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Settlement Pricing Procedure

The English version is for informal use only. Only the German version is legally binding.

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1. Preliminary Remarks

This document outlines the calculation procedure applied by European Energy Exchange ("**EEX**") to determine daily settlement prices, hereinafter referred to as "**Daily Settlement Prices**" of derivatives traded at EEX (including EEX OTF), which are provided by EEX to European Commodity Clearing AG ("**ECC AG**") for clearing purposes, more specifically to calculate each trading participant's variation margin. The Daily Settlement Prices further serve information purposes.

Furthermore, the determination of premiums for options (hereinafter referred to as "**Option Premiums**") is described.

With regards to the final settlement prices of derivatives products (including contracts that do not qualify as financial instruments under MiFID II) traded at EEX and EEX OTF, please refer to the relevant contract specifications.

Indices, such as ELIX and EGIX, are described in EEX AG's Index Description, which is available on the website of EEX AG (www.eex.com). Indices provided by EEX AG that qualify as benchmarks under Regulation (EU) 1011/20016 ("Benchmark Regulation") are exclusively covered in the Benchmark Statement of EEX AG, which is available on the website of EEX AG (www.eex.com).

Daily Settlement Prices are determined on the basis of trades concluded at EEX during a specified period of time during the opening hours (hereinafter referred to as "**Settlement Price Window**") and/or orders entered into the trading system (hereinafter referred to as "Market data"). If no such market data is available or the Market Plausibility Check makes it necessary, additional data, such as trades concluded in direct temporal connection to the Settlement Price Window and/or orders entered into the trading system, fair values obtained via the **Chief Trader Procedure**, data from index or data providers or other market places, are used to determine Daily Settlement Prices.

All times are Central European (Summer) Time (UTC+01:00 or UTC+02:00).

2. General Rules of Price Determination

2.1   Definition of Product-Specific Parameters

In principle, concluded **trades** and the EEX **order book situation** are used as the basis of the price determination procedure. Only trades and orders which fulfil product or contract specific parameters are taken into account. These parameters include:

- Minimum quantity of contracts per trade

- Minimum quantity of contracts per order

- Minimum duration of the cumulated valid best bid and best ask

- Maximum Spread per contract

The **Maximum Spread per contract** is the maximum price range between buy and sell orders, specified for each contract ("**Settlement Spread**"). The Settlement Spread to be applied depends on the market situation.

Based on trades and orders qualifying for consideration a **Theoretical Price** is calculated (section 2.2.). In a second step this Theoretical Price undergoes a market plausibility check (section 2.3), resulting in the determination of the Daily Settlement Price.

2.2 Calculation of Theoretical Prices

a)   Daily Settlement Prices

The **Theoretical Prices** are determined based on the **calculation algorithms** defined below. In this context, the underlying method depends on the number of valid trades and orders which fulfil the product-specific preconditions (see section 4). In principle, the price sources are trades, orders, the Chief Trader Procedure (fair values collected in a price committee) and data of other price sources.

Cancelled trades are not considered. EEX reserves the right to exclude individual trades, orders or fair values from pricing if those are not in line with the actual situation on the market.

The following overview provides examples of possible scenarios and the calculation algorithms connected with these:

Orderbook situation	Calculation algorithm
There was at least one trade There were suitable orders	Theoretical price = 0.75*AverageTradePrice + 0.25*AverageMid
There was at least one trade There were no suitable orders	Theoretical price = AverageTradePrice
There was no trade There were suitable orders	Theoretical price = AverageMid
There was no trade There were no suitable orders	The Theoretical Price can be established under consideration of market data in direct temporal connection to the Settlement Price Window, data of other price sources or the Chief Trader Procedure.

The **AverageTradePrice** is the mean price of trades concluded via orderbook trading at EEX during the Settlement Price Window.

The **AverageMid** is the arithmetic mean of the average (time weighted or arithmetic) best bid and the average (time weighted or arithmetic) best ask, which fulfil the minimum order quantity. The average best bid (the average best ask) is established as the average from all highest buy orders (lowest sell orders), which lie within the limits of the current settlement spread per contract during the Settlement Price Window for the individual contract on the market.

