Prospects for future electricity production and consumption

FINGRID'S FORECAST Q3/2025

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Finland’s competitiveness as an investment destination for power-intensive industries is crucial for the growth of electricity consumption. **3**

The ability to increase the production of clean and affordable electricity is an important competitive advantage for Finland. **8**

Disclaimer

01

Planning basis

Energy production and consumption are undergoing a transition from conventional, primarily combustion-based energy toward increasing utilization of zero-emission electricity. The demand for clean electricity is expected to grow rapidly across Europe. Finland's large and competitive renewable electricity production potential offers excellent conditions to succeed in this transition.

Fingrid sees this first-hand: connection inquiries for renewable electricity production have been increasing rapidly for several years, and the total capacity of the electricity production connection enquiries received by Fingrid exceeds 400 GW. Enquiries related to increasing electricity consumption amount to approximately 70 gigawatts. Some of these projects have already reached the investment decision and construction phases. For example, in district heating and industrial sectors, the total capacity of electric boilers used for heat and steam production is expected to grow to over 3 gigawatts in the coming years due to investment decisions already made. Additionally, several data centers are under construction in Finland.

The majority of electricity demand connection inquiries received by Fingrid consist of industrial projects, such as data centers, hydrogen and e-fuel projects, and other power-intensive industries. Reliable electricity networks are among the most important national competitiveness factors for industrial projects requiring clean energy. Therefore, long-term main grid planning must also account for the realisation of high electricity consumption and production potentials.

Electricity consumption growth in Finland depends particularly on the increase in industrial electricity use, which in turn relies on Finland's ability to attract investments in electricity-intensive industries. Thus, Finland's competitiveness plays a decisive role in electricity consumption growth. The forecast presented in this document is part of the 2025 main grid development plan and consists of two scenarios,

differentiated by Finland's ability to compete for electricity-intensive industrial investments. The higher growth scenario, **"Excellent Competitiveness",** serves as the basis for grid planning to ensure the planned grid can support investments in Finland. It describes a situation where Finland is highly competitive in electricity-intensive industrial projects and succeeds in attracting significant investments. The lower growth scenario, **"Moderate Competitiveness",** reflects a level of competitiveness where only demand projects already under construction and a portion of those with a connection agreement but no investment decision contribute to industrial electricity consumption growth. The differences between the scenarios reflect the uncertainty associated with growth.

Both scenarios account for expected growth in household, service, and transport sector electricity consumption. In the excellent competitiveness scenario, the electrification of district heating is stronger due to better availability of waste heat from data centers, hydrogen plants, and other industries. This enables greater use of heat pumps and a higher share of electricity in district heating production.

The electricity production growth forecast is based on the expected increase in electricity consumption in Finland, as well as the balance between electricity production and consumption in the Baltic Sea region, Central, and Western Europe, as assessed through electricity market modeling. In both scenarios, the production growth includes projects that have not yet reached investment decision or connection agreement stages. The forecast does not include normal annual consumption variations due to weather, industrial cycles, or temporary changes in electricity prices.

Several uncertainties affect the realization of the forecasts, influencing either the progress of the clean transition, Finland's competitiveness in the transition, or both. These uncertainties include, among others, stability and predictability of the operating environment, energy and climate policy, geopolitics, regulation, permitting, taxation, demand outlooks for electricity-intensive sectors, financing conditions, and cost developments of energy production and storage technologies. Particularly significant are the impacts of these factors on Finland's position as a destination for electricity-intensive industrial investments and the growth potential and price competitiveness of Finnish wind power compared to European and global competitors. A substantial portion of the electricity consumption growth forecasted in the excellent competitiveness scenario relies on refining electricity produced by onshore wind into export products and services.

In the first half of 2025, Finland published draft laws on increasing the electricity tax for data centers, and, under the Land Use Act, on a distance requirement for wind power construction. At the time of preparing the forecasts, Fingrid does not have information on the final form of these draft laws or a clear view of their eventual impacts.

