# Study of the collateral model for balance responsible parties 10.3.2026

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# Sisällysluettelo

# 1 Introduction

## 1.1 Background to the assignment

In its decision on 21 March 2025, the Energy Authority confirmed the terms and conditions of the balance responsible parties. In the decision, the Energy Authority also obliges Fingrid Oyj (Fingrid) to carry out a review of the overall principles for determining the collateral of balance responsible parties (collateral study) and to submit the report to the Energy Authority, as well as to submit the amended terms and conditions for determining imbalance collateral to the Energy Authority for approval by 21 March 2026 at the latest.

On 18 February 2026, Fingrid requested an extension from the Energy Authority to submit the collateral study and the terms and conditions for determining the collateral of the balance responsible parties to the Energy Authority by 24 April 2026. On 19 February 2026, the Energy Authority granted the requested extension for the delivery of the study and terms by 24 April 2026.

The Nordic collateral model has been agreed upon in the imbalance settlement agreement between the balance responsible party and the imbalance settlement company eSett Oy (eSett) and in the imbalance service agreement between the balance responsible party and Fingrid. Each balance responsible party must provide a collateral in case the balance responsible party is unable to meet its financial obligations for one reason or another. The collateral is used to ensure the operation of Fingrid's main tasks when financial risks are realised. Sufficient collateral also protects balance responsible parties from rising costs in situations where a balance responsible party causes significant costs with its operations before the end of its operations.

The collateral is used to cover counterparty risk arising from the outstanding obligations of the balance responsible parties, as well as a situation in which the acquisition of the balance responsible party ends in full or in part, and the balance service and imbalance settlement agreements of the balance responsible party have to be terminated for this reason. The acquisition of a balance responsible party can mean the production or purchase of electricity. The collaterals are party-specific, i.e. the financial shortfall of one balance responsible party is not covered by the collateral of the others.

This report examines Fingrid's counterparty risk from balance responsible parties, assesses the effectiveness of the current collateral model in covering this risk, and examines the possibilities of a more efficient alternative than the current model that takes counterparty risk into account better.

# 2 Current collateral model

The Nordic imbalance settlement uses a dynamic collateral model. eSett calculates collateral requirements on a weekly basis based on the latest balance sheet and price information and manages the collateral set by the balance responsible parties. eSett monitors the risk situation during the week and recalculates the collateral requirements if necessary. Collateral requirements increase and decrease dynamically as the market situation

changes, so that the amount of collateral corresponds as closely as possible to the actual counterparty risk. Counterparty risk varies over time depending on price levels and the volumes of production and consumption as well as imbalance deviations.

The overall counterparty risk consists of at least the following components:

1. Delivery days for which the settlement amounts have been invoiced but not yet paid.
2. Delivery days for which the settlement amounts are known but not yet invoiced.
3. Delivery days during which the BRP has been active but the imbalances are unknown; only trade and imbalance adjustments are known.
4. Delivery days in the future during which the BRP will be active, but for which there is no information yet about the BRP's activity; This component needs to be considered as well since there is the risk that a distressed BRP might cease to honour its commitments in the electricity market and accumulate significantly higher imbalances than normally until the point when this is noticed and the accumulation of further imbalances can be prevented.

Under normal circumstances, the collateral requirement of a balance responsible party is currently calculated according to the following formula:

$$\textit{Collateral requirement} = 3 * (S_1 + S_2) + m * (V_1 + V_2) * P$$

where

**$S_1$** = Average of the sums of invoiced volume fees and imbalance fees per week for the last three invoiced weeks, including any VAT on these amounts that the BRP is liable to

**$S_2$** = Average of the absolute amounts of the sums of invoiced imbalances in a week for the last three invoiced weeks, including any VAT on these amounts that the BRP is liable to. (How this is calculated: First we sum up the bought and sold imbalance in a week. Then we take the absolute amount of this sum. This is done for the last three invoiced weeks. Then we calculate the average of these absolute amounts.)

**$V_1$** = Consumption volume of the last seven settled days (current day minus 20 days to current day minus 14 days)

**$V_2$** = Bilateral and PX market sales volumes during the last seven days for which such volumes are available (current day minus 8 days to current day minus 2 days).

**P** = The last seven days average imbalance price for which such prices are available in the MBAs where the BRP is active. When calculating the average price, the negative prices are replaced by zero, and the price of each MBA is weighted according to the share of the BRP's total turnover (consumption, PX market sales and bilateral sales) during the last three invoiced weeks that took place in the respective MBA.

**m** = Multiplier

In its previous decision, the Energy Authority has changed the *m*-multiplier for Finland, unlike the other Nordic countries, to the following:

1/7 for the whole volume of (V1+V2), and no volume cap.

In the collateral calculation used in Norway and Sweden, the *m*-multiplier is determined as follows:

3/7 for the share of (V1+V2) that does not exceed 80 000 MWh,

1/7 for the share of (V1+V2) that exceeds 80 000 MWh but does not exceed 400 000 MWh

0 for the share of (V1+V2) that exceeds 400 000 MWh.

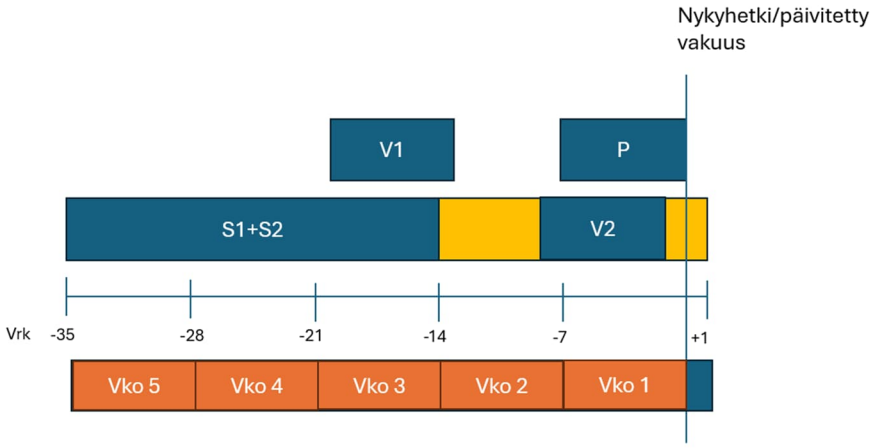



Figure 1: Illustration of the determination periods for the different multipliers of the collateral requirement

The purpose of the first part of the collateral requirement [$3 * (S_1 + S_2)$] is to cover unpaid imbalance deviations and unpaid fees collected from balance responsible parties that have accrued by the current date but have not yet been paid. The price of the imbalance deviation is formed on the basis of the price of the aFRR and mFRR reserve activations required for system balancing. The length of the period of unpaid amounts varies, but it is about three weeks on average. The calculation of the collateral requirement is based on data from the last three invoiced weeks. This means that the collateral requirement is mostly based on information that is older than the outstanding amounts. Therefore, the collateral requirement does not directly represent the amounts outstanding at the time of calculation, but is rather an estimate of what these amounts could be based on the available information.

The second part of the collateral requirement [$m * (V_1 + V_2) * P$] prepares for situations in which the balance responsible party's operations end unexpectedly and, for example,:

- The balance responsible party's electricity procurement will end, but electricity deliveries will continue until the balance responsible party has been closed from the market;
- The balance responsible party has sold its deliveries to e.g. electricity exchange, but has not produced or procured the energy in question.

The situations described above may be due to, for example, running into payment difficulties.

The Energy Authority has ordered that Fingrid can prepare for one-day balance responsible party purchases with its collateral requirement.

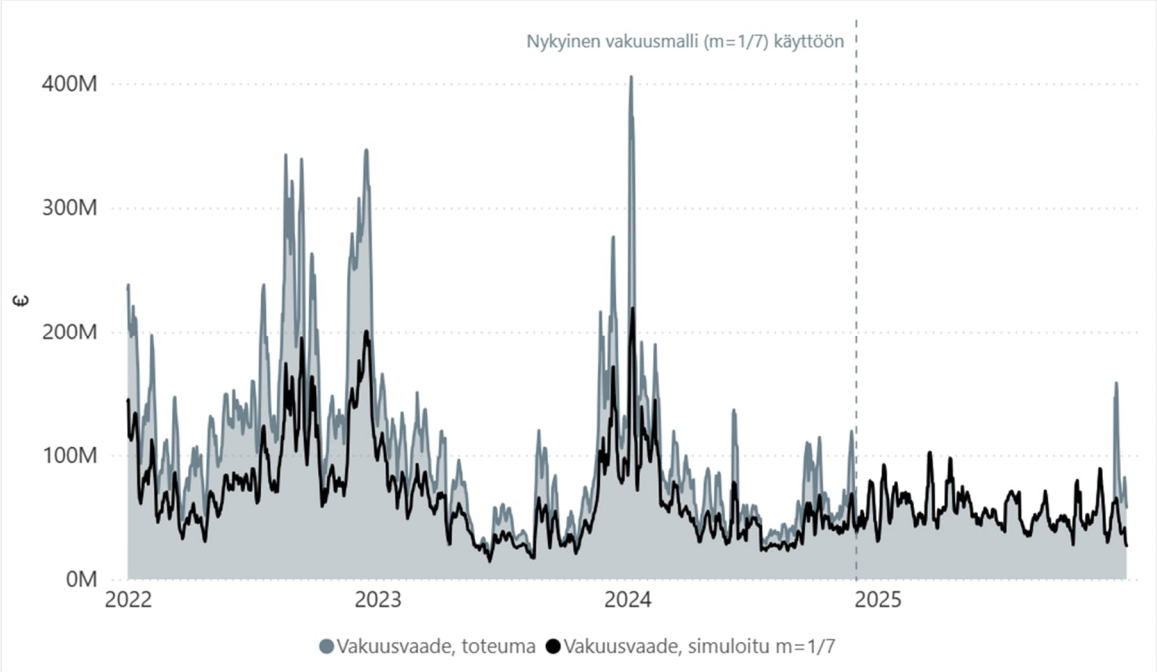



Figure 2: Actual collateral requirement and simulated collateral requirement with a fixed *m*-multiplier of 1/7.

