

Appendix 1 - Technical Requirements and Assessment Criteria

Executive summary

Each potential Electricity System Restoration (ESR) Service Provider will have a different impact on Great Britain (GB)'s restoration, depending on individual characteristics and network location. Detailed in this document are the required capabilities needed from ESR Service Providers, along with information about how these will be valued and how the tender will be assessed.

What's inside?

1. **Technical requirements** – These are the minimum requirements that a provider will need to be able to meet – a provider doesn't need to have all of these at the time of tendering, but during the feasibility and tender process they should ensure their tendered solution details how the provider intends to meet these.
2. **Assessment criteria** – The overall assessment will be weighted 50:50 (Commercial: Technical), this is because providers that meet the minimum criteria will provide an acceptable level of service, but we will still value technical capability that contributes to a faster restoration.

Caveat

This tender will again include Distributed ReStart¹ type projects that will be assessed alongside full transmission-led service provision. The technical requirements for this type of Distribution Restoration are as recommended by the Distributed ReStart project. However, at this stage without knowing the capability of potential applications and the possibility of a feasible Distribution Restoration Zone (DRZ), the final assessment criteria for these projects may change.

1. Technical requirements

1.1 Anchor Generator (Primary/Full) Restoration Service Providers

The Anchor Generator (Primary/Full) Service Provider must be able to meet the technical requirements at one point of connection.

Requirement	Minimum	Definition	Rationale
Time to Connect	≤ 2hours	Time taken to start-up the Restoration Station from shutdown without the use of external power supplies, and to energise part of the NETS, within two hours of receiving an instruction from the Electricity System Operator (ESO) or its delegate.	As per the Grid Code requirement (OC9.4.5.1) ² .
Or Phase 2 Time to Connect	2 - 24hours	Time taken to start-up the Restoration Station from shutdown without the use of external power supplies, and to energise	Primary Restoration Service Providers with the ability to re-start and contribute to Restoration.

¹ <https://www.nationalgrideso.com/future-energy/projects/distributed-restart>

² <https://www.nationalgrid.com/sites/default/files/documents/8589935287-OC9%20Contingency%20Planning.pdf>

Requirement	Minimum	Definition	Rationale
		part of the Network, within 2-24hours of receiving an instruction from the Electricity System Operator (ESO) or its delegate.	
Or Phase 3 Time to Connect	24 - 72hours	Time taken to start-up the Restoration Station from shutdown without the use of external power supplies, and to energise part of the Network, within 24-72hours of receiving an instruction from the Electricity System Operator (ESO) or its delegate.	Primary Restoration Service Providers with the ability to re-start and contribute to Restoration.
Service Availability	$\geq 80\%$	The ability to deliver the contracted Restoration Service over 80% of a year. Note: It is the responsibility of the Provider to demonstrate its service availability. By submitting a tender, the provider commits to ensuring availability at least 80% of each year of the service.	Primary Restoration Service Providers are expected to have a high restoration service availability so that they can be relied upon in the instance of a Total or Partial shutdown, which could happen at any time.
Voltage Regulation	Existent	Ability to create a voltage source and remain connected within acceptable limits during energisation/block loading ($\pm 10\%$).	During events such as load pick-ups, Primary RSPs will need to maintain voltage (within limits) when creating, maintaining, and expanding a power island following instructions from the ESO.
Frequency Regulation	Existent	Ability to manage frequency level when block loading (47.5Hz – 52Hz).	During a restoration event, a Primary RSP will need to maintain frequency within limits when creating, maintaining, and expanding a power island following instructions from the ESO.
Resilience of Supply, Restoration Service	≥ 10 hours	When instructed, the minimum time the RSP will deliver the contracted service.	To support restoration of the NETS.
Resilience of Supply, Restoration Auxiliary Unit(s)	≥ 72 hours	Run continuously at the output required to support / deliver the contracted restoration Service	The ESO or it's delegate would not instruct all Primary RSPs at the same time therefore this is to allow for Primary RSPs to remain ready and instruct able anytime within the resilience period.
Block Loading Size	≥ 10 MW	Capability to accept instantaneous loading of demand blocks.	The restoration approach for GB going forward will be a combination of top-down approach and bottom-up approach. The Primary RSP must be able to match the DNO's ability to segregate and switch the Distribution Network remotely.
Reactive Capability	≥ 50 MVA Leading	Ability to energise part of the NETS, managing Voltage with Leading or lagging capability whilst active power is zero.	Primary RSPs must be able to re-energise parts of the National Electricity Transmission System (NETS), with no load. The higher the reactive capability of a provider, the more quickly access to demand can be achieved.
Sequential Restoration attempts	≥ 3	Ability to perform at least three sequential start-ups.	To allow for possible tripping of the NETS during the re-instatement period, or trips during the Primary RSP's own starting sequence.

