



ARGUS RUSSIAN GENERATION FUELS AND POWER

Contents:

Methodology overview	2
Introduction	5
Coal	5
Fuel oil	7
Natural gas	7
Power	7
Generation economics	8

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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 domestic Russian coal, natural gas, fuel oil 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 market analysts and 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, Argus Open Markets® (AOM®) and directly from the back offices of market participants. Argus will accept market data by telephone, instant messenger, email, AOM 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. Market analysts and 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 manager or editor will engage in an analysis of the market data with the primary market analysts and reporters 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

Market analysts and 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, market analysts and reporters seek to verify the price, the volume, the specifications, location basis, and counterparty. In some transactional average methodologies, market analysts and 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 market analysts and 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 manager or editor will initiate approval and, if necessary, documentation procedures.

Primary tests applied by market analysts and 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 trans-

action 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 market analyst or 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 managers or 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 market analyst or 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 market analysts and 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 market analysts and reporters will make an assessment of market value by applying intelligent judgment based on a broad array of factual market information. Market analysts and 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 manager or 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 market analysts and 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 domestic Russian coal, natural gas, fuel oil and power prices are published in the Argus Russian Generation Fuels and Power report ("Argus Топливо и энергетика") 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 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 market analysts and reporters covering separate markets, and by market analysts and reporters replacing existing market analysts and reporters in the assessment process. In order to ensure this consistency, Argus has developed a programme of training and oversight of market analysts and 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. Managers and editors that float between markets to monitor staff application of best practices
- Experienced managers and editors overseeing reporting teams are involved in daily mentoring and assisting in the application of judgment for illiquid markets
- Managers and 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 managers, editors, market analysts 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 managers, 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 managers and editors will review:

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

Report managers and editors 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 manager or 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.

Introduction

Argus publishes Russian domestic market prices for generation fuels (coal, natural gas, fuel oil) and power in the weekly *Argus Russian Generation Fuels and Power* report ("Argus Топливо и Энергетика"). The publication also contains detailed analysis of the latest market developments, important industry statistical data and an estimation of coal rail transport costs. It is available to subscribers every Wednesday (except for Russian public holidays) in the Russian language. 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).

Coal

Argus publishes price assessments for commonly used grades of steam coal: low-volatile grade T, middle volatile grade SS and high volatile grade D, produced in Kuzbass and Khakassia in Siberia, as well as lignite produced in the Krasnoyarsk region. Coal specifications (calorific value, ash content, volatility) can differ within the same grade, and depending on the mine. All Kuzbass and Khakassia coal has sulphur content of less than 1pc.

Grade T coal is consumed by several power stations in the European part of Russia. This grade is also used by cement producers and other industrial consumers, such as steel mills.

D-grade coal is most widely used by power generators and the municipal heating sector. DPK grade is consumed by housing and public utilities as well as households. Coal for heating needs is usually purchased by regional administrations, state organizations and other users through open tenders, normally held ahead of the heating season. Coal for heating needs is sold both by the dealers of large coal producers and numerous small traders.

There are no power stations in Russia built specifically to burn high quality SS grade coal but it is often used together with other grades to improve efficiency.

The largest consumers of lignite are power plants. Smaller volumes are purchased by households and municipal boilers. Krasnoyarsk 2B-grade lignite contains 3,800-4,100 kcal/kg.

Coal prices

Argus assesses prices in the domestic Russian coal market once a month. Assessments may be less frequent in the absence of market activity. Prices are published in *Argus Russian Generation Fuels and Power*. A publication schedule is available at www.argusmedia.com.

The Argus coal team in Moscow contacts a wide cross section of coal market participants including sellers, buyers, and trading companies. Argus will contact and accept market data from all credible market sources including the front and back office of market participants and brokers.

Argus analysts ask market participants in the survey whether they have done or heard of any trade in coal, and whether they have

made or received any bids or offers. Market participants are asked where they see the level of prices in the spot market for that day. The analysts then assess the price of the coal that conform to the specifications listed in the table below on the basis of transactions and buy/sell estimates.

All information received by the Argus Russian Generation Fuels and Power market reporters/analysts will be used in making the final assessment. Prices are published in Russian roubles per metric tonne, excluding value added tax.

