the construction and planning phase. The war in Ukraine hindered material deliveries and raised costs, but we found successful solutions through close collaboration with material suppliers and service providers.

During the year, we made significant investment decisions to reinforce cross-border connections between countries, to reinforce Finland's internal main grid and

to connect our customers' new electricity use and production to the main grid. The most significant completed project was the Forest Line, which was completed at the end of September. The connection significantly boosts the electricity transmission capacity between northern and southern Finland, helping to efficiently transmit northern renewable energy production to electricity consumers. The Forest Line also enables investments to expand the Aurora Line's cross-border capacity between Sweden and Finland.

Finland has a massive need for new production. At the same time, on the European level, Finland has very favourable conditions to significantly increase the production and consumption of renewable forms of electricity. Based on the updated main grid development plan, it was estimated that at least three billion euros will have to be invested in the main grid over the next ten years. Wind power construction continues in Finland, and we have already connected more than 5,000 megawatts of wind power to the main grid. In the coming years, that amount will double. A stable main grid and electricity system, as well as low electricity prices attract industry and major consumers of electricity, such as data centre investors and battery production, to Finland.

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*During a crisis, various stakeholders' and citizens' trust in the energy industry as a whole is measured.*



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Moreover, several hydrogen production projects are also taking off in Finland.

### Economic turbulence

The exceptional situation was reflected in Fingrid's finances as a significant increase in market-based costs. As a consequence of the high electricity price, the company's loss power costs grew, despite the company's efforts to hedge against price fluctuations as effectively as possible. The costs of reserves maintaining the power system's operations rose to record-high levels. The cessation of imports from Russia in May stopped sales income related to cross-border transmission and increased the already high cost of acquiring power system reserves to some extent.

The high price of electricity also showed in Fingrid's finances as higher purchase and sales prices for imbalance power. In addition, the company amassed significant congestion costs, with Finland's balance surplus transferring from Finland to Sweden via northern transmission connections – from Finland's more expensive price area to the very cheap price area of northern Sweden.

The exceptional situation caused congestion in electricity transmission and

led to major area price differences in Europe. The high area price differences increased TSOs' congestion income. We used the record-high congestion income for investments, but also to cover the rise in costs. In addition, we waived the grid service fees for December.

The market turbulence tested our ability to manage financial risks and retain high liquidity in all situations. Good preparedness and the ability to make decisions quickly helped us get through even this difficult situation.

### Courage and the meaning of work

Security of supply and reasonably priced electricity gained new prominence in the past few months. In these unusual circumstances, Fingrid's work on behalf of Finnish society is now even more important. This can be seen on a daily basis, as we secure the nation's electricity supply and develop the infrastructure needed for a carbon-neutral Finland. On this journey, we work closely with our customers and other stakeholders. Our role today is seen as being clearly broader than a traditional transmission system operator, as a promoter of Finland's competitiveness.

Managing the energy crisis demanded bold actions from us, as well as the abil-

ity to communicate about the electricity shortage. During a crisis, various stakeholders' and citizens' trust in the energy industry as a whole is measured. In the discourse about the electricity shortage, the various options were boldly presented for public debate, because preparing for the upcoming winter was viewed as important for all of Finnish society. A timely message gave consumers, businesses, authorities and cities time to prepare. In terms of corporate responsibility, companies are expected to offer solutions to society's common challenges. As the outcome of cooperation, Fingrid introduced a power system support procedure that enabled voluntary flexibility in electricity consumption from companies and public sector players during electricity shortage situations. The significance of the cooperation was highlighted in our corporate responsibility work during the year under review, as we secured Finnish society's electricity supply during an exceptional period.

The exceptional times also more clearly highlighted the importance of Fingrid's role in managing risks. The company has carried out long-term work in the name of being prepared, both in the company's own operations and in Finland's National Emergency Supply Organisation. The

company has the ability to act in a rapidly changing operating environment. The company has given thought to how the electricity system can be maintained in highly exceptional circumstances. Being prepared is growing in importance, given that our already electricity-dependent society is becoming even more electrified.

We have received positive feedback on our work from various parties in society. Fingrid received the Hyvä YVA (Good EIA) award for the third time, for a successful environmental impact assessment in the Lake Line project. Fingrid was also granted the Finnish Windpower Association's Tuulivoimateko 2021 award. The company's role in developing Finland's wind power production is seen as highly significant. Our efforts to improve personnel well-being and leadership are also reflected in the results. Fingrid came second in Oikotie's 'Great working-life responsibility' survey and third on Great Place to Work Finland's 2022 list in the large companies series. A happy work community, motivated employees and healthy corporate culture are the cornerstones of success of a good company.

**Jukka Ruusunen**  
*President & CEO*

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## Operating environment

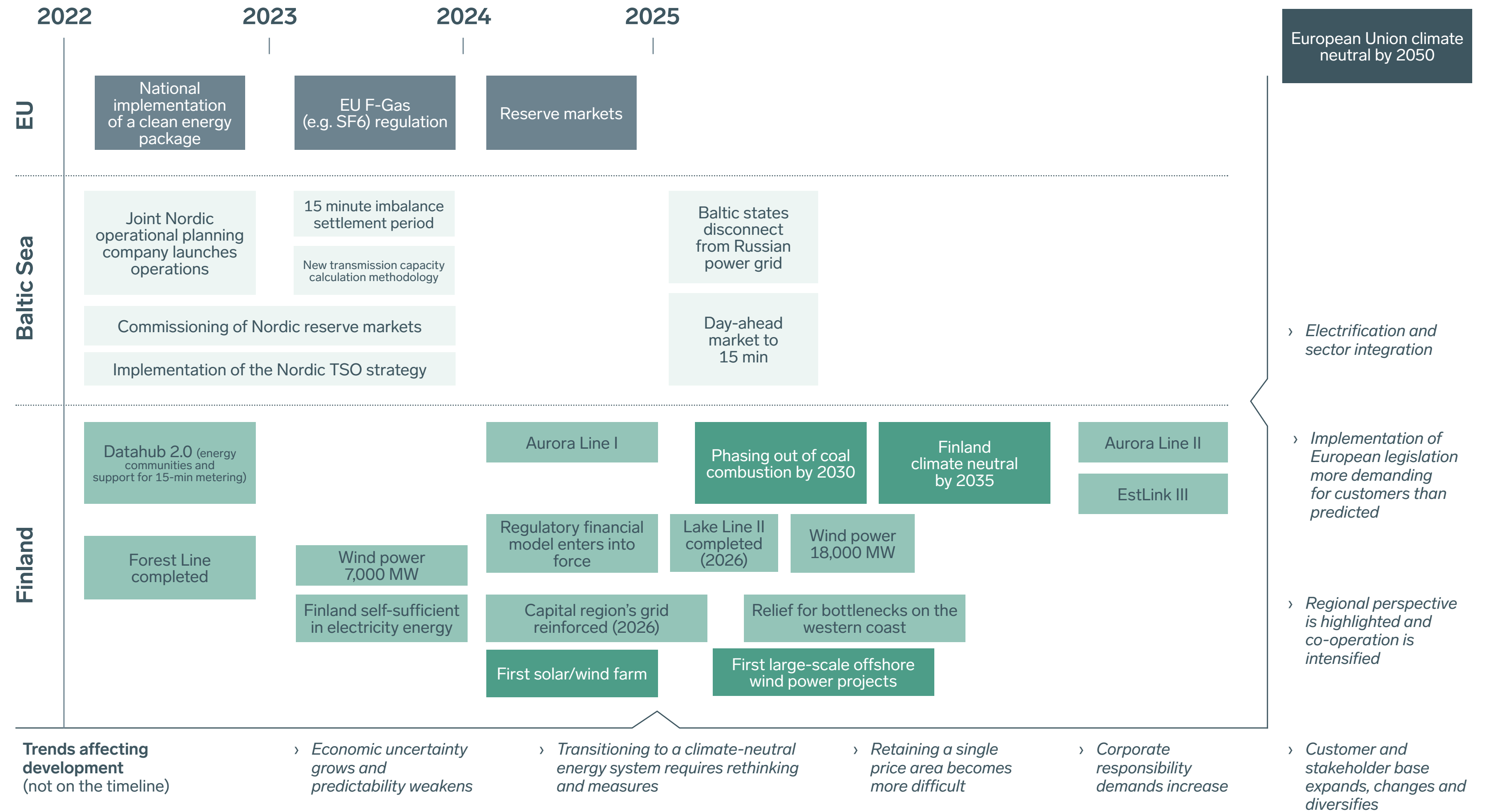
Rapidly growing renewable energy generation is a major opportunity for Finland, and clean energy enables the development of different industrial sectors. This development challenges Fingrid, and the company indeed faces its greatest challenge ever. Fingrid is at the centre of a change in the operating environment that will see Finland transform into a carbon-neutral society by the year 2035. The company must be able to respond to the rapid changes in the near-term operating environment, but at the same time keep long-term goals and trends in mind and be prepared to take quick measures in its plans in order to serve customers as well as possible.



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## Development of the operating environment





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The European Green Deal programme and the Commission's Fit for 55 package, which targets a reduction in EU greenhouse gas emissions, are accelerating the achievement of climate targets – the need for clean energy is growing everywhere in Europe. The EU's classification system for sustainable economic activities ('taxonomy') defines targets that also guide the energy sector towards sustainable business in terms of climate change and the environment.

The rapid phase-out of fossil fuel consumption is further expediting the electrification of industrial processes. The use of electricity-based heating solutions is also on the rise. Russia's attack on Ukraine accelerated this development even further, having created the need to rapidly cut off from Russian gas and oil.

Hydrogen economy and electrofuels are simultaneously enabling the reduction of both natural gas and oil. Large-scale hydrogen economy and green hydrogen production, however, require a strong

infrastructure, such as a main grid, and extensive emission-free electricity production. Transitioning to large-scale hydrogen economy is a massive, decades-long undertaking. Global companies see Finland as a stable and safe place for future investments.

Even before the start of Russia's war of aggression, demand for green hydrogen was predicted to grow rapidly, at the latest, in the 2030s. Now, the geopolitical situation has triggered the need to develop hydrogen economy at an accelerated timeframe and to increase domestic renewable energy production. The fastest possible transition to hydrogen economy is important for the EU, not only in terms of mitigating climate change, but also to improve energy self-sufficiency and security. The use of hydrogen is widely recognised as a key solution for achieving set climate goals. In order for this to be realised, sizeable investments in renewable electricity production capacity are required, and electricity and hydrogen systems must be made com-

patible. Demand for cleanly produced energy-intensive steel and chemical industry products is growing rapidly. This demand is guiding companies to speed up their emission-reduction actions. Industries' low-carbon road maps predict an increase in electricity consumption of up to 50–100 per cent in the coming years. Despite ongoing discussions on connection needs in different parts of the country, concrete investment decisions to increase the electrification of industry have so far been few, which complicates main grid planning and investment decisions related to grid construction.

Electricity is at the heart of Finland's competitiveness. The price of electricity, zero-emissions and good reliability of supply are driving electrification. The high price of electricity that followed Russia's war of aggression is testing faith in the market mechanism, which means national solutions may threaten the progress of market integration and the development of transmission grids. Despite the current energy crisis, Finland

is on track to becoming self-sufficient in terms of electricity on the annual level possibly as early as in 2023. Finland will nevertheless continue to be dependent on its connections with neighbouring countries as it balances electricity supply and demand in various weather and energy consumption situations.

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### Fingrid's operations affected by four megatrends

Fingrid's operations are impacted by four megatrends: climate change and the modernisation of the energy system; security of supply and electricity dependency; globalisation and responsibility; and digitalisation.

### CLIMATE CHANGE AND TRANSFORMATION OF THE ENERGY SYSTEM

Finland's goal is to be a carbon-neutral society in 2035. That goal is still achievable, even though Russia's war of aggression is temporarily increasing carbon dioxide emissions in Finland and elsewhere in Europe. As a consequence of Russia's military action, European society at large will promote low-carbon energy solutions that can be implemented rapidly. Means for achieving the set climate targets are increasingly being adopted. In the [clean power system](#) of the future, electricity will be produced without CO2 emissions. The use of electricity is growing in the

industrial, heating and transport sectors, both as direct consumption and as indirect electrification, for instance, using hydrogen.

Governmental and corporate climate targets are leading the development, but consumers' demand for low-carbon solutions and services are increasingly giving the needed change momentum. The energy sector offers solutions for mitigating climate change. Clean, unbalanced and decentralised production and the consumption that utilises it are growing. Solutions related to the timing of electricity consumption are becoming more common. The European internal electricity market will increase the efficiency and security of supply, while also contributing to increasing weather-dependent, renewable electricity generation.

The capability for supply-side flexibility in response to changes in the demand will decrease as the share of wind and

solar power increases. Electricity price fluctuations will increase in intensity and frequency, which will create business opportunities for flexible production and consumption and energy storage technologies. Thanks to new production technologies, the power system's technical properties will change, which will create challenges for the functioning of the power system.

Fingrid plays an active role in mitigating climate change and in the related energy transformation by helping shape a clean power system on market terms. The company's task is to plan, build and maintain the main grid, thus creating a platform for a clean power system. The energy produced in a new way is being connected to the main grid and, at the same time, preparations are being made for a decrease in flexible production capacity and for the changes it will bring to the electricity system. The company is developing the electricity market and electricity system solutions to meet the

needs of an emission-free power system. We collaborate closely with our customers, technology partners, authorities, and policymakers.

### SECURITY OF SUPPLY AND ELECTRICITY DEPENDENCY

Electricity consumption is increasing and society is increasingly demanding a secure and disturbance-free supply of electricity. Security of supply must be guaranteed in a changing power system with a lot of weather-dependent renewable electricity production and, to an increasing extent, demand flexibility.

Reliability of supply is increasingly a global issue that calls for trust between countries in order to be resolved. The adequacy of electrical energy and the price thereof are also being used as a political tool, however, which could endanger the market-oriented development. Due to the energy crisis and the current insufficient predictability of the electricity markets, national policymakers throughout Eu-

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rope have considered intervening in the operations of the electricity markets. During crises, however, it is especially important to let the markets operate in such a way that all available resources can participate in supplying electricity or in enabling the necessary flexibilities, which supports the reliability of supply.

The Nordic countries have been at the forefront of developing the European electricity markets since the markets opened up in the 1990s and, like other European countries, have been able to enjoy the considerable social and economic benefits and well-being that have resulted from enabling the efficient production, transmission and consumption of electricity in the European internal electricity market.

### GLOBALISATION AND RESPONSIBILITY

Globalisation creates opportunities for service and equipment procurements, the labour markets and financing on international markets, although the Covid

pandemic and the war in Europe have also increased the popularity of domestic solutions. Responsible and ethical practices to promote sustainable development are a condition for business and ensure that affordable financing can be secured. Companies are increasingly expected to offer more solutions to society's common challenges and to operate transparently across the board. Longer procurement chains and increasingly international activities set challenges when it comes to monitoring responsible practices. Along with increasing regulation, sustainability reporting will become statutory.

### DIGITALISATION

The amount of data in the electricity system is growing, and decisions based on the data must be made faster than ever. The automation of processes and the supporting digitalisation are requirements for this development. Digitalisation enables new practices and operating procedures in the power system and electricity market. It also enables advanced and real-time power system operation and

grid maintenance management together with customers and service providers. The increasing rate of automation will also change ways of working. Effective management of intellectual capital and cybersecurity are more important than ever.

Electricity systems and markets were developed at a time when electricity production and distribution could be managed and predicted several days in advance, customers were mainly passive participants and human presence in all decisions was crucial. The changed operating environment demands a further expansion of the physical system, as the amount of data is growing and the electricity system must be managed ever faster. More processes that support technology and operations are needed, as well as more knowledge on which to base decisions. New control and operating models, in which software, data, different networks and processes meet in a network of digital solutions that enable automation, must be implemented. For

example, at the same time as the EU-wide network codes are being adopted, TSOs are already preparing the next steps required by the clean energy package. This means more data management and real-time markets, which cannot be implemented without effective processes and the related digitalisation.

From Fingrid's perspective, digitalisation enables even more productive operating processes and cooperation models, real-time possibilities, better customer service, and more efficient sharing of market information. It also provides new tools for managing a changing and increasingly complex power system. Digitalisation and automation open up new business opportunities for both current and new operators and, in turn, shape Fingrid's customer field.

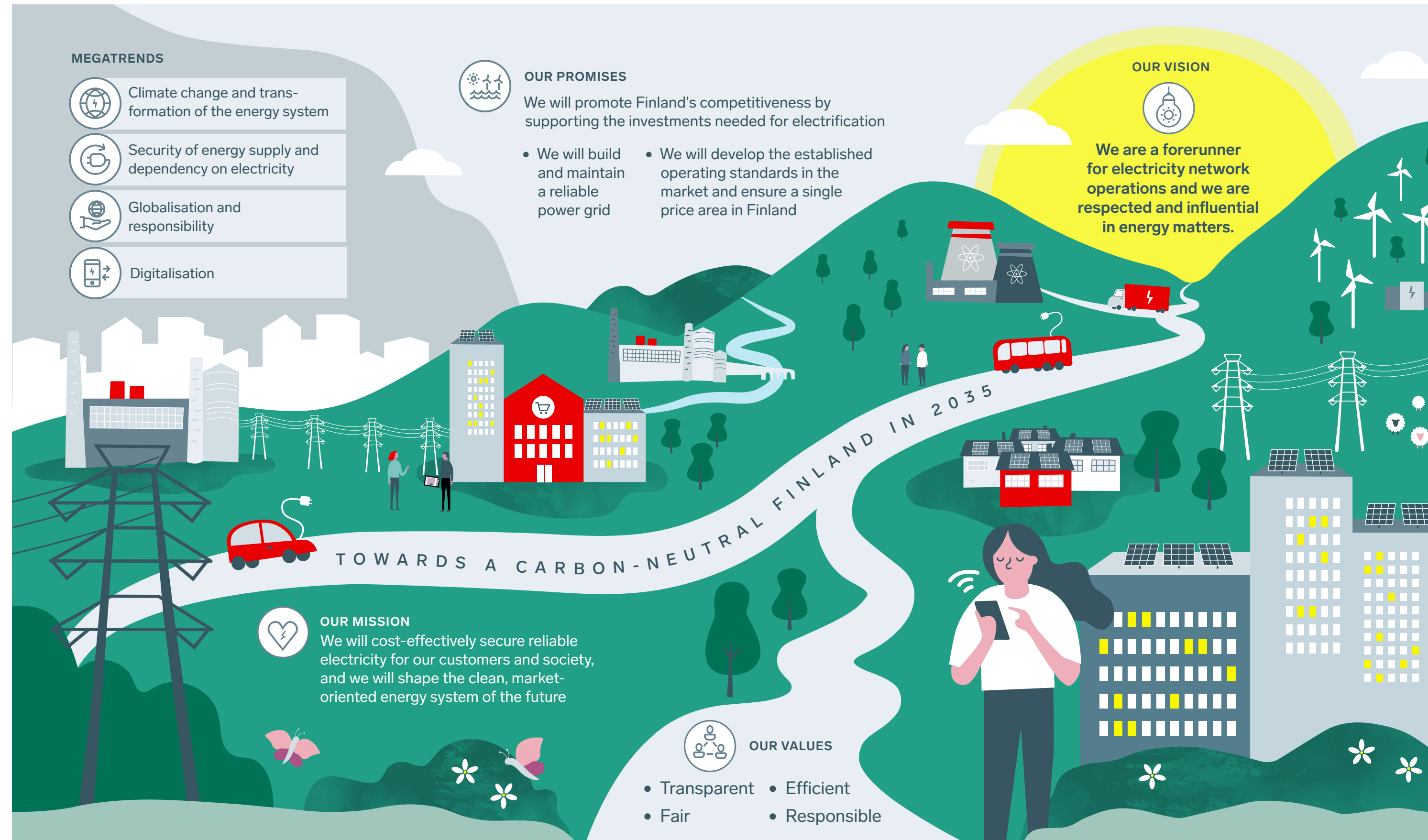
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## Strategy

Fingrid is Finland's transmission system operator, whose main owners are the State of Finland and Finnish pension and insurance companies. The company's mission is to secure a reliable supply of electricity for society through efficient operations, promote a clean energy system of the future and implement a market-based power system.

Finland is on a journey towards self-sufficient and clean energy production. Finland's ambitious target is to be carbon neutral by 2035. Achieving that target will require a considerable increase in electricity production using renewable forms of energy as well as the phasing out of fossil fuels in many applications. We are well on our way, because, based on the agreements that have already been made, the amount of electricity generated by wind power in Finland will increase by one nuclear power plant every year as wind power capacity doubles from the current level to approximately 10,000 MW by 2025.



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Fingrid's strategy extends to the year 2030. The key drivers of the strategy are achieving the climate targets and the related change required in the energy system in which European TSOs play a decisive role.

Integrating new emission-free electricity production into the power system requires reinforcing the main grid. New forms of electricity production differ significantly in their characteristics from previous technology, and they require new solutions in the main grid in order to guarantee power quality. The share of solar and wind power has rapidly increased in energy production, which has brought challenges to the technical effectiveness of the power system. Making clean energy production possible and supplying it to consumers demands billions of euros in main grid investments. According to the current investment plan, approximately three billion euros will be invested in the main grid in Finland over the next ten years. Finland has both good

wind conditions and the possibility to build cost-effective, onshore wind energy based on large wind turbines. There is also room for more solar power. This is Finland's competitive advantage and enabler of future industrial development.

Fingrid's task is to cost-effectively secure reliable electricity for our customers and society, and to enable the implementation of a clean, market-oriented power system of the future. Fingrid produces grid and electricity market services for its customers. The task of electricity market services is to offer industry players an effective domestic electricity market, which is now being implemented in a unified price area in Finland, and harness the benefits of open European electricity markets. Fingrid is, in accordance with its value proposition, the most pro-market TSO. The task of grid services is to secure reliable transmission of electricity in the main grid to meet the needs of electricity companies and energy intensive industry and to enable connections to the power

system. In accordance with its value proposition, the company offers the possibility to connect to the electricity system, as well as reliable and affordable electricity transmission.

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*We have succeeded in our mission of building an effective platform for a clean power system. We have implemented this market-oriented development actively and in cooperation with various stakeholders, and we are a highly esteemed energy influencer in Finland and across the globe.*

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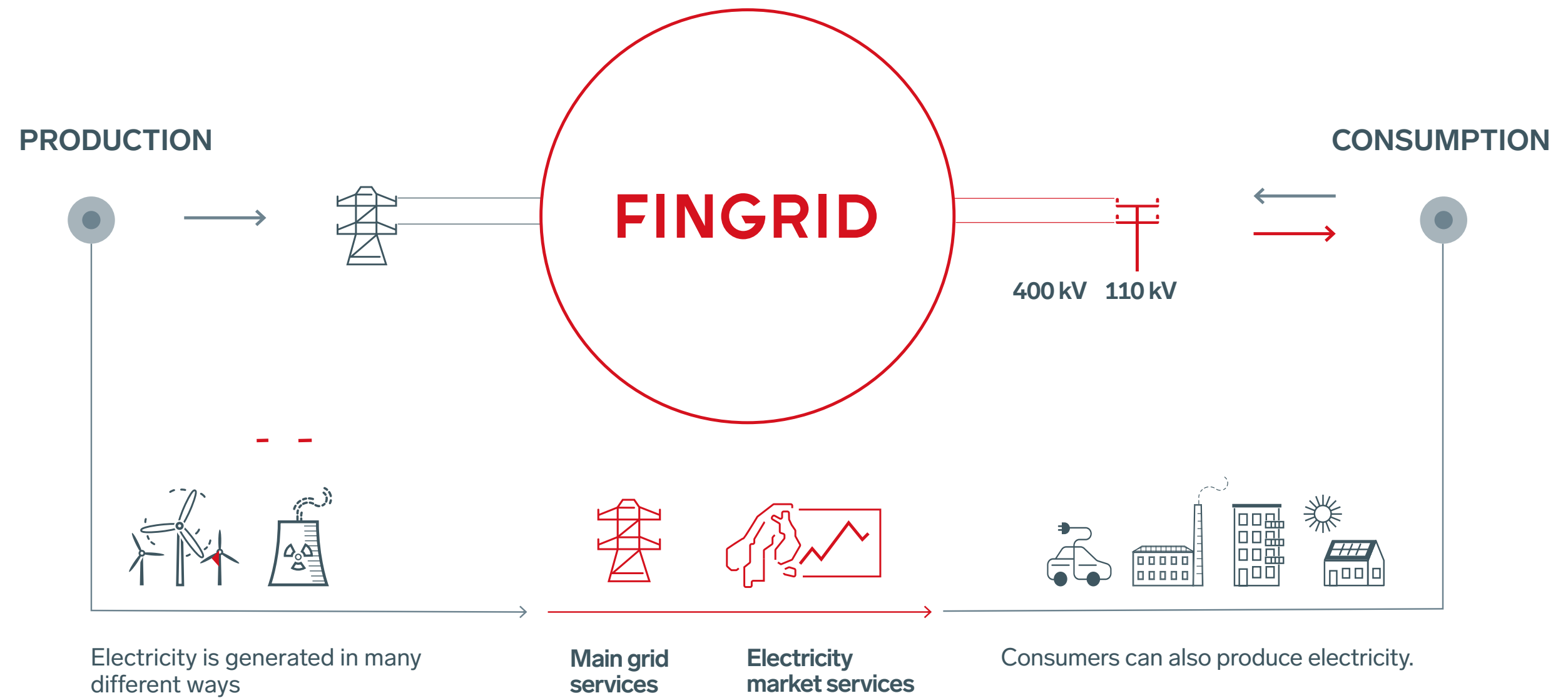
## Fingrid's task

Fingrid's operations are based on Finnish and EU legislation.

In accordance with the Finnish Electricity Market Act, the company develops the main grid, connects new production and consumption to the main grid, maintains a balance between electricity consumption and generation, and promotes the electricity market. The EU Regulation on the internal market for electricity obligates Fingrid to cooperate within ENTSO-E, the European Network of Transmission System Operators for Electricity, and also regionally within the Baltic Sea region, to improve the effectiveness of the internal market in electricity. The company's task is to participate in the drawing up and implementation of the market, operating and connection codes and the proposals prescribed in them. Fingrid's operations are supervised and regulated nationally by the Energy Authority, which has granted the company a licence for the transmission grid operations.

## Fingrid's role in the electricity system

Electricity is transmitted to consumers through Fingrid's transmission grid and the distribution networks of other operators.



## CROSS-BORDER CONNECTIONS

Fingrid's crossborder connections to Sweden, Estonia and Norway



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### Vision

We are a forerunner for electricity network operations and respected and influential in energy matters in Finland and abroad.

### Values

Our values guide us in everything we do, and they lay a solid foundation for our corporate culture. We measure, report on and discuss the realisation of our values as part of monitoring our operations. Fingrid is open, fair, efficient and responsible in all our operations.

