ACER
Agency for the Cooperation of Energy Regulators

European Gas Target Model – review and update

Annex 3

Calculation Specification for Wholesale Market Metrics

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1 Introduction

This document sets out the calculation specifications for the following wholesale market metrics as defined in ACER's 2014 Gas Target Model[1]:

No.	ACER's 2014 Gas Target Model Metrics
'Market participants' need' metrics	
Pre-transactional liquidity	
1.	Order book volumes
2.	Bid-offer spread
3.	Order book price sensitivity
Transactional liquidity	
4.	Number of trades
'Market health' metrics	
6.	Herfindahl-Hirschmann Index
5.	Number of supply sources
7.	Residual Supply Index
8.	Market concentration for bid & offer activities
9.	Market concentration for trading activities

Brief introductory descriptions of the wholesale market metrics are presented below.

1. Order book volume. Sufficient bid and offer volumes in the order book which deliver gas reasonably far into the future allow market participants to buy and sell gas when they need it and support effective risk management.
2. Bid-offer spread. Low bid-offer spreads mean low transaction costs for market participants and support market participants who have less flexibility with respect to when they can trade.
3. Order book price sensitivity. Low order book price sensitivity means less additional cost for market participants when buying or selling substantial volumes and supports market participants who have less flexibility with respect to when they can trade.
4. Number of trades. Sufficient trading activities support market participants' confidence that prices are transparent and represent a reliable market price.
5. *Herfindahl-Hirschmann Index.* The Herfindahl-Hirschmann Index (HHI) is a measure of the level of concentration in a market and is often used by competition authorities when investigating mergers or acquisitions. A higher HHI implies a higher concentration, i.e. fewer suppli-

[1] http://www.acer.europa.eu/Gas/Gas-Target-Model/Pages/default.aspx

ers or a greater market share accounted for by a few suppliers. In the first gas target model the target HHI was 2,000 for each Member State.

6. *Number of supply sources.* The number of supply sources from which a Member State procures gas is a first indicator for the level of concentration in upstream supply to that country. Three or more supply sources per country are considered the minimum to achieve a reasonable diversification of supplies.
7. *Residual Supply Index.* The Residual Supply Index (RSI) measures the reliance of a market on its largest supplier. The supply capability of all but the largest supplier should amount to 110 % of demand.
8. *Market concentration for bid & offer activities.* This metric measures the market share per company or group of companies based on the bid and offer order volumes placed. Lower market shares support a higher level of competition.
9. *Market concentration for trading activities.* This metric measures the market share per company or group of companies based on the traded volumes. Lower market shares support a higher level of competition.

Note: Metrics 2 and 3 are expressed as a percentage to allow comparability across different currencies.

2 Thresholds

ACER's revised Gas Target Model 2014 defines the following threshold values per metric to be fulfilled by each transparent market:

'Market participants' needs' metrics

	Threshold		
Metric	**Day-Ahead Product**	**Front Month Product**	**Forward**
1. Order book volume	≥ 2,000 MW on each bid- and offer-side	≥ 470 MW on each bid- and offer-side	≥ 120 MW on each bid- and offer-side for 17 months ahead
2. Bid-offer spread	≤ 0.4% of bid-price	≤ 0.2% of bid-price	≤ 0.7% of bid-price for 24 months ahead
3. Order book price sensitivity	≤ 0.02% price distance between average price for 120 MW and best price on each bid- and offer-side	≤ 0.1% price distance between average price for 120 MW and best price on each bid- and offer-side	≤ 0.2% price distance between average price for 120 MW and best price on each bid- and offer-side for 24 months ahead
4. Number of trades	≥ 420 trades per day	≥ 160 trades per day	≥ 8 trades per day for 22 months ahead

Note: Metrics 2 and 3 are expressed as a percentage to allow comparability across different currencies.

'Market health' metrics

	Threshold
Metric	**Spot, prompt and forward market together**
5. Herfindahl-Hirschmann Index	≤ 2000
6. Number of supply sources	≥ 3
7. Residual Supply Index	≥ 110%
8. Market concentration for bid and offer activities	≤ 40% market share per company (or group of companies) for the best 120 MW on each bid- and offer-side
9. Market concentration for trading activities	≤ 40% market share per company (or group of companies) for the sale and purchase of gas each

3 Minimum data point requirements for calculation

The following minimum data point requirements for the calculation of the metrics exist. If they are not met by the examined market, the respective metric shall not be calculated and reported, and the examined market shall be considered to have 'failed' the metric.

No.	Data point requirements for the calculation and reporting of the metric
'Market participants' need' metrics	
1. Order book volumes	No minimum data point requirements
2. Bid-offer spread	The metric needs to be calculable for at least 80% of trading days for time horizons up to 12 months into the future and for at least 60% of trading days beyond.
3. Order book price sensitivity	The metric needs to be calculable for at least 80% of trading days for time horizons up to 12 months into the future and for at least 60% of trading days beyond.
4. Number of trades	No minimum data point requirements
'Market health' metrics	
5. Number of supply sources	No minimum data point requirements
6. Herfindahl-Hirschmann Index	No minimum data point requirements
7. Residual Supply Index	No minimum data point requirements
8. Market concentration for bid & offer activities	No minimum data point requirements
9. Market concentration for trading activities	No minimum data point requirements

4 Definitions

No.	Term	Definition for the purpose of this document
Markets and products		
1.	Transparent market	The sum of gas trading activities (spot, prompt and forward) with delivery agreed on a (one) specific delivery point and concluded using a transparent trading venue (i.e. exchange, broker platform). Note: the main delivery points are the virtual points of entry/exit systems. Distinct delivery points are considered as separate markets.
2.	Product	A specific combination of commodity (natural gas), delivery point and delivery period.
3.	Spot products	'Spot' means gas products with 'immediate' delivery (i.e. on the same calendar day and all following calendar days until the next trading day).
4.	Prompt products	'Prompt' means gas products with delivery after the spot window but still in the near future (until the last calendar day of the following (front) month).
5.	Forward products	'Forward' means gas products with delivery after the prompt window.
6.	Day-ahead product	Gas product with (full) delivery on the next gas day.
7.	Front month product	Gas product with (full) delivery in the month immediately following the trading day.
8.	Offer-side of a market	Gas offered for sale. Note: the offer-side is also termed 'ask-side' (as a sale price for the gas is asked for).
9.	Bid-side of a market	Gas requested for purchase, for which a purchase price is bid.
Dates		
10.	Trading day	Day on which trading venues are open for trade (i.e. excluding bank holidays).