Requirement	Minimum	Definition	Rationale
Short-circuit level (SCL) (following the start of a system disturbance)	<p>For $t \leq 80\text{ms}$: $I \geq \frac{240 \text{ [MVA]}}{\sqrt{3} \cdot U} \text{ [kA]}$</p> <p>For $t > 80\text{ms}$: $I \geq \frac{100 \text{ [MVA]}}{\sqrt{3} \cdot U} \text{ [kA]}$</p> <p>$U \equiv$ connection voltage [kV]</p>	Injection of reactive current during a disturbance.	<p>The higher the SCL, the quicker Power Islands are developed.</p> <p>This requirement can be demonstrated from Fault Ride Through test evidence, or in the case of a synchronous generator, Grid Code DRC schedule1 modelling data being provided as an alternative.</p>
Inertia Value	$\geq 400 \text{ MVA.s}$	Stored energy available in the RSP for immediate release in response to changes in power levels and thereby helping to maintain frequency and voltage on the power island within acceptable bounds. (This can be real, physical inertia as in a rotating machine, or virtual inertia as in converter-connected resources with suitable control).	If more Inertia is provided, larger active power imbalances may be managed across re-energisation, enabling larger demand blocks and generation that is not synchronous to be restored earlier than would otherwise be possible.

1.2 Distributed ReStart Projects

1.2.1 Anchor Generators (Distributed ReStart)

Requirement	Minimum	Definition	Rationale
Time to Connect	$\leq 8\text{hours}$	Time taken to start-up the Restoration Station from shutdown without the use of external power supplies, and to energise part of the Network, within up to eight hours of receiving an instruction from the Electricity System Operator (ESO) or its delegate.	Primary Restoration Service Providers with the ability to re-start and contribute to Restoration.
Service Availability	$\geq 80\%$	<p>The ability to deliver the contracted Restoration Service over 80% of a year.</p> <p>Note: It is the responsibility of the Provider to demonstrate its service availability. By submitting a tender, the provider commits to ensuring availability at least 80% of each year of the service.</p>	Restoration Service Providers are expected to have a high restoration service availability so that they can be relied upon in the instance of a Total or Partial shutdown, which could happen at any time.
Voltage Regulation	Existent	Ability to create a voltage source and remain connected within acceptable limits during energisation/block loading ($\pm 10\%$).	During events such as load pick-ups, Primary RSPs will need to maintain voltage (within limits) when creating, maintaining, and expanding a power island following instructions from the ESO.
Frequency Regulation	Existent	Ability to manage frequency level when block loading (47.5Hz – 52Hz).	During a restoration event, a Primary RSP will need to maintain frequency within limits when creating, maintaining, and expanding a power island following instructions from the ESO.