### Our way of working

Our corporate culture is open, collaborative and renewing, and complies with good governance practices. We are known for our expertise. We develop our operations for the long term and in cooperation with our customers, authorities, partners and other stakeholders. We treat everyone impartially and with respect. We are achieving the purposeful and ambitious goals that we have set for operations in cooperation with various stakeholders. High productivity and quality lay the groundwork for planning and executing our operations. Continuous change requires further development of our operating models and partnerships. To achieve our goals, we combine our core expertise with that of the best operators in the industry.

We always work responsibly, effectively, and through open interaction. This is also how we earn the trust of our customers and stakeholders.

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*Finland is making good headway towards becoming a carbon-neutral society in 2035, and Fingrid plays an important role in these efforts.*

*Fingrid continues to deliver. Responsibly.*



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## Implementation of the strategy: perspectives

 <p><b>Focusing on the core mission</b></p> <ul style="list-style-type: none"> <li>We excel in accomplishing our core mission in a changing operating environment. We do not aim to expand into new businesses or to participate in competitive business.</li> </ul>	 <p><b>For the customer</b></p> <ul style="list-style-type: none"> <li>We develop our business operations and operating models actively, together with the customer and with society's interests at heart.</li> </ul>	 <p><b>World-class expertise</b></p> <ul style="list-style-type: none"> <li>We ensure the necessary core competence. We cooperate with the best partners. We actively develop our competence through a coaching style of management. We innovatively utilise the best technologies.</li> </ul>
 <p><b>Market focus</b></p> <ul style="list-style-type: none"> <li>We apply a market-oriented approach in all areas because we believe that an effective market will produce the best and most effective solutions. We actively foster the integration of the electricity markets in Europe and the Baltic Sea region while also taking into account Finland's best interests.</li> </ul>	 <p><b>Efficiency of operations</b></p> <ul style="list-style-type: none"> <li>We keep our operations cost-effective as a whole and make sure to work productively. We anticipate changes using joint situational awareness; we share clear goals, prioritise and measure our operations, and we thus ensure concrete results as well as high-quality and efficient operations.</li> </ul>	 <p><b>Security and responsibility</b></p> <ul style="list-style-type: none"> <li>During the energy sector transformation, we will maintain the current good level of system security. Our investments are aimed at achieving climate targets. Corporate responsibility and safety are highlighted in everything we do.</li> </ul>



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Fingrid's strategy is implemented through four perspectives: Customers & Society, Finance, Internal Processes, and Personnel & Expertise. According to the approach chosen by Fingrid for implementing its strategy, all four perspectives are implemented and developed in a mutually balanced way. Our personnel are at the heart of our strategy implementation. This way, the internal processes can function optimally and efficiently produce services and financial benefits for the shareholders, customers and the whole of society. The strategic perspectives play a key role in the day-to-day management of the company.

At the top of Fingrid's strategy is the outwardly visible **Customers & Society** perspective, in which the company's goal is to be the network operator with the best service. Fingrid offers its customers connections and electricity transmission to meet their needs, as well as pro-market solutions.

In electrified Finland, Fingrid's customer base has diversified, as new players have joined the traditional customer base. New solutions for the needs of the changing

energy system are being created together with customers. An evolving energy system opens up new business opportunities for different electricity market operators, and this is an area where Fingrid can increase customers' awareness. Collaboration with customers and service providers improves Finland's competitiveness and the electricity system's effectiveness, in addition to creating new business models and new business in Finland.

Fingrid's operations and the resulting effective electricity system are seen as a key competitive edge for Finland. The company's investments, professional operations and support for customers guarantee reliable electricity and access to an effective electricity market for customers. A cost-effective main grid with transmission capacity and good connection possibilities is an ever-important competitive factor for energy-intensive industry, whose electricity consumption is set to significantly increase in the future.

From the **Finance** perspective, the company's objective is to act in accordance with best management practices and good governance to ensure the produc-

## Fingrid's strategy

### CUSTOMERS AND SOCIETY

A network operator with the best service.  
Electricity transmission that meets customers' needs.  
The most market-favourable transmission system operator.

### FINANCE

Management and governance based on best practices

Maximising shareholder value responsibly for the long term

Shared, responsible and effective management of the company's main asset classes

### INTERNAL PROCESSES

**Ensuring transmission capacity**  
Transmission capacity meets customers' and society's needs. Our operations are efficient and safe, our quality is at the correct level, and responsibility means actions.

**Managing system security**  
Reliable electricity for a carbon-neutral society.

**Promoting the electricity market**  
The electricity market enables a clean electricity system.

### PERSONNEL

Fingrid is an open, collaborative, renewing and high-performing work community. We are at the leading edge of change and we are prepared for the future with our world-class expertise. We are an excellent employer who attracts and retains the best employees.

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tivity and responsibility of the operations when implementing the strategy. Fingrid maximises owner and customer value responsibly and for the long term, bearing in mind the interests of society. Key capital and risks are managed effectively.

The **Internal Processes** perspective highlights the company's three basic functions:

- **Adequacy of the transmission system:** Transmission capacity meets customers' and society's needs. We operate safely and efficiently. Quality and capacity are at the correct level. Responsibility means actions.
- **System operation:** Electricity is supplied reliably to a carbon-neutral society, and a balance between electricity production and consumption is retained under all circumstances.
- **Promoting the electricity market:** The electricity market enables a clean electricity system. The electricity market is developed in Finland according to EU and national legislation by ensuring the interests of customers.

Fingrid is an open, collaborative, renewing and high-performing work community. The objective of the **Personnel & Expertise** perspective is to be at the leading edge of change and to prepare for the future with world-class expertise. Fingrid is an excellent employer who attracts and retains the best employees.

The preparation of the goals and operations of each strategic perspective are the responsibility of a CEO-appointed responsible director, who ensures that matters are prepared comprehensively and executed efficiently as part of the work of a steering group. Fingrid's approach is to serve the best interests of both society and the company's customers.

Fingrid operates in a matrix model where the strategy is made to guide the entire organisation through perspectives. The model pushes collective efforts and shared goals to the forefront on the company level. Thanks to its matrix organisation, the company is an agile player with a flat hierarchy, able to make decisions quickly, while understanding the big picture. The strategy is implemented as a matrix organisation through coordination



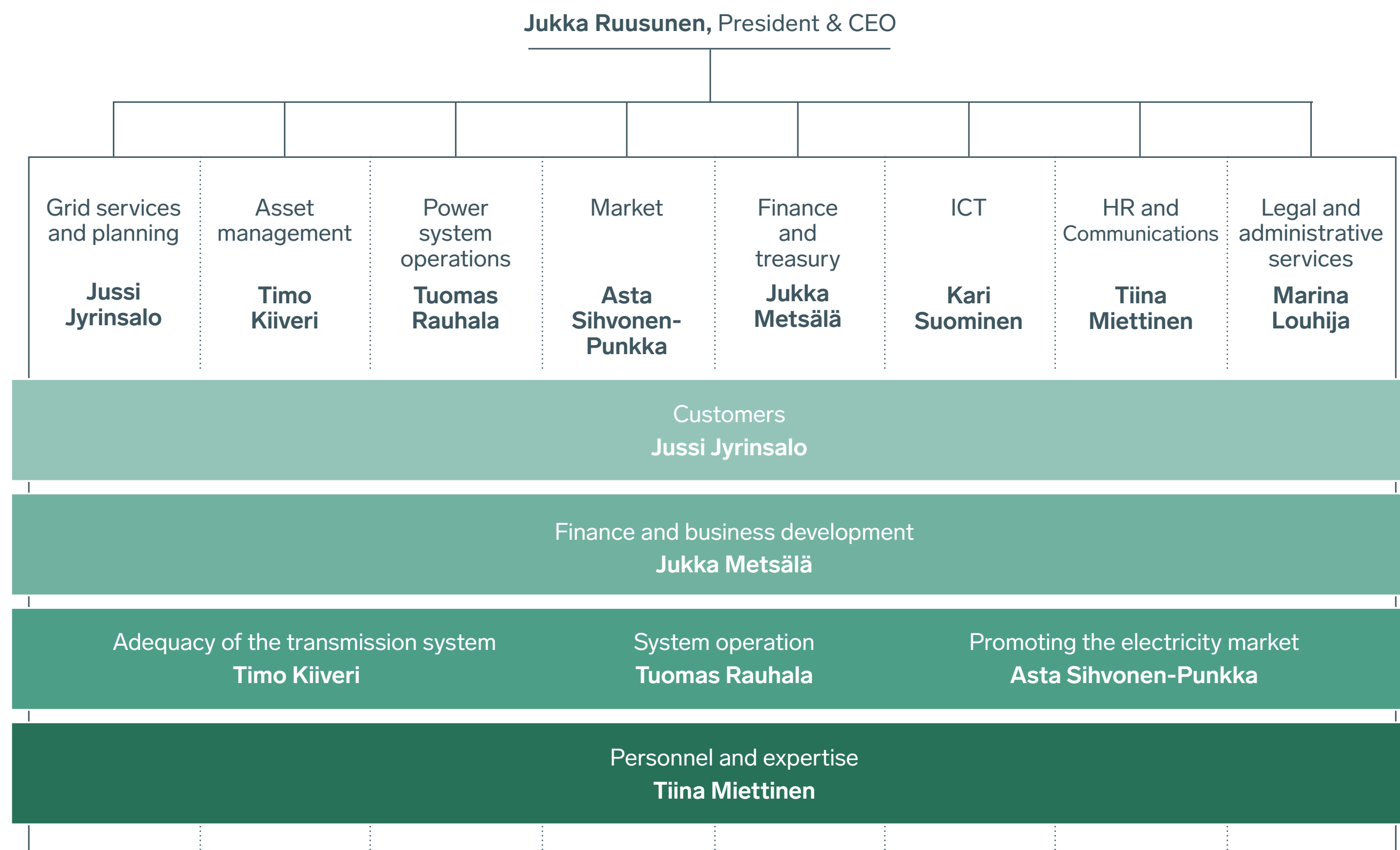
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between the four perspectives and the functional organisation. The functional organisation is responsible for managing and carrying out measures and for ensuring efficiency and responsibility.

Personnel resources are allocated according to the functions such that managers are in charge of the annual planning, financial steering, risk management and responsibility of the tasks in their respective areas of responsibility and of implementing the action plans according to the business targets set forth in the strategy. The company's management model assigns a dual role to the managers as heads of both operations and perspectives. The management system is described in more detail in the '[Management principles](#)' document.

## Fingrid's matrix organisation



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# 03

## Fingrid's reputation, customers and stakeholders

### Reputation

Transmission system operators play a special role in society, both in Finland and elsewhere. They are entrusted with a responsibility for the functioning and development of a service for society, the power system. TSOs hold the role of closely regulated natural monopolies.

In Fingrid's point of view, stakeholders' trust and support for the company is an important issue. A reputable company is an attractive employer, has high customer satisfaction, secures more affordable financing and enjoys the support of society. On the other hand, society can intervene in the operations of a TSO by changing regulation if the company does not accomplish the duties assigned to it.

Reputation management is a part of strategic management. Reputation is measured regularly among the key stakeholders and operations are developed based on the feedback. In 2022, T-Media studied Fingrid's reputation and awareness of Fingrid among the general public, technology professionals and students, authorities and the media. According to the survey, the more familiar the respondent was with Fingrid, the more satisfied they were with the company. The trust of the surveyed stakeholders in the company has remained at a good level. Various stakeholders' support for Fingrid has also remained excellent.

With the energy crisis and the threat of an electricity shortage, awareness of Fingrid has grown particularly among the general public. Fingrid assumed a leading role during the year under review, especially in making statements related to the electricity shortage and in preparing society for the winter power balance. As a consequence of this, the company's profile in the general media increased significantly during the year under review, leading to enquiries from citizens on a wide range of issues.

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*A reputable company is an attractive employer, has high customer satisfaction, secures more affordable financing and enjoys the support of society.*

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## Case

### Excellent results for Fingrid in reputation surveys

*The impartial research and analytics company T-Media conducts an annual reputation survey for Fingrid. In 2022, the focus groups were the general public, technology professionals and students, authorities and the media. The results highlighted strong confidence in Fingrid's finances and increasing trust towards the company.*

*The results, compiled in early summer 2022, are clear: in the eyes of the general public, the company's reputation sits at 3.24 on a scale of 1 to 5, while authorities gave Fingrid a score of 3.95. In the general public's point of view, progress has been made especially in terms of responsibility, while authorities considered Fingrid's strengths to be management, responsibility and governance.*

*Fingrid's reputation among technology professionals and students*

*is proven to be excellent. Fingrid received a very high score of 3.74 on a scale of 1 to 5 from the technology professionals and students surveyed in eight sub-areas of employer reputation. Among those surveyed, the company was considered to be a well-managed and attractive employer overall.*

*Fingrid's overall reputation among representatives of the media improved to an almost excellent level in 2022. The media gave Fingrid an overall score of 3.91 for reputation. Of the areas currently surveyed, representatives of the media rated sustainability as the company's strongest reputation area.*

*The aim will be to maintain this upward trajectory. Fingrid wants to be an interesting company where people are keen to work and invest in.*



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## Customers

### Successful customer work makes a difference:

- Customer and stakeholder satisfaction remains at a high level, and Fingrid is considered as working in the interests of society as a whole. People listen to Fingrid and its word is trusted.
- The impact of disturbances on customers and the impact of transmission restrictions on the market remain at a level that does not disrupt the needs of customers and society.
- The price level of services remains competitive and fair in a European comparison.
- The services meet customer needs, and the evolving electricity market opens up new business opportunities for Fingrid's customers. Personnel participate extensively in the production and development of services together with customers and stakeholders. The aim is to automate the services and the data exchange associated with them, which will facilitate customers' and Fingrid's daily routines as data volumes grow.
- Fingrid builds the grid connections needed for the energy transformation and develops the main grid and electricity market. To customers, Finland is an even more attractive investment object from the point of view of reliable and efficient electricity supply.



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### Fingrid's services

Fingrid's operations are largely based on performing statutory duties. We perform this duty with a maximum customer focus, on impartial and equal terms. Fingrid provides grid services and electricity market services to its customers: DSOs, electricity producers, electricity-consuming industry and other electricity market operators. The goal is to continuously develop Finland's competitiveness by improving Fingrid's services to cater for the different needs of customers. Fingrid's customer base has diversified in recent years, and the sector has also seen the emergence of entirely new types of customers.

**Grid services** secure reliable transmission of electricity in the main grid and connection to the electricity network in accordance with the needs of utility companies and energy intensive industry. Fingrid's value proposition is to offer reliable and affordable electricity transmission to customers. Our grid services consist of connection into the main grid and devel-

oping, operating and maintaining the grid according to the customer's transmission needs. We implement the grid connections the customer needs, we ensure compatibility between the main grid and the customer's networks, and guarantee transmission capability and power quality at the connection points. We make sure that Finland's electricity system operates reliably 24/7, and we prepare for any exceptional circumstances. We carefully plan our maintenance activities and transmission outages in advance to minimise any disturbance they may cause to our customers. An evolving power system demands new investments as well maintenance of aging grid structures, which will cause additional planned interruptions in the power system in order for the necessary work to be safely carried out.

During the year under review, the enquiries regarding renewable energy connections continued to increase. The total power of new connection enquiries in 2022 was approximately 80,000 megawatts, which is nearly six times the

production capacity in Finland at the end of 2022. The sufficiency of connection capacity and the technical functioning of the electricity system already represent a limitation in some places. Not all projects in the planning phase are likely to be implemented, but the number of enquiries indicates that Finland is a very attractive and competitive country for renewable energy producers and, similarly, for energy intensive industries.

Electricity consumption is also joining the electrification trend. Electricity generation investments and growth in production capacity create possibilities for consumption investments. We saw an acceleration in the number of enquiries from customers looking to connect new types of electricity consumption, such as data centres, hydrogen production and battery storage, directly to the main grid.

In 2022, we were highly successful in accomplishing our promise to offer customers reliable and affordable electricity transmission.

”

*Fingrid's customer base has diversified in recent years, and the sector has also seen the emergence of entirely new types of customers.*

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Our **electricity market services** offer all industry players a unified price area for electricity trade in Finland, and the opportunity to buy and sell imbalance power. They maintain and expand the reserve markets required to balance the power system and offer the benefits of open European electricity markets. In accordance with its value proposition, Fingrid is the most market favourable TSO. Through its strong main grid, we ensure that Finland remains a single price area. With our cross-border transmission connections, we offer access to the European electricity markets and give the markets the largest possible transmission capacity. The key grid investment projects serving the electricity market are the Forest Line connection, consolidating the north–south transmission capacity, and the Aurora Line connection between Finland and Sweden. The market rules are being developed and electricity market data is published openly and free-of-charge. More details on electricity market development projects can be found in the Annual Report's [electricity market section](#).

The company maintains and develops the marketplaces for reserve and balancing power. We settle the power balances and supply the imbalance power to the balance responsible parties. Fingrid Datahub Oy, our subsidiary, offers an effective information exchange platform for retail market parties. Another of our subsidiaries, Finextra Oy, provides services related to guarantees of origin (GO) by granting GO certificates for renewable forms of energy and nuclear power.

### **Active interaction – satisfied customers**

Fingrid develops its services openly in collaboration with its customers and stakeholders to be able to account for the different needs of customers and society. The upcoming changes in the power system are communicated and discussed openly with customers early on in the process, and investment decisions concerning the main grid are announced publicly. Together, the most market-based solutions that are also sensible in terms of the national economy are always sought for the changes.

In addition to being able to offer services that meet customer needs, Fingrid values openness, trust and active interaction with its customers. The company's personnel are trained for better customer service, and customers are involved in developing the operations, for example, through the advisory committee, grid committee and market committee.

Customer satisfaction with Fingrid's services is assessed through an annual survey. In the 2022 survey, Fingrid's net promoter score from customers increased to +50 from the previous year's score of +41. Areas that improved were, in particular, disturbance clearing and open electricity market data. Areas in need of development were the reserve markets, balance services and Datahub services. Working with Fingrid's experts was perceived as very positive. The most highly rated areas were Fingrid's expertise and service-mindedness. Fingrid's role in realising a carbon neutral Finland is significant, and the company's operations in the interest of society as a whole were given a score of 4.4 (4.3).

Two major Fingrid Current customer events and an event for DSOs and the media concerning managing the electricity shortage were arranged in 2022. During the year, Fingrid's employees took part as experts in several info sessions and webinars organised by various parties.

Fingrid continuously develops digital solutions to enhance its communication and customer communication. The company already distributes considerable information related to the operations of the electricity markets through its open data service. Information about connection possibilities for new electricity production in different parts of the main grid is available in the Grid Scope map service.

### **Fingrid has managed to maintain its competitive pricing**

Based on the latest European comparison, Fingrid's transmission fees are the second most affordable in a peer group of some 20 countries. Fingrid's objective is to continue to operate cost effectively and thus also do its part to offer a com-

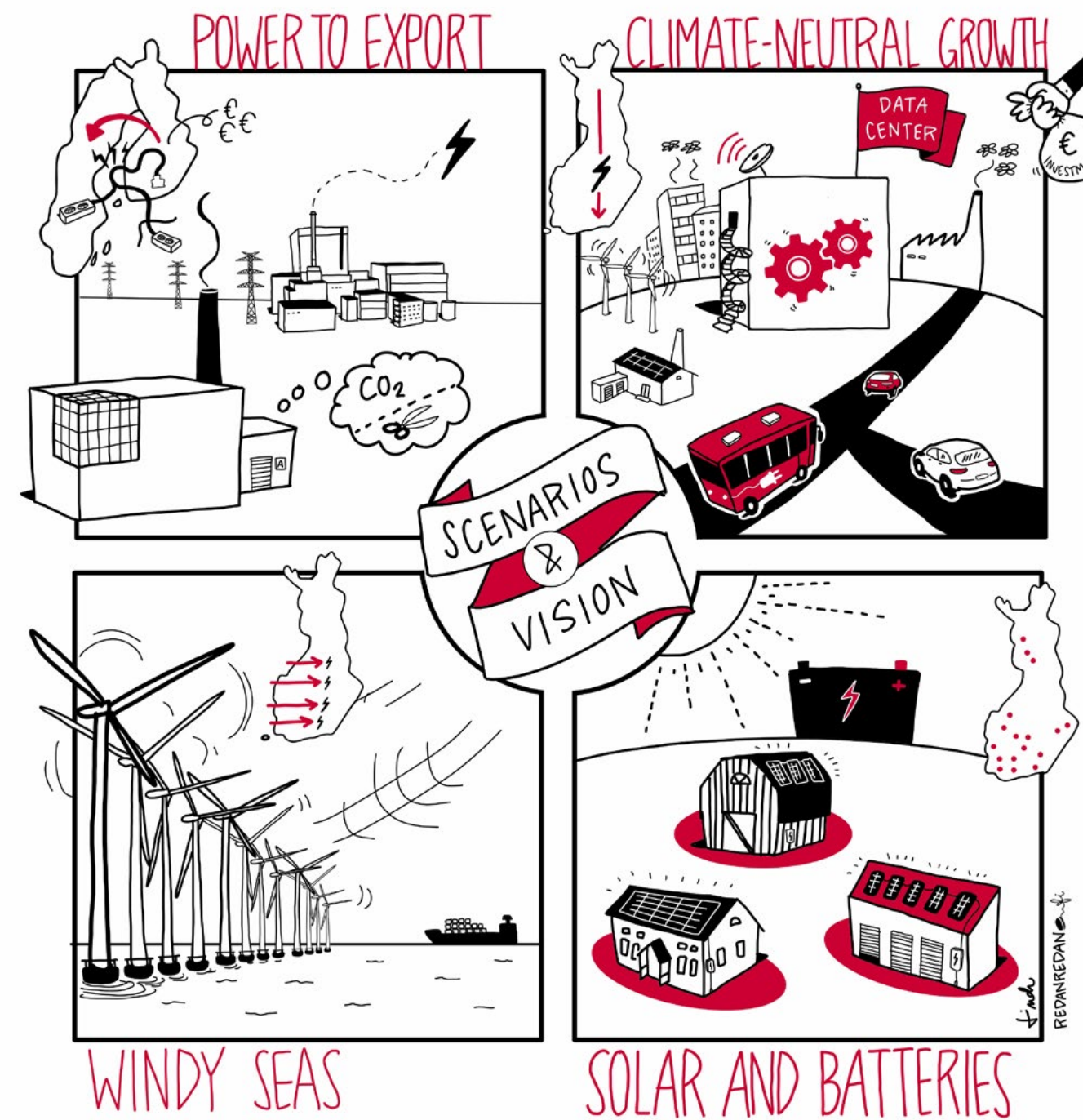


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petitive advantage to companies operating in Finland. The cost effectiveness of the company's operations has been measured for many years, in terms of both internal key figures and international comparison studies, based on which it has been possible to maintain a high level of cost effectiveness.

The high price of electricity and major area price differences have increased Fingrid's congestion income. At the same time, the exceptional situation in the energy market has caused the company's electricity market-based costs to spike. By the Energy Authority's decision, Fingrid used its congestion income for investments to increase cross-border capacity and to cover the increase in operating costs, and did not collect grid service fees for December 2022. Fingrid plans to waive grid service fees for six months in 2023. This would reduce main grid customers' current payments by some EUR 300 million.



## Case

### Future scenarios of Finland's power system published

*In 2022, Fingrid released a draft of Finland's electricity system vision, which includes four separate future scenarios on electricity production and consumption development for the years 2035 and 2045. The scenarios, drawn up together with stakeholders, addressed current themes on ambitious climate targets, the accelerating energy transformation and the electrification of society.*

*The work on the vision is aimed to raise a discussion on the kinds of needs, challenges and opportunities the energy transformation will create for the electricity market, the main grid and the technical effectiveness of the electricity system. Increasing Europe's energy self-sufficiency and the rapid phase-out of fossil fuels now play an even more important role.*

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## Case

### Grid connection opportunities in Grid Scope

Fingrid has developed a Grid Scope map service together with customers. The map provides information on the grid's connection possibilities over different years as well as information about production projects that are under planning or under way. In Grid Scope, customers and stakeholders can easily see both existing power grids and publicly planned projects.

Grid Scope is being developed together with customers and stakeholders on the basis of received feedback. Another stakeholder tool that is in the works relates to monitoring customers' own project proposals as part of Fingrid's online Oma Fingrid service. Going forward, situational awareness, from the proposal of a project to its commissioning, will be maintained in the service.

## Case

### Electricity transmission is monitored in the cross-sections

Fingrid monitors and anticipates electricity transmission in the two cross-sections in Finland's internal transmission grid. Finland's internal transmission lines are split by two boundaries specified according to electrotechnical parameters. These cross-sections are in Central and Northern Finland. Cross-Section Central Finland runs along the axis from Kokkola to Iisalmi, while Cross-Section Northern Finland runs along the line of the Iijoki river, north of Oulu.

Electricity produced in the north of the country is transmitted over the cross-sections to consumption centres in the south. Four-fifths of Finland's electricity consumption takes place south of Cross-Section Central Finland. In the future, several times more electricity will need to be transmitted over the cross-sections. Robust transmission connections between the north and south will ensure that Fingrid retains its uniform price area in the electricity wholesale market.

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### Advisory committee

The advisory committee and the two other customer committees (“grid committee” and “market committee”) play an important role in ensuring interaction and that the customer’s voice is heard. The advisory committee’s task is to provide insight on the company’s operating environment, and business and services from the customer viewpoint. It does not make formal decisions. The issues it handles concern the services produced by Fingrid and the pricing of the services, electricity market regulation, grid investments, developing the electricity markets and issues concerning the use of the grid.

The advisory committee convened four times during 2022. The topics addressed by the advisory committee in its meetings included the management of system security, the main grid investment plans and the company’s finances, Fingrid’s future scenarios of the electricity system and joint Nordic electricity market development projects.

### Members

- Stefan Damlin, Vaasan Sähkö Oy
- Kristian Gullsten, Napapiirin Energia ja Vesi Oy
- Mikko Halonen, S-Voima Oy
- Juha Keski-Karhu, Väre Oy
- Lauri Laine, Valkeakosken Energia Oy, as of 1 September 2022  
Nurmijärven Sähkö Oy
- Markus Lehtonen, Helen Sähköverkko Oy
- Mikko Lepistö, SSAB Europe Oy (Chairman)
- Pirita Mikkonen, Metsä Board Oyj
- Heikki Peltomaa, WPD Finland Oy
- Jouni Pylvänäinen, Kymenlaakson Sähköverkko Oy
- Jukka Toivonen, Vantaan Energia Oy
- Esa Ukkonen, Stora Enso Oyj

### Members from Fingrid

- Jukka Ruusunen
- Jussi Jyrinsalo
- Rami Saajoranta (secretary)



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### Grid committee

The grid committee is made up of Fingrid's customers, and their role in the committee is to generate ideas, insight and experiences for developing Fingrid's grid services. In 2022, among the topics the committee was asked for its insight into were the development of general connection terms and connection fee principles, electricity system vision work and solutions to the technical challenges of a converter-dominated electricity system. The committee meetings also addressed, e.g. the winter power balance, and heard the members' views on the sector's development.

