



Price Methodology Guide

By: Energy Market Data Association

Introduction

The Energy Market Data Association (EMDA) publishes various volume weighted average and settlement price assessments for various Bakken oil products - specifically various grades of oil originated in that geographical region and traded at terminals in the following locations: Guernsey Hub, WY; Clearbrook, MN; Patoka, IL, Beaumont and Nederland, TX; as well as other Midwest locations via pipelines such as Dakota Access and Enbridge - based on source data supplied by Contributing Brokers.

EMDA aims to publish according to the best practices and operate with compliance procedures in accordance with IOSCO Principles for Oil Price Reporting Agencies. EMDA's mission is to promote the collaboration of brokers to more accurately reflect market price, improve energy data aggregation, and support robust hedging products to benefit clients and industry partners. This is done in an effort to address the current technical, compliance, time, and risk mitigation challenges faced by stakeholders accessing market information.

Definitions

- **Benchmark VWAPs:** Key point of reference VWAP products published by EMDA for Energy Products that are based on source data provided by Contributing Brokers, calculated using this Methodology.
- **Canadian Holidays:** Dates considered non-pricing days for Contributing Brokers during the Canadian Pricing Period. More information on Canadian Holidays can be found at <https://energymda.com/holiday-schedule>.
- **Contributing Brokers:** EMDA reports reflect trade and/or settlement source data that is provided by one or more qualifying energy brokerages. Contributing Brokers that may be providing source data currently consist of Link Data Services, LLC ("Link"), Marex Group ("Marex"), Modern Commodities Inc ("Modern"), and One Exchange Corporation ("One Exchange").
- **EMDA Calculator:** The mathematical formulae used to determine the VWAP values. EMDA periodically verifies the calculations and reviews for reasonableness.
- **EMDA Data Reports:** Price assessments, products, methodology, and related reports published by EMDA. EMDA reports are available online at energymda.com to subscribing clients.
- **Energy Products:** Industry standard physical crude oil market grade with defined locations and pipeline/terminals, referenced for bilateral trading. Expressed as one outright energy

product or as a spread of two energy products denoted with a “/” in between the first named and second named.

- **Minimum Thresholds:** EMDA establishes minimum trade data threshold amounts to ensure integrity and reliability of Benchmark VWAP products.
- **Prices:** Trade, VWAP and Settlement prices are in \$USD per barrel. Values in outright Energy Products are expressed as a differential to the Calendar Month Average (CMA) of the NYMEX Light Sweet Crude Oil futures settlement price. Values in spread Energy Products are expressed as a differential from the second named to the first named.
- **Pricing Period:** The dates and hours specified for gathering source data to be included in a particular VWAP calculation. This methodology document details Canadian and US Pricing Periods used for EMDA reports.
- **Settlements:** Settlement prices reflect the fair market value of an Energy Product, as determined by trading activity at a particular point in time known as the settlement period. Settlement prices are typically used to mark-to-market buyer and seller positions on a daily basis, determining whether their trade positions had gains or losses on any particular day.
- **US Holidays:** Dates considered non-pricing days for Contributing Brokers during the US Pricing Period. More information on US Holidays can be found at <https://energymda.com/holiday-schedule>.
- **VWAP:** Refers to volume weighted average price.

Methodology Rationale

EMDA methodologies strive to produce price assessments that are reliable indicators of market value and reflect the way the market trades. The specific products, calculations, and other particulars of an assessment are determined by industry consensus and the company mirrors these industry conventions in final assessment values for publication.

Contributing Brokers act as independent market facilitators, offering more transparent price discovery to transacting industry stakeholders. EMDA’s partnership with multiple Contributing Brokers provides reduced risk for conflicts of interest and increased quality of source data.

All VWAP assessments utilize volume weighted averages based on trades from Contributing Brokers. Volume weighted averages are utilized to minimize any trading anomalies that might otherwise distort the source data.

EMDA recognizes that transparency is vital to developing confidence in the price assessment process. As a result, the company also publishes underlying trade source data that include product prices and volume information, as well as settlement values to allow for independent verification of the Benchmark VWAPs.

Source Data

EMDA reported price assessments are based on trade and/or settlement data from Contributing Broker supported platforms.