Achieving Finland's climate goals and enabling clean transition investments that generate economic prosperity require significant transmission grid construction and development. Fingrid endeavours to implement its grid investment program and attempts to take measures that improve the connectivity of new projects and enhance grid utilization in order to enable the development described in the forecast. Realizing the forecasted growth also demands more from system management, increasing system maintenance costs to ensure the availability of affordable, clean, and reliable electricity. Maintaining opportunities to develop the main grid in the future is important. Smooth permit processes for transmission line projects and predictable regulation that enables grid investments play a key role in this.

02

Prospects for future electricity consumption

Figure 1 illustrates the projected development of electricity consumption in Finland between 2025-2035. Electricity consumption is expected to increase in industry, heating, and transport. The majority of the growth included in the forecast is based on electrification of industrial processes, data centers, and the production of hydrogen and hydrogen-based derivatives. Connection inquiries to Fingrid regarding electricity consumption have increased significantly, and if all inquiries were fully realized, Finland's electricity consumption would exceed 400 terawatt-hours. The forecast assumes a considerably more moderate development, with electricity consumption rising to 103–123 terawatt-hours by 2030 and further to 104–159 terawatt-hours by 2035.

Electricity consumption in industry is expected to grow significantly, driven by multiple factors such as data centers, hydrogen and e-fuel production, the metal industry, and the replacement of fossil fuels with electricity in heat and steam generation. Overall, industrial electricity consumption

Development of electricity consumption (TWh)

Fingrid estimate, September 2025.

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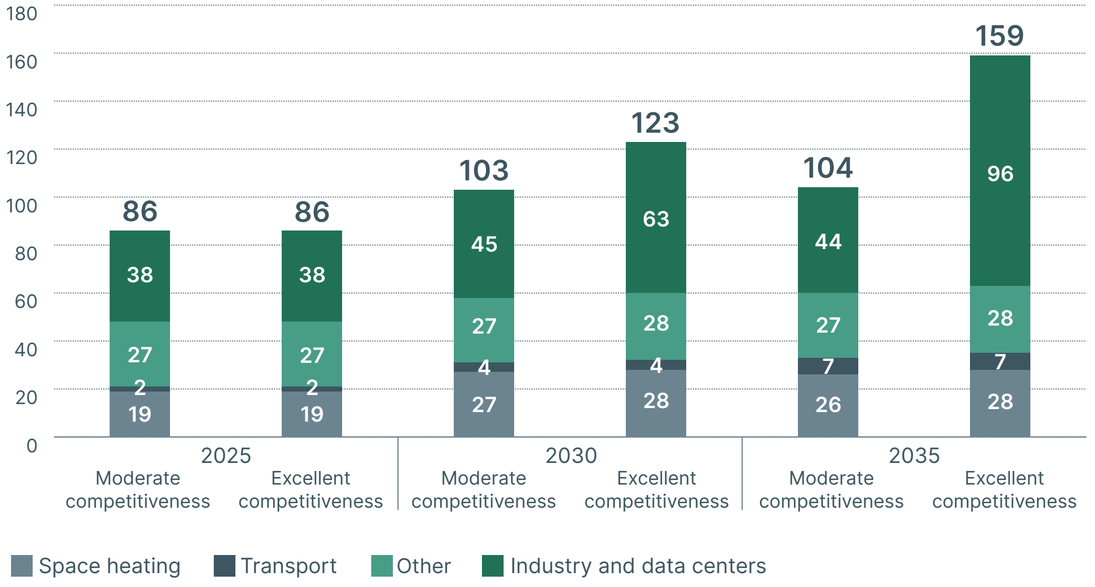

FIGURE 1 Forecasted development of electricity consumption in Finland from 2025 to 2035.

is projected to increase from the current level of under 40 TWh to 45–63 TWh by 2030, and further to 44–96 TWh by 2035. In this report, data centers are included within the industrial consumption figures. In the excellent competitiveness scenario, industrial electricity consumption continues to grow throughout the 10-year forecast period due to new investments. In the moderate competitiveness scenario, growth slows down around 2030 as ongoing projects and those with grid connection agreements are completed, and no new major consumption-driving investments are made.