#### Members

- Janne Ala, Kemijoki Oy
- Mikael Heikkilä, Fortum Oyj
- Petri Hyyryläinen, UPM Communication Papers Oy
- Timo Jutila, Kajave Oy
- Teemu Loikkanen, OX2 Finland Oy
- Magnus Nylander, Porvoon Sähköverkko Oy
- Jani Pulli, PVO Vesivoima Oy
- Mikko Rintamäki, Kokkolan Energia Oy (Chairman)
- Tomi Toivonen, Turku Energia Sähköverkot Oy
- Erik Trast, CPC Finland Oy
- Kari Vessonen, Caruna Oy
- Jarno Virtanen, Keravan Energia Oy

#### Members from Fingrid

- Jussi Jyrinsalo
- Petri Parviainen
- Katariina Saarinen (secretary)

### Market committee

The market committee brings together Fingrid and the electricity market parties active in Finland. The committee is an advisory discussion forum, which helps Fingrid to develop the Nordic and European electricity markets. Fingrid informs the committee on the development in the electricity market and on European cooperation, and in return receives feedback on any development plans topical at the time from the committee.

In 2022, its meetings addressed, among other things, the Datahub go-live, the Nordic balance management project, progress in the adoption of a flow-based capacity calculation methodology, adoption of transmission rights products, the electricity system vision and the exceptional situation in the electricity markets. The committee members additionally took turns presenting their company's operations and views on the development of the electricity market.

#### Members

- Outi Ervasti, Neste Oyj
- Tero Karhumäki, Kuoreveden Sähkö (Chairman)
- Antti Keskinen, Ilmatar Oy
- Mika Laakkonen, Power-Deriva Oy
- Reima Neva, EPV Energia Oy
- Teija Pelkonen, UPM Kymmene Oy
- Ville Pesonen, Gasum Oy
- Jan Rönback, Fortum Oyj
- Ville Sihvola, Elenia Oy
- Harri Sirpoma, Helen Oy
- Matti Supponen, Suomen sähkökäyttäjät ry
- Mikael Surakka, Outokumpu Oyj

#### Members from Fingrid

- Asta Sihvonen-Punkka
- Meri Viikari (secretary)

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## Stakeholders

Fingrid's operations have a major impact on the surrounding society. In addition to the customers, the company also has several other key stakeholders that we identify using a corporate responsibility [materiality assessment](#), for example. The starting point for identifying key stakeholders is to describe the expectations of stakeholders and Fingrid's activities that respond to the expectations.

Being open to the stakeholders' expectations is an essential part of our reputation management and sustainable business. We offer the company's stakeholders information about corporate responsibility work in more detail in the [Corporate Responsibility and Sustainable Development Report included in our Annual Report](#).

## Case

### Fingrid Current and seminars

*Fingrid Current is Fingrid's event concept for discussing hot topics in the electricity and energy sector. In 2022, Fingrid organised two customer events. The first Fingrid Current event, held in May, focussed on ensuring the effectiveness of the power system, while the November event addressed the electricity shortage and the future main grid.*

*Stakeholders and customers were also kept up to date on Fingrid's operations and the energy sector's future outlook through webinars. Several webinars were arranged during*

*the year, with topics ranging from voluntary support for the power system by municipalities and companies during the electricity shortage and power system visions to changes in balancing service providers' terms.*

*At Fingrid Current, participants have the opportunity to catch up during the coffee break. Here, Tiina Miettinen, Päivi Nerg and Jonne Jäppinen exchange their thoughts on the electricity market situation.*



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# 04

## Finance and treasury

- The company's robust financial position remained excellent, despite the highly exceptional situation in the energy market.
- The company's investment program proceeded according to plan, marking the biggest annual investments in the main grid in the company's history and enabling climate targets to be met.
- The higher price of balancing power and the need to balance electricity production and consumption nationwide raised the company's turnover to a record high.
- Large differences between the electricity price areas on Finland's cross-border connections considerably increased Fingrid's share of congestion income. Congestion income was used to fund completed cross-border investments and to reduce the grid service fees paid by main grid customers.
- The company's responsible operations and the enabling of society's climate targets create a foundation for expanding Fingrid's green financing as the investment programme progresses.



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### **Fingrid's business activities and the regulation of transmission system operations**

Fingrid constitutes a natural monopoly as referred to in the Finnish Electricity Market Act (588/2013), with the duties of the transmission grid operator with system responsibility defined in the act. The company's operations and financial result are regulated and overseen by the Energy Authority. The Energy Authority determines Fingrid's allowed financial result in the regulatory methods for electricity grid operations over four-year regulatory periods (2020–2023).

The transmission grid operations that are subject to financial monitoring include the transmission of electricity in the nationwide grid owned by the company, development of the electricity markets and tasks of the grid operator in the management of the national electricity system and the power balance: These operations constitute the bulk of Fingrid's turnover, costs, result and balance sheet. The allowed financial result from transmission grid

operations is formed when the company's grid assets are valued at the regulatory fair value and the amount of equity and interest-bearing debt in the thus formed adjusted balance sheet are multiplied by the reasonable rate of return determined by the Energy Authority. The reasonable financial result allowed by the regulation forms the basis of Fingrid's financial planning and pricing. The amount of allowed turnover is obtained by adding operating expenses to the reasonable financial result. In addition, financial steering methods include a number of incentives related to the operations' cost-effectiveness, quality and innovations which may affect the allowed return level and thus the amount of allowed turnover at any given time. The Energy Authority monitors the reasonableness of grid service revenue by regulatory period (the current regulatory period is 2020–2023) such that any surplus in the regulatory period must be offset in the next regulatory period.

Fingrid's turnover is mainly based on the pricing of the transmitted electricity

and the production and consumption of electricity by Fingrid's customers, and on the sale of balancing power required to maintain the national electricity balance, and the imbalance power tariff. Moreover, the congestion income received by the company in 2022 and recognised in the income statement has significantly affected the company's turnover and other operating income.

For grid services, Fingrid charges its customers for output from and input into the main grid, consumption fees, and a power-based tariff. Most of the overall invoicing is linked to the consumption of electricity as European regulation provides an upper limit for production fees. The company's pricing at any given time is valid until further notice. Fingrid bears responsibility for Finland's power balance together with customers that are balance responsible parties. Since electricity cannot be stored, and the production and consumption of electricity must be in balance at all times, Fingrid balances the power imbalances of its

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balance responsible parties by buying and selling balancing power. Besides revenue and expenses from electricity trade, Fingrid charges balance responsible parties a fixed imbalance power tariff, which covers the costs of balance management. Fingrid's total costs consist of the operating expenses, remuneration and finance costs and taxes. Electricity area price differences give rise to congestion income, which is allocated to TSOs in accordance with EU regulation. The amount of congestion income is determined by the difference in the price of electricity between the price areas and by the transmission capacity available at any given hour. As Finland has one electricity price area, Fingrid's congestion income comes from the borders between Finland and Estonia and Finland and Sweden. EU regulation defines the use of congestion income for investments, covering costs and use as profit. The Energy Authority decides on [the use of the congestion income received by Fingrid](#) in line with EU regulation.

The so-called adjusted profit, realised in compliance with the regulation, is calculated by adjusting the parent company's result according to the Energy Authority's regulation methods and by adding the impact, either positive or negative, of the incentives. The incentives include capex, quality, efficiency improvement and innovations incentives (R&D).

Any realised regulatory profit over a regulatory period that exceeds the allowed financial result constitutes a surplus that must be offset at the latest during the next regulatory period, e.g. in the form of lower prices for customers or by not carrying out the price increases corresponding to the rise in costs. If the realised regulatory profit over a regulatory period is below the allowed financial result, this leads to a deficit which Fingrid may recover from the customers in the form of higher future prices. No regulatory surplus or deficit income is recorded in the financial statements. The aim of Fingrid's business operations is to achieve the allowed financial result over the regulatory period.





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### Goals for financial steering

The key long-term goals for Fingrid's financial steering are as follows:

- Good cost-effectiveness, responsible operations and high productivity in order to maintain service pricing on a moderate level and be able to respond to customers' needs quickly and to a high standard. The company's goal is to rank in the top of its field in international comparisons measuring operational efficiency and quality.
- A high credit rating and sustainable financing, ensuring the availability of long-term, diversified and affordable financing. The company aims to maintain a credit rating of at least 'A-'.
- Company-level risk management, preparing for unexpected changes in the company's financial impacts and counterparty risks, as well as continuity management, enabling the company's continuous operation in various risk scenarios.
- Creating shareholder value and high debt service capacity, achieved by maintaining the company's adjusted income on the level allowed by regulation and paying dividends that correspond to shareholders' profit targets.



### Cost-effective activities and high productivity

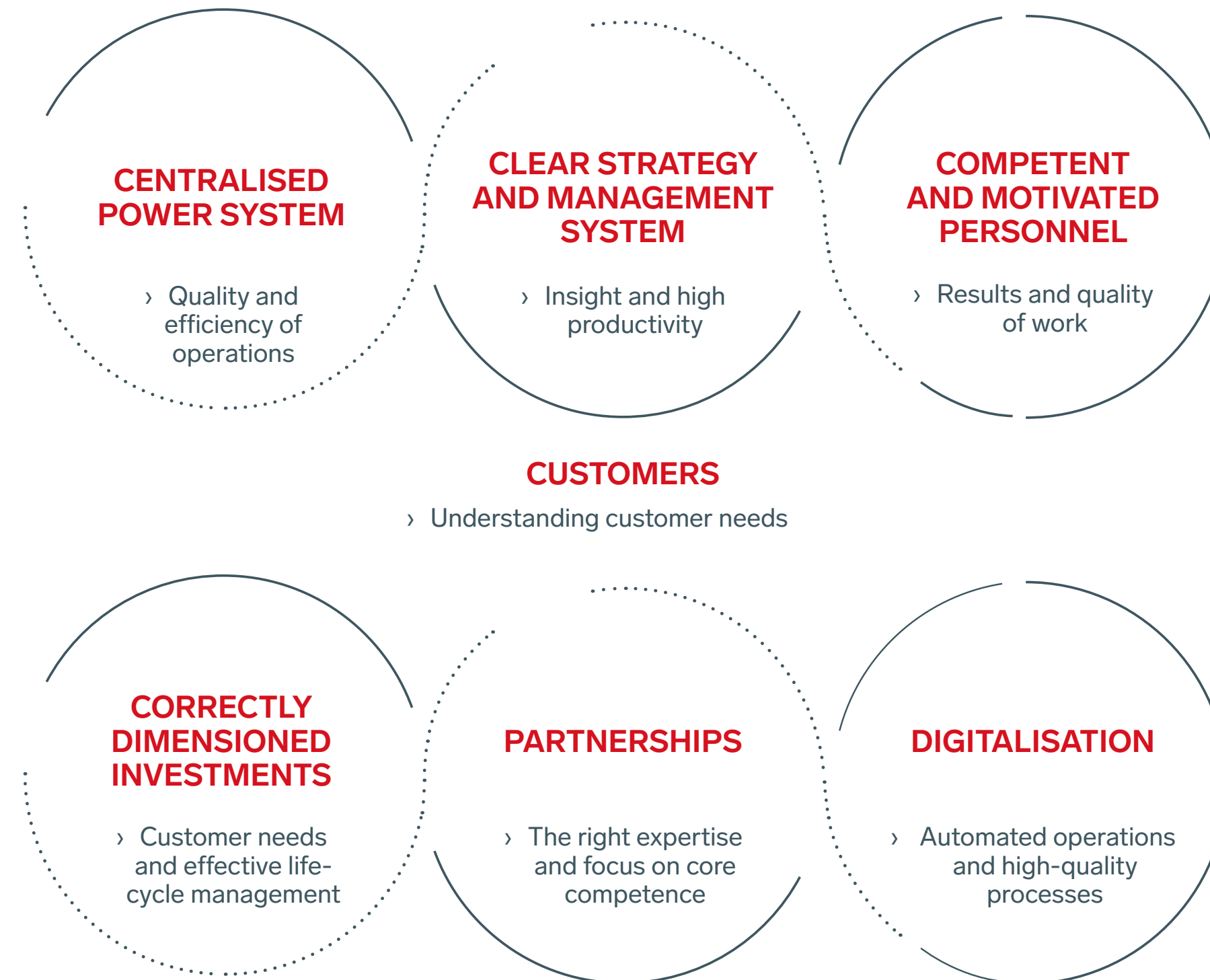
Cost-effectiveness is based on an operating model in which we focus on our basic task and combine our core competence with the best players in the industry. High productivity results from being able to process and implement the growing needs of both customers and the electricity system without delay and to a high standard as the compa-

ny's operations are scaled based on the need at any given time. We actively plan our operations in cooperation with our customers and invite external parties to participate in our innovation processes. Operating processes and models are continuously developed in response to needs. This produces better and more efficient solutions that can be reproduced to meet various needs.

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## Fingrid's world-class efficiency



Fingrid carries out grid construction and maintenance together with its partners, which helps optimise the use of financial and production resources in a scalable manner and ensures that the sector retains and develops its electricity system expertise. The monitoring and control of the main grid is centralised and takes place from a national control centre operated by Fingrid. The growing volume of data and the real-time capabilities required to make decisions are forcing the automation and integration of processes between different electricity market operators. The possibilities created by digitalisation are also being increasingly utilised in areas such as grid maintenance and optimising the power system. Good examples include the [Load Frequency Control](#) to support the implementation of the new balance management model and the progress made in the digital maintenance management project. Fingrid's management system is based on a matrix organisation and specialists' mandates to participate in the company's activities across organisational boundaries. The foundation for all operations is customer needs and the need to maintain and develop the electricity system. This increases the efficiency of operational activities and demands high operational productivity in response to ever-changing needs in the electricity market and in the customer field.

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### Pricing

Fingrid strives for long-term operations in which short-term targets do not dictate investment decisions or other decisions. The electricity system is planned for the long term based on customers' needs, and high system security plays a central role all decision-making, in both the short and long term.

Grid service fees are distributed in full to the roughly 70 DSOs operating in Finland, and to a similar number of electricity producers and major electricity consumers. A substantial proportion of the company's grid service fees is directed to electricity consumption, while the producers have to pay significantly less. This is because the fees set for production are regulated at the EU level. Grid service fees together with uninterrupted electricity transmission have an impact particularly on the competitiveness of electricity-intensive industries. Fingrid does not sell electricity. While the company does not transmit electricity directly to consumers, the small size of the grid service fee portion in an

electricity bill makes our cost-effectiveness evident also to consumers.

The objective of the company's pricing is to match the company's costs and allowed financial result at any given time. Major volatility on the market may necessitate upward or downward price adjustments. Pricing, however, strives to take a long-term approach with good predictability. By a previous decision, Fingrid waived four months of grid service fees (2022 and 2023) and the plan is to also waive three months of grid service fees for 2023 – this plan therefore includes a total of six months of waived grid service fees in 2023. The reason behind the waiving of grid service fees is the high amount of congestion income collected from the country's borders due to the exceptional situation in the energy market. The amount received by Fingrid is half of the congestion income from the electricity transmitted on Finland's borders. In line with the Energy Authority's decision, Fingrid uses the congestion income for cross-border investments,

to cover operating costs and as revenue recognition. A regulatory letter from the Energy Authority also allows the congestion income received by Fingrid to be refunded to main grid customers.

Balance service pricing also tracks the development of operating costs. Unlike grid service fees, balance service tariffs are the same for electricity consumption and production alike. Fingrid adjusted balance service tariffs three times in 2022. The sharp rise in costs is behind the change in balance service tariffs. The aim is to keep customers' balance service tariffs at around the same level as costs over time. In accordance with the Energy Authority's regulatory letter, accumulated congestion income must not be allocated to balance services.

With the end of cross-border transmission service in May 2022 following the end of electricity imports from Russia, Fingrid no longer receives cross-border transmission income.

The company has consistently achieved high rankings in the annual international comparison studies on the cost-effectiveness and quality of TSOs ([ITOMS](#) and [ITAMS](#)), in addition to which it has been granted the international certification for the management of physical assets (ISO 55001). This is proof of the cost-effectiveness of the operations and of the effective management of expense and operational risks related to grid assets. The Council of European Energy Regulators' (CEER) benchmarking study placed Fingrid among the most cost-effective TSOs in Europe.

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### Capital management

Equity and liabilities as shown in the balance sheet are managed by Fingrid as capital. The balance sheet according to the company's accounting is smaller than the balance sheet under the Energy Authority's regulations, in which grid assets have been measured at the regulatory present value in use. The company's borrowings are presented at their carrying amount also on the regulatory balance sheet. Equity on the accounting balance sheet is, of course, smaller than equity on the regulatory balance sheet, which balances out the difference in the grid asset carrying amount and the actual present value in use.

The company has not set specific key figure targets for accounting balance sheet or regulatory balance sheet capital management, but instead monitors and controls the overall situation, for which credit ratings and their underlying risk analyses and the flexibility required by the company's operations create a foundation. The company must have a solid

capital structure to support consistently strong credit ratings and reasonable cost of capital, and enable the implementation of the investment programme as planned, and adequate dividend pay-out capability. The principal aim of Fingrid's capital management and grid asset management is to ensure the company's uninterrupted operations, carry out the planned investment programmes, develop the electricity market while maintaining a high-quality power system and ensure the retention of the main grid's value as well as rapid recovery from any exceptional circumstances.

### Financing

The company takes advantage of the opportunities offered by credit ratings at any given time on the international and domestic financial markets. Market-based and diversified financing is sought from several sources. Fingrid's existing loan agreements as well as debt and commercial paper programmes are unsecured and do not include any financial covenants based on financial ratios.

The company is exposed to various financial risks, such as market risks, liquidity risks, counterparty risks and credit risks. The aim of financial risk management is to protect shareholder value by securing the financing required for the company's business operations, by hedging against the main financial risks and by minimising financial costs within the risk limits.

### Fingrid operates in the debt capital, commercial paper and loan markets as follows:

- For long-term financing (more than 12 months), the company has an international Medium Term Note Programme (EMTN Programme), totalling EUR 1.5 billion.
- For short-term financing (less than 12 months), the company has an international Euro Commercial Paper Programme (ECP Programme) totalling EUR 600 million.
- Fingrid additionally has a domestic commercial paper programme totalling EUR 150 million.

Furthermore, Fingrid has bilateral long-term loan agreements with both the European Investment Bank (EIB) and the Nordic Investment Bank (NIB). To secure liquidity, the company has a revolving credit facility and overdraft facilities at its disposal.

### Green financing

Green financing is an important part of Fingrid's financing strategy. The company's responsible operating model and sustainability goals enable access to green financing schemes. In 2017, Fingrid became the first Finnish company to issue a corporate green bond. The interest rate margin of Fingrid's revolving credit facility is tied to the company's key corporate responsibility targets. The company's objective is to increase the amount of green financing in its total financing. More detailed information on green financing is available in the [Corporate Responsibility and Sustainable Development Report](#) contained in our Annual Report.

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## Financial result for 2022

Fingrid's finances remained solid in the midst of an energy crisis, and the company systematically implemented the largest investment programme in its history. It was an exceptional year. Fingrid Group's turnover grew to a record high as a consequence of the high price of balancing power. The company's market-based costs spiked. Correspondingly, the area price differences on Finland's cross-border connections considerably increased Fingrid's share of congestion income. Congestion income was used to finance completed cross-border investments and to compensate for the sharp rise in costs and the decrease in electricity consumption for the benefit of main grid customers. The company also did not collect grid service fees for December.

Based on the company's own calculations, the result according to the regulatory model that governs transmission grid operations amounts to a surplus of around EUR 5 million for 2022 and was cumulatively at the allowed level in the 2020–2023 regulatory period. Fingrid's credit rating

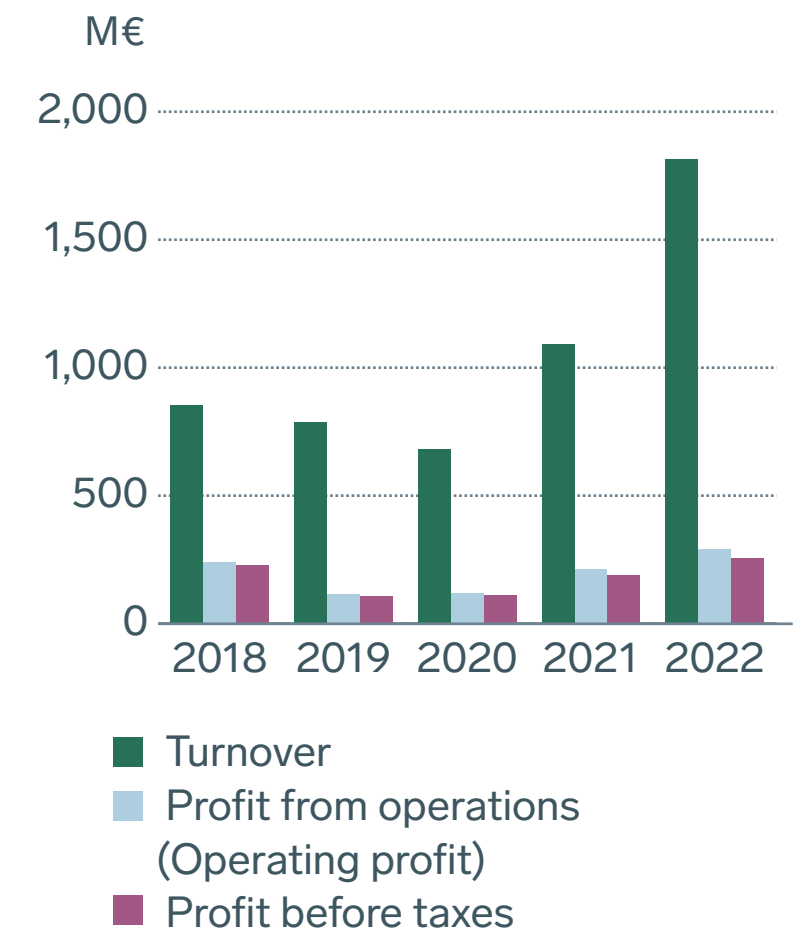
remained high, reflecting the company's strong overall financial situation, its key role as an implementer of climate targets, and its debt service capacity. During the year under review, Fitch Ratings (Fitch) raised Fingrid's long-term company credit rating to 'A+' and unsecured senior debt rating to 'AA-'. The company's finances and financing are on a stable footing, which enables a controlled transition to a clean power system.

The Group's turnover reached a record-high EUR 1,815.2 (1,090.9) million. The increase in turnover is attributed to the remarkably high price of balancing power fees, which Fingrid collects to balance the power imbalances of its balance responsible parties, and increases in balance service tariffs. The turnover from balance services was EUR 1,160.2 (613.8) million. Grid service revenue decreased to EUR 333.7 (394.3) million, due to lower electricity consumption and to Fingrid waiving the grid service fees for December. Finland's electricity consumption to-

talled 81.7 (87.1) terawatt hours in 2022. Cross-border transmission between Finland and Russia ended in May 2022. Cross-border transmission income from that connection amounted to EUR 11.1 (34.4) million. The exceptional situation on the electricity market increased the volume of inter-TSO transmission, which caused greater area price differences on Finland's border compared to previous years. Inter-TSO income grew to EUR 23.1 (22.6) million. The congestion income received by Fingrid increased significantly. In 2022, a total of EUR 229.5 (0.0) million in congestion income was recognised in turnover, and EUR 18.8 (0.0) million in other operating income. Other operating income increased to EUR 171.4 (64.9) million. The increase is due to recognising congestion income as turnover and to the increase in the fair value of derivatives related to business operations.

The Group's total costs amounted to EUR 1,695.8 (945.0) million. With the high price of balancing power, electricity trade costs

Turnover and profit from operations 2018–2022, MEUR



of the balance service increased to EUR 1,141.2 (584.7) million. The exceptional market situation and the high price of electricity increased the costs of market-based loss power and power system reserves, as well as increased congestion costs, which arise from the transmission

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of electricity across borders from more expensive price areas to lower-priced areas. Loss power costs amounted to EUR 103.9 (65.6) million. The volume of loss power remained at the previous year's level. The realised average price of loss power procurement was EUR 60.32 (41.34) per megawatt hour. The cost of reserves to safeguard the grid's system security increased to EUR 186.9 (68.4) million. Congestion costs increased to EUR 69.4 (24.2) million. Depreciation amounted to EUR 107.9 (99.9) million, and grid maintenance costs to EUR 19.6 (19.9) million. Personnel costs grew to EUR 38.1 (33.6) million. The headcount was increased in response to a growing workload, as operations expanded both domestically and in international cooperation.

The Group's operating profit was EUR 290.4 (210.8) million. To recognise changes in the fair value of electricity derivatives and the currency derivatives related to capital expenditure and other operating expenses, EUR 140.6 (62.2) million was recorded in operating profit.

The Group's net financial costs were EUR 32.7 (23.2) million, including EUR 0.6 million in interest expenses on the lease liabilities booked into the balance sheet. Net financial costs grew due to the rise in market interest rates. In 2022, equity amounted to 22,4% and liabilities amounted to 77,6% of the consolidated balance sheet total.

Interest-bearing borrowings totalled EUR 1,056.2 (1,158.1) million, of which non-current borrowings accounted for EUR 990.4

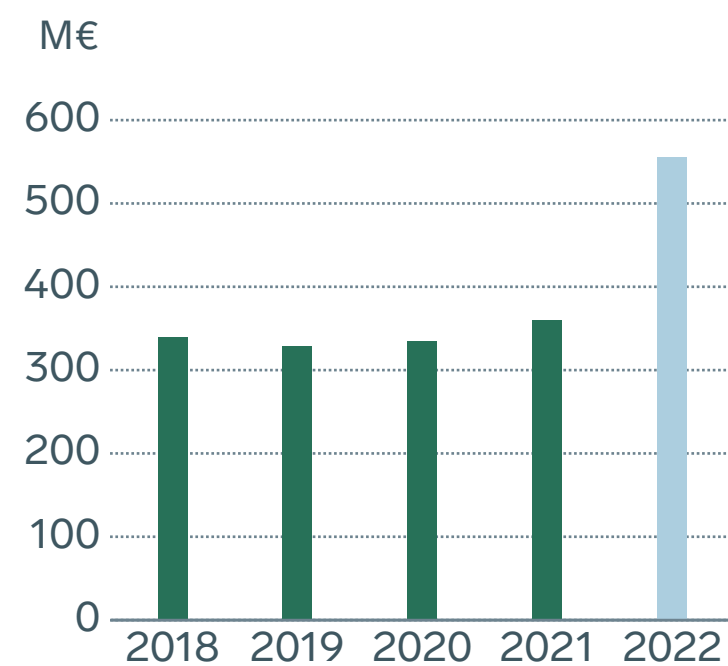
(1,022.6) million and current borrowings for EUR 65.8 (135.5) million.