The trade data contains the following fields:

- Product Name: Name of the industry standard physical crude oil market grade with defined locations, pipeline/terminals, and pricing basis referenced for bilateral trading. Expressed as one outright energy product or as a spread of two named energy products.
- Price: The price agreed to in the trade, expressed in \$USD per barrel.
- Volume: The transaction volume agreed to in the trade, expressed in at least one of the following formats.
 - Bbls/day: The daily delivery quantity of energy agreed to in the trade, expressed in barrels per day.
 - Bbls/month: The total delivery quantity of energy agreed to in the trade, expressed in total barrels (bbls).
 - m3/month: The total delivery quantity of energy agreed to in the trade, expressed in total cubic meters (m3).
- Term: Identifies the month or months for which the product will be delivered.
- Trade ID: The unique identifier of the trade.
- Transaction Date: The date and time of the trade.

Contributing Brokers use a secure automated process to send the trade data to the EMDA Calculator for calculation of Daily and Monthly Calculations, EMDA then processes the data for publishing.

Any trade that is verified as being made outside defined Pricing Period trading hours or dates, executed for credit facilitation purposes, or trades subsequently cancelled or traded in error with the Contributing Brokers may be excluded.

Settlements are forward curves based on combined settlement data provided by Contributing Brokers. The Settlement prices reflect a 3:00PM MT/4:00PM CT settlement period on each business trading day.

Pricing Periods & Calculations

Canadian Pricing Period

Canadian Pricing Period begins at 7:00AM MT/8:00AM CT (“Canadian Opening Time”) on the 1st calendar day of the month, one month prior to the delivery month, until 4:00PM MT/5:00PM CT (“Canadian Closing Time”) on the last day before the first Notice of Shipments (NOS)* date for the delivery month, inclusive.

** The official Notice of Shipment - NOS dates as published by Enbridge Pipeline.*

US Pricing Period

US Pricing Period begins 6:00AM MT/7:00AM CT (“US Opening Time”) on the 26th calendar day of the month, two months prior to the delivery month until 4:00PM MT/5:00PM CT (“US Closing Time”) on the 25th calendar day of the month, one month prior to the delivery month, inclusive.

Daily Calculation

The Daily Calculation uses a daily weighted average formulae, which is defined as the daily weighted average price over the Pricing Period and is calculated and published daily using the following methodology:

- a) Calculate the volume-weighted average prices for each individual business trading day over the Pricing Period.
- b) Sum the total of the daily values in (a).
- c) Sum the number of business trading days in the Pricing Period.
- d) Divide (b) by (c).

$$Daily\ VWAP = \frac{\sum Daily\ VWAPs}{\sum Number\ of\ business\ trading\ days\ in\ Pricing\ Period}$$

The daily weighted average prices are automatically calculated for the respective Pricing Periods by the EMDA Calculator, then Benchmark VWAPs are periodically cross-checked against a manual calculation for accuracy and Minimum Thresholds.

In the event that no trades are reported for a Benchmark VWAP on an applicable business trading day, EMDA makes a daily determination of the Daily VWAP used in the generation of

the EMDA Report. Such price assessments are arrived at by using the published EMDA settlement price for the respective Benchmark VWAP. In the event that a Benchmark VWAP contains more than one settled product, EMDA weights each settlement price based on the volume traded within each term/product combination in the 90-day window extending backward from that day.

Any trades executed prior to the final business trading day of the Pricing Period for a Benchmark VWAP after the Canadian Closing Time or US Closing Time are included in the following business trading day's Daily VWAP. Any trades executed on a weekend or holiday prior to the final business trading day of a Pricing Period are included in the following business trading day's Daily VWAP.

Monthly Calculation

The Monthly Calculation use a volume weighted average formulae, which is defined as the volume weighted average price over the Pricing Period and is calculated and published daily using the following methodology:

- a) Multiply the trade price by the normalized trade quantity for each trade in the trade data file.
- b) Sum the product(s) achieved in step (a).
- c) Sum the trade quantity for each trade in the source data file.
- d) Divide the sum from step (b) by the sum from step (c).

$$\text{Monthly VWAP} = \frac{\sum(\text{Price} * \text{Quantity})}{\sum \text{Quantity}}$$

Trades executed on a holiday or weekend during the Pricing Period are included in the Monthly Calculation.