The figure above shows the actual collateral requirement and a simulated collateral requirement in which the collateral requirement *m*-multiplier of 1/7 would have been used for the entire period under review in 2022–2025. In the actual collateral requirement, the *m*-multiplier was variable according to consumption and sales volumes until 30 November 2024. In December 2025, the *m*-multiplier of the collateral requirement was increased due to the Christmas holidays. This has not been taken into account in the simulated *m*=1/7 collateral requirement. In the energy crisis in the winter of 2022–2023 and at the turn of the year 2023–2024, the collateral under the current collateral formula would have been significantly lower than the actual amount at the time.

## 2.1 Challenges of the current model

The volatility of the imbalance deviation price is the most significant challenge of the current model from the perspective of both the balance responsible parties and Fingrid. The collateral requirement collected from balance responsible parties is very strongly correlated with the price of the imbalance deviation. Another challenge with the current model is that the collateral provided by the balance responsible parties is not up to date, because the current collateral model reacts slowly to changes in both the price of the imbalance deviation and changes in collateral claims caused by imbalance deviations by the balance responsible parties. On the other hand, from Fingrid's point of view, the risk caused by high prices consists of both the growing risk of payment difficulties for balance responsible parties and the structural challenge caused by the time it takes to complete imbalance settlements, which is why the collateral model reacts to rising prices with a delay.

Another challenge with the current model is that negative imbalance deviation prices are not taken into account in the collateral calculation, but they have been reset to zero in the calculation. However, the number of negative imbalance deviation prices has increased significantly as a result of the energy transition.

In addition to fluctuations in electricity prices and actual imbalance deviations, the size of Fingrid's risk exposure is affected by operational and administrative factors, such as the time it takes to complete the imbalance settlement, the billing cycle and customers' payment periods. In total, the risk exposure caused by imbalance deviations can accumulate over an average period of three weeks, taking into account the factors mentioned above.

In the current model, the balance responsible party's collateral can be placed as a cash deposit in a collateral account, as a bank collateral or a combination of these. In other words, the current model only allows cash or an on-demand collateral to cover the collateral claim.

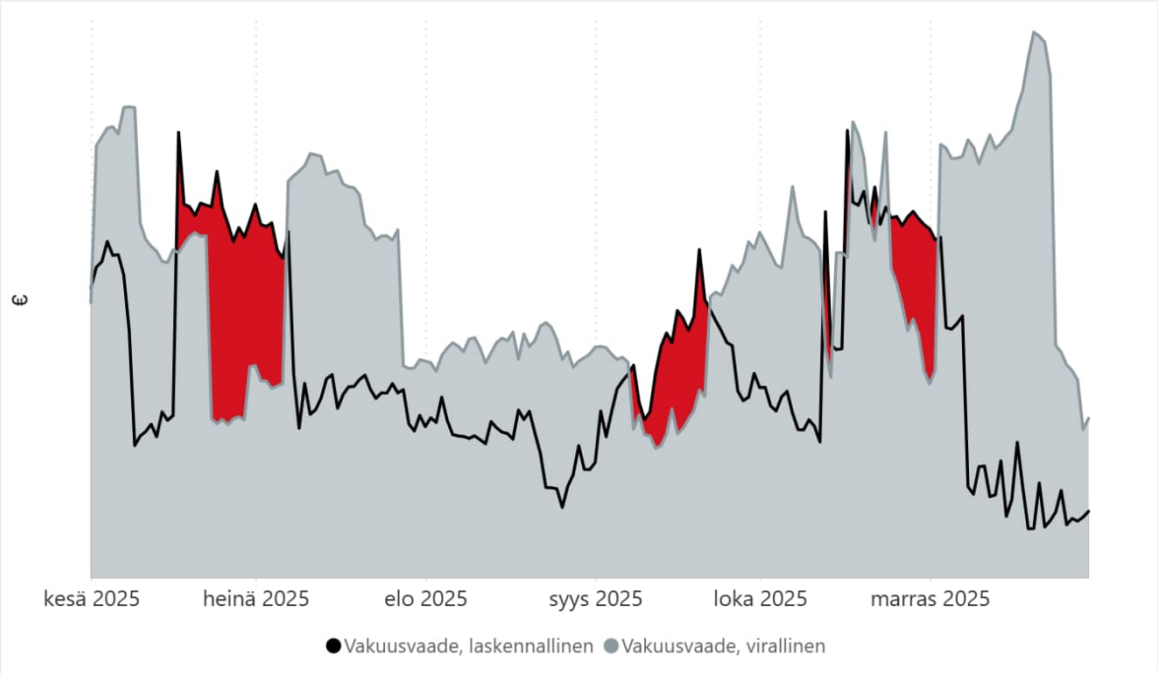



Figure 3: Comparison of the official collateral requirement and the computational collateral requirement for a balance responsible party.

The figure above illustrates the temporal difference between the collateral requirement of a balance responsible party and the computational collateral requirement of a balance responsible party. The grey line and area describe the balance responsible's actual collateral requirement (Collateral requirement, official). The black line shows the risk created for Fingrid by the balance responsible party calculated on the basis of the realisations (Collateral requirement, computational). The red area describes the difference between the two, i.e. undercollateral. The realisations for June-July and October-November clearly illustrate how the collateral requirement currently reacts with a delay. The official collateral requirement increases when the computational collateral requirement already decreases in connection with the payment of the bill.

## 2.2 Fingrid's risk exposure

Fingrid's risk exposure consists of two components in accordance with the collateral formula. The first part consists of volume fees and the product of the actual imbalance deviations and the price of the imbalance deviation. The second part consists of a potential financial disadvantage if, for example, the balance responsible party decides all its electricity procurement for one reason or another and is left to rely on imbalance power.

In addition, the time it takes for balance responsible parties to offset their obligations due to imbalance settlement and administrative factors must be taken into account when determining the risk arising from actual imbalance deviations. Fingrid's computational risk exposure due to imbalance deviations is the sum of all market participants, accumulating in euros over an average period of three weeks, with which Fingrid has had to balance electricity production and consumption. The risk exposure in question is very strongly linked to

the price of the imbalance deviation. In other words, when examined at the aggregate level, the impact of fluctuations in the volume of gross imbalances on the risk of the system operator has historically been moderate, and the size of the risk exposure fluctuates strongly due to the impact of the price of the imbalance deviation.

According to the Energy Authority's decision, the second part of the plan can be used to prepare for a one-day procurement or delivery that the balance responsible party does not carry out. The starting point is that substantially abnormal balance responsible party behaviour would be detected quickly and the operator could be excluded from the market in order to avoid further damage. The share of the total risk of the system responsible party referred to in the second part of the formula depends on the size (volumes), solvency and, like the first part, above all on the development of the price of the imbalance deviation. Regardless of the operating principle, undercollateral may arise because the average price of a seven-day imbalance deviation is used in the collateral formula. If the price of the imbalance deviation increases, the realised average daily price of the imbalance deviation is higher than the *P*-multiplier, and the share of the risk referred to in the second part of the formula is actually lower than the potential risk exposure when the balance responsible party is acquired or production on the balance sheet ends. In addition, it should be noted that the business risk of the system responsible party is related to, for example, the balance responsible party's profile. Balance responsible parties with very little or no production are forced to purchase electricity through the exchange and are therefore more exposed to risk than electricity producers during potential market disturbances. On the other hand, on the producer side, wind power companies, for example, must be considered riskier operators in certain market conditions than, for example, nuclear power or hydropower companies due to the impact of external factors (e.g. time fluctuations in production caused by wind conditions).

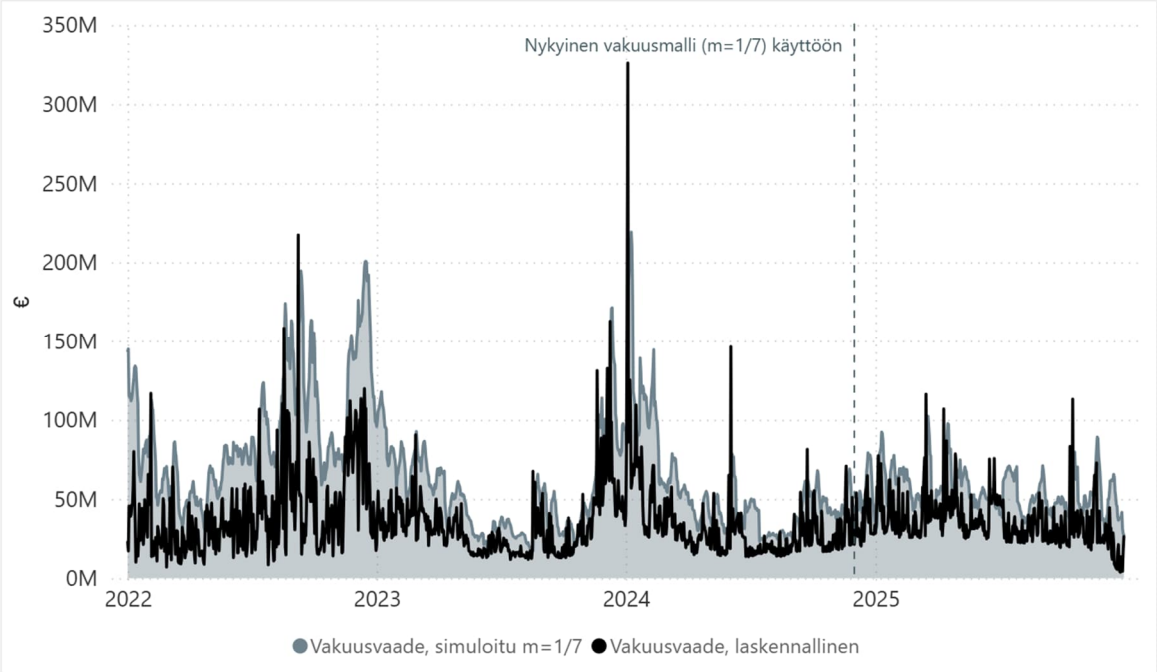



Figure 4: Simulated collateral requirement calculated according to the current collateral formula and Fingrid's computational collateral requirement for 2022–2025.

The computational collateral requirement describes Fingrid's actual risk as accurately as possible. The computational collateral requirement takes into account the accrual of balance responsible party fees calculated on the basis of the realisations of the previous 21 days and the imbalance deviation costs. This describes the actual costs that have not yet been paid. In addition, the computational collateral requirement includes a cost per balance responsible party in a situation where the balance responsible party would rely on imbalance power for its electricity procurement. This is calculated on the basis of the actual imbalance deviation prices on the review date and the consumption and sales of the balance responsible party. The calculation has been made for each imbalance settlement period. The actual production of the balance responsible party is taken into account in full, i.e. it reduces the balance responsible's collateral requirement. The simulated collateral requirement is the collateral formula currently in use (*m=1/7).* The comparison shows that Fingrid's actual risks often exceed the collateral in the current collateral formula at the sum level. An examination of the balance responsible party shows that undercollateral is created even more often at the operator level.