No.	Term	Definition for the purpose of this document
11.	Trading window	For certain metrics, only bids/offers and/or trades occurring during a certain time window of a trading day are considered in order to record the 'most liquid' phase of the day. The 'trading window' denotes this time window. The default trading window in this calculation specification is 10:00 to 16:00 local time. If the default trading window is too long for a certain market and would lead to grossly distorted results, a different (shorter) trading window may be defined and shall be made transparent in the documentation of the calculation.
12.	Analysis period	A certain period of time for which order books and transactions are analysed. For the purpose of the analyses described in this document, the analysis period shall be 12 consecutive months, specifically the most recent full calendar year.
13.	Relative delivery month	The number of full months between the delivery month(s) of a specific product and the trading day on which a bid/offer is made or a trade is executed. Examples: • The front month product always has a relative delivery month 1. • If transacted in May, the front quarter product delivers gas from July to September; hence the relative delivery months are 2, 3 and 4. • If transacted in June, the front quarter product delivers gas from July to September; hence the relative delivery months are 1, 2 and 3.
14.	(Order book) Snapshot	The state of the order book at a specific point in time, including all valid bid- and offer-orders. The calculation of order book related metrics requires a series of snapshots of the order book during a certain time interval, whereby an interval of 15 minutes is sufficient for the purposes of this specification. Note: a higher temporal resolution increases accuracy further.

5 Data requirements

The calculations of the metrics defined in this document require the following data:

- A full set of trades in all spot, prompt and forward products, including an (unambiguous) identification of buyer and seller, on the examined transparent markets for the full analysis period.
- A full set of visible order book data (bid- and offer-side) for all spot, prompt and forward products, including an (unambiguous) identification of buyer and seller, on the examined transparent markets for the analysis period. A series of snapshots of the order books at an interval of 15 minutes during the trading window is sufficient.
- Data on supply by supply country (i.e. import-export statistics) and composition of that supply by firm.
- Information on companies belonging to the same group.
- Capacity data from ENTSOG, LNG import capacity data from GLE and demand data.

Note: anonymised data is sufficient for the calculations.

6 General notes on the calculations

All calculations described in this document shall be conducted for each transparent market separately over an analysis period of the latest full calendar year.
Note: as the metrics are defined as averages over the analysis period, it is important that the analysis period includes summer as well as winter periods.

In order to show how a market performs (and develops over time) with regard to a specific metric, the value of the metric for the market is to be calculated and reported (as opposed to reporting just a 'pass/fail' with regard to the threshold value of the metric).

7 Calculation specification per metric

7.1 Metric 1: Order book volumes

7.1.1 Introduction

The order book volume metric examines the availability of sufficient bid and offer volumes in the analysed transparent market. Higher available volumes mean better market functioning.

The metric is determined separately for the bid- and the offer-side on spot, prompt and forward markets, whereby different calculation methods apply for spot and prompt on the one hand and for the forward market on the other.

For the spot and prompt market, the available bid and offer volumes are examined for the day-ahead and the front month product. The median over both the daily maximum bid and offer volumes available for these products is calculated and compared to the minimum threshold value.

For the forward market, the metric measures for how far into the future the required bid and offer volumes of at least 120 MW are on average available in the market, whereby all traded forward products are considered. This liquid order book horizon is then compared to the minimum threshold value.

Overall, the order book volume metric provides six values per examined transparent market: two values (bid and offer) for each spot, prompt and forward markets.

7.1.2 Data requirements

The metric calculation requires a full set of visible (exchanges, brokers) order book entries (bid- and offer-side) for the day-ahead and front month product as well as for all forward products on the examined transparent market for the analysis period. A series of snapshots of the order books at an interval of 15 minutes is sufficient.

7.1.3 Minimum data point requirements for calculation

There are no minimum data point requirements for the calculation of this metric. This means the metric shall be calculated and reported in all cases.

7.1.4 Spot and prompt market calculation

The following description is provided for the spot and prompt markets, for which the day-ahead product and the front month product are analysed. The calculation is described for the offer-side of an analysed product; the bid-side value is calculated analogously.

Step 1: For every trading day in the analysis period: determine the maximum total amount (in MW) simultaneously offered for the analysed product on that trading day, whereby 'simultaneously' refers to a specific order book snapshot on that trading day.

Step 2: Calculate the median offer-side order book volume for the analysed product, as the median over all daily volumes (results of step 1) on all trading days in the analysis period.

Notes:

- For trading days where there are no orders available at all for the analysed product, the maximum amount of gas available (step 1) is to be set to zero.

7.1.5 Forward market calculation

7.1.5.1 Primary calculation

The following description is provided for the offer-side of all available forward market products; the bid-side value is calculated analogously.

Step 1: For every trading day in the analysis period: determine the maximum total amount (in MW) simultaneously offered per product on that trading day, whereby 'simultaneously' refers to a specific order book snapshot on that trading day.

Step 2: For every trading day in the analysis period: based on the volumes calculated in step 1, identify the products meeting the order book liquidity volume requirement (i.e. the offered product volume is at least 120 MW).

Step 3: For every trading day in the analysis period: based on the products identified in step 2, find the one product which delivers furthest into the future. For this product determine the number of full months between its last month of delivery and the specific trading day ('daily liquid order book horizon').

Example: the front quarter product, when transacted in May, delivers gas from July to September. The number of full months between its last month of delivery and the specific trading day is 4 (June, July, August and September).

Step 4: Calculate the average liquid order book horizon as the arithmetic average over all daily liquid order book horizons (results of step 3) on all trading days in the analysis period.