The monthly weighted average prices are automatically calculated for the respective Pricing Periods by the EMDA Calculator, then Benchmark VWAPs are periodically cross-checked against a manual calculation for accuracy and Minimum Thresholds.

VWAP Index Codes

Index Codes	<u>Index Full Name</u>	Pricing Periods	Calculations
CADI	Canadian Daily Index	Canadian	Daily
CAMI	Canadian Monthly Index	Canadian	Monthly
USDI	US Daily Index	US	Daily
USMI	US Monthly Index	US	Monthly

Daily Settlements

EMDA provides closing settlement assessments as of 3:00 PM MT/4:00 PM CT for products on or after 3:30 PM MT/4:30 PM CT, each business trading day of the month. Settlements are not published on weekends or some holidays.

Settlement Calculation

EMDA uses the following algorithm to arrive at a final settlement assessment to reflect the closing of each business trading day:

Algorithm Definitions:

x = An ordered list of settlement prices, consisting of:

- i. Settlement prices from Contributing Brokers with trades in that term/product combination for that business trading day, sorted based on who has the most recent trade before 3:00 PM MT/4:00 PM CT. The Contributing Broker with the trade closest to 3:00 PM MT/4:00 PM CT is put in position 1, the Contributing Broker with the next closest trade to 3:00 PM MT/4:00 PM CT is put in position 2, etc...
- ii. If there are any Contributing Brokers with no qualifying trades, average all of their settlement prices together, and include this value as an additional element at the end of the list.

n = The length of the list x

w = Weight assigned to each Contributing Broker. These weights all sum to 1.00.

e = Final EMDA settlement price

Algorithm:

- a) Solve for w for each i from 1 to n :

$$w_i = \frac{2}{n} * \left(1 - \frac{i}{n+1}\right)$$

- b) EMDA derives a final settlement price with the following formula:

$$e = \sum_{i=1}^n x_i * w_i$$

Example One:

Contributing Broker	Term	Product	Trade Today	Trade Time	Settlement Price(s)	i Value	Overall Weight (w)
Link	Feb-24	Bakken-Patoka	Yes	1:20 PM	1.500	4	10.00%
Marex	Feb-24	Bakken-Patoka	Yes	2:50 PM	1.600	2	30.00%
Modern	Feb-24	Bakken-Patoka	Yes	2:00 PM	1.400	3	20.00%
One Exchange	Feb-24	Bakken-Patoka	Yes	2:55 PM	1.400	1	40.00%
EMDA	Feb-24	Bakken-Patoka	-	-	1.470	-	-

Example Two:

Contributing Broker	Term	Product	Trade Today	Trade Time	Settlement Price(s)	i Value	Overall Weight (w)
Link	Feb-24	Bakken-Patoka	Yes	2:55 PM	1.400	1	50.00%
Marex	Feb-24	Bakken-Patoka	Yes	1:30 PM	1.700	2	33.33%
Modern + One Exchange	Feb-24	Bakken-Patoka	No	-	1.625	3	16.67%
EMDA	Feb-24	Bakken-Patoka	-	-	1.538	-	-

*In the above example, Modern provided a 1.65 settlement price and One Exchange provided a 1.60 settlement price.

Example Three:

Contributing Broker	Term	Product	Trade Today	Trade Time	Settlement Price(s)	i Value	Overall Weight (w)
Link + Marex + Modern + One Exchange	Feb-24	Bakken-Patoka	No	-	1.470	1	100.00%
EMDA	Feb-24	Bakken-Patoka	-	-	1.470	-	-

*In the above example, settlement prices from each broker were as follows: Link provided 1.50, Marex provided 1.60, Modern provided 1.40, and One Exchange provided 1.40.

In the event that a Contributing Broker provides multiple settlement prices that are mapped to a single EMDA product, the Contributing Broker's settlement prices are weighted evenly and reduced into a single average price.

After reducing any multiples of settlement prices described previously, and excluding any Contributing Brokers which have a trade for a particular term/product combination on a given business trading day for considerations of being an outlier: Using a normal distribution, if a Contributing Broker's settlement price for a particular term/product combination falls outside one standard deviation from the mean of all settlement prices contributed for a particular

term/product combination, then the settlement price is not taken into consideration for any settlement calculation. If, however, one standard deviation from the mean produces a range of less than \$1.00 (plus or minus \$0.50 from the mean), then a minimum range of \$1.00 is used to replace using a single standard deviation.