Fingrid's congestion income significantly increased the company's financial assets and thus decreased its net debt. Unused congestion income is part of the company's liquidity management. The company's liquidity remained very good. Cash and cash equivalents and other financial assets totalled EUR 733.4 (219.6) million on 31 December 2022. Fingrid has a EUR 300 million revolving credit facility tied to

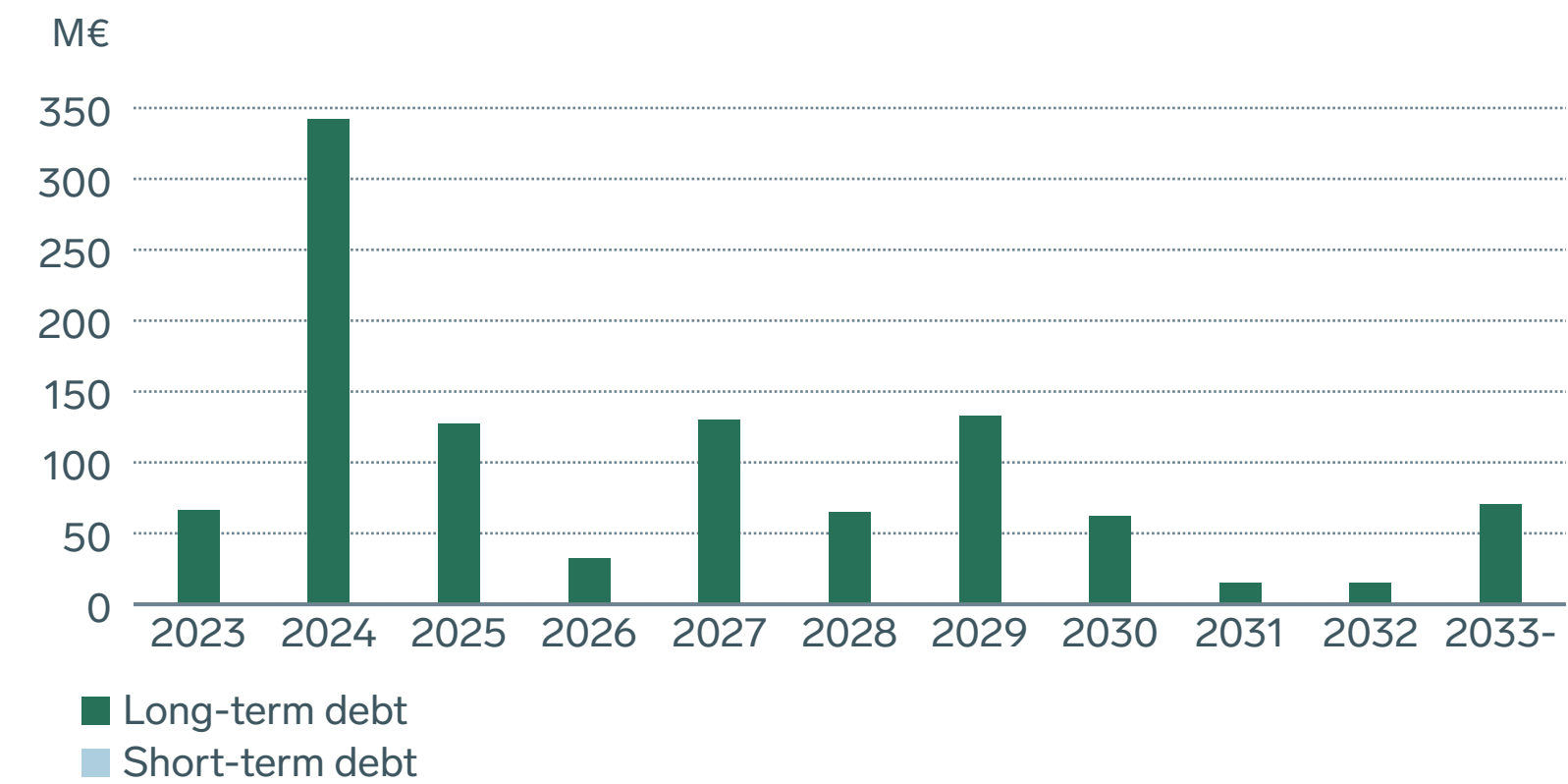
the responsibility targets. The revolving credit facility's loan period extends until 30 November 2027. The company's interest rate, currency and commodity price risks were hedged in line with Fingrid's hedging policies. The counterparty risk arising from derivative contracts relating to financing was EUR 8.8 (16.7) million.

We provide more information on the company's tax obligations and tax footprint in our [Corporate Responsibility and Sustainable Development Report](#).

**Total costs (without imbalance power) 2018–2022, M€**



**Debt maturity profile, M€**



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## Operations

### Main grid

#### Key points:

- The electrification of society is rapidly gaining momentum in order to achieve Finland's goal of carbon neutrality. Rapidly increasing renewable energy production creates opportunities to increase electricity consumption. This development requires substantial investments in the main grid.
- Onshore wind energy is being planned and built at a record pace. A scarcity of connection capacity may occur locally. Moreover, interest in connecting offshore wind and solar energy to the main grid is growing strongly. These projects already make up roughly a third of all connection enquiries.
- New forms of production challenge the operation of the power system, and connecting them requires planning and solutions for maintaining system security and power quality.
- The importance of cross-border connections grows as electricity production situations change. Finland's north-south transmission capacity must be reinforced in order to ensure the flow of electricity production to consumption centres.

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*Development of the main grid is based on anticipating the needs of customers and society, correctly timed grid construction, promoting the effectiveness of the electricity market, cost-effectiveness, and managing the ageing of the grid.*

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Development of the main grid is based on anticipating the needs of customers and society, correctly timed grid construction, promoting the effectiveness of the electricity market, cost-effectiveness, and managing the ageing of the grid. The long-term planning of the main grid and the related investment programme support the implementation of Finland's climate and energy strategy and promote industry's business goals, maintain the main grid's system security, increase electricity transmission capacity, and promote the electricity market.

In autumn, Fingrid published four scenarios on the power system's development, including a description of the related challenges. The purpose of this so-called electricity system vision work is to provide clearer situational awareness of the energy transformation and its impacts and to analyse the main grid's development needs. Finland's goal of being a carbon-neutral society by 2035 means a significant increase in emission-free electricity production and consumption. Electricity consumption is predicted to

grow from the current level of approximately 90 terawatt hours on the annual level to roughly 130 terawatt hours annually in the first half of the 2030s. In the future scenarios, wind power is the main form of electricity generation in the power system, and it is expected to grow significantly this decade.

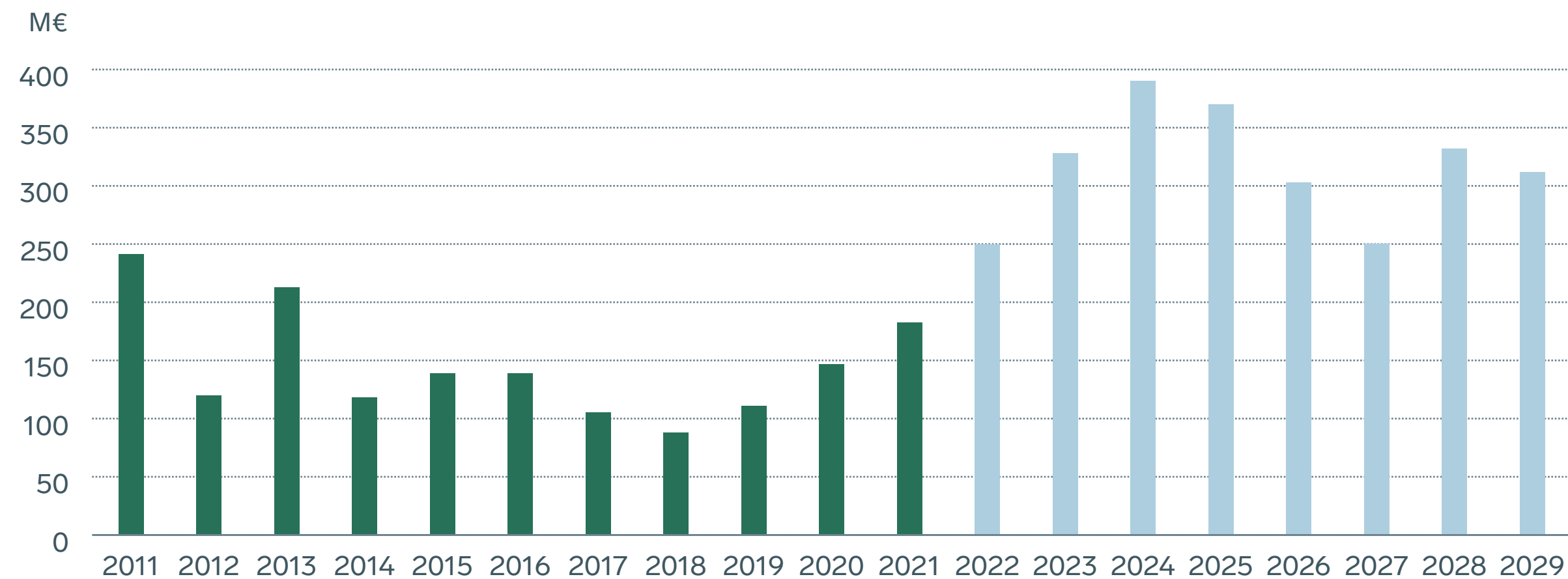
In spring, Fingrid increased its ten-year investment programme from two to three

billion euros. The growth in investments is a consequence of the electrification of society and the transition of electricity production forms to renewable energy. This is reflected in a growing north–south transmission demand and the need for new cross-border transmission connections to Sweden and Estonia. Moreover, the connections between production centres and electricity consumption and the transmission connections between

them must be further strengthened as electricity consumption increases.

The main grid was reinforced in 2022 in several projects throughout Finland. Fingrid completed 16 substations and 500 kilometres of transmission lines during the year under review.

**Fingrid's capital expenditure in the main grid**





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The most significant project completed in 2022 is the roughly 300-km-long, 400-kilovolt Forest Line, which significantly strengthens the electricity transmission capacity between northern and southern Finland. The Forest Line is one of Fingrid's four main transmission lines, and its construction began in 2019 as part of Fingrid's long-term development plan. It allows the increasingly effective connection and transmission of renewable energy from the northern parts of the country to electricity consumers in the south.

Modernisation work on the Oulujoki and North Karelia electricity networks was also completed during the year under review. As part of the Oulujoki project, substations were expanded and modernised, and a new 45-km-long 400- and 110-kilovolt transmission line was built, which is an important long-term component in reinforcing the planned transmission line towards eastern Finland, the so-called Lake Line. In the project to improve the transmission reliability of North Karelia's electricity network, some 112 kilometres

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*The main objective is to ensure that transmission capacity is sufficient to meet the needs of customers and society, operations are efficient and safe, and quality is at the correct level.*

of the area's aging 110-kilovolt power lines were renewed, in addition to which, the area's substations were modernised and a new substation was built.

North-south transmission capacity and cross-border connections are being further reinforced. In autumn, construction of the Aurora Line, i.e. the electricity transmission connection between Finland and Sweden, began. The Aurora Line is Fingrid's most important main grid investment of the decade, and it will increase the transmission capacity between the two countries: from Finland to Sweden by roughly 900 megawatts, and from Sweden to Finland by some 800 megawatts. Fingrid is also planning the construction of the next connection, Aurora Line 2, together with Svenska kraftnät. Preliminary studies for the project are under way with respect to, among other things, the transmission line's routing options. At the end of 2022, a decision was made to reinforce the Lake Line connection, which, once completed, will increase Finland's north-south transmission capacity.

Wind power is projected to be built in Finland in the amount of up to roughly 2,000 megawatts per year this decade. The total power of new connection enquiries for renewable energy that Fingrid received in 2022 was roughly 80,000 megawatts. In addition to onshore wind energy, interest in connecting offshore wind and solar energy to the main grid is growing strongly.

A scarcity of wind power connection and transmission capacity may also occur locally. This is highlighted on Finland's west coast, where wind power production is growing faster than predicted. The increase in converter-connected wind power production and the change in the system's technical characteristics demand new competence and technologies.

Fingrid has identified several solutions to the challenges faced in the west coast. During the year under review, an investment decision was made to acquire for the area a synchronous compensator, i.e. a large synchronous machine without an energy source. The solution will ensure

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reliable wind power operation in the area. Fingrid also made an investment decision in the autumn on a new transmission line connection from Huittinen to Forssa. Once completed, the new line will enable the growing volume of the west coast's surplus production to be transmitted to southern Finland.

Investments in the main grid are based on long-term planning, which takes place in close and confidential cooperation with customers and with TSOs in Europe and the Baltic Sea region, taking into account the electricity market's development needs. The main objective is to ensure that transmission capacity is sufficient to meet the needs of customers and society, operations are efficient and safe, and quality is at the correct level.

Investments in the main grid are growing, and some planned investments have been moved up – there is also a high number of uncertain investment projects. The challenges include securing the adequacy of

resources, and maintenance and outage management taking place simultaneously with grid construction projects. New operating models have been developed to address those challenges. Consistent situational awareness of production and consumption connection needs is being created, projects in the investment programme are being prioritised and scheduled, and capabilities are being improved with the help of a proactive environmental procedure, land acquisition and procurement options. The implementation lead-time for grid investments – from planning, land acquisition and the permit process to the project's construction and the start-up of electricity transmission – is typically much longer, as much as 7–9 years, compared to many power production and consumption investments. It is precisely for that reason that proactivity and confidential cooperation with electricity market operators is key and enables the development of a main grid that supports the development of the electricity market.



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### A carbon-neutral Finland will require strong power transmission connections

Fingrid planned and built transmission lines in several sites throughout Finland in 2022. During the year under review, 500 kilometres of transmission lines were completed, 740 kilometres of transmission lines were under general planning, and four projects reached the environmental impact assessment phase. During the year under review, four investment decisions to build transmission lines were made:

- **A new connection will increase electricity transmission capacity from the west coast to southern Finland.** A decision was made to invest in the construction of a new 69-km-long, 400- and 110-kilovolt transmission line connection from Huittinen to Forssa. The connection will increase electricity transmission capacity from the west coast to southern Finland and significantly improve energy efficiency while reducing power losses arising from electricity transmission by an estimated 48,000 megawatt hours per year. Construction of the transmission line will begin in 2023, and it will be completed in 2025.

- **Aurora Line will increase the transmission capacity between Finland and Sweden and support industry's green transition investments.** Construction work on the substations that are part of the Aurora Line connection and the overall project was started in Finland in autumn. The Aurora Line will stretch 380 kilometres from Messaure in northern Sweden to Pyhänselkä south of Oulu. In the first phase, a 153-kilometre-long transmission line will be built from the Pyhänselkä substation in Muhos to the Viitajärvi substation in Tornio. The new Viitajärvi substation in Tornio and the Isomaa shunt compensation substation in Oulu will also be built. An investment decision was made to expand the construction of the Aurora Line connection to the Finnish–Swedish border and to contribute to the costs of building the transmission line section on the Swedish side.

The 400-kilovolt Aurora Line is being built in cooperation with Svenska kraftnät, and it will increase the electricity transmission capacity between the countries, in turn lowering the cost of electricity in Finland. It will also support industry's green transition

investments; major investments are being planned for the northern parts of Finland, Sweden and Norway in order to implement the future green transition mainly in industry and mining operations. The estimated cost of the Aurora Line is EUR 270 million. In January 2022, the EU granted the project EUR 127 million as part of the Connecting Europe Facility funding instrument. The entire Aurora Line will be completed in 2025.

- **Reinforcements of the Lake Line will increase transmission capacity.** An investment decision to reinforce the Lake Line was made. Fingrid is building a new approximately 290-kilometre-long 400/110 kilovolt power line from Vaala to Joroinen mainly alongside the current Lake Line, or replacing them in the northernmost section of the route. At the same time, a new substation will possibly be built, and old ones will be modernised. Reinforcing the Lake Line will increase electricity transmission capacity from north to south and enable the connection of wind and solar power projects, as well as industrial investments, to the main grid in eastern Finland.

The project is currently in the general planning phase. Based on the plans, construction work on the Lake Line will begin in winter 2023–2024, and the transmission link is due for completion in 2026.

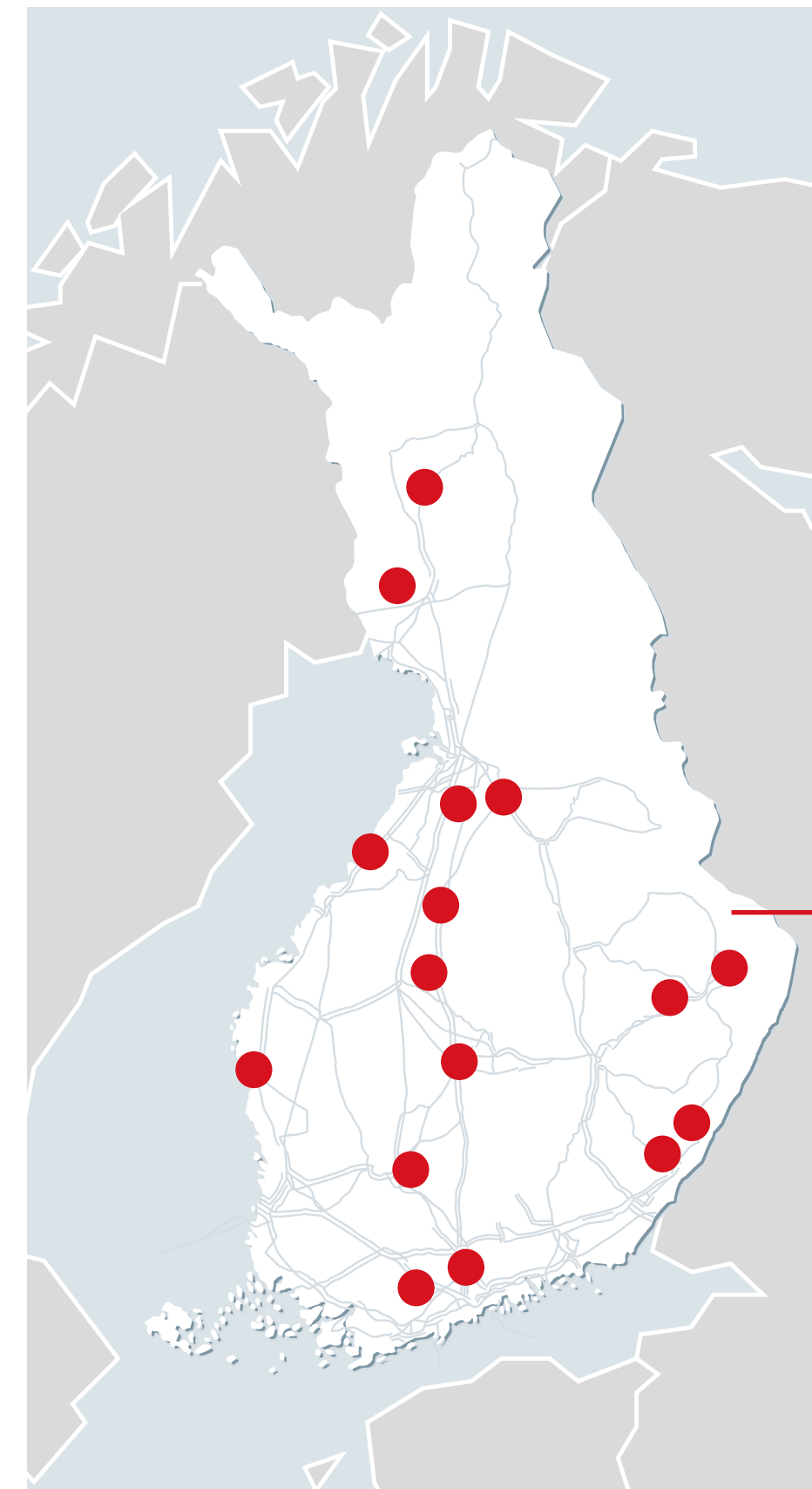
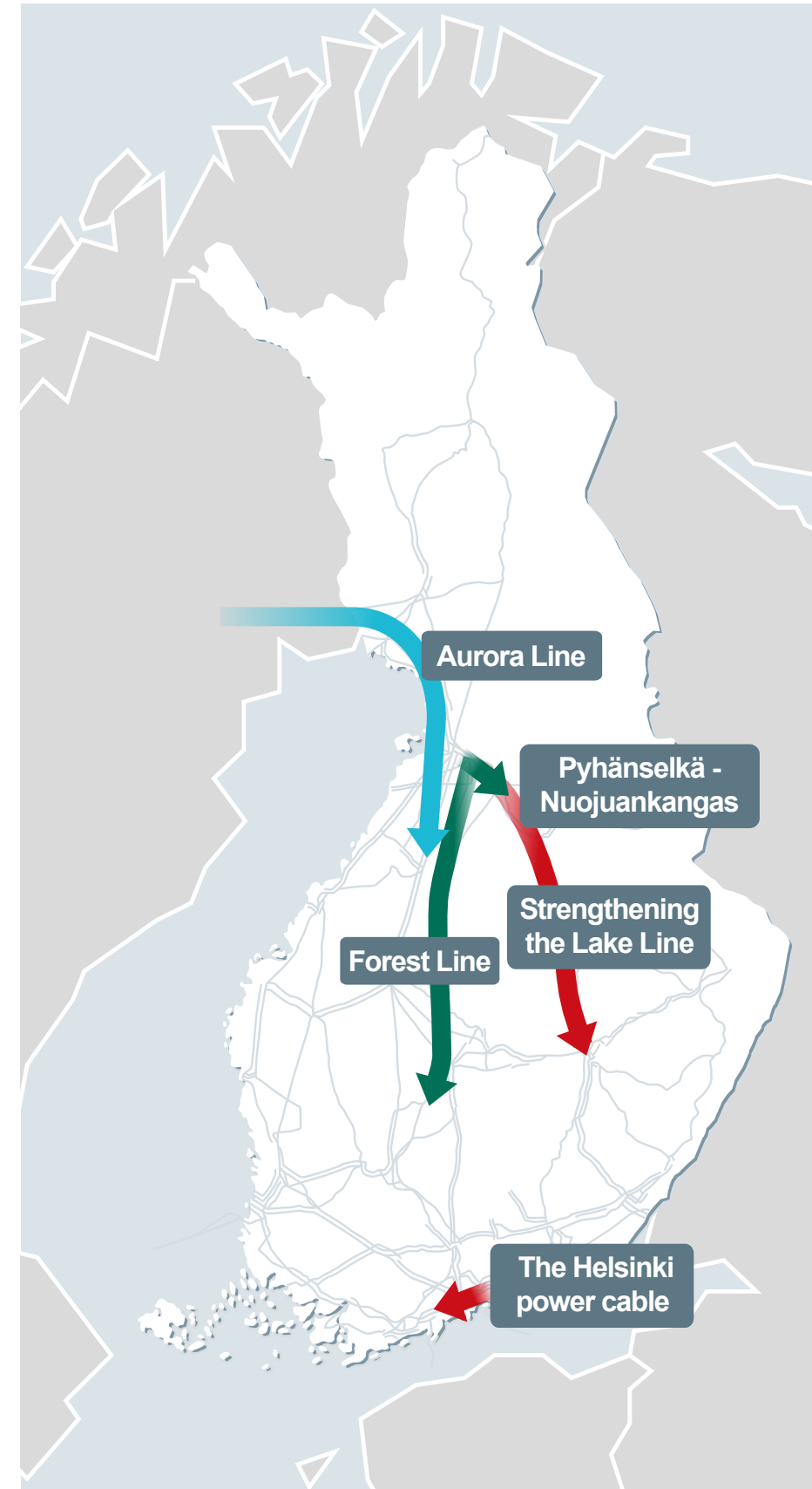
- **New cable link will cater for the increase in electricity consumption.** An investment decision was made to build a 400-kilovolt underground cable connection in Helsinki. Fingrid has planned, in close cooperation with the City of Helsinki and Helen Sähköverkko, Finland's first main grid 400-kilovolt cable link in Helsinki to respond to the growing electricity consumption in the capital region and to promote the green transition. General planning on the project began at the end of 2020, and in spring 2022, preliminary routing was selected for the underground cable, from the Länsisalmi substation in Vantaa to the Viikinranta energy block in Helsinki, where a new grid substation will also be built. Fingrid's goal is to build the cable link and the Vanhakaupunki substation in the course of 2023–2026.

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*The map shows the most significant transmission line projects of 2022. In 2022, a total of 500 kilometres of transmission lines were completed, 740 kilometres of transmission lines were under general planning, and four transmission line projects were in the environmental impact assessment phase.*

- █ Under general planning  
Strengthening the Lake Line  
The Helsinki power cable
- █ Under construction  
Aurora Line
- █ Completed  
Forest Line  
Pyhänselkä - Nuojuankangas (Oulujoki)



● Substation projects, completed

*In 2022, Fingrid completed 16 new substations. A total of 68 substation projects were under way.*

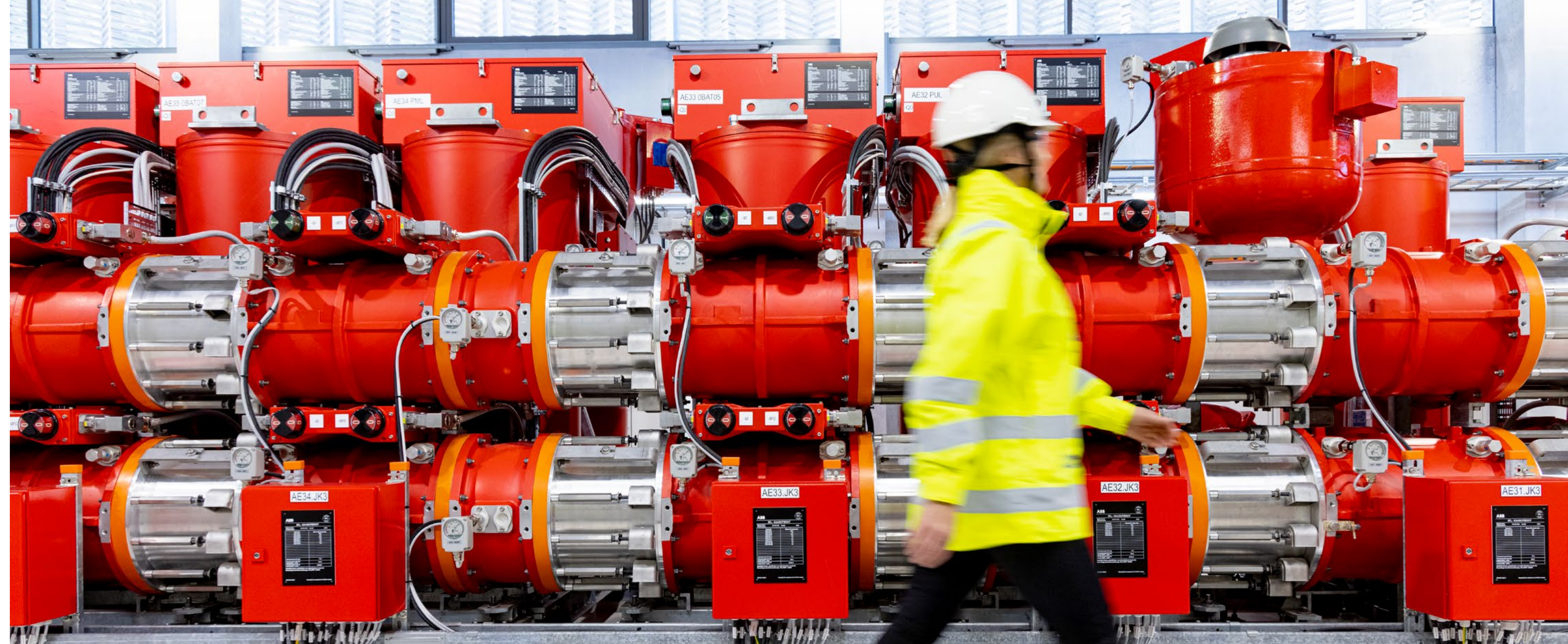
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### Substations continue to be built at a record pace

In 2022, Fingrid completed 16 new substations. A total of 68 substation projects were under way. The substations operate as the electricity network's nodes through which customers' electricity production and electricity consumption are connected to the main grid.

