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ARGUS NORTH AMERICAN ELECTRICITY LONG-TERM FORWARD CURVES

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The most up-to-date *Argus North American Electricity Long-Term Forward Curves* methodology is available on www.argusmedia.com

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 Electricity Long-Term Forward Curves are published on weekdays, according to a publishing schedule that is available at www.argusmedia.com.

Argus price assessments

Argus North American Electricity Long-Term forward curves rely on price data published in Argus market reports, each of which is governed by a published methodology.

See the [Argus US Electricity methodology](#) for more information about Argus price assessments.

Argus Long-term Electricity Forward Curves

Argus assesses forward physical electricity markets at some locations and forward financial markets (swap futures) at others.

For both physical and financial assessments, the base period assessed is the calendar month. Argus assesses multi-month periods

(for example, quarters and seasons) as an average of the constituent monthly assessments, weighted according to the number of peak, off-peak, RTC, 2*16, or 7*8 hours over the entire period.

Prices are published for 216 forward months beginning with the 85th month forward. Shorter-term forward curves are published in [Argus North American Electricity Forward Curves](#).

Forward physical assessments are of the market price of a standard quantity of firm physical electricity delivered during predefined hours over the course of a month or multi-month period. Forward financial assessments are of the market price of a swap future that will settle against the monthly average of:

- the location's day-ahead market clearing price
- the locational marginal price (LMP)
- the average of realtime LMPs for the appropriate hours

Timing

Assessments are of prices at the close of CME's Henry Hub futures primary trading session, normally 14:30 EST.

Currency and units of assessment:

Electricity assessments are made in US dollars per megawatt hour (MWh), unless otherwise specified.

Heat rates

Please see the [Argus North American Heat Rate Forward Curves methodology](#).

Hours assessed											
Assessment	System operator										
	FRCC	ISO-NE	MISO	NYISO	PJM	SERC	SPP	VACAR	ERCOT	WSPP	
On Peak	07:00-23:00, Monday-Friday, except NERC holidays								06:00-22:00, Monday-Friday, except NERC holidays		06:00-22:00, Monday-Saturday, except NERC holidays
Off Peak	00:00-07:00 and 23:00-24:00, Monday-Friday; 00:00-24:00, Saturday-Sunday, 00:00-24:00 NERC holidays								00:00-06:00 and 22:00-24:00, Monday - Friday; 00:00-24:00, Saturday-Sunday; 00:00-24:00 NERC holidays		00:00-06:00 and 22:00-24:00, Monday - Saturday; 00:00-24:00, Sunday; 00:00-24:00 NERC holidays
RTC	00:00-24:00										
2x16									06:00-22:00 Saturday-Sunday		
7x8									00:00-06:00 and 22:00-24:00, Monday-Sunday		

Locations, price types, delivery points and corresponding natural gas markets				
Region	Market	Product assessed	Physical power delivers to:	Settles against monthly average of
ERCOT	Houston Load Zone	Physical	See ERCOT nodal protocols, section 3	
	Houston Zone	Physical	ERCOT's Houston Generation Zone	
	North Load Zone	Physical	See ERCOT nodal protocols, section 3	
	North Zone	Physical	ERCOT's North Generation Zone	
	South Zone	Physical	ERCOT's South Generation Zone	
	South Load Zone	Physical	See ERCOT nodal protocols, section 3	
	West Zone	Physical	ERCOT's West Generation Zone	
	West Load Zone	Physical	See ERCOT nodal protocols, section 3	
FRCC	Florida	Physical	FRCC control area	
ISO-NE	Connecticut Zone	Swap future		ISO New England's Connecticut Zone day-ahead LMP
	Massachusetts Hub	Swap future		ISO New England's Mass Hub day-ahead LMP
	Maine Zone	Swap future		ISO New England's Maine Zone day-ahead LMP
	NEMA Zone	Swap future		ISO New England's Northeast Massachusetts day-ahead LMP
	New Hampshire Zone	Swap future		ISO New England's New Hampshire Zone day-ahead LMP
	Rhode Island Zone	Swap future		ISO New England's Rhode Island Zone day-ahead LMP
	SEMA Zone	Swap future		ISO New England's SEMA Zone day-ahead LMP
	WCMA Zone	Swap future		ISO New England's WCMA Zone day-ahead LMP

