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Methodology Guide

M2M Gas Curve

LATEST UPDATE: APRIL 2005

SHORT-TERM GAS CURVE: DEVELOPMENT METHODOLOGY

Platts produces 36-month forward curves for natural gas at 60 delivery points across North America. For 11 of these hubs, seasonal financial basis is available through the Platts Natural Gas Alert, while basis for the remaining 49 hubs is inferred from the current market. To summarize, the 36-month curves combine information from three sources:

- The daily traded New York Mercantile Exchange (NYMEX) natural gas future strip.
- Daily forward assessments for natural gas basis published in Natural Gas Alert.
- The forward curve simulation engine developed for Platts GPCMdat and *Platts Gas Outlook in North America*.

The process by which Platts develops curves for assessed hubs differs for hubs without assessed prices. For assessed hubs, Platts relies principally on assessment data. In the first step, Platts forward assessments are mapped to discrete forward months on the curve. Outside the front month, Platts assessments are typically quoted for the next two to three trading seasons, which include summer (April through October) and winter (November through March). Platts then shapes each seasonal assessment according to trading factors unique to each month of the season. Platts infers these factors through a continual review of historical front-month assessments (that is, the typical pattern associated with the basis assessment for the front months within each season). Finally, Platts adds the shaped monthly value for the basis assessment to the NYMEX settlement price of the day. This process typically provides monthly index pricing for the first 16-20 months of the curve.

The latter part of the curve is determined by basis values provided from the Gas Pipeline Competition Model (GPCM), the fundamental model used by Platts (and described in "Long-Term Gas Curve: Forecast Methodology"). Because the model is determined on a fundamentally derived Henry Hub strip, Platts adjusts the basis values given by this model to reflect actual price levels at Henry Hub, mitigating a "basis break" in which assessed prices differ substantially from model-derived prices. The result is a discrete, smooth curve that gives priority to market data when available but has a robust, consistent process for building prices when market data are not available.

The majority of natural gas curves provided in Platts M2M Gas do not have assessment data available, and therefore they require a different approach. This approach necessarily relies on model data to a greater degree than the process for the 11 assessed hubs. Platts performs three calculations to estimate these strips:

1. The assessed hubs are identified in the modeled price series, and the unassessed hubs are assigned to assessed hubs based on their similarity in seasonal pricing patterns and overall price correlation;

2. The price spread between the pair of hubs defined in step one (assessed hub and unassessed hub) is calculated from the model data set; and

3. Platts then adds this spread value to the monthly value for the assessed hub that is developed from forward assessment data to determine the price value for the unassessed hub.

To summarize the approach for unassessed hubs, Platts examines the model data set to determine the spread relationships between hubs that are suggested by the model. This spread is then added to an assessed hub with similar pricing characteristics to arrive at an unassessed price. In this way, relevant market information is considered even in the development of prices for hubs where no assessment data is available. Platts gives highest priority to available market data, but Platts allows for the use of model data to fill out curves where market data provide no indications.

GAS FORWARDS MARKET

Platts gas forwards prices provide the market with a daily assessment of financial basis differentials at major pricing points in North America for future time periods. Trading generally is done by the month, for nearby months, and by the season. Standard products traded are for two seasons: summer (April through October) and winter (November through March). Trades are also done for the balance of the current season.

Forwards prices are traded and reported as a basis differential to the corresponding NYMEX Henry Hub futures contract: in other words, the closing price of that month's futures contract for a specified month or the average of the months that make up a seasonal strip of futures contracts. Depending on the location, the differential price may vary above or below the Henry Hub price. Prices are reported in U.S. cents/MMBtu.

Daily forward assessments are based on a confidential market survey of active buyers and sellers, and these assessments reflect actual transactions as well as bids and offers. Sources include brokers, marketers, financial institutions, utilities, and other parties involved in forward trading. Surveys are designed to capture as wide a sample of deal-making as possible.