- In terms of wind power connection, several significant substation projects, including those in Jylkkä, Kärppiö and Pysäysperä, were completed in 2022. The expansion of the Jylkkä substation alone will enable the connection of 1,250 megawatts of wind power to the main grid. In 2022, construction projects were also under way in Arkkukallio, Alajärvi, Kellarijänkkä, Valkeus and Seinäjoki. These substations play an important role in enabling wind power connection.
- The Virkkala substation was completed in 2022, and the Luukkala, Kauppila and Framnäs substations were under construction. SF6-free technology is being used in these construction projects. Fingrid's objective is that all new indoor 110-kilovolt switchgear (GIS switchgear) represent the latest, environmentally friendly insulation technology starting in 2025.
- Major renovations were carried out during the year, including at the Rauma, Kangasala and Keminmaa substations. The new Hovinpaikka connection station in eastern Finland was completed. It will cost-effectively improve the region's system security and replaces a legacy transmission line connection.
- In terms of the capital region's system security, significant modernisation work on the Tammisto substation was wrapped up in 2022.
- Fingrid additionally acquired roughly 30 system transformers, which will be commissioned by 2026. New transformers will enable the connection of ever-increasing wind power to the main grid and create the conditions for industrial investments in Finland.



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### During the year under review, Fingrid made several substation investment decisions:

- A second transformer will be added to the Kymi substation in southeast Finland, enabling the development of energy-intensive industry in the area. The second transformer will be commissioned in 2024.
- Salo's aging substation is being modernised. The modernisation will ensure good system security for the main grid also in the future. The project also includes modernising the substation's protection and control systems, i.e. secondary systems, that are important in terms of system security. The modernisation will be completed in 2024.
- Two substations that are important in terms of Lapland's electricity supply will be renovated. Thanks to the investments, system security in Lapland will remain at a high level also in the future. The projects will be completed in late 2024.
- Electricity transmission capacity between northern and southern Finland will be increased with the help of a technical innovation, i.e. shunt compensation. In the shunt compensation project, 16 capacitors will be added to six of Fingrid's substations. The shunt compensation solution will help achieve a significant environmentally friendly, cost-effective and rapid increase in capacity. The project is due to be completed in 2024–2026.
- The new Framnäs substation is being built in Kirkkonummi to secure the area's power supply as electricity consumption grows and to ensure the electricity supply for the data centres that are planned for the area. The construction of the substation will make use of environmentally friendly SF6-free technology.
- The Utanen substation in Utajärvi will be expanded in the course of 2023–2024. This will enable the first solar park to be connected to Finland's main grid.
- The new Linnamäki substation will be built in Tervakoski. It will improve the system security of the area's electricity network and support the Tervakoski Oy paper mill's transition to using fossil-free electricity. Construction of the substation will begin in spring 2023, and the substation will be completed in 2025.
- The new Hepokorpi substation is being planned for Espoo, and old substations in Espoo and Siuntio will be expanded, which will help secure a reliable supply of electricity for the capital area as electricity consumption grows. The substations will also help ensure the availability of electricity for Microsoft's and Fortum's investments well into the future, as well as carbon-free district heat production in Espoo.
- A synchronous compensator, i.e. a large synchronous machine without an energy source, will be built at the Jylkkä substation in Kalajoki. The solution will be used to ensure wind power operations, which are strongly focussed on western Finland, and to improve the main grid's system security in the area.

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### Life-cycle and maintenance management

Finland's main grid comprised altogether 14,500 kilometres of transmission lines and 121 substations in 2022. The main grid represents a totality of assets amounting to several billion euros, which is why, besides building a new network, high-quality maintenance management and correctly timed replacement investments are also important components of the main grid's life-cycle management.

Fingrid's asset management has been certified since 2016 according to the international ISO 55001 standard, and it was re-certified in October. Lloyd's Register carried out a certification-related audit of the processes and documentation Fingrid uses and the work performed on Fingrid's work sites. No deviations arose during the audit.

Fingrid has, for five years now, been developing a digital condition monitoring concept that aims to automate maintenance processes and cooperation between partners, as well as time maintenance measures according to need. The system draws on modern sensor technologies, telecommunications and analytics solutions, and it provides continuous up-to-date data on the condition of switchgear and current transformers, and automatically proposes maintenance objects.

Digital condition monitoring is cost effective and provides better information than before on the condition of the equipment, thus allowing maintenance measures to be targeted precisely to where they are needed rather than based on the age of the equipment. In the first phase, digi-

tal condition monitoring systems were installed in substations whose equipment was reaching the end of their life cycle. The system went live in a total of ten substations in 2022, and the objective is to introduce digital condition monitoring throughout the main grid in 2025. Digital condition monitoring also improves the customer experience, as it more effectively prevents component failures and ensures high-quality electricity transmission.

In 2022, the project that involved taking aerial photographs of all the transmission lines in the main grid was also completed. The material can be used, for instance, to plan maintenance and to support vegetation trimming.

### Reserve power always on the ready

Reserve power is used to prepare for disturbances in electricity production. Reserve power plants are rarely started up, but their preparedness is maintained continuously in order to secure a reliable supply of electricity for customers and society in the event of electricity system disturbances.

Fingrid owns a total of eight reserve power plants, which can provide approximately 900 megawatts of electricity to the main grid in 15 minutes in a disturbance situation. Reserve power plants are used only in larger power system disturbances, for example, if there is a failure at a large power plant. The reserve power plants are not used for commercial electricity production. Reserve power plants are maintained and developed also in case of a major disturbance, or a blackout. In addition, reserve power plants are being developed for the grid's voltage control in exceptional situations.

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### Case

Strong main grid attracts clean-energy-based industry, such as data centre investments and hydrogen production, to Finland

*"A strong main grid and renewable energy generation are key sources of Finland's competitiveness. Through main grid investments, we want to enable not only the achievement of climate targets, but also the realisation of industrial investments that create well-being and utilise clean electricity," states Director Asta Sihvonen-Punkka of Fingrid.*

### Case

Main Grid Day themes: future investments and safety of grid construction

*Fingrid organised a 'Main Grid Day' (Kantaverkkopäivä) for its service providers on 11 May 2022. During the event, which took place in Vantaa, information about investments in the near future was given, and safety factors related to grid construction and maintenance were examined.*

*At the event, Fingrid also awarded its cooperation partners for excellence in main grid operations. Builders, maintenance operators and occupational safety representatives were among those awarded. One Main Grid Lifetime Achievement Award was also granted at the event for excellent work as a subcontractor.*





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## Case

### CIGRE Session

*Established in Paris in 1921, CIGRE (the Council on Large Electric Systems) is a global nonprofit organisation that focuses on power system expertise. The Chair of the Finnish National Committee of CIGRE is Liisa Haarla of Fingrid.*

*The CIGRE event for energy sector professionals, organised every two years, took place in 2022. Close to 10,000 experts in the field of electricity gathered in Paris for the event, and visitors were offered an extensive programme as well as the opportunity to take part in several group discussions.*

## Case

### Frost begone!

*Among the important wintertime maintenance measures on transmission lines is hoar frost removal. Ice load usually occurs between December and February in an area stretching from South Karelia to Lapland, but especially in the regions of North Savo, North Karelia, and Kainuu. Frost is removed using helicopters and special tools developed for the purpose, but the conventional "man and a rope" technique is also still used today.*

*Every year, ice load is removed from an average of 100 spans, but there is significant year-to-year variation. If there is a very large amount of ice load, the tower structures or earth wires could break. Fingrid has developed a special tower for ice loads that can withstand frost burdens in excess of the normal design criteria. These towers are used on new lines in areas where ice loads commonly occur.*

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## Power system

Key points:

- Preparation for the 2022/2023 winter season
- Maintaining the current good level of system security and preventing electricity shortages
- Efficient operations and trust in the markets
- Developing the Nordic power system as a coherent whole and close cooperation with Baltic Sea region countries in particular
- The company maintains strong grid operation expertise.

2022 was a turbulent year in the sector. Russia's war of aggression against Ukraine, the end of electricity transmission from Russia to Finland, and preparing for an electricity shortage were closely linked to electricity system management in 2022.

Electricity imports from Russia have traditionally been an important part of Finland's electricity procurement, and they came to an end on Saturday 14

May 2022. In the public debate, the end of electricity transmission was linked to Finland's NATO bid, but the real reason behind it was the Western-imposed sanctions, which cut off payment transactions related to the sale of electricity in the market. Prior to cutting off electricity imports from Russia, on 24 April 2022, Fingrid limited the transmission capacity of the connections with Russia to 900 megawatts from the maximum 1,300 megawatts for system security reasons.



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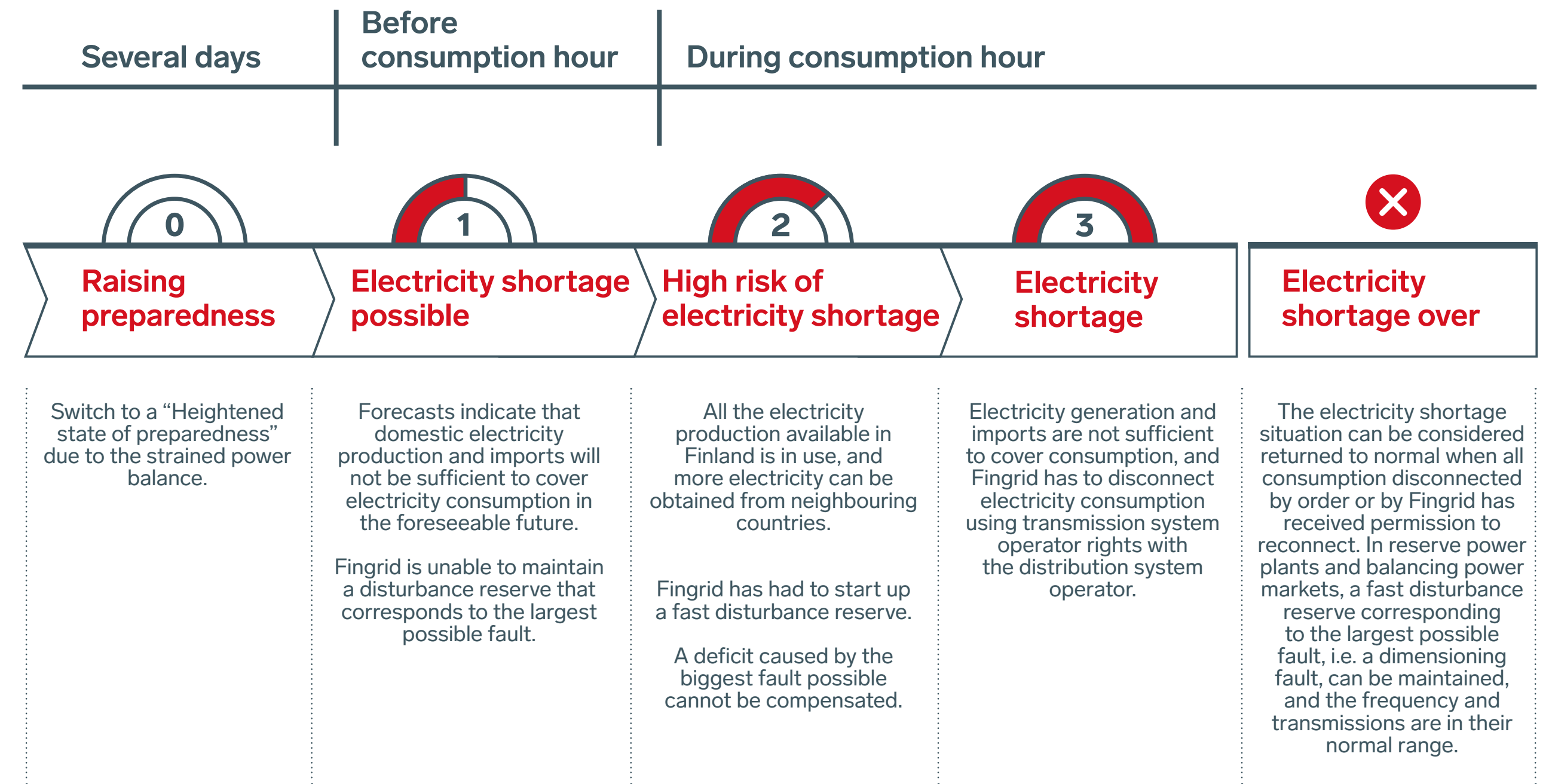
## Concern over the sufficiency of electricity

At the end of August, Fingrid released an estimate of electricity adequacy for the coming winter. War in Europe, the exceptional situation in the energy markets and delays in the start-up of the Olkiluoto 3 nuclear power plant increased uncertainty related to the availability of electricity. As a consequence of major uncertainties, Finns were urged to prepare for possible power outages caused by electricity shortages.

The exceptional situation in the electricity markets was reflected as major uncertainty in assessing the sufficiency of electricity during the winter. Fingrid updated its estimate several times over the rest of the year as the situation became clearer. The end of imports of electricity and natural gas, which is used in electricity production, from Russia increased electricity consumption and further weakened the situation in Finland.

Three key factors were considered to affect the adequacy of electricity: the prevailing weather conditions, Finland's electricity production capacity, including the scheduled start-up of the Olkiluoto 3 nuclear power plant, and electricity trade with Sweden and Estonia. During peak consumption periods in previous years,

## How is the electricity shortage procedure progressing?



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considerable volumes of electricity have been imported from Sweden and Estonia, as well as from Russia. The availability of electricity from Sweden and the Baltics, however, is affected by these countries' own electricity supply issues, for instance, possible natural gas supply problems in the Baltics. Failures of major domestic power plants or electricity transmission connections, as well as problems with the availability of power plant fuels, especially natural gas, increase the risk of a power shortage. On one hand, the rapid growth of wind power capacity was seen to improve the availability of electricity in Finland, but on the other hand, wind power's impact on the adequacy of electricity is subject to the prevailing wind conditions, which increases uncertainty.

Energy savings and the timing of electricity consumption were considered to have a significant impact on the adequacy of electricity. In late autumn, Motiva launched an energy-efficiency campaign under the leadership of the Ministry of Economic Affairs and Employment. From September to December, electricity consumption was reduced by an average of 8 per cent. The record-high price of electricity partly contributed to the reduction of consumption.

Several measures were initiated to mitigate and manage the electricity shortage. In autumn, the company went over procedures and communication guidelines with customers and cooperation parties, established electricity shortage web pages and trained the company's employees in managing the electricity shortage situation. A machine-readable electricity shortage scale that can be used in various automation solutions to switch off flexible low consumption during a power shortage was added to Fingrid's Open Data web page. In the autumn, Fingrid adopted the voluntary power system support procedure for companies and the public sector to prevent electricity shortages during the winter period. The objective was to mobilise the entire flexibility potential in the event of an electricity shortage. Industrial demand response and the stand-by generators of buildings were sought for inclusion in the procedure.

In October, the company organised an event for DSOs and authorities to discuss the upcoming winter's power balance situation as well as the process for dealing with an electricity shortage. At the same time, a media event was held to explain practical measures related to an electricity shortage.

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### **Olkiluoto 3 nuclear power plant connected to the main grid**

History was made at the start of March, when the Olkiluoto 3 nuclear power plant was connected to the main grid. The start-up of the nuclear power plant represents a significant increase in Finland's self-sufficiency in electricity production. The connection went without a hitch, and electricity generated by Olkiluoto 3 has since been transferred via the main grid to electricity consumers.

Following the successful connection, the aim was to test the plant's operation for a few months prior to commercial use. In this context, Fingrid's task in its role as the grid operator is to ensure that Olkiluoto 3 fulfils the specifications set for it and thereby ensure the system security of the power system. As the nuclear power plant's test programme progressed, Olkiluoto 3 was not in test use for several periods of varying lengths, and as a result, the commissioning test phase has been prolonged and the start of commercial operation has been delayed.

Olkiluoto 3 is Finland's largest power plant, and the electricity it generates affects the electricity transmission capacity between northern Sweden and Finland. When Olkiluoto 3 reaches its full capacity of 1,600 megawatts, the import capacity from northern Sweden will be a maximum of 1,200 megawatts. If Olkiluoto 3's electricity generation is less than 1,000 megawatts, the transmission capacity from northern Sweden to Finland will be at most 1,500 megawatts.

### **Reinforcements in western Finland**

The rapidly increasing wind power generation creates a significant need for investments in the main grid in order to be able to meet all the required connection needs. In Finland, this is highlighted on the west coast, which has a shortage of transmission capacity. Agreement has already been reached on connecting roughly 5,000 megawatts of wind power generation to the main grid in the region by the end of 2024.

Fingrid has reinforced the area's main grid by building, for instance, the Coastal Line (Rannikkolinja) connection, which

was completed five years ago, and several substations alongside it. That is not enough, however, as new reinforcements and entirely new solutions are still needed. Grid reinforcements are needed on the west coast for three reasons:

- to ensure that the main grid's transmission capacity is sufficient for the region's wind power, particularly in maintenance and fault situations
- to ensure that the area's wind power park modules remain stable during the grid's various consumption situations, and
- to ensure that the new electricity production can be connected to the main grid also in the future.

Fingrid has identified several solutions to the region's problems that will relieve the situation in the short term before new transmission line connections are completed. The key solution in the longer term is to increase the region's transmission line connections. Fingrid is, in fact, currently planning, as well as carrying out environmental impact assessments on, a new

400-kilovolt transmission line connection from Kristiinankaupunki to Tampere, as well as two similar connections from Kalajoki to central Finland. The new connections will be completed in 2027 and 2028.

Increasing the transmission capacity of the main grid is an important project, but the west coast also needs solutions that can be implemented more quickly. Examples of such solutions include:

- The voltage controllers in wind power plants could be fine-tuned to operate in a network dominated by wind power
- Dynamic Line Rating (DLR) technology could be introduced in the region to provide more accurate information about the actual current-carrying capacity of the transmission grid under different weather conditions
- The possibilities of rapid down- and up-regulation will be investigated
- A synchronous compensator (a large synchronous machine without an energy source) will be purchased to keep the region's network in balance

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### Nordic TSOs deepen their co-operation

The operational planning office (Regional Coordinator Center, RCC) of the four Nordic transmission system operators is situated in Copenhagen. RCC coordinates the joint Nordic operational planning. RCC launched its operations in their current form on 1 July 2022 in Copenhagen. The company replaced the former Nordic RSC (Regional Security Coordinator) and expanded its operations.

RSC has received five statutory tasks: the calculation of cross-border transmission capacity, system security analyses and risk identification, coordination of cross-border transmission outages, maintenance and development of joint grid models, and regional short-term electricity sufficiency reviews. In the future, the company will also begin calculating how much of their own reserves TSOs require for emergency power generation.

### Electricity consumption decreased in 2022 – system security was high

The usability and reliability of Fingrid's DC connections have been at a very good level. There were fewer disturbances in 2022 than in 2021, and capacity was rapidly recovered for use in the markets. The total duration of disturbances was affected, in particular, by a prolonged fault in the EstLink 1 connection at the end of the year. The exceptional situation on the electricity markets also affected the planned maintenance outage schedules, which were removed from the spring and winter seasons on a risk basis.

The energy crisis caused by Russia's war of aggression and the consequent rise in electricity prices reduced electricity consumption in all electricity consumer groups. Increased awareness of the scarcity of electricity among citizens and the nationwide effort to reduce electricity consumption especially during consumption peaks further contributed to the



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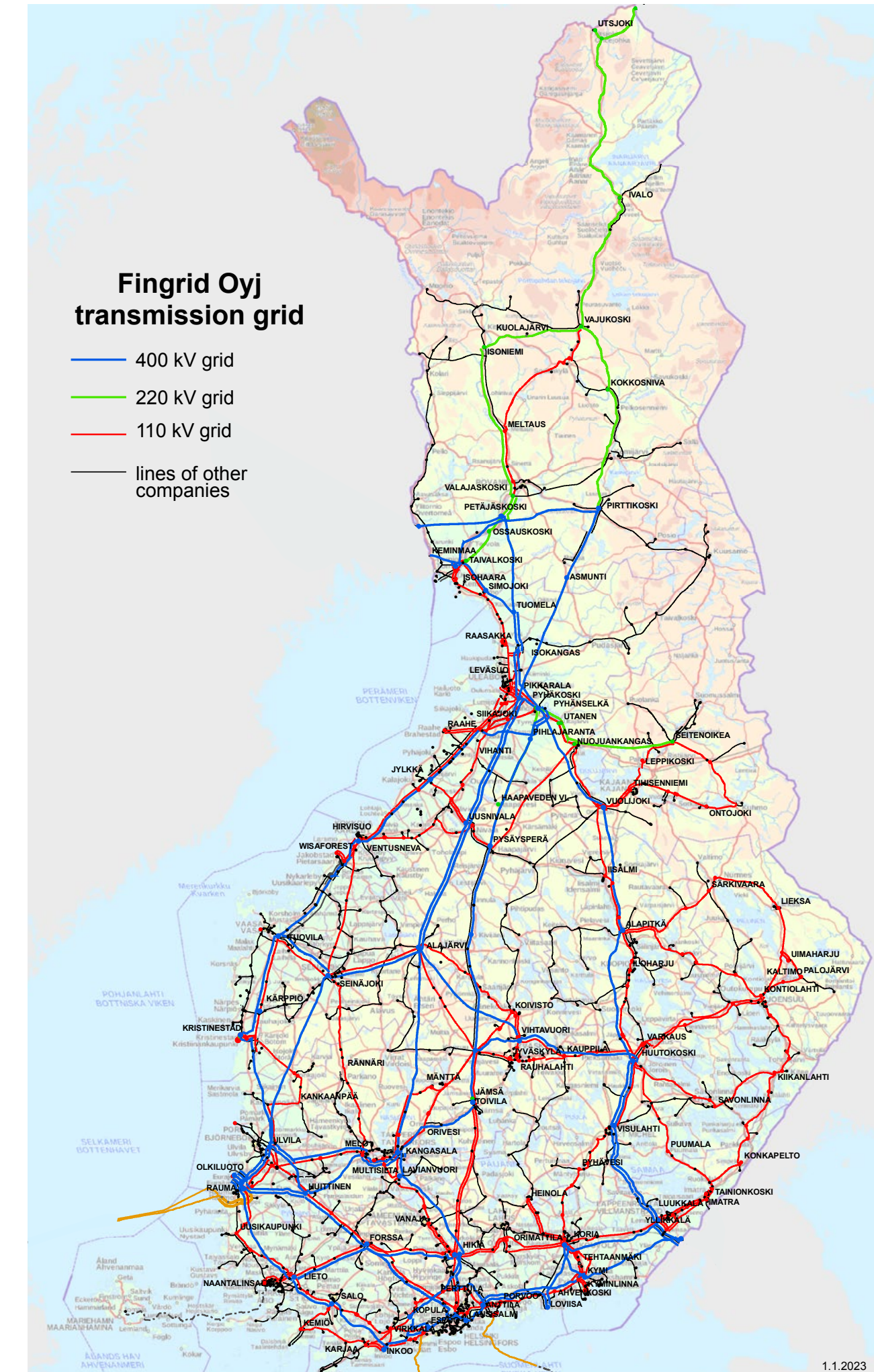
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decrease in consumption. In 2022, Finland's electricity consumption decreased by roughly six per cent compared to the previous year, with the biggest decline taking place in the second half of the year. The total consumption was 81.7 (87.1) terawatt hours. Fingrid transmitted 70.1 (72.9) terawatt hours of electricity in the grid, representing 78.4 (77.1) per cent of the transmission volume in Finland (consumption and inter-TSO).

In winter 2021/2022, electricity consumption peaked at 13,767 (14,267) MWh/h on 11 January 2022 between 8 and 9 am, with Finland's electricity production contributing 11,215 MWh/h and the remaining 2,552 MWh/h being imported. The area price of electricity on the day-ahead market in Finland was €201.93/MWh during the peak consumption hour. The electricity supply was not in jeopardy during the peak consumption hour. Finland's production peak was reached between 6 pm and 7 pm on 12 December with 12,532 MWh/h.