Argus also publishes price assessments for less liquid coal grades. Assessments are published for coal sold in the domestic market and for exports. Argus also publishes Argus Russian Coal, Argus Coal Daily International, Argus Coal Daily, Argus Petroleum Coke, and Argus Coal Transportation as well as market and business intelligence reports on a wide range of other energy markets.

Coal netback price calculation

Argus publishes netbacks for thermal 6,000 kcal/kg coal exported through the ports of Ust-Luga and Vostochny on an fca Kuzbass (Kemerovo region of Russia) basis.

See the [Argus Russian Coal methodology](#).

Coal cpt index calculation

Argus calculates and publishes each month a list of cpt indices in RUB/t, without VAT.

Indexes are calculated as:

$$C = F + T + L$$

where:

C - cpt index for the given region (RUB/t, without VAT)

F - fca Kuzbass spot coal price assessment

T - average railway tariffs from Kuzbass to the given region

L - daily coal transportation fees from Kuzbass to the given region

Cpt indexes for grade D coal are published for:

North, North-West

Arkhangelsk

Vologda

Kaliningrad

Karelia

Komi

Leningrad

Murmansk

Novgorod

Pskov

Smolensk

Center

Vladimir

Ivanovo

Kostroma

Moscow

Ryazan

Tver

Tula

Yaroslavl

Volga area

Astrakhan

Mari El

Nizhniy Novgorod

Perm krai

Saratov

Udmurtia

Ural

Kirov

Kurgan

Orenburg

Sverdlovsk

Chelyabinsk

West Siberia

Altai krai

Novosibirsk

Omsk

Tomsk

Tyumen

Khanty-Mansi au-

tonomous okrug

East Siberia, Far Zabaykalsky krai

East Irkutsk

Amur Primorsky krai

Jewish autonomous Khabarovsk krai

oblast Yakutia

Coal rail transportation costs

Daily open-top railcar rents, daily coal transportation fees and route transportation costs in Russia are assessed on a monthly basis by contacting car owners, operators and their customers — energy and coal companies.

Daily open-top railcar rent (Rbs/d, excluding VAT)

- Short-term (up to one quarter), 69t carrying capacity
- Short-term (up to one quarter), 75t carrying capacity
- Long-term (up to one year), 69t carrying capacity
- Long-term (up to one year), 75t carrying capacity

Daily coal transportation fees (Rbs/d, excluding VAT)

- Short-term (up to one quarter), 69t

Route coal transportation cost (Rbs/railcar, excluding VAT)

- Short-term (up to one quarter), open-top railcar 69t:
 - Kuzbass-Far East (port of Vostochny)
 - Kuzbass-Northwest (port of Ust-Luga)
 - Kuzbass-South (port of Taman)
 - Central Kazakhstan-Northwest (port of Ust-Luga)
 - Central Kazakhstan-South (port of Taman)
- Short-term (up to one quarter), open-top railcar 75t:
 - Kuzbass-Far East (port of Vostochny)

Rates are published on the Argus Direct platform on the first publishing day of the month and subsequently in the first weekly issue of Argus Russian Generating Fuels and Power each month.

Total cost of coal rail transportation in open-top railcars

(in Rbs/t, including VAT) are published for the main domestic transportation routes of Russian coal grades D, T, SS, G, middlings and brown coal.

For each route, the calculation includes the shipment station, destination station and posted mileage. Argus uses the specialized Rail-Tariff software published by STM for the calculation of tariffs.

The cost of rail transport is calculated and published in two ways – for a full train (fixed-route dispatch), and on a per-car basis.

For the calculation of a full train cost, the following basic terms are used

- Open-top railcar capacity – 69t
- Average actual open-top railcar load – 68t
- Full train (fixed-route dispatch) railway tariffs
- Speed of loaded open-top railcar in Russia – 550 km/d
- Speed of empty open-top railcar return in Russia – 330 km/d
- Total delays during open-top railcar loading and discharge – 4 days
- Daily coal transportation cost in open-top railcars

For the calculation of a single open-top railcar cost, the following basic terms are used:

- Open-top railcar capacity – 69t
- Average actual open-top railcar load – 68t
- Wagon dispatch railway tariffs
- Speed of loaded open-top railcar in Russia – 330 km/d
- Speed of empty open-top railcar return in Russia – 330 km/d
- Total delays during open-top railcar loading and discharge – 4 days
- Daily coal transportation cost in open-top railcars

Key features of assessed coal					
Grade	SS	D	DPK	T	2B
Size mm	0-300	0-300	50-300	0-300	0-300
Typical NCV, kcal/kg	5,700	Khakassia: 5,200 Kuzbass: 5,100	Khakassia: 5,200 Kuzbass: 5,300 Khakassia: 5,500	6,000	3,800-4,100
Location (fca)	Kuzbass	Khakassia, Kuzbass	Khakassia, Kuzbass	Kuzbass	Krasnoyarsk
Delivery period, days	1-90	1-90	1-90	1-90	1-90
Volume, '000t	>1	>1	>1	>1	>1

Coal transportation cost components

Index	Daily open-top railcar rent	Daily coal transportation fee	Route transportation cost	Total cost of coal rail transportation
Expenses included				
Railcar maintenance and repairs with parts replacement	+	+	+	+
Minor repairs without parts replacement	—	+	+	+
Cost of railcar operation and margin	—	+	+	+
Empty railcar return railway tariff	—	—	+	+
Loaded railcar railway tariff	—	—	—	+
VAT	—	—	—	+

Coal prices: D

Russia, fca Kuzbas, excluding VAT Rbs/t		
Grade of coal	NAR, kcal/kg	Fraction size, mm
DPK	5,900-6,100	50-300
DO	5,100-5,400	25-50
DOMSSH	5,000	0-50
DOMSSH	5,300-5,500	0-50
DrOK	4,700-4,900	0-300
Export, fca Kuzbas, \$/t		
DPK	5,400-5,700	50-300
DPK	6,000-6,500	50-300
DO	5,400-5,700	25-50
DOMSSH	5,000-5,200	0-50
DOMSSH	5,300-5,500	0-50
DOMSSH	6,000	0-50

Coal prices: T and SS

Russia, fca Kuzbas, excluding VAT Rbs/t		
Grade of coal	NAR, kcal/kg	Fraction size, mm
TPK	6,400-6,500	50-300
TO	6,500-6,700	25-50
TOMSSH/TMSSH	5,900-6,000	0-25/0-50
SSPK	6,300-6,500	50-300
SSOMSSH	5,900-6,000	0-50
Export, fca Kuzbas, \$/t		
TPK	6,500-6,700	50-300
TOMSSH	6,000	0-50
TO	6,500-6,700	25-50
TPK	7,000	50-200
SSOMSSH	6,000	0-50
SSPK	6,500-6,700	50-300

Fuel oil

Argus assesses domestic fuel oil markets in Russia and publishes price assessments in the Argus Heavy Oil Products and Marine Fuels report. Argus Russian Generation Fuels and Power analyses the fuel oil market for power generation weekly and publishes average prices for the week before publication for the following basis/locations:

- M-100 fca Moscow refinery
- M-100 fca Ufa refineries
- M-100 fca Samara refineries
- M-100 fca Omsk refinery
- M-100 fca Nizhny Novgorod refineries
- M-100 fca Yaroslavl refineries
- M-100 fca Ryazan refineries
- M-100 fca Angarsk refineries

See the [Argus Heavy Oil Products and Marine Fuels methodology](#).

Natural gas

Gas prices

In absence of liquidity in the over-the-counter natural gas market Argus publishes current regulated tariffs set up by the Federal Tariff Service of the Russian Federation for industrial users and power generators. Separate tariffs are set annually for each region of Russia.

Power

Argus publishes weekly analysis of Russian power market in Argus Russian Generation Fuels and Power. The market commentary covers price movements, changes in supply and demand, power plant and grids outages, fuel price changes, fluctuations of hydrological resources and other fundamental factors.