Electricity consumption for **space heating** is forecasted to rise to approximately 26–28 TWh. This growth is particularly driven by electrified district heating, where investments in electric boilers have surged in recent years. As a result, the capacity of electric boilers used in district heating is expected to increase significantly in the coming years. Additionally, the use of heat pumps that recover waste heat from industry and data centers is expanding in district heating production. In the excellent competitiveness scenario, it is assumed that more waste heat is available, allowing heat pumps to replace fuel-based heat production. This increases the electrification rate of district heating beyond what would be achieved with a system relying solely on electric boilers and fuels. On-site electric heating is expected to remain relatively stable at around 17 TWh, as improvements in energy efficiency and the replacement of direct electric heating with heat pumps offset the relative growth in electricity-based heating methods. However, on-site electric heating will continue to have a significant impact on electricity consumption peaks during cold winter days.

In addition to district heating, the number of electric boilers is also increasing in industry. In this report, industrial electric boiler consumption is presented under the "industry" category, while district heating production is included under "space heating."

Electricity consumption in transport[1] is forecasted to increase from under 2 TWh currently to about 4 TWh by 2030 and approximately 7 TWh by 2035. Despite the rapid increase in the number of electric vehicles, total annual electricity consumption in transport remains small compared to overall electricity consumption. However, the impact of EV charging on power demand is significant, making the optimization of charging times important for the electricity system and transmission needs in both the main and distribution grids. **Other electricity consumption** includes household and service sector usage, excluding heating, and also accounts for transmission and distribution losses. This category remains stable due to improved energy efficiency.

From a competitiveness perspective, it is essential that the electricity system can align variable electricity production with industrial electricity demand. This requires increased capacity for demand response, electricity storage, dispatchable

[1] Does not include the electricity used for producing e-fuels for transport. The electricity used for domestic e-fuel production is included under industrial electricity consumption in the forecast.

power generation, and cross-border interconnectors. Demand response is expected to grow significantly. Flexible use of electric boilers could enable several gigawatts of demand response already over the next few years. The role of smart EV charging in demand response will grow as the number of vehicles increases. Flexible electricity consumption in hydrogen production is expected to increase in the 2030s due to tightening RFNBO regulations and advancements in storage solutions. Growth in industry and data centers may also enable flexibility through process adjustments or backup power solutions. For example, in high-growth scenario, back-up power capacity in data centers could reach thousands of megawatts in Finland. The amount of electricity storage is projected to grow very rapidly along with the growth of electricity generation and consumption. The total amount of flexibility from hydrogen, industry, data centers, and electricity storage is tied to consumption growth, meaning that in the excellent competitiveness scenario, absolute amount of flexibility is larger than in the moderate competitiveness scenario.

Fingrid is preparing for strong consumption growth across the sectors mentioned above. Compared to the Q3/2024 prospects report, the forecast range for total consumption in 2030 has narrowed to 103–123 TWh (Q3/2024 report: 99–126 TWh). The forecast range for 2035 remains nearly unchanged at 104–159 TWh (Q3/2024 report: 102–159 TWh). Consumption is now slightly more weighted toward the heating and transportation sectors.

The forecasted annual growth rate of electricity consumption is 6.1% in the high competitiveness scenario and 2.1% in the moderate competitiveness scenario for the years 2024–2035. Measured consumption in Finland during January–July 2025 was at the same level as the previous year. Adjusted for temperature and leap day effects, consumption increased by approximately 4%.

03

Prospects for future electricity production

Electricity production in Finland has grown significantly. Between 2012 and 2022, production ranged between 65–70 terawatt-hours, and has since increased to over 80 TWh. In addition to this growth, electricity generation has become more weather-dependent, and its geographical focus has shifted increasingly toward Western and Northern Finland. This trend is expected to continue, with growth being based on wind and solar power. By 2030, electricity production is forecasted to reach 108–122 TWh, and by 2035, 120–169 TWh. This growth is dependent on the increase in domestic electricity consumption, which enables market-based expansion of production. The development of electricity production is illustrated in Figure 2.

