Tariff model for the natural gas entry-exit system for the common Baltic-Finnish market

Baringa final report

CLIENT: Finnish and Baltic National Regulatory Authorities

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V3.0	19 November 2018	Final	Vladimir Parail Peter Hicks Remy Nguyen	Jayesh Parmar

Contact Jayesh Parmar (jayesh.parmar@baringa.com +44 7770 956674)

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Executive Summary

Introduction

This report builds on Baringa's Phase 1 tariff and gas market modelling, which analysed and compared Postage Stamp, Capacity Weighted Distance (CWD) and Matrix tariff methodologies for the common Baltic and Finnish entry and exit zone. Our Phase 1 analysis concluded that the Postage Stamp methodology has many attractive features, including simplicity and being associated with the most favourable impacts on competition and consumer welfare. A major drawback of the Postage Stamp methodology was found to be high associated inter-TSO transfers. The Reference Price Methodology (RPM) for Phase 2 was chosen by the NRAs, with guidance from ACER and Baringa, to incorporate the key desirable aspects of the Postage Stamp methodology, but with specific structural features to address the issue of high inter-TSO transfers.

This report analyses the tariff model that was chosen for further analysis at the end of Phase 1, comparing it to a CWD counterfactual as required by TAR NC. The chosen RPM is characterised by flat entry tariffs across the Baltic and Finnish region, to be justified through benchmarking, regional interconnection points being eliminated, including those to storage, and entry tariffs being determined separately in each country to minimise inter-TSO transfers.

The report should be read in conjunction with Baringa's Phase 1 report, which sets out our methodological approach and the genesis of Phase 2 analysis in detail.

Reference Price Methodology parameters

Baringa's Phase 2 analysis constructed a tariff methodology for the Baltic and Finnish region that has the following features:

- Postage Stamp methodologies applied separately in each country;
- Interconnection points within the region are eliminated, including the Inčukalns UGS Interconnection Points;
- Flat entry tariffs are set across the region on the basis of justification to be provided through benchmarking; and
- Expected inter-TSO transfers are minimised by setting appropriate exit tariffs in each country.

The methodology produces a uniform tariff for each entry point in the common entry-exit zone, subject to application of a discount to LNG facilities, and exit tariffs that are uniform in each country but differ between different countries. Exit tariffs are set to recover each TSOs remaining transmission revenue after recovery of entry revenues on their networks.

In terms of additional Reference Price Methodology (RPM) parameters, for Phase 2 of our analysis, we considered in more detail the rationale for a discount on LNG entry tariffs. We consider that benefits for competition in the region, and hence lower prices for consumers, are the relevant factor that can justify an LNG discount. We also consider it likely that the Klaipėda LNG facility has contributed to a significant increase in gas market competition in Lithuania and to a lesser extent in some neighbouring connected markets. The level of the discount needs to balance supporting the economics of the FSRU to secure the benefits for competition against avoiding distortions to regional gas flows and trade. While an analysis of economics of the Klaipėda LNG facility is outside of the scope of Baringa's work, we consider that a discount of 25% on entry tariffs for LNG strikes an appropriate balance between these conflicting goals.

Cost allocation assessment

Article 5 of the TAR NC requires the NRAs to conduct two assessments to help indicate the cost-reflectivity of the proposed tariffs and whether there is any cross-subsidisation between different network uses. Article 5(6) requires the NRA to provide a justification if either of the cost allocation comparison indices exceeds 10 percent in the decision referred to Article 27(4).

On the basis of the calculated ratios, we cannot definitively conclude that any cross-subsidisation between intra-system network use and cross-system network use takes place under the Phase 2 RPM. Volatility of the relevant ratios indicates that the extent to which over- or under-recovery of costs of different parts of the network occurs is highly dependent on the pattern of gas flows around the network.

RPM analysis

Baringa's analysis compared this methodology to the CWD counterfactual model constructed in Phase 1 of Baringa's work, which calculates tariffs jointly across the Baltic states and Finland. The comparison identified the following key differences between these methodologies.

	Phase 2 RPM	CWD counterfactual
Entry tariffs	Flat entry tariffs across the region	Maximum factor of two difference in tariffs at different entry points
Exit tariffs	Significant differences in exit tariffs between different countries but flat tariffs within each country	Moderate differences in tariffs between countries and within individual countries
Consumer welfare	Consumer welfare maximised by flat entry tariffs	Variation in entry tariffs leads to slightly higher prices for consumers
Inter-TSO transfers	Zero transfers targeted by methodology design	Significant inter-TSO transfers required

Stakeholder survey

Baringa's work included conducting a stakeholder survey in relation to RPM assumptions and modelling approach that were employed in Baringa's analysis, as well as the RPM selection criteria that were used by the NRAs to select the methodology for further analysis in Phase 2. Key conclusions from the survey included:

- All RPM selection criteria were found to be important, with a slightly higher prioritisation for Economic efficiency and Facilitation of competition.
- There was an emphasis on avoidance of cross-subsidisation between member states.
- A number of respondents called for tariff simplicity.
- There was strong support for the Postage Stamp entry tariffs, with equally strong support in the comments for each state determining its own exit tariffs.
- There was consensus on most tariff methodology.
- There was no consensus on the LNG discount.

Baringa's recommendations

As described above, Baringa has conducted analysis to assess the Postage Stamp, CWD and Matrix tariff methodologies in Phase 1 of the project, concluding that the Postage Stamp methodology has many attractive features and one specific drawback to address. The RPM chosen for further analysis in Phase 2 incorporates the key desirable aspects of the Postage Stamp methodology, but with specific structural features to address the issue of high inter-TSO transfers. Baringa then carried out detailed analysis of the Phase 2 RPM as described above, using the modelling and assessment framework developed in Phase 1.

Following on from our work in Phase 1 and Phase 2, we consider that the Phase 2 RPM meets the key objectives of the Baltic and Finnish NRAs. Our recommendation is therefore for the NRAs, with appropriate support and involvement from the TSOs, to proceed with implementing the general framework of the methodology, subject to consultation on and resolution of the following issues.

Benchmarking study – Under the relevant provisions in TAR NC, benchmarking of transmission tariffs requires proof that different pipelines are in effective competition with one another. Baringa's initial view is that, in the context of the Baltic and Finnish region, effective competition should be demonstrated to prevail between different entries in the common entry-exit zone. This would provide the economic basis for flat entry tariffs across the region.

LNG discount – Options to be consulted on by the NRAs may include any discount granted to LNG entries.

Products and discounts – The consultation will need to include options on allocation and pricing of different products, firm and non-firm, and of different tenor as this was not covered by the scope of Baringa's analysis.

Primary and secondary networks – The NRAs may wish to consult on the possibility to apply a split of the network into primary and secondary components on the basis of a consistent set of principles.

Customer impacts – Since introduction of a new RPM for the Baltic and Finnish region is likely to involve significant change in tariffs for individual system users, we recommend that the NRAs undertake analysis of the impacts of changing the RPM on different user types.

Finally, in parallel with the consultation process, the TSO will need to undertake preparatory work with the view of implementing the new tariff methodology. Among other tasks, this will involve scoping mechanisms for any necessary inter-TSO transfers and mechanisms for allocation of capacity products in the market.

1 Introduction

This report builds on Baringa's Phase 1 tariff and gas market modelling, which analysed and compared Postage Stamp, Capacity Weighted Distance (CWD) and Matrix tariff methodologies for the common Baltic and Finnish entry and exit zone. Our Phase 1 analysis concluded that the Postage Stamp methodology has many attractive features, including simplicity and being associated with the most favourable impacts on competition and consumer welfare. A major drawback of the Postage Stamp methodology was found to be high associated inter-TSO transfers. The Reference Price Methodology (RPM) for Phase 2 was chosen by the NRAs, with guidance from ACER and Baringa, to incorporate the key desirable aspects of the Postage Stamp methodology, but with specific structural features to address the issue of high inter-TSO transfers.

This report analyses the tariff model that was chosen for further analysis at the end of Phase 1, comparing it to a CWD counterfactual as required by TAR NC. The chosen RPM is characterised by flat entry tariffs across the Baltic and Finnish region, to be justified through benchmarking, regional interconnection points being eliminated, including those to storage, and entry tariffs being determined separately in each country to minimise inter-TSO transfers.

The report should be read in conjunction with Baringa's Phase 1 report, which sets out our methodological approach and the genesis of Phase 2 analysis in detail. The rest of the report is organised as follows.

- Section 2 describes the reference price methodology modelled in Phase 2 and the CWD counterfactual
- Section 3 describes Baringa's tariff modelling methodology
- Section 4 details the results of Baringa's tariff modelling
- Section 5 details the results of Baringa's gas market modelling
- Section 6 carries out a comparison of the Phase 2 RPM against the CWD counterfactual
- Section 7 describes Baringa's stakeholder survey and a summary of responses
- Section 8 provides Baringa's conclusions and recommendations
- Appendix A sets out the detailed results of Baringa's stakeholder survey

2 Reference Price Methodologies

This section describes the parameters of the Reference Price Methodology for the Baltic and Finnish entry-exit zone analysed by Baringa in Phase 2 of the project, as well as the CWD counterfactual model that is used for comparison purposes.

The computational approach we took to model each RPM is set out in Section 3.

2.1 Reference Price Methodology for the Baltic and Finnish Region

The Baltic and Finnish NRAs have decided to proceed with the postage stamp methodology with the following features:

(i) Postage Stamp methodologies applied separately in each country;
(ii) Interconnection points within the region are eliminated, including the Inčukalns UGS Interconnection Points;
(iii) Flat entry tariffs are set across the region on the basis of justification to be provided through benchmarking;
(iv) Expected inter-TSO transfers are minimised by setting appropriate and flat exit tariffs separately in each country; and
(v) Appropriate ITC transfers, and an appropriate Izborsk-Miso-Korneti arrangement to reflect the specific features of this entry point.

This methodology produces a uniform tariff for each entry point in the common entry-exit zone, subject to application of a discount to LNG facilities, and exit tariffs that are uniform in each country but differ between different countries. Exit tariffs are set to recover each TSOs remaining transmission revenue after recovery of entry revenues on their networks.[1]

The methodology requires the following data.

- The TSOs allowed transmission revenue
- RPM parameters
- Entry and exit capacity bookings or forecast of entry and exit capacity bookings
- Forecast gas flows at each entry and exit point

[1] We note that in our modelling Korneti is marked it as a Latvian entry. While the first corresponding entry from Russia to the EU is through Estonia, and the entry point does serve a limited amount of demand in Estonia, the wider network topology is such that we considered it to be effectively a Latvian entry. We consider that this reflects fairly the expectation of a specific arrangement between Latvia and Estonia in relation to entry revenues at this point.

2.2 Capacity-Weighted Distance methodology

In compliance with Article 26(1)(a)(vi) of TAR NC, the Capacity-Weighted Distance methodology is employed as a counterfactual against which the RPM for the Baltic and Finnish region is assessed. This is applied as in Baringa's Phase 1 analysis, jointly in the Baltic states and Finland. It produces a different tariff for each entry and exit point in the region. We calculate the tariff at every entry point by the shortest network path length (weighted by capacity) to every possible exit point and vice versa.

We use the physical topology of the four TSOs transmission networks, making no distinction between primary and secondary network.

The Capacity-Weighted Distance methodology requires the same data as the Reference Price Methodology for the Baltic and Finnish Region and the following extra data.

- The technical capacity of each entry and exit point
- The pipeline length of each segment of the transmission network

2.3 RPM parameters

The central tenet of the RPM parameters is to allocate costs in the form of recoverable revenue to different types of tariffs.

2.3.1 Capacity / Commodity split

The Capacity / Commodity split is a ratio used to divide transmission services revenue recoverable by capacity-based tariffs and commodity-based tariffs. We agreed with the NRAs in Phase 1 of the project to use a cost-reflective capacity / commodity split that mirrors relative shares of costs that are fixed and variable where:

- Capacity-based tariffs generally reflect the fixed costs of building and operating the gas network (Capex)
- Commodity-based tariffs generally reflect the variable costs of operating the gas network (Opex)

The capex / opex split of the TSOs in the region does change year on year but is consistently around a 3:1 ratio. On that basis, we chose a 75:25 capacity / commodity split.[2] We see no firm basis for changing this approach in Phase 2 of our analysis and have applied this parameter to the RPM for the Baltic and Finnish region. However, we also note that gas transmission network opex is likely to include an element of fixed cost. Hence, a greater share of revenue from capacity tariffs may also be justifiable.

[2] We note that Article 5 of the TAR NC sets out an assessment procedure the NRAs must undertake to make this decision. A key part of that assessment is the NRAs must justify any capacity / commodity split decision where the capacity or commodity comparison index (calculated under the TAR NC) exceed 10%.

The TAR NC requires NRAs to apply a RPM to determine capacity-based tariffs. In our assessment, we apply the same approach to derive capacity-based tariffs and commodity-based tariffs.

2.3.2 Entry / Exit split

The Entry / Exit split is a ratio used to divide transmission services revenue recoverable by entry tariffs and exit tariffs. Entry tariffs relate to supply of gas entering the regional network while an exit tariffs relate to gas consumption (demand) or gas that leaves the regional network. We apply the same Entry / Exit split to the capacity-based tariffs and commodity-based tariffs.

In Phase 1 of this study, we agreed with the NRAs to use an Entry / Exit split of 25:75 to reduce the likelihood of a substantial step change in the entry or exit tariffs for consumers in different countries. In Phase 2, as set out in section 2.1, the RPM for the Baltic and Finnish region is characterised by flat entry tariffs across the region, to be justified through benchmarking, and entry tariffs that are set separately in each country to recover the remaining TSO revenue requirement after entry tariff revenues are recovered. This will make the entry/exit split an output of our analysis. Given differences in TSO revenue requirements and expected entry tariff revenues between different countries in the Baltic and Finnish region, the differences in the resulting entry/exit split between countries are expected to be substantial.

