Proposed changes to the structure of main grid fees

- ADDRESSING CHALLENGES WITH THE GRID CAPACITY

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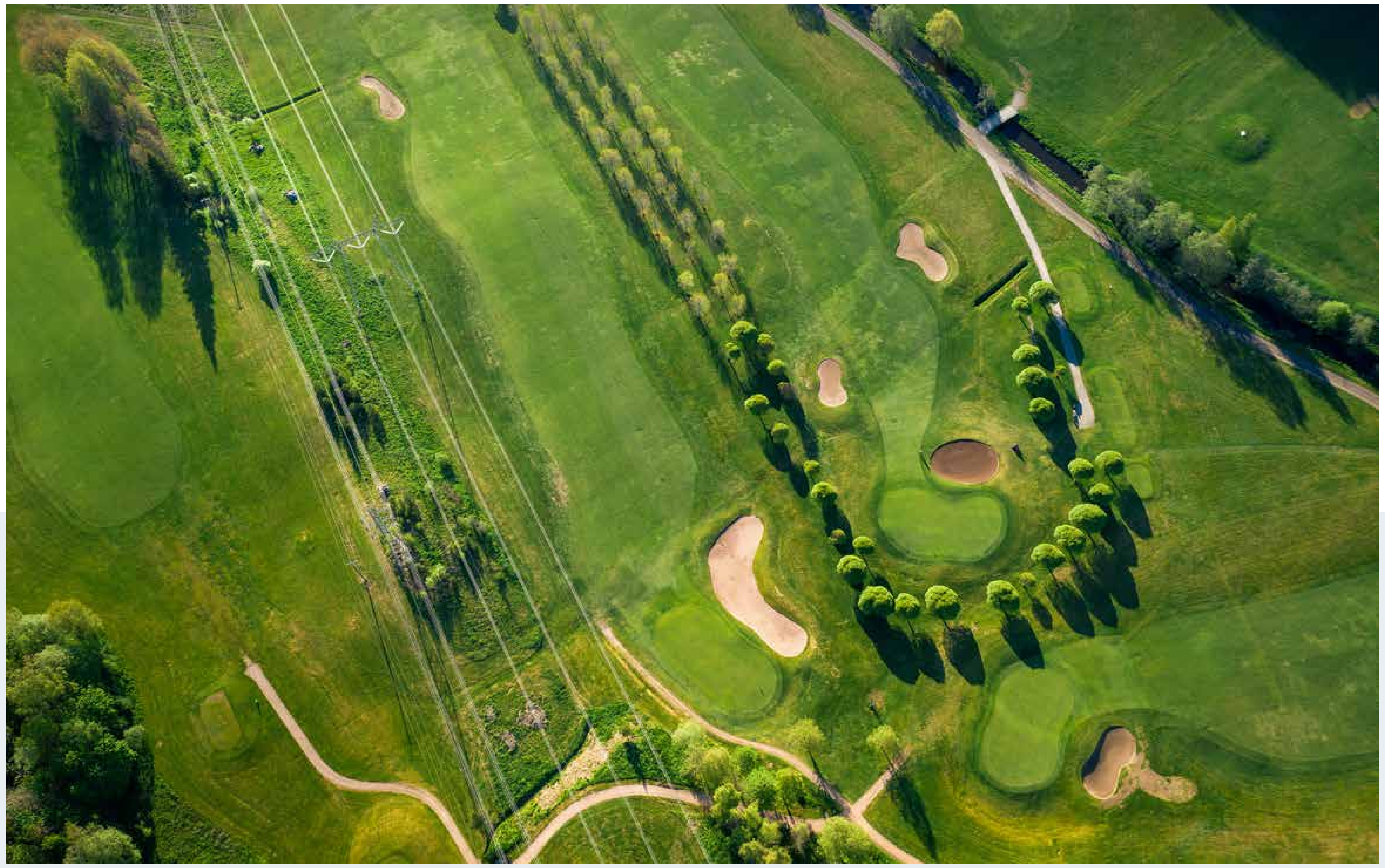

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01

Congestion in the grid

The number of main grid connection enquiries and the requested capacities have soared in recent years. Whereas connection enquiries used to seek capacities in the dozens of megawatts, the typical size of a new main grid connection is now in the hundreds of megawatts, with the largest planned connections reaching a couple of thousands of megawatts. Moreover, the planned power required for a project can change dramatically as planning progresses. Ideally, there would be time to prepare for these connections and reinforce the main grid in advance. However, the energy transition is advancing at such a pace—and future requirements are so hard to predict—that parts of the grid will be "sold out" before system reinforcements are completed.

One solution could be having customers connect to a part of the grid that still has capacity. This may be possible if the operator has identified various potential locations, for example, for a wind or solar power plant or a grid energy storage facility. In contrast, industrial and heating solutions do not usually have such freedom to choose alternative sites, as the investment is tied to a specific place.

If the connection cannot wait until system reinforcements are built, the solution is to seek opportunities for flexibility with the customer. Thankfully, the peak transmission volumes for renewable electricity production and consumption are typically short-lived, and faults that restrict the transmission capacity are rare. Cases like these demand cost-effective alternatives that are reasonable for connecting parties.

Fingrid is now presenting proposals which aim to improve customer connectivity while using the main grid as efficiently as possible before building new connections. Above all, this is the responsible course of action. Secondly, if the solutions are cost-effective for society overall, Finland will gain a clear competitive advantage. More efficient utilisation of the grid will help Finland remain a single bidding zone for electricity trading, ensuring stability for operators and protecting them from significant electricity price fluctuations.

We would be grateful for our stakeholders' comments on the proposals presented in this document. It is important that every operator considers these proposals from their own perspective and helps us enrich our understanding of their implications. On the other hand, we also hope that each operator will consider the national economic impact of the proposals, especially as they enable more and faster green investments in Finland. Although the methods we propose could replace some grid investments, we do not aim to slow or stop the development of the main grid. Instead, our intention is to complement it to suit connecting parties' needs by mutually accepted means.

Jussi Jyrinsalo
Senior Vice President, Fingrid

02
Demand for transmission is rising in the main grid

The energy transition is transforming our operating environment. Electricity consumption is expected to increase by over one-and-a-half times by the end of the decade as industrial processes, heating, transport, and many other sectors become electrified. At the same time, the structure of electricity production is evolving rapidly, as production based on renewable energy, which varies according to the weather, overtakes production based on combustion. Electricity consumption cannot increase in isolation from production—one requires the other.

Demand for transmission in the main grid will multiply in the coming years because electricity production and consumption are growing rapidly, and the facilities are increasingly distant from each other. Challenges in ensuring adequate grid transmission capacity will lead to difficulties implementing main grid connections for customer projects in certain areas. Established practices must change to ensure that parties can connect to the grid efficiently in the future. There is no single solution; the change calls for a reassessment of the main grid fee structure, new technical solutions, and the development of new market-based mechanisms. Other countries are facing a similar trend, so Finland should seek the most cost-effective solutions to these challenges to ensure its competitiveness.

Electricity production and consumption are increasingly distant from each other

Demand for transmission in the main grid is rising sharply, as electricity production and consumption are increasingly far apart. Electricity consumption is weighted towards Southern Finland, while most electricity is produced on the west coast and in Northern Finland. Consequently, the demand for transmission from the north and west to the south are increasing in the main grid. Figure 1 illustrates the regional weights of electricity consumption and production.

One major factor is the rapid change in how district heating is produced. Large towns and cities that were once self-sufficient in electricity are now phasing out combined heat and power plants based on combustion. In the future, heat will be produced using electric boilers and industrial-scale heat pumps. Thus, electricity production in towns and cities is falling while electricity consumption could rise to several multiples of today's figure. Large data centres also tend to choose locations near existing consumption centres. At the same time, new wind and solar power plants are being built in areas with ample space, far from towns and cities.