Methodology Revisions/Changes

EMDA is entitled to periodically review and amend this methodology in such manner and with such notice to any person, including Users, as it may determine in its sole discretion. The latest version of this methodology is available at energymda.com.

Proposals to change methodologies typically emerge out of the ongoing process of internal and external review of the methodologies. EMDA engages with industry stakeholders to gain acceptance of proposed changes; however, cannot guarantee universal acceptance and will act in good faith to ensure the continued integrity of its price assessments as an overriding objective.

Corrections

EMDA may on occasion publish corrections to price assessments up to 48 hours after the initial publication date, in an effort to correct errors that arise from clerical mistakes, calculation errors, or a misapplication of stated methodology. EMDA does not retroactively assess markets based on new information learned after the assessments are published. Best efforts are used to assess markets based on the information gathered during assessed business trading days.

Complaints Procedure

Any complaints regarding this methodology or EMDA reports may be directed to complaints@energymda.com. Complaints are reviewed and responded to in a timely manner, then escalated as required.

Limits of Liability

Neither EMDA, Contributing Brokers, nor their agents, directors, officers and employees shall be liable for any losses, costs or expenses arising from any matter relating to the calculation,

methodology, compilation, or publication of any EMDA Reports and which are used for the settlement of any trade.

Neither EMDA, Contributing Brokers, nor their agents, directors, officers and employees shall, under any circumstances, be liable for errors or deficiencies in the calculation, methodology of calculation or publication of any reports nor shall EMDA be obligated to provide notice of, or publish, errors in any manner.

EMDA Product Definitions*

EMDA Product	Market Name	Location	Pipeline/Terminal	Pricing Basis
Bakken Field Blend	Bakken	Alexander, Any Injection, Beaver Lodge, Dore, East Fairview, Epping, Johnsons Corner, Ramberg, Stanley, Trenton, Watford City	Bayou, Caliber, Colt Tank, Colt Terminal, DAPL, Ex-Sacagawea, Ex-Targa, Four Bears, Hiland, NDPL, Savage, Tesoro	WTI CMA
Bakken-DAPL	Bakken	Alexander, Any Injection, Epping, Johnsons Corner, Ramberg, Stanley, Trenton, Watford City	DAPL	WTI CMA
Bakken-Gulf Coast	Bakken	Beaumont, Nederland	DAPL, Enterprise, Ex-DAPL, Ex-ETCOP	WTI CMA + ARGUS WTI CMA Diff + ARGUS MEH
Bakken-Gulf Coast	Bakken	Beaumont, Nederland	DAPL, Enterprise, Ex-DAPL, Ex-ETCOP	WTI CMA + ARGUS WTI CMA Diff
Bakken-Patoka	Bakken	Patoka	DAPL, Ex-DAPL, Plains Tank	WTI CMA

Bakken-Rail FCA	Bakken	BNSF, Epping, Fryburg, Palermo, Tioga, Trenton	BNSF Terminal	WTI CMA
DAPL Space	Leg 1 & Leg 2: Bakken	Leg 1: Nederland, Beaumont, Patoka Leg 2: Alexander, Any Injection, Epping, Johnsons Corner, Ramberg, Stanley, Trenton, Watford City	Leg 1: Ex-ETCOP, Ex-DAPL Leg 2: DAPL	Leg 1 & Leg 2: WTI CMA
Light Sweet - Guernsey	Light Sweet	Guernsey	Butte, HH, HUB, Iron Horse, Pony Express,	WTI CMA
Sweet Guernsey Blend	Light Sweet, Powder River Sweet, Rocky Mountain Sweet	Guernsey, Fort Laramie	Butte, Fort Laramie Terminal, HH, HUB, Plains, Pony Express, Powder River Express, Powder River Gathering System, EX-Powder River Express, Ex-HUB, Iron Horse	WTI CMA

UHC- Clearbrook	UHC	Clearbrook	Enbridge TAS, Enbridge In-Line, MNPL, NDPL	WTI CMA
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*Above are the benchmark EMDA products, or blended products combined in order to publish one average price. EMDA publishes more than the defined products above.