Requirement	Minimum	Definition	Rationale
Resilience of Supply, Restoration Service	≥ 72 hours	When instructed, the minimum time the RSP will deliver the contracted service.	To support restoration relevant Distribution Restoration Zone.
Resilience of Supply, Restoration Auxiliary Unit(s)	≥ 120 hours	Run continuously at the output required to support / deliver the contracted restoration service.	The ESO or it's delegate would not instruct all RSPs at the same time therefore this is to allow for RSPs to remain ready and instruct able anytime within the resilience period.
Block Loading Size	≥ 2 MW	Capability to accept instantaneous loading of demand blocks.	The restoration approach for GB going forward will be a combination of top-down approach and bottom-up approach. The contracted RSP must be able to match the DNO's ability to segregate and switch the Distribution Network remotely.
Reactive Capability	Power factor of 0.95 lead/lag at Point of Connection	Ability to energise part of the NETS, managing Voltage with Leading or lagging capability whilst active power is zero.	Restoration Service Providers must be able to re-energise parts of the Electricity System with no load. The higher the reactive capability of a provider, the more quickly access to demand can be achieved.
Sequential Restoration attempts	≥ 3	Ability to perform at least three sequential start-ups.	To allow for possible tripping of the NETS during the re-instatement period, or trips during the Restoration Service Provider's own starting sequence.
Short-circuit level (SCL) (following the start of a system disturbance)	≥ 1 x Anchor's MVA Rating	Injection of reactive current during a disturbance.	<p>The higher the SCL, the quicker Power Islands are developed.</p> <p>This requirement can be demonstrated from Fault Ride Through test evidence, or in the case of a synchronous generator, Grid Code DRC schedule1 modelling data being provided as an alternative.</p>

Requirement	Minimum	Definition	Rationale
Inertia Value	<p>Linked to the Block Loading Capability:</p> <ul style="list-style-type: none"> - 2MW, ≥ 80 MVA.s - 3MW, ≥ 120 MVA.s - 4MW, ≥ 160 MVA.s - 5MW, ≥ 200 MVA.s - 6MW, ≥ 240 MVA.s - 7MW, ≥ 280 MVA.s - 8MW, ≥ 320 MVA.s - 9MW, ≥ 360 MVA.s - 10MW, ≥ 400 MVA.s - etc. 	<p>Stored energy available in the RSP for immediate release in response to changes in power levels and thereby helping to maintain frequency and voltage on the power island within acceptable bounds. (This can be real, physical inertia as in a rotating machine, or virtual inertia as in converter-connected resources with suitable control).</p>	<p>If more Inertia is provided, larger active power imbalances may be managed across re-energisation, enabling larger demand blocks and generation that is not synchronous to be restored earlier than would otherwise be possible.</p>
Earthing	<p>Will depend on the requirements of the network area for which services are being procured.</p>	<p>The Provider must have facilities suitable for safe and effective earthing consistent with their proposed role in the restoration process and the earthing design and facilities of the network to which they are connected.</p>	<p>Safe operation of the network and compliance with ESQCR is necessary. Please note that the exact earthing requirement will be known post tender following assessment of the RSP network area in conjunction with the DNO.</p>

1.2.2 Top-up Services (Distributed ReStart)

Requirement	Minimum	Definition	Comments
Resilience of Supply - Service delivery	≥ 72 hours	When instructed to start-up the service will be available for a minimum duration of 72 hours (exact capability to be declared).	
Service Availability	≥ 80 %	The ability to deliver the contracted service for 80 per cent of each year of the contracted period (exact availability to be declared).	
Fast MW control	<p><200ms provide available MW, sustained for at least 15 minutes with gradual reduction toward preferred operating position,</p> <p>and/or</p> <p><200ms provide available MW, sustained for at least 10 seconds with gradual reduction toward preferred operating position,</p> <p>and/or</p>	<p>Deliver rapid MW response triggered by a local frequency measurement or on receipt of an external control request (which will change the set point at an agreed ramp rate).</p> <p>For the mock tender this will be assessed in terms of the maximum MW change upwards and downwards that can be achieved within 200ms.</p>	<p>This response will support the anchor to maintain DRZ frequency in the event that the Anchor Generator alone cannot restore frequency within limits. As an example, this response could be required if a DER tripped, or if additional sub second MW support is required to energise demand.</p>

