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ECC Spot Market Margining

Version 1.9

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CCP Risk Methodology

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1.   Introduction

This document provides the documentation of ECC's spot margin model. The current values of used calculation parameters, if not set in this document, can be found in the risk parameter file[1].

The margining for derivatives is documented in a separate document that is published on the ECC website[1].

Information on margin reports that are available for members can be found here:
https://www.ecc.de/en/member-section/smss-reporting

1.1   Overview of Margin Types

On spot markets, the credit exposure comprises all payment obligations from concluded transactions by a trading participant that have not been settled yet. ECC uses an in-house model based on the time-series of trading participants trading behavior to calculate the margin requirement.

ECC clears spot markets for commodities on which mainly non-financial trading participants are active. Settlement cycles between the non-financial trading participants and their Clearing Member are usually longer than between ECC and the Clearing Members. On some spot markets (power, natural gas) trading and clearing takes place 24/7 while the settlement of payments from accrued exposures is restricted by the business hours of the payment systems.

ECC measures exposure on spot markets near-to-real time using the Current Exposure Spot Market that must be covered with collateral. To avoid frequent margin calls due to collateral shortfalls and to cover exposures that might arise from trading activities outside the business hours of the payment systems, ECC has established the Initial Margin Spot Market (IMSM) as an additional margin component. This IMSM is a buffer and is designed to cover exposure from potential spot transactions in the future until the next settlement time.

Margin requirements on spot markets are adjusted on each ECC business day to adopt to changes in both market conditions and trading behavior (except for CESM which is calculated near-to-real time). ECC performs daily back testing for IMSM. ECC Validation performs an independent annual validation of methods, models, and model assumptions.

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[1] https://www.ecc.de/ecc-en/risk-management/margining

The following table gives an overview of the different margin types:

Exposure Type	Margin Type	Description
Current Exposure	Current Exposure Spot Market[2] (CESM)	The net exposure (debit payment amount after consideration of margin parameters) of all concluded transactions on the spot markets to be settled the next ECC business day.
	Deferred Payment Margin (DEPA)	Used to cover the net debits from daily payments in the case of problems or delays within the payment settlement.
	Additional Margin Curtailment (AMCU)	The expected closeout costs of physical positions in the case a trading participant is curtailed by transmission system operators (TSO).
Potential Future Exposure	Initial Margin Spot Market (IMSM)	The IMSM is called for expected spot transactions in the future until the next payment time and serves as a buffer to reduce intraday margin calls.
	Pre-Auction Margin (PAMA)	This margin is a pre-collateralization for certain types of spot products.

1.2 Regulatory Requirements

Regulatory Item	ECC Methodology
ESMA[3] Article 24 requires that for the calculation of initial margins the CCP shall at least respect the following confidence intervals: (a) For OTC derivatives, 99.5%; (b) For financial instruments other than OTC derivatives, 99 %.	For spot initial margin ECC uses 99% confidence level.
ESMA Article 25 requires that a CCP shall ensure that initial margins cover at least with the confidence interval defined the exposures resulting from historical volatility calculated based on data covering at least the latest 12 months. A CCP shall ensure that the data used for calculating historical volatility capture a full range of market conditions, including periods of stress.	ECC uses a one-year lookback period.

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[2] Storable commodities (e.g. EUA certificates) have current exposure only; non-storable commodities (e.g. gas and power transactions) also have potential future exposure.

[3] Commission Delegated Regulation (EU) No 153/2013 (Regulatory technical standards), p.41ff, Official Journal of the European Union, L 52, 23 February 2013

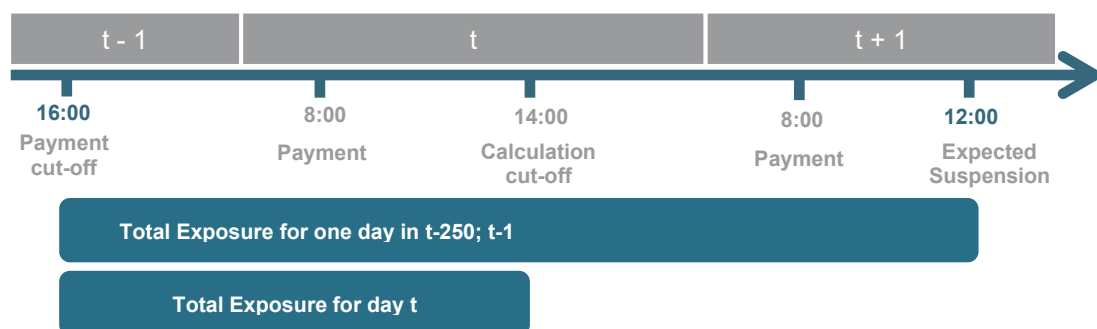|	
ESMA Article 26 requires that the liquidation period shall be at least two business days for financial instruments other than OTC derivatives.	A liquidation period is not relevant for spot products. ECC uses the period between last settlement and the expected termination of a trading participant from the markets as basis for calculating potential future exposure or delivery risk.