Notes:

- For trading days where there are no orders at all available for the analysed product, the 'maximum total amount of gas' (step 1) is to be set to zero.
- For trading days where no product meets the order book liquidity volume requirement (step 2), the daily liquid order book horizon is to be set to zero.
- This metric only measures the time horizon for the product which delivers furthest into the future (and fulfils the order book liquidity volume requirement). It is possible that for certain periods within this time horizon the volume requirement is not met; this does not impact on the calculation however.

- Optionally, the calculation can be repeated for various requirements on the order book liquidity volume. The results can be represented as a xy-diagram with the (resulting) liquid order book horizons on the x-axis and the respective order book liquidity volume requirements on the y-axis.

7.1.5.2 Fall-back calculation

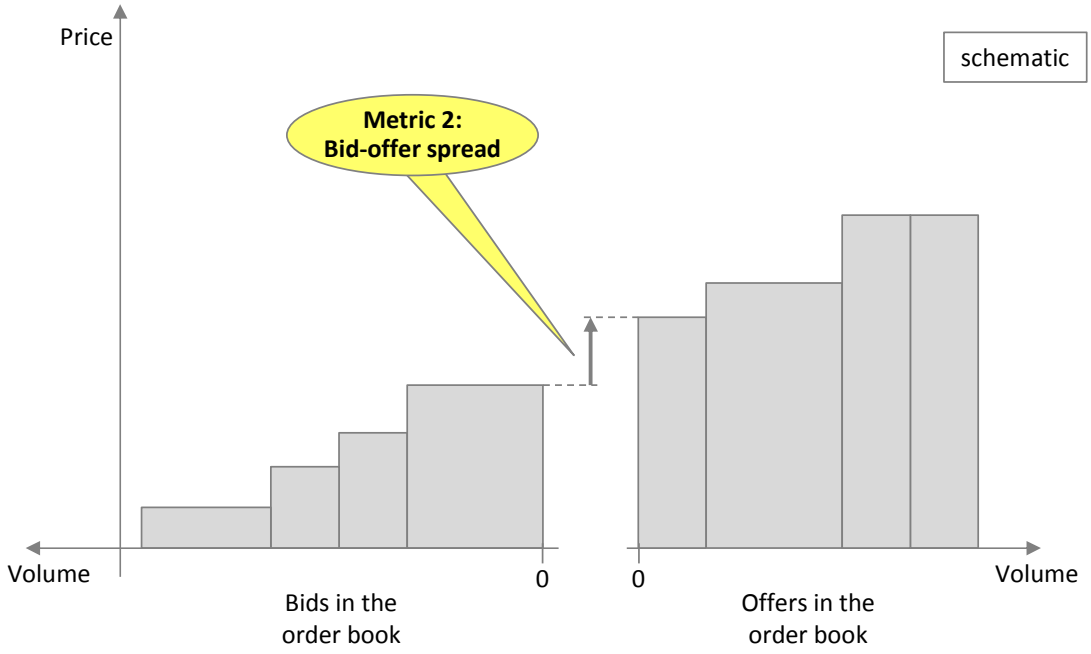
If the average liquid order book horizon resulting from the 'primary calculation' does not fulfil the threshold value, the calculation shall be repeated (and reported) with reduced requirements on the order book volumes (90 MW, 60 MW, 30 MW and 10 MW).

7.2 Metric 2: Bid-offer spread

7.2.1 Introduction

The bid-offer spread metric examines how close the lowest price for which a seller is willing to sell gas (best offer-price) and the highest price that a buyer is willing to pay for it (best bid-price) are at a certain point in time. It describes the price gap which needs to be paid on a full 'turnaround' (buy gas and sell it immediately again). The bid-offer spread is the key element of transaction cost in gas trading. Lower bid-offer spreads mean better market functioning.

The bid-offer spread metric is expressed as a percentage of the best bid-price. This way currency issues are avoided.



The metric is determined separately for spot, prompt and forward markets, whereby different calculation methods apply for spot and prompt on the one hand and for the forward market on the other.

For the spot and prompt markets, the average bid-offer spread is calculated for the day-ahead and the front month product and compared with the maximum threshold.

For the forward market, the metric is calculated for different delivery periods with regard to the trading date. Specifically the 6th, 12th, 18th and 24th month after the respective trading day are examined. The metric includes all forward products with deliveries in the analysed month. For the average bid-offer spread of the respective month, only those forward products leading to the lowest bid-offer spreads are included. The calculated average bid-offer spreads for the different analysed months are then compared with the threshold value.

Overall, the bid-offer spread metric provides six values per examined transparent market: one value for spot and prompt each and four values (for 4 different months in the future) for the forward market.

7.2.2 Data requirements

The metric calculation requires a full set of visible (exchanges, broker platforms) order book data (bid- and offer-side) for the day-ahead and front month product as well as for all forward products on the examined transparent market for the analysis period (during the trading window). A series of snapshots of the order books at an interval of 15 minutes is sufficient.

7.2.3 Minimum data point requirements for calculation

The following minimum data point requirement is to be fulfilled to calculate and report the metric:

> For time horizons up to 12 months into the future, the metric needs to be calculable for at least 80% of the trading days. For time horizons further into the future, it needs to be calculable for at least 60% of trading days.
> To be able to calculate the metric at a specific snapshot, at least one bid- and one offer-order need to be available in the order book. For the forward market this requirement needs to be met per analysed month individually.

The fulfilment of the minimum data point requirement shall be examined separately for the spot, prompt and forward markets. If the minimum data point requirement is not fulfilled, the respective metric of spot, prompt or forward markets shall not be calculated and reported. In this case the market shall be considered to have 'failed' the metric.

The share of trading days for which the metric is calculable shall be presented regardless of whether the minimum data point requirement is fulfilled or not.

7.2.4 Spot and prompt market calculation

The following description is provided for spot and prompt markets, for which the day-ahead product and the front month product are analysed.

Step 1: For every order book snapshot during the trading window on every trading day in the analysis period: identify the snapshots that show at least one bid-order and one offer-order in the order book for the analysed product.