Requirement	Minimum	Definition	Comments
	<p>Active power output reduction in response to a change in system frequency above a certain value (value and required rate of reduction to be confirmed).</p> <hr/> <p>and/or</p> <hr/> <p>Active power output increase in response to a system frequency below a certain value (value and required rate of increase to be confirmed). This will only be required if output has been constrained below the maximum output power.</p>		
Inertia	There is no minimum requirement for individual generators/resources, but the service provider should state what inertia is available.	<p>The inertial response should be provided by an inherent response without any measurement delays.</p> <p>(For synthetic inertia refer to 'Fast MW Control'.)</p>	DRZ feasibility study to confirm what (if any) the inertia requirements will be (e.g. this may be required to increase the block load pick up capability within the DRZ).
Frequency Control	Provide frequency sensitive control of active power.	<p>Frequency control capability as defined in Engineering Recommendation G99.</p> <p>All frequency response requirements are applicable including LFSM-O, LFSM-U and FSM.</p>	This response will support the Anchor Generator to maintain the frequency within limits during normal operational.
Reactive Capability (Voltage Control)	<p>Provide continuous steady state control of the voltage at point of connection.</p> <p>Compliant with Engineering Recommendation G99 requirements on reactive capabilities.</p>	<p>Voltage control capability as defined in Engineering Recommendation G99.</p> <hr/> <p>As specified in G99 the voltage control should be provided with a droop characteristic.</p> <hr/> <p>The voltage setpoint should be adjustable by an external control system.</p> <hr/> <p>If voltage control cannot be provided, it may be acceptable to provide a MVar set point controlled by an external signal.</p> <hr/> <p>Ability to absorb MVar (leading power factor) to energise part of the network.</p>	<p>MVar leading and lagging values to be declared.</p> <p>The DER will support the Anchor Generator to maintain voltage within limits during events such as energisation of the distribution/transmission network and block loading.</p>
Short-Circuit Infeed	$\geq 1 \times \text{DER MVA rating (at } t \geq 1\text{s)}$	Injection of reactive current during a disturbance.	To increase DRZ fault level if Anchor Generator alone

Requirement	Minimum	Definition	Comments
		The maximum equivalent MVA short-circuit infeed that can be sustained as measured at the DNO point of connection for at least one second.	doesn't provide the DRZ minimum acceptable fault level.
Energy (MWh)	Generate or consume MW on instruction from an external control system, deliver within 10 seconds of request.	<p>During operation the DER will report the maximum and minimum range of MW output which can be delivered if requested.</p> <p>Average power output that can be maintained over a period of 120 hours.</p>	The DER will support the Anchor Generator to deliver MW to the DRZ and energise more demand.

1.3 Top-up Services

1.3.1 Mandatory Requirements

Requirement	Minimum	Definition	Rationale
Resilience	≥ 24h	<p>Ability to maintain a state of readiness that will enable the Restoration Service Provider, once external electrical supplies are re-established, to receive an instruction from the ESO and Start-Up in alignment with the expected behaviour under normal operating conditions.</p> <p><i>Example: external electrical supplies re-established to a given wind farm 36 hours into a partial or total shutdown.</i></p>	Increase likelihood of availability/readiness of generation to support Restoration.
Service Availability	≥ 80%	<p>The ability to deliver the contracted Restoration Service over 80% of a year.</p> <p>Note: It is the responsibility of the Provider to demonstrate its service availability. By submitting a tender, the provider commits to ensuring availability at least 80% of each year of the service.</p>	Aligned with Primary RSPs, Providers expected to have a high availability so that they can be relied upon in the instance of a Total or Partial shutdown, which could happen at any time.
Voltage Regulation	Existent	Ability to manage voltage and remain connected within acceptable limits during energisation/block loading.	Grid Code CC.6 / Grid Voltage Variations
Frequency Regulation	Existent	Ability to manage frequency and remain connected within acceptable limits during energisation/block loading.	Grid Code CC.6 / Grid Frequency Variations