Building grid reinforcements is not enough

Fingrid has a EUR 4 billion investment plan for the next decade. It includes more than 6,000 km of new 400 kV and 110 kV transmission lines to reinforce the main grid, especially in the north–south and west–south directions. The

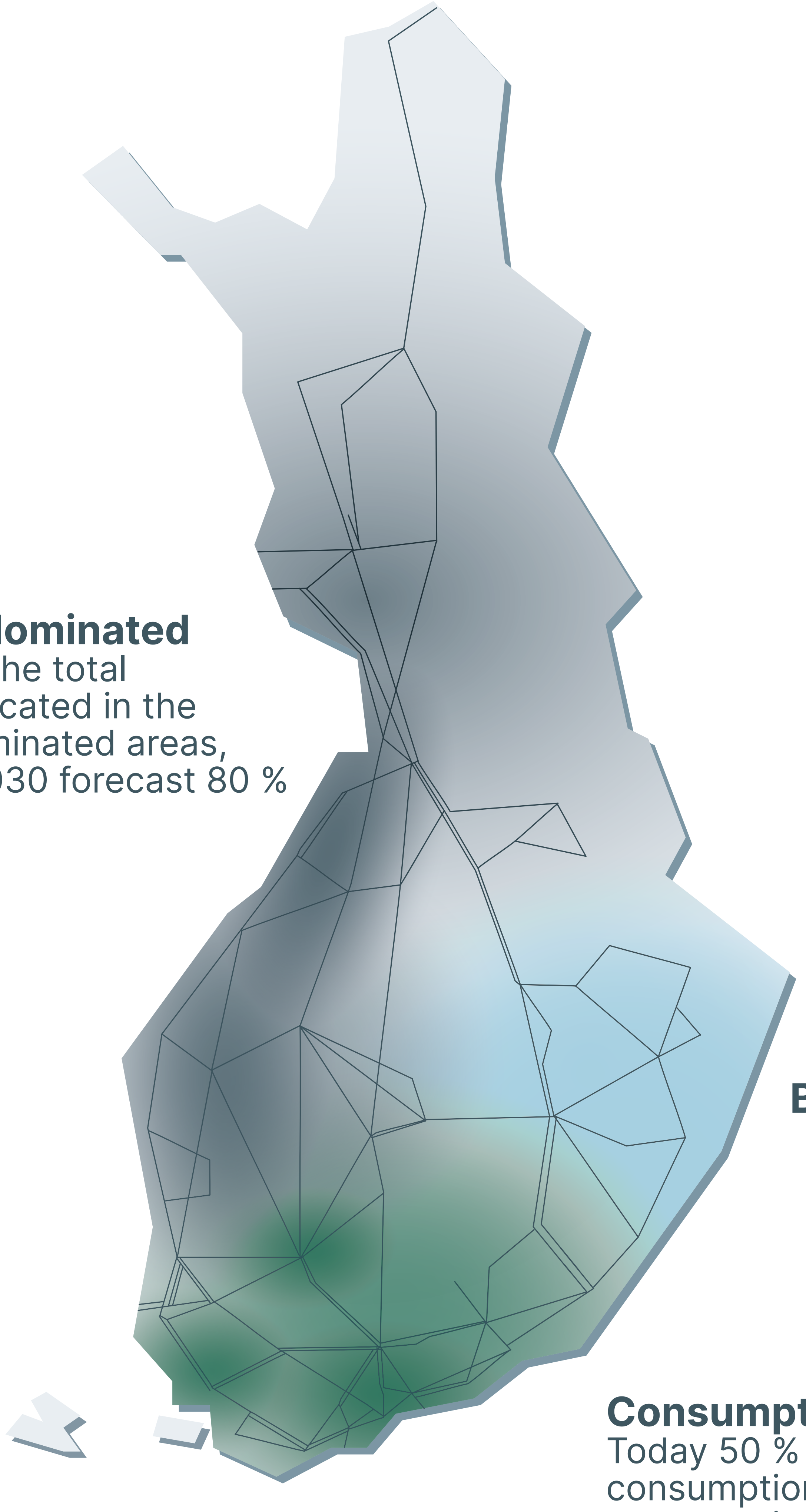


FIGURE 1. The geographical concentrations of production and consumption.

network investments featured in Fingrid's investment plan will substantially increase the main grid's transmission and connection capacity in the coming years and decades.

However, the power system is evolving so rapidly that building grid reinforcements cannot be the sole solution. Network investments cannot provide enough transmission capacity quickly enough to cover all foreseeable transmission situations. Furthermore, the financial and operational resources will not stretch to this.

The demand for transmission will become increasingly variable as it becomes more common for electricity production to fluctuate according to the weather. This reduces the utilisation rate of the power grid. Future transmission demands are strongly correlated with wind speeds; transmission peaks will arise at times of high wind power production during the heating season. The difference between transmission peaks and the average transmission demand will increase. Building a network that can cover every possible transmission peak is no longer appropriate or justified. Figure 2 illustrates a hypothetical situation in which system reinforcement investments cover the transmission peak.

Increasing flexibility and incentives improves connectivity for new customers

In addition to building new grid, the growing demand for electricity transmission can be addressed by seeking out some means to raise the grid utilisation rate. For the sake of system security, the grid is dimensioned to accommodate

Duration curve for transmission demand

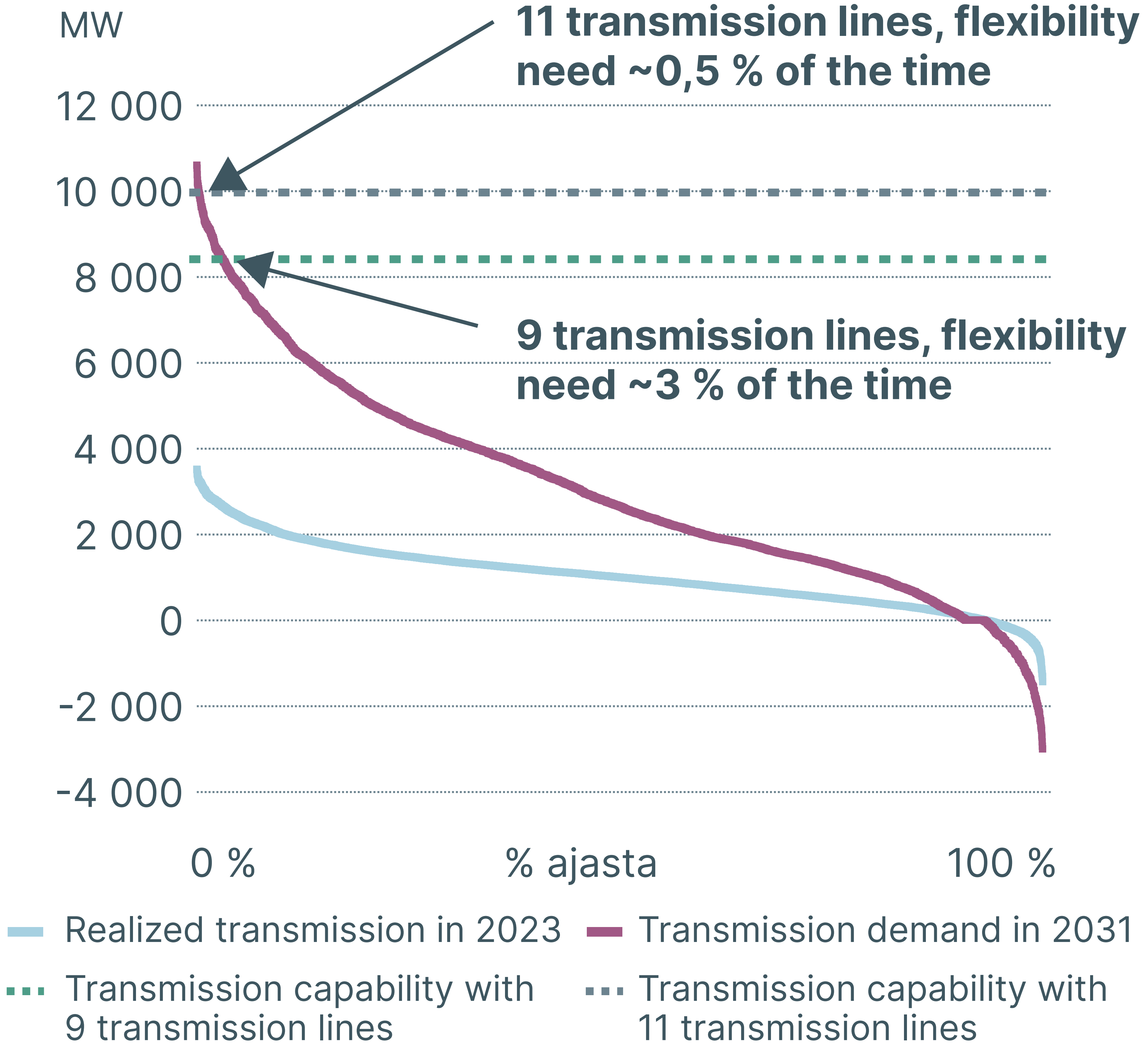


FIGURE 2. Example of how transmission demand could be covered with reinforcement investments.

peaks. In other words, the grid was traditionally built to cover all predicted peak transmission needs, resulting in a lot of unused capacity outside peak transmission times. Taking advantage of customer flexibility during transmission peaks, rarer faults, or exceptions could be one way of expediting and increasing the possibility of offering connections to customers.