Step 2: For every order book snapshot identified in step 1: determine the bid-offer spread (in %) for the analysed product at that snapshot (time), as the difference between the lowest offer-price and the highest bid-price, divided by the highest bid-price for this product at that same snapshot (time).

Step 3: For every trading day in the analysis period: determine the daily bid-offer spread for the analysed product as the arithmetic average of the snapshot-specific bid-offer spreads (results of step 2) on that trading day.

Step 4: Calculate the average bid-offer spread for the analysed product as the arithmetic average of the daily bid-offer spreads (results of step 3) over all trading days in the analysis period.

7.2.5 Forward market calculation

The following description is provided for forward market products, with deliveries in the 12th month after the trading day. The calculations for the other delivery periods (6th, 18th and 24th month after the trading day) are analogous.

Step 1: For every trading day in the analysis period: based on the delivery period of the respective products, identify all forward products which deliver gas in the 12th month after that trading day.

Example: the two-seasons-ahead product, when transacted in May, is in delivery from April to September the following year. Hence gas deliveries under this product also take place in the 12th month after the trading day (which is May in the following year).

Step 2 to 4 (inclusive) shall be conducted for every order book snapshot during the trading window on every trading day in the analysis period.

Step 2: Identify every product for which at least one bid-order and one offer-order is available in the order book at that snapshot (time), and which delivers gas in the 12th month after that trading day (result of step 1).

Step 3: Determine the snapshot bid-offer spread (in %) for every product identified in step 2, as the difference between the lowest offer-price and the highest bid-price, divided by the highest bid-price for the respective product at that same snapshot (time).

Step 4: Identify the forward product which has the lowest bid-offer spread at this snapshot (time).

Step 5: For every trading day in the analysis period: determine the daily bid-offer spread as the arithmetic average of the lowest snapshot-specific bid-offer spreads (results of step 4) on that trading day.

Step 6: Calculate the average bid-offer spread on the forward market for products with delivery in the 12th month into the future, as the arithmetic average of the daily bid-offer spreads (results of step 5) over all trading days in the analysis period.

7.3 Metric 3: Order book price sensitivity

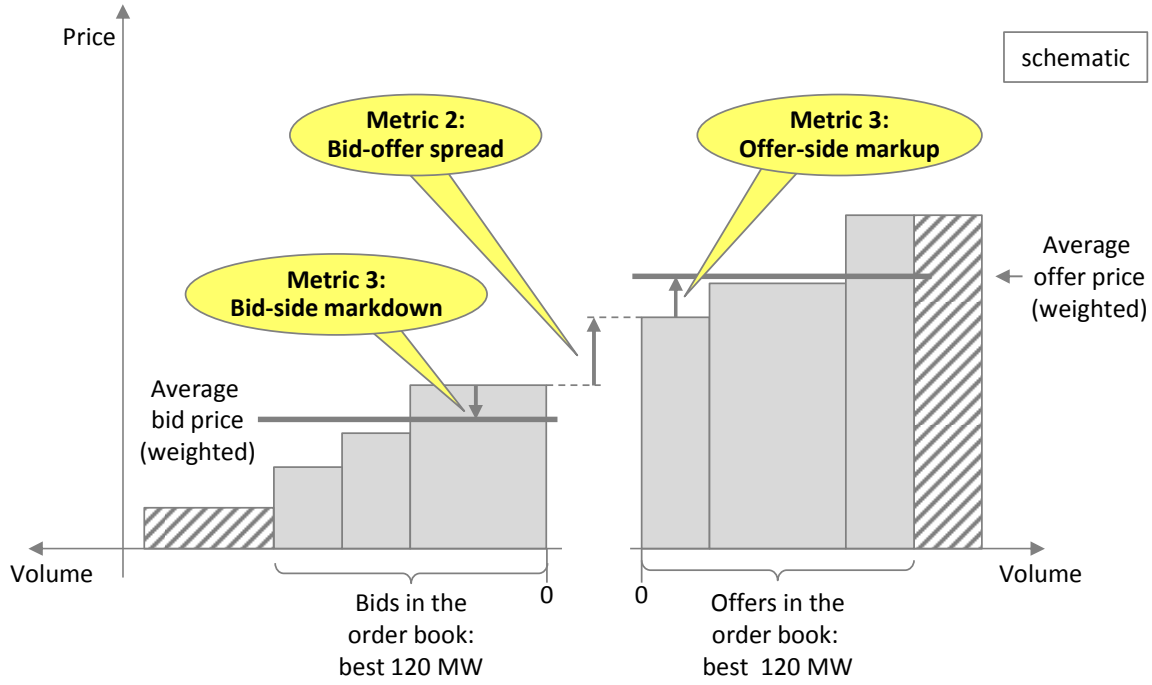
7.3.1 Introduction

The order book price sensitivity metric examines how close all average gas offer and bid prices in the order book are to the 'best' prices. This is especially relevant for market participants who need to buy and sell significant volumes of gas at a specific moment in time, for instance for purposes of risk hedging. The metric describes the 'steepness' of the bid and offer curves, i.e. how prices move if quantities beyond the best bid/offer are sold/bought.

The metric is determined separately for the bid- and the offer-side. For the offer-side of the order book the metric calculates the difference (markup) between the best (lowest) offer price and the weighted average price for a certain volume of gas (the 'maximum quantity'). Similarly, for the bid side the metric evaluates the relative difference (markdown) between the average bid prices (again for a certain maximum volume) and the best (highest) bid price. Lower markups and markdowns mean better market functioning.

To avoid outliers and to make the metric comparable between markets, the metric is only calculated for points in times where at least 90 MW are available in the order book (separately for bid and offer side). Furthermore, only the best bids and offers up to a total of 120 MW are included in the analysis. For forward market analyses reaching more than 12 months into the future, only points in time where at least 60 MW are available are considered, with a maximum of 90 MW.

The metric is expressed as relative markup or markdown in percent, by relating it to the best offer and bid price available. This avoids currency issues.



