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ARGUS NORTH AMERICAN NATURAL GAS IMPLIED VOLATILITY FORWARD CURVES

Contents:

Methodology overview	2
Source data	2
Forward curve production	2
Consistency and adjustment	2
Validation, oversight and control frameworks	2
Corrections	2
Ethics and compliance	3
Review of methodology	3
Changes to methodology	3
Publishing schedule	3
Argus price assessments	3
North American Natural Gas Implied Volatility	3

LAST UPDATED: NOVEMBER 2024

The most up-to-date *Argus North American Natural Gas Implied Volatility Forward Curves* methodology is available on www.argusmedia.com

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Methodology overview

Methodology rationale

Argus produces daily forward price curves that are distinct from the forward price assessments published in Argus market reports.

Argus forward curves are the modelled current value of a forward delivery or loading period at the specified timestamp on the day of publication and are not forecasts of future spot prices.

Argus forward curves are produced using models designed to produce reliable and representative indicators of commodity market values, free from distortion.

Model inputs and outputs, including the final forward curves, intermediate values that may be generated during the production process and reports, are subjected to ongoing validation to ensure that the models perform as expected in generating representative prices.

Source data

Argus forward curves are calculated using a variety of current and historical inputs. Inputs are subject to rigorous quality and relevance checks.

Forward curves are underpinned by information from the traded forward markets, where it exists, and from the historical relationships between more liquid and less liquid markets.

Argus price assessments

Argus publishes a wide variety of spot and forward price assessments in relevant spot and forward commodities markets. Argus price assessments are governed by published methodologies, the most up-to-date versions of which are available at www.argusmedia.com.

Where Argus publishes both a price assessment and a forward curve value for the same commodity and time period, the forward curve value will equal the published price assessment.

Historical price assessments are often used in combination with Argus forward curve data when producing forward curves for illiquid markets.

External market data

Argus also uses trade, bid, offer and other market information in producing forward curves. Market information is scrutinised before being considered for inclusion in the production of forward curves.

Forward curve production involves a wide array of data relevant to the state of the underlying commodity market, the wider commodities complex and the state of local, regional and global economies.

Argus forward curves

Argus forward curves are continually compared with one another. Those with the highest correlations are assigned as proxy markets

to one another and are used as sources of information when generating forward curves for which price assessments or external market data are unavailable.

Forward curve production

In markets with some forward liquidity or Argus price assessments, Argus will use that market information as the starting point for the generation of forward curve prices. Price spreads to other, more liquid forward markets and price spreads to more liquid time periods in the same forward market are used to fill gaps in the forward curve for which market information or Argus price assessments are unavailable.

Argus may also use the historical relationship between the value of strip contracts and their components in interpolating the price shape of the forward curve.

In particularly illiquid markets, Argus may use a rolling history of spot prices to form a relationship between illiquid and liquid forward markets. The period of historical spot prices and the relationships they imply are regularly reviewed.

Consistency and adjustment

Argus produces zero-arbitrage forward curves — the price of a strip product will always be equal to the average of the component periods. For example, the value of a fourth-quarter contract will be equal to the average of the values of the October, November and December contracts.

Abnormally large day-on-day price changes are investigated, cross-checked and ultimately confirmed or revised by Argus analysts.

Validation, oversight and control frameworks

Argus forward curves are produced in strict adherence to published methodologies, the most up-to-date versions of which are available at www.argusmedia.com.

All models are under continual review, including an evaluation of conceptual soundness, ongoing monitoring and outcome analysis.

Corrections

Argus will on occasion publish corrections to forward curve prices after the publication date. We will correct errors that arise from clerical mistakes, calculation errors, or a misapplication of our stated methodology. Argus will not retroactively change published prices based on new information learned after publication. We make our best effort to produce forward curves based on the information we gather during the trading day assessed.

Ethics and compliance

Argus operates according to the best practices in the publishing field, and maintains thorough compliance procedures throughout the firm. We want to be seen as a preferred provider by our subscribers, who are held to equally high standards, while at the same time maintaining our editorial integrity and independence. Argus has a strict ethics policy that applies to all staff. The policy can be found on our website at www.argusmedia.com.

Included in this policy are restrictions against staff trading in any energy commodity or energy related stocks, and guidelines for accepting gifts. Argus also has strict policies regarding central archiving of email and instant messenger communication, maintenance and archiving of notes, and archiving of spreadsheets and deal lists used in the forward curve generation process. Argus publishes prices that report and reflect prevailing levels for open-market arms length transactions (please see the [Argus Global Compliance Policy](#) for a detailed definition of arms length).

Review of methodology

The overriding objective of any methodology is to produce prices which are reliable and representative indicators of commodity market values and are free from distortion. As a result, Argus regularly examines our methodologies and is in regular dialogue with the industry in order to ensure that the methodologies are representative of the market being assessed.

In addition to this ongoing review of methodology, Argus conducts reviews of all of its methodologies and methodology documents on at least an annual basis.