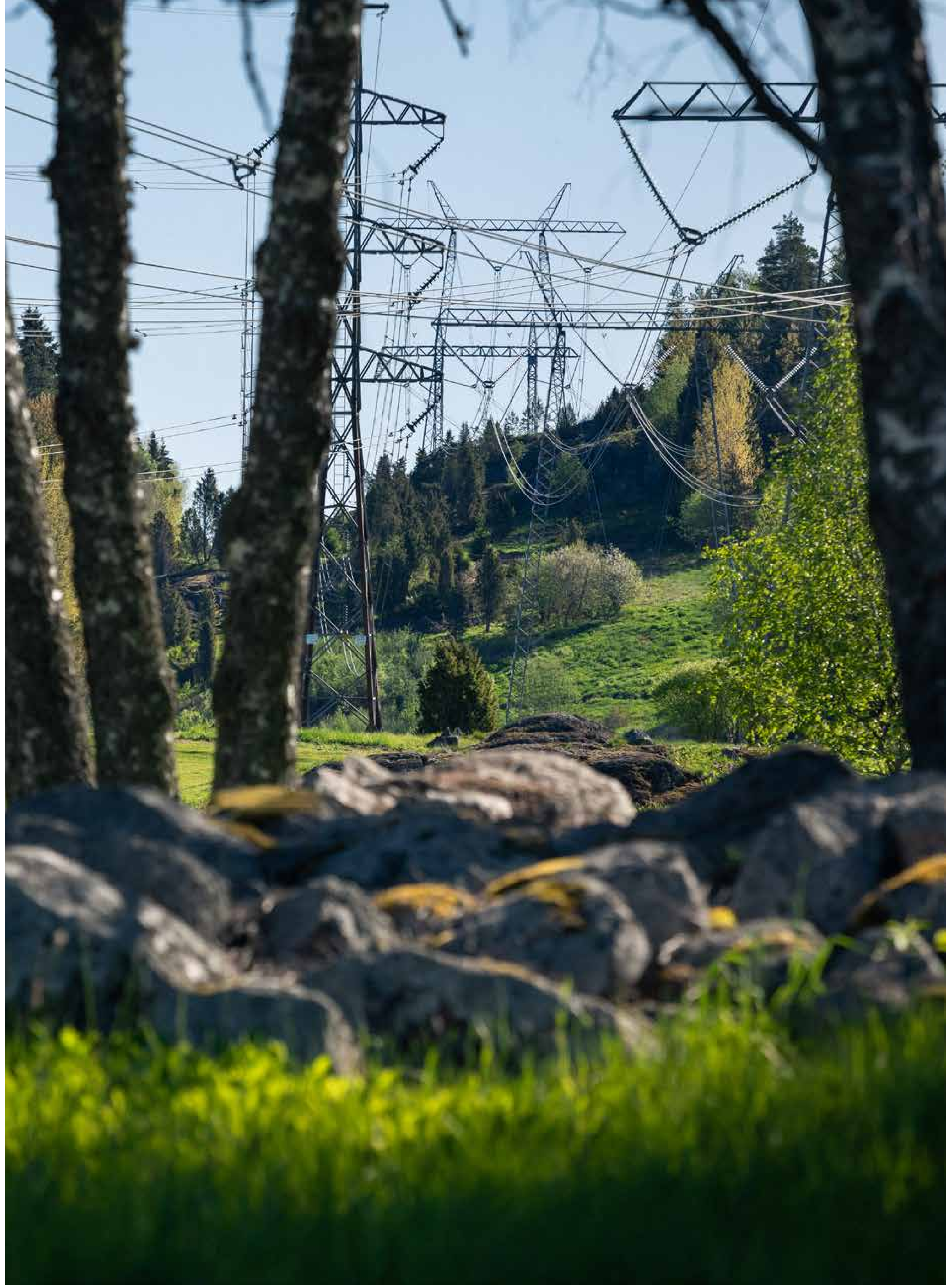
It is also important to create incentives for new consumption and production projects to be built in optimal locations relative to the main grid and to use the connection capacity more efficiently. Increasing flexibility and incentives is key to addressing the main grid reinforcement needs and smoothly connecting customer projects to the grid. When incentives are implemented correctly, they can support the energy transition and Finland's competitiveness.

More flexibility is required in the management of main grid transmissions

Fingrid is already acquiring a lot of flexibility from its balancing markets to manage the power balance between electricity consumption and production. The need for such flexibility will increase dramatically as the energy transition proceeds. Grid transmissions can also be managed by exploiting flexibility, a solution which is expected to grow substantially in the coming years.

Transmission management ensures that the power flows remain within the transmission capacity. At present, Fingrid's main method of managing transmissions is to order special regulation from the manual Frequency Restoration Reserve (mFRR). Transmission management requires resources to be available in the right parts of the grid. For example, to manage large north–south transmission volumes, electricity production must decrease or consumption must increase in the north (down-regulation), while in the south, electricity consumption must decrease or production must increase (up-regulation). When regional regulation is used to manage transmissions, an adjustment is always required in the opposite direction to avoid an imbalance between electricity production and consumption.

However, the potential for using market-based flexibility to manage transmissions is constrained by a shortage of flexible resources in the balancing market. Not all flexible resources are in suitable locations to serve the needs of transmission management. The need for regulation in both directions further limits the suitability of flexible resources on the market. New procurement models should be developed to enable the more extensive use of flexibility in electricity consumption, production, and energy storage for transmission management.



03

The main grid fee consists of a connection fee and grid service fees based on grid usage

Fingrid's grid service fees have always had the same structure. The connection fee structure was last revised in the early 2010s. The amounts of the fees have varied. The grid service fee covers the costs of building, maintaining, and operating the grid, including purchasing loss power and the operating expenses arising from transmission management. Table 1 shows the current structure of the main grid fees.

The main grid connection fee is a fixed one-off fee depending on the voltage level of the connection. The grid service charges are ongoing charges based on the use of the grid. They include main grid input and output fees determined according to the volume of energy transmitted in the main grid. An energy-based and time-staggered consumption fee is also charged for electricity consumption. Similarly, a power-based fee is levied on power plants based on the installed generation capacity or, alternatively, an energy-based fee is charged for power plants operated for short periods. The grid service fees also include reactive power fees. Customers receive a separate invoice for reactive power if the use of reactive power exceeds the threshold of the specified reactive power window for any given connection point.

		GRID SERVICE FEES	
	MAIN GRID CONNECTION FEE	MAIN GRID TRANSMISSION FEE	POWER / ENERGY FEE
CONSUMPTION	Yes (€/connection)	Input into the grid/output from the grid fee (€/MWh)	Consumption fee (€/MWh)
PRODUCTION	Yes (€/connection)	Input into the grid/output from the grid fee (€/MWh)	Generation capacity fee for power plants (€/MW) or energy fee for short operating times (€/MWh)
GRID ENERGY STORAGE	Yes (€/connection)	Input into the grid/output from the grid fee (€/MWh)	

TABLE 1. Current structure of the main grid fees.

04

Reform of the connection fee to encourage electricity production and consumption facilities to be located closer each other

Various models are used throughout Europe for the connection fees charged when a customer connects to the grid. Connection fees can be categorised as deep, shallow, or super shallow based on the costs they include. The deep model includes all the costs of system reinforcement incurred due to the connection. In other words, each connecting party's connection fee is determined individually. The part-deep model only passes on some of the system reinforcement costs to the connecting party. The rest of the costs are covered by the tariffs collected from all customers. Under the super shallow model, no connection fee is charged at all. Instead, the full cost of the connection is charged to all grid users in the form of tariffs. Table 2 presents the current connection fee model in Finland and a few of its neighbouring countries.

Finland uses the shallow model for main grid connections: the fee charged to the connecting party is based on the average direct costs incurred by Fingrid from similar connections at the same voltage level, including, for example, expanding a substation to accommodate the customer's connection. In contrast, the connecting party is not charged the costs of system reinforcements behind the connection point. Instead, these costs are covered by the grid service fees collected from every user of the power system. However, the system reinforcements necessitated by new connecting parties differ substantially depending on the part of the grid where the connection is implemented and the rated capacity of the connection.

