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ARGUS BUTADIENE

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The most up-to-date Argus Butadiene 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 butadiene and raffinate-1 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. The deals are also published in the daily report.

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 judgment 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 judgment 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 judgment 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 judgment 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 judgment.

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 judgment 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 butadiene and raffinate-1 prices are published in the Argus Butadiene 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 judgment 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 judgment
- 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 judgment for illiquid markets
- Editors are required to sign-off on all price assessments each day, thus ensuring the consistent application of judgment.

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.

Butadiene market prices

Argus publishes prices that report and reflect prevailing levels for open-market arms length transactions. Price assessments include market information over the course of the two-week trading period.

Various methodological approaches are employed in reporting butadiene markets to produce the most representative price assessments. These include volume-weighted averages of deals done, lows and highs of deals done, and other methods.

In illiquid markets, Argus assesses the range within which butadiene could have traded, based on bids and offers through the entire day, movements of similar or related grades, and extensive polling of market participants. Formula-priced deals, market fundamentals and information regarding trade in material that does not meet

specifications also informs assessments but a primary emphasis is placed on the physical markets.

To be included in the price formation process, deals must meet the strict delivery, timing, and specification requirements in the methodology, and must be executed at arms length between a willing buyer and seller.

Survey method and verification

Price assessments in the Argus Butadiene report rely on a wide variety of sources for information, including refiners, marketers, importers, traders and brokers.

Argus does not restrict itself to one subsection of the market, such as a single trading platform or single informational channel for the market information collected. The market surveys are intended to be balanced in approach and are conducted by experienced industry specialists.

Confidentiality

Argus asks for counterparties from contacts in order to confirm trades and to avoid double-counting in volume-weighted averages. But Argus does not publish counterparty names in the butadiene markets. Many companies have existing confidentiality agreements with counterparties and can only reveal trade information to Argus if confidentiality is maintained.

Definition of trading period

Argus price assessments include information from the entire two-week trading period between the publication of the Argus Butadiene report.

Butadiene markets

US

Contract prices

US contract prices are for the price of material containing a minimum 95pc butadiene, sold fob US Gulf under long-term contract, delivering during the named month, and priced in US cents per pound (lb). They do not include surcharges, aggregation fees, transaction fees, transportation or equipment fees, or discounts.

Contract prices are published as soon as they become available for a given month, and are republished in each subsequent report until the next month's contract price becomes available.

Butadiene contract prevailing fob:

Assessed at the price posted for the named month by at least three of ExxonMobil, Shell, LyondellBasell, and TPC Group. If fewer than three of the four producers post identical prices, assessed at the average of the prices posted.

Butadiene contract fob:

The low is the lowest of the four prices posted by ExxonMobil, Shell, LyondellBasell, and TPC Group, and the high is the highest of the prices posted by those four companies.

Spot prices

Prices are for at least 2,000t of material containing a minimum 95pc butadiene, traded fob or cfr US Gulf, for delivery 10-30 days forward. The low is the lowest price traded since Argus Butadiene was last published, and the high the highest. In the absence of trade, prices are unchanged from the previous publication.

Northwest Europe

Argus publishes a Monthly Contract Price (MCP) for butadiene as established by negotiation between the major butadiene producers and their contract customers. As part of the negotiation process, any agreement between a major producer and at least two of their contract customers or any agreement between a contract butadiene buyer and at least two of their producer suppliers is communicated to Argus.

These settlements are typically accepted by all butadiene producers and contract buyers in northwest Europe. The settlement price applies to the following month. The price includes freight and other distribution costs but does not include any discounts or surcharges.

Spot butadiene prices are based on a survey of producers, buyers, and traders in the major regions. The survey confirms spot transactions in which the parties have agreed to a price, volume, method of transportation, and intended shipping and delivery dates since Argus Butadiene was last published. Prices are reported as a low and high of prices agreed during that period.

Northwest Europe specifications

Location: All northwest European butadiene production sites
 Timing: For the Monthly Contract Price, the current month. For spot prices, based on deals that include dates of shipments that will typically occur within 10-30 days.
 Volume: As provided in contracts for contract pricing. For spot sales, 1,000-12,000 metric tonnes.
 Basis: For contract prices or domestic spot sales, the basis is "free delivered" via pipeline, ship, barge, railcar, or truck. For export cargoes, spot prices are on an fob basis.

Asia-Pacific

Argus publishes a monthly Taiwan Contract Price and spot prices for cargoes exported from South Korea and cargoes imported into northeast and southeast Asia.

Spot butadiene prices are based on a survey of producers, buyers, and traders in the major regions. The survey confirms spot transactions in which the parties have agreed to a price, volume, method of transportation, and intended shipping and delivery dates since Argus Butadiene was last published. Prices are reported as a low and high of prices agreed during that period.

Northeast Asia specifications

Location: South Korea, China, Taiwan and Japan
 Timing: 2-6 weeks from the assessment date
 Minimum trade size: 1,500 metric tonnes
 Basis: fob South Korea and cfr northeast Asia

Argus also publishes the monthly averages in the Butadiene and Butadiene Asia-Pacific Supplement reports for the fob South Korea, cfr northeast Asia and cfr southeast Asia assessments. This single price is the arithmetic average of the mid-points of the published spot range for the calendar month. For example, the fob South Korea January monthly average price is the average of the mid-points of the published spot fob South Korea ranges during January.

Southeast Asia specifications

Location: Indonesia, Thailand, Malaysia, and Singapore
 Timing: 2-6 weeks from the assessment date
 Minimum trade size: 1,500 metric tonnes
 Basis: cfr southeast Asia

The cfr southeast Asia market is illiquid. Priority in assessing prices is given to fixed price trades and discussions. In the absence of fixed price trade and discussion, the cfr southeast Asia price is assessed by applying ocean freight differential to the cfr northeast Asia price assessment.

Taiwan CP butadiene contract

The monthly Taiwan Contract Price is the settled price that is established between CPC and its contract customers for the preceding month. CPC confirms the settlement by phone, email, or other direct communication with Argus by the end of calendar month.

Raffinate-1 markets

Argus assesses weekly spot Raffinate-1 prices for cargoes imported into China and exported from southeast and northeast Asia. Prices are assessed based on a survey of producers, buyers and traders in the major regions.

The survey confirms spot transactions that have taken place since the last assessment was published in which the parties have agreed to a price, volume, method of transportation, and intended shipping and delivery dates.

Prices are reported as a low and high of prices agreed during the period.

Due to the variety of raffinate-1 specifications, the low end of the published price range typically represents the prices of cargoes with lower iso-butylene content, while the high end of the published price range typically represents those with higher iso-butylene content.

Fob trades priced as a premium to naphtha c+f Japan are converted to a fixed price by adding the naphtha swaps price for the month of loading on the day of trade to the reported premium.

Fob Asia

Port locations:

- Anyer, Indonesia
- Map Ta Phut, Thailand
- Mailiao, Taiwan
- Daesan, South Korea
- Yeosu, South Korea
- Singapore

Timing: 2-6 weeks from the assessment date

Minimum trade size: 1,500 metric tonnes

Specifications: min 35pc and up to 75pc iso-butylene content

Fob Asia Raffinate-1 price assessments are published as outright values and as differential to naphtha c+f Japan swaps prices for the month of loading.

Cfr China

Port locations: Shandong, Huizhou, Zhejiang, Guangdong

Timing: 2-6 weeks from the assessment date

Minimum trade size: 1,500 metric tonnes

Specifications: min 35 pc and upto 75pc iso-butylene content

Cfr China Raffinate-1 price assessments are published as outright values only.