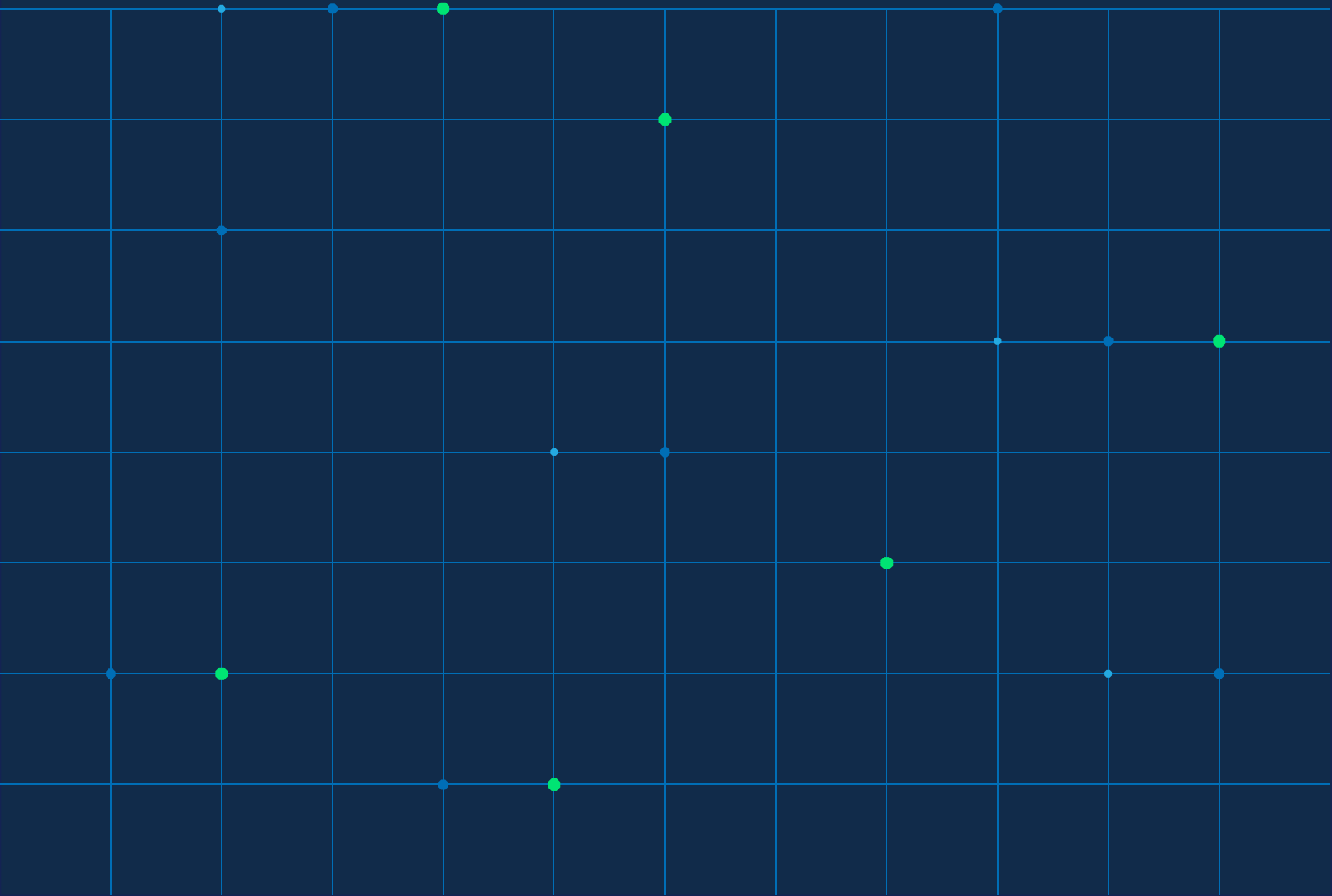


CME Group Petroleum Index Benchmark Methodology

CME Group Benchmark Administration Limited

Version 1.7

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Version Control

VERSION	KEY CHANGES	APPROVAL DATE
1.0	Creation of the CME Group Petroleum Index	3 rd August 2020
1.1	Various changes improving language and formulae	9 th December 2020
1.2	Legal update	9 th December 2020
1.3	Minor reviews of language	25 th March 2021
1.4	Updates to Publication and Error Policy	26 th July 2021
1.5	- Validation checks added - Weightings annual review	20 th January 2022
1.6	Weighting's review	22 nd March 2023
1.7	Update to roll period	5 th June 2023

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1. Introduction

CME Group Petroleum Index is a benchmark administered by CME Group Benchmark Administration Limited (“CBA” or “the Administrator”) and is intended to provide a single value for a basket of underlying energy futures.

