METHODOLOGY AND SPECIFICATIONS GUIDE

ARGUS BRAZIL GAS AND POWER

Contents:

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The most up-to-date Argus Brazil Gas and Power methodology is available on www.argusmedia.com

Methodology overview

Methodology rationale

Argus strives to construct methodologies that reflect the way the market trades. Argus aims to produce price assessments which are reliable and representative indicators of commodity market values and are free from distortion. As a result, the specific currencies, volume units, locations and other particulars of an assessment are determined by industry conventions.

In the Brazilian gas and power markets, Argus publishes physical market prices in the open market as laid out in the specifications and methodology guide. Argus uses the trading period deemed by Argus to be most appropriate, in consultation with industry, to capture market liquidity.

In order to be included in the assessment process, deals must meet the minimum volume, delivery, timing and specification requirements in our methodology. In illiquid markets, and in other cases where deemed appropriate, Argus assesses the range within which product could have traded by applying a strict process outlined later in this methodology.

Survey process

Argus price assessments are informed by information received from a wide cross section of market participants, including producers, consumers and intermediaries. Argus reporters engage with the industry by proactively polling participants for market data. Argus will contact and accept market data from all credible market sources including front and back office of market participants and brokers. Argus will also receive market data from electronic trading platforms and directly from the back offices of market participants. Argus will accept market data by telephone, instant messenger, email or other means.

Argus encourages all sources of market data to submit all market data to which they are a party that falls within the Argus stated methodological criteria for the relevant assessment. Argus encourages all sources of market data to submit transaction data from back office functions.

Throughout all markets, Argus is constantly seeking to increase the number of companies willing to provide market data. Reporters are mentored and held accountable for expanding their pool of contacts. The number of entities providing market data can vary significantly from day to day based on market conditions.

For certain price assessments identified by local management, if more than 50pc of the market data involved in arriving at a price assessment is sourced from a single party the supervising editor will engage in an analysis of the market data with the primary reporter to ensure that the quality and integrity of the assessment has not been affected.

Market data usage

In each market, Argus uses the methodological approach deemed to be the most reliable and representative for that market. Argus will utilise various types of market data in its methodologies, to include:

- Transactions
- Bids and offers
- Other market information, to include spread values between grades, locations, timings, and many other data.

In many markets, the relevant methodology will assign a relatively higher importance to transactions over bids and offers, and a relatively higher importance to bids and offers over other market information. Certain markets however will exist for which such a hierarchy would produce unreliable and non-representative price assessments, and so the methodology must assign a different relative importance in order to ensure the quality and integrity of the price assessment. And even in markets for which the hierarchy normally applies, certain market situations will at times emerge for which the strict hierarchy would produce non-representative prices, requiring Argus to adapt in order to publish representative prices.

Verification of transaction data

Reporters carefully analyse all data submitted to the price assessment process. These data include transactions, bids, offers, volumes, counterparties, specifications and any other information that contributes materially to the determination of price. This high level of care described applies regardless of the methodology employed. Specific to transactions, bids, and offers, reporters seek to verify the price, the volume, the specifications, location basis, and counterparty. In some transactional average methodologies, reporters also examine the full array of transactions to match counterparties and arrive at a list of unique transactions. In some transactional average methodologies, full details of the transactions verified are published electronically and are accessible by subscribers.

Several tests are applied by reporters in all markets to transactional data to determine if it should be subjected to further scrutiny. If a transaction has been identified as failing such a test, it will receive further scrutiny. For assessments used to settle derivatives and for many other assessments, Argus has established internal procedures that involve escalation of inquiry within the source's company and escalating review within Argus management. Should this process determine that a transaction should be excluded from the price assessment process, the supervising editor will initiate approval and, if necessary, documentation procedures.

Primary tests applied by reporters
- Transactions not transacted at arm's length, including deals between related parties or affiliates.
- Transaction prices that deviate significantly from the mean of all transactions submitted for that day.
- Transaction prices that fall outside of the generally observed lows and highs that operated throughout the trading day.
- Transactions that are suspected to be a leg of another transaction or in some way contingent on an unknown transaction.
- Single deal volumes that significantly exceed the typical transaction volume for that market.
- Transaction details that are identified by other market participants as being for any reason potentially anomalous and perceived by Argus to be as such.