The entry/exit split in Phase 2 of our study is only specified as an average for the Baltic and Finnish region as a whole, with splits in individual markets varying around this average. This is specified as 25:75 for entry and exit respectively. The economic rationale for a heavier weighting of network cost recovery on exit is that revenue recovery charges which are not designed to incentivise a particular kind of behaviour should be levied on market participants who are least likely to change their behaviour in response to such charges. Price elasticity of demand for gas is generally lower than the elasticity of gas supply where supply sources have alternative markets and entry points into which to offer their output.

2.3.3 Storage

As set out in section 2.1, the RPM for the Baltic and Finnish region envisages interconnection points within the region being eliminated, including the Inčukalns UGS Interconnection Points. Hence, transmission tariffs are not charged on storage.

2.3.4 LNG discount

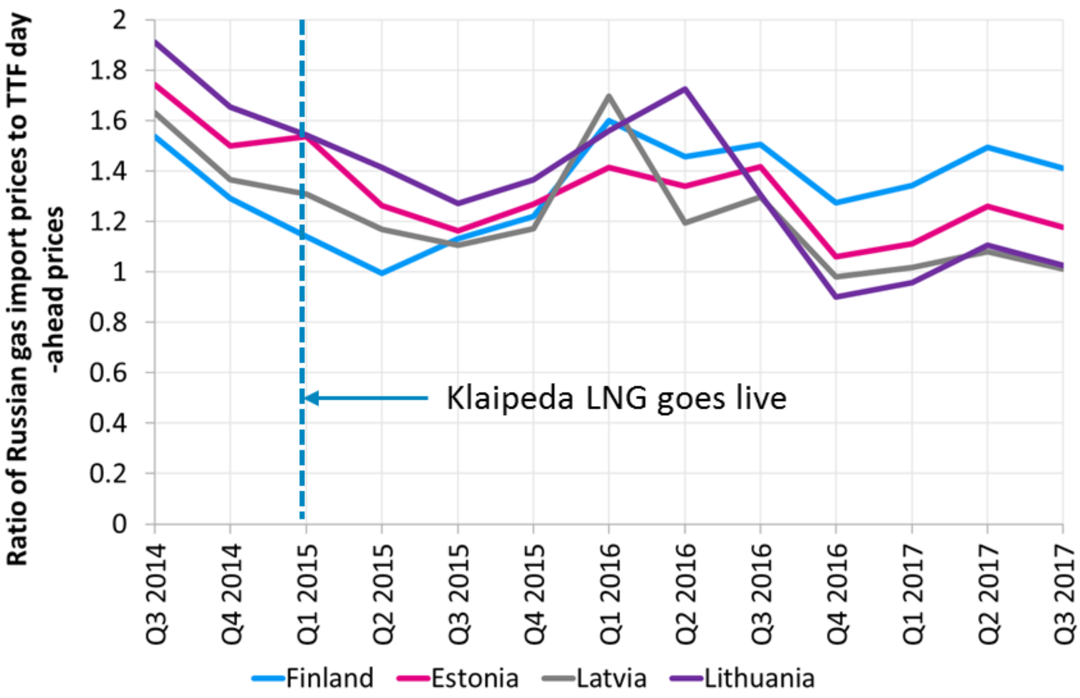
LNG facilities increase the diversity of supply of gas, enhancing security of supply and competition in the gas market. The TAR NC, in Article 9(2) makes the following specific reference to LNG facilities: "*At entry points from LNG facilities, and at entry points from and exit points to infra-structure developed with the purpose of ending the isolation of Member States in respect of their gas transmission systems, a discount may be applied to the respective capacity-based transmission tariffs for the purposes of increasing security of supply*."

There is currently one LNG facility in the Finnish-Baltic common entry exit zone. The Klaipėda LNG facility in Lithuania, which became operational in December 2014, does not currently receive a discount on its entry tariffs. After discussions with the NRAs in Phase 1, we agreed to apply a 25%

discount to LNG facilities in the Phase 1 analysis to reflect the positive impacts of the Klaipėda LNG facility on competition in the region.

For Phase 2 of our analysis, we considered in more detail the rationale for a discount on LNG entry tariffs. We consider that benefits for competition in the region, and hence lower prices for consumers, are the most relevant economic factors that can justify an LNG discount. In terms of evidence for the competitive effect of LNG, Figure 1 shows the ratio of TTF spot prices and import prices for Russian gas in the Baltic states and Finland. In particular, the figure shows prices of Russian gas imports converging to TTF in Lithuania, and to a lesser extent in Latvia, around two years after the Klaipėda LNG facility became operational. Our view is that Klaipėda is likely to have contributed to this trend to a significant extent.

Figure 1 Ratio of Russian gas import prices to TTF day-ahead prices



Source: European commission and Baringa analysis

Other factors that may justify a discount for LNG include benefits for supply diversity and security of supply. These are related since lower reliance on a single supply source improves the ability of the gas system to cope with that supply source becoming unavailable. This factor is explicitly provided for under Article 9(2) of TAR NC.

In terms of the level of the discount, it needs to balance supporting the economics of the FSRU to secure the benefits for competition and security of supply against avoiding distortions to regional gas flows and trade. While an analysis of the economics of the Klaipėda LNG facility is outside of the scope of Baringa's work, we consider that a discount of 25% on entry tariffs for LNG strikes an appropriate balance between these conflicting goals. We note that precedents vary across different jurisdictions. Many jurisdictions apply no discount on entry charges for LNG, but others do. France applies a 5% discount,[3] whereas Poland applies a 100% discount.[4] Hence, precedents from other jurisdictions may not be very helpful for determination of the exact discount for LNG entry in the Baltic and Finnish region.

[3] See DNV GL (2017), A study on the implementation status of TAR NC in six northwest European countries: study for Gasunie Transport Services

[4] See Gaz System (2018), CONSULTATION DOCUMENT: IN FULFILMENT OF ARTICLE 26 OF COMMISSION REGULATION (EU) 2017/460 OF 16 MARCH 2017 ESTABLISHING A NETWORK CODE ON HARMONISED TRANSMISSION TARIFF STRUCTURES FOR GAS.

3 Tariff modelling methodology

3.1 Tariff model inputs

The tariff model contains all the input data for each RPM.

- Worksheet 1.1 contains the building blocks allowances and total recoverable revenues for transmission services for each TSO.
- Worksheet 1.2 lists the RPM parameters
- Worksheet 1.3 contains a complete list of each part of the transmission network infrastructure used in our modelling
  - Unique networks IDs for all pipelines, junctions and entry and exit points
  - Pipeline segment length and cost data, and pipeline technical capacity
- Worksheet 1.4 contains the forecast gas flows, this is an output from the gas model

3.2 RPM for the Baltic and Finnish Region

The methodology calculates a uniform tariff for each pipeline entry point, applies a discount for LNG entry, and then a separate uniform tariff for exit points in each country given the remaining TSO revenue requirement in each country after entry revenues have been recovered. The model calculates tariffs in a single worksheet in Microsoft Excel using the computational process set out in section 7 of our Phase 1 report.

- To set capacity-based entry tariffs, the tariff model takes the recoverable revenue for capacity-based entry tariffs and divides it by the total gas flow through all types of supply entry points making no distinction what type of supply point is. This is done on the initial presumption of a 25-75 entry-exit split and calculates an initial tariff.
- The initial tariff requires an adjustment for the discounts to LNG. This results in a lower LNG entry tariff. A sum product formula then calculates the revenue the adjusted tariffs would recover.
- By applying discounts, the revenue recovered will be less than the allowance for capacity-based entry tariffs. Dividing the revenue recoverable using the adjusted tariff by the revenue allowance for capacity-based entry tariffs derives a scalar.
- Multiplying each adjusted tariffs by the scalar increases the entry tariffs to a level where multiplying them by the gas supply from each type of entry point equals the revenue allowance for capacity-based entry tariffs.
- Adjusted entry tariffs and network flows from the gas model are used to calculate entry revenues for each country.
- Separately for each country – total revenue requirement and entry revenues are used to calculate revenues to be recovered from exit tariffs.

- Separately for each country – required revenues from exit tariffs are divided by total exit flows in each country to calculate uniform exit tariffs in each country.
- We perform this procedure for each year from 2018 to 2030 in different columns of Worksheet 2.1.

The tariff model repeats this process for commodity-based entry and exit tariffs. Summing the revenue recoverable from the different tariffs gives the transmission revenue allowance.

3.3 Capacity-Weighted Distance

The Capacity-Weighted Distance methodology, which is applied jointly in the Baltic and Finnish region, produces a different tariff for each entry and exit point in the region. The tariff model calculates Capacity-Weighted Distance tariffs in two worksheets in Microsoft Excel using the computational process set out in Figure 2.

Worksheet 3.1 contains a distance matrix with the shortest network path (length) to transport gas from every entry point to every exit point, which we use to calculate the capacity-weighted average distance and weighted cost of each entry and exit point.

- We calculate this distance matrix in the gas model using a shortest path optimisation to identify the shortest path between each entry and exit point.
- We make a number of other calculations after constructing the distance matrix.
- For each entry point, we multiply the shortest path from each exit point to the entry point by the technical capacity of each exit point. This is one column of distance matrix. This is a sum product calculation that weights the distance by the pipeline's technical capacity.[5] We divide that sum product by the sum of the shortest path distance from each exit point to the entry point. This calculates the capacity-weighted average distance from exit points to the entry point.
- We repeat this calculation for each entry point. That is, every column in the distance matrix.
- Next, we calculate the weighted cost of each entry point by multiplying the resulting capacity-weighted average distance for the entry point by the technical capacity of the entry point. We then divide this multiplication by the sum product of the capacity-weighted average distance and the technical capacity for all entry points. This determines a weighted cost for each entry point as a percentage. The sum of each entry point's weighted cost equals 100%. This means that pipeline length (distance) and technical capacity act as a proxy for pipeline cost. This weighted cost is the used to derive a tariff for the entry point.
- We apply the same process for each exit point. That is, for every row in the distance matrix.

[5] by the forecast or actual annual booked capacity at that entry point in the year derives an initial tariff. The four countries do not have actual or forecasts of booked capacity. In the absence of this data,

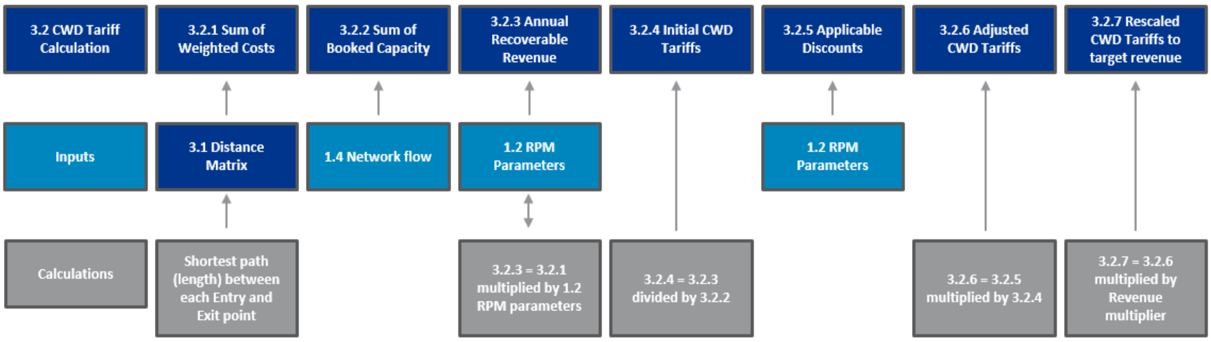
- This is a one-off calculation. The distance matrix does not change as we iterate the gas model and tariff model. For simplicity, we assume the network does not change between years.

Worksheet 3.2 calculates the Capacity-Weighted Distance capacity-based entry tariffs:

- The tariff model multiplies the weighted cost for each entry point from distance matrix by the revenue recoverable from the capacity-based entry tariffs. This calculates an annual recoverable revenue value for each entry point.
- Dividing this recoverable revenue for each entry point by the forecast or actual annual booked capacity at that entry point in the year derives an initial tariff. The four countries do not have actual or forecasts of booked capacity. In the absence of this data, we use the maximum forecast gas flow in any year from 2018 to 2030 as a proxy. We repeat this calculation for each entry point.
- The initial tariff requires an adjustment for any applicable discounts to Storage and LNG facilities. This results in a zero tariff for Storage entry tariff and a lower LNG entry tariff. Other production entry point tariffs do not receive a discount. A sum product formula then calculates the revenue the adjusted tariffs would recover using the forecast gas flow through each entry (supply) point in each year.
- The revenue recovered from the adjusted tariffs will be less than the allowance for capacity-based entry tariffs. This is dues to discounts and using pipeline length and technical capacity as a proxy for cost. Dividing the revenue recoverable using the adjusted tariff by the revenue allowance for capacity-based entry tariffs derives a scalar.
- Multiplying each adjusted tariff by the scalar increases the entry tariffs to a level where multiplying them by the gas supply from each entry point equals the revenue allowance for capacity-based entry tariffs. Applying the scalar in this way maintains the applicable discount to different supply sources.
- The effect of the Storage and LNG discounts is that production entry points pay a greater share of the capacity-based entry revenue. The LNG capacity-based entry tariff is lower than it otherwise would be and the Storage facility has a zero tariff to inject gas into the common entry-exit zone.
- We perform this procedure for each year from 2018 to 2030 in different columns of Worksheet 3.2.

We apply the same approach to calculate capacity-based exit tariffs. The tariff model repeats this process for commodity-based entry and exit tariffs. Summing the revenue recoverable from the four tariffs equals the transmission revenue allowance.

