nationalgridESO

Stability Pathfinder Phase 2: Expressions of Interest

# Draft Assessment Methodology (v2)

**Draft version 2, published December 2020**

## Changes from Version 1

- Added detail on how infrastructure costs are provided and checked
- Added detail on our approach to assessing tenders that do not meet the latest in-service date of April 2024
- Added detail on how we will consider the cost of energy losses in any TO submissions
- Added detail on re-evaluating the solution in the case of tenders not progressing

## Principles

This document sets out the approach National Grid ESO intends to take in assessing options submitted to manage stability in Scotland as part of the Stability Pathfinder Phase 2 tender process.

Our aim is to ensure our Short Circuit Level (SCL) requirements in Scotland are met at the lowest overall cost to consumers, while also considering the additional value of options which reduce our national inertia need. This could be through contracting with commercial providers, asking a Network Owner to build a regulated asset, by managing the issue through balancing mechanism (BM) actions, or some combination of these.

## Feedback

We have updated sections of the document in response to the feedback we received to the first draft. There are also updated questions and answers in the FAQ document where this was more appropriate.

This second draft is open for feedback until 22nd Jan, after which the final version will be prepared. This is due to be published in February alongside the final contract terms.

Please email box.networkdevelopment.roadmap@nationalgrideso.com with feedback or questions.

## Information required for the assessment

From the information to be submitted by participants as part of the tender process, the following will be used in the economic assessment of our preferred solution:

- A price in £ per settlement period (£/SP), which should be inclusive of all costs faced by the provider, for example all applicable network / use of system charges, levies & losses.
- Short circuit current contribution in kA at the point of stability [1] at 100ms after a 3-phase symmetrical fault at 8 ESO locations of need. These values need to be demonstrated in the technical feasibility study and should be the additional capability only, as defined in slide 16 of the tender pack.

[1] Point of Stability is defined in the technical specification.

- Their contribution to inertia in MJ, as stated in the technical specification. This should be the additional capability only, as defined in slide 16 of the tender pack. Their availability to provide inertia, as a percentage of settlement periods over the course of a year.
- Transmission substation name and voltage level at the point of stability
- Where a provider submits multiple options, they should indicate if any options are mutually exclusive to each other or part of an 'all or nothing' group.

## What we are procuring

We are looking to meet a requirement for 8400 MVA of short circuit level across eight locations, with the minimum requirement at each location detailed in Table 1. We are also setting an inertia requirement for at least 6000 MVA.s of inertia, which will contribute towards our national need for inertia. We will not be valuing static / steady state reactive range.

For SCL, a contribution at any single point will reduce the requirement across all eight locations to different amounts, depending on the effectiveness for each location. Therefore, it is expected that the total SCL capability procured may be less than 8400MVA.

For inertia, we will seek to meet a minimum requirement of 6000 MVA.s and will stop selecting pathfinder or TO options either when this requirement is met or when it becomes cheaper to meet the requirement using alternative actions (i.e. the balancing mechanism).

We will seek an overall solution that minimises our net costs allowing us to meet these requirements. Tendered options will be compared to each other, TO assets, and to our counterfactual costs of using Balancing Mechanism (BM) actions. We may therefore procure less than our requirements through the pathfinder process if it is cheaper to meet the requirements in other ways.

*Table 1: Requirements at each location*

| Location | Ref | SCL Requirement (MVA) |
|---|---|---|
| Spittal | 1 | 600 |
| Blackhillock | 2 | 1,300 |
| Peterhead | 3 | 1,300 |
| Longannet area | 4 | 600 |
| Hunterston | 5 | 1,200 |
| Mark Hill/Coylton area | 6 | 400 |
| Moffatt/Elvanfoot area | 7 | 1,800 |
| Eccles area | 8 | 1,200 |
| **Total SCL** | | **8,400** |
| Inertia | 9 | 6000 MVA.s |

# Parts of the Assessment

## Effective SCL Contributions

Each solution will be assessed using its effective short circuit level (SCL) contribution in MVA. The effective MVA of a solution is the contribution toward the SCL at the 8 requirement nodes for a fault at each of those 8 nodes. There will be two factors that contribute to this effectiveness:

1. The network impedance between the point of stability and the 8 requirement nodes. These are published by the ESO as the effectiveness factors.
2. The solution's short circuit current contribution for faults at the 8 requirement nodes. This is to be given by the provider and demonstrated for each solution at the feasibility study stage.