If there are no trades and orders fulfilling the product-specific parameters, EEX can determine the Daily Settlement Price under consideration of market data in direct temporal connection to the Settlement Price Window, data of the Chief Trader Procedure or other prices sources. Every trading participant can take part in the Chief Trader Procedure. The EEX Market Operations department provides a standardised form to all trading participants, who agree to provide a market price for the respective derivatives. If required, EEX determines the Daily Settlement Prices by calculating the arithmetic mean from all estimates of the market price indications given. For the calculation, EEX reserves the right to not consider indications which deviate considerably.

There is no order book trading in products for Trade Registration only. As a result, Daily Settlement Prices are established with the Chief Trader Procedure, prices from Trade Registration or other price sources.

EEX reserves the right to adjust the Theoretical Prices established in advance to ensure freedom from arbitrage.

For derivatives contracts without open interest, EEX reserves the right to waive the determination of Daily Settlement Prices. In this case, the Daily Settlement Price will be set to the minimum price as defined in the contract specifications.

b) Option Premiums

EEX determines Option Premiums on a daily basis for all option contracts and all respective exercise prices (strike prices). The calculation of **Option Premiums** (except for Options on Freight Futures), are based on the mathematical equation of the Black-76 model. The essential influencing parameters comprise the underlying futures price, the exercise price, the residual term, the short-term risk-free interest rate and the implied volatility of the underlying security. In this context, the implied volatility is established by EEX based on data of other price sources or using the Chief Trader Procedure and with the help of historic market prices.

Subject to the assumption of the standardised normal distribution, Theoretical Prices are established in accordance with the following equation:

$$c = e^{-rT} \left[F\, N\,(d_1) - X\, N\,(d_2) \right]$$
$$p = e^{-rT} \left[X\, N(-d_2) - F\, N\,(-d_1) \right]$$

with

$$d_1 = \frac{\ln\left(\frac{F}{X}\right) + \frac{\sigma^2 T}{2}}{\sigma\sqrt{T}}$$

$$d_2 = \frac{\ln\left(\frac{F}{X}\right) - \frac{\sigma^2 T}{2}}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T}$$

with

c   = price of the call option

p   = price of the put option

F   = current futures price (of the underlying security), here: Daily Settlement Price

X   = exercise price (strike price)

T   = residual term of the option

r   = short-term risk-free interest rate. This is the interbank interest rate, at which banks of good credit standing lend each other money.

N (x) = cumulative standardised normal distribution at point x, i.e. N (x) indicates the likelihood for a variable to be subject to a standard normal distribution of being smaller than x or equal x

ln ( )   = natural logarithm

σ   = expected annual volatility of the futures price (of the underlying security)

In the case of Futures Style Margin Options, the payment of the agreed option premium by the buyer is not made by a one-time payment after the purchase of the option, but only on the day the option expires or is exercised as final premium payment. Additionally, during the holding period, a daily settlement based on the change in the option premium will take place in accordance with the Clearing Conditions of ECC AG. On the day of the conclusion of the transaction, daily settlement shall

be settled based on the agreed option premium and the Daily Settlement Price, and subsequently on the basis of the Daily Settlement Prices of the Exchange Day and the previous Exchange Day. The daily settlement may also result in an interim debit to the seller of the future-style option. When the future style option is exercised and assigned as well as when it expires, the final premium payment is made on the ECC Business Day following the Last Trading Day. The final premium payment is the Daily Settlement Price of the option contract on the exercise or expiration day. The buyer of a future style option is obliged to pay the final option premium on the settlement day after the exercise and assignment or expiration. The final option premium is credited to the seller of the future style option on the same day.