The strongest growth in electricity production is in wind power. In the Excellent Competitiveness scenario, wind power capacity increases to 16 gigawatts by 2030 and 33 gigawatts by 2035. Corresponding electricity production would be 51 TWh in 2030 and 95 TWh in 2035. If the growth in

Projected development of electricity production (TWh)

Fingrid estimate, September 2025.

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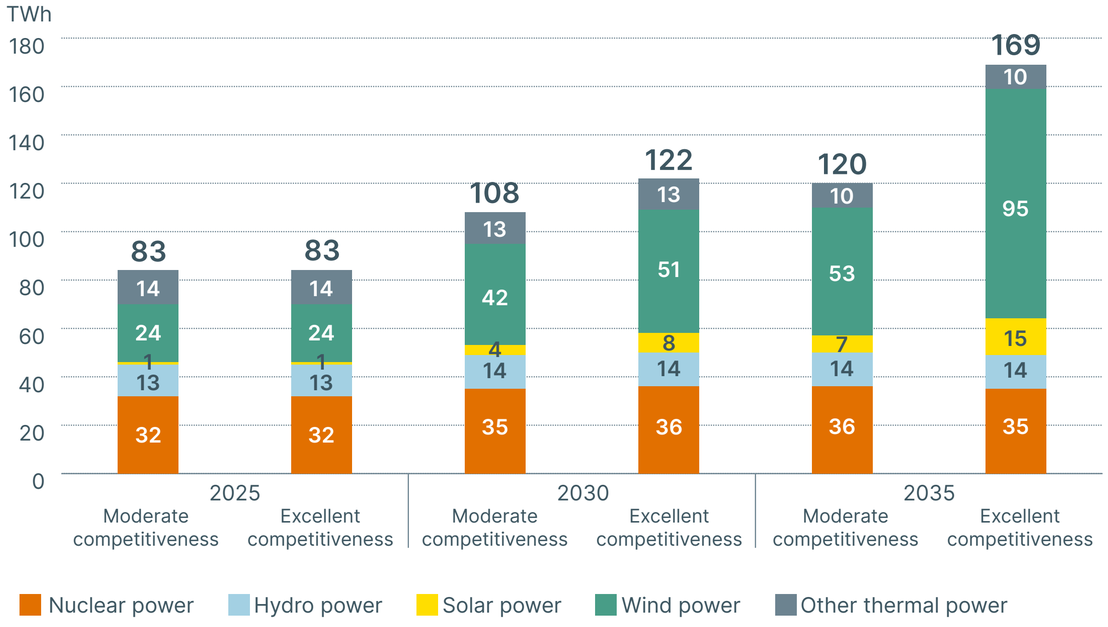

FIGURE 2 Forecasted development of electricity production in Finland from 2025 to 2035.

electricity consumption remains at the level of the moderate competitiveness scenario, the growth of wind power would also be significantly lower, and would amount to 42 TWh in 2030 and 53 TWh in 2035. The vast majority of wind power capacity is estimated to be onshore wind power. Fingrid is preparing for the realization of the first offshore wind power projects in the 2030s.

Solar power capacity has increased strongly in the years 2022–2024, mainly due to solar panels installed on rooftops. At the beginning of 2025, according to the Energy Authority[2], solar power capacity was about 1.2 gigawatts, of which the share of industrial-scale plants was about 0.1 gigawatts. In the high competitiveness scenario, solar power capacity grows to about 6.5 gigawatts in 2030 and to 14 gigawatts in 2035. In the moderate competitiveness scenario, capacity would be at the level of 4 gigawatts in 2030 and 7 gigawatts in 2035. The share of rooftop installations in capacity is slightly over 2 GW in 2030 and slightly under 4 GW in 2035 in both scenarios.

Nuclear power forecast includes planned power upgrades[3], after which the annual production of nuclear power would be about 35–36 terawatt-hours. The net production of hydropower[4] is expected to remain at about 14 terawatt-hours.

The production of thermal power is expected to decrease, as CHP capacity decreases due to plant closures. The growth in electricity consumption and the reduction in CHP capacity increase the need for new dispatchable power capacity, but its impact on the annual amount of electricity production is small.