2. Calculation of the Spot Initial Margin

Spot markets for commodities such as power or natural gas are different from derivatives markets for several reasons:

- On power and natural gas spot markets transactions are concluded 24 hours a day, 7 days a week that can result in credit exposures during that time. The credit exposures from those transactions are measured on a near-to-real time basis with the Current Exposure Spot Market (CESM) as described in chapter 3.
- A delivery versus payment (DVP) standard cannot be employed to limit counterparty exposures as delivery of power and natural gas takes place shortly after trading and those commodities are not or only very limited storable.

For these reasons ECC has introduced the concept of Initial Margin Spot Market (IMSM) which is based on an in-house developed model. The IMSM is called for expected transactions i.e. before any transactions are concluded and before any credit exposure has arisen. It serves as a buffer to reduce the number of margin calls during the day and to ensure that credit exposure (measured with the CESM) in times where settlements/margin calls are not possible (e.g. weekends), i.e. the potential exposure from expected transactions, will be covered with a high degree of confidence.

The calculation of IMSM is based on statistics of the history of daily total exposures. The daily total exposure[4] comprises the net payment amount of all spot transactions that have been concluded between the payment cut-off of the previous weekday[5] and the latest point in time where a trading participant in default would be suspended from trading the next weekday. On calculation day, ECC takes the exposure from all concluded and registered trades of the previous exposure day $t - 1$ after 16:00 CET until the point in time of exposure calculation (currently 14:00 CET) to improve the forecast of the model. This "incomplete" exposure is often referred to as "t-Exposure" since it includes in particular the trades of the day ahead auction for power of calculation day t. The following graphic gives an overview of the total exposure:

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[4] In EUR, used EOD FX rates can be found at https://www.eurex.com/ex-en/data/clearing-files/Haircut-and-adjusted-exchange-rate

[5] Monday to Friday including all holidays on weekdays

The IMSM model for non-storable commodities for one trading participant is based on his historical daily exposure during a look-back period of 1 year. The history of one year is modelled by using 250 exposure days which are all weekdays. Exposures from different commodities are netted.

The Spot Initial Margin is called with admission of a new trading participant and is only returned when the trading admission is terminated and all pending payments with the trading participant have been settled.

Contracts with no 24/7 trading, e.g. Emission certificates[6], are excluded from IMSM, however these products are considered in CESM calculation. For products that are storable and where the notional market value of the product can be used to offset potential losses in a default (e.g. European Emission Allowances that can be used like securities) only the price-change risk is considered as exposure.

2.1   Initial Margin Spot Market

The calculation of the IMSM is based on the historical daily exposures of the past year. The exposure $E_{i,g}(t)$ for an account i and a product group g on day t is defined as

$$E_{i,g}(t) = \sum_{s \in S} P_{i,g}(s) Q_{i,g}(s)$$

$P_{i,g}(s)$ is the price paid by trading participant i for the trade of product g at date time s and $Q_{i,g}(s)$ is the corresponding quantity bought ($Q > 0$) or sold ($Q < 0$). The exposure is calculated for every exposure day t and the index set S contains trade timestamps[7] in the time window for one exposure day as in the graphic above. An example for the exposure aggregation can be found in section 2.4

The exposure is further adjusted by a specific margin parameter $MP_{g,(Buy; Sell)}$, which is given for each product g and depends on whether $E_{i,g}(t)$ signals a net buy or sell.

$$E_i(t) = \sum_{g=1}^{n} E_{i,g}(t) \, MP_{g,(Buy; Sell)}$$

For standard products and markets the margin parameters $\mathrm{MP}_g{}^{sell}$ and $\mathrm{MP}_g{}^{buy}$ are set to 1 to determine the net payment amount. A list of adjusted margin parameters for affected market areas can be found in the ECC Risk Parameters file.