Figure 2 Capacity-Weighted Distance tariff model



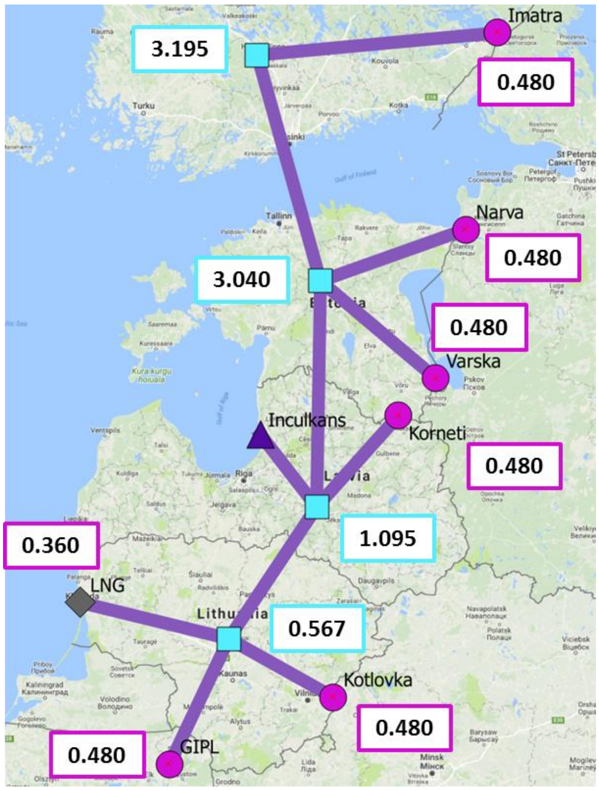
4 Tariff modelling results

4.1 RPM for the Baltic and Finnish Region

Figure 3 shows a simplified representation of the network topology used in our gas model, where all exit points within each country are shown as a single unit. Calculated tariffs are shown for each entry point, respecting the discount for LNG, and as an average for all exit points in each country, which in any case are flat within each country.

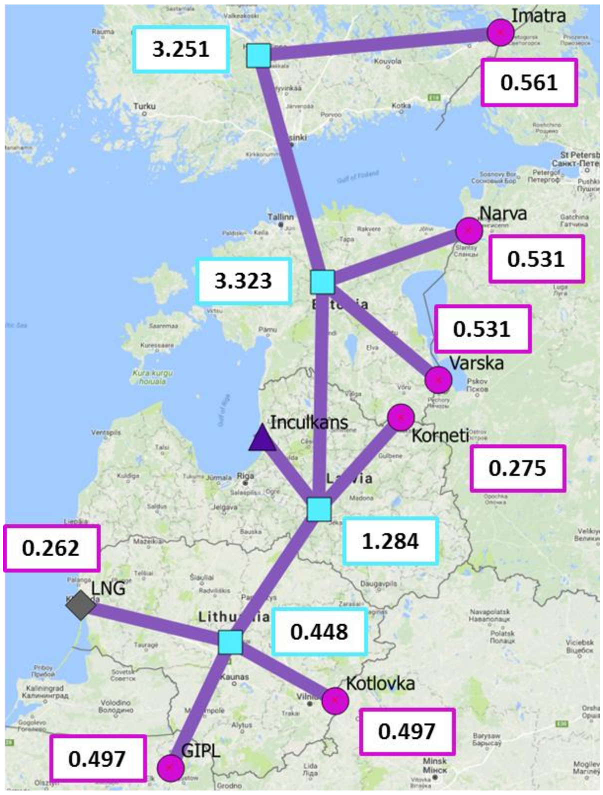
We note that the tariffs presented in this section and used for the cost allocation assessment are based on updated information shared with Baringa by the NRAs and are not the same as the tariffs used for the analysis in sections 5 and 6. However, this difference affects only the scale of the tariffs and not their structure, hence we consider that this does not affect the key conclusions of our analysis.

Figure 3 Summary of modelled RPM tariffs – peak storage inaction – Central scenario (€/MWh)



The tariffs shown are from the peak storage inaction demand profile in 2023 under the Central scenario and are a sum of capacity-based and commodity-based tariffs. They are expressed in €/MWh since our modelling does not distinguish capacity booking and flows. Hence, they are equivalent to flow-based tariffs.

Figure 4 Summary of modelled RPM tariffs – weighted average – Central scenario (€/MWh)

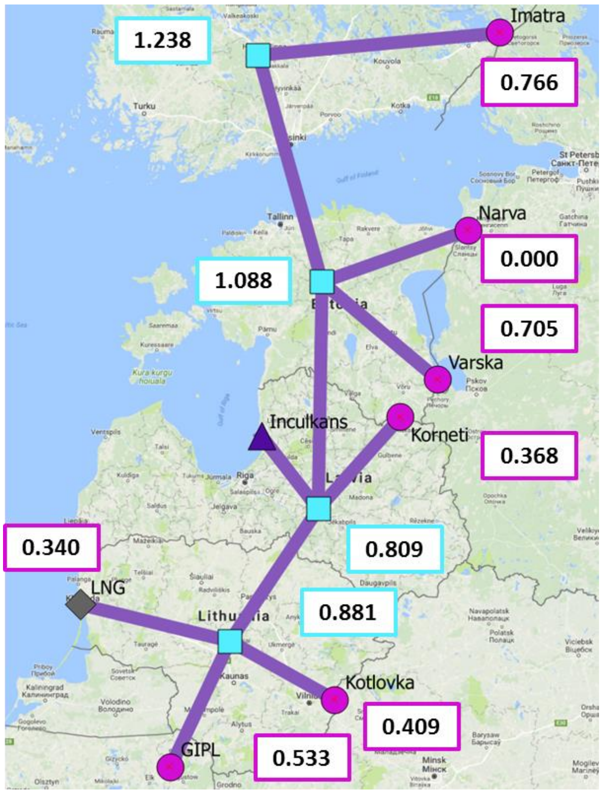


The tariffs shown are for 2023 under the Central scenario and are a sum of capacity-based and commodity-based tariffs. They are an average (weighted by flows) of the tariffs determined under the four demand and storage scenarios set out in section 4.3.1.3, and are therefore a proxy for a flat annual tariff. We note that weighted average entry tariffs are not flat across different pipeline entry points. This is due to the fact that different characteristic periods in our modelling have different associated entry tariffs, and relative weighting factors for different entry points vary between characteristic periods due to changes in the pattern of flows. Hence, entry tariffs that are equal for contemporaneous characteristic periods are not necessarily equal on a weighted average basis across different characteristic periods.

4.2 Capacity Weighted Distance

Figure 5 shows modelled entry and exit tariffs under the Capacity Weighted Distance methodology.

Figure 5 Summary of modelled CWD tariffs – peak storage inaction – Central scenario (€/MWh)



The tariffs shown are from the peak storage inaction demand profile in 2023 under the Central scenario and are a sum of capacity-based and commodity-based tariffs. Exit tariffs shown are linear averages across all exit points within a given country.

The figure shows that entry tariffs vary significantly across the common entry-exit zone, with the lowest entry tariff that is not subject to a discount being 0.368 €/MWh and the highest being 0.766 €/MWh. This variation is determined by the average capacity weighted distance to all of the exit points in the zone.

Noting that the CWD tariff methodology introduces variation in exit tariffs across the common entry-exit zone, Table 1 shows the minimum, maximum and median exit tariffs, as well as the difference between median and maximum tariffs as an indicator of intra-country tariff variation.

Table 1 Summary of Capacity Weighted Distance tariffs (€/MWh)

	Estonia	Finland	Latvia	Lithuania
Min	0.000	1.8055	0.892	0.000
Max	2.358	2.436	1.561	1.623
Median	1.821	2.147	1.153	1.203
Max-Median	0.537	0.289	0.407	0.421

The CWD model produces variations in exit tariffs within each country, measured as the difference between the maximum and median tariffs, that within the country represent up to around 35% of the median exit tariff. Note that the model produces a zero tariff for entries and exits at which there is no flow, hence they do not represent the extent of tariff variation within the CWD model.

Overall, the purpose of the CWD methodology is to approximate the cost of the infrastructure required to carry gas between different entry and exit points on the network by the capacity weighed distance between the respective points. In the context of the Baltic and Finnish entry-exit zone, the long North to South dimension of the zone results in lower tariffs in Latvia and higher tariffs at GIPL and in Finland, which are at the outer edges of the zone.

4.3 Cost allocation assessment

Article 5 of the TAR NC requires the NRAs (or the TSOs as decided by the NRAs) to conduct two assessments to help indicate the cost-reflectivity of the proposed tariffs and whether there is any cross-subsidisation between different network uses. The assessment itself requires the calculation of two cost allocation comparison indices that show:

- the ratio of intra-system and cross-system network use for capacity based tariffs (capacity cost allocation comparison index); and
- the ratio of intra-system and cross-system network use for commodity based tariffs (commodity cost allocation comparison index)

Article 5(6) requires the NRA to provide a justification if either of the cost allocation comparison indices exceeds 10 percent in the decision referred to Article 27(4).

This assessment required under Article 5 must be part of the final consultation referred to in Article 26. ENTSOG notes there is no obligation at an earlier stage, so it is only optional to perform such assessments at a separate stage prior to the final consultation.[6]

The Article 5 assessment is only necessary if the NRA makes a distinction between intra-system network use and cross-system network use. To Baringa's knowledge, in Finland and the Baltic States,

[6] ENTSOG, Implementation Document for the Network Code on Harmonised Transmission Tariff Structures for Gas Second Edition, September 2017, p.51.

this distinction is currently only made in Lithuania. In this section, we have made this calculation for Lithuania using our Phase 2 modelling.

4.3.1 Methodology

We took the following steps to calculate the cost allocation comparison indexes using the TAR NC and ENTSOG's implementation document as guidance.

4.3.1.1 Identify cost drivers for capacity-based tariffs and commodity-based tariffs

Article 5(1)(a) sets out criteria for selecting a cost driver for capacity based transmission tariffs .

- technical capacity; or
- forecasted contracted capacity; or
- technical capacity and distance; or
- forecasted contracted capacity and distance

Article 5(1)(b) sets out criteria for selecting a cost driver for commodity based transmission tariffs:

- the amount of gas flows; or
- the amount of gas flows and distance

In response to our Phase 1 information request, AmberGrid, the Lithuanian TSO, provided a detailed description of the pipeline segments used for cross-system network use. A number of domestic exit points are along this part of the network. AmberGrid also provided a forecast of the booked capacity for this part of the transmission system for each year. This is a cost driver under the Article 5(1). Distance is not a relevant cost driver because the Phase 2 RPM is a variation on the Postage Stamp methodology and is not dependent on distance. We therefore chose to use this figure as a cost driver for capacity based transmission tariff under Article 5(1)(a). We chose the amount of gas flow as the cost driver for commodity-based tariffs for the same reasons.

The corresponding intra-system network use revenue (cost driver) is €28.1m (the transmission services revenue €55.6m less €27.5m). For consistency, we have applied the same approach for the cost allocation comparison index for commodity-based tariffs.

Applying the Capacity / Commodity split to these values provides the denominator values for the equations in Article 5(3) and 5(4) that determine:

- the intra-system capacity ratio; Article 5(3)(a)
- the cross-system capacity ratio; Article 5(3)(b)
- the intra-system commodity ratio; Article 5(4)(a); and
- the cross-system commodity ratio; Article 5(4)(b)

4.3.1.2 *Identify pipeline segments for cross-system and intra-system network use*

AmberGrid states that cross-system (or transit) flows enter the Lithuanian gas transmission system from Russia at Kotlovka (EN.5) with gas exiting the Lithuanian system to Russia at Karliningrad (EX.1). AmberGrid also note there is a possibility of transit flows from the Latvian entry point at Kiemenai. AmberGrid deems the remaining Lithuanian entry and exit points are for intra-system network use.

4.3.1.3 *Identify gas flows through the gas transmission system*

Section 6.5.3 of our Phase 1 report set out four characteristics periods that use two dimensions, peak and off-peak demand, and storage inaction and storage action. Figure 5 describes these four characteristics periods. This is a reproduction of Figure 9 from the Phase 1 report.

This means we need to weight the four characteristic days into a single gas network flow to calculate the cost allocation comparison indices. The same logic applies to the resulting postage stamp tariffs that each characteristic day derives. We have weighted these tariffs using the same weightings.

Figure 6 Four characteristic periods based on two dimensions

	Off-Peak	Peak
Storage Inaction	▪ Summer demand levels. ▪ No storage action ▪ “Full state”	▪ Winter demand levels ▪ No storage action ▪ “Empty state”
Storage Action	▪ Summer demand levels. ▪ Storage Injection	▪ Winter demand levels ▪ Storage Withdrawal

Applying weightings apportions the recovery of revenue from the peak / off-peak and storage scenarios. The resulting calculation provides a weighted gas flow across the Lithuanian gas transmission system.

The relevant ratios are also calculated separately on the basis of gas flows in the Central and Sensitivity scenarios, which are described in detail in section 6.5 of our Phase 1 report.

4.3.1.4 *Calculate the revenue recovered from tariffs*

Multiplying the weighted Postage Stamp entry and exit tariffs by the weighted gas network flow calculates the revenue recoverable for different types of network use. This requires four separate calculations to determine the numerator values for each of the equations in Article 5(3) and 5(4).

- Capacity-based entry and exit tariffs for intra-system network use; Article 5(3)(a)
- Capacity-based entry and exit tariffs for cross-system network use; Article 5(3)(b)

- Commodity-based entry and exit tariffs for intra-system network use; Article 5(4)(a)
- Commodity-based entry and exit tariffs for cross-system network use; Article 5(4)(b)

4.3.1.5 Calculate the intra-system and cross-system capacity and commodity ratios

Using the outputs from the calculations in section 4.3.1.1 and section 4.3.1.4 we can calculate the capacity cost allocation comparison index and the commodity cost allocation comparison index in and the equation in Article 5(3)(c) and 5(4)(c).

4.3.2 Cost allocation comparison indexes

Applying the above methodology to the Central scenario produces the following results for 2023. We chose this as a representative year after the Balticconnector and Gas Interconnector Poland-Lithuania are operational.

- The intra-system capacity ratio of 1.07 indicates an over-recovery of the cost driver revenue by €1.4 million.
- The cross-system capacity ratio of 0.93 indicates an under-recovery of the cost driver revenue by €1.4 million.
- The capacity cost allocation comparison index is 0.14.
- The intra-system commodity ratio of 1.22 indicates an over-recovery of the cost driver revenue by €1.3 million.
- The cross-system commodity ratio of 0.94 indicates an under-recovery of the cost driver revenue of €0.4 million.
- The commodity cost allocation comparison index is 0.26.

Applying the above methodology to the Sensitivity scenario produces the following results.