Data used to compile the assessments may include both consummated transactions and other information on prices at which deals could be transacted—including bids, asks, spread relationships between points, and historical relationships. Because the forwards market is not as deep and liquid as the daily or monthly physical gas markets, prices—at least at this time—are likely to reflect both actual transactions and editorial assessments of transactable values.

For consummated deals, Platts seeks transaction-level data from a back-office (noncommercial) segment of the company, with the accuracy and completeness of the report certified by a senior officer. Platts seeks counterparties for transactions and, upon request, will sign a confidentiality agreement. However, due to the relatively sparse trading in the forwards market, Platts also currently uses market information obtained from traders.

LONG-TERM GAS CURVE: FORECAST METHODOLOGY

This section describes the fundamental model Platts uses to develop relationships between North American hubs and long-term prices. The primary tool that Platts uses to project gas demand, price, and pipeline utilization is the GPCM, a model maintained by RBAC Associates in Santa Monica, California. As a network linear programming model, GPCM replicates the economics of the natural gas industry, including the production, transportation, storage, marketing, distribution, and consumption sectors. The gas model makes use of supply and demand curves for major market and supply areas by month, over a 20-year forecast period, and also uses a detailed approximation of the physical characteristics of the North American pipeline grid to solve for the equilibrium volumes and prices.

Platts has developed a detailed data set for input to GPCM, which includes over 125 distinct pipelines and 237 unique pipeline zones, 73 supply regions, 437 demand points representing customers across each of the various gas consumption sectors, 110 storage areas, and 667 pipeline interconnects. The pipeline data also include rates for firm and interruptible transmission and storage. In cases where a pipeline had a variety of rate schedules for, say, firm transportation service, the rates for that pipeline's primary firm transportation were used. A discounting algorithm based on pipeline utilization simulates activities in the pipeline capacity release market. Data on storage facilities were summarized by pipeline and state and balanced to storage levels consistent with publicly available state and regional sources.

Demand curves for GPCM were developed from historical data on price and demand. Separate regression analyses were performed for each end-use sector and state. The objective of the demand curve and regression analyses was to estimate regional price elasticity and demand levels for input to GPCM. Using log transformations of monthly gas consumption as the dependent variable, state-level econometric models were constructed. The independent variables were population, gross state product (GSP), constant dollar city-gate price, and heating and cooling degree-days in an ordinary least squares (OLS) linear regression model with an adjustment for first-order autocorrelation.

Platts derives projections of population and GSP from U.S. Census Bureau and U.S. Bureau of Economic Analysis data. Heating and cooling degree-days are assumed to follow 30-year normal weather averages. Analyses of historical Federal Energy Regulatory Commission (FERC) Form 2 data, along with Energy Information Administration (EIA) Form 176 data contained in the Platts GASdat information system, are used to disaggregate the state-level forecasts to the customer or substate level.

For gas-supply modeling, Platts uses natural gas resource estimates based on the U.S. Geological Survey natural gas resource and the National Petroleum Council's assessments. The reserve base is related to the costs of extraction to form the long-term supply curves for each major gas-producing basin. In the short term, the supply curve for each basin is assumed to have two segments. The lower segment is defined to be a relatively price-sensitive portion of the curve where production is gradually shut in as prices fall below the break point. The upper segment is an inelastic portion of the curve where production is expected to be relatively stable up to the maximum productive capacity for a month.

Platts uses a variety of sources to develop pipeline capacity data in GPCM. A primary source, however, is FERC Form 567 receipt and delivery point data, along with compressor station design capacity collected in GASdat. These data were supplemented with capacity estimates from EIA's "Deliverability on the Interstate Natural Gas Pipeline System" (a government-sponsored research report), industry newsletters, pipeline company annual reports, and state public utility filings. Pipeline capacity is modeled using three separate measures of capacity:

- Transportation zone capacity—the estimated physical capacity to move gas across a zone. The zones are derived from the rate zones used by pipelines. This is Platts' primary measure of mainline transportation capacity.
- Transportation link capacity—the capability to move gas across a point between two zones. When this link is between two different pipelines, it is defined as an interconnection.
- Deliverability to a market—this is a measure of the ability to move gas from a pipeline zone to an end user.