	FINLAND	SWEDEN	DENMARK	NORWAY	ESTONIA	LATVIA
PRODUCTION	Shallow	Deep	Partly-deep	Deep	Shallow	Shallow
CONSUMPTION	Shallow	Deep	Super-shallow	Deep	Deep	Super-shallow

TABLE 2. Current connection fee models in Finland and its neighbouring countries.

Proposal 1: Introducing a new component of the connection fee based on location and power

Fingrid proposes changing the connection fee structure to a part-deep model. In addition to the current direct connection fee, the connecting party will be charged a new component based on the location and power, to be known as the power-based fee for the connection. The power-based fee will be calculated according to the average system reinforcement costs incurred for the connection. In practice, under the new model, the power-based fee for the connection will apply to production projects connecting in production-dominated areas. Similarly, a power-based fee will be charged to connect consumption projects in consumption-dominated areas. The power-based fee will be waived for production or consumption projects connecting to the grid in balanced areas. Fingrid plans to charge a power-based fee for connecting grid energy storage facilities connecting to consumption-dominated areas according to the facility's rated capacity in consumption mode.

According to preliminary plans, the power-based fee for connection will only apply to connections with a rated capacity of at least 10 MW. It will apply to connections to the main grid and high-voltage distribution grids. In other words, parties connecting to the high-voltage distribution grid will be charged a connection fee by the distribution system operator and a power-based fee by the transmission system operator. This is necessary because new connections generate equal pressure for transmission in the main grid, irrespective of whether they connect directly to the main grid or via a high-voltage distribution grid. It would also be inappropriate to create an incentive to connect high-powered facilities to distribution grids rather than the main grid. The direct connection fee will only be charged to parties connecting directly to the main grid; this component of the fee will not change. Figure 3 illustrates the connection fee charged to customers after the reform.

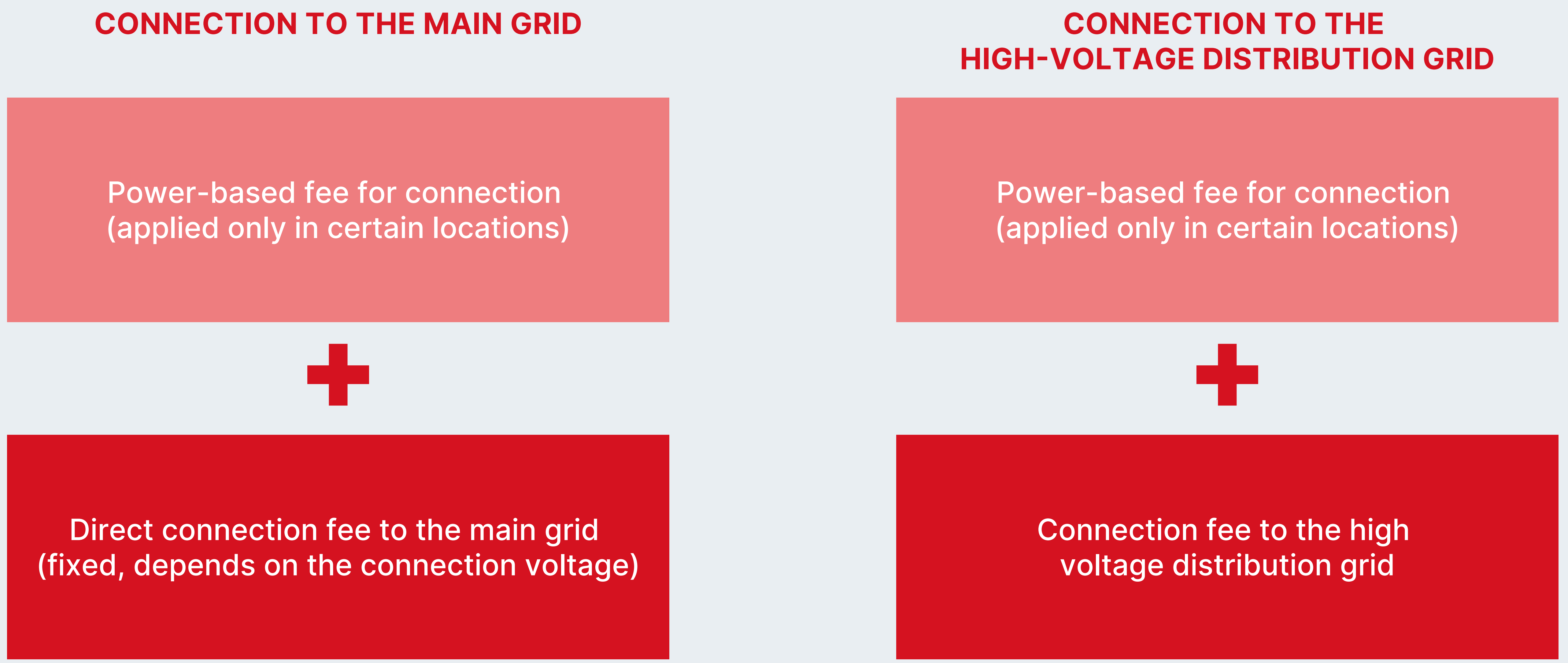


FIGURE 3. Determining the connection fee when connecting to the main grid or a high-voltage distribution grid following the proposed connection fee reform

Under the plan, the power-based fee for connection will depend on the connection's rated capacity, i.e., the maximum active power at the connection point, as agreed upon by the customer and the network operator. The power-based fee for connection is planned to be roughly EUR 10,000–20,000 per MW, depending on the connection voltage. The power-based fee charged for 400 kV connections will be lower because the power-based fees for connections at lower voltage levels will also cover the costs of transforming the voltage to 400 kV. Figure 4 illustrates the proposed new connection fee model.

Example of new connection fee (direct main grid connection)