Subject to the assumption of the standardised normal distribution, Theoretical Prices are established in accordance with the following equation:

$$c = [\, F\, N\, (d_1) - X\, N\, (d_2)\,]$$
$$p = [\, X\, N(-d_2) - F\, N\, (-d_1)\,]$$

with

$$d_1 = \frac{\ln\left(\frac{F}{X}\right) + \frac{\sigma^2 T}{2}}{\sigma\sqrt{T}}$$

$$d_2 = \frac{\ln\left(\frac{F}{X}\right) - \frac{\sigma^2 T}{2}}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T}$$

with

c   = price of the call option

p   = price of the put option

F   = current futures price (of the underlying security), here: Daily Settlement Price

X   = exercise price (strike price)

T   = residual term of the option

N (x)   = cumulative standardised normal distribution at point x, i.e. N (x) indicates the likelihood for a variable to be subject to a standard normal distribution of being smaller than x or equal x

ln ( )   = natural logarithm

σ = expected annual volatility of the futures price (of the underlying security)

The calculation of Option Premiums for Options on Freight Futures is based on the mathematical equation of the Turnbull and Wakeman formula extended by Espen Gaarder Haug. The essential influencing parameters comprise the underlying futures price, the exercise price, the time to maturity, the start of the averaging period, the short-term risk-free interest rate and the implied volatility of the underlying asset. In this context, the implied volatility is established by EEX based on data provided by EEX Asia.

Subject to the assumption of the standardised normal distribution, Theoretical Prices are established in accordance with the following equation:

$$c_A = e^{-rT} [F N (d_1) - X N (d_2)]$$
$$p_A = e^{-rT} [X N(-d_2) - F N (-d_1)]$$

with

$$d_1 = \frac{\ln\left(\frac{F}{X}\right) + \frac{\sigma_A{}^2 T}{2}}{s_A \sqrt{T}}$$

$$d_2 = d_1 - \sigma_A \sqrt{T}$$

where

$$\sigma_A = \sqrt{\frac{\ln (M)}{T}}$$

$$M = \frac{2e^{\sigma^2 T} - 2e^{\sigma^2 \tau}[1 + \sigma^2 (T - \tau)]}{\sigma^4 (T - \tau)^2}$$

c_A = price of the call option with volatility of the average on the futures s_A

p_A = price of the put option with volatility of the average on the futures s_A

F = current futures price (of the underlying asset), here: Daily Settlement Price

X = exercise price (strike price)

T = Time to maturity

τ = Time to the beginning of the average period

r = short-term risk-free interest rate. This is the interbank interest rate, at which banks of good credit standing lend each other money.

N (x) = cumulative standardised normal distribution at point x, i.e. N (x) indicates the likelihood for a variable to be subject to a standard normal distribution of being smaller than x or equal x

ln ( ) = natural logarithm

σ = expected annual volatility of the futures price (of the underlying asset)

If the option is into the average period the strike price must be replaced by Y and the option value must be multiplied by $\frac{T}{T_2}$, where

$$Y = X\frac{T_2}{T} - F_A \frac{(T_2 - T)}{T_2}$$

T_2 = the original time in the average period

F_A = the average futures price during the realized or observed time period $T_2 - T$.

During the average period F_A will be assumed to be equal to F.

2.3 Market Plausibility Check

The Theoretical Price is validated against the actual market situation. For the market plausibility check external price sources will be used like prices from other trading venues, information from data providers and chief traders or prices from trade registration. Furthermore, especially in the case of having insufficient market data within the Settlement Price Window, trades and orders in direct temporal connection to the Settlement Price Window can be used for the market plausibility check.

3. Product-Specific Rules and Parameters for the Determination

3.1 Settlement of Financial Power Futures

Parameter	Specification

Settlement Price Window
 	
   EEX Japanese Power Futures
   EEX Nordic Power Futures
   Other EEX Power Futures
	
	08:30 – 09:30 CET, 09:30 – 10:30 CEST
	15:50 – 16:00 CE(S)T
	17 :05 – 17 :15 CE(S)T

Minimum number of contracts per trade	1 contract = 1 MW constant output per delivery hour (h) during the delivery period
Minimum number of contracts per order	1 contract = 1 MW constant output per delivery hour (h) during the delivery period
Settlement spread for the consideration of best bid / best ask	specified on contract level