- The intra-system capacity ratio of 1.00 indicates no material under or over recovery of the cost driver revenue.
- The cross-system capacity ratio of 1.00 indicates no material under or over recovery of the cost driver revenue.
- The capacity cost allocation comparison index is -0.01.
- The intra-system commodity ratio of 1.14 indicates an over-recovery of the cost driver revenue by €0.8 million.
- The cross-system commodity ratio of 1.01 indicates an over-recovery of the cost driver revenue of €0.1 million.
- The commodity cost allocation comparison index is 0.12.

We cannot conclude from these ratios that any cross-subsidisation between intra-system network use and cross-system network use takes place under the Phase 2 capacity tariffs and commodity tariffs. Volatility of the relevant ratios indicates that the extent to which measures of over or under-recovery of costs of different parts of the network occurs is dependent on the pattern of gas flows around the network, which are themselves affected by external factors in the wider gas market. The cost allocation used by Baringa in the ratio tests is static and refers to historic contractual transit flows between mainland Russia and Kaliningrad through Lithuania. If the pattern of gas flows changes, as it does in the forward-looking scenarios modelled in Baringa's analysis, the historic cost allocation would no longer be appropriate and the ratio tests would no longer be meaningful.

4.3.3 Complying with TAR NC

Article 5(6) requires the NRAs to provide a justification if either the capacity cost allocation comparison index and or the commodity cost allocation comparison index exceed a 10% threshold, that is, a result less than 0.9 or greater than 1.1. The TAR NC obligates the NRAs to provide a justification as part of the final decision referred to in Article 27(4).

This is also consistent with the requirements of Article 7 of TAR NC that relate to selecting a Reference Price Methodology ensuring non-discrimination and prevent undue cross-subsidisation including by taking into account the cost allocation assessments set out in Article 5.

We reiterate ENTSOG's guidance that there is no obligation at an earlier stage, so it is only optional to perform such assessments at a separate stage prior to the final consultation.[7]

Our modelling suggests there is substantial variation in gas flows between different scenarios and also between different years. Once GIPL comes online, there is considerably less gas entering the system at Kotlovka in our Central scenario. The extent to which GIPL is used to supply customers in Lithuania and also to some extent demand in Kaliningrad is a key difference between the Central and Sensitivity scenarios. This in turn would be expected to affect the split of network cost between intra-system and cross-system usage.

Given the potentially significant changes in network flows in the future, which are to some extent reflected in the forward-looking scenarios, Baringa's recommendation is that the NRAs, with support from the regional TSOs, estimate capacity bookings and calculate network cost split on a short-term basis (e.g. 1 year ahead) for the purposes of ratio calculations. This would give a more accurate picture of whether charges applied to transit flows appropriately reflect the cost of the network used to carry those flows. Ratio calculations could then be updated on a historic basis at the year-end to check if cost allocation needs to be altered in light of actual outturn capacity bookings.

If the approach set out above leads to the conclusion that calculated ratios consistently fall outside of the bounds allowed for under TAR NC, Baringa's recommendation to the NRAs is to explore the potential to apply a primary-secondary network distinction on a consistent basis across the different transmission networks, which could be helpful in addressing the issue of cross-system flows. If this option is pursued, a related recommendation is to continue to review the path and extent of transit flows and to update the cost allocation accordingly in order to monitor any cross-subsidisation that may be taking place.

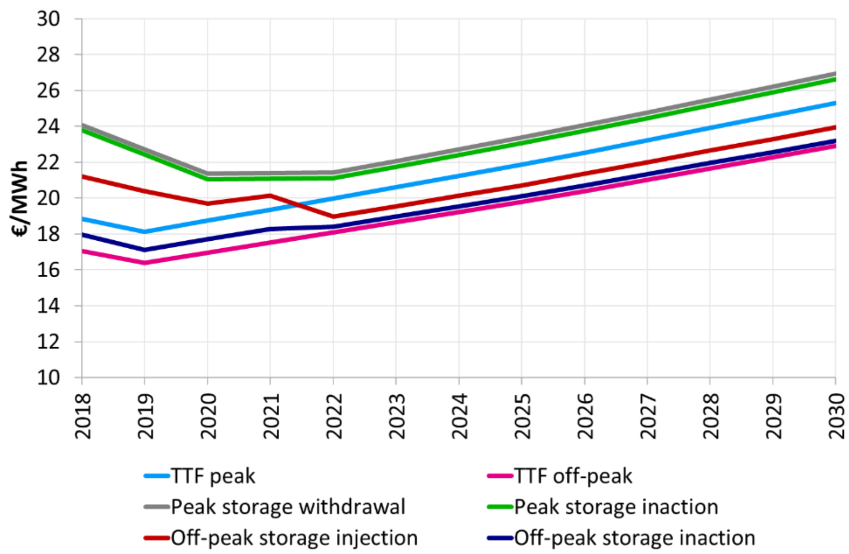
[7] ENTSOG, Implementation Document for the Network Code on Harmonised Transmission Tariff Structures for Gas Second Edition, September 2017, p.51.

5 Gas market modelling results

This section sets out the results of our modelling of the Baltic and Finnish gas market. The modelling is carried out under two different supply pricing scenarios to reflect uncertainty in the relative market shares of different supply points and the consequent flows on the gas network. More detail on our gas modelling assumptions can be found in section 6.5 of our Phase 1 report.

Figure 7 shows the model gas prices under the Central scenario and different assumptions with regard to the level of demand and storage activity.

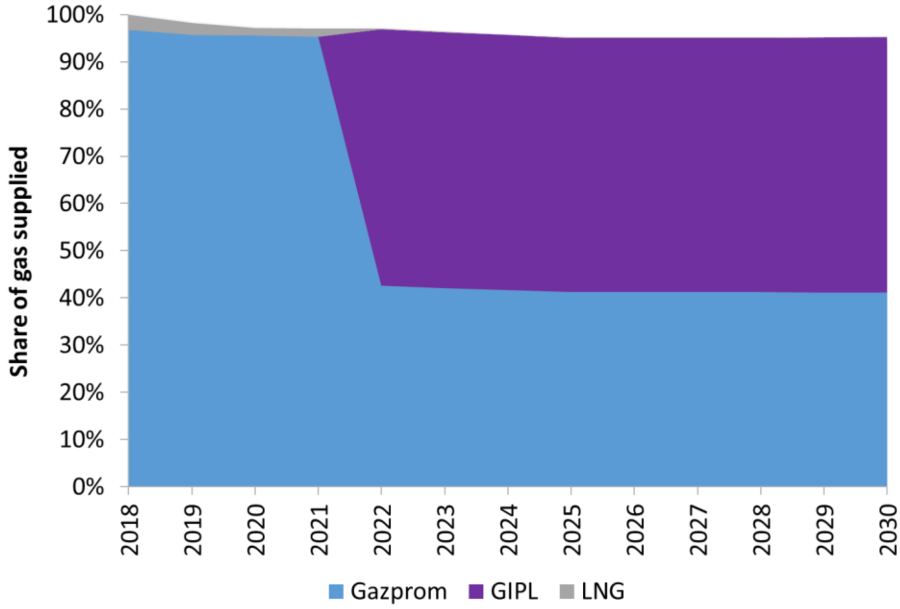
Figure 7 Gas prices under Central scenario



Broadly, the regional gas price predicted by the model follows the same pattern as pricing of supply sources, with off-peak prices under storage inaction showing a faster transition to TTF hub pricing due to the greater ability of the region to rely on the cheapest supply sources in such periods. Storage behaviour can have a noticeable effect on tariffs and thus also prices. In particular, storage withdrawal at peak lowers tariff revenue collected at other entry points and can result in higher tariffs and prices. Storage injection in off-peak periods can also have an upward effect on prices because it may bring a higher cost marginal supply source into play.

Figure 8 shows the market shares of different supply sources during the modelled horizon.

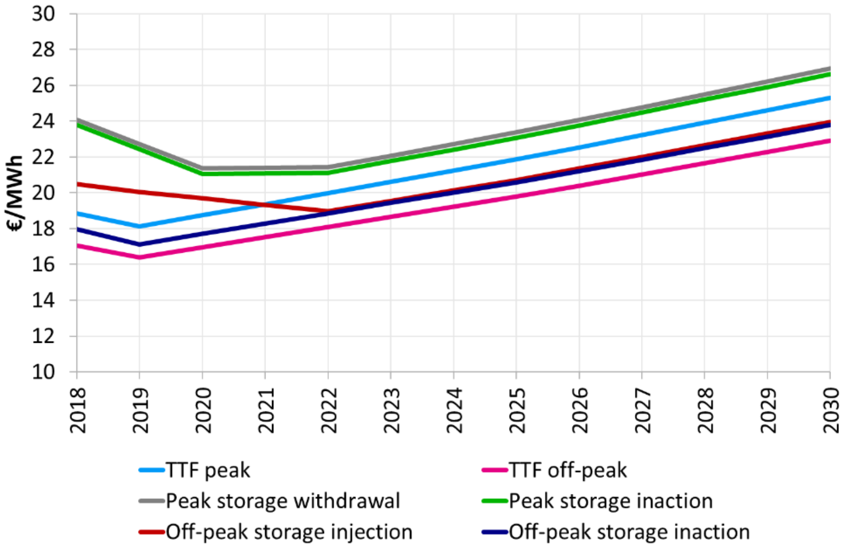
Figure 8 Market shares of different supply sources under Central scenario



In the Central scenario, due to a relatively high price of LNG supply, it takes a very small share of the regional market in volume terms. From 2022, high capacity of GIPL combined with the assumption that GIPL is the cheapest supply source ensures that it takes significant market share mainly from Gazprom but also from LNG shippers. This trend is a significant driver of the South to North gas network flows in this scenario.

Figure 9 shows the model gas prices under the Sensitivity scenario and different assumptions with regard to the level of demand and storage activity.

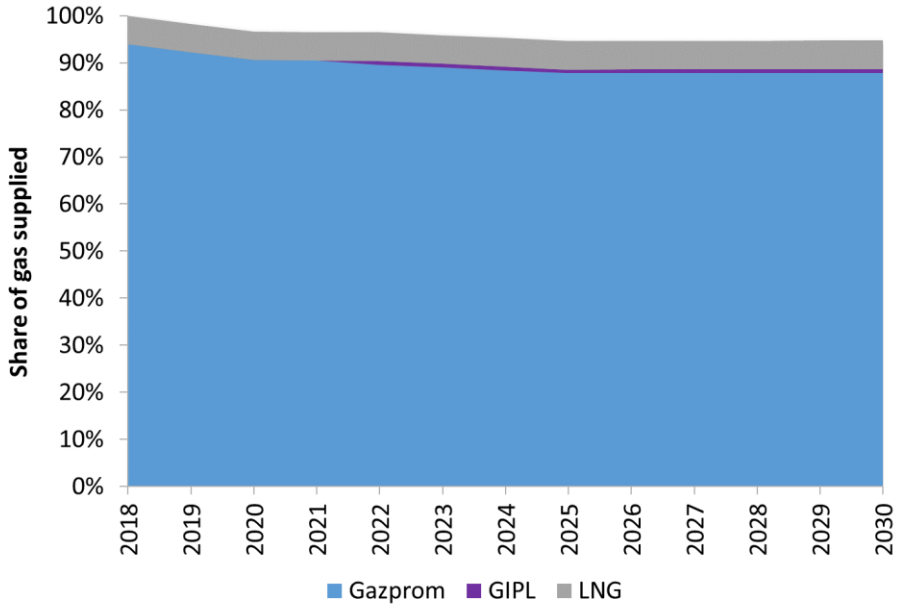
Figure 9 Gas prices under Sensitivity scenario



Higher GIPL pricing in this scenario has a noticeable effect on market prices, with prices being higher particularly in off-peak periods.

Figure 10 shows the market shares of different supply sources during the modelled horizon under the Sensitivity scenario.

Figure 10 Market shares of different supply sources under Sensitivity scenario



In this scenario, convergence of Gazprom pricing to TTF plus a small premium, combined with marginally higher GIPL pricing, ensures that Gazprom retains a dominant market share.

6 RPM comparison

This section compares key modelling results under the Phase 2 RPM and the CWD counterfactual, drawing out differences in key metrics under those models, as required under TAR NC.

6.1 Tariff comparison

Section 4 sets out the results of tariff modelling under the Phase 2 RPM and the CWD counterfactual. While the two methodologies are calculated on a different basis, they have certain features in common, including:

1. Elimination of interconnection points within the Baltic and Finnish region – including those to storage
2. Discount on entry charges for LNG
3. Total revenue to be recovered

Differences in tariffs derived from the two models arise as a direct result of the principles according to which they are calculated. They primarily affect the extent to which tariff revenue is derived from different entry and exit points, with total revenue recovered being equal in both cases.

In terms of entry tariffs, the Phase 2 RPM sees flat entry across the region with the exception of discounted tariffs for LNG. Under CWD, variation in entry tariffs is determined by differences in capacity-weighted distance between different entry points and demand centres. This results in higher tariffs at the Northern and Southern entry points, namely GIPL and Imatra, which can be up to twice the level of tariffs in the most central entry points in a peak demand scenario.

In terms of exit tariffs, the CWD model calculates these jointly across the Baltic states and Finland, hence it largely socialises differences in network costs between different countries and only reflects differences to the extent that some demand points are further away from supply points on a capacity-weighted basis. As shown in Table 1, this results in modest differences in exit tariffs within states and between different states.

The Phase 2 RPM is calculated separately in the four countries, with exit tariffs set to target recovery of remaining revenues after expected entry tariff revenues for each country have been accounted for. In the context of this methodology, and flat entry tariffs across the region, significant differences in network cost between different countries create very substantial differences in exit tariffs. This can be seen in Figure 3, where there is a factor 15 difference in the level of exit tariff between the highest and lowest tariff countries under a peak demand scenario.

We note that the economic impact of the exit tariff differences highlighted above is likely to be largely distributional given low elasticity of demand for gas and the fact that network tariffs make up a relatively small proportion of the overall cost of gas. On the other hand, differences in entry tariffs can affect supply competition and thus the average price of gas paid by users across the region.