- Transaction details that are reported by one counterparty differently than the other counterparty.
- Any transaction details that appear to the reporter to be illogical or to stray from the norms of trading behaviour. This could include but is not limited to divergent specifications, unusual delivery location and counterparties not typically seen.
- Transactions that involve the same counterparties, the same price and delivery dates are checked to see that they are separate deals and not one deal duplicated in Argus records.

Secondary tests applied by editors for transactions identified for further scrutiny

Transaction tests

- The impact of linkage of the deal to possible other transactions such as contingent legs, exchanges, options, swaps, or other derivative instruments. This will include a review of transactions in markets that the reporter may not be covering.
- The nature of disagreement between counterparties on transactional details.
- The possibility that a deal is directly linked to an offsetting transaction that is not publicly known, for example a "wash trade" which has the purpose of influencing the published price.
- The impact of non-market factors on price or volume, including distressed delivery, credit issues, scheduling issues, demurrage, or containment.

Source tests
- The credibility of the explanation provided for the outlying nature of the transaction.
- The track record of the source. Sources will be deemed more credible if they
  - Regularly provide transaction data with few errors.
  - Provide data by Argus' established deadline.
  - Quickly respond to queries from Argus reporters.
  - Have staff designated to respond to such queries.
- How close the information receipt is to the deadline for information, and the impact of that proximity on the validation process.

Assessment guidelines
When insufficient, inadequate, or no transaction information exists, or when Argus concludes that a transaction based methodology will not produce representative prices, Argus reporters will make an assessment of market value by applying intelligent judgement based on a broad array of factual market information. Reporters must use a high degree of care in gathering and validating all market data used in determining price assessments, a degree of care equal to that applying to gathering and validating transactions. The information used to form an assessment could include deals done, bids, offers, tenders, spread trades, exchange trades, fundamental supply and demand information and other inputs.

The assessment process employing judgement is rigorous, replicable, and uses widely accepted valuation metrics. These valuation metrics mirror the process used by physical commodity traders to internally assess value prior to entering the market with a bid or offer. Applying these valuation metrics along with sound judgement significantly narrows the band within which a commodity can be assessed, and greatly increases the accuracy and consistency of the price series. The application of judgement is conducted jointly with the supervising editor, in order to be sure that guidelines below are being followed. Valuation metrics include the following:

Relative value transactions
Frequently transactions occur which instead of being an outright purchase or sale of a single commodity, are instead exchanges of commodities. Such transactions allow reporters to value less liquid markets against more liquid ones and establish a strong basis for the exercise of judgment.
- Exchange one commodity for a different commodity in the same market at a negotiated value.
- Exchange delivery dates for the same commodity at a negotiated value.
- Exchange a commodity in one location for the same commodity at another location at a negotiated value.

Bids and offers
If a sufficient number of bids and offers populate the market, then in most cases the highest bid and the lowest offer can be assumed to define the boundaries between which a deal could be transacted.

Comparative metrics
- The relative values between compared commodities are readily discussed in the market and can be discovered through dialogue with market participants. These discussions are the precursor to negotiation and conclusion of transactions.
- Comparison to the same commodity in another market centre.
- Comparison to a more actively traded but slightly different specification commodity in the same market centre.
- Comparison to the same commodity traded for a different delivery timing.
- Comparison to the commodity's primary feedstock or primary derived product(s).
- Comparison to trade in the same commodity but in a different modality (as in barge versus oceangoing vessel) or in a different total volume (as in full cargo load versus partial cargo load).

Volume minimums and transaction data thresholds
Argus typically does not establish thresholds strictly on the basis of a count of transactions, as this could lead to unreliable and non-representative assessments and because of the varying transportation infrastructure found in all commodity markets. Instead, minimum volumes are typically established which may apply to each transaction accepted, to the aggregate of transactions, to transactions which set a low or high assessment or to other volumetrically relevant parameters.