1.3.2 At least one of the Requirements below

Requirement	Minimum	Definition	Rationale
Resilience of Supply, Restoration Service	≥ 10 hours	When instructed, the minimum time the RSP will deliver the contracted service.	To support restoration of the NETS.
Block Loading Size	≥ 10 MW	Capability to accept instantaneous loading of demand blocks.	The restoration approach for GB going forward will be a combination of top-down approach and bottom-up approach. The Primary RSP must be able to match the DNO's ability to segregate and switch the Distribution Network remotely.
Reactive Capability	≥ 50 MVAR Leading	Ability to energise part of the NETS, managing Voltage with Leading or lagging capability whilst active power is zero.	Primary RSPs must be able to re-energise parts of the National Electricity Transmission System (NETS), with no load. The higher the reactive capability of a provider, the more quickly access to demand can be achieved.
Short-circuit level (SCL) (following the start of a system disturbance)	<p>For $t \leq 80$ms: $I \geq \frac{240 \text{ [MVA]}}{\sqrt{3} \cdot U} \text{ [kA]}$</p> <p>For $t > 80$ms: $I \geq \frac{100 \text{ [MVA]}}{\sqrt{3} \cdot U} \text{ [kA]}$</p> <p>$U \equiv$ connection voltage [kV] voltage [kV]</p>	Injection of reactive current during a disturbance.	<p>The higher the SCL, the quicker Power Islands are developed.</p> <p>This requirement can be demonstrated from Fault Ride Through test evidence, or in the case of a synchronous generator, Grid Code DRC schedule1 modelling data being provided as an alternative.</p>
Inertia Value	≥ 400 MVA.s	Stored energy available in the RSP for immediate release in response to changes in power levels and thereby helping to maintain frequency and voltage on the power island within acceptable bounds. (This can be real, physical inertia as in a rotating machine, or virtual inertia as in converter-connected resources with suitable control).	If more Inertia is provided, larger active power imbalances may be managed across re-energisation, enabling larger demand blocks and generation that is not synchronous to be restored earlier than would otherwise be possible.

ESO

2. Type of Services to Procure

2.1 Anchor Generator (Primary/Full) Restoration Service Providers

A potential Anchor Generator (Primary/Full) Restoration Service Provider must be able to provide all of the minimum technical requirements listed above under the relevant section. The potential Anchor Generator (Primary/Full) Restoration Service Provider may achieve this through adaptations proposed in the Feasibility Study, or by contracting with other parties if they cannot meet all of the above themselves.

If a potential provider has a limitation on one of the technical requirements, but can meet the others, we will allow Expressions of Interest to be submitted, and where possible will assess whether a provider could contribute, but it will be entirely at the discretion of the ESO to confirm whether a provider not meeting all of the requirements will be eligible to participate.

2.2 Distributed ReStart Projects

As applicable, potential Anchor Generators and Top-up Services (Distributed ReStart) must be able to provide all of the minimum technical requirements listed above under the relevant section. The potential Providers may achieve this through adaptations proposed in the Feasibility Study, or by contracting with other parties if they cannot meet all of the above themselves.

If a potential provider has a limitation on one of the technical requirements, but can meet the others, we will allow Expressions of Interest to be submitted, and where possible will assess whether a provider could contribute, but it will be entirely at the discretion of the ESO to confirm whether a provider not meeting all of the requirements will be eligible to participate.