The metric is determined separately for spot, prompt and forward markets, whereby different calculation methods apply for spot and prompt on the one hand and for the forward market on the other.

For the spot and prompt market, the average markup and markdown are calculated for the day-ahead and the front month product and compared to the threshold values.

For the forward market, the metric is calculated for different delivery periods with regard to the transaction date. Specifically the 6th, 12th, 18th and 24th month after the trading day are analysed. The metric includes all forward products with deliveries in the analysed month. For the average markup and markdown of the respective month only forward products with the lowest markups/markdowns are included. The calculated markups and markdowns for the different analysed months are then compared with the maximum threshold values.

Overall, the metric provides twelve values per examined transparent market: two values (bid and offer) for both the spot and prompt and eight values (bid and offer for 4 different months in the future) for the forward market.

7.3.2 Data requirements

The metric calculation requires a full set of visible (exchanges, brokers) order book data (bid- and offer-side) for the day-ahead and front month product as well as for all forward products on the examined transparent market for the analysis period (during trading window times). A series of snapshots of the order books at an interval of 15 minutes is sufficient.

7.3.3 Minimum data point requirements for calculation

The following minimum data point requirement needs to be fulfilled to calculate and report the metric:

> For spot, prompt and forward market analyses up to 12 months into the future, the metric needs to be calculable for at least 80% of the trading days in the analysis period. To be able to calculate the metric at a specific snapshot (time), at least 90 MW bid or offer volumes need to be available in the order book. For the forward market this requirement needs to be met per analysed month individually.
>
> For forward market analyses reaching more than 12 months into the future, the metric needs to be calculable for at least 60% of the trading days in the analysis period. To be able to calculate the metric at a specific snapshot (time), at least 60 MW bid or offer volumes need to be available in the order book. For the forward market this requirement needs to be met per analysed month individually.

The fulfilment of the minimum data point requirement shall be examined separately for the spot, prompt and forward market and separately for the bid- and offer-side of the order book. If the minimum data point requirement is not fulfilled, the respective metric for spot, prompt or forward markets (bid- or offer-side) shall not be calculated and reported. In this case the market shall be considered to have 'failed' the metric.

The share of snapshots for which the metric is calculable shall be presented regardless of whether the minimum data point requirement is fulfilled or not.

7.3.4 Spot and prompt market calculation

The following description is provided for the spot and prompt markets, for which the day-ahead product and the front month product are analysed. The calculation is described for the offer-side of an analysed product; the bid-side value is calculated analogously using the best bid-prices (with the highest prices).

Step 1: For every order book snapshot during the trading window on every trading day in the analysis period: determine the volumes available in the order book as a sum over all offers for the analysed product. Identify the snapshots for which the available volume is at least 90 MW for the analysed product at that snapshot.

Step 2 and 3 shall be conducted for every order book snapshot identified in step 1.

Step 2: Identify the best offer-orders (i.e. the orders with the lowest prices) for the analysed product within the volume range of 120 MW and calculate the corresponding weighted average offer-price at that snapshot.
If an order partly exceeds the volume range, take only the share of its volume which is within the volume range into consideration.

Step 3: Determine the markup (in %) for the analysed product at that snapshot (time), as the difference between the weighted average offer-price and the best offer-price (i.e. the offer with the lowest price), divided by the best offer-price for this product at that snapshot (time).

Step 4: For every trading day in the analysis period: determine the daily markup for the analysed product, as the arithmetic average of the snapshot-specific markups (results of step 3) of that trading day.

Step 5: Calculate the average markup for the analysed product as the arithmetic average of the daily markups (results of step 4) over all trading days in the analysis period.

7.3.5 Forward market calculation

The following description is provided for forward market products, with deliveries in the 12th month after the respective trading day. The calculations for the other delivery periods (6th, 18th and 24th month after the respective trading day) are analogous.
The calculation is described for the offer-side of an analysed product; the bid-side value is calculated analogously using the best bid-prices (with the highest prices).

Step 1: For every trading day in the analysis period: based on the delivery period of a product, identify all forward products which deliver gas in the 12th month after that trading day.

Example: the two-seasons-ahead product, when transacted in May, is in delivery from April to September in the following year. Hence gas deliveries under this product also take place in the 12th month after the transaction (which is May in the following year).
Note: this step is identical to step 1 of the forward bid-offer spread calculation (metric 2).

Step 2 to 6 (inclusive) shall be conducted for every order book snapshot during the trading window on every trading day in the analysis period.

Step 2: For every forward product identified in step 1: determine the volumes available in the order book as a sum over all offers for that product at that snapshot (time).

Step 3: Identify the products for which the available volume is at least 90 MW at that snapshot.

Note: in calculations for months lying more than 12 months into the future, volumes of at least 60 MW are to be considered.

Step 4: For every product identified in step 1 and step 3: identify the best offer-orders (i.e. the orders with the lowest prices) for the analysed product within the volume range of 120 MW and calculate the corresponding weighted average offer-price at that snapshot (time). If an order partly exceeds the volume range, take only the share of its volume within the volume range into consideration.

Note: in calculations for months lying more than 12 months into the future, volumes of not more than 90 MW are to be considered.

Step 5: For every product identified in step 1 and step 3: determine the markup for the analysed product at that snapshot, as the difference between the weighted average offer-price and the best offer-price (i.e. the offer with the lowest price), divided by the best offer-price for this product at that snapshot.

Step 6: For each snapshot: identify the forward product which has the lowest markup at this snapshot.

Step 7: For every trading day in the analysis period: determine the daily markup for the analysed month as the arithmetic average of the lowest snapshot-specific markups (results of step 6) of that trading day.

Step 8: Calculate the average offer-side markup on the forward market for products with delivery in the 12th month into the future as the arithmetic average of the daily markups (results of step 7) over all trading days in the analysis period.

7.3.6 Supplementary information

As supplementary information, the average order-volumes per snapshot considered in the calculation (in MW) shall be provided for the spot, prompt and forward market calculation for the bid- and offer-side. For the spot and prompt market this is the average of the results of step 2. For the forward market this is the average of the results of step 4 restricted to the products identified in step 6.