At the feasibility stage the ESO will provide a figure for the retained voltage (voltage dip seen during a fault) at a solution's point of stability for a fault at each of the 8 requirement nodes. The provider will then be required to calculate the reactive current output of their solution for these 8 faults. This is defined here as the short circuit current contribution in kA.

To get the effective short circuit level for each of the 8 locations, the ESO will multiply the 8 short circuit current contributions in kA by the effectiveness factors relevant to each location for that solution. We will convert these into MVA by multiplying the 'effective kA' by the phase voltage of the requirement node. This will result in a set of 8 'effective SCL' figures in MVA, which are then used in the assessment.

For a full worked example, please see Example 1.

## Inertia

Based on feedback from the RFI, we are also setting an inertia requirement. We will buy inertia where the costs of doing so are less than our counterfactual option, for a requirement of 6000 MVA.s and subject to being technically feasible. If the full inertia requirement is met, there will not be any value associated with inertia above this limit.

If you are proposing a solution which could have more inertia added to it for an additional cost, we strongly recommend that you submit at least two mutually exclusive options with a cost for each different level of inertia. Once the inertia requirement has been reached, there will in effect be no value to buying any additional inertia, so putting forward a cheaper but lower inertia option raises the likelihood of being part of the solution to the SCL requirement.

For a worked example that shows how high and low inertia options might interact in the assessment, see Example 3.

### Availability

#### SCL

We are looking for options with an availability of over 90% for SCL. Unless there are a significant number of options which cannot meet this availability requirement, options with lower availability will not be considered in the assessment. However, if we cannot meet our SCL requirements using only options with >90% availability, or to do so is more expensive than our counterfactual costs, then we may consider reducing the availability requirement and bringing these less available options into the assessment.

#### Inertia

As detailed in the EOI slide pack and Heads of Terms, providers will be able to specify their availability for providing the inertia service. In the assessment, we will multiply the stated availability % by the amount of inertia provided and compare bids on this basis. For example, a unit providing 500MVA.s with 100% availability would be valued the same as a 1000MVA.s unit with 50% availability. Inertia contributions should be a single number, where the availability is the proportion of settlement periods for which your inertia will be at or above this level.

## Start Date

Contracts can start on any date between 1st April 2022 and 31st March 2024, with a fixed end date of 31st March 2030. The assessment will be comparing costs over an eight-year period, regardless of the actual length of the contract. This means that while an option connecting earlier will receive payments from an earlier date, we assess them on the same basis as an option connecting later.

The latest start date is driven by system needs, which is why we wish to procure options that can connect before this date. However, we will not fail an option at the EOI stage based on the connection date, allowing it to take part in the TO connections review. At this stage we will receive a better view of all options' start dates and may find it beneficial to select options which start later than 31st March 2024 if there are a limited number of options which can meet this start date.

When comparing options which connect before and after April 2024, we will include additional costs in those which connect after 31st March 2024 representing the cost of using the balancing mechanism to manage an amount of SCL and inertia equivalent to what that option provides. This will mean that those who connect 'on time' will perform better than those who do not meet the deadline in an otherwise equal bid, for example a connection in May 2024 would better than one in January 2025. Before April 2024, bids will not have any additional costs associated with them, such that an otherwise equal bid for connecting in March 2023 will perform equally to one connecting in March 2024. This does mean that a 'late' option may beat an 'on time' option in the case where the earlier option is more expensive than the sum of the late option's costs plus the cost to manage its contribution in the BM for the period from April 2024 to its connection date. This avoids a hard cut off whereby options connecting before April 2024 would win at any cost over those who connect even a week beyond the deadline, while encouraging delivery before April 2024 where possible.