# 3 Collateral model from the perspective of market participants

The current collateral model works well when it is sufficient to cover both unpaid imbalance deviations and volume payments (first part of the formula) and the system operator's risk of potential damage caused by a counterparty guilty of intentional misuse or human error (second part of the formula). From the perspective of risk management and in line with the operating principle of the current collateral formula, the risk exposure referred to in the second part of the formula should increase as the probability of misuse or financial challenges by the balance responsible party is to be considered. On the other hand, from the system operator's point of view, a higher buffer between the computational risk and the margin requirement can be justified for large operators due to their larger market position and higher potential overall risk.

## 3.1 Interviews with market parties

The following types of market parties were interviewed in the collateral study:

- Electricity producer company
- Electricity producer and consumer company
- Company selling electricity
- A company operating as an industrial consumer
- Company acting as a service provider

This section describes the views expressed in the interviews with the market parties on the collateral model for balance responsible parties.

From the perspective of one market party, the biggest challenges of the current model are related to the price component. The market party sees the current model as far too sensitive to the impact of the price, and the amount of collateral rises unreasonably high in relation to counterparty risk in a short period of time due to price spikes. Harmonisation of the *m*-multiplier to 1/7 was seen as a positive change that evened out the variation in the collateral requirement over time. The party commented that it understands the importance of collateral for the functioning of the market, but does not want to bear the risk and potential costs caused by price fluctuations for Fingrid in the form of collateral. According to the party, the model should take better account of the risk profile or credit rating of each party. Taking production into account as a factor that reduces risk and collateral requirements was seen as a valuable element, but this should be combined with a party-specific credit rating assessment in an objective manner. In extreme situations, smaller operators with a riskier business profile should, according to the party, bear a larger share of their risks, and this should not be reflected in an increase in the collateral requirement for large and solvent operators.

From the perspective of another market party, the current balance sheet model works reasonably well. However, in connection with the interview, the impact of the price of the imbalance deviation on the amount of collateral was highlighted as the most significant area for development. In the current calculation, price spikes cause a strong increase in the collateral requirement in a short period of time, which must be reacted to quickly by the balance responsible party. In order to moderate the impact of price spikes, the party proposed the use of the median instead of the average in the calculation of the *P*-multiplier. In addition, the reintroduction of the old "staircase model" was considered an idea worth considering. Fairness and reasonableness were seen as valuable elements in the collateral model. In the party's view, the amount of the collateral should not rise so high that it would become an obstacle to entering the market. As a multinational player, it also saw value in harmonising the model in all the Nordic countries. All in all, the collateral requirement does not currently pose significant challenges for the party, because considering the size of the company, the collateral requirement is nevertheless reasonable in their view.

In an interview with a third market party, the price sensitivity of the current formula emerged as a very significant problem. The market party sees the current model as significantly increasing their risk exposure, because in an extreme situation, the collateral requirement may grow unreasonably large in a short period of time, and it is not possible to react to this quickly enough. Due to this risk, the market party currently holds excessive collateral as deposited. In the party's view, the calculation formula should be substantially changed with regard to the price component, for example by extending the review window for the *P*-multiplier or by not taking into account electricity prices above a certain level in the collateral calculation. On the other hand, the market party is prepared to convert negative prices used in the calculation of the *P*-multiplier into absolute values instead of the current zero floor. In the party's view, the current calculation formula does not correspond to counterparty risk in the right way, as historically meticulously managed obligations do not have a sufficient impact on the amount of collateral, but the collateral fluctuates according to the effect of market prices. This should not be passed on to the balance responsible party's risk. There were no grounds for taking production into account in the collateral calculation, it would be more essential to make the current model more predictable and better correspond to the actual counterparty risk, especially in extreme situations.

In the view of the fourth market party, the current collateral model works quite well. The calculation principles are clear, understandable and fair. However, the previous "tiered model" was seen as administratively easier, as the amount of the collateral did not have to be constantly monitored and updated. Improving price sensitivity in one way or another and extending the response time to updating the amount of collateral were identified as areas for development. At present, the collateral requirement may grow rapidly as a result of price spikes, and the deposited collateral must be withdrawn in such a short period of time that it occasionally causes administrative challenges. The market party did not see any grounds to take production into account more specifically in the collateral calculation, it would be more essential to moderate the impact of price changes on the collateral requirement and to extend the time window for updating the collateral.

In the interview with the fifth market party, the price sensitivity of the collateral requirement was highlighted as the most important area for development. In particular, the problem is related to the impossibility of forecasting; The collateral requirement may multiply in a very short period of time, and this cannot be predicted in any way. This leads to the fact that the deposited collateral has to be kept constantly oversized, because the continuous optimization of the collateral amount is administratively too burdensome. A solution to this was identified, for example, by extending the review window for the *P*-multiplier. In addition, the idea of integrating the party-specific risk factor as part of the collateral calculation came up in the interview with the market party. This could be done, for example, in a way similar to the Nord Pool model. The amount of the collateral would be reduced if certain criteria were met for each balance responsible. In the formula, this would be reflected as an additional component (multiplier), which would be lower for balance responsible parties classified as low-risk.

# 4 Development options for the collateral model

This section analyses the development options for the collateral calculation formula and the effects of the alternatives on both Fingrid and the balance responsible parties. In the electricity market, risks can increase rapidly. In order for collateral to cover growing risks, collateral requirements should either be at a high level in principle or they should react sensitively to the changed risk environment. In order to avoid continuous overcollateralization, the development of the model in this collateral settlement is guided by the objective of developing a collateral model that relies on the most recent available imbalance settlement data and covers risks as accurately and timely as possible. The new collateral requirement, which rises easily due to the risk level, also decreases rapidly due to the balance counterparty's payments and when the market situation calms down.

In accordance with the Energy Authority's decision, the consideration of production as a risk reducing factor in the calculation of the security has been taken into account. Appendix 1 presents the calculation periods and schedules of the data used in the different parts of the current and the collateral model under development.

## 4.1 Development options for the first part of the collateral formula

The first part of the collateral formula covers the actual but unpaid costs. The development proposal for the first part of the collateral formula seeks to ensure that as recent final imbalance settlement data as possible would be used in collateral calculation. The development of the collateral formula also aims to ensure that the collateral calculation reacts as quickly as possible to price changes that affect the costs of balance responsible parties.

### 4.1.1 Risk exposure for balance responsible party payments ($S_{payments}$)

In the collateral model and collateral calculation formula currently in use, $S_1$ refers to the average of the weekly invoiced volume fees for production and consumption and the volume fees for imbalance deviations for the last three invoiced weeks, including possible value added tax.

The collateral model and the component of the collateral calculation formula $S_1$ will be developed in such a way that the collateral calculation formula will use the imbalance settlement data that are already finalised closer to the date of collateral calculation. Final imbalance settlement information refers to information that has been reported to eSett's imbalance settlement no later than 13 days after the delivery date. The collateral calculation uses data for 21 days, calculated from the 14th day and ending on the 34th day of the current day. The calculation calculates the average of the amounts of the volume fees for production and consumption invoiced by the balance responsible party and the volume fees for the imbalance deviation, including possible value added tax. The prices used in the calculation of the fees are the prices in force at the time for the period in question.

The reason for this development is that the imbalance settlement data that are as close as possible to the time of the collateral calculation and that have been reported as final to the imbalance settlement are used in the collateral calculation.

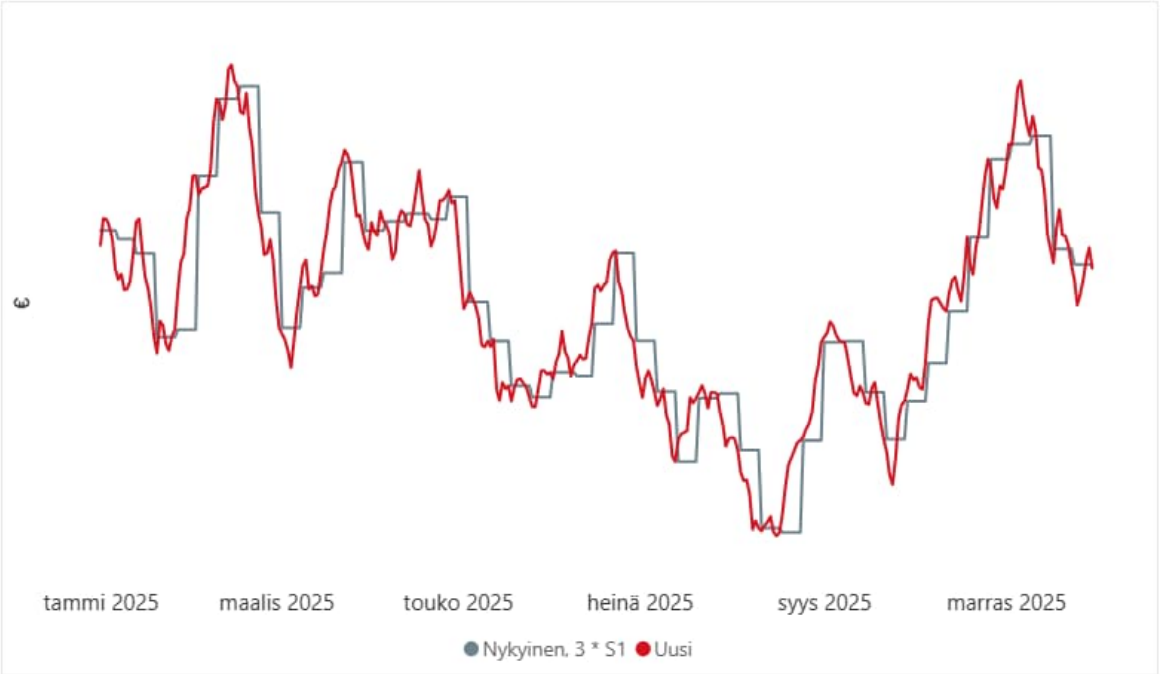



Figure 5: Risk exposure of the example entity's unpaid balance responsible party contributions calculated in the current and new way 01/2025–11/2025.