Argus will periodically and as merited initiate reviews of market coverage based on a qualitative analysis that includes measurements of liquidity, visibility of market data, consistency of market data, quality of market data and industry usage of the resulting forward prices. Argus will review:

- Appropriateness of the methodology of existing forward curves
- Termination of existing forward curves
- Initiation of new forward curves

An informal process will be initiated to examine viability. This process includes:

- Informal discussions with market participants
- Informal discussions with other stakeholders
- Internal review of market data

Should changes, terminations, or initiations be merited, an internal proposal will be submitted to management for review and approval. Should changes or terminations of existing forward curves be approved, then formal procedures for external consultation are begun.

Changes to methodology

Formal proposals to change methodologies typically emerge out of the ongoing process of internal and external review of the methodologies. Formal procedures for external consultation regarding material changes to existing methodologies will be initiated with an announcement of the proposed change published to subscribers.

This announcement will include:

- Details on the proposed change and the rationale
- Method for submitting comments with a deadline for submissions
- Notice that all formal comments will be published after the given consultation period unless submitter requests confidentiality.

Argus will provide sufficient opportunity for stakeholders to analyse and comment on changes, but will not allow the time needed to follow these procedures to create a situation wherein unrepresentative or false prices are published, markets are disrupted, or market participants are put at unnecessary risk.

Argus will engage with industry throughout this process in order to gain acceptance of proposed changes to methodology. Argus cannot however guarantee universal acceptance and will act for the good order of the market and ensure the continued integrity of its forward curves as an overriding objective.

Following the consultation period, Argus management will commence an internal review and decide on the methodology change. This will be followed by an announcement of the decision, which will be published to subscribers and include a date for implementation.

Publishing schedule

Argus North American Natural Gas Implied Volatility Forward Curves are published on weekdays according to the Argus Natural Gas Americas publishing schedule, which is available at www.argusmedia.com.

Argus price assessments

Argus North American Natural Gas Implied Volatility Forward Curves rely on price data published in Argus Natural Gas Americas. See the [Argus Natural Gas Americas methodology](#).

North American Natural Gas Implied Volatility

Forward curves are published at a New York 2:30pm timestamp. Volatilities are published for 24 months forward.

Argus North American Natural Gas Implied Volatility Forward Curves

Market	Product assessed	Market	Product assessed
Gulf		East	
ANR - SE	Swaps	Algonquin Citygates	Swaps
Carthage	Swaps	Columbia Gas Appalachia (TCO)	Swaps
Columbia Gulf (CG) Onshore	Swaps	Eastern Gas Transmission	Swaps
FGT - Z1	Swaps	Iroquois Zone 2	Swaps
FGT - Z2	Swaps	Leidy Hub	Physical
FGT - Z3	Swaps	Leidy Line	Physical
Henry Hub Futures	Futures	Millennium	Physical
Houston Ship Channel (HSC)	Swaps	Niagara	Physical
Katy	Swaps	TCPL - Enbridge CDA	Physical
NGPL - South Texas (STX)	Swaps	TETCO - M2	Physical
Sonat	Swaps	TETCO - M3	Swaps
TETCO - ELA	Swaps	TGP - Z4 (Marcellus)	Physical
TETCO - ETX	Swaps	TGP - Z4 (200 line)	Physical
TETCO - M130	Physical	TGP - Z4 (300 line)	Physical
TETCO - South Texas (STX)	Swaps	Transco Zone 5	Physical
TETCO - WLA	Swaps	Transco Zone 6 (non-NY)	Swaps
TGP - 500 leg	Swaps	Transco Zone 6 (non-NY North)	Physical
TGP - 800 leg	Swaps	Transco Zone 6 (NY)	Swaps
TGP - Zone 0 (Z0)	Swaps	Union Parkway	Physical
TGT - SL	Swaps	Waddington	Physical
TGT - Zone 1	Swaps	Rockies and West	
Transco Zone 1	Swaps	AECO	Swaps
Transco Zone 2	Swaps	APC - ATP	Physical
Transco Zone 3	Swaps	CIG Rockies	Swaps
Transco Zone 4	Swaps	El Paso (EP) Permian	Swaps
Trunkline-LA	Swaps	El Paso (EP) San Juan	Swaps
Midcontinent		Empress	Physical
ANR - SW	Swaps	Kern River	Physical
ANR ML7	Physical	Malin	Swaps
CenterPoint	Swaps	NWPL Rockies	Swaps
Chicago Citygates (CG)	Swaps	Opal	Physical
Columbia Gulf (CG) Mainline	Swaps	PG&E Citygate (CG)	Swaps
Consumers (CG) Physical Consumers City Gates	Physical	Socal border	Swaps
Dawn	Swaps	Socal Citygate (CG)	Swaps
Michcon Citygates (CG)	Swaps	Spectra-Station 2	Physical
NGPL - Midcontinent	Swaps	Sumas	Swaps
NGPL - TxOk	Swaps	TCPL - Emerson	Physical
NNG Demarc	Swaps	Transwestern (TW) Permian	Swaps
NNG Ventura	Swaps	Waha	Swaps
Oneok	Swaps		
PEPL	Swaps		
Southern Star	Swaps		