## MW Export

This tender is open to solutions which are not 0MW, however if the provision of the service is dependent on exporting **additional** active power to what would usually be expected, we will make an adjustment for increased balancing costs in our assessment. For example, if additional capability is added to a gas generator, but providing this capability requires the generator to run when it would not normally be in merit, this would cause additional costs. A wind generator that adds capability will still only export active power when wind power is available and so its behaviour will not change.

To do this, we will estimate the costs to re-balance the system to accommodate the active power export using our market modelling tool (BID3), Future Energy Scenarios, and assumptions on alternative generation. If a proposed solution must export additional MW to provide the service, then we may need to turn off generation elsewhere to maintain a balanced system. In this case, the generation that can be turned off may be limited to units that are not also providing a service such as inertia or SCL, leading to higher balancing costs that if the action were taken for thermal reasons.

## Infrastructure Costs

When a user connects to the network, there are costs associated with assets for the new connection. Some of these will be connection assets where the cost is recovered from the connecting party through a connection charge. Others will be infrastructure assets, where the cost is socialised and recovered through TNUoS.

For solutions owned by TOs, the capital costs we receive will include the costs for assets which, for a user connection, would be infrastructure assets. Therefore, in order to more accurately reflect the cost to consumers of a particular solution and to ensure a fair comparison with TO costs, we will include infrastructure costs for new connections in the assessment.

The costs used will be provided as part of the connections review stage, or if a connection has a connection agreement then the costs in that agreement will be used. If the connection is not new, i.e. it already had TEC on the July 2019 TEC register, then the infrastructure costs of their connection will not be included. Costs from the connection review will be checked against the ESO's cost book to ensure accuracy, and we will also check that costs are consistent between connections. The costs we use will be specific to the location and connection type of each solution

We are aware that some providers may plan to use their connection for the provision of other services. It is not possible to portion the costs up and reduce the infrastructure cost the project is assessed on as this would require us to make a judgement on the viability of future projects. If in the future you use the same connection to provide another service to the ESO, we will not count the infrastructure cost again for the assessment of that service.

## Availability Price

Each option should have an availability price per settlement period which should be inclusive of all costs faced by the provider. It will not be possible to change or negotiate the price after the commercial tender period closes. Depending on the solution these may include:

- Cost to build the asset
- Ongoing operating and maintenance costs, including
  - Energy costs, including all relevant levies and charges, e.g. Final Consumption Levies, TNUoS, BSUoS
  - Connection charges, as faced by the user (i.e. not infrastructure asset costs, which are socialised and accounted for separately)

It should not include:

- Additional costs associated with reactive power utilisation, which will be covered by an ORPS payment.

## TO proposed options

Network Owners, i.e. Scottish Power (SPT) and Scottish Hydro Electric Transmission (SHET) for Scotland, will be invited to propose options for inclusion in this assessment via the regulated SRF route. Because of differences in how TOs are regulated, the way they recover their costs and the charges that apply to them, the methodology that applies will be different. We will aim to reflect the cost to the consumer of any option to allow for a fair comparison with commercial solutions.

The total cost of a TO option will be divided by the number of years it is present (out of the total eight years of this service) to compare with the costs per year of tendered options.

### Capital Cost and Operating and Maintenance Costs

TOs will provide us with a capital spend profile to build a given asset. We will calculate the present value of the cost to consumers for the asset, taking into account capital spend and the operating and maintenance costs for eight years and also the cost to consumer of losses. The capital spend will include the TO's weighted average cost of capital and their allowed rate of return. As TOs are not paid ORPS for reactive power, any costs associated with reactive utilisation should be included in the operating and maintenance costs. TO costs will be checked against the ESO's cost book for accuracy.

### Adjustment for Losses

The cost of energy losses from TO owned assets are passed onto consumers, not paid by the TO. However, commercial providers will have to pay for the energy their solutions use and are asked to build this cost into their bid. We will include an estimate of the cost of energy losses to consumers for TO solutions and add this onto a TO's assessment cost. TOs will provide details of their solution's energy consumption and using FES electricity price forecasts we will calculate an estimated cost for losses.