The figure above shows the risk exposure of one example of an unpaid balance responsible party payment using the $S_1$ component of the current collateral requirement calculation formula ($3*S_1$) *and the* $S_{payments}$ component of the new collateral requirement to be developed. The $S_1$ component of the current collateral requirement is based on the invoiced amounts of the balance responsible parties' production and consumption volume fees and imbalance deviation volume fees, and the new $S_{payments}$ component monitors the volume fees of production and consumption as well as the volume fee of the imbalance deviation based on the most recent actual imbalance settlement data possible.

### 4.1.2 Risk exposure of balance responsible parties for imbalance deviations ($S_{deviations}$)

In the currently used collateral model and collateral calculation formula, the $S_2$ component refers to the average absolute values of the weekly invoice deviations for the last three invoiced weeks, including any value added tax. This is calculated by first adding up the balance deviation bought and sold for the week and taking the absolute value of this sum from it. This has been done for the last three invoiced weeks. Then the average of these absolute values is calculated.

The collateral model and the component of the collateral calculation formula $S_2$ are developed in such a way ($S_{deviations}$) that the unpaid imbalance deviation costs are calculated in two parts. The first part uses the costs and receivables caused by the balance responsible's actual imbalance deviations. Thus, 8-day data are used in the collateral calculation, calculated from the 14th day and ending on the 21st day of the current day. In the second part, the volumes of the imbalance deviation are used in the collateral calculation from 13 days ago, calculated from the 14th day and ending on the 26th day of the day. The calculation

uses the volumes per imbalance settlement period as absolute values and from which the sum for the period in question is calculated. The imbalance deviation price used in the collateral calculation is 13-day data calculated from the previous day and ending on the 13th day of the current day. The absolute values of the prices per imbalance settlement period are used to calculate an average for the period in question. In the calculation of the $S_{deviations}$ of the calculation formula, the costs of the collateral claim are included in the calculation in accordance with the first and second parts of the formula, added together.

The reason for this development is that the imbalance settlement data that are as close as possible to the time of the collateral calculation and that have been reported as final to the imbalance settlement are used in the collateral calculation.

The figures presented below show that the $S_{deviations}$ -component of the calculation of the new collateral requirement to be developed reacts much faster and more correctly, following the actual collateral needs than the collateral formula currently in use. Timeliness can be seen both when collateral needs increase and also when collateral needs decrease.

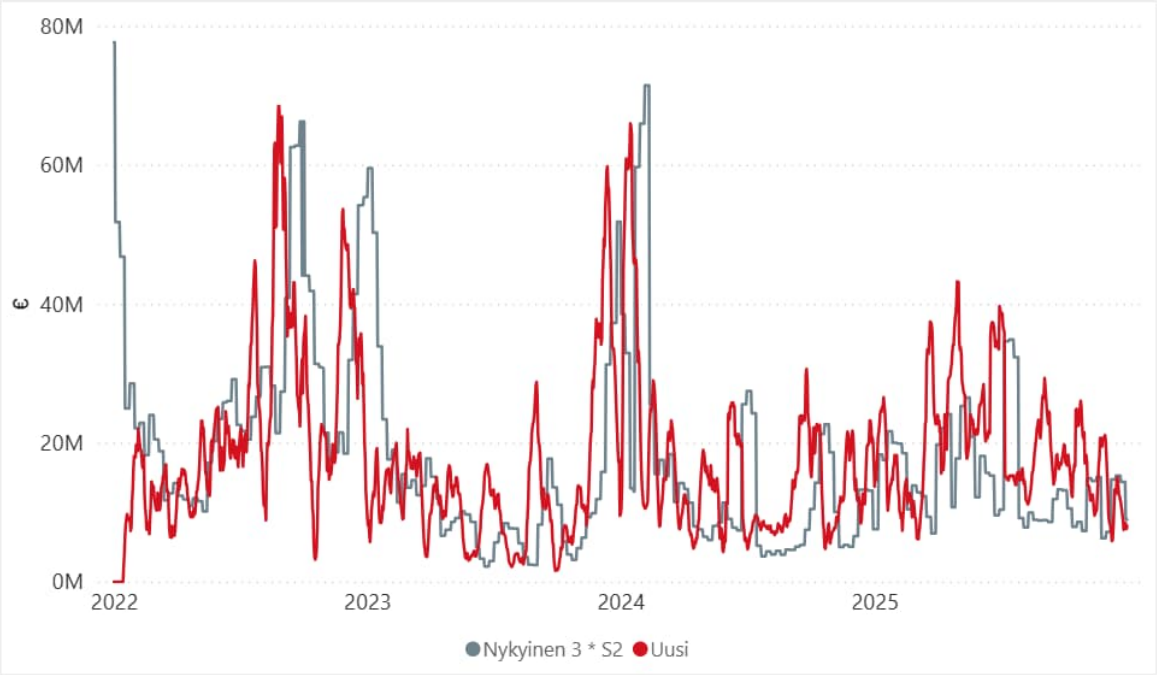



Figure 6: The current collateral requirement in use with the $S_2$ (in the graph Current 3 * $S_2$) and the collateral requirement to be developed with the $S_{deviations}$ component (in the graph New). The data used in the analysis is available from 1 January 2022 onwards, so the risk exposure of balance responsible parties for imbalance deviations is accurate only 26 days after the beginning of the year.

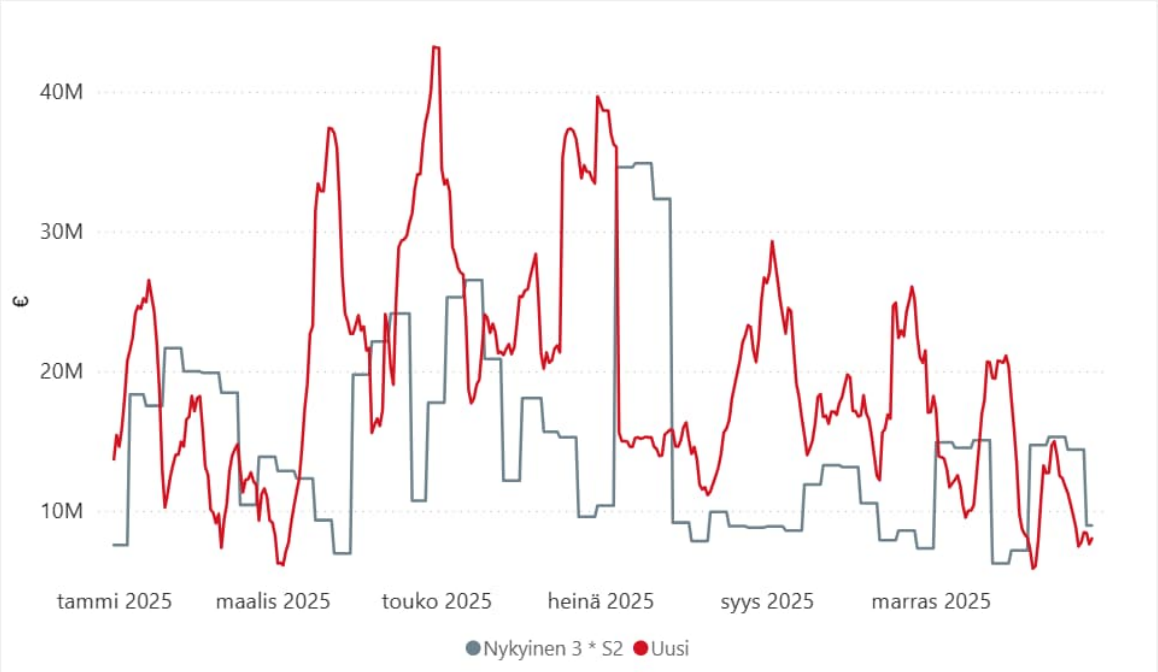



Figure 7: The current collateral requirement in use with the $S_2$ component (in the graph Current 3 * $S_2$) and the collateral requirement to be developed with $S_{deviations}$ (in the graph New) presented for a shorter period.

In the collateral settlement, even more recent imbalance settlement data closer to the current date were examined for use in the calculations of both the $S_{payments}$ and $S_{deviations}$ components, but this was abandoned because this would have been preliminary imbalance settlement data, which may still change before they have been reported as final data to eSett's imbalance settlement. It should be noted and also as one of the conclusions that if the reporting schedule for final imbalance settlement data based on Finnish legislation were shortened from the current one, it would make it possible for imbalance settlement data to be used in the imbalance settlement of balance responsible parties and its collateral calculation even closer to the current date.

## 4.2 Development options for the second part of the collateral formula

The second part of the collateral formula covers the risk of Fingrid and other market parties if, for example, a party fails to carry out the procurement due to bankruptcy or other financial difficulties that prevent the implementation of the procurement. An accidental mistake made in electricity exchange trading can also lead to a situation where the party is no longer able to meet its payment obligations. The proposed amendments to the second part of the collateral formula are intended to ensure that the formula reflects the prevailing market situation and price level as well as possible and that the most up-to-date final imbalance settlement information can be used in the calculation.

As part of its request for clarification, the Energy Authority has obliged Fingrid to develop a collateral formula to take into account the production of balance responsible parties. With certain limitations, production can be seen as a factor that reduces counterparty risk.

Factors affecting the level of risk include, for example, the form of production, the size of the production facility, the total number of production facilities, and the ownership and control of the balance responsible party in different production facilities, as well as commercial agreements entered into (e.g. PPA).

### 4.2.1 Taking production into account in collaterals

In the second part of the collateral formula currently in use, production is not directly taken into account. Indirectly, production is currently taken into account in the calculation of the collateral requirement through the $V_2$ -component. The $V_2$ -component covers the sales of fixed trades and the sales of electricity exchange trades for the last seven days for which volumes are available. The sales volumes of balance responsible parties profiled as producers are higher than those of consumers, which means that the $V_2$ component increases. Because the $V_2$ component is positive in the formula, the increase in sales volumes increases the collateral requirement of the balance responsible party and thus covers, for example, situations where commercially sold electricity is not produced or purchased when a party leaves the market.

Production with the ability to adjust reduces the risk of the balance responsible party more than inflexible production. In this collateral model, the ability to regulate production is assessed by examining whether production is scheduled for imbalance settlement periods that are more expensive or cheaper than the average for the day-ahead market.

It is proposed to add a new component $V_{production}$ to the second part of the collateral formula and its calculation, which takes into account the production as a factor that reduces the collateral requirement.