For price assessments used to settle derivatives, Argus will seek to establish minimum transaction data thresholds and when no such threshold can be established Argus will explain the reasons. These

thresholds will often reflect the minimum volumes necessary to produce a transaction-based methodology, but may also establish minimum deal parameters for use by a methodology that is based primarily on judgement.

Should no transaction threshold exist, or should submitted data fall below this methodology's stated transaction data threshold for any reason, Argus will follow the procedures outlined elsewhere in this document regarding the exercise of judgement in the price assessment process.

Transparency

Argus values transparency in energy markets. As a result, where available, we publish lists of deals in our reports that include price, basis, counterparty and volume information. The deal tables allow subscribers to cross check and verify the deals against the prices. Argus feels transparency and openness is vital to developing confidence in the price assessment process.

Swaps and forwards markets

Argus publishes forward assessments for numerous markets. These include forward market contracts that can allow physical delivery and swaps contracts that swap a fixed price for the average of a floating published price. Argus looks at forward swaps to inform physical assessments but places primary emphasis on the physical markets.

Publications and price data

Argus Brazilian gas and power prices are published in the Argus Brazil Gas and Power report. Subsets of these prices appear in other Argus market reports and newsletters in various forms. The price data are available independent of the text-based report in electronic files that can feed into various databases. These price data are also supplied through various third-party data integrators. The Argus website also provides access to prices, reports and news with various web-based tools. All Argus prices are kept in a historical database and available for purchase. Contact your local Argus office for information.

A publication schedule is available at www.argusmedia.com

Corrections to assessments

Argus will on occasion publish corrections to price assessments 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 assess markets based on new information learned after the assessments are published. We make our best effort to assess markets 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 price assessment 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).

Consistency in the assessment process

Argus recognises the need to have judgement consistently applied by reporters covering separate markets, and by reporters replacing existing reporters in the assessment process. In order to ensure this consistency, Argus has developed a programme of training and oversight of reporters. This programme includes:

- A global price reporting manual describing among other things the guidelines for the exercise of judgement
- Cross-training of staff between markets to ensure proper holiday and sick leave backup. Editors that float between markets to monitor staff application of best practices
- Experienced editors overseeing reporting teams are involved in daily mentoring and assisting in the application of judgement for illiquid markets
- Editors are required to sign-off on all price assessments each day, thus ensuring the consistent application of judgement.

Review of methodology

The overriding objective of any methodology is to produce price assessments which are reliable and representative indicators of commodity market values and are free from distortion. As a result, Argus editors and reporters are regularly examining our methodologies and are in regular dialogue with the industry in order to ensure that the methodologies are representative of the market being assessed. This process is integral with reporting on a given market. 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 market report editors and management 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 assessments. Report editors will review:

- Appropriateness of the methodology of existing assessments
- Termination of existing assessments
- Initiation of new assessments.

The report editor will initiate an informal process 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, the report editor will submit an internal proposal to management for review and approval. Should changes or terminations of existing assessments 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 in the relevant Argus report. This announcement will include:

- Details on the proposed change and the rationale
- Method for submitting comments with a deadline for submissions
- For prices used in derivatives, 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 price assessments 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 in the relevant Argus report and include a date for implementation. For prices used in derivatives, publication of stakeholders' formal comments that are not subject to confidentiality and Argus' response to those comments will also take place.

Argus Brazil Gas and Power

Argus publishes the Argus Brazil Gas and Power report every Monday, with calculated prices and fundamentals data from the week before. Gas network prices, equivalent prices and power spreads are published daily via Argus Direct using the latest information available at 4.30pm Brasilia time on the day of publication.

In the event that calculated price components are unavailable for a given product or location, Argus may republish the latest available price in the print edition of Argus Brazil Gas and Power. If previously unavailable calculation components are subsequently published or published prices are otherwise revised, the digital history on Argus Direct will be updated.

Publication schedule

All prices follow the Brazilian public holiday publication calendar. A publication schedule is available at www.argusmedia.com.