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*Finland's main grid operated very reliably in 2022, at a high transmission reliability rate.*



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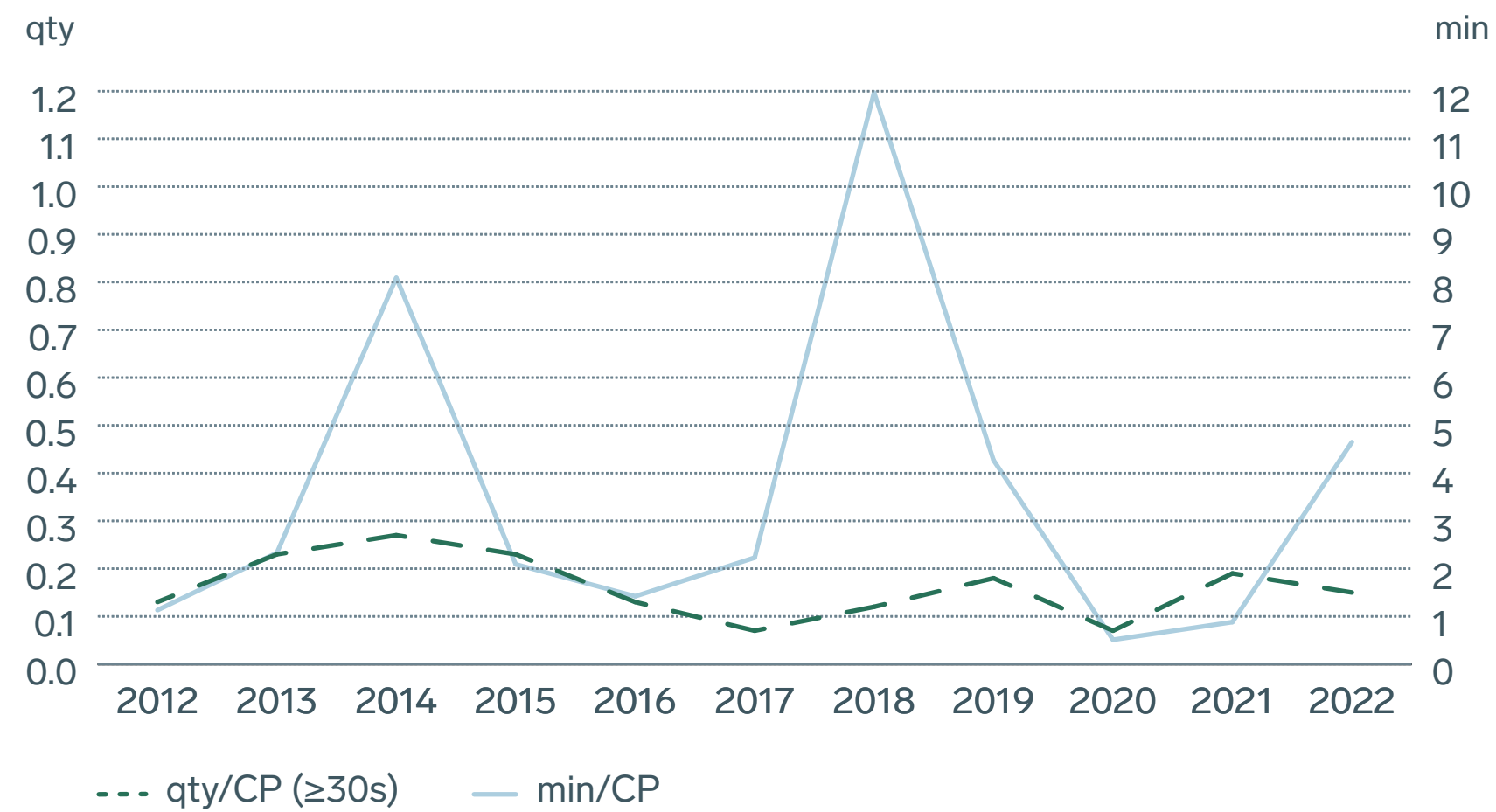
Finland's main grid operated very reliably in 2022, at a high transmission reliability rate. Disturbance-clearing readiness was raised three times during the year under review due to poor weather or crown snow-load. We proactively raise our readiness when factors such as difficult weather are expected to pose challenges to grid maintenance to enable as rapid

clearing and communication of disturbances as possible.

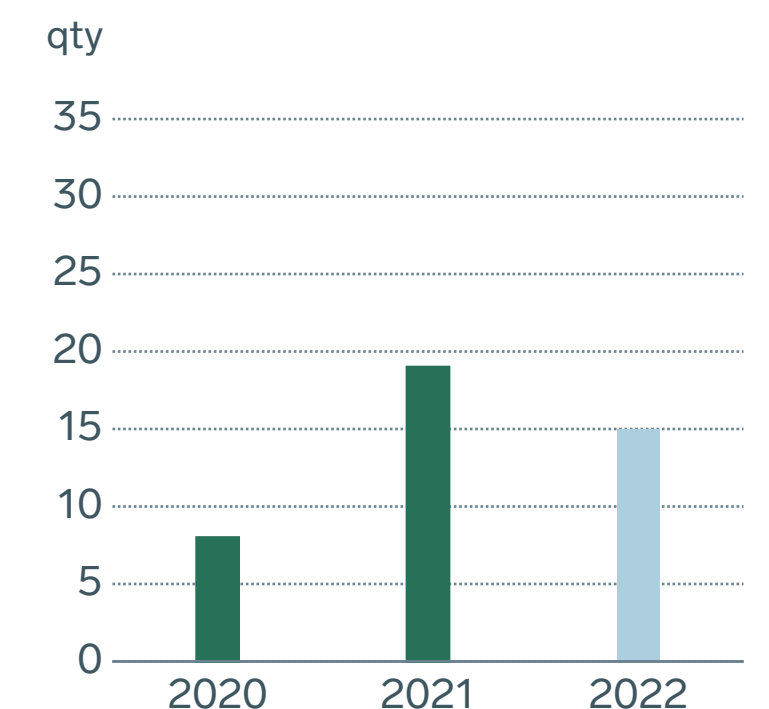
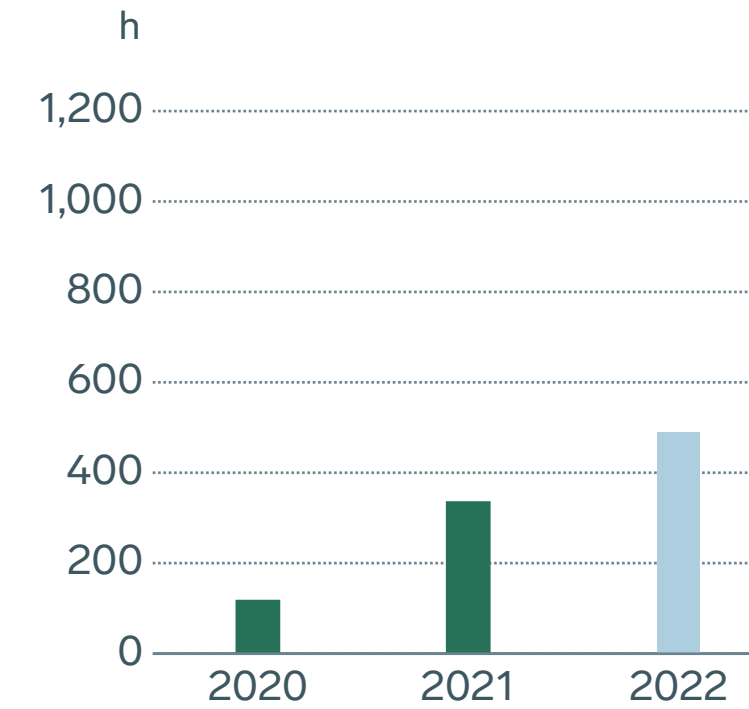
The transmission reliability rate was 99.99993 (99.99992) per cent in 2022. An outage in a connection point in the main grid caused by a disturbance in Fingrid's transmission system lasted an average of 4.7 (0.9) minutes. The cost

of the disturbances (regulatory outage costs) was EUR 2.0 (2.3) million, and including the quick reclosures, EUR 4.7 (5.8) million.

### Interruptions at connection points due to grid disturbances



### HVDC disturbances, total duration and quantity





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Countertrade costs continued to rise compared to previous years, amounting to EUR 7.3 (2.5) million. The costs were raised by, among other things, the high price of electricity, disturbances in cross-border transmission connections and countertrade resulting from local transmission outages around Finland. Countertrade refers to special regulations for transmission management purposes which are used to eliminate short-term grid bottlenecks, i.e. areas where electricity transmission is congested. Fingrid additionally guarantees the cross-border transmission it has confirmed by carrying out countertrades, i.e. purchasing and selling electricity, up until the end of the 24-hour usage period. The causes of

countertrade include outages and disturbances in power plants or in the grid.

Some transmission outages in connection with capex projects took place throughout Finland. The main focus has been on northern Finland, Ostrobothnia and central Finland. Demanding outages require careful advance planning and close cooperation with customers.

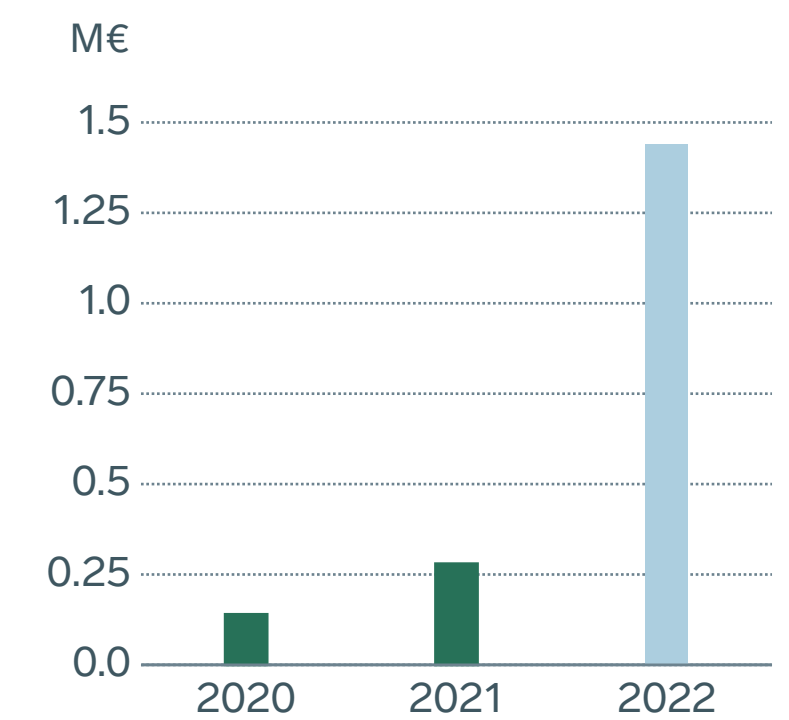
Reserves required to maintain the power balance of the power system were procured from Finland, other Nordic countries, Estonia and, in the first half of 2022, Russia. The availability of reserves has been challenging at times, and reserve costs have risen significantly. As a consequence

of the high price level on the electricity markets, production capacity has been diverted to the day-ahead markets and there has already been flexibility in the adjustable consumption resources, guided by the price level of the day-ahead markets, which has reduced the reserve bids. On the other hand, during peak situations in wind power production, hydroelectric power has run at minimum output, which has led to a scarcity in the supply of reserves. Interest in grid energy storage on the reserve markets has continued to grow. The ever-increasing wind power will be needed as a reserve more and more in the future. In December, the first joint Nordic reserve capacity market was launched for the procurement of automat-

ic frequency restoration reserves (aFRR), and the broader markets are expected to lower and stabilise the price level. During the testing phase of Olkiluoto 3, the possibility of failures was anticipated, which increased the volume of reserves to be procured in the event of disturbances. [Read more about the reserves in the electricity market section.](#)

Countertrade	1-12/22	1-12/21	10-12/22	10-12/21
Countertrade between Finland and Sweden €M	3.8	0.3	3.7	0.0
Countertrade between Finland and Estonia €M	1.7	0.2	0.0	0.1
Countertrade between Finland's internal connections €M	1.8	2.0	1.2	0.5
<b>Total countertrade €M</b>	<b>7.3</b>	<b>2.5</b>	<b>4.9</b>	<b>0.6</b>

Countertrade costs caused by HVDC disturbances



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The volume of transmission losses in the main grid increased from the level of the previous year and amounted to 1.6 (1.5) terawatt hours. This was 2.3 per cent of Fingrid's transmission volume, which was 70.1 (72.9) terawatt hours. The losses are affected by the quantity of the electricity consumed and transferred.

<b>Power system operation</b>	<b>2022</b>	<b>2021</b>	<b>2020</b>
Electricity consumption in Finland, TWh	81.7	87.1	80.9
Fingrid's transmission volume, TWh	70.1	72.9	68.4
Fingrid's loss power volume, TWh	1.617	1.469	1.470
<b>Electricity transmission Finland-Sweden</b>			
Exports to Sweden, TWh	1.2	0.9	0.3
Import from Sweden, TWh	16.6	15.9	18.8
<b>Electricity transmission Finland-Estonia</b>			
Exports to Estonia, TWh	6.8	6.7	6.6
Import from Estonia, TWh	0	0.07	0.04
<b>Electricity transmission Finland-Russia</b>			
Exports to Russia, TWh	0	0	0.02
Import from Russia, TWh	3.6	9.2	3
<b>Electricity transmission Finland-Norway</b>			
Exports to Norway, TWh	0	0.02	0.04
Import from Norway, TWh	0.4	0.3	0.3



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## Case

### Hourly electricity price app actively used by citizens

The popularity of Fingrid's 'Tuntihinta' app grew considerably in autumn 2022 and was one of the most popular free apps in Finland. In the app, customers with an exchange electricity contract and other electricity consumers can keep track of the fluctuations in the price of electricity and take advantage of cheaper hours when electricity demand is lower.

Electricity savings and preventing an electricity shortage by spreading out consumption peaks was a hot topic in winter 2022, including in the media. Even before the threat of an electricity shortage escalated, Fingrid emphasised the possibilities of consumers and other customers to take a more active role in managing energy consumption. Demand-side management, meaning electricity equipment controls,

is being used to balance the energy system.

The Tuntihinta app, which shows the hourly electricity price, was created ten years ago as part of the demand response project. In that context, Fingrid arranged an internal brainstorming competition, the best ideas of which led to the creation of the app.

"Back then, many people were not aware that electricity exchange prices vary by the hour. We wanted to create an easy channel where consumers could follow the price fluctuations. Another notion was to inspire builders of different automation solutions to make use of cheap hourly prices and develop automation on top of that," explains Unit Manager Jonne Jäppinen.

The Tuntihinta app, which shows the hourly electricity price, became familiar to the entire nation in 2022.



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### Electricity market

#### Key points for the electricity markets:

- Market-based approaches enable the cost-effective transition to a clean power system.
- Well-functioning electricity markets support security of supply.
- Preparations for a 15-minute Imbalance Settlement Period and a new capacity calculation method progressed, and the reserve markets expanded within the Nordics.
- The construction of wind power continues strongly. Investors are increasingly interested in the possibilities of building offshore wind power

Fingrid maintains and develops the electricity market. By maintaining a strong main grid, we make sure that Finland forms a unified price area. With our cross-border transmission connections, we offer the market parties access to the European electricity markets. Transmission outages are planned so that they cause minimal harm to the functioning of the markets. The largest possible transmission capacity, taking system security into account, is made available to the

markets at every moment. The market rules are being developed and electricity market data is published openly. The marketplaces for reserve and balancing power are maintained and developed continuously. We settle the power balances and supply the imbalance power to the balance responsible parties. Fingrid Datahub Oy will offer an effective information exchange platform for retail market parties.

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*The largest possible transmission capacity, taking system security into account, is made available to the markets at every moment. The market rules are being developed and electricity market data is published openly. The marketplaces for reserve and balancing power are maintained and developed continuously.*

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### Electricity market outlook

Record-high prices on the electricity markets dominated public debate throughout the year. There were several reasons for the high prices, the most significant of which was Russia's attack on Ukraine in early 2022. As a result of the invasion, problems related to the availability of fuels and high fuel prices increased the price of electricity everywhere in Europe. The supply crisis was exacerbated by problems related to France's nuclear power production. The scarcity of hydroelectric power in southern Norway further raised the price level in the Nordic countries. In Finland, the market was anxious about the success of the test runs of Olkiluoto 3 started in summer 2022 and the start date for its commercial operation, which ultimately did not happen during the year under review.

The electricity market crisis was not limited to a discussion about high prices. In the second half of the year, concern over the adequacy of electricity as winter approached was highlighted in the public debate in an unprecedented way. The

crisis set in motion a series of political measures at both the EU level and within member states. In autumn, the EU swiftly agreed on a Council Regulation to address high energy prices and reduce electricity demand. The regulation entered into force in member states at the end of the year, but even before then the high prices triggered many companies and consumers to considerably reduce their electricity consumption. Demand-side flexibility emerged as a key means of preparing for scarcity in the availability of electricity. And in Finland, guidelines were updated concerning the use of rotating power cuts as a last resort for limiting consumption during electricity shortages. In an effort to prevent electricity shortages, Fingrid also launched a voluntary power system support procedure for using electricity sparingly in November 2022. The objective of the procedure, aimed at companies and the public sector, is to offer, during crisis situations, the opportunity to support infrastructure that is critical for the functioning of society, including to operators who do not actively participate in it under normal conditions.

High electricity prices also devastated the electricity financial market. Trading on the electricity financial market includes various electricity derivatives that market actors can use to hedge against variations in the price of electricity. The underlying asset of electricity derivatives is often the spot price of electricity that is formed on the physical day-ahead market. During a contract's trading period, the parties are required to produce guarantees to ensure their ability to fulfil their future obligations also during disturbance situations. The dramatic price increase in the day-ahead market during the year significantly increased the guarantees required from the parties and caused liquidity problems for companies. Various interventions by public authorities, such as support packages and loan arrangements aimed at securing the operating conditions of companies during the crisis situation, were seen both in Finland and elsewhere during the year.

Along with the electricity crisis, demands to limit electricity exports in the name of national interests also came up from time

to time in the political debate. Fortunately, however, restrictions based on political decisions were not seen in practice; in the worst-case scenario, they could threaten the security of electricity supply and are destructive from a market efficiency point of view. During times of crisis, the importance of solidarity is highlighted.

Prices on the European day-ahead market reached the highest possible level allowed by the price cap for the first time in the internal market's history. In April, France and the Netherlands came close to the price cap in the markets at the time, i.e. EUR 3,000 per megawatt hour, triggering an increase of EUR 1,000 per megawatt hour in the price cap as required by the automatic mechanism under European regulation. The new price cap of EUR 4,000 euros per megawatt hour was reached in Lithuania, which restarted the automatic increase mechanism. This time, however, the increase was not imposed, as the EU's energy ministers demanded a freeze on the price cap. However, the freezing of the price cap in the Nordic

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balancing power markets was unsuccessful, so the price cap in Finland's balancing power market also rose, in line with the Energy Authority's decision, to EUR 10,000 per megawatt hour on 1 November 2022.

During the year under review, the electricity transmitted between Finland and Sweden mostly consisted of large imports from Sweden to Finland. The transmission of electricity between Finland and Estonia was dominated by exports from Finland to Estonia. Finland's electricity imports from Russia ended in May 2022.

Electricity trading takes place per hour, and the direction of transmission can change from one hour to another. Large quantities of electricity were imported to Finland, based on market incentives, throughout the year under review. The price differences between the Nordic countries, which were large at times, resulted above all from a different production mix and the limited transmission capacity. The Norwegian production is mainly hydroelectric power, while Sweden

has hydropower as well as wind and nuclear power. Area prices diverge in situations where the transmission capacity between price areas is insufficient to meet the demand. Of the Nordic countries, Sweden and Norway are divided into several electricity price areas. In Finland, exchange electricity is the same price throughout the country. Wind power has increased at a rapid pace in Finland, and the installed wind power capacity exceeded 5,000 megawatts in 2022. On very windy days, the price of electricity in Finland is often close to northern Sweden's and northern Norway's lower price level. On less windy days, Finland's prices are closer to the higher prices in Baltic countries. In the price areas of southern Sweden and southern Norway, electricity prices were also exceptionally high during the year.

The cross-border transmission capacity limitations that started in 2021 as a result of the Swedish transmission grid's congestion also affected the markets in 2022. The most significant limitation for Finland was the limitation of electricity exports from Finland to Sweden using the

Fenno-Skan link. The technical availability of our cross-border connections were, however, good during the year.

Transmission outages related to maintenance work, investments and fault repairs were implemented both on the cross-border connections between Sweden and Finland and on connections within the countries. Maintenance work was scheduled on weekends and similar periods to limit the impact on the market and electricity prices. The exceptional situation on the electricity markets at times negatively affected the planned maintenance schedules.

Sufficient transmission capacity is a necessary prerequisite for the markets to function effectively. To increase the cross-border transmission capacity between Finland and Sweden, we are currently preparing, in cooperation with the Swedish TSO, a third AC connection to Sweden called the Aurora Line. The increased transmission capacity will help to decrease the price disparities between the countries. The transmission link is due

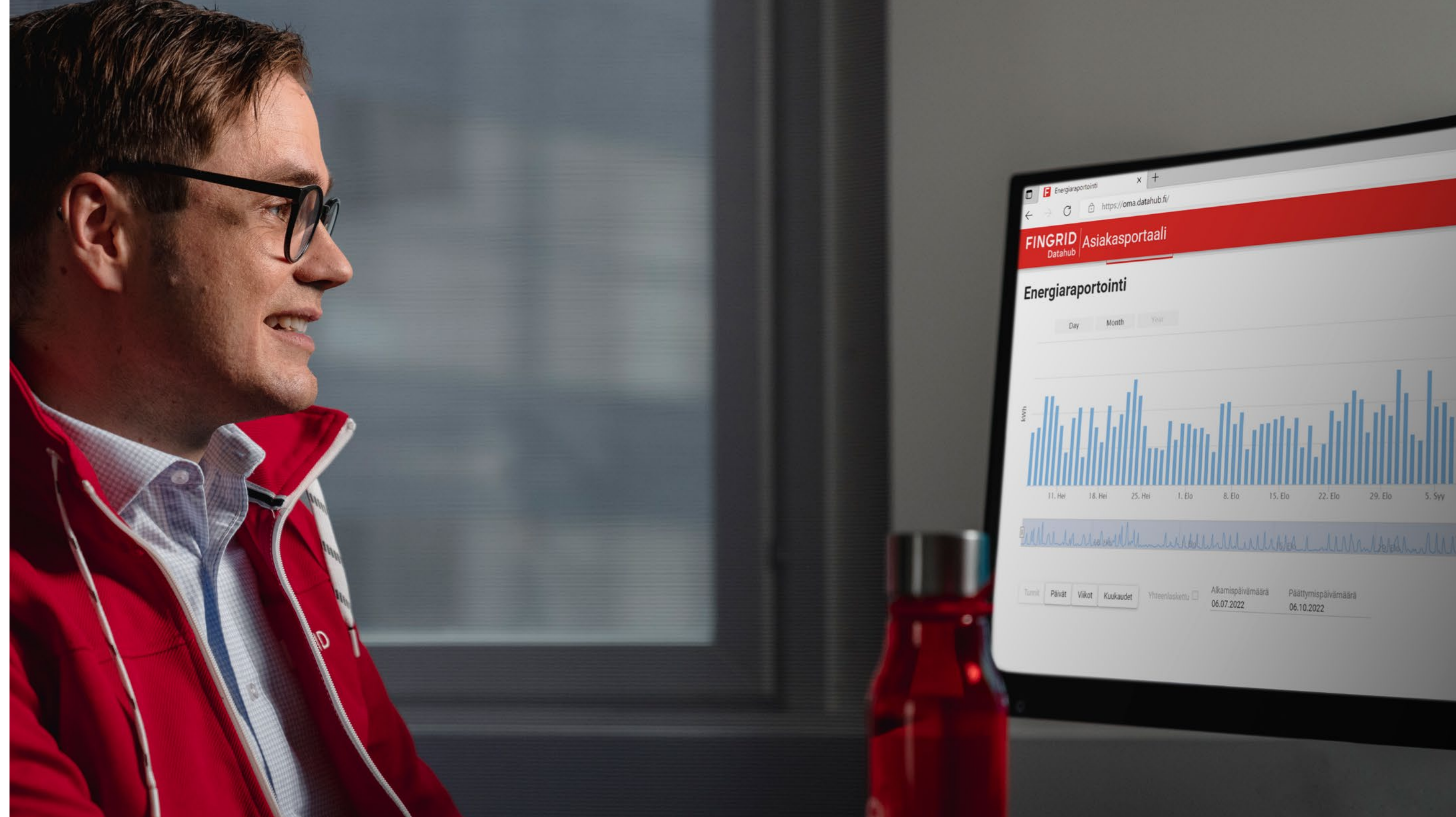
to be completed by 2025 at the latest. During the year under review, Finland's internal transmission connections were reinforced as the Forest Line between central Finland and Oulujoki was completed in record time. The Forest Line will significantly increase the north-south transmission capacity necessary for the Finnish power system and help to keep Finland as a single price area in electricity trading. After the Forest Line, we will build more north-south transmission capacity by reinforcing the Lake Line connection between Lappeenranta and Oulu. The targeted construction start for the Lake Line is in 2023 and the connection is due for completion in 2026.

At the end of the year under review, Fingrid and the Estonian TSO Elering adopted transmission rights for the Finland-Estonia border in order to support the operations of the wholesale electricity markets. Transmission rights give market operators new opportunities to hedge electricity prices in long-term electricity trade.

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On 21 February 2022, Finland introduced a centralised information exchange system for the retail market of electricity, called Datahub, which stores, in accordance with the Electricity Market Act, data from some 3.8 million electricity accounting points. The Datahub's go-live and the successful integration of different systems and processes required considerable work not only from Fingrid but also from several electricity market operators. Datahub was further developed during the year to take customer needs into consideration, and in March a customer portal that allows consumers to view their own consumption data was opened. In December, Datahub was successfully upgraded to version 2.0, which enables, among other things, support for the 15-minute measurement period and imbalance settlement, and energy communities. The Datahub platform enables the development of new services to support the electricity retail markets.



Electricity market	2022	2021	2020
Day-ahead system price, €/MWh	135.86	62.31	10.93
Area price Finland, average €/MWh	154.03	72.34	28.02
Congestion income between Finland and central Sweden (SE3), €M	329.6	76.7	70.6
Congestion hours between Finland and central Sweden (SE3), %	42.8	28.5	44.5
Congestion income between Finland and northern Sweden (SE1), €M	1221.5	365.4	174.8
Congestion hours between Finland and northern Sweden (SE1), %	73.3	59.6	62.8
Congestion income between Finland and Estonia, M€	334.7	125.5	48.1
Congestion hours between Finland and Estonia, %	38.2	40.3	32.9

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### Developing the electricity market

Fingrid's mission is to develop the electricity market. In order for the power system to operate as much on market terms as possible, it is important that the electricity market and the technical system characteristics are optimally in synch. The market access of versatile and flexible resources as well as diverse trading opportunities close to the electricity consumption hour promote the efficient operation of the electricity market and the market entry of new players.

The growing share of variable renewable capacity is a welcome addition to the power system, but at the same time, it is a challenge to the functioning of the system and demands new operating models for the electricity market. The market environment and its rules must be developed in order to successfully connect all renewable capacity, such as wind power, to the electricity system, making it increasingly cleaner.

Fingrid has several ongoing projects for developing the electricity market, and investments required to develop the electricity markets are growing strongly. Key projects include the Nordic Balancing Model and transmission capacity calculation development. Moreover, a wide array of development work is under way to promote the market entry of flexible resources that support the functionality of the electricity system.

### The Nordic Balancing Model progressed on a broad front in 2022

A key task of TSOs is the real-time balancing of electricity production and consumption, in other words balance management. The Nordic Balancing Model (NBM) modifies and automates the way in which the power system is balanced in the Nordic synchronous area, which consists of Finland, Sweden, Norway, and eastern Denmark. The NBM develops new Nordic marketplaces for automatic and manual frequency restoration reserves

(aFRR and mFRR) to enable the TSOs to procure reserve energy necessary for balance management. The NBM also helps the Nordic TSOs to prepare for joining the pan-European reserve marketplaces currently under development.

In addition to the development of reserve energy marketplaces, there will be other significant updates to the electricity market when the Nordic countries adopt a 15-minute Imbalance Settlement Period (ISP). The 15-minute Imbalance Settlement Period go-live in Finland has been confirmed, based on a decision by the Energy Authority, to be 22 May 2023. Initially, the go-live will mean processing the electricity grid's measurement data and settling imbalances in 15-minute time periods.