6.2 Social welfare comparison

Modelling of regional market prices and quantities of gas consumed enables the calculation of consumer welfare under the different modelled tariff methodologies. Since there is no indigenous gas production in the Baltic states and Finland, our social welfare analysis assumes that consumer welfare and social welfare are equivalent.

Social welfare is measured as consumer surplus, being the product of gas consumption and the difference between the market price and willingness to pay. Since Baringa had no data on actual willingness to pay, a notional value was used. This means that the absolute values of social welfare are not meaningful. However, a comparison of social welfare under different tariff methodologies is valid since the notional value of willingness to pay cancels out in the calculation of differences in social welfare.

The Phase 2 RPM produces the highest net consumer welfare result across the two modelled scenarios. This corresponds to the result of our Phase 1 analysis, where the Postage Stamp methodology produced higher net consumer welfare than the CWD and Matrix methodologies. The intuition behind this result is that flat tariffs across different entry points allow the model, which mimics expected market dynamics, to maximise flow from the lowest marginal cost supply sources.

The CWD methodology is estimated to result in consumer welfare being €39m per year lower than under the Phase 2 RPM on average across the two modelled scenarios. Under this methodology, sources of gas supply that are distant from demand centres are penalised with higher tariffs on the basis of likely higher associated cost of utilising the gas network infrastructure to link these sources to demand. Hence, lowest marginal cost supply sources are not always highest in the merit order because they may have a higher entry tariff associated with them. This can result in a supply mix with a higher marginal cost in some instances. It can also result in the marginal price-setting technology having a higher cost due to it facing a higher entry tariff.

We note that these are modelling estimates calculated on the basis of two pricing scenarios that do not reflect any restrictions associated with long-term gas contracts. Actual differences in social welfare may be lower due to inertia and existing contract terms. In addition, our analysis does not assume any differences in network investment under the different tariff models. This is justified on the basis of declining demand in the region, which removes the need for significant new investment in the gas network beyond the projects that are already committed. Finally, our modelling assumes that any changes in costs of the marginal supply source, including changes in entry tariffs faced by a supplier, are passed on into prices in full. While this assumption is valid in the context of perfect competition, we note that market power may lead to incomplete pass-on of cost changes into prices.

6.3 Comparison of inter-TSO transfers

The function of inter-TSO transfers in a common entry-exit zone is to ensure that each national TSO recovers its full revenue requirement in each year even when there are mismatches between entry and exit tariffs collected within the borders of any given country and the revenue requirement of that country's TSO.

Table 2 shows the estimated transfers, measured as the sum of absolute transfers, both positive and negative, across all countries under each tariff methodology.

Table 2 Estimates sum of absolute inter-TSO transfers (€m)

Year	Phase 2 RPM	CWD	% of total allowed revenue
2018	0	208	76%
2019	0	204	76%
2020	0	198	73%
2021	0	184	69%
2022	0	181	69%
2023	0	176	68%
2024	0	170	66%
2025	0	164	64%
2026	0	157	62%
2027	0	151	60%
2028	0	145	58%
2029	0	139	56%
2030	0	133	54%

The Phase 2 RPM is estimated to result in zero inter-TSO transfers because its design is specifically targeted at achieving this goal. We note that, in reality, tariffs are likely to be set ex-ante, which means that actual tariff revenue would be uncertain and subject to outturn capacity bookings and flows. Hence, a mechanism would be required to resolve any surpluses or shortfalls in revenue either through inter-TSO transfers or through mechanisms that smooth tariff revenues over time.

The CWD tariff methodology, which is applied jointly in the Baltic states and Finland, results in very substantial inter-TSO transfers. This is explained by the fact that network length does not reflect the full variation in network cost in the Baltic and Finnish region, where cost per km on network also varies substantially between different countries. It is also explained by the fact that changes in network flows that are expected to result from interconnection points in the region being removed will lead to changes in collection of tariff revenue at different parts of the network.

A notable feature of inter-TSO transfers is that they are also transfers between groups of consumers. This is especially true if a significant proportion of the overall tariff revenue is recovered from exit tariffs. In a common entry-exit tariff zone, which applies to the CWD counterfactual, if the cost of the network is not proportional to gas consumption across different countries, and exit tariffs do not reflect such differences, the consumers in countries that have cheaper networks on a unit demand basis will be subsidising consumers in countries with a more expensive network compared to a situation where consumers in each country pay the full cost of that country's network. Hence, large inter-TSO transfers are likely to be seen as an undesirable feature of a tariff methodology.

7 Stakeholder survey

Baringa's work included conducting a stakeholder survey in relation to RPM assumptions and modelling approach that were employed in Baringa's analysis, as well as the RPM selection criteria that were used by the NRAs to select the methodology for further analysis in Phase 2. The survey is described in Appendix A and detailed results of the survey are set out in Appendix B. Our key conclusions from the survey, which includes a review of more detailed written responses that are not reproduced in this report but were shared with the NRAs, are as follows.

- There was a good spread of responses with all stakeholder types represented.
- All RPM selection criteria were found to be important, with a slightly higher prioritisation for Economic efficiency and Facilitation of competition.
- There was an emphasis on avoidance of cross-subsidisation between member states in the comments.
- A number of respondents called for tariff simplicity.
- There was strong support for the Postage Stamp entry tariffs, with equally strong support in the comments for each state determining its own exit tariffs.
- There was consensus on most tariff methodology parameters with little dissent from the proposed values.
- There was no consensus on the LNG discount, with several respondents arguing for either a higher discount or no discount at all.

Our view is that the Phase 2 RPM meets several of the more clear-cut elements of feedback from the survey, including expressed preferences for a methodology characterised by economic efficiency, simplicity, avoidance of cross-subsidisation, and each state determining its own exit tariffs.

8 Conclusions and recommendations

As described above, Baringa has conducted analysis to assess the Postage Stamp, CWD and Matrix tariff methodologies in Phase 1 of the project, concluding that the Postage Stamp methodology has many attractive features and one specific drawback to address. The RPM chosen for further analysis in Phase 2 incorporates the key desirable aspects of the Postage Stamp methodology, but with specific structural features to address the issue of high inter-TSO transfers. Baringa then carried out detailed analysis of the Phase 2 RPM as described above, using the modelling and assessment framework developed in Phase 1.

Following on from our work in Phase 1 and Phase 2, we consider that the Phase 2 RPM meets the key objectives of the Baltic and Finnish NRAs. Our recommendation is therefore for the NRAs, with appropriate support and involvement from the TSOs, to proceed with implementing the general framework of the methodology, subject to consultation on and resolution of the following issues.

LNG discount

Options to be consulted on by the NRAs may include any discount granted to LNG entries.

Products and discounts

The consultation will need to include options on allocation and pricing of different products, firm and non-firm, and of different tenor as this was not covered by the scope of Baringa's analysis.

Primary and secondary networks

The NRAs may wish to consult on the possibility to apply a split of the network into primary and secondary components on the basis of a consistent set of principles.

Customer impacts

Since introduction of a new RPM for the Baltic and Finnish region is likely to involve significant change in tariffs for individual system users, we recommend that the NRAs undertake analysis of the impacts of changing the RPM on different user types.

Benchmarking study

Phase 2 of Baringa's analysis was carried out on the expectation that the NRAs would successfully conduct a benchmarking study in order to justify the setting of flat entry tariffs across the Baltic and Finnish region. While the possibility of such a study being conducted was not contemplated at the start of the project, this report provides Baringa's initial high-level recommendation on how the NRAs may proceed with the study.

Baringa is aware of examples in the Netherlands, Germany and Slovakia where benchmarking was either used or contemplated for the setting of gas network tariffs. We are aware of only one such study that has been published.[8] However, there is no established precedent for a benchmarking study in a similar context to the proposed Baltic and Finnish common entry-exit zone.

According to regulatory guidance NRAs can perform benchmarking in order to adjust the reference price at a given entry or exit point if the point faces competition from the entry or exit point(s) of other TSOs. The economic logic is that if two or more entries or exits are in effective competition, different network tariffs on those points are likely to distort competition. The Baltic and Finnish region is not a transit region as such and is currently fairly isolated from the rest of the EU gas network. Baringa's view is that, in the context of the Baltic and Finnish region, which is currently isolated from other EU gas markets and is unlikely to become a material transit route even after GIPL is commissioned in the short-term, effective competition should be demonstrated to prevail between different entries in the common entry-exit zone.[9] This would provide the economic basis for flat entry tariffs across the region because tariff differentiation would distort competition between different entry points within the zone.

Demonstrating competition in entry would require an assessment of whether, in the absence of price regulation, regional TSOs would have the incentive to increase entry tariffs significantly above current levels. This could be done by employing a standard Small but Significant Non-transitory Increase in Prices (SSNIP) test. The test would require estimation of whether an increase in entry tariffs of around 5-10% on a given entry point, keeping tariffs on other entry points constant, results in an increase in revenues on that entry point. If the answer is no, this may suggest that there is effective competition between different entries.

The analysis would need to consider:

- Substitutability between different entries into the Baltic and Finnish region
- Effect of network transmission constraints within the region on substitutability between different entry points
- Pass-on of changes in entry tariffs into wholesale gas prices

Modelling of the regional gas market and network flows would be required to undertake analysis of entry point competition on a quantitative basis. Comparison with entry tariffs in neighbouring regions could then be undertaken on an optional basis to provide a benchmark for the absolute level of entry tariffs in the common entry-exit zone.

Preparation for implementation

In parallel with the consultation process, the TSO will need to undertake preparatory work with the view of implementing the new tariff methodology. Among other tasks, this will involve scoping mechanisms for any necessary inter-TSO transfers and mechanisms for allocation of capacity products in the market.

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[8] See https://www.acm.nl/sites/default/files/old_publication/bijlagen/11387_Rapport%20Brattle%20-%20Assessing%20Pipe-to-Pipe%20Competition%20Theoretical%20Framework%20and%20Application%20to%20GTS%20-%20december%202007.pdf

[9] In particular, the analysis would need to examine the extent to which capacity bookings on different entry points in the common entry-exit zone would be affected by differences in tariffs on those entry points.

Appendix A Stakeholder survey

The Finnish and Baltic NRAs will need to consult on their chosen RPM in accordance with Article 26 and 27 of the Tariff Network Code (TAR NC). This survey is not a substitute for those requirements. The survey serves the dual purpose of providing the NRAs with advanced notice of any contentious or potentially contentious issues ahead of the RPM formal consultation requirements in the TAR NC as well as identifying areas or potential areas for refinement in Baringa's phase 2 analysis and final report.

The survey aims to elicit stakeholder views on three aspects of the project:

- The RPM selection criteria
- The approach to modelling each RPM
- The RPM assumptions

The rest of this appendix sets out the survey and Appendix B sets out a summary of the responses. The survey also included a number of places where respondents had the opportunity to clarify their responses. These questions and the corresponding responses are not listed in this report but have been provided to the NRAs.

Introduction

The Finnish and Baltic National Regulatory Authorities (NRAs) engaged Baringa to assess three different Reference Price Methodologies (RPM) to calculate gas transmission tariffs in the soon to be regional entry and exit zone. One dimension of this engagement is to conduct a stakeholder survey on various aspects of the assessment.

The Tariff Network Code (TAR NC) requires National Regulatory Authorities (NRAs) to consult and decide upon a Reference Price Methodology (RPM) to derive gas transmission tariffs.[10] The chosen RPM must comply with the requirements in Article 7 of the TAR NC. The TAR NC embodies the principles set out in the regulatory framework of the Third package.[11]

The Finnish and Baltic NRAs engaged Baringa to assess three different RPMs permitted under the TAR NC that would apply in the common entry-exit zone of Estonia, Latvia, Lithuania and Finland. The three RPMs Baringa is assessing are:

- Postage stamp
- Capacity Weighted Distance (CWD)
- A bespoke version of Matrix

[10] Commission Regulation (EU) 2017/460 establishing a network code on harmonised transmission tariff structures for gas.
[11] Regulation (EC) 715/2009 on conditions for access to the natural gas transmission networks.

A short description of each RPM is set out in Figure 1. A more detailed description of the different RPMs and their applications is available on the ACER and ENTSOG websites.[12] [13]

Figure 11 Simplified representation of RPMs

	Postage stamp*	Capacity weighted distance (CWD)	Matrix
Description	A tariff is calculated for each entry/exit point on the basis of the total revenue to be recovered from entry/exit tariffs and forecasted contracted capacity.	Entry and exit tariffs for each entry/exit point are typically calculated on the basis of capacity, distance, and capacity costs, where distance is between a given entry/exit point and a notional system mid-point. Tariffs are then fixed.	Unit capacity costs of every possible path are calculated – typically using capacity, distance and capacity costs as inputs. Tariffs for each entry and exit point are calculated through an optimization algorithm and may vary.

A choice of a reference price methodology – depending on used assumptions – can lead to different user tariffs if applied to the relevant gas transmission networks.

This survey is an opportunity for stakeholders to provide views on a number of key aspects, assumptions and parameters applied in this assessment. The outputs will inform further analysis by Baringa and support our final report for the NRAs. We intend to publish an anonymised set of responses as appendix to our final report along with some high-level commentary. We will not publish individual responses.

Extracts of our analysis and discussions with the NRAs to date has informed the survey's structure and content. The survey contains four sections.

1) Information about respondents
2) Questions on the criteria to select a Reference Price Methodology
3) Question about the approach to modelling each Reference Price Methodology
4) Question on key assumption in the Reference Price Methodology

This survey employs a Likert scale (a symmetric 'agree-disagree' scale) for each statement. This allows respondents to express a level of agreement or disagreement with each statement capturing their views on that particular question. This type of rating scale is common in questionnaires and survey research. The survey also includes a short text space at the end of each section for any stakeholder who wants to explain the reasons for their responses. This is optional.

To assist respondents who are less familiar with this subject matter the survey contains descriptions and information about each question.

The NRAs sent us a list of stakeholders to invite to complete the survey. We will create a single log in for each organisation to respond using the information the NRAs provided to us.