Compared to the forecast published in Q3/2024, the growth forecast for wind and solar power production has decreased. For 2030, the total production forecast in the high competitiveness scenario has decreased to 122 terawatt-hours (Q3/2024 report: 131 TWh), and for 2035 to 169 terawatt-hours (Q3/2024 report: 175 TWh). In the moderate competitiveness scenario, the corresponding total productions are 108 TWh in 2030 and 120 TWh in 2035. The decrease in the production forecast is mainly due to Finnish wind power being replaced by imported electricity. This is enabled by the decrease in electricity consumption forecasts in Sweden[5] and thereby increased possibilities for electricity imports from Sweden to Finland. However, in grid planning, preparation is still made for strong growth in Finnish wind and solar power, due to anticipated demand growth and Finland's competitive advantage especially in onshore wind power production. There are no significant changes in the forecast for other forms of production.

2 www.epressi.com/tiedotteet/energia/aurinkosahkon-tuotantokapasiteetti-kasvoi-24-vuonna-2024.html

3 Fortumin Loviisan ydinvoimalaitoksen matalapaineturbiinit modernisoidaan ja sahkotehoa lisataan noin 38 MW. Olkiluoto 1 ja Olkiluoto 2 -laitosyksiköiden käyttöiän pidennysta ja tehonkorotusta koskeva yva-ohjelma on valmistunut.

4 Production of hydro power without electricity produced or consumed by pumped storage power plants

5 Fingrid utilizes forecasts obtained from other transmission system operators where applicable in its analysis. In Svenska kraftnät's KMA analysis reports, the projected electricity consumption in Sweden for 2028 decreased by 15 TWh between the KMA2023 and KMA2024 reports. The background of the forecast changes in Sweden is explained in more detail in the KMA2024 report.

04

Prospects for future electricity imports and exports

Finland is almost self-sufficient in terms of electricity on an annual basis. In 2024, electricity production was 80 TWh and consumption 83 TWh, with net imports of about 3 TWh. This represents a significant change in the level of net imports, as during 2012–2021, Finland's net electricity imports were about 15–20 terawatt-hours per year, or 20–25 percent of consumption. In the high consumption growth scenario for the latter half of the 2020s, Finland's electricity balance is expected to show an average net import of a few terawatt-hours and turn into net exports in the 2030s. Most of the growth in electricity production will meet the increase in electricity consumption in Finland, and instead of exporting electricity, Finland will produce higher value-added products from electricity for domestic and export markets. In the moderate competitiveness and lower consumption growth scenario, net electricity exports are slightly higher and achieved earlier. The forecast for Finland's electricity balance is shown in Figure 3.

Changes in electricity production and consumption balances in Finland and nearby regions will alter power flows on cross-border interconnections between Finland and neighboring countries. In recent years, electricity has mainly been imported from Sweden to Finland and exported from Finland to Estonia. The flow between Finland and Sweden is becoming more balanced. This is influenced not only by increased electricity production in Finland but also by significant electricity consumption growth in Northern Sweden – even after downward forecast revisions. The forecast assumes that the Aurora Line interconnection will be completed in 2025 and Aurora Line 2 in 2034.

Electricity transmission from Finland to Estonia are currently strongly export-oriented. The Baltic region has good electricity production potential, and if wind and solar capacity there grows as expected, electricity flows on the EstLink interconnections between Finland and Estonia will gradually become more balanced as the decade progresses. Electricity consumption in the Baltics is not expected to grow significantly.

Finland is not expected to become self-sufficient in terms of generation capacity within the forecast horizon, meaning that Finland will still need imported electricity during peak demand situations with low wind conditions. The development of capacity self-sufficiency depends on the extent to which retiring fossil capacity is replaced by, for example, energy storage or new flexible generation capacity. In addition, capacity self-sufficiency will be significantly affected by how flexible future electricity consumption investments in Finland will be. On the other hand, even if Finland were capacity self-sufficient, electricity imports and exports would be market-driven, meaning electricity will be imported from neighboring countries when it is cheaper than domestic production. The annual import-export balance is strongly influenced by actual weather conditions (precipitation, wind, sunshine, temperature) in Finland and surrounding regions.