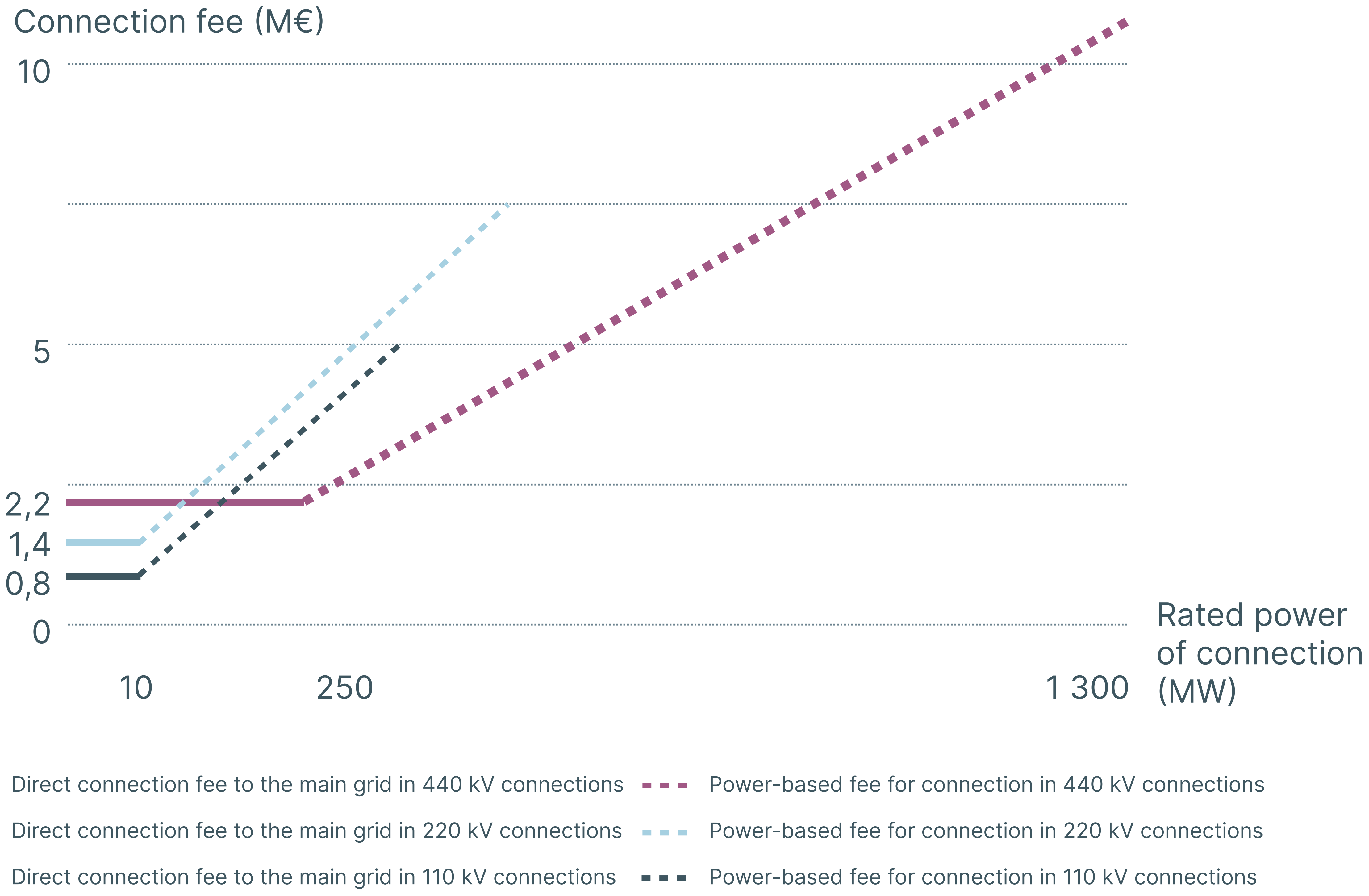


FIGURE 4. Illustration of how the main grid connection fee will be determined for different connection voltages following the connection fee reform.

Power-based fees of the proposed sizes would still not cover the full costs of system reinforcements for the connection. Instead, they would typically cover 10–20% of them. If the connection fee followed the fully deep model, it would need to be determined individually for each customer, making investments less predictable and leading to substantial differences between connecting parties and regions. Table 3 presents approximate examples of connection fees following the planned connection fee reform.

CASE	LOCATION	RATED POWER OF CONNECTION (MW)	CONNECTION VOLTAGE (KV)	DIRECT CONNECTION FEE TO THE MAIN GRID* (M€)	POWER-BASED FEE FOR CONNECTION** (M€)	TOTAL CONNECTION FEE (M€)
CONSUMPTION	production-dominated	100	110	0.8	-	0.8
CONSUMPTION	production-dominated	1000	400	2.2	-	2.2
CONSUMPTION	balanced area	100	110	0.8	-	0.8
CONSUMPTION	balanced area	1000	400	2.2	-	2.2
CONSUMPTION	consumption-dominated	100	110	0.8	2.0	2.8
CONSUMPTION	consumption-dominated	1000	400	2.2	10.0	12.2
PRODUCTION	production-dominated	100	110	0.8	2.0	2.8
PRODUCTION	production-dominated	1000	400	2.2	10.0	12.2
PRODUCTION	balanced area	100	110	0.8	-	0.8
PRODUCTION	balanced area	1000	400	2.2	-	2.2
PRODUCTION	consumption-dominated	100	110	0.8	-	0.8
PRODUCTION	consumption-dominated	1000	400	2.2	-	2.2

* Assumption 2024 level. ** Assumption in this example, 10 000 €/MW for 400 kV connections and 20 000 €/MW for 110 kV connections.

TABLE 3. Approximate examples of connection fees for the main grid following the proposed connection fee reform.

Currently, Fingrid determines the connection fees annually in accordance with the Main Grid Connection Fee Principles. In the future, Fingrid plans to specify the direct connection fee and power-based fee for connections annually. The geographical distribution of the power-based fees for connections and the status of regions (production-dominated, balanced, consumption-dominated) would also be reviewed annually.

Fingrid intends to continue charging the direct connection fee when the connection agreement is signed. We are still studying the charging model for the power-based fee, including the possibility of paying it in instalments. We are also exploring ways of calculating rated power for consumption connections.

Connection fee reform for fairer principles to cover the system reinforcement costs incurred from new connections

The proposed connection fee reform aims to create incentives for customer projects to be built in more efficient locations in terms of the power system and make connecting parties pay a greater share of the system reinforcement costs incurred due to their connections based on the matching principle. A power-based connection fee creates clear financial incentives to optimise the rated capacity of the connection and use hybrid connections, which contribute to the efficient utilisation of the grid and improve connectivity.

The electricity network business is strictly regulated. The Energy Authority's regulatory model specifies the allowed revenue. Under the model, all the payments collected from customers in different ways are treated equally. Fingrid's revenue would not increase under the proposed reforms, even if higher connection fees were collected from connecting parties, and Fingrid also collected connection fees from parties connecting to a high-voltage distribution grid. In practice, any higher connection fees that may be charged to connecting parties would result in Fingrid's other customers being charged for a lower proportion of the system reinforcement costs.

05

A flexible service level for the main grid service to enable more efficient use of the grid

The electricity transmission service has traditionally allowed customers to consume or produce electricity freely within the agreed thresholds. The network operator's responsibility is to prepare to transmit the electricity consumed or produced by customers. The energy transition has created a lot of pressure to reinforce the power system. Consequently, network operators have begun developing new models to utilise customer flexibility, in addition to building grid reinforcements. This enables new customer projects to connect as efficiently as possible.

Proposal 2: A flexible main grid service alongside a traditional electricity transmission service

Fingrid is now proposing introducing a new, flexible main grid service alongside the traditional electricity transmission service. The premise is to create a market-based contractual model in which the customer agrees to be flexible in its electricity consumption or production according to principles agreed upon in advance with the transmission system operator. The principles will be equal for all customers. The benefit to the customer is a rebate paid for the flexible service level, tied to the grid service fees charged to the customer. In practice, the rebate will be tied to a generation capacity fee for power plants or the consumption fee. The initial proposal is to offer a rebate of about half the power-based or consumption fee.

In the future, existing customers and new connecting parties will be able to choose the service level. In addition to customers connecting directly to the main grid, the service level model will need to be expanded to larger facilities connected to distribution grids. For example, electric boilers, which are quickly becoming commonplace, mainly connect to distribution grids and cause significant transmission demands in the main grid. As such, the option to choose the service level should be agreed upon with distribution system operators. Distribution system operators may also need flexibility in their networks, so the potential for facilities connected to the distribution grid to participate in the flexible service level should be examined on a case-by-case basis. In contrast, the incentives tied to grid service fees will also apply to facilities connected to the distribution grid because the consumption fee and power-based fee for power plants are also charged to facilities in distribution grids.

Fingrid would only offer the flexible service level in a limited way to cater to genuine transmission management needs. The transmission management needs are based on the geographical division presented in Figure 1. In practice, the flexible service level will be offered to production facilities in production-dominated areas and to consumption facilities in consumption-dominated areas. The quantity of production and consumption resources within the flexible service level must be balanced because transmission management always requires flexibility in both directions. If the decision is made to promote the introduction of this model, the prerequisites for grid energy storage facilities to participate in the flexible service level must still be clarified.

The flexible service level would be intended as a permanent model, and a change of service level should always be negotiated separately. However, as this is an entirely new model, a date would be set a few years after its introduction to review the terms and conditions of the flexible service level based on the accumulated experience.

Flexible main grid service operating model

The flexible main grid service is designed to be used at peak transmission times over the main cross-sections in the grid. Models indicate that peak transmission situations will typically occur during the heating season—especially the winter, spring, and autumn—when the electricity price is low, wind power production is high, and electric boilers are used for heating. According to the model, peak transmissions will not arise on cold days with no wind because combined heat and power plants are assumed to operate at such times, and the consumption of price-dependent electricity is expected to be lower.

In practice, the required flexibility will be a reduction in electricity production in production-dominated areas (down-regulation) and a reduction in electricity consumption in consumption-dominated areas (up-regulation). A fixed-term quota will be agreed upon with customers in advance to specify how much flexibility Fingrid can use within the scope of the service-level model. Fingrid will notify customers of the need for flexibility during the operating day at least two hours before the 15-minute period when the resources are to be used.

Fingrid proposes recording a fixed trade between itself and the customer's supplier for each time flexibility is used. The energy volume in the trade will be equal to the required flexibility, as communicated by Fingrid to the customer. The trade price will be the price quoted in the day-ahead market or another corresponding reference price. This will ensure that the flexibility will not cause the customer to incur an imbalance, and the effect on imbalance costs will be neutral. The financial compensation that the customer receives for the flexible service level will not come from the trade. Instead, Fingrid will pay a separate rebate, which will be agreed upon in advance and tied to the grid service fee. The rebate will not depend on how flexibility is required in practice.