The four FES scenarios include different assumptions on the future price of energy, and consumers will be exposed to changes in this price. If we find that the solution is sensitive to the scenario used (i.e. that using the cheapest cost of energy leads to a TO option being selected, while the more expensive scenario does not) then we will perform a least-worst regrets analysis on the competing options. The tendered option's cost will remain the same in each scenario, while the TO's will differ with the energy price assumption. If choosing the TO in the most expensive energy scenario carries less regret than choosing the alternative in the least expensive energy scenario, the TO will be preferred. See Example 4.

## Further Notes on Assessment

Costs that are incurred across future years will be discounted back to a single year in line with the recommendations of the Treasury Green Book (i.e. a discounting rate of 3.5% for the first 30 years). Any spending by Transmission Owners, including infrastructure costs and any TO proposed solutions will be converted into a present value according to the Spackman methodology, using the TO's Weighted Average Cost of Capital.

Providers are allowed two weeks in which outages can be taken without an impact on their availability payments and availability performance figures (see Heads of Terms). We will not be costing outages in the assessment.

## BM Counterfactual Option

It is possible that a proportion of the SCL need at a given location could be met using generators present in the balancing mechanism. The cost of using the BM will vary with the location and the volume needed. Tendered options which do not provide a benefit above the cost of using the BM to provide the same level of capability will be discounted from the solution.

## Finding the Optimal Solution

We will use a linear optimisation tool to find the most cost-effective solution to our requirements. It will be set up to minimise cost, subject to meeting all eight SCL requirements and the inertia requirement, and constraints such as mutually exclusive options. Mutually exclusive constraints will be added based on the information in individual tender submissions, as well as to reflect any constraints that prevent multiple solutions from different providers from connecting. For example, if two options are proposed on the same piece of land, such that only one could be built.

Each option will have a set of eight effective SCL contributions, one for each node where we have set the requirement. They will also have an inertia contribution. Their cost will be the total present value over eight years (with options that start late having costs calculated as if they arrived in April 2022).

In addition to the options submitted by tender parties and TOs, there will be options that represent the cost of buying different amounts of SCL and inertia using balancing mechanism units. This may mean that the full requirement is not bought from the pathfinder solutions if the cost would be excessive and there are alternative actions we could take to meet the requirement.

| Option | Cost | SCL_1 | SCL_2 | SCL_3 | SCL_4 | SCL_5 | SCL_6 | SCL_7 | SCL_8 | Inertia |
|---|---|---|---|---|---|---|---|---|---|---|
| A | | | | | | | | | | |
| B | | | | | | | | | | |
| C | | | | | | | | | | |
| … | | | | | | | | | | |
| [Costs for BM actions] | | | | | | | | | | |

Once a solution is found, we will check that it is feasible technically, and that there are no interactions between the selected options. For example, if two options are proposed at the same site it may be necessary to check if there would be additional cost associated with connecting the second option.

## Re-evaluating the solution

Whilst we expect that all options proffered in the tender will progress to a signed contract if selected as part of the optimal solution, there may be circumstances in which an accepted option does not progress to contract as expected[2].

When communicating the results, we will make clear if any offer is linked to another party also signing their offer. There will be a period of 1-2 months (the exact length will be confirmed as part of the Tender Rules) after we make the offers for all parties to sign them. If any of the linked offers are not signed, we reserve the right to reconsider all the linked offers in this period. Once all the linked offers are signed, we will not remove any as a result of other unlinked offers failing to progress.