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[6] Currently including all EUA, EUAA and CER contracts.

[7] Here, for convenience the timestamp is assumed to be a unique identifier of a trading participants trade, although in ECC's settlement instructions there is a unique primary key for each trade, because, e.g., all trades belonging to an auction are settled simultaneously.

Based on the historical exposures the spot margin $M_i(t_0)$ for trading participant i is calculated at ECC business day t_0 and called the following ECC business day via

$$M_i(t_0) = RoundedUp(\max\{ M_{stat,i}(t_0) ; \ \beta \cdot max_{t' \in T'} \{E_i(t')\} \}; 10{,}000) + M_{\min}$$

Generally, the equation of spot margin consists of three main components:

1. $M_{\min}$ ensures that there is a minimum margin all the time, e.g. when there is no historical data for a new client, the historical and the short-term moving component would not result in a margin. Moreover, $M_{\min}$ is generally an additional buffer to the margin. The latest parameterization of $M_{\min}$ can be found in the ECC Risk Parameters file.

2. A short-term component allowing the IMSM model to react to drastic changes of the trading participants trading behavior or market price movements. The short-term component $\beta \cdot max_{t' \in T'} \{E_i(t')\}$ uses a look-back period of the last 30 exposure days with $T' = T'(t_0) = \{t_{29}, \dots, t_0\}$. The latest parameterization of β can be found in the ECC Risk Parameters file.

3. A statistical component using the mean and the empirical weighted standard deviation using the exposures of the past year, in form of the last 250 business days, denoted by the time period $T = T(t_0) = \{t_{250}, \dots, t_1\}$. Hereby, t_1 refers to the previous business day before t_0, the day t_2 refers to the business day before that and so on. For the calculation of the mean and standard deviation, only exposures greater than 0 are considered. Other exposures are replaced by a missing value and are ignored.

    The mean is calculated as follows

    $$\mu_i(t_0) = \sum_{k \in \{1, \dots, 250\}:\ E_i(t_k) > 0} \frac{\lambda^k \cdot E_i(t_k)}{m},$$

    where m denotes the number of dates in T with exposure greater than zero.

    The standard deviation is calculated using an exponential weighting with weight factor $\lambda = 0.99$ to provide a faster adaptation to recent changes in trading behavior but also to ensure a stable margin calculation. It is given via

    $$\sigma_i(t_0) = \sqrt{\sum_{k \in \{1, \dots, 250\}: E_i(t_k) > 0} \left(E_i(t_k) - \mu_i(t_0)\right)^2 \cdot \frac{\lambda^k}{m}} .$$

    The core statistical component is now defined as

$$\widehat{M}_{stat,i}(t_0) = \mu_i(t_0) + \alpha \cdot \sigma_i(t_0),$$

where the parameter α is calibrated regularly to ensure sufficient margin levels and adequate backtesting results. The latest parameterization of α can be found in the ECC Risk Parameters file.

To prevent an increase in the statistical component of IMSM even though there is a zero or negative exposure at day t_0, the core statistical component is additionally capped. We use

$$M_{stat,i}(t_0) = \begin{cases} \min\{\widehat{M}_{stat,i}(t_0), M_{stat,i}(t_1)\}, & E_i(t_1) \le 0 \\ \widehat{M}_{stat,i}(t_0), & E_i(t_1) > 0 \end{cases}$$

as the final value of the statistical component of the IMSM model.

2.2 Special Holiday Adjustment

The IMSM is designed to cover potential future exposures between two consecutive payment settlement dates which usually add up to at most 3 days for exposure periods containing weekends where no financial settlement takes place. To cover longer exposure periods due to extra non-settlement days (e.g. Easter or Christmas holidays in which the TARGET2 system for interbank payments is closed), a specific "Holiday Adjustment" is incorporated in the IMSM model.

ECC increases the IMSM by scaling the requirement calculated according to section 2.1 up by the number of hours the settlement period is extended and hence by the time the IMSM needs to provide an additional buffer. The standard exposure periods contain at most 92 hours (from Thursday 16:00 [booking cut] to Monday 12:00 CET). In case of additional non-ECC business days, the number of hours is increased by 24 per day.