Locations, price types, delivery points and corresponding natural gas markets				
Region	Market	Product assessed	Physical power delivers to:	Settles against monthly average of
MISO	Entergy	Physical	Parts of AR, LA, MS, TX	
	Illinois Hub	Physical	Cental, Southern, Southwest IL	
	Indiana Hub	Swap future		MISO's Indiana Hub real-time LMP
	Michigan Hub	Physical	Lower MI	
	Minnesota Hub	Physical	Minneapolis and St Paul, MN	
	Arkansas Hub	Physical	Arkansas	
	DEOK Hub	Physical	Duke Energy Ohio Kentucky	
	Louisiana Hub	Physical	Louisiana	
	Texas Hub	Physical	Texas	
NYISO	Zone A	Swap future		NYISO Zone A day-ahead LBMP
	Zone B	Swap future		NYISO Zone B day-ahead LBMP
	Zone C	Swap future		NYISO Zone C day-ahead LBMP
	Zone D	Swap future		NYISO Zone D day-ahead LBMP
	Zone E	Swap future		NYISO Zone E day-ahead LBMP
	Zone F	Swap future		NYISO Zone F day-ahead LBMP
	Zone G	Swap future		NYISO Zone G day-ahead LBMP
	Zone H	Swap future		NYISO Zone H day-ahead LBMP
	Zone I	Swap future		NYISO Zone I day-ahead LBMP
	Zone J	Swap future		NYISO Zone J day-ahead LBMP
	Zone K	Swap future		NYISO Zone K day-ahead LBMP
PJM	AD Hub	Swap future		PJM's AD Hub real-time LMP
	AECO Zone	Swap future		PJM's AECO Zone day-ahead LMP
	AEP Zone	Swap future		PJM's AEPO Zone day-ahead LMP
	APS Zone	Swap future		PJM's APS Zone day-ahead LMP
	ATSI Zone	Swap future		PJM's ATSI Zone day-ahead LMP
	BGE Zone	Swap future		PJM's BGE Zone day-ahead LMP
	ComEd Zone	Swap future		PJM ComEd Zone Day-Ahead LMP
	Dayton Zone	Swap future		PJM's Dayton Zone day-ahead LMP
	DPL	Swap future		PJM's DPL Zone day-ahead LMP
	Duquense Zone	Swap future		PJM's Duquense Zone day-ahead LMP
	East Hub	Swap future		PJM's East Hub day-ahead LMP
	FE Ohio	Swap future		PJM's FE Ohio day-ahead LMP
	JCPL Zone	Swap future		PJM's JCPL Zone day-ahead LMP
	Meted Zone	Swap future		PJM's METED Zone day-ahead LMP
	NI Hub	Swap future		PJM's NI Hub real-time LMP
	Peco Zone	Swap future		PJM's PECO Zone day-ahead LMP
	Penelec Zone	Swap future		PJM's Penelec Zone day-ahead LMP
	Penn Power	Swap future		PJM's Penn Power day-ahead LMP
	PEPCO DC	Swap future		PJM's PEPCO Zone DC day-ahead LMP
	PEPCO MD	Swap future		PJM's PEPCO Zone MD day-ahead LMP
PEPCO Zone	Swap future		PJM's PEPCO Zone day-ahead LMP	
PPL Zone	Swap future		PJM's PPL Zone day-ahead LMP	
PSEG Zone	Swap future		PJM's PSEG Zone day-ahead LMP	
RECO Zone	Swap future		PJM's RECO Zone day-ahead LMP	
West Hub	Swap future		PJM's West Hub day-ahead LMP	
SERC	Southern Hub	Physical	Parts of GA, MS, FL	
SPP	SPP North Hub	Physical	NPPD, OPD, and LES control areas	
	SPP South Hub	Physical	OG&E and AEP control areas	
VACAR	VACAR	Physical	VA, NC, SC	
WSPP	COB	Physical	Captain Jack and Malin substations on CA-OR Intertie	
	Four Corners	Physical	Switchyard of Four Corners power plant in Fruitland, NM	
	Mead	Physical	Switchyard of Hoover Dam, outside Las Vegas, NV	
	Mid Columbia	Physical	Five dams along a 118-mile stretch of Columbia River	
	NP 15	Swap future		CAISO's NP 15 day-ahead LMP
	Palo Verde	Physical	Switchyard at Palo Verde, AZ	
SP 15	Swap future		CAISO's SP 15 day-ahead LMP	