Customers who choose the flexible service level should provide Fingrid with production and consumption plans on which the customer-specific flexibility notifications will be based. Fingrid has also considered requiring customers to provide reserve maintenance plans in advance for facilities covered by the flexible service level. This is to ensure that any commitments in the reserve capacity market can be taken into account. However, the effects of the flexible service level on participation in the reserve capacity market must be examined in more depth if the introduction of the model is promoted.

As transmission management situations can change closer to the moment of use, facilities covered by the flexible service level will be obligated to make themselves available for transmission management needs, even if Fingrid does not notify the customer of the need for flexibility by the advance notification deadline. In practice, this will mean, for example, participating in the mFRR energy market with the available capacity. In this case, the customer will receive compensation for flexibility in accordance with the arrangement or the terms and conditions of the marketplace, and the order for flexibility will not affect the flexibility quota.

Case 40 MW electric boiler in the flexible service level

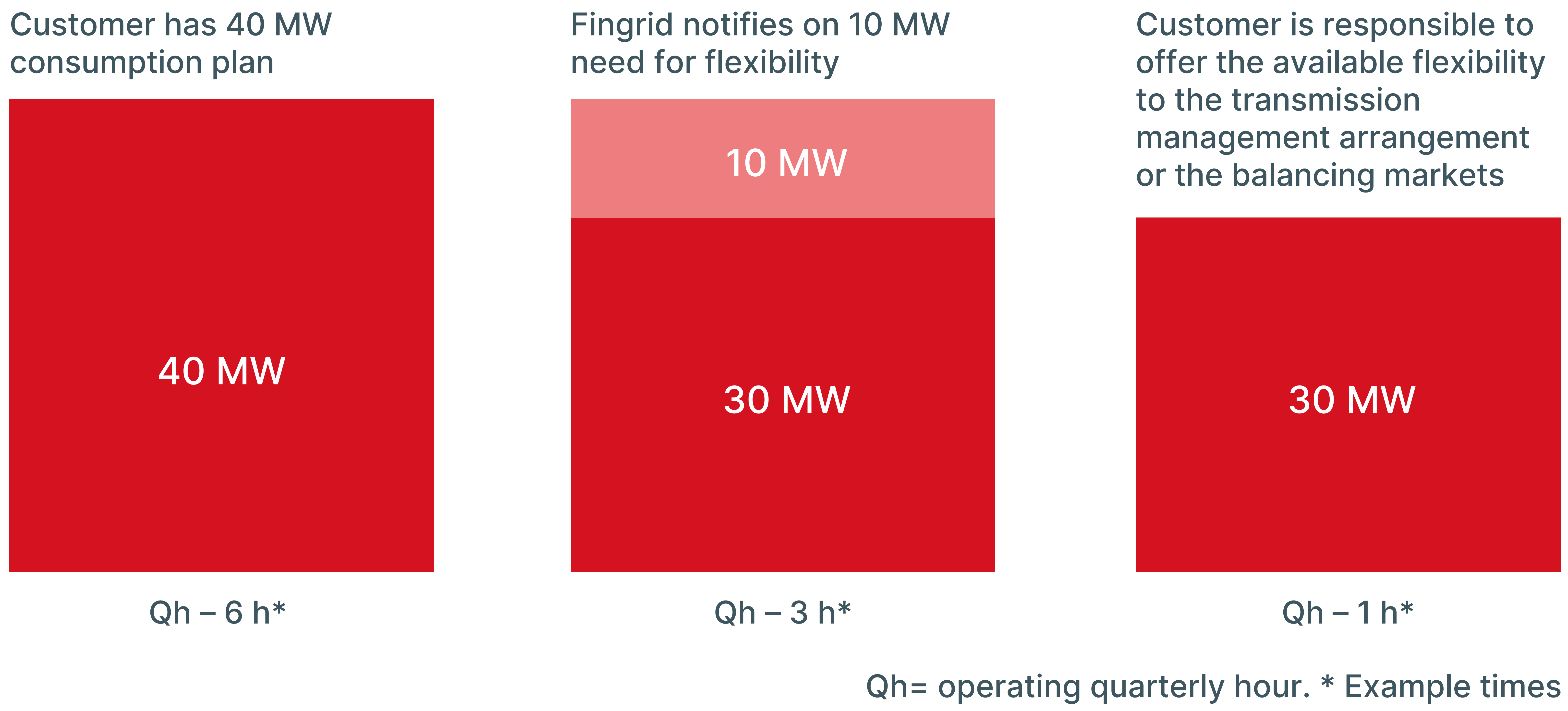


FIGURE 5. Example of the flexible service level operating model.

Flexible main grid service: a contractual approach to enhancing the efficiency of grid utilisation

Fingrid will only use the flexibility agreed upon within the service level model to manage peak transmission situations within the bidding zone. Fingrid will not use it to manage the power balance or possible electricity shortages. The choice of service level will not affect how customers are treated if restrictions are necessary due to outages or on the basis of the rights of the system responsibility, such as in the event of an electricity shortage.

The flexible service level could enable Fingrid to offer connections in areas where they could not otherwise be implemented with the customer's desired schedule. In addition, the model will help avoid system reinforcement investments dimensioned according to peak transmissions. Such investments would have a low overall utilisation rate and represent poor value for society. The model will also contribute to the main grid's cost-efficiency and Finland's competitiveness.

06

New operational solutions planned for transmission management

Fingrid is also planning to use flexibility for transmission management needs with new operational solutions. New procurement models must be developed so that the flexibility available from customers outside the balancing market can be effectively harnessed for transmission management purposes. Fingrid has prepared for the introduction of framework agreements and identified various opportunities for new procurement models to access flexibility for transmission management.

Framework agreements can be introduced quickly

Fingrid has prepared for the introduction of framework agreements as a new means of transmission management alongside special regulation ordered from the mFRR market. Bilateral framework agreements between Fingrid and parties capable of supporting the power system aim to harness flexible resources that cannot participate in the balancing market. The framework agreements will state the pre-agreed compensation and the amount of flexibility the customer can provide. Framework agreements are a quick solution that could be introduced as early as the 2024–2025 winter season.

The framework agreement is intended specifically for flexible resources that cannot participate in the mFRR market with a 15-minute bidding cycle. With longer activation times and in planned situations, such resources could provide flexibility that benefits the entire power system.

In 2022, Fingrid implemented a Voluntary Power System Support scheme in preparation for possible electricity shortages. Major electricity consumers and producers contributed more than 500 MW of flexible capacity to the scheme. Fingrid is discontinuing the Voluntary Power System Support scheme, and the framework agreement is a new opportunity to agree on additional flexibility.

Developing marketplaces for transmission management

Fingrid has actively developed the balancing markets from which it procures flexibility to maintain the power balance between electricity consumption and production. However, balancing market products are created to maintain the grid's frequency and are strictly regulated by EU legislation. In contrast with power balancing, transmission management needs are usually longer-lasting and more predictable. Flexible resources with a longer activation time than reserve products could meet such needs. This would allow the use of flexible resources that are unsuitable for the balancing market. The procurement solutions for transmission management could be designed according to local needs and available resources, as the regulations are less strict.
Distribution system operators increasingly need flexible resources within their distribution grids to tackle the same transmission management challenges that arise in the main grid. An efficient solution would be a unified marketplace that makes flexible resources available to distribution grids and the main grid. European regulations are also driving in this direction. Fingrid plans to work with distribution system operators to trial a unified marketplace for distribution grids

and the main grid in the near future. The marketplace must have sufficient liquidity to offer an alternative to network investments.

Several marketplaces already exist for flexible resources, but they lack one essential detail for transmission management needs: the precise locations of the resources. One possibility is to include the location of bids in the intraday market. This would enable a single marketplace to serve the needs of market actors and network operators seeking to control the flow of electricity in their networks.

07
Flexible connections to increase local connectivity

In addition to the sharp growth in system-level transmissions, Fingrid has recently faced the challenge of ensuring local transmission capacity. Local transmission capacity indicates how much electricity can be supplied to or taken from a single substation. The network operator is responsible for ensuring sufficient local transmission capacity for the needs of customers who consume and produce electricity. If the transmission capacity is insufficient, the network must be reinforced before any new connections can be made.

Ensuring local transmission capacity

Fingrid dimensions the local transmission capacity using the traditional N-1 principle. This principle is founded on the idea that the main grid and the customers connected to it should be able to operate normally if a single fault occurs in the main grid. Such a fault could be, for example, a transmission line failure or a transformer disturbance. The system security of Finland's main grid is extremely high. For example, storm fronts and heavy snow do not usually cut off the power supply to industrial plants and distribution grids.