Conversions

Inflation rate

Argus uses the inflation rate from the General Market Price Index (IGPM, Indice Geral de Precos - Mercado) as calculated by the Getulio Vargas Foundation (FGV, Fundação Getulio Vargas).

Exchange rate

Argus uses the US dollar/Brazilian real ($/R) exchange rate from the Central Bank of Brazil (BCB, Banco Central do Brasil). Exchange rates are expressed to five decimal places, and converted assessments are rounded to three decimal places.

Energy equivalents

Energy conversions assume 26.8mn m³/mmBtu, in line with the Ministry of Mines and Energy (MME, Ministério de Minas e Energia).

Gas network average prices

National and regional average gas network prices are calculated for the current working day in R/m³ and published in R/m³, $/m³ and $/mmBtu.

Network prices are the average of pricing formulas in contracts between gas suppliers and pipeline distributors, as posted by the National Agency of Petroleum, Natural Gas and Biofuels (ANP, Agência Nacional do Petróleo, Gás Natural e Biocombustíveis) using the latest available inflation rates, exchange rates and international benchmarks prices.

Calculated average prices
- TAG - pipeline network in Northeastern Brazil
- NTS - pipeline network in Sao Paulo and Rio de Janeiro
- TBG - pipeline network with Bolivian gas and connection to and from southwestern Brazil
- Brazil Network average

Natural gas calculated transportation tariffs

Argus publishes calculated transportation tariffs for natural gas entry and exit capacity. The calculated prices include transportation tariffs posted by Brazil's oil, gas and biofuels regulator ANP, plus surcharges and costs as posted by gas transportation companies. Penalties and extra gas volumes for use by the system operator are not included in the calculated price.

Prices are published in R/mmBtu.

Prices are updated whenever surcharges, costs or ANP tariff rates are adjusted.

Natural gas calculated transportation tariffs

TAG network

Entry points	Exit points
Atalaia I	Alagoas
Atalaia II	Bahia
Cacimbas	Ceará
LNG Pecém	Espírito Santo
Guamaré I	Paraíba
Guamaré II	Pernambuco
Marechal Deodoro	Rio de Janeiro
Pojuca II	Rio Grande do Norte
TECAB	Sergipe
Conexion TECAB	
LNG São Francisco do Conde III	
São Francisco do Conde I	
São Francisco do Conde II	
LNG São Sebastião do Passé (TRBA)	
UTGSUL	

TBG Network

Entry points	Exit points
Corumbá	Gascar
Gascar	Mato Grosso do Sul
Garuva	Paraná
	Rio Grande do Sul
	Santa Catarina 1
	Santa Catarina 2
	São Paulo 1
	São Paulo 2
	São Paulo 3
	São Paulo 4

NTS network

Entry points	Exit point
Caraguatatuba	Minas Gerais
Paulínia	Replan Interconnection
LNG Baía de Guanabara	TECAB Interconnection
Guararema Interconnection	Rio de Janeiro
Guapimirim	São Paulo
Replan Interconnection	
TECAB	
TECAB Interconnection	

Natural gas posted retail tariffs

Argus publishes posted retail natural gas tariffs for the final industrial consumers of each of the local distribution companies in Brazilian states.

Tariffs are updated monthly in the second week of each month. Argus publishes the tariffs for three levels of gas consumption: 50,000 m³/month or 1,700m³/d; 2mn m³/month or 70,000 m³/d; and 10mn m³/month or 340,000 m³/d.

Tariffs are published in R/m³ and include fixed fees (when applicable), variable fees and state taxes.

Tariffs are published for: Amazonas, Alagoas, Bahia, Ceará, Espírito Santo, Minas Gerais, Rio de Janeiro, Mato Grosso, Paraná, Pernambuco, Paraíba, Santa Catarina, São Paulo, Sergipe, Rio Grande do Norte and Rio Grande do Sul.