The scaling factors are hence as follows:

Number of extra non-settlement days	Hours that need to be covered	Scaling Factor ($f(t)$)
1	92 + 1 * 24 = 116	$1.3 \left(\approx {}^{116}/_{92}\right)$
2	92 + 2 * 24 = 140	$1.6 \left(\approx {}^{140}/_{92}\right)$

The IMSM minimum component is not scaled up. Therefore, the holiday adjusted IMSM requirement is given as

$$M_{i,HA}(t_0) = RoundedUp(f(t_0) * (M_i(t_0) - M_{\min}); 10{,}000) + M_{\min}.$$

A list of the days a holiday adjustment will be applied, and the corresponding scaling factor can be found in the ECC Risk Parameters file.

2.3 Consideration of delivery risk in the exposure generation

For markets where ECC faces a delivery risk, i.e. where ECC's physical nomination can be cancelled by the network operator, the delivery risk is included in the exposure generation of the corresponding product groups by taking a relative portion[8] of the financial exposure.

Example:
For the UK market, sellers are facing a curtailment risk by the TSO. To cover the potential payments of imbalances, 30% of the financial exposure is considered.

$$\text{Exposure}_{\text{old}} \ = \ -\text{GBP}\,1{,}000 \qquad \text{Exposure}_{\text{new}} \ = \ -\text{GBP}\,1{,}000 \cdot -0.3 \ = \ \text{GBP} \quad 300$$

2.4 Example for exposure aggregation

ECC's exposures towards the trading participant contain all trades between the last booking cut-off on the previous exposure day at 16:00 CET and the next exposure day at 12:00 noon CET. They are the basis of ECC's Spot Margin.

The following example shows how they are derived over one week:

Day	Time	Trade Value[9] (k€)	Exposure
— — · ECC 4pm Booking Cut		**———— Latest possibility for suspension 11:45 am**	
Mo	22:00	-56.00	0.00
Tue	12:00		165.00
	12:00	233.00	
	16:00	98.00	
	21:00	-110.00	
Wed	12:00		63.00
	13:00	29.00	
	16:00	108.00	
	20:00	36.00	
Thu	12:00		226.00
	13:00	13.00	

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[8] Can be found in the ECC Risk Parameter File.

[9] The trade value is the traded quantity times the price.

	14:00	99.00	
	16:00	34.00	
	19:00	44.00	
Fri	12:00		783.00
	13:00	190.00	
	16:00	122.00	
	22:00	346.00	
Sat	12:00	55.00	
	14:00	-3.00	
	21:00	-31.00	
Sun	13:00	4.00	
	15:00	86.00	
	21:00	-30.00	
Mo	12:00		737.00
	13:00	192.00	
	16:00	28.00	
	21:00	90.00	
Tue	12 :00		

In order to better illustrate the IMSM algorithm and how the exposures are processed by the daily margin calculation ECC provides an IMSM calculator as an excel version. The current version can be downloaded on the ECC website http://www.ecc.de/ecc-en/risk-management/margining.

2.5 Computation of Spot Initial Margin during change of Clearing Member

Considering the ECC booking cut at 16:00 CET on ECC business days and the time of the transfer on the "Transfer Day" (TD) at 12:00 am CET, it must be taken into consideration that the NCM has the possibility to trade in the time between booking cut and time of effective Clearing Member (CM) change while creating additional exposure at the old CM. This exposure is settled the day after the TD and remains as exposure for the old CM until this point in time.

To reduce the possible remaining exposures during that period, the change of the CM is effectively possible only on days not following a weekend or holiday period of relevant currencies. To cover possible exposure of the remaining period at the old CM, the Spot Initial Margin (IMSM) is split between the old and the new CM on the day before the TD. The old CM keeps 20% of IMSM requirement and ECC pledges 80% of IMSM requirement from the new CM until the remaining exposure is settled. The Current Exposure Spot Market (CESM) relevant for transactions between 16:00 pm CET and 12:00 am CET at the TD will be considered for the old CM at that time.

3. Calculation of the Current Exposure Spot Market

ECC's intraday exposure (also referred to as current exposure) is reflected in the "Current Exposure Spot Market" (CESM). It should be noted that the CESM is not actually paid but rather a calculation to monitor the market participant's trading behaviour.