Fingrid receives dozens of connection enquiries for electricity consumption, production and energy storage projects weekly. Some of the planned electricity consumption and production projects are much larger than any plants currently operating. For example, a single data centre project could need hundreds of megawatts of electricity, an amount corresponding to the electricity consumption of one or more cities.

A suitable connection solution can be identified for most connection enquiries within the customer's requested timetable. Due to the large number of connection enquiries, it is not always possible to meet the customer's connection needs according to the desired timetable. In such cases, it may be necessary to identify a connection point further away. Alternatively, the connection must be postponed until system reinforcements are built.

Flexible connections for faster connection to the main grid

When calculated according to the N-1 principle, the local transmission capacity in Fingrid's grid is often constrained by an individual potential fault, known as the local dimensioning fault. If the plans could account for the customer's ability to be flexible in the event of a sudden fault, the grid's transmission and connection capacities would be substantially higher.

An alternative solution in such a situation could be to offer the customer a temporary flexible connection on a case-by-case basis. This means that if the local dimensioning fault arises, the new connecting party will quickly need to be flexible and compromise on its reliability rate. This guarantees an uninterrupted electricity supply to the other parties connected in the same area. The model benefits new connecting parties with the capacity for flexibility because they can connect to the main grid more quickly than would otherwise be possible. No separate compensation will be paid for this flexibility. The model will be temporary: flexibility is only needed until system reinforcement investments are completed. Figure 6 presents the operating principle of the flexible connection.

Flexible connections are suitable for customers who can tolerate a reliability rate lower than the main grid's current 99.9999%. Examples include renewable energy producers, grid energy storage facilities, and electric boilers. Flexible connections will still offer a very high reliability rate: on average, the local dimensioning fault occurs less than once every ten years. For example, 400 kV/110 kV transformer faults occur approximately once every 65 years and permanent faults per 100 km of 110 kV overhead lines occur approximately once every 20 years. From the customer's perspective, the risk of a long connection outage is not significantly higher.

Depending on the type of local dimensioning fault, customers with flexible connections will need to activate their flexibility within seconds or minutes. In practice, flexibility that can be activated within seconds requires an automatic protection solution, such as a circuit breaker that isolates the customer from the main grid's supply if a fault occurs. In slower cases—for example, if the local dimensioning fault is the overloading of Fingrid's main transformer—manual adjustments activated within 15 minutes may be sufficient.

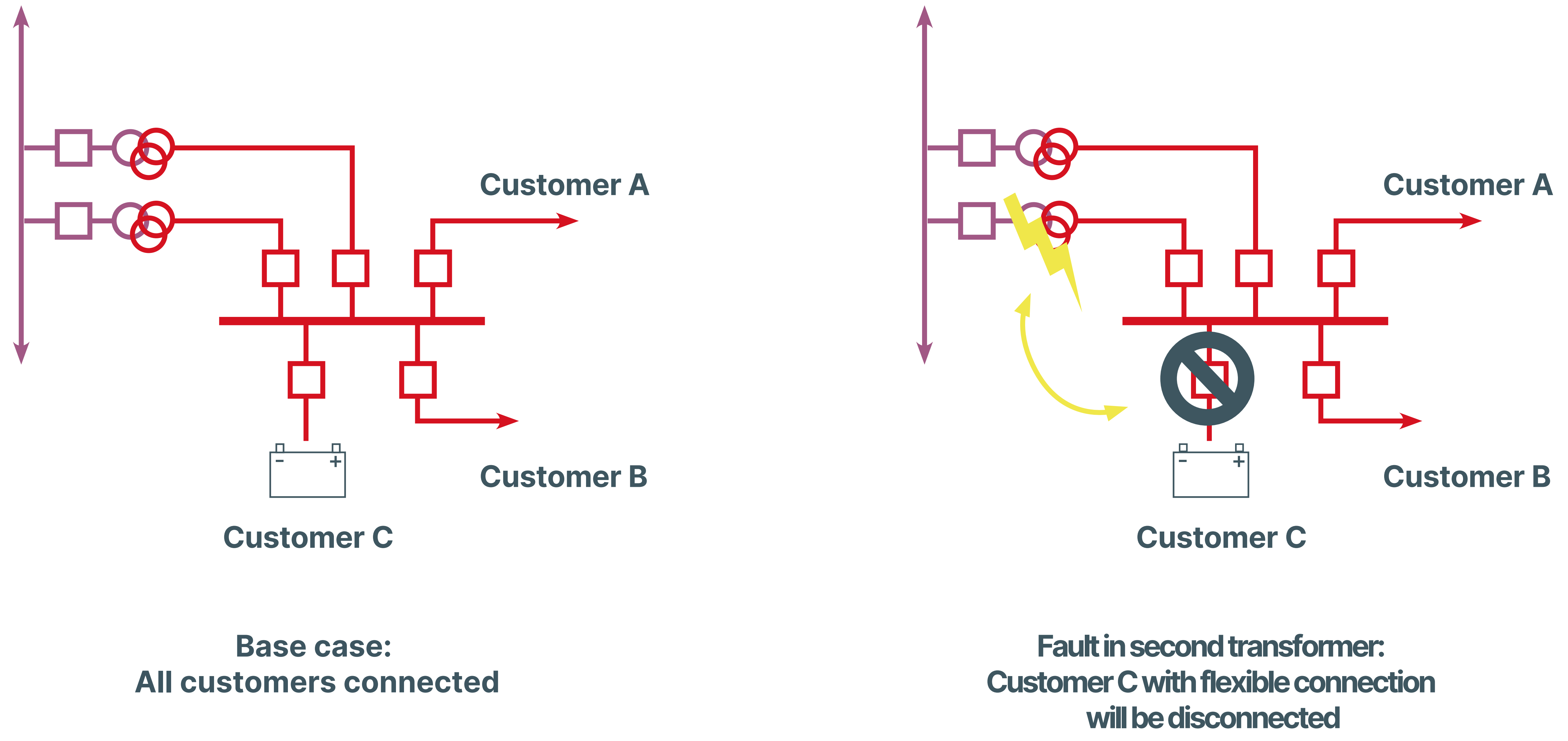


FIGURE 6. Operating principle of a flexible connection.

Proposal 3: Flexible connections used as permanent solutions

In addition to temporary flexible connections, Fingrid proposes flexible connections as a permanent solution offered to existing customers as well as new connecting parties. Customers with a permanent flexible connection could be offered financial compensation in the form of a fixed sum or a rebate tied to the activation of flexibility.

Flexible connections would require an agreement between the customer and Fingrid stating that the customer's connection must be permanently flexible in the event of a fault limiting the local transmission capacity. The agreement should describe the local faults or overloads in the main grid that would cause the flexibility to be activated. It must be possible to revise flexible connections and the associated terms and conditions as the network develops. If a customer wishes to switch from a permanent flexible connection to a traditional connection, the parties must negotiate the change and schedule.

Flexible connections as a permanent solution would reduce the need for investment in the main grid

Permanent flexible connections would enable more connections to the existing grid without new investments. This would enable significantly more efficient use of the main grid than in the current scenario and reduce the need to reinforce the grid. However, the possibility of flexible connections should always be assessed on a case-by-case basis. Flexible connections cannot be provided at every location on the grid.

08

Summary and next steps

Summary of the proposed changes:

1. **The power-based fee for connections** is proposed as a new component of the connection fee. It would only apply to new connecting parties and would depend on their rated capacity and location. In the future, the connection fee would consist of a direct connection fee of the current type and a power-based fee for the connection.
2. **The flexible main grid service** is a new service level for the main grid service, proposed alongside the current main grid service. It would apply to new and existing connections, but Fingrid would determine how it would be offered to customers. The flexible service level would offer the customer financial compensation tied to the consumption fee or the power-based fee for power plants or grid energy storage facilities.
3. Flexible connections are already in use today and provide for a temporary reduction in the connection's reliability rate in return for enabling the connection to be made more quickly. The customer receives no financial benefit from using this model. **The permanent flexible connection** is a proposed new solution that uses a reduced connection reliability rate as a permanent solution. In such cases, the customer would be offered a financial incentive.

Table 4 presents Fingrid's proposal for the new main grid fee structure.