Minimum duration of the cumulated valid
best bid and best ask during the Settlement Price Window
 	
   EEX PXE Power Futures
   All other Futures
	
	60 seconds
	180 seconds

Other notes	The Daily Settlement Prices of the front month and front week are calculated as an average of the available spot prices and the available Daily Settlement Prices of the respective day- and/or week futures and estimated prices. Where the Theoretical Price is negative, the Daily Settlement Price is set to the minimum price of 0.01 EUR/MWh or 0.01 GBP/MWh, as applicable.

3.2 Settlement of Futures on Emission Allowances

Parameter	Specification
Settlement Price Window	17:05 – 17:15 CE(S)T
Minimum number of contract per trade	1 contracts = 1,000 t CO_2 equivalent
Minimum number of contracts per order	1 contracts = 1,000 t CO_2 equivalent
Settlement spread for the consideration of best bid/best ask	specified on contract level
Minimum duration of the cumulated valid best bid and best ask during the Settlement Price Window	180 seconds

3.3 Settlement of Freight Futures

Parameter	Specification
Trade Registration Product	There is no order book trading in these products. The Daily Settlement Prices for Freight Futures are based on the daily prices published by Baltic Exchange.

3.4 Settlement of Options on Power Futures

Parameter	Specification
Intraday Fixing Prices	On the last trading day the expiry of the option takes place at 15:00 CE(S)T. For the purpose of determining whether an option is in the money or out the money, the exchange determines an Intraday Fixing Price for the underlying Power Future. The methodology for determining the Intraday Fixing Price follows the same principles as methodology for determining the Daily Settlement Price. However, the relevant time window is from 13:50 to 14:00 CE(S)T.

3.5 Settlement of Options on EUA Dec Futures

Parameter	Specification
Intraday Fixing Price	On the last trading day the expiry of the option takes place at 15:00 CE(S)T. For the purpose of determining whether an option is in the money or out the money, the exchange determines an Intraday Fixing Price for the underlying EUA Dec Future. The methodology for determining the Intraday Fixing Price follows the same principles as methodology for determining the Daily Settlement Price. However, the relevant time window is from 13:50 to 14:00 CE(S)T.

3.6 Settlement of Options on Freight Futures

Parameter	Specification
Trade Registration Product	On the expiry day of the option, the Daily Settlement Prices of the underlying Freight Future also serve to inform whether an option is in or out of the money. With regard to the determination of these Daily Settlement Prices, reference is made to Section "Settlement of Freight Futures".

3.7 Settlement of Futures on Agricultural Products

Parameter	Specification
Settlement Price Window	
Dairy Futures (excluding Liquid Milk Futures)	08:55 – 18:00 CE(S)T
Liquid Milk Futures	08:55 – 18:00 CE(S)T
Potatoes Futures	10:00– 16:00 CE(S)T
Minimum number of contracts per trade	
Dairy Futures (excluding Liquid Milk Futures)	1 contract = 5 metric tons
Liquid Milk Futures	1 contract = 25.000kg
Potatoes Futures	1 contract = 250 quintals
Minimum number of contracts per order	
Dairy Futures	1 contract = 5 metric tons
Potatoes Futures	1 contract = 250 quintals
Settlement spread for the consideration of best bid/best ask	specified on contract level
Minimum duration of the cumulated valid best bid/best ask during the Settlement Price Window	300 seconds