CME Group and CME Group Benchmark Administration Limited

As a leading and diverse derivatives market operator, CME Group is the parent of four U.S.-based designated contract markets (DCMs): Chicago Mercantile Exchange Inc. (CME), Board of Trade of the City of Chicago, Inc. (CBOT), New York Mercantile Exchange, Inc. (NYMEX), and the Commodity Exchange, Inc. (COMEX) (collectively, the CME Group Exchanges). These exchanges offer a wide range of products available across all major asset classes, including: futures and options based on interest rates, equity indexes, foreign exchange, energy, metals, and agricultural commodities. CME Group offers futures trading through the CME Globex® electronic trading platform (Globex), fixed income trading via BrokerTec, foreign exchange trading on the EBS platform, and central counterparty clearing services at CME Clearing, a division of CME. CBA capitalizes on CME Group’s wealth of electronic transaction-based data in the calculation of its indices and benchmarks.

CME Group Benchmark Administration Limited (CBA) is a regulated benchmarks administrator, authorized and supervised by the UK Financial Conduct Authority (FCA). CBA is the Administrator of the CME Group Petroleum Index, with Chicago Mercantile Exchange Group Inc. providing calculation agent and distribution services.

Regulatory and IOSCO Compliance

CME Group Petroleum Index is a Benchmark designed on the basis of industry best practices and the IOSCO Principles for Financial Benchmarks. This will include, but is not limited to, the creation of an Oversight Committee and a published methodology.

CBA is regulated under the UK Benchmark Regulation (BMR)¹.

¹ <https://www.fca.org.uk/markets/benchmarks/regulation>

2. CME Group Petroleum Index

CME Group Benchmark Administration Limited (CBA or the Administrator) has created the CME Group Petroleum Index, representing a single value for a basket of underlying energy futures listed for trading on NYMEX, a CME Group Designated Contract Market (DCM).

The CME Group Petroleum Index (the Index) starting value, as calculated on launch date, 3rd August 2020, is 100, based on a Weighted Average Price (WAP) of 43.968396.

The value of the Index changes daily, relative to the movement on the underlying components, according to the calculation methodology detailed herein.

The Index is administered by CBA, authorized and supervised by the UK Financial Conduct Authority (FCA (UK)).

The Calculation Agent of the Index is Chicago Mercantile Exchange Group Inc. (CME Group), with whom CBA has a calculation agent agreement in place.

3. Source of Input data

Input data

The Index reflects a weighted basket of three (3) exchange traded energy futures contracts. These components are:

- NYMEX WTI Crude Oil futures (CME Group Commodity code CL)²
- NYMEX RBOB Gasoline futures (CME Group Commodity code RB)³
- NYMEX NY Harbor ULSD futures (CME Group Commodity code HO)⁴.

Weighting of Input Data

The percentage weight of each futures contract within the Index is based on the respective average open interest volumes for the last quarter of the calendar year, from October 1st to December 31st inclusive.

The Administrator reviews the weights of each component at the end of the calendar year and makes a recommendation to the Oversight Committee. In the event that weightings have changed by more than 3% (three percent) versus the previous year, the weights must be adjusted accordingly. Changes to the weights will be advised to stakeholders and applied on the first day of the second quarter of the following year.

The latest review of open Interest weights for the fourth quarter of 2022, resulted in no change of average open interest weight larger than 3%. As required, the index components will remain unchanged, effective 1st April 2023:

NYMEX WTI Crude Oil	75%
NYMEX RBOB Gasoline	11%
NYMEX NY Harbor ULSD	14%

² https://www.cmegroup.com/trading/energy/crude-oil/light-sweet-crude_contractSpecs_futures.html

³ <https://www.cmegroup.com/trading/energy/refined-products/rbob-gasoline.html>

⁴ <https://www.cmegroup.com/trading/energy/refined-products/heating-oil.html>

4. Calculation Methodology

CME Group Petroleum Index Calculation

The Index calculation is based on the official exchange futures settlement prices of the first nearby contract month, except during a roll period.

To ensure the consistency of calculation, the underlying components are represented in USD per barrel. Therefore, RB and HO contracts are converted from “cents/gallon” to “USD/barrel” using a standard conversion factor of 1 barrel = 42 US gallons.