For all spot products, the CESM is the net exposure value of all concluded transactions on the spot markets during the day to be settled the next ECC business day. Hereby, the net exposure value refers to the net payment amount per product that will be multiplied with a multiplier to reflect

- an increased risk for market areas where ECC faces a delivery risk (e.g. by trading on a non-virtual balancing point or by a local limit implementation of the TSO) or currency risk.
- the risk from storable products (like EUA or CER) where the CESM is the price change risk and not the full payment amount.

The CESM is calculated in the following way: Firstly, all outstanding payment amounts $PA_{i,g}$ with payment date the next settlement day for account i and product group g are determined with $P_{i,g}$ as the price and $Q_{i,g}$ quantity for Product g (e.g. POWER 50HZ, NATGAS TTF) traded in margin account i:

$$PA_{i,g} = \sum_{s \in S} P_{i,g}(s) \cdot Q_{i,g}(s)$$

The amounts $PA_{i,g}$ are then multiplied by the respective MP_g^{buy} as multiplier in case there is an outstanding payment ($\mathrm{PA}_{i,g} \geq 0$) and by MP_g^{sell} as multiplier in case there is an outstanding payout ($\mathrm{PA}_{i,g} < 0$). Thus, the CESM for account i results in:

$$\sum_{g=1}^{n} \begin{cases} \mathrm{PA}_{i,g} \cdot \mathrm{MP}_g^{buy} & \text{if } \mathrm{PA}_{i,g} \geq 0 \\ \mathrm{PA}_{i,g} \cdot \mathrm{MP}_g^{sell} & \text{if } \mathrm{PA}_{i,g} < 0 \end{cases}$$

For standard products and markets the multipliers MP_g^{buy} and MP_g^{sell} are set to 1. A list of multipliers by market area can be found in the ECC Risk Parameters file.

The CESM is floored at 0, so no credit will be granted to other margin classes. This margin is uploaded intraday into the EUREX Clearing system and is updated every 10 minutes. It is reported in EUREX's reports so Clearing Members can detect accumulating exposure on the spot market intraday.

The margin will be reduced as soon as the corresponding payments for the next business day have been instructed in the payment system at the end of the business day (currently 18:00 CET). For products not listed in EUR where the financial settlement is deferred (e.g. due to non-TARGET2 holidays in the corresponding market like GBP for UK), the CESM additionally includes these deferred payments by considering these payments until the second next ECC business day for settlement of non-EUR currencies.

4. Other Margins related to Spot Markets

4.1 Pre-Auction Margin

The Pre-Auction Margin[10] (PAMA) reflects the financial limit set by the Clearing Member per auction and NCM. The margin is used only for auction markets (AM) having a longer repetition cycle and trading systems that provide a financial pre-trade limit. The collateralization of the pre trade limit is used to prevent unexpected margin calls for Clearing members caused by the auction.

$$Limit_{NCM/AM} = PAMA_{NCM}$$

PAMA is released to the Clearing Members after the financial settlement of payments related to the auction at the next business day.

4.2 Deferred Payment Margin

The Deferred Payment Margin (DEPA) is used for cases where financial settlement with Clearing Members is not possible during the common ECC payment cycle[11]. This could be the case if it is technically impossible to generate payments for daily cash settlement or if a delay in provision of transactions results e.g. as part of the *Nordic Fallback*.

The margin is calculated after 18:00 CET and becomes effective at the next business day. It reflects the open net payment amount (debits only) from all spot market that should usually been settled the next business day. The DEPA is only called if the amount is not covered by the Initial Margin Spot Market (IMSM) e.g. at Thursday (effective on Friday) for settlement on Monday or Friday (effective on Monday) for settlement on Tuesday.

4.3 Additional Margin Curtailment

The Additional Margin Curtailment (AMCU) is used for the handling of imbalances or deviations in case that the TSO suspends trading participants balancing group agreements. This makes it impossible for ECC to nominate transactions already concluded by the trading participant to the TSO. It is only called after an actual imbalance took place and covers the actual costs for position close out including the expected price for balancing energy. The margin will be called until all open obligations are fulfilled.

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[10] The Pre-Auction Margin is currently only used for Guarantees of Origin auctions.

[11] As a consequence, these transactions are not considered correctly by CESM and a separate margin needs to be called.