Compared to previous forecasts, the reduction in net exports is mainly due to the slowdown in Finland's wind power development and changes in the electricity balance of other Nordic countries, meaning that electricity imports from Northern Sweden to Finland may continue longer than previously estimated if necessary.

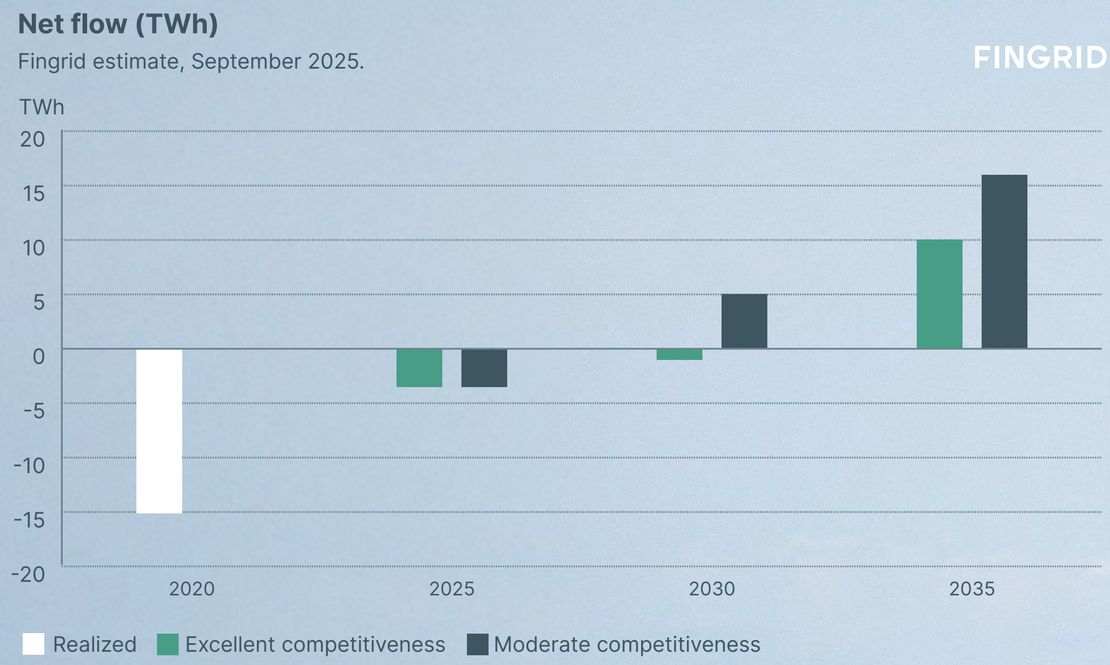

FIGURE 3 Projected electricity balance of Finland from 2020 to 2035.

05

Preparing the forecast

The forecast has been prepared as a basis for Fingrid's transmission grid planning and is based on connection inquiries for production and consumption as well as the results of electricity market modeling. The forecast takes into account the growing demand for clean electricity and electricity-based products in Europe, as well as Finland's excellent potential to be a competitive producer of these products. The higher scenario, which guides transmission grid planning, has been designed to be challenging for grid planning and the power system, yet still realistic if Finland's competitiveness in electricity-intensive industrial projects is excellent. This scenario directs Fingrid to proactively address challenges related to the energy system transition and to identify grid investments and other solutions that will enable investments in clean electricity in Finland. The moderate competitiveness scenario, on the other hand, reflects a situation where Finland is unable to broadly attract new industrial investments, and only projects that have progressed to the construction or connection agreement phase are realized. In this case, the need for transmission grid investments is also smaller. The range between the scenarios thus illustrates the uncertainty in grid planning related to consumption and production growth prospects.

Electricity market modelling models the operation of the electricity market and the resulting electricity transmission needs on an hourly basis. The modelling takes into account growing electricity consumption and growing electricity production that is becoming increasingly variable according to the weather. In addition to Finland, the entire Baltic Sea region and central and Western Europe have been taken into account in electricity market modelling. For other countries, forecasts received from other transmission system operators and scenarios prepared by the European Network of Transmission System Operators for Electricity (ENTSO-E) have been utilized as appropriate.

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