Data Sufficiency

The calculation of the Index is based on the daily availability of settlement prices for its three futures contract constituents. NYMEX, where the futures contracts used as inputs are traded, has in place a waterfall methodology that always ensure a timely publication of settlement prices. Details of the settlement prices waterfall calculation for each constituent can be found on the following CME Group web pages:

[NYMEX Crude Oil](#)

[NYMEX RBOB Gasoline](#)

[NYMEX NY Harbor ULSD](#)

Expert Judgement

CME Group Futures Daily Settlement Procedure referenced above are based on a waterfall approach whereby a settlement price is always available, even at time of high market disruption. Notwithstanding those rules, Expert Judgement is never exercised in determining the value of the CME Group Petroleum Index.

Roll Period

Trading liquidity of futures contracts tends to transfer from the front month to the second month around 6 days prior to the expiry of the front month contract. During those roll periods, the settlement price used for the Index calculation, is the weighted sum of the respective settlement prices of the front month contract and the second month contract, smoothed according to the following weights.

Roll Period weights	1 st month	2 nd month
Expiry Day -7	100%	0%
Expiry Day -6	80%	20%
Expiry Day -5	60%	40%
Expiry Day -4	40%	60%
Expiry Day -3	20%	80%
Expiry Day -2	0%	100%
Expiry Day -1	0%	100%
Expiry Day	0%	100%

Hence, two days before expiry of the front month contract, only the second month contract is used in the calculation and so thereafter, until the next roll period.

CME Group Petroleum Index Settlement Price Calculation

The daily value of the Index is calculated as per the following formula:

$$CPI^t = \frac{WAP^t}{WAP^0} * 100$$

where

CPI^t = CME Group Petroleum Index settlement at date t
 WAP^t = Weighted Average Price at date t
 WAP⁰ = Weighted Average Price at rebase date

Weighted Average Price at date t calculation:

$$WAP^t = CL^w * CL^t + ULSD^w * 42 \frac{gal}{bbl} * ULSD^t + RBOB^w * 42 \frac{gal}{bbl} * RBOB^t$$

Weightings:

CL^w = NYMEX WTI Crude Oil weighting
 ULSD^w = NYMEX NY Harbor ULSD weighting
 RBOB^w = NYMEX RBOB Gasoline weighting

Settlement Prices:

CL^t = NYMEX WTI Crude Oil settlement price in USD/bbl at date t
 ULSD^t = NYMEX NY Harbor ULSD settlement price in USD/gal at date t
 RBOB^t = NYMEX RBOB Gasoline settlement price in USD/gal at date t

Weighted Settlement Prices calculation during roll period:

$$CL^t \text{ or } ULSD^t \text{ or } RBOB^t = (mth^1 * D^r * 0.20) + mth^2 * (1 - D^r * 0.20)$$

where

mth¹ = month 1 settlement price
 mth² = month 2 settlement price
 exp¹ = expiry date of mth¹
 D^r = (exp¹ -2) – today

The input: (exp¹ -2), accounts for the day-count adjustment needed to reflect front month contract roll two days before its expiry.

Validation Checks

To ensure that the input data used in the calculation are correct, the Calculation Agent validates the inputs before the publication of the index Value. The validation checks aim to identify day-on-day changes of the input data above a set threshold calculated as 2.33 times the standard deviation (σ) from the mean change in inputs Δ . The standard deviation is calculated as follows:

$$\sigma = \sqrt{\frac{\sum(\Delta_t - \mu)^2}{N}}$$

where:

Δ_t = change on business day t

$$\mu = \frac{\sum \Delta_i}{N}$$

N = 30 calendar days

The validation is performed on the final input price used for the calculation, including any adjustment occurring over roll-over periods.

If the daily change (Δ) is greater than 2.33 times the standard deviation (σ) from the mean, the Calculation Agent must promptly inform the Benchmark Administrator and validate the input data against the respective futures settlement prices. If the input data used in the calculation is found to be incorrect, the calculation will be re-run.

5. Publication and Error Policy

Calculation Agent and Publication

CME Inc is the calculation agent of the Index; a calculation agent agreement is in place between CBA and CME Inc.

The Index is calculated and published each CME Group settlement day as per the official schedule available on the [CME Group Settlement Notices calendar](#); the Index is published daily by 17:30 ET (05:30AM SGT +1).

If the Calculation Agent receives an empty or corrupted data set, it will check the integrity of the input data and re-run the calculation. If the error persists, the previous day index value will be re-published. If the previous day value is used for more than five consecutive business days, the Administrator must promptly convene the Oversight Committee to assess available remedial actions.

Error Policy

If the Administrator - within 24 hours from publication - finds that there is an incorrect publication resulting from miscalculation or inaccurate data inputs, the benchmark will be republished if the error is greater than 1% of the index value. If the difference is smaller than 1%, there will be no re-publication.