7.4 Metric 4: Number of trades

7.4.1 Introduction

The number of trade metric examines the presence of a sufficient number of executed trades in the analysed transparent market. A higher number of trades means better market functioning.

The metric is determined separately for spot, prompt and forward markets, whereby different calculation methods apply for spot and prompt on the one hand and for the forward market on the other.

For the spot and prompt market, the metric is examined for the day-ahead and the front month product. The median daily number of executed trades for these products is calculated and compared with the minimum threshold values.

For the forward market, the metric measures how far into the future the required minimum number of eight trades per trading day is available in the market on average. This average trading horizon is then compared to the minimum threshold value.

Overall, the number of trades metric provides three values per examined transparent market: one value each for spot, prompt and forward markets.

7.4.2 Data requirements

The metric calculation requires a full set of trades for the day-ahead and front month product as well as for all forward products on the examined transparent market for the analysis period.

7.4.3 Minimum data point requirements for calculation

There are no minimum data point requirements for the calculation of this metric. This means the metric shall be calculated and reported in all cases.

7.4.4 Spot and prompt market calculation

The following description is provided for spot and prompt markets, for which the day-ahead product and the front month product are analysed.

Step 1: For every trading day in the analysis period: determine the number of trades for the analysed product executed on that trading day.

Step 2: Calculate the median number of trades for the analysed product, as the median over all daily trade numbers (results of step 1) on all trading days in the analysis period.

Notes:

- For trading days where no deals at all are executed for the analysed product, the 'number of trades' (step 1) is to be set to zero.

7.4.5 Forward market calculation

7.4.5.1 Primary calculation

The following description is provided for forward market products.

Step 1: For every trading day in the analysis period: determine per product the number of trades executed on that trading day.

Step 2: For every trading day in the analysis period: based on the number of trades calculated in step 1, identify the products meeting the minimum number of trades requirement (i.e. the product is at least traded eight times per day).

Step 3: For every trading day in the analysis period: based on the products identified in step 2, find the product which delivers furthest into the future. For this product determine the number of full months between its last month of delivery and the specific trading day ('daily trading horizon').

Example: the front quarter product, when transacted in May, delivers gas from July to September. The number of full months between its last month of delivery and the specific trading day is 4 (June, July, August and September).

Step 4: Calculate the average trading horizon, as the arithmetic average over all daily trading horizons (results of step 3) on all trading days in the analysis period.

Notes:

- For trading days where no deals at all are executed for the analysed product, the 'number of trades' (step 1) is to be set to zero.
- For trading days where no product meets the number of trades requirement (step 2), the daily trading horizon is to be set to zero.
- This metric measures the time horizon only for the product which delivers furthest into the future (and fulfils the minimum number of trades requirement, i.e. the threshold value). It is possible that for certain periods within this time horizon this trade requirement is not met; this does not impact on the calculation however.
- Optionally, the calculation can be repeated for various requirements for the daily minimum number of trades. The results can be represented in an xy-diagram with the resulting trading horizons on the x-axis and the respective number of trades requirement on the y-axis.

7.4.5.2 Fall-back calculation

If the average trading horizon resulting from the 'primary calculation' does not fulfil the threshold value, the calculation shall be repeated with the following underlying number of trades: 4 and 2 trades per day.

7.5 Metric 5: Herfindahl-Hirschmann Index

7.5.1 Introduction

The Herfindahl-Hirschmann Index (HHI) is a measure of the level of concentration in a market and is often used by competition authorities when investigating mergers or acquisitions. A higher HHI implies a higher concentration, i.e. fewer suppliers or a greater market share accounted for by a few suppliers.

Compared to Metric 6, the HHI offers additional insights because:

- it refers to firms (instead of sources/countries); and
- it reflects a firm's specific market share (instead of the binary information whether or not a player is active in a market).

In this set of metrics the HHI refers to the upstream supply of gas, i.e. not taking into account sales by firms who bought gas (for instance under long-term contracts) from others to resell it. Ultimately, competitive conditions in any market are limited by the number and market shares of upstream suppliers no matter how many intermediaries or traders may buy and resell in that market. The HHI metric here is used to address the issue of the health of structure of upstream supply. Markets shares used in this calculation are not the same as those used in measures related to the number of possible sellers in day to day trading.

7.5.2 Data requirements

The HHI is calculated as the sum of squared market shares for each firm supplying gas at the import level[2].

This requires data on supply by supply country (the same as for Metric 6), composition of that supply by firm, and ownership of firms (to account for firms effectively also controlling volumes sold by other firms which might be part of the same holding).

7.5.3 Calculation

HHIs at a firm-level are calculated by:

Step 1: taking imports into a Member State by upstream supply country (see Metric 6).

Step 2: assigning these supply volumes pro-rata to upstream producer market shares in the respective supply countries. Upstream producer market shares are derived from production statistics (e.g. Norway, the UK), the shareholder structure of export facilities (for LNG) as well as desktop research for other gas producer shares (e.g. in Bulgaria, Italy, Germany, etc). For a number of countries, all exports can also be assigned to single firms owing to the existence of export monopolies (e.g. Russia).

Step 3: we correct for any cross-shareholding between firms with the same owners.

Step 4: the HHI is calculated as the sum of squared market shares expressed in percentage terms.

[2] E.g. if there are two firms with a market share of 50 % each in a market, the market would have an HHI of 5,000 ($50^2 + 50^2$).

7.6 Metric 6: Number of supply sources

7.6.1 Introduction

With respect to the criterion of the pluralism of supply sources, it would be theoretically possible to define a supply source as the gas field from which gas is produced, or as the firm from which gas is bought. However, firm and capacity level aspects are covered by Metrics 5 and 7. This measure refers to the number of supplying countries.