2.3 Top-up Services

A potential Provider of a Top-up Service for Restoration must be able to provide all the Mandatory Requirements (Resilience, Availability, Frequency Regulation and Voltage Regulation) and at least one of the others listed under the relevant section above. The potential Provider of a Top-up service for Restoration may achieve this through adaptations proposed in the Feasibility Study, or by contracting with other parties if they cannot meet all of the above themselves.

3. Assessment Criteria

We are proposing to assess the tender submissions in line with the assessment criteria outlined below. The technical elements have a range of sub-criteria that make up each element, and the rationale for these is also explained.

Commercial assessment will be based on cost per Settlement Period, based on 87648 SPs (based on a 5-year contract including one leap year), however, at tender submission, a full breakdown of all submitted costs will be required, and the ESO will reserve the right to employ a third party to verify and challenge the costs associated with designs.

Note that in the case of Distribution Restoration through Distributed ReStart type projects, the final evaluation will be based on the possibility of having a **feasible Distribution Restoration Zone (DRZ)** which requires one Anchor Generator and at least one Top-up service. As a result, if the DRZ is not possible in any given scenario, the Anchor Generator or Top-up service(s) will be assessed on their merit but may not get an award on account of the required combination for the DRZ.

We are unable to provide assessment criteria for DRZ because each DRZ is set up differently based on the potential bids from Anchor Generator and Top-up services, plus we need input from the DNO towards this, which is still in progress. We may be able to share this at the next ITT stages following evaluation of bids at EOI.

3.1 Anchor Generator (Primary/Full) Restoration Service Providers

Technical 50%	Minimum requirements	Pass/Fail
	Connection to Network	8%
	Time to Connect	5%
	Service Availability	10%
	Power Output	25%
	Block Loading Size	10%
	Resilience of Supply	20%
	Contribution to System Stability	12%
	Contribution to Restoration Time	10%
Commercial 50%	Total costs £/Settlement Period (87,648 SPs)	100%

3.2 Distributed ReStart – Anchor Generators

Technical 50%	Minimum requirements	Pass/Fail
	Connection to Network	5%
	Time to Connect	10%
	Service Availability	15%
	Power Output	20%
	Block Loading Size	10%
	Resilience of Supply	25%
	Contribution to Restoration Time	15%
Commercial 50%	Total costs £/Settlement Period (87,648 SPs)	100%

3.3 Distributed ReStart – Top-up Services

Technical 50%	Minimum requirements	Pass/Fail
Commercial 50%	Total costs £/Settlement Period (87,648 SPs)	100%

3.4 Top-up Services

Technical 50%	Minimum requirements	Pass/Fail
	Connection to Network	8%
	Resilience	20%
	Service Availability	10%
	Power Output	25%
	Block Loading Size	10%
	Resilience of Supply	15%
	Contribution to System Stability	12%
Commercial 50%	Total costs £/Settlement Period (87,648 SPs)	100%

3.5 Requirements

3.5.1 Connection to Network

The restoration under the current Restoration Strategy for GB follows a top-down approach: re-energisation of the NETS followed by restoration of demand. The point at, and way in, which a potential contracted provider is connected has an impact on the speed of restoration.

Transmission connected providers are able to progress with the energisation of the NETS without having to energise (part) of a Distribution Network first. This also simplifies the initial stages of restoration and allows for all of the reactive capability of those providers to be used in the expansion of the NETS.

Nonetheless and acknowledging increase in Distributed Energy Resources (DER), the ESO is now seeking to move from a top-down approach to a hybrid framework, combining top-down and bottom-up approaches in Restoration, hence the further relaxation on requirements and the new opportunity to contribute to Restoration from Distributed ReStart type projects.

Where a contracted Restoration Service Provider has more than one connection onto the Network, that increases the likelihood of availability of that specific Service Provider under a full or partial National Power Outage event.

Resilience is also affected by geographical locations, and diversification of technologies.