The 15-minute Imbalance Settlement Period is a requirement for 15-minute products offered on the [electricity exchange](#). Within Finland, the goal is to introduce 15-minute products in the intraday mar-

ket in 2023. In cross-border trade, the aim is to switch to 15-minute products on the intraday market in 2024 and on the day-ahead market in 2025. In the Nordic countries, launching cross-border trading with 15-minute products requires the use of the mFRR's new joint Nordic energy marketplace, which enables the balancing of the electricity system by price area and which will also be based on a 15-minute trading period.

The changes in the electricity system will increase the need for automatically activated reserves in balancing the power system. The availability of aFRRs is ensured on the joint Nordic capacity market. On these markets, some of the cross-border connections are reserved for the use of the aFRRs, if it is profitable with regard to the overall financial situation. The maximum amount of reserved capacity is ten per cent of the available cross-border transmission capacity. Performing the capacity calculation in line with European regulation is a prerequisite



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for the reservation. During the year under review, the capacity market for aFRRs initially operated nationally, but at the end of the year, approval for limited cross-border trade from authorities was obtained. Finland joined the Nordic markets and trading began on 24 December 2022. In Finland, unlike other Nordic countries, cross-border transmission capacity can only be allocated against the current transmission direction of the day-ahead electricity market. This means that Fingrid can only purchase aFRR down regulation capacity from other Nordic countries, and correspondingly, other Nordic TSOs can only purchase aFRR up regulation capacity from Finland.

In addition to the market development of aFRRs, the market environment of mFRRs is also being continuously developed to respond the electricity market's rapidly changing operating environment. In Finland, the mFRR capacity market switched from weekly to hourly products on 1 December 2022.

### **The reserve markets improved preparedness for future challenges**

The changing needs of the power system require new properties of the frequency containment reserves (FCR) used in support of the system. In June 2022, Nordic TSOs submitted a proposal for approval by national authorities concerning new technical requirements and dimensioning rules for FCR resources. The aim is for the new requirements to enter into effect in early 2023. At the start of 2022, the FCR resources were also expanded, as a Frequency Containment Reserve for Disturbances (FCR-D) product for down-regulation was introduced to prepare for the power system's over-frequency disturbances. Down-regulation refers to a decrease in generation or increase in consumption. The need for a new down-regulation product can occur, for instance, in a situation in which a fault occurs in the cross-border transmission connection when exporting a large quantity of electricity from the Nordic countries to continental Europe. The disturbance reserves intended for

down-regulation prevent, in the situations in question, disturbances caused by over-frequency in the Nordic power system. Overfrequency can cause problems, for example, for power plants' and industry's large rotating electrical equipment.

Other development measures have also been initiated to address the scarcity of down-regulating resources. One such example is the pilot project announced in November 2022 aimed at wind power producers concerning participating in the reserve market. In addition, the mFRR capacity market will introduce a new down-regulating product in January 2023.

The significance of ensuring the availability of aFRRs is highlighted as renewable and variable forms of electricity generation account for an ever-increasing share of total production. During the year under review, the matter was advanced, for instance, by developing independent aggregation models for the reserve markets. As the outcome of the work, rules

for the aFRR capacity market concerning independent aggregation were drawn up and will enter into force in May 2023. In addition, aFRR trading from Estonia to Finland was continued during the year under review. The participation of Estonian market parties increases the offering and competition in the aFRR hourly market in Finland.

### **Flow-based capacity calculation methodology is used to improve the effectiveness of transmission capacity allocation**

A flow-based capacity calculation methodology will be adopted in the Nordic countries to improve the allocation of transmission capacity available to the markets. The development of the methodology entered a new phase in March 2022, with the start of parallel operation to compare the market impacts of the new and current capacity calculation method. The responsibility for calculating capacity lies with the [Nordic Regional Coordination Center \(Nordic RCC\)](#), which is located in Copenhagen and is jointly

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owned by the Nordic TSOs. Each TSO submits the input data required for the calculation to the Nordic RCC. The new methodology will be adopted at the earliest in the first quarter of 2024.

### **Making use of intraday markets during cross-border transmission disturbances**

A new operating model that uses the intraday markets was piloted in the management of transmissions during disturbances in cross-border transmission connections. The pilot will clarify the opportunities to correct the regional surplus resulting from the loss of the exporting connection with intraday market sales. The pilot will continue until 26 November 2023.

### **Sector integration advances**

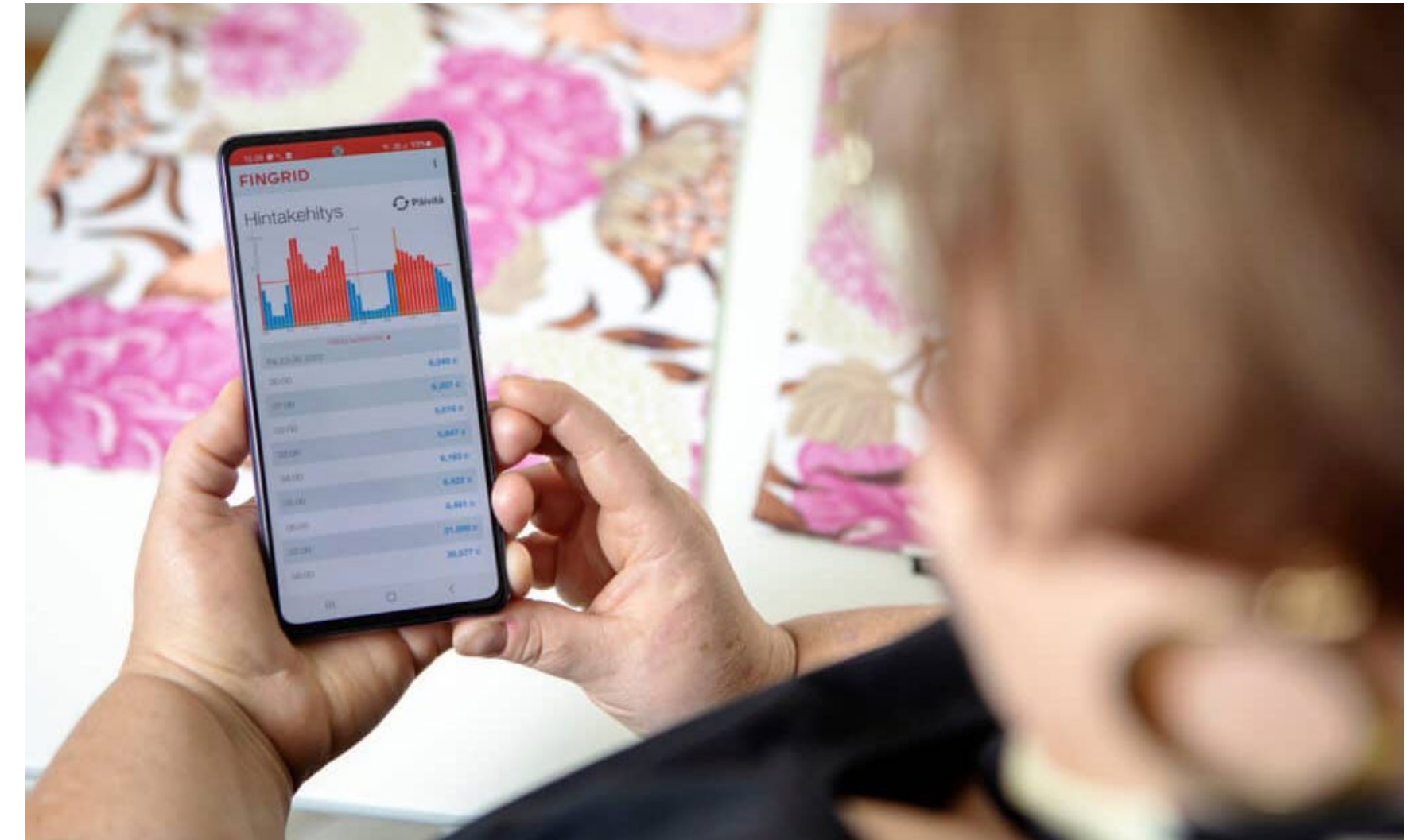
Sector integration refers to the integration of the energy sectors and the energy vectors, both on the system level and on the end-user level. The energy sectors consist of traffic, built-up environment

and the industry, while the energy vectors consist of electricity, heat and gas. Sector integration can help to achieve a clean energy system both resource- and cost-effectively through the capability to process energy in the most optimal form in each stage of production, transfers and consumption, such as electricity, heat, gas or liquid. The joint strategy of Nordic TSOs concerning wind power and sector integration was also completed during the year.

### **Flexibility markets are needed**

As the energy transformation accelerates, new market-based solutions are needed to maintain the power system. Flexible response is necessary both for balancing the consumption and production and to support efficient use of the grid infrastructure. Fingrid's development of flexibility market solutions has progressed within, among other projects, the [INTERRFACE](#) and [OneNet](#) projects funded from the EU's Horizon Europe research programme.

[Read more in the research and development section.](#)



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## Case

### Which reserve, which markets?

Electricity cannot essentially be stored very efficiently, and electricity production must be equal to electricity consumption at all times. Electricity is balanced through the use of reserves. Reserves are power plants and consumption resources which adjust their electric power according to the need of the power system. Electricity storage is thus replaced by an increase in power, which in turn is offset by a

decrease in power during lower periods of consumption. This enables maintaining a balance of electricity production and consumption.

The reserve markets help assure electricity system users that Fingrid will cost-effectively maintain a continuous balance in the electricity system. The reserve market includes both small and large players, whose operations vary from large-scale industrial facilities to smaller surplus electricity producers.

## Case

### What is the Datahub?

The Datahub, a subsidiary of Fingrid that launched its operations at the start of 2022, compiles information on electricity accounting points into one system. Approximately 80 DSOs in charge of electricity transmission and the same number of electricity suppliers have started using the Datahub, i.e. a centralised information exchange system.

The shared system improves and speeds up the service received by electricity consumers, with the system providing secure, fair and up-to-date access to data for all authorised parties. This means faster services, for instance, when changing electricity supplier. Previously, information related to electricity accounting points was fragmented in the systems of various electricity suppliers and DSOs.



Image. The Datahub launched customer service in spring 2022. Jenni B, Nelli and Jenni M have been closely involved in customer service work.

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## Personnel

The operating environment of Fingrid's personnel has changed quite a bit in recent years, and 2022 was no exception. The energy transformation and the unprecedented main grid construction programme that supports it, as well as the requirements for the development of the electricity market, have increased the workload. The modernisation of the electricity system calls not only for more manpower, but also for entirely new competence, particularly for managing weather-dependent electricity production in the power system.

As the workload grows, the company has focussed efforts on both improving supervisors leadership skills and recruiting dozens of new experts. In addition to the increased workload, the risk to person-

nel's mental load also grew with Russia's war of aggression against Ukraine. The war itself is frighteningly close, but its repercussions on the energy sector have also been considerable, and they have changed the nature of Fingrid's work towards more basic tasks and risk management. The meaningfulness of the work is even clearer to personnel. The exceptional geopolitical situation has, however, made us bolder and forced us to seek new solutions to the challenges of the energy transformation.

Fingrid strives to prevent serious illness by focusing on essential core tasks during rushes, fostering a unifying "no one left behind" corporate culture, good supervisory work and securing proactive occupational health care. Fingrid's HR

strategy focuses on four goals to ensure personnel's well-being: Fostering the Fingrid culture, supporting multi-expertise, bold leadership and the best employer reputation in the energy sector.



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PERSONNEL BY LOCATION	2022	2021	2020
Helsinki	410	382	346
Hämeenlinna	21	18	17
Oulu	18	16	14
Jyväskylä	17	13	14
Rovaniemi	4	4	2
Vaasa	6	4	3
Varkaus	13	14	12



NUMBER OF EMPLOYEES	2022	Men	Women	2021	Men	Women	2020	Men	Women
Permanent	439	332	107	400	301	99	363	281	82
	90%	76%	24%	89%	75%	25%	89%	77%	23%
Temporary	50	33	17	51	31	20	45	32	13
	10%	66%	34%	11%	61%	39%	11%	71%	29%
Full-time	451	344	107	418	316	102	376	292	84
	92%	76%	24%	93%	76%	24%	92%	78%	22%
Part-time	38	21	17	33	16	17	32	21	11
	8%	55%	45%	7%	48%	52%	8%	66%	34%
Total	489	365	124	451	332	119	408	313	95
Average	480			440			400		

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*With good energy. Together.*

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### Fingrid culture

Our values guide the work of our professional community and lay a solid foundation for our corporate culture. Fingrid's intent, in line with its values, is an open, fair, efficient and responsible work community. For Fingrid's employees, that means being at the leading edge of change and preparing for the future with our world-class expertise, creating opportunities to develop and grow within the company. The members of the work community are responsible result achievers and go-getting team players.

Our values say a lot about our operating methods, which are aimed at achieving a team culture, in particular. In a team culture, cooperation, listening to others and helping one another are highlighted. It is important to understand the issues and developments, as well as their impacts. A systematic approach and responsibility are important because of the company's societal impact, which is why the company is careful to have clear processes and operating guidelines in place.

For years now, Fingrid has consciously strived to build its corporate culture and promote openness, community, renewal and efficiency. The goal has been to promote the target culture through various management means.

The matrix organisation was built to increase cooperation. Discussions with personnel are held on values and shared ways of working, most recently at the spring 2022 coaching day. How employees function in the work community has been integrated into the specialist career criteria. The assessment of every Fingrid employee's performance is based on reaching strategic targets and how they function in the work community. Feedback is also collected from personnel and forms the basis for decision making. In recruitment, the willingness to learn new things and to renew are highlighted. Personnel are offered training and joint recreational activities.

A flat hierarchy also contributes to a sense of community. Daily interaction in

the work community is uncomplicated, and most employees participate in joint events. During the year under review, a coaching day was organised for all personnel under the theme "The Fingrid culture", and at the company's Christmas party, the attendees celebrated diversity in Finland. The President & CEO held his regular briefings during the year under review.

The joint events of various units and teams are also important, and the aim is often for those occasions to have a more informal programme. We strive to celebrate both small and large occasions and successes over coffee and cake.

A corporate culture can be led, but in reality, it is built on competent and inspired Fingrid employees who genuinely care for one another. The company has a lot of long-standing and dedicated employees who are willing to go the extra mile in tight situations. And people really put in extra effort during the year under review, as all of Europe faced an energy crisis.

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*Fingrid's intent, in line with its values, is an open, fair, efficient and responsible work community.*

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### Multi-skilled Fingrid

As technology and the entire operating environment evolve, working life changes continuously, which means people must have the ability to adapt, initiative and the drive to learn new things. The energy transformation challenges the company, which must take care of its constantly changing sector expertise, service competence and success factors.

Fingrid responds to changes by offering its employees opportunities to develop and grow their competence. The approach of securing expertise as a strategic choice improves the quality of personnel planning and helps the company to better prepare for future needs.

The aim is to secure competence by offering personnel internal and external training, and through job rotation and switching up duties within teams. Once a year the company carries out unit-specific competence surveys with the objective of ensuring the critical competence required by the strategy.

Skill development needs are agreed on in performance reviews, which are held twice a year with each permanent Fingrid employee. The employee, together with their supervisor, is responsible for the implementation of the measures agreed on in the development plan.

Fingrid's aim is to support the diversification of competence along two different career paths: The supervisor career path focuses on the diverse development of people leadership and management practices; while the specialist career path is based on developing as a specialist on a six-tier career path from planner to lead specialist.

In 2022, Fingrid Academy offered induction events, the use of office software for training, coaching for supervisors, project management coaching, language training, and unit-specific coaching mainly related to change, work community and emotional skills. Specialists also had access to the Loikka training programme for increasing communication and engagement skills,

and to customer service coaching on the company's services and communicating on them.

The company invests a significant sum annually to develop both the work com-

munity and the personal development of each employee. In 2022, each Fingrid employee received an average of 5 (3) days of training, and the training costs amounted to EUR 1.4 (1.0) million.

#### EDUCATION LEVEL OF PERMANENT PERSONNEL

	2022	2021	2020
Basic and secondary education	21	22	20
Lowest level of tertiary education	31	32	31
Bachelor's degree	146	134	126
Master's degree	231	203	176
Post-graduate degree	10	9	10

#### TRAINING HOURS BY EMPLOYEE GROUP AND GENDER

	2022	2021	2020
Training hours, women	26	23	31
Training hours, men	31	21	23
Training hours, total	16,942	9,609	9,832
Training hours per person	31	21	25
Training days per person	5	3	3

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### **Bold management**

The core of the company's work community management is in the bold supervisory work, in which the supervisor is responsible for inspiring and encouraging their team members to continuously develop themselves and improve their performance. Management within the company is strongly based on the company's values, strategy and Code of Conduct. Management and supervisory work aims to promote collaboration and maintain personnel's motivation. Healthy, motivated and committed personnel are productive and renewing.

Supervisory work emphasises a bold coaching style of management, which means managing results and targets, trusting in people, supporting people when they face challenges and boldly addressing shortcomings. Supervisors give specialists considerable independent responsibility and ensure that they understand their duties and the related targets. Upholding trust is among the most important tasks of HR management.

Specialists have the opportunity to do their work autonomously. At Fingrid, specialist positions come with an inherent responsibility for the work and for developing it, and for strengthening one's own skills. In this sense, all of the employees are the CEOs of their own work. Being the CEO of one's own work involves responsibility and freedom, but also helping others and working as a team.

Supervisors are trained for their responsible role regularly each year through separate supervisor development days and the quarterly Info & Inspiration briefings. Supervisor coaching in 2022 focused on strategic management and productivity. The aim is to ensure consistent practices and guidelines through joint training and discussions.

Fingrid regularly takes part in HR management comparison surveys as a means of tracking best practices and further developing operations. During the year under review, we carried out a PeoplePower personnel survey, in which we received a AAA rating for how we manage our work community.





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### Best employer reputation in the energy sector

A positive employer image is important to attract competent personnel and ensure resources. In recent years, Finland has experienced a shortage of skilled workforce, which has hampered recruitment in many companies.

Fingrid has had difficulty at times recruiting technology professionals for roles that require special skills. For that reason, the company works hard to enhance its employer image and participates in student events at technical colleges and in recruitment fairs every year. In 2022, the company's visual presentation used in recruiting was revamped, the recruitment software was made more user friendly, and a trainee programme in balance services was launched. Fingrid also takes part in Women-in-Tech Finland events, the aim of which is to encourage more women to consider careers in technical fields.

### FINGRID'S EMPLOYER PROMISE

#### With good energy. Together.

Fingrid is a community of experts that maintains and safeguards Finland's electricity system and in this way promotes a well-functioning society as a whole. We are building a new type of carbon-neutral energy system in Finland. Our work community is open and supportive and offers excellent possibilities for personal development and further training. We promise that Fingrid will remain one of Finland's best places to work going forward.

The energy sector offers interesting jobs, and along with the energy transformation, there has been growing interest in energy and electricity, which has somewhat alleviated the recruiting situation. The energy sector nevertheless continues to face a shortage of experts. Fortunately for Fingrid, the company has so far managed

to secure competent professionals for its vacant positions.

Interesting and independent work duties, meaningful work, opportunities to engage and influence, as well as a strong community spirit make Fingrid one of Finland's best places to work.

## Case

### Alumni Day

*Once a year, Fingrid welcomes its former employees back to the Käpylä office for Alumni Day. Fingrid alumni who retired or left the company to pursue new challenges had the opportunity to re-acquaint themselves with their former workplace on 30 August 2022.*

*At the intimate event, a welcome speech by CEO Jukka Ruusunen was followed by an alumni speech by Tom Pippingsköld, who shared news from the world from the perspective of his current employer Finnlines. The afternoon gave current and former employees the chance to catch up over good food and drinks.*

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# 07

## Internal control and risk management

### Risk management governance

Fingrid's risks are managed according to the internal control and risk management principles approved by the Board of Directors.

The nature and crucial importance of Fingrid's operations to society are strongly reflected in the company's risk management culture and its development. Fingrid is responsible for the functioning of Finland's power system, which makes it fundamentally a risk management company.

## Fingrid's societal responsibility as the foundation for risk management



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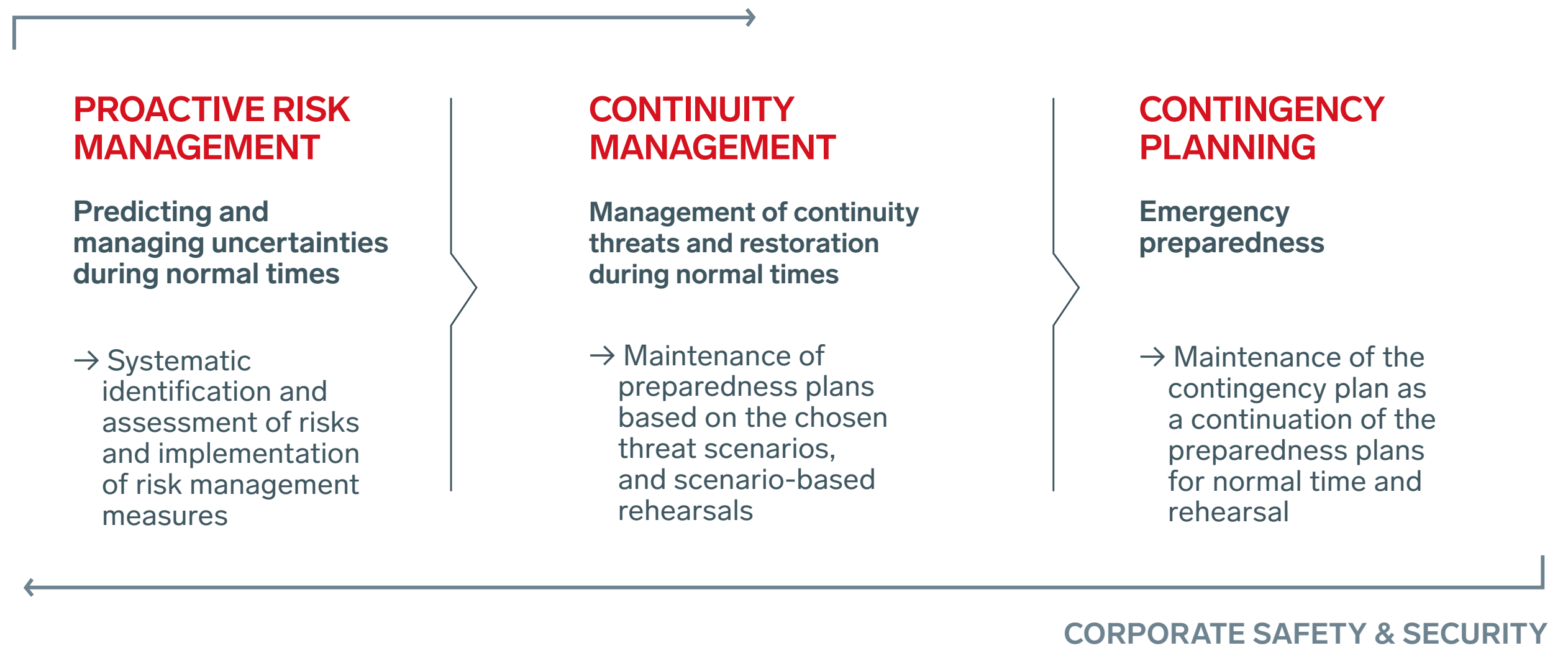
Risk management is planned and governed holistically. The objective is to comprehensively identify, assess and monitor various threats and risks that the company's operations, environment, personnel and property are subjected to and which also have societal implications, and to be protected against them. Ensuring systematic corporate safety & security is a part of risk management.

Continuity management is included in comprehensive risk management. Its objective is to improve the organisation's readiness and to prepare, in the best possible way, for the realisation of various risks and ensure the continuity of operations in such situations.

The planning of comprehensive risk management during normal times contributes to the contingency planning during societal states of emergency as required of a company with duties critical to the national security of supply.

## Key elements of Fingrid's risk management

### COMPREHENSIVE RISK MANAGEMENT



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## Proactive risk management

The company's risks are divided based on significance into strategic and major business risks to be reported to the company's Board of Directors, and operational risks.

Risks are identified and assessed in a consistent manner as part of the company's strategy process and in connection with significant changes affecting operations. Risk management measures are planned and recorded in the risk management system where their implementation is also monitored regularly.

Risks identified in the risk assessment are classified in relation to the risk management measures into one of three groups:

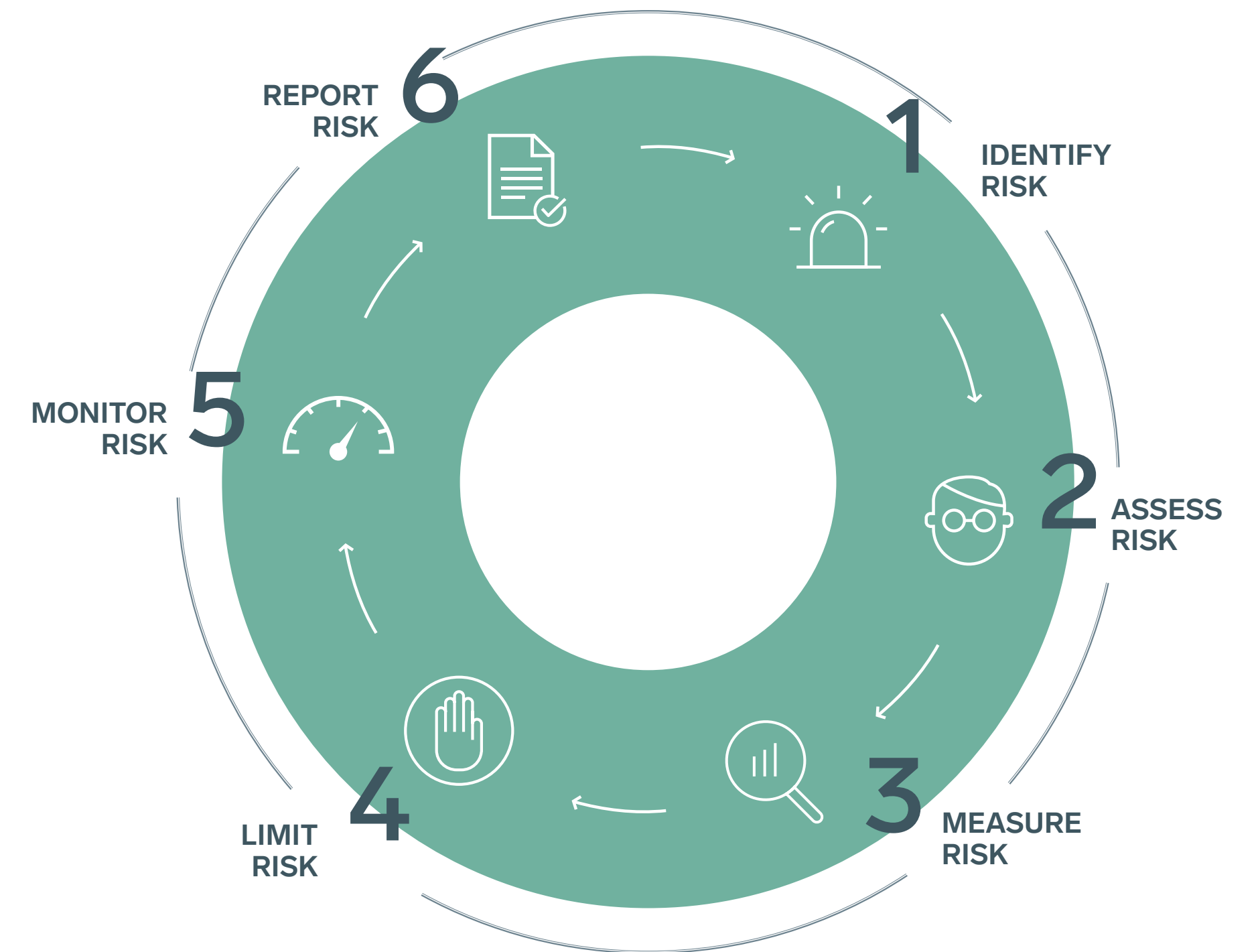
- risk factors that are deemed significant in terms of their impacts and which are to be transferred, if possible, by contracts, insurance, derivatives or similar means,
- risk factors that are deemed moderate in terms of their impacts

and which the company can manage through clear controls and other practical measures, and

- risk factors that are deemed minor in terms of their impacts and whose consequences we can bear, but which require monitoring.