[12] https://www.acer.europa.eu/en/Gas/Framework%20guidelines_and_network%20codes/Pages/Harmonised-transmission-tariff-structures.aspx

[13] https://www.entsog.eu/publications/tariffs

Section 1: Stakeholder identification

This section contains a number of pre-set fields for respondents to complete. This allows for some useful segmentation of the responses. Each field will appear as a multiple-choice list in the survey. The options for respondents to select are set out in Table 1.

Q1: Please select what best describes you as a respondent?

[allow for multiple selections]

Q2: Please select what best describes your interest in this subject matter

[allow for multiple selections]

Q3: Please select which Member State or Member States you operate in

[allow for multiple selections]

Table 3 Stakeholder identification fields

Q1.1 Respondent	Q1.2 Interest	Q1.3 Member State
Transmission System Operator	Gas transmission tariffs	Finland
Distribution System Operator	Gas security of supply	Estonia
LNG or Storage Operator	Cost of gas	Latvia
Gas Shipper		Lithuania
Network User	Gas trading	More than one of the above
Directly Connected Customer	Regional gas market integration	
Government Ministry	Gas production	
Consumer Organisation	Gas supply	
Other		

Section 2: Selection Criteria

This section seeks stakeholders' views on the criteria to select a Reference Price Methodology. The aim is to identify priorities amongst the criteria. This section has six questions based around the content of Table 2.

Table 4 Selection Criteria

#	Selection criteria	Description

1	Economic efficiency	▸ Static (short-term) efficiency requires maximum usage of cheapest supply source and maximum utilisation of existing infrastructure – Achieving a given outcome (e.g. certain quantity of gas consumption) at minimum cost ▸ Dynamic (long-term) efficiency requires appropriate signals to invest to reduce cost
2	Facilitation of competition and long-run consumer welfare	▸ Greater dynamic efficiency ▸ A lower level of market concentration
3	Simplicity	▸ A simpler approach is likely to more transparent ▸ A simpler approach is likely to be easier to understand and reproduce the results
4	Avoidance of significant transfers between national TSOs	Minimise the amount of transfers between TSOs through the Inter-TSO compensation mechanism
5	Compliance with Article 7 of the Tariff Network Code	Article 7 of the TAR NC states the RPM shall aim to: a) enable network users to reproduce the calculation of reference prices and their accurate forecast; b) take into account the actual costs of providing transmission services considering the level of complexity of the transmission network; c) ensure non-discrimination and prevent undue cross-subsidisation; d) ensure that significant volume risk related particularly to transports across an entry-exit system is not assigned to final customers within that entry-exit system; and e) ensure that the resulting reference prices do not distort cross-border trade

Q4: Please rank the five selection criteria in order of importance to you (where 5 is the most important and 1 is the least important)

Q5: How important to you is the economic efficiency selection criterion?

- Very important

- Somewhat important
- Neither important nor unimportant
- Somewhat unimportant
- Very unimportant
- Don't know

Q6: How important to you is the facilitating competition and long-run consumer welfare selection criterion?

- Very important
- Somewhat important
- Neither important nor unimportant
- Somewhat unimportant
- Very unimportant
- Don't know

Q7: How important to you is the simplicity in the selection criterion?

- Very important
- Somewhat important
- Neither important nor unimportant
- Somewhat unimportant
- Very unimportant
- Don't know

Q8: How important to you is it to minimise significant transfers between Transmission System Operators?

- Very important
- Somewhat important
- Neither important nor unimportant
- Somewhat unimportant
- Very unimportant
- Don't know

Q9: How important to you is the compliance with the Tariff Network Code selection criterion?

- Very important
- Somewhat important
- Neither important nor unimportant

- Somewhat unimportant
- Very unimportant
- Don't know

Please use this space if you want to explain the reasons for your response(s) to any of the above questions

[Insert text field max 500 words]

Section 3: Modelling each Reference Price Methodology

This section invites stakeholder views on the representation of each Reference Price Methodology in Baringa's modelling.

Postage stamp

Postage stamp is the simplest methodology that results in flat charges across different entry and exit points.

Q11: How suitable is the representation of the postage stamp RPM?

- Highly suitable
- Suitable
- Neither suitable nor unsuitable
- Unsuitable
- Highly unsuitable
- Don't know

Capacity-Weighted Distance

The Capacity-Weighted Distance approach has a number of variants – we propose to model an approach where tariff at every entry point is determined by average distance (weighted by capacity) to every possible exit point and vice versa.

Q12: How suitable is the representation of the capacity weighted distance RPM?

- Highly suitable
- Suitable
- Neither suitable nor unsuitable
- Unsuitable
- Highly unsuitable
- Don't know

Matrix

Our proposed matrix methodology requires specification of costs for every potential combination of entry and exit point in a matrix, which solves to minimise the sum of squared differences between tariffs and costs subject to any constraints:

- Assignment of network costs to transmission routes will be modelled in a cost-reflective manner
- Presence of constraints may change the tariffs determined by the model

Q13: how suitable is the representation of the Matrix RPM?

- Highly suitable
- Suitable
- Neither suitable nor unsuitable
- Unsuitable
- Highly unsuitable
- Don't know

Please use this space if you want to explain the reasons for your response(s) to any of the above questions

[Insert text field max 500 words]

Section 4: Reference Price Methodology parameters

This section seeks stakeholders' views on the parameters used to model each of the Reference Price Methodologies. The parameters determine the apportionment of recoverable revenue to different types of tariffs. We describe the function of each parameter below and show the current application in each Member State for reference.

Capacity / Commodity split

The Capacity / Commodity split is a ratio used to divide transmission services revenue recoverable by capacity-based tariffs and commodity-based tariffs. The Tariff Network Code allows for such a split.

After discussions with NRAs, Baringa is assuming a 75:25 Capacity / Commodity split, given inter alia the specific unique character of the common entry-exit zone of the four Member States. Table 3 shows the Capacity / Commodity split currently applied in each Member State.

A Capacity / Commodity split of 75:25 means that 75% of transmission services revenue is recoverable from capacity-based tariffs while 25% is recoverable from commodity-based tariffs. The Reference Price Methodology applies only to calculating capacity-based tariffs.

Table 5 Capacity / Commodity split

Parameter	FI	EE	LV	LT	Baringa
Capacity / Commodity split	0:100	0:100	100:0	73:27	75:25

Q15: How suitable is a 75:25 Capacity / Commodity split to apply in the common Finnish-Baltic gas market?

- Highly suitable
- Suitable
- Neither suitable nor unsuitable
- Unsuitable
- Highly unsuitable
- Don't know

Entry/Exit cost split

The Entry / Exit split is a ratio used to divide transmission services revenue recoverable by capacity-based tariffs for gas entering and gas exiting the regional transmission system.

- An entry tariff is a charge on the supply of gas entering the regional transmission system
- An exit tariff is a charge on the demand for gas exiting the regional transmission system

After discussions with NRAs, Baringa is assuming a 25:75 Entry / Exit split, given inter alia the specific unique character of the common entry-exit zone of the four Member States. Table 4 shows the Entry / Exit split currently applied in each Member State.

An Entry / Exit split of 25:75 means that 25% of transmission services revenue recoverable from capacity-based tariffs is recoverable from entry tariffs (supply) with the remaining 75% recoverable through exit tariffs (demand).

Table 6 Entry / Exit split

Parameter	FI	EE	LV	LT	Baringa
Entry / Exit split	0:100	0:100	20:80	20:80	25:75

Q16: How suitable is a 25:75 Entry / Exit split to apply in the common Finnish-Baltic gas entry-exit zone?

- Highly suitable
- Suitable
- Neither suitable nor unsuitable
- Unsuitable
- Highly unsuitable

- Don't know

Storage

The Tariff Network Code makes specific reference to the benefits that gas storage can provide the transmission system and that these benefits can be a consideration in setting or approving tariffs for storage facilities.

Applying entry and exit charges to storage can result in double charging for gas that enters the regional transmission system and then enters a storage facility. Similarly, gas that exits a storage facility and then exits the regional transmission system may result in paying two exit charges. Discounts for storage injections and withdrawals are a common way to provide an incentive to construct and operate these facilities, noting the benefits they can provide, and to avoid or reduce the impact of doubling charging.

There is currently one gas storage facility in the Finnish-Baltic common entry exit zone. The Inčukalns gas storage facility in Latvia currently receives a 50% discount on its entry and exit tariffs, and that will soon increase to 100% in 2019. With that in mind, and after discussion with the NRAs, Baringa has applied a 100% discount to gas storage in its analysis.

Q17: How suitable is a 100% discount to apply to gas storage facilities in the common Finnish-Baltic gas market?

- Highly suitable
- Suitable
- Neither suitable nor unsuitable
- Unsuitable
- Highly unsuitable
- Don't know

LNG

LNG facilities increase the diversity of supply of gas, enhancing security of supply and competition in the gas market. Like storage facilities, the Tariff Network Code makes specific reference to the benefits LNG facilities can provide the transmission system and that these benefits can be a consideration in setting or approving tariffs for LNG facilities.

There is currently one LNG facility in the Finnish-Baltic common entry exit zone. The Klaipėda LNG facility in Lithuania does not currently receives a discount on its entry tariffs. After discussions with the NRAs, Baringa has applied a 25% discount to LNG facilities in its analysis.

Q18: How suitable is a 25% discount to LNG facilities in the common Finnish-Baltic gas market?

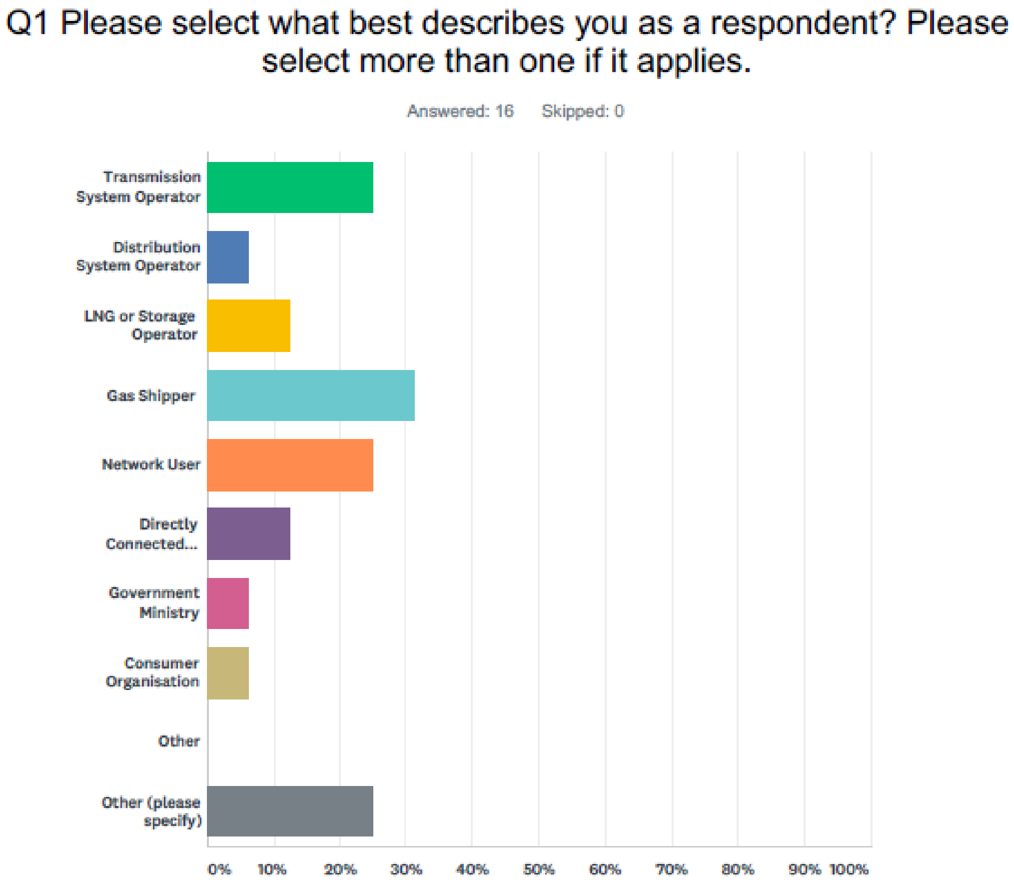
- Highly suitable
- Suitable
- Neither suitable nor unsuitable

- Unsuitable
- Highly unsuitable
- Don't know

Please use this space if you want to explain the reasons for your response(s) to any of the above questions

[Insert text field max 500 words]

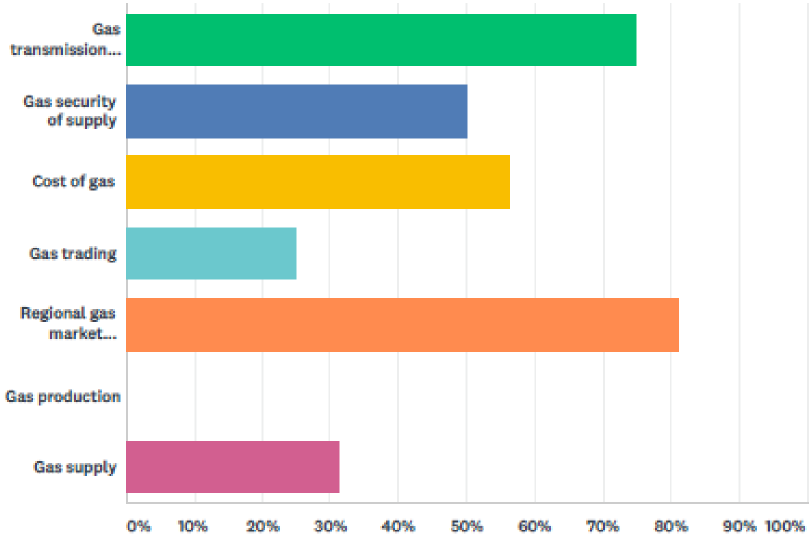
Appendix B Stakeholder survey responses



ANSWER CHOICES	RESPONSES	
Transmission System Operator	25.00%	4
Distribution System Operator	6.25%	1
LNG or Storage Operator	12.50%	2
Gas Shipper	31.25%	5
Network User	25.00%	4
Directly Connected Customer	12.50%	2
Government Ministry	6.25%	1
Consumer Organisation	6.25%	1
Other	0.00%	0
Other (please specify)	25.00%	4

Q2 Please select what best describes your interest in this subject matter.Please select more than one if it applies.