Anchor Generator (Primary/Full) Service Providers and Top-up Services

		Score (%)
Connection to the Network (8%)	Transmission Connected	2
	Distribution Connected	0
	Multiple connections to the Network	3
	Single connection to the Network	0
	Other contracted Service Provider(s) in the same Substation (if NO)	3

ESO

(Distributed Restart) Anchor Generators

		Score (%)
Connection to the Network (5%)	Multiple connections to the Network	5
	Single connection to the Network	0

3.5.2 Time to Connect

Contracted providers with the ability to self-start will have different challenges to Start-Up and will be able to contribute to Restoration at different stages.

Anchor Generator (Primary/Full) Service Providers

				Score (%)
Time to Connect (5%)	Phase 1	$0h < t \leq 2h$		5
	Phase 2	$2h < t \leq 24h$		2
	Phase 3	$24h < t \leq 72h$		1

Anchor Generators

				Score (%)
Time to Connect (10%)		$0h < t \leq 2h$		10
		$2h < t \leq 6h$		5
		$6h < t \leq 8h$		2

3.5.3 Service Availability

Contracted Restoration Service Providers are expected to have a high restoration service availability so that they can be relied upon in the instance of a Total or Partial shutdown, which could happen at any time.

Anchor Generator (Primary/Full) Service Providers and Top-up Services

				Score (%)
Service Availability (10%)		$80\% \leq SA < 85\%$		2
		$85\% \leq SA < 90\%$		6
		$SA \geq 90\%$		10

Anchor Generators

				Score (%)
Service Availability (15%)		$80\% \leq SA < 85\%$		3
		$85\% \leq SA < 90\%$		8
		$SA \geq 90\%$		15

3.5.4 Resilience – Top-up Services

Ability to maintain a state of readiness that will enable the Restoration Service Provider, once external electrical supplies are re-established, to receive an instruction from the ESO and Start-Up in alignment with the expected behaviour under normal operating conditions.

	Score (%)
Resilience (20%)	$24h \leq t < 48h$ 5
	$48h \leq t < 72h$ 10
	$72h \leq t < 96h$ 15
	$96h \leq t < 120h$ 20

3.5.5 Power Output

A higher active and reactive capability will support a faster restoration.

Anchor Generator (Primary/Full) Service Providers and Top-up Services

Reactive Capability (10%) (MVar > 0, MW = 0)	MVar	Score (%)
	$50 \leq RC < 100$	2
	$100 \leq RC < 150$	6
	$RC \geq 150$	10

Active Capability (15%)	MW	Score (%)
	≤ 100	2
	$100 < P \leq 200$	6
	$200 < P \leq 350$	10
	$P > 350$	15

(Distributed Restart) Anchor Generators

Active Capability (20%)	MW	Score (%)
	≤ 50	5
	$50 < P \leq 100$	10
	$100 < P \leq 150$	15
	$P > 150$	20

3.5.6 Block Loading

Blocks of bigger size will require less switching and will contribute to speed up Restoration.

Anchor Generator (Primary/Full) Service Providers and Top-up Services

	Score (%)
Block Loading Size (10%)	$10 \leq \text{BLS} < 15$ 2
	$15 \leq \text{BLS} < 20$ 6
	$\text{BLS} \geq 20$ 10

(Distributed Restart) Anchor Generators

	Score (%)
Block Loading Size (10%)	$2 \leq \text{BLS} < 10$ 2
	$10 \leq \text{BLS} < 20$ 6
	$\text{BLS} \geq 20$ 10

3.5.7 Resilience of Supply

After a shutdown the ESO will work to restore demand as quickly as possible. Returning to a normal system operation will not resume for a while after the event, so the ability of contracted Restoration Service Providers to contribute to different stages of Restoration will be valued.