Power prices

Argus Russian Generation Fuels and Power publishes the following price series:

Weekly results of ATS marketplace power trades (the week from Tuesday through Monday) for both Russian market zones (Europe-Urals and Siberia-East) and for 20 free flow zones:

- Weighted average price in the day-ahead market, Rbs/MWh
- Weekly sales volume in the day-ahead market, MWh
- Weekly sales volume in the regulated segment, MWh
- Weekly total sales volume in each market zone, MWh

Results of power trading on the ATS platform on Monday:

- Monday average-weighted day-ahead power price (Rbs/MWh) for each power grid system in the market: Center, North-West, Middle Volga, Urals, South, Siberia

Price zones

The wholesale market for electricity and capacity functions in regions consolidated into two price zones Europe-Urals (Price zone 1) and Siberia-East (Price zone 2).

Electric grids in other regions are not connected to the united national power grid and are non-price zones where electricity and capacity are sold at regulated tariffs.

Free flow zones

Price zones consists of 20 free flow zones. Electricity in a free flow zone can be transferred to any customer without restrictions on grid. Electricity and capacity produced by any generator in a free flow zone can be easily replaced by electricity and capacity of other generator situated in the same zone (see list of free flow zones).

Generation economics

Argus spark and dark spreads provide illustrative information about generation economics. They are derived from ATS day-ahead power prices, regulated natural gas tariffs and Argus' fuel oil and coal price assessments.

Argus calculates power generation costs for different types of fuel in several regions of Russia. The calculations of spark and dark spreads for each Monday are published weekly in the Argus Russian Generation Fuels and Power report. Spark (gas) and dark (coal) spreads show the difference between the price of power and fuel costs for its generation. Argus does not take into account other generation costs

Free flow zones

Power system/Free flow zone	Region
Europe – Ural	
Middle Volga	
Balakovo	Balakovsko-Saratovskiy district of Saratov region
Volga	Penza, Samara, Ulyanovsk regions, Saratov region (excluding Balakovsko-Saratovskiy district), Mordovia, Tatarstan (excluding Kazanskiy district)
North-West	
West	Novgorod, Pskov, Leningrad regions, Karelia, Saint-Petersburg
Kolskaya	Murmansk region
Ural	
Vyatka	Kirov region, Udmurtian republic, South district of Perm territory, Mari El, Chuvash Republic, Kazanskiy district of Tatarstan
North Tyumen	North district of Tyumen region including Yamal-Nenets autonomous area and Nenets autonomous area
Tyumen	Tyumen region and Khanty-Mansi autonomous area – Yugra (excluding North district of Tyumen region), North district of Tomsk region
Ural	Perm Territory, Kirov, Kurgan, Orenburg, Chelyabinsk regions, Sverdlovsk region, Bashkortostan
Center	
Moscow	Moscow and moscow region
Center	Belgorod, Bryansk, Vladimir, Voronezh, Ivanovo, Kaluga, Kostroma, Kursk, Lipetsk, Moscow, Nizhny Novgorod, Orel, Ryazan, Smolensk, Tambov, Tver, Tula, Vologda, Yaroslavl regions
South	
Volgograd	Volgograd Region
Mahachkala	Daghestan
Kavkaz	Stavropol territory, Ingushetia, Kabardino-Balkarian republic, Karachayev-Circassian republic, North Ossetia-Alania, Chechen Republic
Kaspia	Astrakhan region
Kuban	Krasnodar territory, Crimea, Adygeya, Rostov region, Kalmykia
Siberia	
Altai	Barnaulsko-Byiskiy district of Altai and Altai territory
Omsk	Omsk region
Siberia	Altai and Altai territory (excluding Barnaulsko-Byiskiy district), Irkutsk, Novosibirsk regions, Tomsk region (excluding North district), Kemerovo region (excluding South district), Krasnoyarsk territory, Khakassia, Tuva, Buryatia
Chita	Trans-Baikal territory
Yuzhnyi Kuzbass	South district of Kemerovo region

not related to fuel such as maintenance or modernization of power plants. Spreads are calculated according to the formula:

$$\text{Spread} = \text{Power price} - (\text{Fuel Price} / \text{Power plant efficiency})$$

Spreads are calculated for five regions of the Europe-Urals zone of the Russian power market (Moscow, Leningrad, Ryazan, Smolensk, Sverdlovsk regions) and for three regions of Siberia (Kemerovo, Novosibirsk and Tomsk regions)

Depending on the region, spreads are calculated for different types of fuel: natural gas, various grades of coal or fuel oil (see table below for details). Gas, coal and fuel oil have different calorific values. The calorific value of natural gas is assumed at 7,900 kcal/m³ and 9,800 kcal/kg for fuel oil. The calorific value of coal depends on the grade of coal.