In the second part of the collateral formula, in order to take production into account, the average price of the daily market is first calculated for seven days, calculated for -13 to -19 days from the date of review. After this, the production of the balance responsible party produced during the imbalance settlement period with a daily market price higher than the calculated daily market average price is calculated for the same period, and the production of the balance responsible party produced during the imbalance settlement period with a daily market price lower than the calculated daily market price for the same period is calculated for each imbalance settlement period.

The proposed collateral model aims to use the latest available final imbalance settlement data for each component of the collateral formula. The challenge in this regard is that sales and production are taken into account from different periods, which means that sometimes the sum of production for the week under review exceeds the sum of sales for the week under review. Production cannot be taken into account using preliminary data, as any deficiencies and errors would distort the results of the collateral calculation. Therefore, production cannot be fully taken into account in the collateral formula, so that the second part of the formula does not fall to zero.

For the reasons mentioned above, it is proposed that 75% of the output be taken into account in the calculation of the collateral requirement to be developed, and that output produced during imbalance settlement periods where the day-ahead market price is lower than the average day-ahead market price is taken into account 25% of the output.

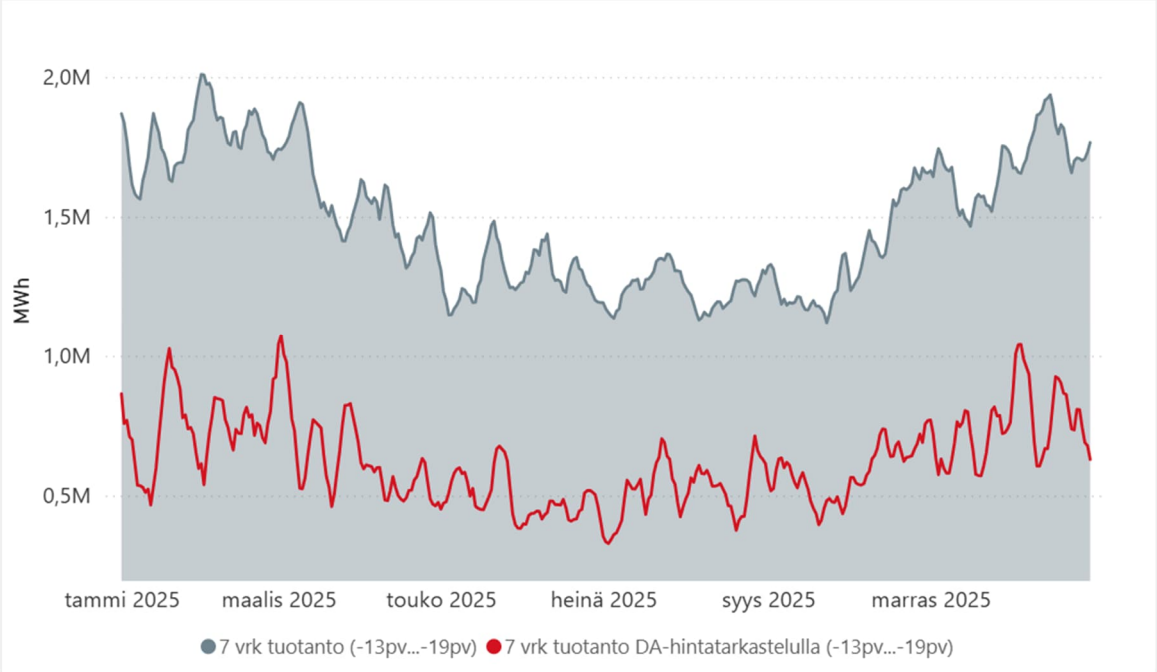



Figure 8: The actual production of all balance responsible parties and the amount of production to be taken into account in the new collateral formula, calculated on the basis of the realisations in 2025.

The figure above shows the amount of actual production taken into account in the collateral calculation for 2025.

Technology neutrality and the fact that the information required for collateral calculation is easily available are seen as positive aspects of the proposed consideration of production. The challenge in the proposed increase in production is to identify changes in production volumes as the production on the balance sheet of the balance responsible party participates in the intraday market or the reserve market. However, as a whole, it is seen that the impact of these changes is quite limited.

### 4.2.2 Consumption and sales development options ($V_{consumption}$ ja $V_{sales}$)

In the current collateral formula, the data for component $V_1$ (consumption) in the second part of the formula are calculated on the basis of the settled data so that the consumption volume is for the last seven settled days (starting 20 days before the current day and ending 14 days before the current date) and the data for component $V_2$, including the sales of bilateral and electricity exchange transactions for the last seven days for which the volumes are available (starting from eight days before the current date). and ending two days before the current day).

It is proposed that the latest available final imbalance settlement data be used in the calculation of the components $V_{consumption}$ (consumption) and $V_{sales}$ (commercial sales) in the second part of the formula, so that the result of the calculation would reflect the current counterparty risk as well as possible.

After the proposed change in the second part of the formula, the data in the $V_{consumption}$ component would be calculated in the new model so that the $V_{consumption}$ consumption volumes would be for the last seven settled days (starting 19 days before the current day and ending 13 days before the current day). After the change, the data in the $V_{sales}$ component would be such that the sales of bilateral trades would be for the last seven settled days for which volumes are available (starting eight days before the current date and ending two days before the current date) and the sales of electricity exchange trades for the last seven days for which the volumes are available (starting seven days before the current date and ending one day before the current date).

Figures 9 and 10 below show that the $V_{consumption}$ and $V_{sales}$ of the collateral model under development react more correctly to collateral needs than the current models $V_1$ and $V_2$.

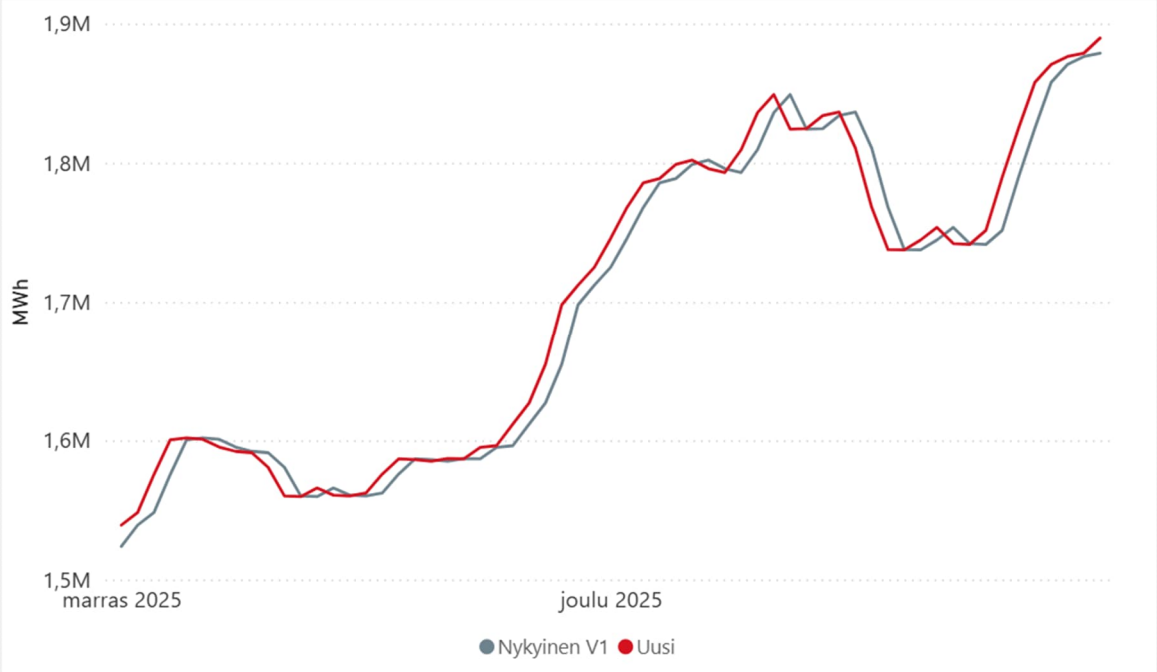



Figure 9$V_1$ component of the currently used collateral formula and the $V_{consumption}$ of the new collateral requirement to be developed (in the graph New).

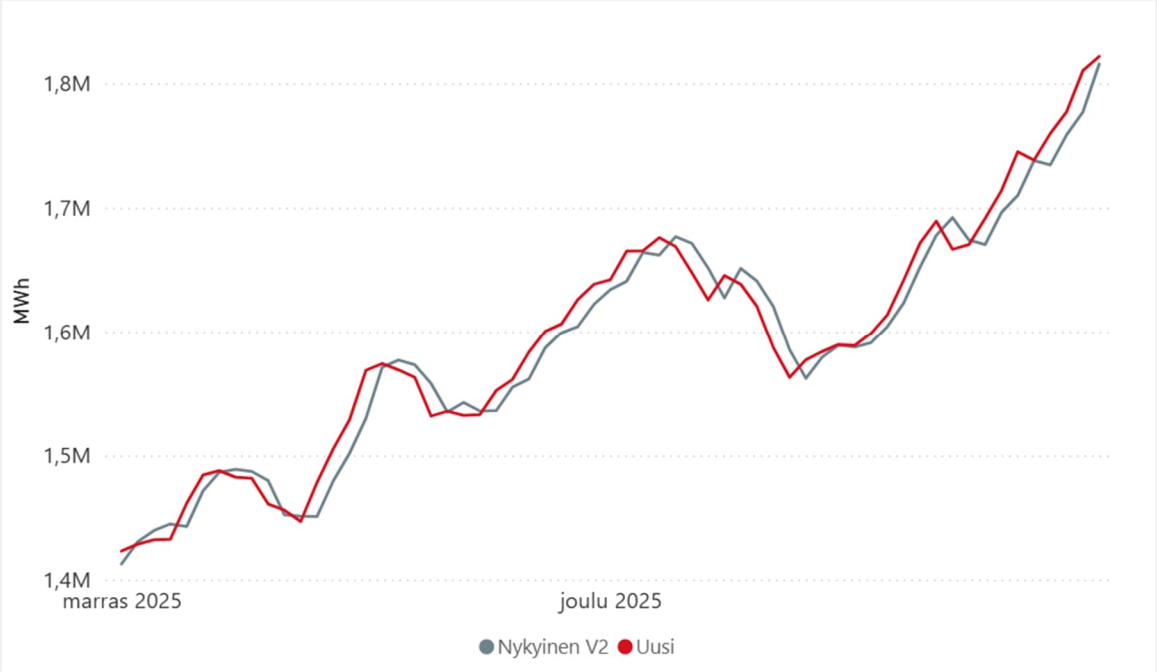



Figure 10: Sales of the currently used collateral requirement $V_2$ and the new collateral requirement $V_{sales}$ (New).