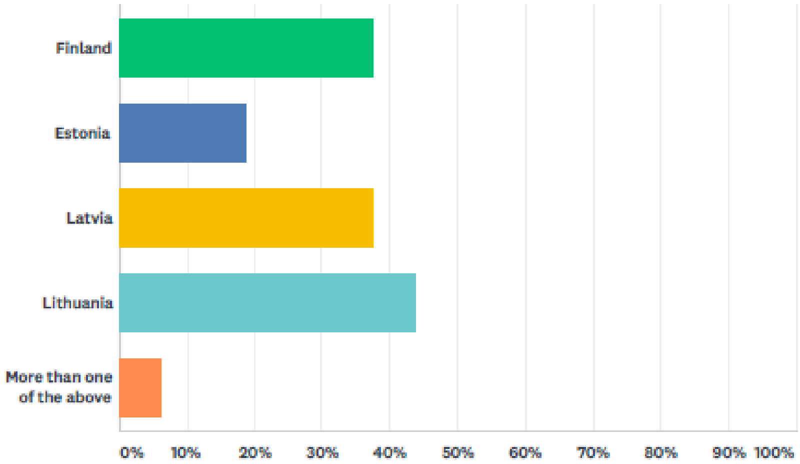
Answered: 16 Skipped: 0



ANSWER CHOICES	RESPONSES	
Gas transmission tariffs	75.00%	12
Gas security of supply	50.00%	8
Cost of gas	56.25%	9
Gas trading	25.00%	4
Regional gas market integration	81.25%	13
Gas production	0.00%	0
Gas supply	31.25%	5
Total Respondents: 16		

Q3 Please select which Member State or Member States you operate in.Please select more than one if it applies.

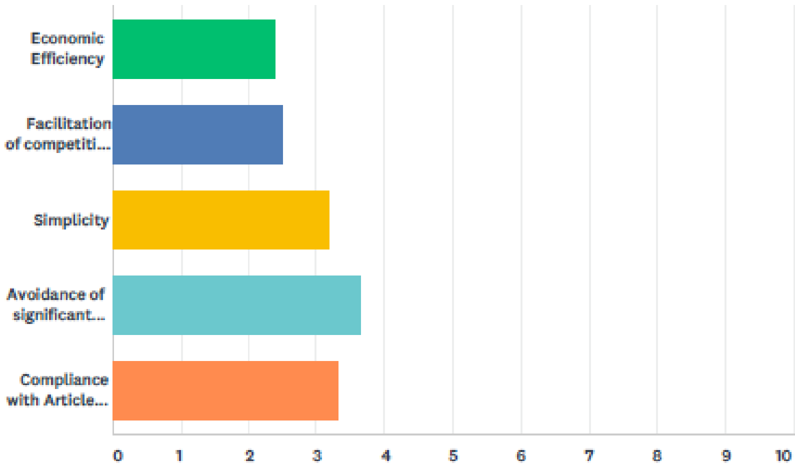
Answered: 16 Skipped: 0



ANSWER CHOICES	RESPONSES	
Finland	37.50%	6
Estonia	18.75%	3
Latvia	37.50%	6
Lithuania	43.75%	7
More than one of the above	6.25%	1
Total Respondents: 16		

Q4 Please rank the five selection criteria in order of importance to you (where 5 is the most important and 1 is the least important)

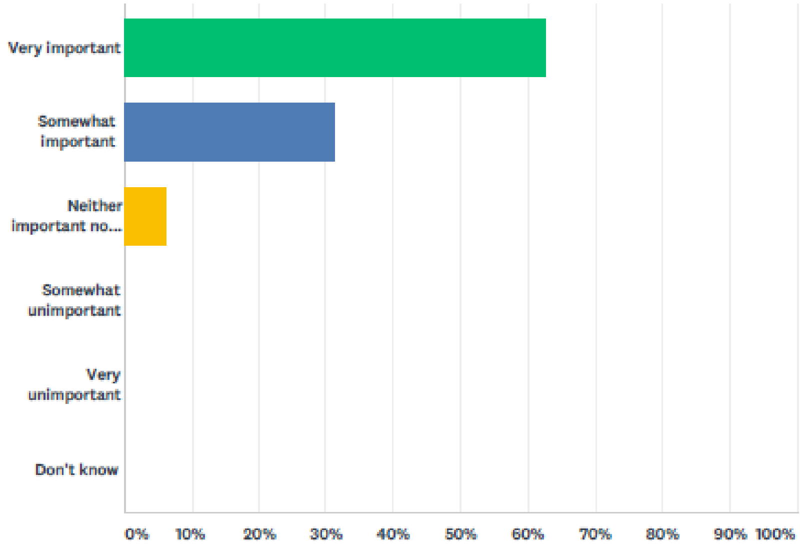
Answered: 16 Skipped: 0



	1	2	3	4	5	TOTAL	SCORE
Economic Efficiency	6.25% 1	6.25% 1	37.50% 6	18.75% 3	31.25% 5	16	2.38
Facilitation of competition and long-run consumer welfare	12.50% 2	18.75% 3	6.25% 1	31.25% 5	31.25% 5	16	2.50
Simplicity	6.25% 1	37.50% 6	31.25% 5	18.75% 3	6.25% 1	16	3.19
Avoidance of significant transfers between national TSOs	43.75% 7	18.75% 3	12.50% 2	6.25% 1	18.75% 3	16	3.63
Compliance with Article 7 of the Tariff Network Code	31.25% 5	18.75% 3	12.50% 2	25.00% 4	12.50% 2	16	3.31

Q5 How important to you is the economic efficiency selection criterion?

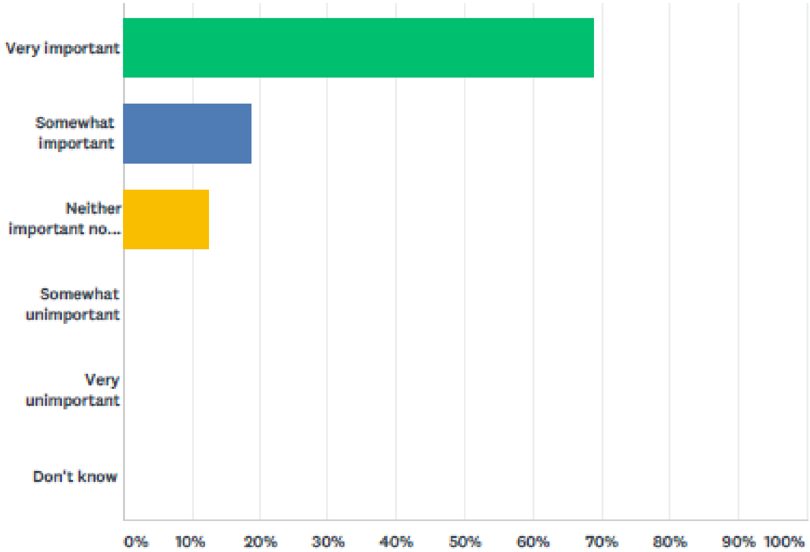
Answered: 16   Skipped: 0



ANSWER CHOICES	RESPONSES	
Very important	62.50%	10
Somewhat important	31.25%	5
Neither important nor unimportant	6.25%	1
Somewhat unimportant	0.00%	0
Very unimportant	0.00%	0
Don't know	0.00%	0
TOTAL		16

Q6 How important to you is the facilitating competition and long-run consumer welfare selection criterion?

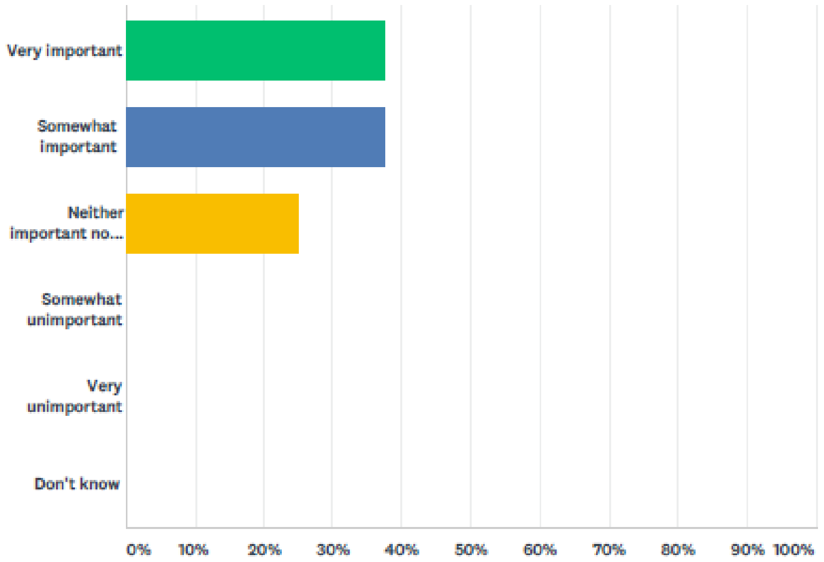
Answered: 16 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very important	68.75%	11
Somewhat important	18.75%	3
Neither important nor unimportant	12.50%	2
Somewhat unimportant	0.00%	0
Very unimportant	0.00%	0
Don't know	0.00%	0
TOTAL		16

Q7 How important to you is the simplicity in the selection criterion?

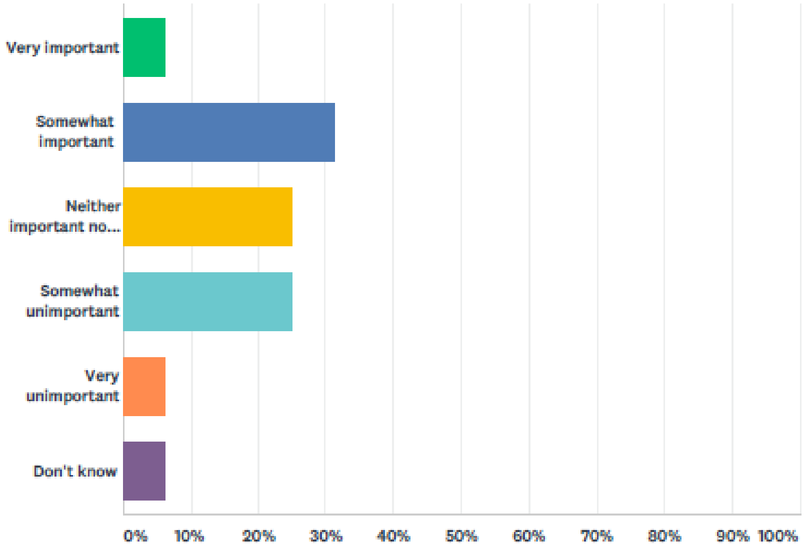
Answered: 16 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very important	37.50%	6
Somewhat important	37.50%	6
Neither important nor unimportant	25.00%	4
Somewhat unimportant	0.00%	0
Very unimportant	0.00%	0
Don't know	0.00%	0
TOTAL		16

Q8 How important to you is it to minimise significant transfers between Transmission System Operators?

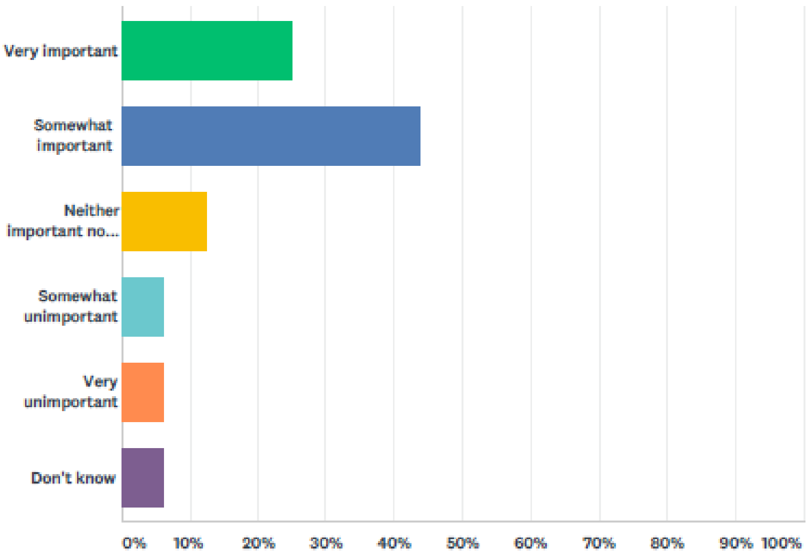
Answered: 16 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very important	6.25%	1
Somewhat important	31.25%	5
Neither important nor unimportant	25.00%	4
Somewhat unimportant	25.00%	4
Very unimportant	6.25%	1
Don't know	6.25%	1
TOTAL		16

Q9 How important to you is the compliance with the Tariff Network Code selection criterion?

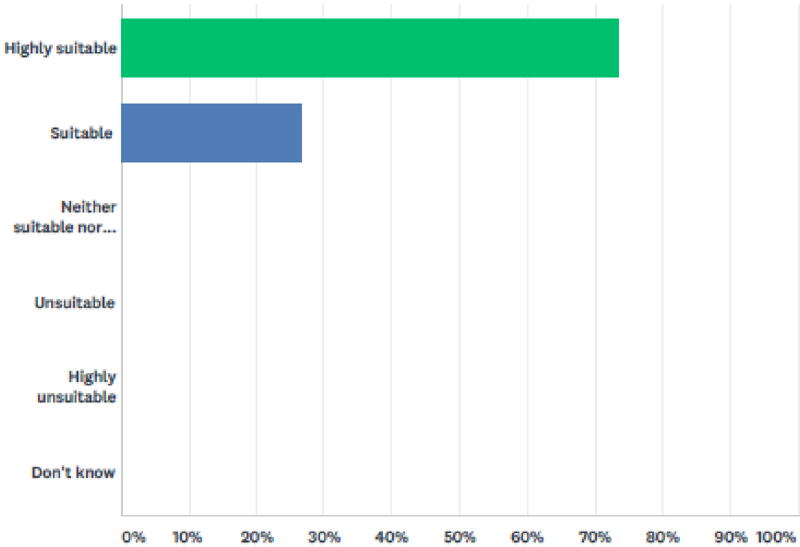
Answered: 16 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very important	25.00%	4
Somewhat important	43.75%	7
Neither important nor unimportant	12.50%	2
Somewhat unimportant	6.25%	1
Very unimportant	6.25%	1
Don't know	6.25%	1
TOTAL		16

Q11 How suitable is the representation of the Postage Stamp RPM?