Coal prices used in the spread calculation are Argus Russian domestic coal assessments, published in the Argus Russian Generation Fuels and Power report. Gas prices used in the spread calculation are state-regulated tariffs for particular regions of Russia (for industrial consumers). Gas tariffs are published in the Argus Russian Generation Fuels and Power report.

Fuel oil prices used in the spread calculation are Argus Russian fuel oil assessments for Monday, published in the Argus Heavy Oil Products and Marine Fuels daily report. See the [Argus Heavy Oil Products and Marine Fuels methodology](#).

Electricity prices used in spread calculations are Monday average-weighted day-ahead power prices for particular power grid systems, in which the regions chosen for calculation are located (Centre, North-West, Urals, Siberia power grid systems). Electricity prices are measured in Rbs/MWh excluding value-added tax. Fuel prices used in spread calculation are measured in Rbs/MWh and include transport costs and value-added tax.

Prices for natural gas in Russia are traditionally measured in Rbs/1,000m³, for coal in Rbs/t and for fuel oil in Rbs/t. Argus uses the following formula to convert traditional fuel prices to Rbs/MWh:

Calculated fuel price = Initial fuel price / Conversion factor
 The conversion factor shows the amount of power which may be produced from a particular fuel in ideal conditions, i.e. at 100pc power plant efficiency. The calculation of the conversion factor is based on the calorific value of the particular fuel and its comparison to the calorific value of conventional fuel, which is 7000 kcal/kg.
 1 kcal of conventional fuel allows to produce 1.163Wh or (1.163 / 1,000,000) MWh of power. Consequently, different types of fuel correspond to the following conversion factors:

- Natural gas – 9.1877 MWh/1,000m³
- Coal D-grade – 5.9313 MWh/t
- Coal T-grade – 6.9780 MWh/t
- Coal SS-grade – 6.6291 MWh/t
- Fuel oil M-100 – 11.3974 MWh/t

Most Russian power plants have a generation efficiency in the range from 30pc to 50pc, although the most modern gas turbines may have an efficiency of up to 56-58pc. During the spread calculation, Argus divides calculated fuel price by the power plant efficiency factor (see formula above). For the calculation of generation economics, Argus uses the following common power plant efficiency factors: 30pc, 35pc, 40pc, 50pc, 55pc.

Key data for dark spreads calculation

Region	Coal			Fuel oil		Electricity	
	Grade	NCV, kcal/kg	Transportation route	Basis	Transportation route	Key station	Price zone
Moscow	D	6000	Belovo – Krivandino	fca Moscow refinery	Yanichkino – Krivandino	Shatura GRES	Europe-Urals
	T	5100	Tyrgan – Ozherelye			Kashira GRES	
Leningrad	–	–	–	fca Yaroslavl refinery	Novoyaroslavskaya-Kupchinskaya	South TETs-22	Europe-Urals
Ryazan	D	5100	Meret – Voslebovo	fca Ryazan refinery	Stenkino – Voslebovo	Ryazan GRES	Europe-Urals
Smolensk	D	5100	Erunakovo – Valutino	fca Ryazan refinery	Stenkino – Valutino	Smolensk GRES	Europe-Urals
Sverdlovsk	SS	5,700	Bochaty – Maloreftinskaya	fca Omsk refinery	Kombinatskaya – Maloreftinskaya	Reftinskaya GRES, Novosverdlovskaya TETs	Europe-Urals
Kemerovo	T	6000	Kiyzak – Kaltan	fca Omsk refinery	Kombinatskaya – Kaltan	Yuzhniy Kuzbass GRES	Siberia
	SS	5,700	Zaboischik – Kemerovo			Kemerovo GRES	
Novosibirsk	D	5100	Meret – Zherebtsovo	fca Omsk refinery	Kombinatskaya – Zherebtsovo	Novosibirsk TETs-5	Siberia
Tomsk	D	5100	Erunakovo – Tomsk-1	fca Omsk refinery	Kombinatskaya – Tomsk-1	Tomsk GRES-2	Siberia