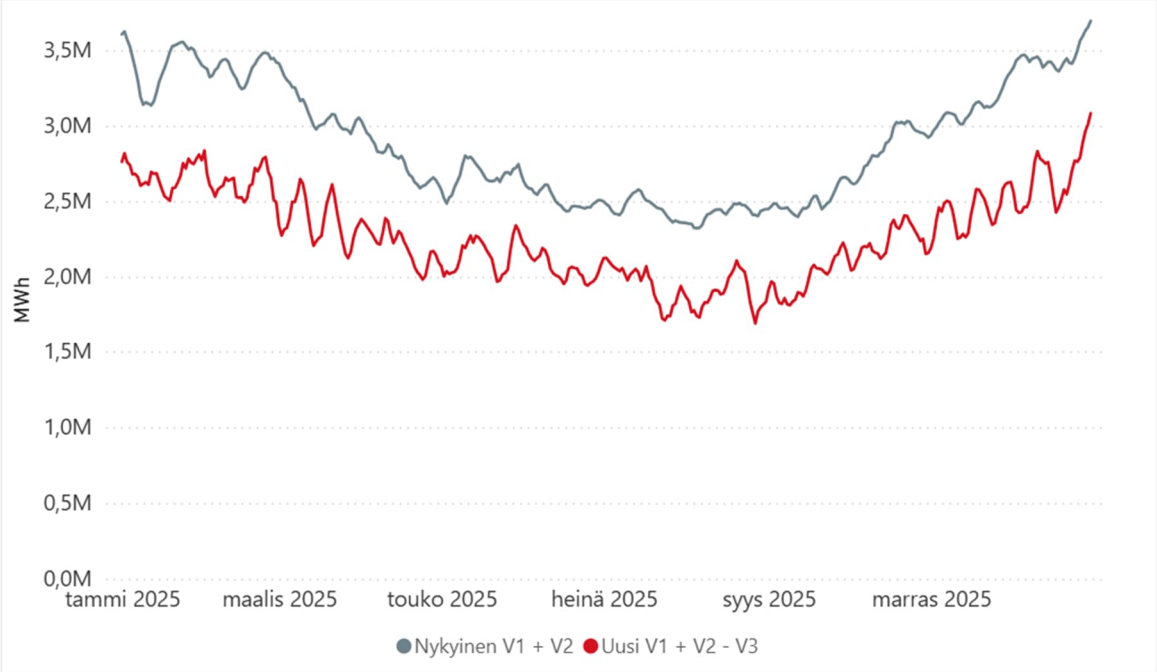



Figure 11: The sum of the current collateral requirement $V_1$ and $V_2$ and the sum of the new collateral requirement $V_{consumption}$ and $V_{sales}$ minus the production of the balance responsible parties $V_{production}$ (in the graph New V1 + V2 - V3), which takes into account the day-ahead market price analysis.

Figure 11 shows the decrease in the volume multiplied by the *P*- and *m* -multipliers in the second part of the collateral formula, when output is taken into account in the calculation of the collateral requirement.

### 4.2.3 Price of imbalance deviation ($P_{absolutvalue}$)

In the current collateral model, the *P*-multiplier is calculated as the average price of the imbalance deviation price in the market balance area over a seven-day period. If the imbalance deviation price is negative, the value zero is used in the calculation of the average price for the imbalance settlement period in question. The development proposal is that prices should be examined according to their absolute values, because at all price levels, the system operator must balance the frequency of the electricity network with purchases or sales. The graph below shows the values of the *P*-multiplier based on the "zero floor" used in the current model and calculated according to the absolute value of prices from the beginning of July 2023, using the seven-day moving average price.

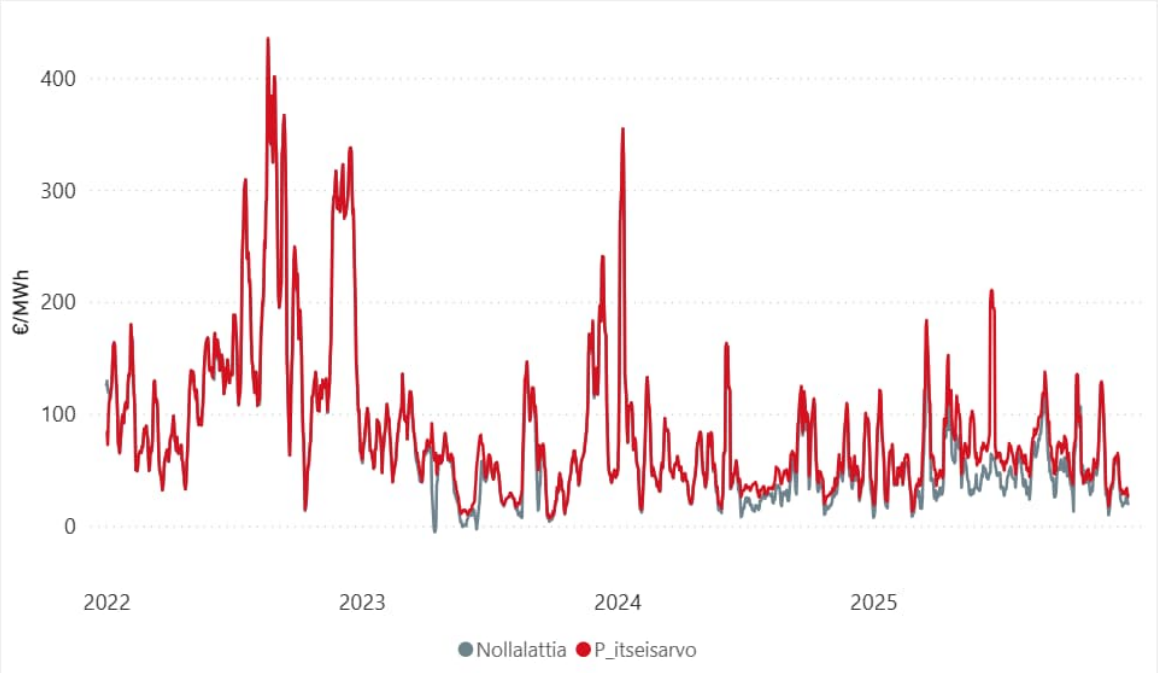



Figure 12: The official *P*-multiplier (Zero floor), which currently uses zero floor, and $P_{absolutvalue}$, which has been calculated from the absolute values of the imbalance deviation prices for the same period.

In line with the figure above, it can be stated that the effects of the change would remain very moderate during the period under review, taking into account, however, that negative prices have increased substantially during 2025, as the surplus caused by balance responsible parties is actively adjusted off. In June 2025, collateral requirements would have increased due to a negative price spike, which would have corresponded to the actual counterparty risk.

The figure below shows the calculation of the *P*-multiplier for periods of different lengths (7 and 21 days) as a comparative time series.

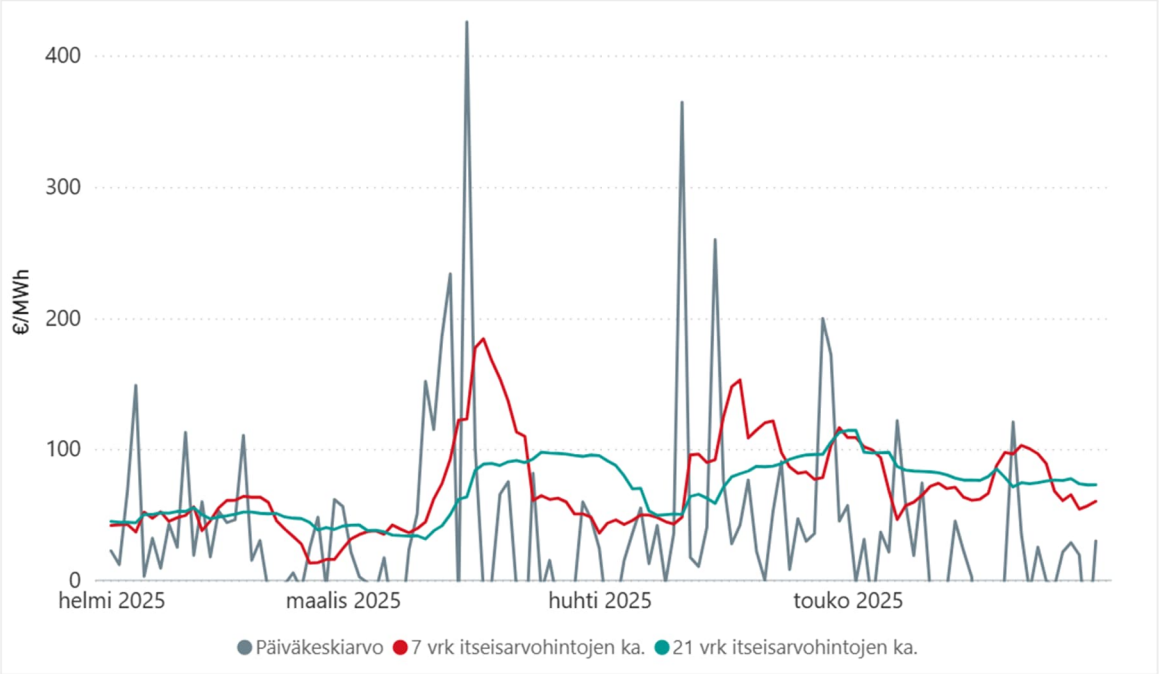



Figure 13: 1-day average of the price of the imbalance deviation and the 7-day and 21-day averages of the absolute values of the price.

Due to the time it takes to complete the imbalance settlements, the collateral requirement currently in use is generally already structurally arrears in relation to the risk exposure that will open up for Fingrid. Extending the time span of the average calculation of the *P*-multiplier would intensify this phenomenon, which would actually increase Fingrid's uncovered risk exposure at times of rising market prices, and the prices used in the calculation would not correspond to the counterparty risk that the second part of the margin formula prepares for (Figure 13). In addition, by increasing the time period, the impact of rising prices would be visible in the result of collateral calculation for a longer period of time, and the model would react with a delay even if prices stabilised. The current collateral model as a whole should be developed in such a way that it is possible to use imbalance settlement data that is as recent as possible.