Pipeline zone link and interconnect link data were derived from FERC Form 567 non-coincidental peak-day flow and compressor station maximum design capacity data. If data were not available, as was the case with some of the intrastate pipelines, a generic interconnect capacity of 100 million cubic feet per day (MMcfd) was used. These data give a measure of the amount of gas that can flow from region to region or from pipe to pipe. The customer and supplier link data are also derived from the FERC Form 567 data. For customers for whom data were not available, the average annual flow was adjusted for seasonality in the region.

TRANSPORTATION AND STORAGE TARIFF STRUCTURE

One of the important changes that has occurred in over two decades of deregulation in the natural gas industry has been the introduction of free-market principles into gas transmission and storage markets. Nonetheless, these markets are still subject to regulation. Hence, although the structure of the rates charged is known, the amount charged is not.

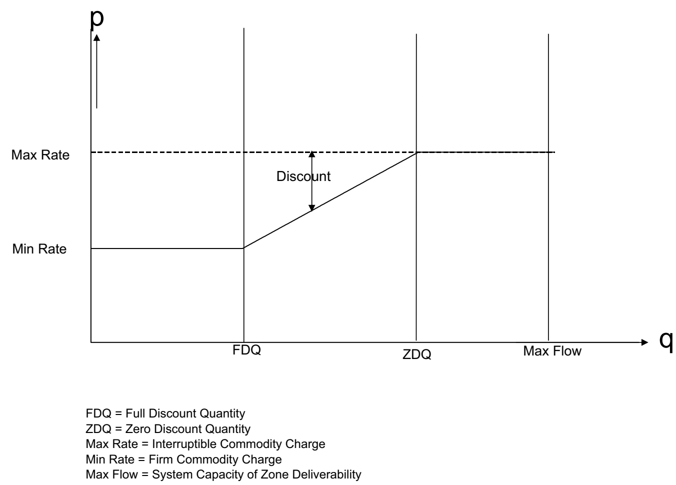
In general, each transportation and storage transaction cost is parameterized by six values: a unit demand charge, a unit firm commodity charge, a unit interruptible commodity charge, a full discount quantity (FDQ), a zero discount quantity (ZDQ), and a fuel and loss factor.

The cost model for such transactions assumes that, for a price, some amount of the capacity could be reserved for certain customers. The cost of such capacity reservations will be the unit demand charge multiplied by the capacity reserved plus the unit firm commodity charge times the amount actually used. This structure is consistent with the rate structure most widely used by the pipeline industry, although some systems do employ mileage-based rates. The cost for interruptible service is based entirely on the interruptible commodity charge. Interruptible service is available when firm customers do not utilize all of the space in the pipeline. The cost of interruptible transportation will generally be lower per unit shipped than the total cost for firm service, but it will be higher than the firm commodity charge. Further, under most current used-rate designs, the variable cost of interruptible transportation will be greater than or equal to the variable cost of firm transportation. (Under the straight fixed variable rate design, the variable cost of firm transportation, excluding fuel, is quite low.)

However, the value of transportation is not the same under all conditions. In slack periods, interruptible rates may be discounted significantly, because the nonfuel variable costs of transmission are quite low (see **Exhibit 1**). Further, firm capacity can now be assigned in the capacity release market at less than maximum rates. GPCM deals with this problem through a discounting algorithm. The specification of the function requires the user to designate two points for each transportation zone: the FDQ and the ZDQ. Simply stated, the ZDQ is the flow volume above which the pipeline will not discount and below which it will begin to do so. The FDQ is the quantity at which the pipeline will offer its maximum allowable discount.

The function works as follows: If demand for the capacity is higher than the ZDQ, the pipeline will be able to charge the full interruptible rate for transportation and will not discount. If demand is lower than the ZDQ, the pipeline may discount. The amount of the discount in this model is maximized when demand falls lower than FDQ. Then the price of transportation is equal to the firm commodity charge. The discount declines in a linear fashion as demand increases from the FDQ up to the ZDQ. For all demand greater than or equal to ZDQ, the price is the full interruptible commodity charge; no discounting occurs. The general outline of the relationship between these two points is shown in Exhibit 1. The shape of the FDQ-ZDQ functions will have an important impact on the value of capacity in each model zone.