The number of supplying countries gives an indication of the extent to which supply sources are diversified. However, it is a parameter that needs to be interpreted with caution:

- A low number of supply sources does not necessarily imply a low level of competition. There can be extensive competition between just two supply sources, or indeed between several firms supplying gas from only one supply source (e.g. the UK Continental Shelf). Alternatively, there can be potential competition from existing suppliers who could readily deliver gas into the Member State in question but do not yet do so. None of this would be reflected accurately in the number of supply sources.
- A high number of supply sources is not evidence of fierce competition. Some supply sources might only be able to sell marginal volumes and hence be unable to constrain the behaviour of a dominant supply source. Alternatively, for example in the case of LNG sources, supply sources might only be supplied into a market at all because the prices are significantly above the competitive level.

Therefore, the number of supply sources should only be considered in the context of other measures for competition (particularly Metrics 5 and 7).

7.6.2 Data requirements

The analysis requires data on supply from which upstream supplies countries deliver gas to which Member States, i.e. essentially import-export statistics.

The calculations are based on BP[3] and Eurostat data.

7.6.3 Calculation

The BP data reveals the number of supply countries for pipeline and LNG supplies for many Member States. It is the most up-to-date data available. For small Member States not covered in the BP data, Eurostat data has been used.

[3] BP Statistical Review of World Energy 2013.

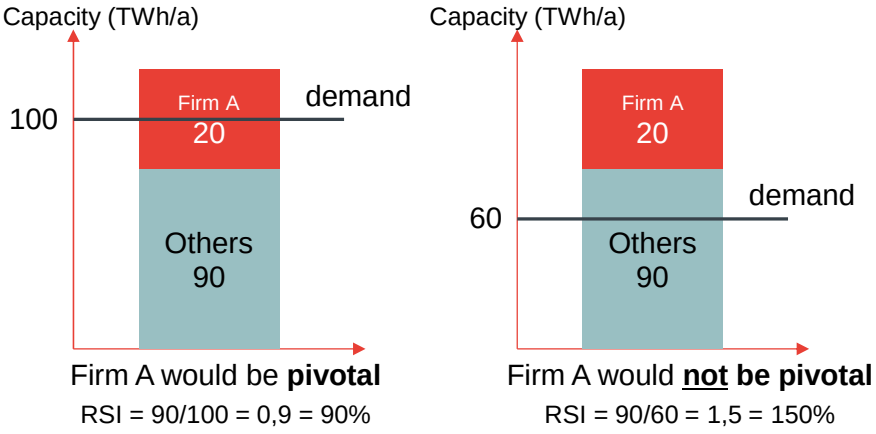
7.7 Metric 7: Residual Supply Index

7.7.1 Introduction

The RSI is closely linked to the concept of pivotality which determines if a certain source of supply is pivotal, i.e. the market cannot be supplied without supply from that specific source.

Therefore the RSI focuses on capacity and determines the relationship between the sum of the supply capabilities of all suppliers except the largest source – and total demand in the market. This ratio is the RSI. If at any given time the RSI is equal to or greater than 1 (i.e. 100 %), the largest supplier can be replaced because the supply capability of all other suppliers is sufficient to meet demand. It would then be concluded that the largest supplier is not pivotal to the market. If the RSI is less than 100 %, the respective supplier is considered to be pivotal.

Figure 1: Illustration of RSI index calculation



Source: Frontier

This concept has so far been mainly applied when investigating electricity markets. Examples include:

- CAISO (since 2001) – California power wholesale market
- AGCM & AEEG (2005): Italian electricity wholesale market
- EC Sector Inquiry (2007): six European electricity markets: the EC considers an RSI below 110 % as an indication for the existence of market power.
- German cartel office sector enquiry (2011) of wholesale power markets: the presumption of dominance exists when the RSI is below 100 % more than 5 % of the year.

An application in gas markets was how NMa investigated the Dutch flexibility market for gas (decision 102651 / 103).

In electricity or gas flexibility markets, ownership of (or access to) capacity is the crucial parameter. Gas flexibility is largely concerned with trade of capacity (to release volumes of gas); in electricity markets, unless one presumes constraints in the upstream fuel markets, the ownership of generation capacity is linked to the capability to produce.

However, this is not necessarily true in gas wholesale markets for the following reasons:

- Role of imports – in most Member States, an overwhelming share of gas demand is met by volumes imported from other countries. So a large share of "capacity" relevant to determine the RSI is transport and not physical production capacity. Unlike production capacity, the discretion for transport capacity holders in relation to the use of their capacity may be limited – because they still depend on the upstream supply of gas (which could be limited by upstream capacity or congestion along the transport route).
- Role of storage – also, depending on the time of year, a significant share of gas supplies to a country may come from gas storage. However, these storages have to be refilled at some point.

The following specific characteristics need to be taken into account when computing RSIs:

- Importance of supply sources instead of capacity ownership – it is relevant to consider which upstream supplier is likely to provide the gas at different entry points into a market. For instance, Germany imports gas from, among others, Poland, the Czech Republic and directly from Russia. While the direct route from Russia is the largest capacity, the others may not constitute a competitive pressure on the respective upstream supplier because, ultimately, gas from the same upstream supplier is needed to import gas via those routes. Hence, they need to be considered together as the largest gas import capacity to the country.[4]
- Analysis on an annual level – storage has typically been used to match supply and demand within an annual cycle[5]. While on a single day, storage may be able to provide its maximum nominal withdrawal capacity to the market, it cannot do so for prolonged periods of time. Hence, considering storage for the RSI is likely to overstate the level of competition. When considering annual demand and supply capacity, it is reasonable to ignore storage.

Despite these adjustments, the RSI might still overstate the level of competition:

- Volumes vs. capacity – while the aforementioned focus on supply sources corrects for some discrepancies between capacity and actual volumes "backing" them up, this may still be too optimistic from a competition perspective. For instance, Western entry points in, say, Slovakia, would still not be considered to rely on Russian gas because they can import volumes from, say, Germany or Norway in theory. However, this does not mean that these volumes would actually arrive in Slovakia in appropriate quantities because adjacent markets (to the West) may be equally dependent on the same Russian upstream sources as Slovakia.

[4] For the computation of an RSI in a competition analysis context. This may be different for "N-1" calculation – which is essentially a RSI looking at (technical) security of supply. In this context, the different routes might be considered as separate capacities as a technical failure of one is not necessarily correlated with a stop of supply on the other routes.