The study also examined an alternative in which the *P*-multiplier would be the median of the imbalance deviation prices for the period under review. The challenge with this is that there are relatively few very expensive or cheap imbalance prices in terms of numbers. In this case, the median does not effectively take into account changing risk levels.

### 4.2.4 Assessment of market party -specific risk

The study also examined an alternative in which a risk factor would be calculated for the operators of the balance counterparty. However, the challenge of this option was seen as the difficulty of ensuring equity, the availability and interpretation of the information required for the assessment of risk, and the adaptation of company-specific risk to the electricity market.

# 5 Conclusions

This collateral study examined Fingrid's counterparty risk from balance responsible parties and proposes a new collateral formula that takes counterparty risks into account more efficiently than at present.

In the electricity market, risks can increase rapidly. In order for collateral to cover growing risks, collateral requirements should either be at a high level in principle or they should react sensitively to the changed risk environment. In order to avoid over- and under-collateralization, the aim of this collateral settlement was to develop a collateral model that relies on the latest available imbalance settlement data and covers risks as accurately and in a timely manner as possible. The new collateral requirement, which rises easily due to the risk level, also decreases rapidly due to the balance counterparty's payments and when the market situation calms down.

The most significant development proposals in this collateral study in terms of collateral management focus on the following areas:

- In the first part of the collateral formula, unpaid receivables are used in the collateral calculation when estimating unpaid imbalance settlement data closer to the calculation date;
- If the price of the imbalance deviation is negative, the absolute value shall be used in the calculation of the average price for the imbalance settlement period in question; and
- Taking production into account in collateral calculation.

The new collateral formula to be developed is presented below. Appendix 1 describes the calculation periods and schedules of the different components of the collateral formula.

$$\text{Collateral requirement} = S_{\text{payments}} + S_{\text{deviation}} + m * (V_{\text{consumption}} + V_{\text{sales}} - V_{\text{production}}) * P_{\textit{average-price}}$$

where

$S_{\text{payments}}$ = calculated as an average of the sum of the 21-day production and consumption volume fees and imbalance deviation volume charges, including any VAT (volumes starting 14 days before the current date and ending 34 days before the current date). The prices used in the calculation of the fees are the prices in force at the time for the period in question.

$S_{\text{deviation}}$ = calculated the costs of 21-day imbalance deviations, including any value added tax. The sum consists of two different combined parts. The first part of the sum consists of the balance responsible's actual purchase and sale costs of the imbalance deviation for 8 days (imbalance costs starting 14 days before and ending 21 days before the current date). The second part of the amount is calculated using the absolute values of the imbalance

deviation volumes for 13 days (starting 14 days before and ending 26 days before) multiplied by the average price calculated from the absolute values of the imbalance price for 13 days (starting on the previous day and ending 13 days before the current date).

**$V_{consumption}$** = consumption volume for the last seven settled days (starting 19 days before the current day and ending 13 days before the current day).

**$V_{sales}$** = sales of fixed trades (starting eight days before the current date and ending two days before the current date) and sales of electricity exchange trades (starting seven days before the current day and ending one day before the current date) for the last seven days for which volumes are available.

**$V_{production}$** = production volume for the last seven settled days (starting 19 days before the current date and ending 13 days before the current date). In the second part of the collateral formula, the average price of the daily market is first calculated for seven days, calculated for -13 to -19 days from the date of review. After this, the production of the balance responsible party produced during the imbalance settlement period with a daily market price higher than the calculated daily market average price is calculated for the same period, and the production of the balance responsible party produced during the imbalance settlement period with a daily market price lower than the calculated average daily market price is calculated for the same period. The calculation of the collateral requirement takes into account 75% of the production produced during imbalance settlement periods where the daily market price is higher than the average daily market price and 25% of the production produced during imbalance settlement periods where the daily market price is lower than the calculated daily average price.

**$P_{averageprice}$** = the average price of the imbalance difference price of the market balance area over the last seven days for which prices are available (starting seven days before the current day and ending on the day preceding the current day). If the price of the imbalance deviation is negative, the absolute value is used in the calculation of the average price for the imbalance settlement period in question.

**m** = multiplier (1/7)

The study compared the functionality of the current collateral formula and the proposed collateral formula to be developed with Fingrid's computational collateral needs.

The figure below shows the collateral requirements under the official collateral requirement, the simulated collateral requirement and the new collateral requirement to be developed for all balance responsible parties for the years 2022–2025. Formal realised collateral claims refer to collateral claims as they have been for the period in question. The simulated collateral requirement has been calculated so that the *m*-multiplier would have been 1/7 for the entire period under review and in other respects the calculation of the collateral requirement and its components would have been similar to that of the official collateral requirement, with the exception of the end of December 2025, when the *m*-multiplier of the collateral requirement was increased due to the Christmas holidays. This has not been taken into account in the simulated *m*=1/7 collateral requirement. The new collateral requirement has been calculated in the way that the collateral calculation is proposed to be developed in the manner presented in this collateral study.

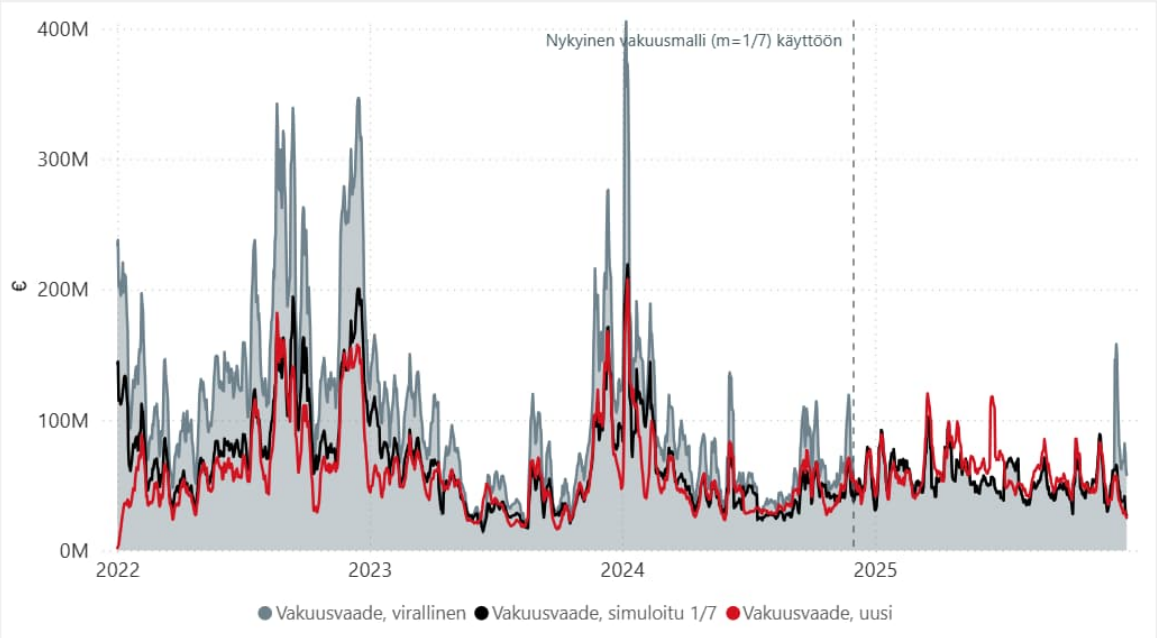



Figure 14: Official collateral requirement, simulated collateral requirement with a fixed *m*-multiplier of 1/7, and collateral requirement according to the proposed new collateral formula based on the realizations of 2022–2025.

The figure shows that, as a rule, a new collateral requirement reacts to collateral needs quite similarly to a simulated collateral claim. In particular, both offset the high collateral requirements caused by high imbalance prices. One of the most significant developments in the new collateral requirement is that when the most recent final imbalance settlement data and prices are used in collateral calculation, the calculation of collateral requirements reacts as quickly as possible to changing situations. This may be difficult to see in the figure above, but the matter has been justified and presented for a shorter period of time earlier in this report. The figure shows the effect of the new *P*-multiplier for the collateral requirement as it increases the collateral requirements when the absolute values of prices are used in the calculation. As previously reported in the report, negative prices have increased substantially during 2025, as the surplus caused by balance responsible parties is actively adjusted away. In June 2025, collateral requirements would have increased due to a negative price spike, which would have corresponded to the actual counterparty risk.

The two figures below examine the over- and under-collateral claims generated by the current and the new proposed collateral formula. This has been done by comparing the collateral in accordance with the formula with the computational collateral requirement. The computational collateral requirement describes Fingrid's actual risk as accurately as possible. The computational collateral requirement has been calculated retrospectively for each day using the balance settled figures for the previous three weeks and the review date. These figures are not yet available on the date of review.

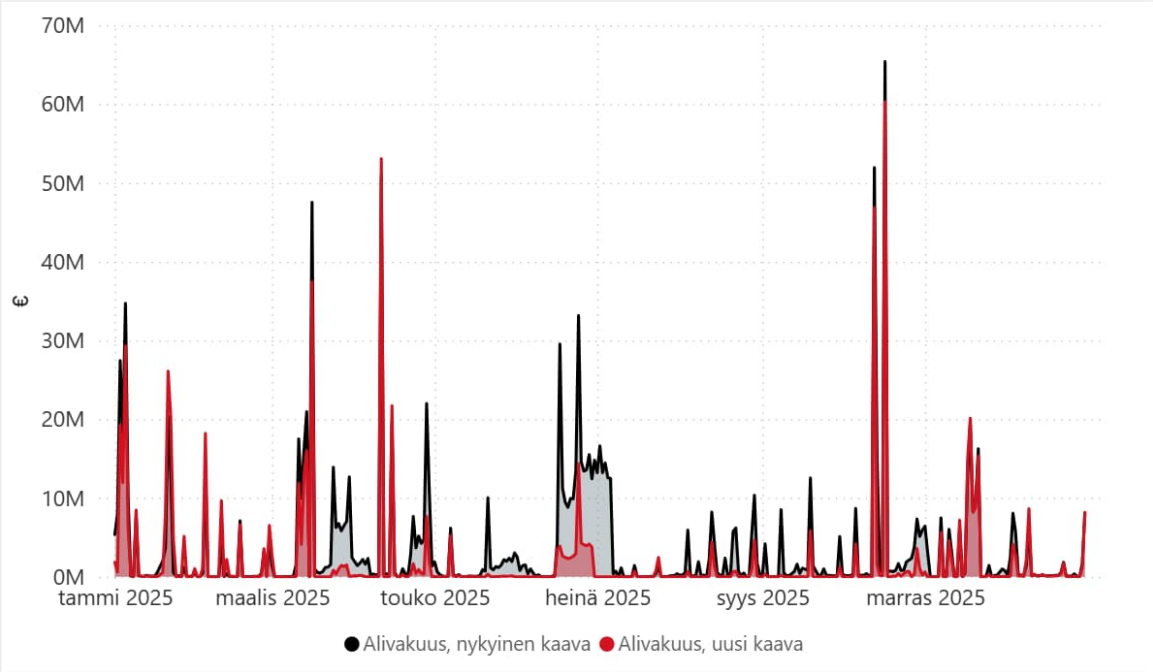



Figure 15: The amount of undercollateral in 2025 with the current collateral formula and the collateral according to the new proposed formula. The undercollateral has been calculated by comparing the collateral amount in the collateral formula with the computational collateral requirement.