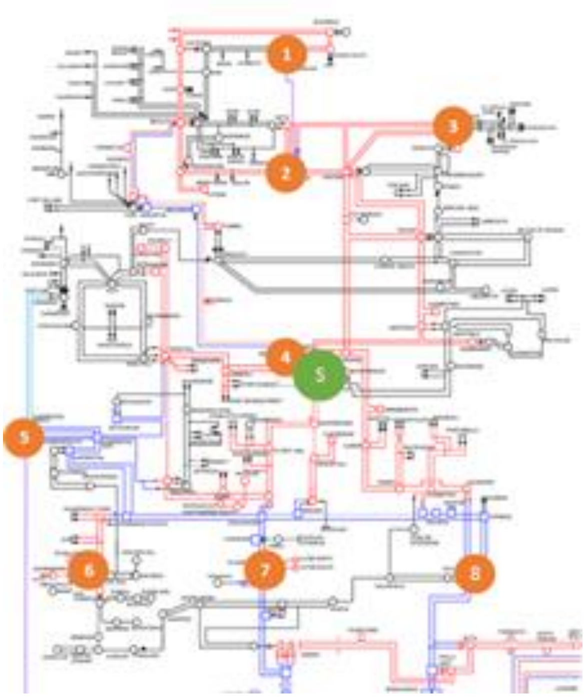
If we need to re-evaluate the solution after this period, or if offers which does not progress to signature are not linked to any others, then we may procure the most economic replacement(s) for the option(s) which have not progressed only, while keeping previously accepted options as part of the solution. The replacement(s) would be chosen from the previously unsuccessful tendered options (while tenders are still valid), or if managing the system need through the BM is more economic than procuring a replacement option, then we will not procure replacements. Selecting a replacement may lead to an overall less optimal solution than the original outcome and to over procuring against our requirements, but will prevent the other options with signed contracts from being 'knocked out' of the solution after they have committed to delivering.

[2] See Heads of Terms for details on our approach to assurance

# Examples

## 1. Calculating Effective MVA values for SCL requirements

Note: Numbers are illustrative in order to demonstrate the process. This example has been also been reproduced in excel form as part of the Effectiveness Figures (v3) spreadsheet.

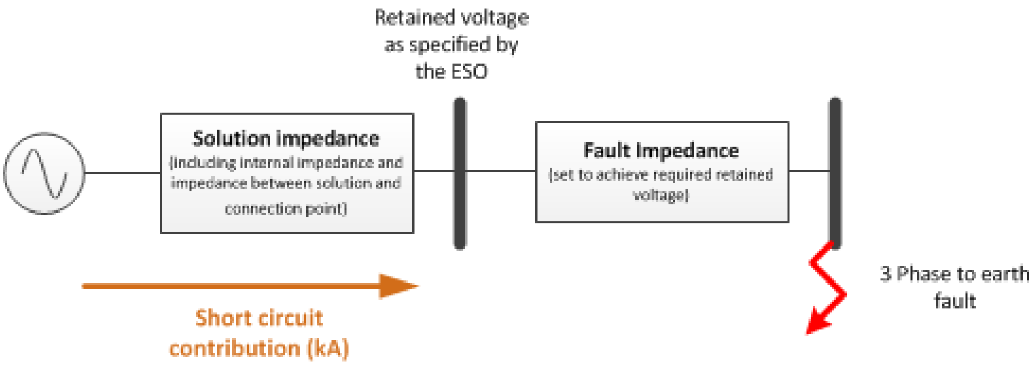


In the example a solution is proposed at Longannet 275kV substation. At the feasibility stage, the ESO will provide the retained voltage at Longannet 275kV substation for a fault at each of the 8 requirement nodes, as below:

| | Fault at: | Blackhillock | Eccles | Hunterston | Logannet | Peterhead | Spittal | Mark Hill | Moffatt |
|---|---|---|---|---|---|---|---|---|---|
| Retained voltage (P.U.) | Point of stability: Longannet 275kV | 0.9 | 0.3 | 0.7 | 0 | 0.5 | 0.6 | 0.3 | 0.3 |

Note: figures for illustration only

Using this data, providers will be expected to provide the fault contribution at their point of stability for a remote fault causing the given retained voltage. Further guidance on how to provide this is given in the feasibility study guidance.




The information returned by the provider is expected to look like:

| | Fault at: | Blackhillock | Eccles | Hunterston | Logannet | Peterhead | Spittal | Mark Hill | Moffatt |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SCL contribution (kA) | Point of stability: Longannet 275kV | 0.06 | 2.02 | 2.02 | 3.36 | 1.34 | 0.67 | 0.33 | 2.02 |

Note: figures for illustration only

To get the effective SCL the above numbers are multiplied by the published effectiveness values and converted into MVA using the equation:

$$S_n = \sqrt{3} V I_S E_n$$

Where;

$S_n$ is the effective SCL (in MVA) at point n, each of the eight nodes where the requirement is defined

V is the line voltage of the substation where the requirement is defined.