3.8 Settlement of Natural Gas Futures

Parameter	Specification
Settlement price window EEX Natural Gas Futures	17:00 – 17:15 CE(S)T
Minimum number of contracts per trade	
EEX PEG and PVB Natural Gas Futures	1 contract = 1 MWh/d constant output per delivery day (d) during the delivery period
EEX NBP Natural Gas Futures in p/therm	1 contract = 1 ktherm/d constant output per delivery day (d) during the delivery period
EEX TTF Natural Gas ($/MMBtu) Futures	1 contract = 10.000 MMBtu
All other EEX Natural Gas Futures	1 contract = 1 MW constant output per delivery hour (h) during the delivery period
Minimum number of contracts per order	
EEX PEG and PVB Natural Gas Futures	1 contract = 1 MWh/d constant output per delivery day (d) during the delivery period
EEX NBP Natural Gas Futures in p/therm	1 contract = 1 ktherm/d constant output per delivery day (d) during the delivery period
EEX TTF Natural Gas ($/MMBtu) Futures	1 contract = 10.000 MMBtu
All other EEX Natural Gas Futures	1 contract = 1 MW constant output per delivery hour (h) during the delivery period
Spread for the consideration of best bid and best ask	Specified for each market area in Table 3.10.1
Minimum duration of the cumulated valid best bid and best ask during the Settlement Price Window	
EEX Financial EGSI Gas Futures	60 seconds
EEX CZ VTP and EEX PVB Natural Gas Futures	60 seconds
EEX TTF Natural Gas ($/MMBtu) Futures	60 seconds
All other EEX Natural Gas Futures	180 seconds

Table 3.10.1   Maximum spread for orders

Contract	ZTP (EUR/MWh)	PEG PVB (EUR/MWh)	TTF (EUR/MWh)	THE (EUR/MWh)	PSV (EUR/MWh)	NBP (p/th)	ETF (EUR/MWh)	CEGH VTP CZ VPT (EUR/MWh)	TTF ($/MMBtu)
Short term	n/a	n/a	1.5	1.5	n/a	3	n/a	1.5	-
M+1	1.5	0.9	0.8	0.9	0.9	0.9	0.9	0.9	1.1
M+2	1.1	1.1	0.9	1.0	1.1	1.1	1.1	1.1	1.1
Month after	1.1	1.1	1.0	1.3	1.1	1.1	1.1	1.1	1.1
Q+1	1.1	1.1	0.9	1.0	1.1	1.1	1.1	1.1	-
Q+2	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	-
Q+3	1.1	1,4	1.2	1.3	1.4	1.2	1.1	1.1	-
Q+4	1.5	1.4	1.2	1.3	1.4	1.2	1.5	1.5	-
Quarter after	1.5	1.4	1.4	1.3	1.4	1.4	1.5	1.5	-
S+1	1.1	1.1	0.9	1.0	1.1	1.1	1.1	1.1	-
S+2	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	-
Season after	1.5	1.2	1.2	1.3	1.2	1.2	1.5	1.5	-
C+1	1.2	1.1	0.9	1.0	1.1	1.1	1.2	1.2	-
C+2	1.2	1.1	0.9	1.1	1.1	1.1	1.2	1.2	-
Cal after	1.2	1.1	1.0	1.3	1.1	1.1	1.2	1.2	-

M: month contracts, Q: quarter contracts, S: season contracts, C: calendar contracts, Short term: day, week, and weekend contracts

The Daily Settlement Prices determined for Physical Natural Gas Futures listed on EEX are also applied to the corresponding Physical Natural Gas Futures listed on EEX OTF.

3.9 Settlement of EEX JKM LNG Natural Gas Futures

Parameter	Specification
Trade Registration Product	JKM LNG Natural Gas futures are only available for Trade Registration. As a result, prices are determined by means of the Chief Trader Procedure, prices from Trade Registration or other price sources

3.10 Settlement of Options on Gas Futures

Parameter	Specification
General notes	On the expiry day of the option, the Daily Settlement Prices of the underlying Gas Futures also serve to inform whether an option is in or out of the money.

3.11 Settlement of Futures on Guarantees of Origin (GO)

Parameter	Specification
Settlement Price Window	15:30 – 16:00 CE(S)T
Minimum number of contracts per trade	1 contract = 1000 GO certificates
Minimum number of contracts per order	1 contract = 1000 GO certificates
Settlement spread for the consideration of best bid/best ask	specified on contract level
Minimum duration of the cumulated valid best bid and best ask during the Settlement Price Window	180 seconds