The figure above shows the amount of undercollateral with the current collateral formula and the new formula to be developed in 2025. The figure shows that undercollateral situations occur in the same periods in both formulas. The figure also shows that the new proposed formula will reduce the amount of undercollateral. In 2025, the average daily undercollateral calculated with the current formula was approximately EUR 3.55 million and with the new formula approximately EUR 1.93 million. The change in the average amount of undercollateral is about -45%. The result is in line with the fact that the new formula uses the latest available imbalance cleared figures, which means that the collateral requirement reacts more correctly to rising risk levels.

The figure below shows the amount of overcollaterals with the current collateral formula and the new formula to be developed, in 2025.

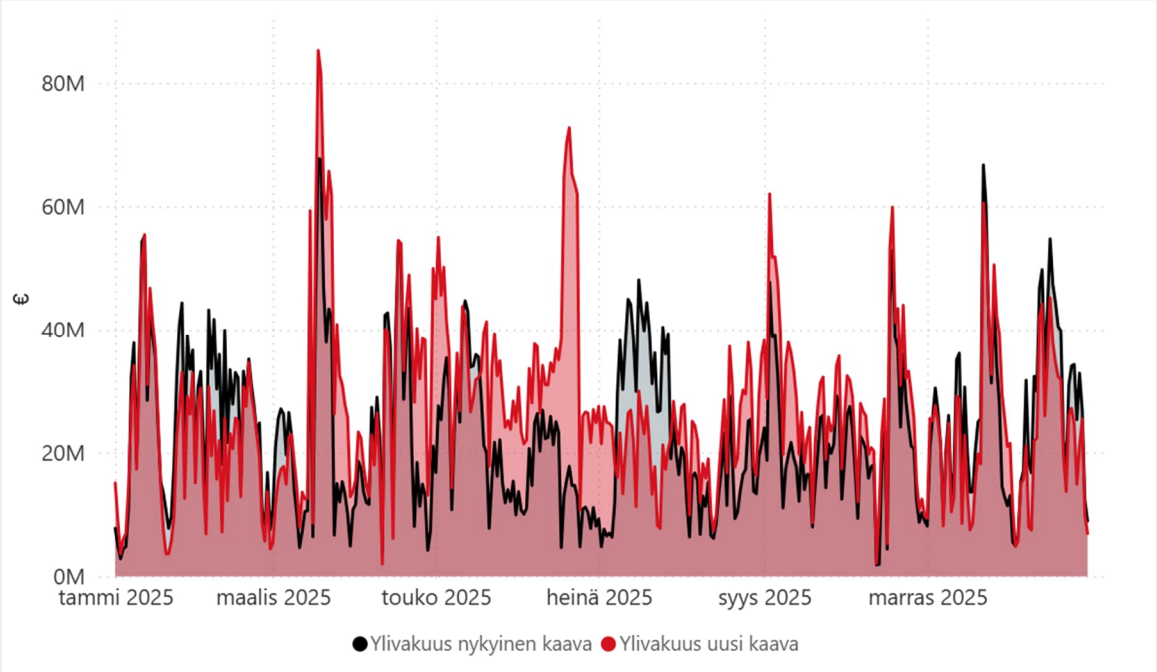



Figure 16: The amount of overcollateral in 2025 with the current collateral formula and the collateral according to the new proposed formula. The overcollaterals has been calculated by comparing the collateral amount in the collateral formula with the computational collateral requirement.

The figure shows that there is more overcollateral than undercollateral. The overcollateral situations in both the current and the new proposed collateral formula are mainly in the same periods. In 2025, the average daily overcollateral under the current plan was approximately EUR 23.3 million and with the new plan approximately EUR 26.8 million. The change in the average amount of overcollateral is approximately +15%. The figure shows that most of the increase in overcollateral takes place in May-July. A significant reason for this is the proposed change in the consideration of the price of the imbalance deviation. In May-July, the price of the imbalance deviation was often negative. In the current collateral formula, the *P*-multiplier, negative imbalance deviation prices are treated as zero. In the new proposed formula, negative imbalance deviation prices are taken into account as absolute values in the $P_{absolutvalue}$ -multiplier. At other points in the review year 2025, it is noticed that the new proposed collateral formula often reduces the amount of overcollateral. This is also in line with the fact that the proposed reform aims to use the most recent imbalance settlement figures possible, so that the collateral requirement also reacts downwards as timely as possible.

In interviews with this collateral study, some of the balance responsible parties have pointed out that the so-called fixed collateral prices used in the past were better than the current model, and the current model means that collateral must be continuously increased or correspondingly reduced further. In this respect, it can be stated that the parties acting as balance responsible parties plan their own production and consumption in advance in their balance management. This means that balance responsible parties can also calculate their own collateral requirements in advance based on their plans and actual imbalance settlement data, and they can thus also pre-establish collateral at a level where there is no

need to constantly re-establish them as new collateral claims are calculated. The deadline for lodging collateral has been extended to the next day, and the parties' collateral management has already been facilitated in that respect.

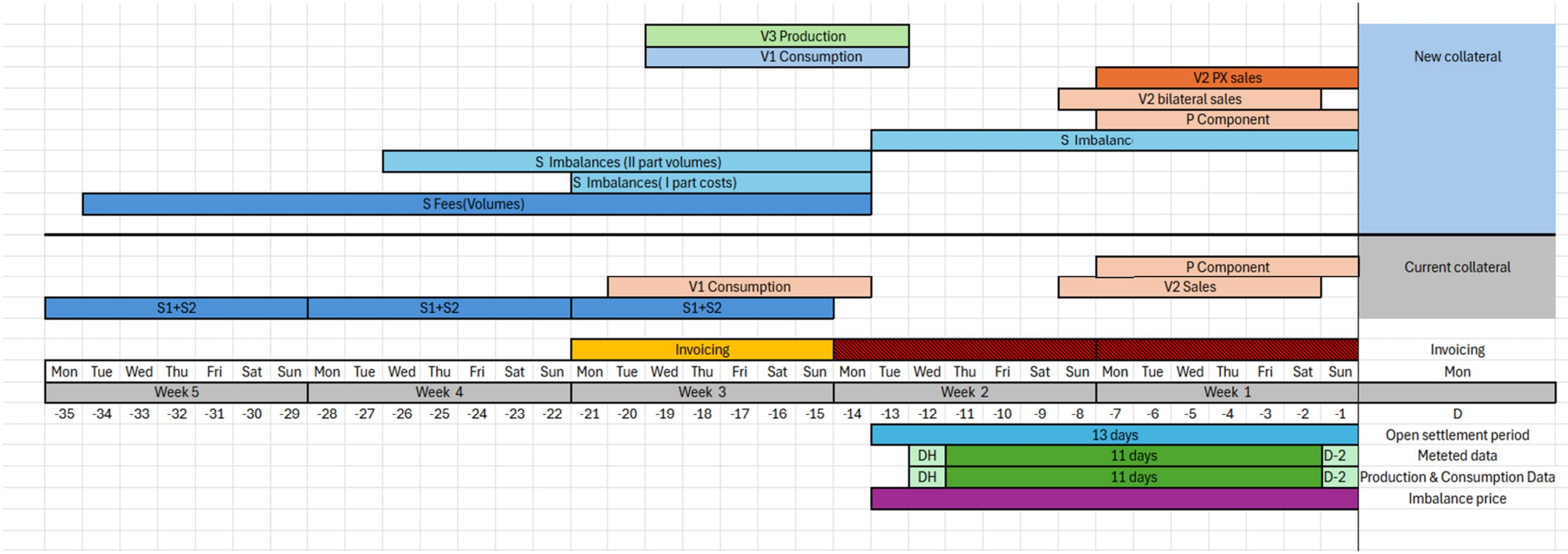
### 5.1.1 Recommendations and other further developments

A general observation regarding imbalance settlement and its enhancement is considered to be the shortening of the reporting times for the current final imbalance settlement data, which have been set out in the Decree of the Ministry of Economic Affairs and Employment on the exchange of information in electricity trade and electricity supply settlement. Shortening the reporting times for the final imbalance settlement periods would thus speed up the completion of the imbalance settlement.

Shortening the open imbalance settlement period would reduce the collateral requirements of balance responsible parties. Shortening the reporting times for the final imbalance settlement data would make it possible to use even more recent data in the calculation of the collateral requirement than in the proposed calculation of the new collateral requirement to be developed in accordance with this collateral settlement. Shortening the reporting times for final imbalance settlement data could also make it possible to speed up the invoicing of balance responsible parties, in which case it would not be necessary to collect collateral for three weeks, but for a shorter period. With the current weekly invoicing cycle, this would mean that the reporting time for the final imbalance settlement data would have to be shortened by 6... 7 days from the date of delivery. In the cost calculations of the imbalance deviations of the collateral requirement ($S_{deviations}$ Part II volumes and Part II prices), the actual imbalance deviation costs could be used instead of using the estimated imbalance deviation costs, which, using the principle of prudence, are in principle higher than the actual costs.

Fingrid is developing the price formation of imbalance deviations so that the volume weighting of the aFRR and mFRR energy markets would be introduced in 2026. Compared to the current price formation, the prices of the imbalance deviation are expected to decrease in upward adjustment situations and to increase in downward adjustment situations. This change will therefore also have a downward impact on the collateral requirements of balance responsible parties.

Appendix 1: Calculation periods and schedules for the different components of the new collateral requirements under development and currently in use

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