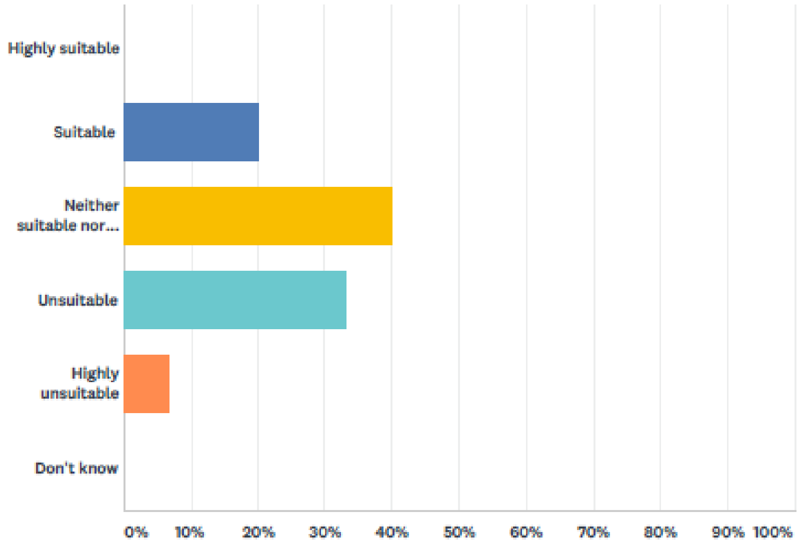
Answered: 15 Skipped: 1



ANSWER CHOICES	RESPONSES	
Highly suitable	73.33%	11
Suitable	26.67%	4
Neither suitable nor unsuitable	0.00%	0
Unsuitable	0.00%	0
Highly unsuitable	0.00%	0
Don't know	0.00%	0
TOTAL		15

Q12 How suitable is the representation of the Capacity Weighted Distance RPM?

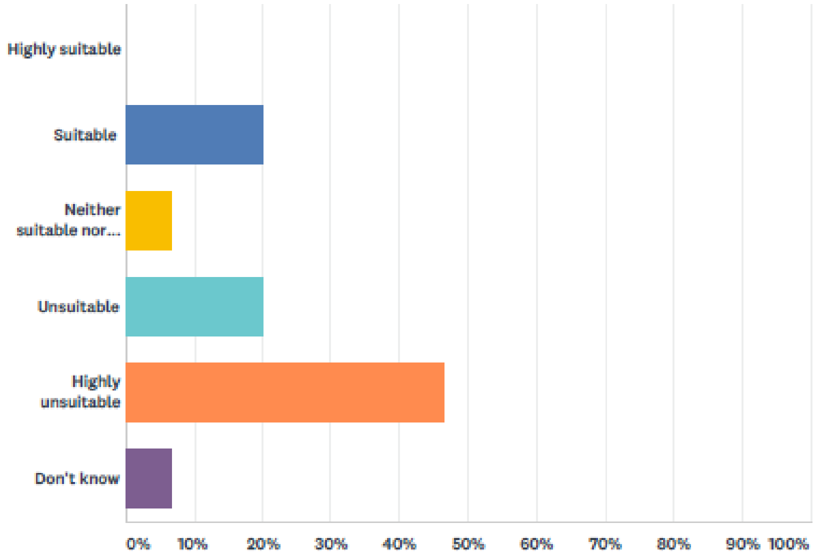
Answered: 15 Skipped: 1



ANSWER CHOICES	RESPONSES	
Highly suitable	0.00%	0
Suitable	20.00%	3
Neither suitable nor unsuitable	40.00%	6
Unsuitable	33.33%	5
Highly unsuitable	6.67%	1
Don't know	0.00%	0
TOTAL		15

Q13 How suitable is the representation of the Matrix RPM?

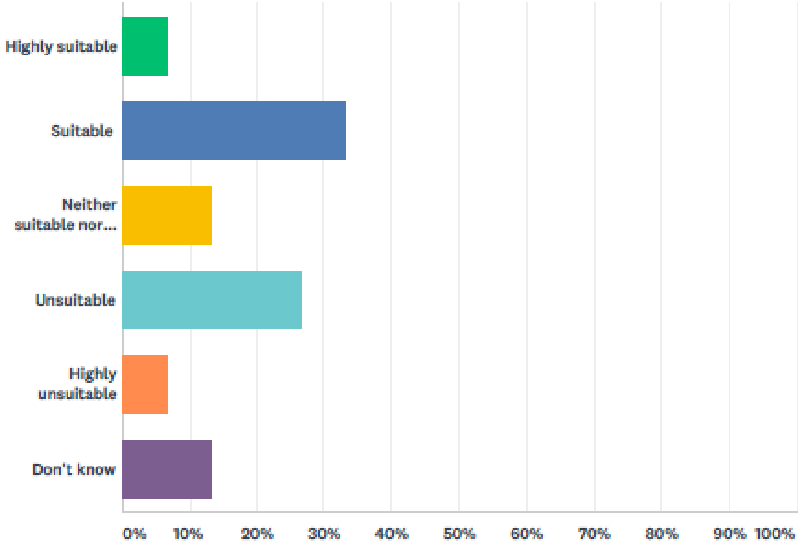
Answered: 15   Skipped: 1



ANSWER CHOICES	RESPONSES	
Highly suitable	0.00%	0
Suitable	20.00%	3
Neither suitable nor unsuitable	6.67%	1
Unsuitable	20.00%	3
Highly unsuitable	46.67%	7
Don't know	6.67%	1
TOTAL		15

Q15 How suitable is a 75:25 Capacity / Commodity split to apply in the common Finnish-Baltic gas market?

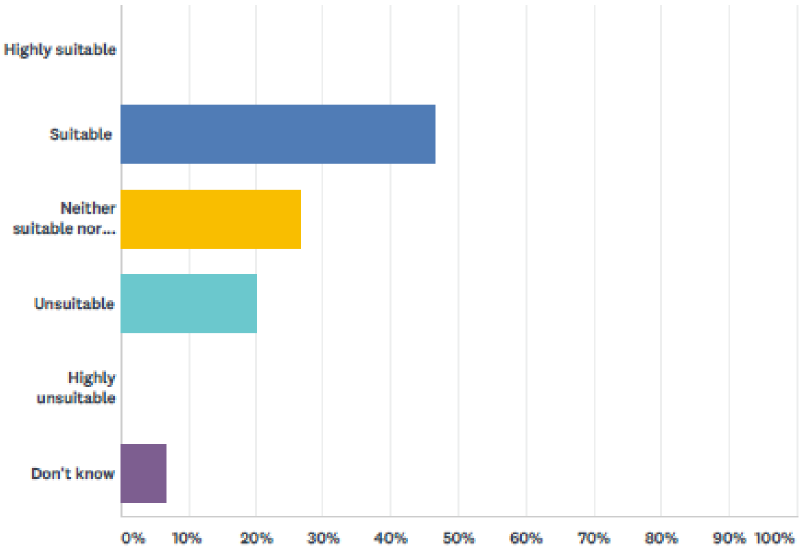
Answered: 15 Skipped: 1



ANSWER CHOICES	RESPONSES	
Highly suitable	6.67%	1
Suitable	33.33%	5
Neither suitable nor unsuitable	13.33%	2
Unsuitable	26.67%	4
Highly unsuitable	6.67%	1
Don't know	13.33%	2
TOTAL		15

Q16 How suitable is a 25:75 Entry / Exit split to apply in the common Finnish-Baltic gas entry-exit zone?

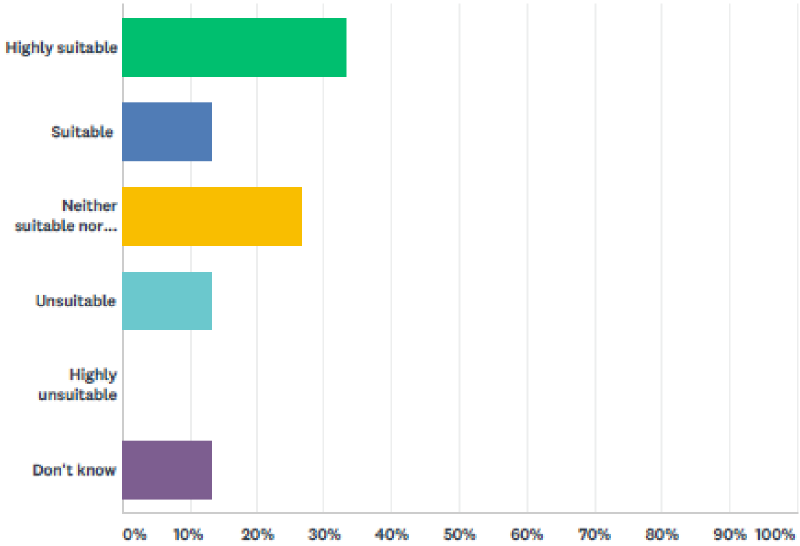
Answered: 15 Skipped: 1



ANSWER CHOICES	RESPONSES	
Highly suitable	0.00%	0
Suitable	46.67%	7
Neither suitable nor unsuitable	26.67%	4
Unsuitable	20.00%	3
Highly unsuitable	0.00%	0
Don't know	6.67%	1
TOTAL		15

Q17 How suitable is a 100% discount to apply to gas storage facilities in the common Finnish-Baltic gas market?

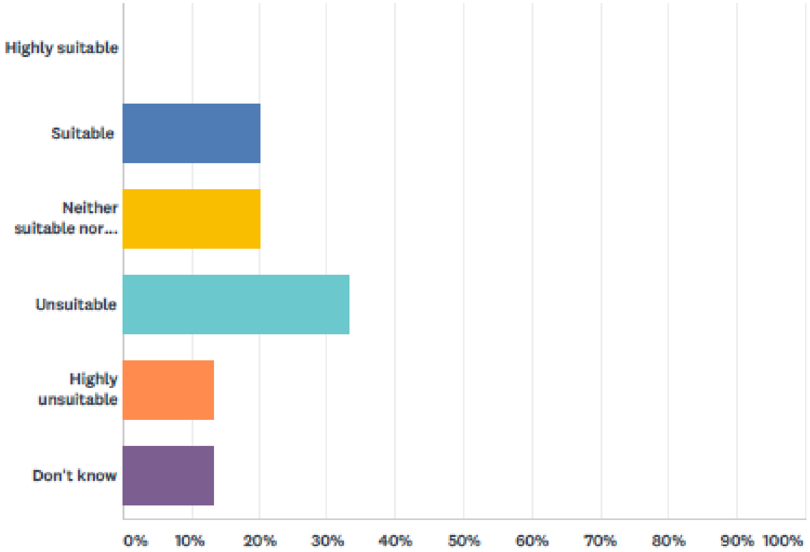
Answered: 15 Skipped: 1



ANSWER CHOICES	RESPONSES	
Highly suitable	33.33%	5
Suitable	13.33%	2
Neither suitable nor unsuitable	26.67%	4
Unsuitable	13.33%	2
Highly unsuitable	0.00%	0
Don't know	13.33%	2
TOTAL		15

Q18 How suitable is a 25% discount to LNG facilities in the common Finnish-Baltic gas market?

Answered: 15 Skipped: 1



ANSWER CHOICES	RESPONSES	
Highly suitable	0.00%	0
Suitable	20.00%	3
Neither suitable nor unsuitable	20.00%	3
Unsuitable	33.33%	5
Highly unsuitable	13.33%	2
Don't know	13.33%	2
TOTAL		15

Appendix C About Baringa

Baringa Partners is an award-winning management consultancy specialising in energy, financial services, utilities, telecoms and media – in the UK, Ireland and Continental Europe. It partners with organisations when they are developing and delivering key elements of their business strategy, as well as working extensively with government and regulators providing policy and advisory services. Baringa works with its clients to either implement new or optimise existing business capabilities relating to their people, processes and technology.

Baringa is recognised both in the UK and internationally for its unique culture for which it has been awarded a number of accolades and continues to reaffirm its status as a leading people-centred organisation.

We currently have around 500 consultants, of which approximately 200 are specialists in the energy sector. The business is owned and operated by its 55 Partners who are based in London, Dusseldorf or New York. We have recently established Baringa Ireland Limited, which is a wholly owned subsidiary of Baringa Partners LLP.

Our team ranges from Analyst (< 2 years' experience) to Director (15 years+ experience) level with people joining us from industry, other consultancies and academia.

Baringa (and formerly Redpoint) has been at the heart of energy market regulation and energy policy, working extensively with regulators and governments across Europe, including the Regulatory Authorities (RAs) on the island of Ireland, the Department of Communications, Energy and Natural Resources (DCENR), the Department of Energy and Climate Change (DECC), Ofgem, the Norwegian Water Resources and Energy Directorate (NVE), the Dutch Office of Energy Regulation (NMa), the Commission de Regulation de l'Energie in France and the European Commission.

We help clients using our deep industry insights to:

- Run more effective businesses
- Launch new products & businesses and reach new markets
- Understand and navigate industry shifts

We have worked with energy companies across:

- Strategy & Regulation
- Market design
- Enterprise Architecture
- Programme delivery and assurance
- We deliver these services across the whole energy value chain

Our clients include:

We all roll up our sleeves to deliver.

We bring deep industry experience to client projects.

Collaboration runs through everything we do.

Our independence means we provide impartial advice.

Our award-winning culture attracts the brightest people.

We don't want to be the biggest but... Baringa was founded in 2000 and now has:

550
- employees

55
- partners

5
- Offices worldwide (UK, Germany, Ireland, UAE and USA).

Our reputation is hard won and we're determined to keep it growing.