[5] Storage may also meet shorter term demands, for example those of intermittent power gas fired power generation.

- Price effects – similarly, all LNG capacities could, of course, theoretically be filled with LNG imports, i.e. the RSI might be low if lots of spare LNG capacity exists. However, given current price premiums for LNG in Asia, these LNG cargos would only arrive in Europe if gas wholesale prices rose significantly. In competition economics, volumes which are only brought to the market if the price were to rise by more than 5 to 10 percent are typically not considered to constitute a competitive constraint on the largest supplier.

These conceptual issues need to be taken into account when interpreting the RSI.

7.7.2 Data requirements

The RSI is computed using pipeline capacity data from ENTSO-G, LNG import capacity data from GLNGE, and demand data for 2012 from BP (and Eurostat).

7.7.3 Calculation

The RSI is calculated by:

Step 1: determining the largest "supplier" in each country. This can be derived from the previous calculation of market shares (see Metric 5).

Step 2: estimating the capacity from all other supply sources which can be used if the largest supplier is no longer available. The following assumptions are made based on this context:

- For domestic production, it is assumed that there is no potential for significant increases in all Member States.
- Pipeline capacity used for transits or exports cannot be used for replacing the largest supplier
- Likewise, transits and exports are not considered as part of domestic demand in a country.[6]
- Maximum average annual utilisation of import capacity at entry points is 85 % (unless it has been higher in reality).
- LNG terminal utilisation cannot exceed an annual average of 75 %. This may be considered optimistic: given the global ratio of LNG production to import capacities, the average utilisation of all LNG import facilities is only 42 %[7]; actual terminal utilisation in Europe in the recent past has been even lower.[8]

Step 3: the sum of available capacity from all but the largest supplier is divided by the demand in the Member State. The result expressed in percentage terms is the RSI.

[6] This assumption is only relevant to the results of the RSI for those Member States where there are transits which originate from suppliers other than the largest supplier of the respective country (because it is assumed that the respective supplier would also control these transits which, therefore, do not constrain its potential market power).

[7] GIINGL.

[8] EC Quarterly Review of European Gas Markets.

7.8 Metric 8: Market concentration for bid & offer activities

7.8.1 Introduction

The bid & offer concentration metric examines the market share of companies (or groups of companies) in bid- and offer-orders in the examined transparent market.

The metric is determined separately for the bid- and offer-side, but in total over all spot, prompt and forward products. For each company the average market share in total bids and offers in the analysis period is calculated and then compared to a threshold value.

Overall, the metric provides two values (bid- and offer-side) for each company (or group of companies) which is active on the examined transparent market.

7.8.2 Data requirements

The calculation of the metric requires a full set of visible order book data (bid- and offer-side) for all spot, prompt and forward products, including the identification of buyer and seller, on the examined transparent market for the analysis period (during trading window times). A series of snapshots of the order books at an interval of 15 minutes is sufficient.

Furthermore the calculation of the metric requires information on companies belonging to the same group.

7.8.3 Minimum data point requirements for calculation

There are no minimum data point requirements for the calculation of this metric. This means the metric shall be calculated and reported in all cases.

7.8.4 Calculation

The following description is provided for the offer-side of the order book for spot, prompt and forward products together; the bid-side value is calculated analogously using the best bid-prices (with the highest prices).

Step 1: For every trading day in the analysis period: determine the total offer-volume in MWh over all offer-orders over all products and over all snapshots during the trading window of that trading day.

Step 2: For every trading day in the analysis period for every company (or group of companies): determine the company specific offer-volume in MWh over all offer-orders, identified in step 1, over all products and over all snapshots during the trading window of that trading day, which were placed by that company or by that group of companies.

Step 3: For every trading day in the analysis period and for every company (or group of companies): determine the daily offer-side market share per company as the ratio between the daily

company specific offer-volume (result of step 3) and the total offer-volume (result of step 2) on that day.

Step 4: For every company (or group of companies): determine the average offer-side market share per company as the arithmetic average over its daily offer-side market shares on all trading days in the analysis period.

7.9 Metric 9: Market concentration for trading activities

7.9.1 Introduction

The trading concentration metric examines the market shares in the total sales and purchases of gas by companies (or groups of companies) on the examined transparent market. Trading activities between companies of the same group are not taken into consideration for this metric.

The metric is determined separately for the sales- and purchase-side, in total over all spot, prompt and forward products. For each company the average sale and purchase market share is calculated and then compared to the corresponding threshold value.

Overall, the metric provides two values (sales- and purchase-side) for each company or group of companies active on the examined transparent market.

7.9.2 Data requirements

The metric calculation requires a full set of trades for all spot, prompt and forward products, including the identification of buyer and seller, on the examined transparent market for the analysis period.

Furthermore the metric calculation requires information on companies belonging to the same group.

7.9.3 Minimum data point requirements for calculation

There are no minimum data point requirements for the calculation of this metric. This means the metric shall be calculated and reported in all cases.

7.9.4 Calculation

The following description is provided for sold products (short) on the spot, prompt and forward markets together; the calculation for bought products (long) is analogous.

Step 1: For every trading day in the analysis period: determine the total trading volume in MWh over all products executed on that trading day. Trades executed between companies of the same group shall not be taken into consideration. Note: do not count both the buy- and the sell-side of a trade. (Example: Company 'A' sells

100 MWh gas to company 'B'. The corresponding total trading volume amounts to 100 MWh.)

Step 2: For every trading day in the analysis period and for every company (or group of companies): determine the company specific sales volumes in MWh over all products sold on that trading day per company. Trades executed between companies of the same group shall not be taken into consideration.

Step 3: For every trading day in the analysis period and for every company (or group of companies): determine the daily sales market share per company as the ratio between the company specific sales volume (result of step 2) and the total trading volume (result of step 1) on that day.

Step 4: For every company (or group of companies): determine the average market share per company for the sales of gas as the arithmetic average over the daily shares on all trading days in the analysis period.