6. Governance

The Administrator operates under a comprehensive Risk and Control Framework, providing clear policies on Governance, Oversight, Benchmark Design and Calculation, Outsourcing, Operations, Reporting of Infringements and Business Continuity.

CBA has in place a "Three Lines of Defence" model, enabling close cross-monitoring of the governance process - this being business, compliance and audit who all have a key role in ensuring that CBA meets its regulatory requirements.

Oversight Committee

An Oversight Committee is appointed by the Administrator to review the integrity of the benchmark, in accordance with the CBA Terms of Reference for the Oversight Committees.

The Oversight Committee will provide independent oversight of, and challenge, to the Administrator on all aspects of the Benchmark determination process. The minutes of the Oversight Committee are made available on the Administrator's website.

The Oversight Committee will escalate to the CBA Board if required.

Review of the Methodology

The Administrator constantly monitors the Benchmark Methodology and its consistency with the stated objectives. The Benchmark Methodology is reviewed annually by the Administrator and the Oversight Committee.

The Oversight Committee approves proposed changes to the Benchmark Methodology including, but not limited to, the structure of the Benchmark, input data used and all aspects of the Calculation Methodology.

The Oversight Committee may direct the Administrator to consult on any changes to the methodology with Stakeholders and the wider market.

Consultation Process

The Administrator will engage relevant stakeholders and end-users on material changes to the Benchmark Methodology, if required by regulation or where the Oversight Committee requests such consultation.

Changes to the Methodology are deemed material on the basis of an assessment conducted by the Administrator and submitted to the Oversight Committee for advice and feedback.

The Administrator will publish notice of the consultation on its website, inviting feedback from stakeholders and the wider market. Notice of a consultation will be posted at least 1 (one) month prior to the deadline for responses. The notice will include the details of the proposed material change, the timeline and the rationale for the change.

Findings of the consultation process and proposed changes to the Benchmark Methodology, recommended as a result of the consultation, will be presented by the Administrator to the Oversight Committee for its consideration.

Feedback to a consultation is considered confidential, however the Administrator will publish an anonymized summary with its conclusions, as soon as it is practical, but before implementation of any changes.

Cessation

The Administrator constantly monitors the representativeness of the Benchmark. If the Benchmark is deemed to be unrepresentative of the underlying economic reality due to paucity of input data or systemic changes in the related markets, the Administrator will engage the Oversight Committee at the earliest opportunity. These cessation arrangements are designed to mitigate cessation and transition risks.

The Oversight Committee may direct the Administrator to consult with Stakeholders as described in the [Consultation Process section](#).

As a last resort, if no alternative arrangements are feasible, the Oversight Committee may advise the Administrator to discontinue the Benchmark, providing Stakeholders at least 6 (six) months' notice and assistance to explore alternative reference instruments.

The Administrator will endeavour to identify alternative benchmarks; however, this might not always be possible due to Regulations, market conditions or suitable alternatives.

Users of the benchmark are recommended to ensure that they have adequate fallback policies and procedures in the event of the Benchmark becoming unrepresentative of its economic interest.

Records Retention

The Administrator has in place policies for the retention of any relevant evidence and documentation related to the determination and dissemination of the Benchmark, either in paper or in electronic format, for at least the mandatory term of 5 (five) years.

Auditing

An internal audit process is undertaken regularly, to ensure adherence to the stated Methodology, the IOSCO principles and regulatory requirements.

External audits can be requested at any time by the Administrator's Board, the Oversight Committee or the internal audit function.

Data Licensing and Distribution

The Benchmark is made available subject to execution of an Information License Agreement (ILA) together with the appropriate Schedules. Market participants that intend to subscribe to the benchmark should contact the Administrator at the following email address: datasales@cmegroup.com

Complaints Procedures

The [CME Group EMEA / APAC Complaints Procedures](#) sets out details on the management of customer complaints to ensure that they are handed fairly and effectively, in a prompt and transparent manner and in accordance with applicable regulatory requirements.

Complaints will be dealt with by a senior member of staff not directly involved with the benchmark calculation and dissemination.

Information related to complaints will be stored in a restricted access area and kept for a period of at least 5 (five) years following the date when the complaint was first lodged. Complaints can be submitted at internationalcompliance@cmegroup.com

7. Appendix I – Key Terms & Definitions

TERM	DESCRIPTION
CBA	CME Group Benchmark Administration Limited
CL	NYMEX WTI Crude Oil future
CME Group	Chicago Mercantile Exchange Group Inc.
FCA (UK)	Financial Conduct Authority (UK)
HO	NYMEX NY Harbor ULSD future
IOSCO	International Organisation of Securities Commissions
RB	NYMEX RBOB Gasoline future