Anchor Generator (Primary/Full) Service Providers and Top-up Services

Restoration Service at Contracted Output	Time (hours)	Score (%)
	$10 \leq t < 24$	2
	$24 \leq t < 72$	6
	$72 \leq t < 120$	10
	$t \geq 120$	15

Anchor Generator (Primary/Full) Service Providers

Electricity System Restoration Auxiliary Unit(s)	Time (hours)	Score (%)
	$72 \leq t < 120$	2
	$t \geq 120$	5

(Distributed ReStart) Anchor Generators

Restoration Service at Contracted Output	Time (hours)	Score (%)
	$72 \leq t < 96$	5
	$96 \leq t < 120$	10
	$t \geq 120$	15
Electricity System Restoration Auxiliary Unit(s)	$120 \leq t < 180$	5
	$t \geq 180$	10

3.5.8 Contribution to System Stability

Throughout restoration and particularly during block loading, contracted Restoration Service Providers will need to manage and be able to withstand larger frequency deviations than normal within their power island (47.5Hz – 52Hz). Providers that can contribute to inertia of the power island will reduce the risk of trips/restarts. Also, throughout restoration, the higher the Short-Circuit Level the more robustly voltage and voltage angle movement will be contained across larger network and load energisation, allowing a power island to be developed faster.

3.5.8.1 Short-Circuit Level

Anchor Generator (Primary/Full) Restoration Service Providers and Top-up Services

 $t \leq 80\text{ms}$ following the start of a system disturbance

kA	Score (%)
$I \geq \frac{240 [\text{MVA}]}{\sqrt{3} \cdot U}$	2
$I \geq \frac{360 [\text{MVA}]}{\sqrt{3} \cdot U}$	3
$I \geq \frac{480 [\text{MVA}]}{\sqrt{3} \cdot U}$	4

 $>80\text{ms}$ following the start of a system disturbance

kA	Score (%)
$I \geq \frac{100 [\text{MVA}]}{\sqrt{3} \cdot U}$	1
$I \geq \frac{150 [\text{MVA}]}{\sqrt{3} \cdot U}$	2
$I \geq \frac{200 [\text{MVA}]}{\sqrt{3} \cdot U}$	3

$U \equiv$ connection voltage [kV]

3.5.8.2 Contribution to Inertia

Anchor Generator (Primary/Full) Restoration Service Providers and Top-up Services

Inertia	MVA.s	Score (%)
	$400 \leq \text{Inertia} < 800$	1
	$800 \leq \text{Inertia} < 1200$	3
	$\text{Inertia} \geq 1200$	5

3.5.9 Contribution to Restoration Time

The ESO's plan, as defined under the current Strategy, is to achieve an average Restoration Time across the year of 24 hours to restore 60% of national demand. To assess that Restoration Time a model has been developed by the ESO (validated by BEIS and Ofgem) and is the tool used to monitor Restoration performance.

By end 2026, the ESO will be obligated to meet the future Electricity System Restoration Standard (ESRS) target to restore 60% of regional demand within 24 hours and 100% within 5 days.

The ESO is considering further developments in the model to accommodate individual contributions from contracted Service Providers to Zonal Restoration Times.

Anchor Generator (Primary/Full) Restoration Service Providers: 10%

(Distributed ReStart) Anchor Generators: 15%

Operational Metering Requirements

Frequency (Hz);

Voltage (kV);

Availability (Available/Unavailable);

Active Power Output (MW);

Reactive Power Output (MVar);

For Contracted Top Up Plant comprising wind turbines, wind speed forecasts and observations (ms-1) and wind direction forecasts and observations (degrees); and

For Contracted Top Up Plant comprising hydro-electric plant, the upper reservoir limits.

Next Steps

Please read all sections within this document, if you have any questions about any of the information provided please submit them using Appendix 4 – Query Form to commercial.operation@nationalgrideso.com marked 'Tender Query'.

The ITT1 stage closes on the **22nd April 2024**. All ITT1 submissions should be completed via the submission forms provided within the 'ITT1 Tender Documents' on the restoration webpage before the deadline. Failure to do so will result in a non compliant submission.