Equivalent natural gas prices

The price differential in $/m³ for competing generation fuels as compared with Argus LNG des Brazil price on an equivalent calorific value basis. The comparisons use the latest available prices for each fuel at the time of publication and the assumed energy contents as published by the Energy Research Company (EPE, Empresa de Pesquisa Energética) in its Energy Outlook (BEN, Balanço Energetico Nacional).

- Argus Gas Network Brazil Average
- Natural gas hub Henry Hub day-ahead index - see the Argus Natural Gas Americas methodology
- Argus Petroleum Coke del Brazil 6.5% sulphur 40 HGI - see the Energy Argus Petroleum Coke methodology
- Petrobras S500 diesel posted price Paulínia (SP) - see the Argus Brazil Motor Fuels methodology
- Argus Propane-butane mix 70:30 del Santos - see the NGL Americas methodology

LPG

The calculated price of US propane and propane-butane mixes delivered to the Brazilian ports of Suape and Santos from the US.

For each port, prices are published for
- 100% propane
- 90% propane:10% butane
- 70% propane:30% butane

See the NGL Americas methodology.

Related markets

Argus Brazil Gas and Power includes related daily prices republished from other Argus publications.

- Argus LNG des Brazil -see the Argus LNG Daily methodology
- Argus North Sea Dated Brent -see the Argus Crude methodology
- Argus Henry Hub day-ahead - see the Argus Natural Gas Americas methodology

Spot power prices

Argus publishes the minimum, maximum and average hourly spot power prices each day as calculated by the Electric Energy Clearing Chamber (PLD, Preço de Liquidação das Diferenças as calculated by the CCEE, Câmara de Comercialização de Energia Elétrica).

Prices are published for each regional power dispatch submarket: Southeast/Mid Center; Northeast; North and South.

Generating costs

Spark and fuel oil spreads are the difference between power and fuel prices and indicate the profitability of running a power plant taking into account variable fuel costs.

Argus spark and fuel oil spreads are published in R/MWh and $/MWh and are calculated from Argus' latest available power and fuel price assessments and are not assessments of trade in the over-the-counter spark-spread market.

The spreads assume power plant efficiencies of 49% and 60% for natural gas fired power generation and 38% for fuel oil based power generation.

Argus calculates natural gas spreads using the Brazil average gas network price or the Argus LNG des Brazil price, including simple regasification costs from the EPE. Argus calculates fuel oil spreads using Petrobras' posted fuel oil price in Paulinia.

Spot spreads
Argus calculates spot power generation spreads by comparing the highest hourly day-ahead power spot price for the Southeast /Mid Center submarket each day, as published by the CCEE, with the cost of natural gas or fuel oil. The CCEE spot power prices used are for the date of publication, usually published the previous day.

Note: regulated minimum and maximum spot power prices can affect published spark and fuel oil spreads.

Spark spreads
Max spot power price - (LNG des Brazil + regasification and storage) ÷ conversion factor ÷ 49%

Max spot power price - (LNG des Brazil + regasification and storage) ÷ conversion factor ÷ 60%

Max spot power price - Brazil Network average gas price ÷ conversion factor ÷ 49%

Max spot power price - Brazil Network average gas price ÷ conversion factor ÷ 60%

Fuel oil spreads
Max spot price - Petrobras A1 fuel oil posted price Paulínia (SP) ÷ conversion factor ÷ 38%

Long-term auction spreads
Argus calculates long-term power generation spreads by comparing the highest generation cost, from a single generator, per megawatt-hour from power plants with long-term contracts in regulated market auctions, as published by the National Electric System Operator (ONS, Operador Nacional do Sistema Elétrico), with the cost of natural gas or fuel oil. The ONS generation costs used for each generating fuel are published the previous week, usually on Friday.

Spark spreads
Max gas generation cost – (LNG des Brazil + regasification and storage) ÷ conversion factor ÷ 49%

Max gas generation cost – Brazil Network average gas price ÷ conversion factor ÷ 49%

Fuel oil spreads
Max fuel oil generation cost – Petrobras A1 fuel oil posted price Paulínia (SP) ÷ conversion factor ÷ 38%