Exhibit 1: Pipeline discounting function in GPCM



Source: Platts

Storage transactions work in a manner similar to the interruptible commodity charge. There are three storage transactions: injection, storage, and withdrawal. Injection and withdrawal transactions have the same structure defined above for pipeline transactions. The storage transaction has a simpler structure: a constant unit cost per period, which may be zero. Firm storage also incurs the appropriate demand charge. The user may model a situation where gas is transported to a storage location on one rate schedule, injected and withdrawn under a second schedule, and delivered to another location under a third. The user may also model a “bundled” structure involving movement from one location to the storage location and then downstream to yet a third location, all under the same rate structure.

HENRY HUB LONG-TERM CURVE

As a fundamentals-based model, GPCM solves for price levels and basis with inputs for such factors as productive capacity in supply regions, pipeline and storage deliverability, and expected demand. The physical and financial market, however, trades on expectations for these variables (as well as others) that may differ from model inputs at any point in time. This can be seen in frequent divergence between where the Henry Hub strip trades and GPCM model forecasts for a similar period. Platts believes that the long-term structural trends indicated by GPCM are sound and based on the best fundamental data and judgment available. In order to adjust for divergence in long-term price levels, Platts develops a correlation between its nominal Henry Hub forecast using GPCM and the trading day's NYMEX strip using linear regression. Platts then extrapolates values beyond the strip based on the linear equation. The results are a long-term strip with the structural trends suggested by GPCM as well as pricing levels and a transition that are consistent with the current NYMEX strip.

APPENDIX: LIST OF NORTH AMERICAN NATURAL GAS M2M PRICE CURVES

North American Natural Gas M2M Price Curves

Code	Hub description	Code	Hub description	Code	Hub description
Heavily traded hubs					
NCA	Columbia Gas Appalachia	NHS	Houston Ship Channel	NSC	So Cal Gas
NCG	Chicago CG	NMG	Michigan Consolidated CG	NTC	Transco Zn 3
NES	El Paso SanJuan	NNR	Kern River/Opal Plant	NTN	Transco Zn 6 NY
NHH	Henry Hub	NPT	Panhandle TX OK	NWA	Texas Intra, WAHA Area
Lightly traded hubs					
NAL	ANR LA	NGS	Texas GT Zn 2	NT0	Tenn GP Zn 0
NAM	ANR ML7	NGT	NGPL S TX	NT1	Transco Zn 1
NAO	ANR OK	NLS	Lone Star	NT2	Transco Zn 2
NCL	Columbia Gulf LA	NMA	Malin	NT4	Transco Zn 4
NCR	CIG Rocky Mt	NNA	Nova AECO-C	NT5	Tenn GP 500 Leg
NDO	Dawn Ont	NND	Northern NG Demarc	NT5	Transco Zone 5
NDS	Dominion South	NNT	Northern NG TX/OK/KS	NT6	Transco Zn 6 Non-NY
NEE	Tennessee, 100 Leg	NNV	Northern NG Ventura	NT8	Tenn GP 800 Leg
NEP	El Paso Permian	NON	Oneok	NTE	Texas E Zn M3
NEM	Empress	NPG	PG&E CG	NTL	Texas E ELA
NF1	Florida Gas Zn 1	NPS	PG&E South	NTP	Transwestern Permian
NF2	Florida Gas Zn 2	NCE	Consumers Energy	NTR	Trunkline
NF3	Florida Gas Zn 3	NRE	Reliant East	NTS	Texas E STX
NG1	Texas GT Zn 1	NRW	Reliant West	NTT	Texas E ETX
NGM	NGPL Midcon	NSL	SoNat LA	NTW	Texas E WLA
NGO	NGPL TX/OK	NSU	Sumas	NWT	Williams TX/OK/KS
NGR	Niagra				