$I_s$ is the Short circuit current contribution from the solution

$E_n$ is the effectiveness factor of the solution from the solution's location to node n, the substation where the requirement is defined

The effectiveness factors for Longannet 275kV are:

| | Fault at: | Blackhillock | Eccles | Hunterston | Logannet | Peterhead | Spittal | Mark Hill | Moffatt |
|---|---|---|---|---|---|---|---|---|---|
| Effectiveness factor | Point of stability: Longannet 275kV | 12% | 13% | 23% | 100% | 15% | 2% | 13% | 23% |

Therefore, the effective MVA of the solution will be:

| | Fault at: | Blackhillock | Eccles | Hunterston | Logannet | Peterhead | Spittal | Mark Hill | Moffatt |
|---|---|---|---|---|---|---|---|---|---|
| Effective SCL (MVA) | Point of stability: Longannet 275kV | 5 | 182 | 322 | 1600 | 96 | 6 | 20 | 322 |

## 2. Submitting 'bundled' options

If a provider would like to offer a range of prices depending on the total size of a solution, i.e. to reflect incremental costs associated with adding extra capability, or savings associated with taking forward multiple options, the can do so through a series of mutually exclusive options.

Example: Provider A would like to offer a 100MVA option for £1 /SP and a 150 MVA option for £1.50 /SP. However, it is possible to build both and if so they can offer a discounted price for the combined solution of £2 / SP.

The best way to present this information is to submit three options with different prices, as below.

Option A1, 100 MVA, £1/SP

Option A2, 150 MVA, £1.50/SP

Option A3, 250MVA, £2/SP.

Options A1, A2, A3 are mutually exclusive.

## 3. Worked example on Inertia Options

This example aims to show how submitting both smaller and larger options for inertia is beneficial where the provider is able to offer a choice on the amount of inertia, and how options with lower levels of inertia may still be beneficial in the tender.

| | Cost | SCL_1 | SCL_2 | Inertia |
|---|---|---|---|---|
| A | 160 | 180 | 30 | 800 |
| B | 105 | 10 | 90 | 110 |
| C | 105 | 15 | 100 | 110 |
| D | 100 | 160 | 60 | 250 |
| E | 140 | 40 | 140 | 400 |
| E1 | 90 | 40 | 140 | 110 |

In this simplified example, we need 200 MVA of SCL at nodes 1 and 2, and 2000 MVA.s of inertia. Note that E1 is an option mutually exclusive to E, providing the same amount of SCL but lower inertia. The optimal solution is A + D + E1, costing £350.

If provider E had only submitted their higher inertia option E, the optimal solution would have been A+B+C, as this meets the SCL and inertia requirements at a lower cost than a solution involving E.

In this case, buying most of the inertia from larger providers and using cheaper, lower inertia, SCL providers proved to be the overall lowest cost option. In the pathfinder assessment, the additional cost of options with more inertia will also have to be competitive against using the BM.

## 4. Least Worst Regret Analysis

| | LW | CT | ST | SP | |
|---|---|---|---|---|---|
| Option A | 100 | 100 | 100 | 100 | |
| Option TO | 105 | 99 | 103 | 96 | |
| min cost | 100 | 99 | 100 | 96 | |
| Regrets | | | | | Worst Regret |
| Option A | 0 | 1 | 0 | 4 | 4 |
| Option TO | 5 | 0 | 3 | 0 | 5 |

The non-TO option is chosen.

| | LW | CT | ST | SP |
|---|---|---|---|---|
| Option A | 101 | 101 | 101 | 101 |
| Option TO | 104 | 98 | 102 | 95 |
| min cost | 101 | 98 | 101 | 96 |

| Regrets | | | | | Worst Regret |
|---|---|---|---|---|---|
| Option A | 0 | 3 | 0 | 6 | 6 |
| Option TO | 3 | 0 | 1 | 0 | 3 |

The TO option is chosen.