	CONNECTION FEE		GRID SERVICE FEES	
	DIRECT CONNECTION FEE TO THE MAIN GRID	POWER-BASED FEE FOR CONNECTION	MAIN GRID TRANSMISSION FEE	POWER / ENERGY FEE*
CONSUMPTION	Yes(€/connection)	In a consumption-oriented area (€/MW)	Input into the grid / output from the grid fee (€/MWh)	Consumption fee (€/MWh)
PRODUCTION	Yes(€/connection)	In a production-oriented area (€/MW)	Input into the grid / output from the grid fee (€/MWh)	Generation capacity fee for power plants (€/MW) or energy fee for short operating times (€/MWh)
GRID ENERGY STORAGE	Yes(€/connection)	In a consumption-oriented area (€/MW)	Input into the grid / output from the grid fee (€/MWh)	Capacity fee for grid energy storages** (€/MW)

* In the flexible service level, customer receives a rebate which is tied to these payments
** New fee component under reparation

TABLE 4. Fingrid's proposal for the new main grid fee structure.

Fingrid has also prepared for the introduction of a power-based tariff for grid energy storage facilities. Grid energy storage is a new technology, which, so far, has only been subject to main grid input and output fees. However, as grid energy storage facilities become more widespread, it is justified to collect the same grid service fees as for consumption and production. The power-based tariff for grid energy storage facilities is planned to correspond to the power-based tariff for power plants. It would be charged for grid energy storage facilities with a rated capacity of at least 1 MW in consumption or production mode. The fee would be based on the sum of the grid energy storage facility's rated capacities in consumption and production modes. Fingrid plans to introduce the power-based tariff for grid energy storage facilities in the next update of the terms and conditions for main grid services, preliminarily in 2025.

In addition to these reforms of the grid service fee, Fingrid is developing and preliminarily planning various operational measures to tackle transmission management challenges. Of these, the most progress has been made in preparing framework agreements, while introducing market-based solutions will take longer. Figure 7 presents an approximate timetable for implementing the proposed changes.

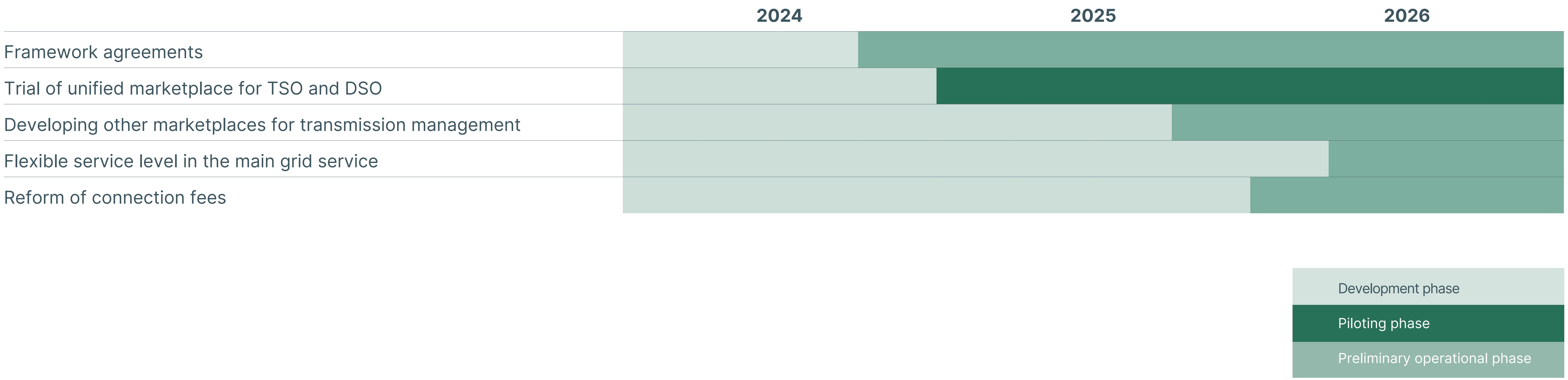


FIGURE 7. Approximate timetable for implementing the proposed changes.

The proposed changes require updates to the terms, conditions, and agreements, as well as the development of processes and information systems by Fingrid and its customers. The legal feasibility of the proposed changes must also be discussed with the Energy Authority. However, the EU legislation currently under preparation supports the adoption of flexible connections and the use of network tariffs to contribute to more efficient use of the grid and promote the energy transition.

Fingrid aims to promote its proposed changes in consultation with stakeholders. We hope to receive feedback from stakeholders on the proposed changes in this report in writing by 31 August 2024. Fingrid will use stakeholder feedback to assess the promotion of the proposed changes and plan more detailed implementation models. Figure 8 illustrates the timeline for work on the proposed changes.

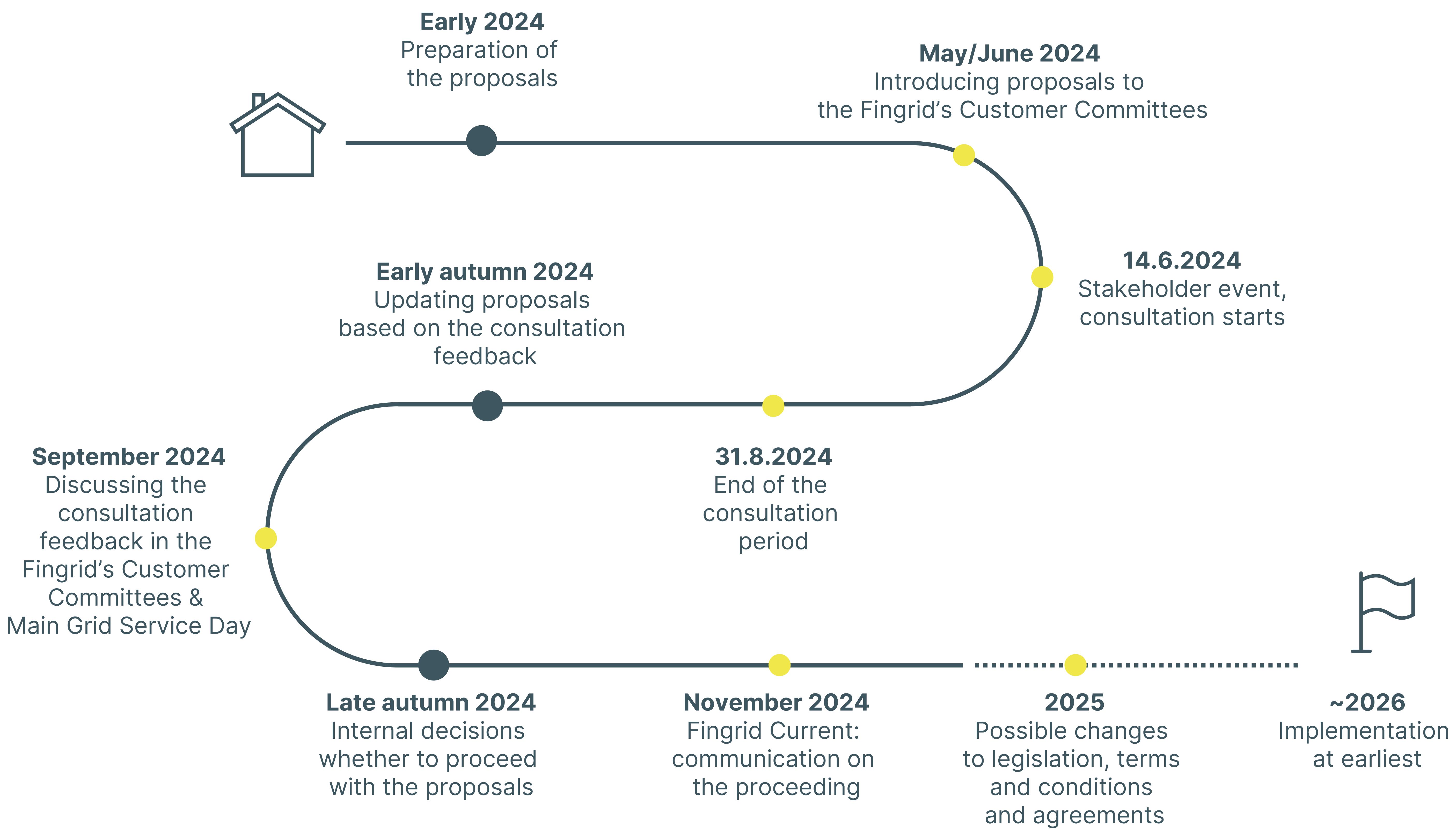


FIGURE 8. Timeline for work on the proposed changes.

Fingrid delivers. Responsibly.

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