The company's risk management is continuous and aims to engage the entire personnel to identify the risks associated with the company's operations and implement risk management measures as part of their day-to-day work. An overall risk assessment is carried out annually based on an assessment of the operating environment. The planning of risk management measures is part of strategy implementation planning and the day-to-day routines of Fingrid employees. In order to manage the risks with significant impacts, risk management projects with separate responsibility are launched as needed on the company level in order to arrange supplementary measures and monitoring.

## Risk management process



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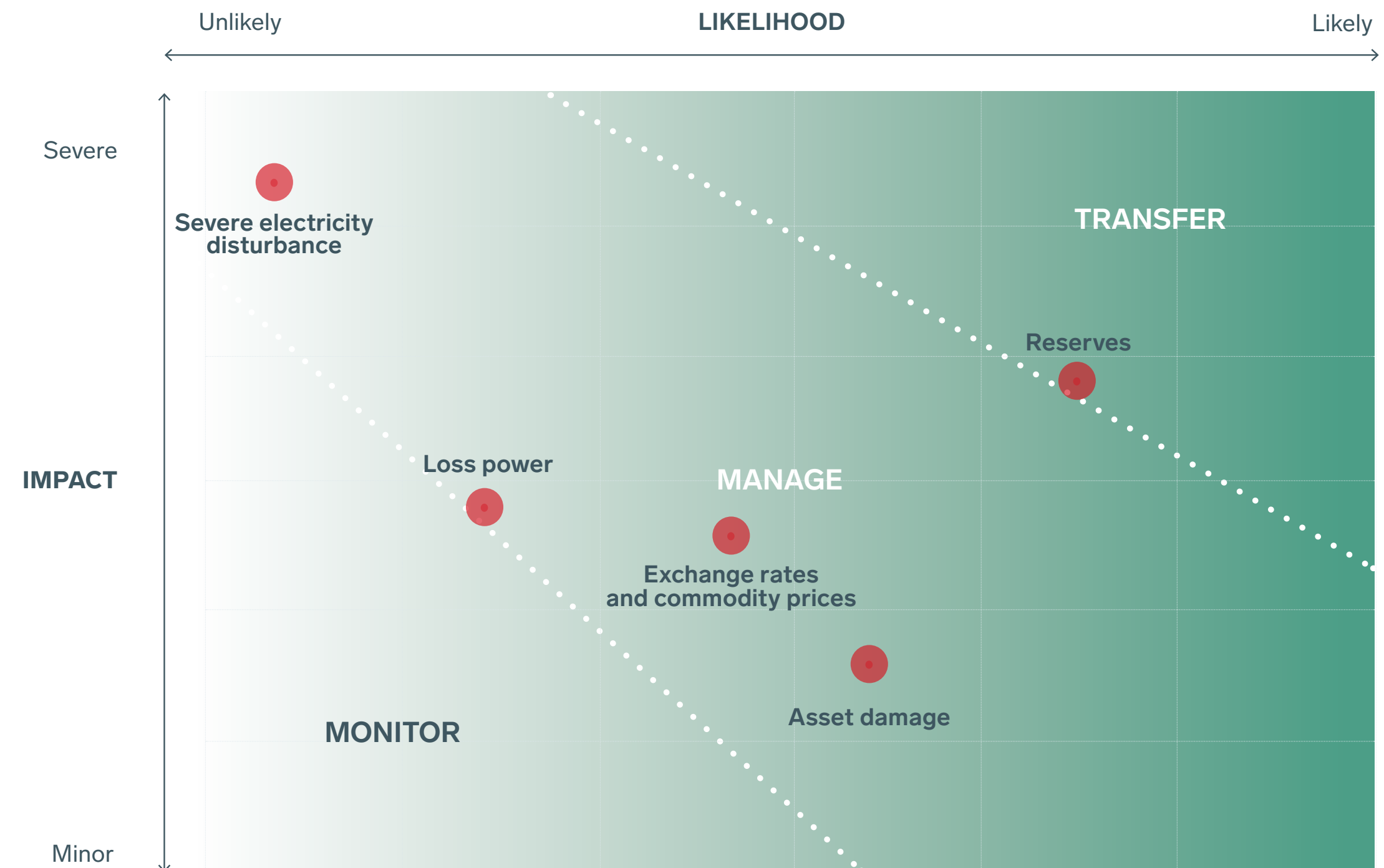
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*The nature and crucial importance of Fingrid's operations to society are strongly reflected in the company's risk management culture and its development.*

Both strategic and financially significant business risks are reported to the company's Board of Directors annually. Risk reporting is supplemented in connection with significant business projects and changes in the operating environment.

Risk matrix



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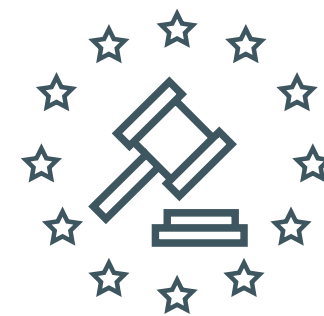
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## Strategic risks



### SEVERE ELECTRICITY DISTURBANCE

- › Regional or Finland-wide main grid disturbance



### SIGNIFICANT NEGATIVE CHANGE IN REGULATION

- › A derailing of business prerequisites
- › A legislative change that brings down shareholder value and credit rating



### DISTORTION IN CORPORATE CULTURE

- › Disregarding sustainability requirements, and misconduct
- › Unprofessional activities under a monopoly

As a general rule, risks are protected against if the costs that the protection entails are justified in relation to the magnitude of the risk. Risks related to major personal injury and environmental damage are always protected against.

Risk protection takes place by reducing the likelihood of an adverse event and/or its impacts on Fingrid and society. The most important protection measures are:

- supporting Fingrid's risk management culture and improving employees' risk awareness,
- comprehensive strategy work and operational planning,
- influencing the regulation of operations,
- limiting risk through contractual arrangements,
- developing technical solutions and operations, and modifying procedures,
- auditing operations and reporting on and monitoring the implementation of measures, and
- derivatives and insurance policies.

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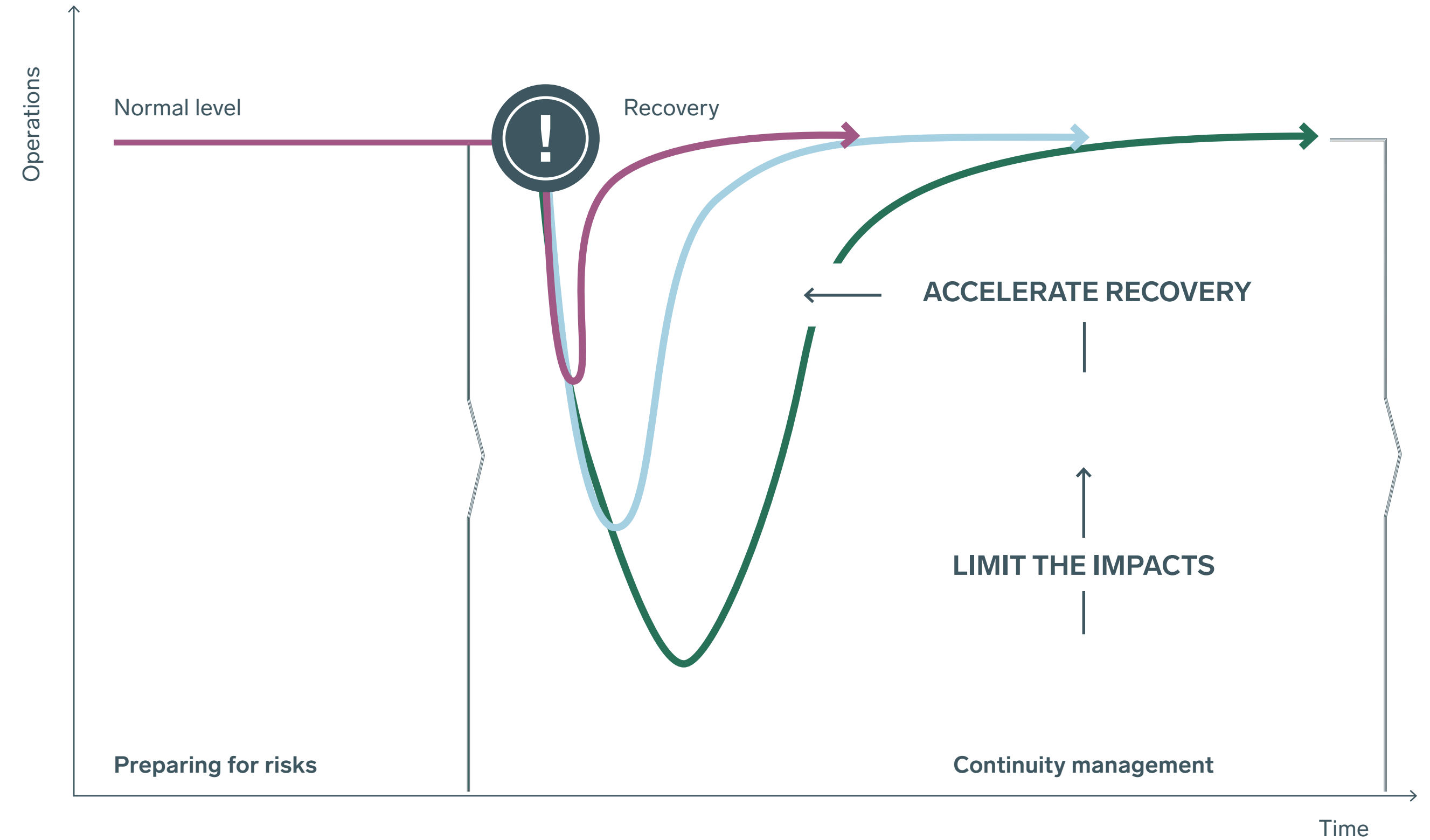
## Continuity management

Continuity management, included in comprehensive risk management, is used to reduce the direct impacts of a realised risk and to accelerate recovery from an adverse event. The planning of continuity management is based on threat scenarios that are created based on a risk and operating environment analysis. The scenarios are used to assess the company's ability to maintain the functionality of critical processes and systems during emergencies when proactive risk management has failed. Among the scenarios that must be analysed are the loss of business premises or IT systems, a prolonged blackout and extreme weather conditions.

The technical and administrative preparedness required by proactive risk management and, in particular, continuity management is guided on the company level by the preparedness policy, and by the system defence plan that the company maintains in accordance with the Finnish Electricity Market Act.

The threat scenarios are decided on as part of the company's strategy. The necessary recovery plans are drawn up and the implementation of the plans is rehearsed for the most significant continuity threats. The rehearsals are planned together with the company's preparedness unit.

### Systematic preparation for managing disturbance situations and diverse scenario-based rehearsals



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## Contingency planning

Fingrid is a company with duties critical to the national security of supply and must be able to continue its operations even when emergency legislation is in force. Fingrid maintains a contingency plan as part of the system defence plan referred to in the Finnish Electricity Market Act. Fingrid is an active participant in the collaboration to develop the energy sector's preparedness activities and participates diversely in the authorities' and Finnish industries' joint Power and District Heat Pool coordinated by the National Emergency Supply Agency. In recent years, the Pool has invested in extensive regional preparedness rehearsals for municipal, rescue and law enforcement authorities, the Finnish defence forces, and energy companies.

## Corporate safety & security

At Fingrid, corporate safety & security and the related preparedness and co-operation with authorities are planned and managed as part of the company's overall risk management. Essential elements of corporate safety & security planning and operations guidance are electrical safety and occupational safety, the safety of properties and premises, [information security](#), personal and travel safety, emergency rescue operations, and internal and external protection against crime related to the company's business.

## Risk controls

Risk management controls that are significant in terms of the company's operations and finances are described and implemented by each process and function to support good governance, overall efficiency, the quality of internal control and operational audits.

The preparation and description of decision-making controls take into account the segregation of duties, as well as existing approval authorisations and other factors that ensure appropriate decision-making. The effectiveness of the existing controls is assessed regularly.

The company complies with the Board-approved insider guidelines and related party principles, as well as separately maintained guidelines concerning conflicts of interest and judicial disqualification.

Risk management at Fingrid is described in more detail on the company's [website](#).



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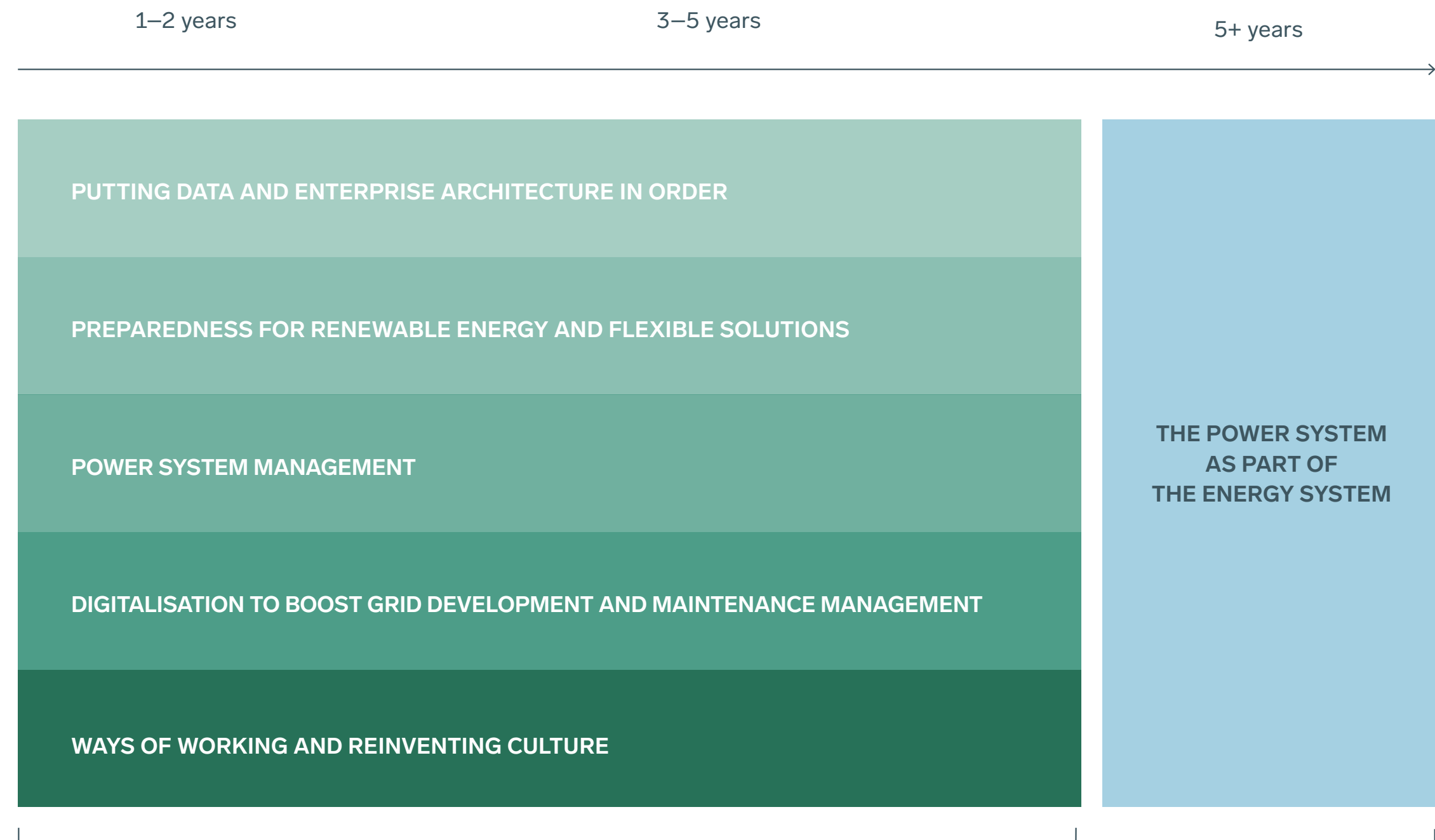
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# 08

## Research and development

Fingrid's research and development activities respond to the challenges of the energy transformation, improve the cost-effectiveness of the operations and increase competence. During the year under review, EUR 2.0 (3.0) million was spent on research and development. Although, measured in euros, there is a downward trend in the volume of R&D activity, there is a growing need for both development and for adopting new solutions at an increasing pace. The focus of R&D in 2022 was on resolving near-term challenges, and part of the development work is so close to operational activities that it is not visible in the R&D portfolio.

### Fingrid's strategic development themes



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During the year under review, the rapid growth of wind power production, the adequacy of electricity and the increase in the cost of reserves needed to balance the power system have contributed to the increasing pressure on R&D to find quick solutions. Although the previously chosen R&D priorities (see figure) very accurately focus on resolving those challenges, the rapid pace of the change challenges us all. The war in Ukraine and its repercussions have also accelerated the already ambitious goal of achieving a carbon-neutral Finland by 2035.

The rapid construction of wind power and connecting it to the electricity system is a key means of reducing carbon dioxide emissions. At the same time, it creates several challenges that need to be resolved. In situations where grid reinforcements cannot keep pace with the construction of wind power, regional flexibility will be required in outage and disturbance situations alongside the grid's transmission capacity. Flexibility will also be needed to balance wind power and other var-

ying forms of production. Other Nordic countries and several other European countries as well are also wrestling with the similar challenges. The growing need for flexibility in the near future has been met, for instance, by developing the balancing capacity market and the reserve capacity market. One example of how the reserve markets are being developed is the reform of the balancing capacity market's [procurement model](#) from weekly to hourly procurement. The change aims to relieve the offering of balancing capacity as procurement needs increase. The growing need for procurement and the scarcity of balancing capacity has been reflected in the [increase in reserve costs](#). A model for predicting the need for frequency restoration reserves (FRR) is being developed in the joint Nordic R&D project. This will make it possible to estimate how much reserve needs to be procured from the capacity markets and thus significantly optimise the procurement of reserves and guarantee a good level of system security.



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To fulfil future flexibility needs, a European flexibility market platform has been developed as part of the INTERRFACE and OneNet projects in order to bring diversified resources to the market and to make them available to network operators. Coordination of TSO's and DSO's flexibility, as well as [the participation of buildings' heat pumps](#) in the markets were developed as part of the INTERRFACE project. The INTERRFACE project was completed at the end of 2022. In the OneNet project, opportunities for network operators to make use of the flexibility market platform have been de-

veloped. Further information on making use of flexibility in network planning and in grid operations can be found in the publications that were completed during the year.

The growth of wind power production and its related new technology also bring new challenges, as the characteristics of converter-connected production differ significantly from the characteristics of traditional synchronous generators. A joint Nordic R&D project was launched during the year in order to resolve the challenges described above.

Fingrid has sought to make broad use of the opportunities offered by digitalisation. One example of this is the extensive, multi-year grid asset condition monitoring [digitalisation project](#), in which a digital monitoring system can be used to reduce the risks related to using substation equipment and thus also outages to customers caused by defects. In 2022, [the start-ups of monitoring systems for switching substations](#) were continued, and current transformers, cable seals and, e.g. a monitoring system for the internal insulation of cable terminals were adopted.

Other examples of R&D projects completed in 2022 are a doctoral dissertation on power system restoration after a nationwide blackout and an [intermediate report](#) on the opportunities that electricity and hydrogen transmission infrastructure enable for the future energy system. The management of the environmental risks associated with substations has been developed previously in a project, that determined how non-toxic, biodegradable ester oils could be used in high-voltage transformers instead of conventional mineral oil. In 2022, Fingrid ordered the first ester-oil-insulated equipment for a substation located on a groundwater deposit. It will be installed in 2023.

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*The focus of R&D in 2022 was on resolving near-term challenges.*

In 2022, Fingrid's personnel performed 14 man-years of work, involving 66 people, towards Fingrid's R&D activities. Close to 44 R&D projects, with outsourced work accounting for 53,5 per cent of that amount, were under way during the year.

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# 09

## Glossary

**Balancing power markets:** The balancing power markets help maintain a balance in real time between electricity production and consumption. Fingrid orders up- or down-regulating power according to the needs of the power system. Up-regulation refers to an increase in generation or reduction in consumption. Down-regulation refers to a decrease in generation or increase in consumption.

**Clean power system (also low-carbon power system):** A power system where electricity generation is based on carbon-free production, such as wind, solar, biomass, hydro or nuclear power.

**Cross-section Central Finland:** Also referred to as Cut P1. The Cross-section Central Finland refers to a trans-section across the transmission lines between northern and southern Finland defined on electrotechnical grounds. The exact future location of the cross-section is affected by factors such as the new production and consumption connecting on the north– south transmission lines.

**Day-ahead market:** The day-ahead market refers to an electricity marketplace where electricity is sold and purchased for different hours of the following day.



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**Demand-side management/demand response:** Demand-side management means reducing the consumption of electricity or transferring it to another point in time based on price. Electricity consumption is reduced when the price in the electricity market is high.

**Electricity market operators:** Electricity producers, retailers and consumers – including households that participate in the electricity market.

**ENTSO-E:** (European Network of Transmission System Operators for Electricity) is a cooperation organisation of European transmission system operators (TSO). Its task is to develop the European Union's electricity markets and to improve cooperation between TSOs. The organisation is headquartered in Brussels, Belgium.

**eSett:** A company that carries out the imbalance settlement of the Nordic electricity market parties' actual electricity consumption and production. The company, eSett Oy, is owned equally by the Nordic TSOs Energinet, Fingrid, Svenska Kraftnät, and Statnett.

**ESG framework:** Corporate responsibility related to a company's environmental (E), social (S) and corporate governance (G) impacts.

**The European Green Deal:** The goal is to transform the EU into a modern, resource-efficient and competitive economy, which will no longer cause net emissions of greenhouse gases by 2050, economic growth has been decoupled from resource use, and no person and no place will be left behind.

**Fit for 55:** The European Commission's legislative package published in 2021. It aims for a 55% reduction in greenhouse gas emissions in the EU from 1990 levels by 2030. The newly proposed legislative package provides the means to upgrade the current EU reduction target of 40% to the level proposed by the Commission in September 2020.

**GRI (Global Reporting Initiative):** Corporate sustainability reporting standards in wide use throughout the world.

**Horizon2020:** An international project financed by the EU Commission. The project aims at developing a new kind of platform for electricity market flexibility services and related processes.

**Imbalance power:** For the electricity consumer, imbalance power is the difference between the electricity purchased and actual electricity consumption. For the electricity producer, it refers to the difference between the electricity sold and the actual electricity produced.

**INTERRFACE project:** The European INTERRFACE flexibility market platform project is one of the research projects financed under the EU's extensive Horizon 2020 programme. Fingrid and Elering are involved in the project, which seeks solutions for flexible market platforms that enable the utilisation of distributed decentralised resources for both maintaining power system balance and the needs of distribution system operators and balance responsible parties.

**Invasive species:** An invasive species is a species that has spread beyond its natural range, crossing its natural dispersal barrier through human intervention, either unintentionally or intentionally. Invasive species classified as harmful have been found to pose a threat to the original ecosystem and biodiversity.

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**ITAMS:** International Transmission Asset Management Study. ITAMS evaluates the efficiency of TSOs' asset management. The study has been carried out five times, and Fingrid has placed at the top each time. Fingrid focusses especially on making use of digitalisation, which is one factor behind the good success in the study.

**ITOMS:** International Transmission Operations & Maintenance Study. This study looks into the efficiency of maintenance based on criteria such as maintenance costs and disturbance statistics. The goal is to save costs and improve the system security. Fingrid has often placed close to the top and has received Top Performer nominations both for the maintenance of transmission lines and substations.

**Load Frequency Control:** Load Frequency Control is an integral part of the implementation of the new Nordic Balancing Model based on Area Control Error (ACE). It calculates ACE, i.e. the difference between electricity transmission measured at Finland's borders and electricity transmission according to market results, in real time.

**Lost time injury frequency (LTIF):** Number of occupational accidents that led to at least one day of inability to work per million completed work hours.

**Materiality assessment:** The materiality assessment is used to identify topics that are the most important for Fingrid's primary operations and corporate responsibility. It includes an assessment of the substantial financial, social and environmental impacts of Fingrid's operations, as well as of the impacts on stakeholders' decision-making.

**Net Promoter Score (NPS):** The percentage of promoters, i.e. those willing to recommend the company, minus that of detractors. Example: if 45% are promoters and 6% are detractors, the NPS is  $45\% - 6\% = 38\%$ . The maximum score is 100%.

**Network codes:** The goals of the EU's third energy package adopted in July 2009 for an internal electricity market in the European Union. The main players preparing the network codes are the European Commission, energy regulators through their cooperation agency ACER, and European transmission system operators through their cooperation organisation ENTSO-E.

**Power exchange:** A public marketplace for selling and purchasing electricity.

**Reserve markets:** The amount of electricity generated and the amount consumed must be equal at any given moment. The electricity market parties draw up an advance plan for balancing their consumption and production, but the balancing of deviations during each hour of operation requires reserves, which Fingrid acquires from the markets it maintains.

**SDG (Sustainable Development Goals):** In 2015, the UN member states agreed on the Agenda 2030 for sustainable development. It includes 17 global sustainable development goals to be achieved by 2030.

**Security of supply:** Security of supply refers to how reliable the electricity supply is.

# Fingrid delivers. Responsibly.

For more detailed information on Fingrid and the contact persons for various functions, see the company's website at [www.fingrid.fi](http://www.fingrid.fi)

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