



Programme Area: Energy Storage and Distribution

Project: RSFCL

Title: Request for Proposal

Context:

This project's aims were to develop and demonstrate a resistive superconducting fault current limiter device (RSFCL), to reduce the impact of faults on electricity distribution networks.

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Request for Proposals (RfP)



Title of Services for which Proposals are Requested:

Development, Test and Demonstration of a Resistive Superconducting Fault Current Limiter

Request Issue Date:

8th January 2010

Deadline for Notification of Intention to Submit a Proposal:

18th January 2010

Bidder Engagement Workshop:

25th & 26th January 2010

Closing Date:

Proposals must be received before 5pm on 4th February 2010

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1. Introduction and Overview of the Services Required

1.1. Introduction to the Energy Technologies Institute

The Energy Technologies Institute LLP (the ETI) is a private organisation formed as an innovative Limited Liability Partnership between international industrial energy companies and the UK government.

Our mission is to accelerate the development, demonstration and eventual commercial deployment of a focused portfolio of energy technologies, which will increase energy efficiency, reduce greenhouse gas emissions and help achieve energy and climate change goals.

We will do this by leveraging the skills, capabilities and market access routes of our members, working with other organisations worldwide, to take the most challenging large-scale energy projects to full system demonstration, thus bridging the gulf between laboratory proven technologies and full scale commercially tested systems. Our projects will also develop knowledge, skills and supply-chains, and will inform the development of regulation, standards and policy. Hence we aim to overcome major barriers, de-risk the future development and shorten the lead times to market for secure, affordable, low-carbon energy systems for power, heat and transport.

Our portfolio includes programmes in areas such as Offshore Wind, Marine, Distributed Energy, Transport, Energy Storage & Distribution, Buildings and Carbon Capture & Storage.

Further information on the ETI, its members and its programmes can be found on our web-site at www.energytechnologies.co.uk

1.2. Background to the Project

1.2.1. Impact of System Fault Levels and Fault Current Management Technologies

One of the focus areas in the ETI's 'Energy Storage and Distribution' (ESD) programme is Fault Current Management (FCM).

Faults within electrical power systems are inevitable. Typical causes include equipment failure, external damage (e.g. trees falling onto overhead lines) and severe weather conditions (e.g. lightning strikes). Very high electrical currents can flow into the fault location, leading to high electrical, thermal and mechanical stresses on distribution system equipment. In general the more generators close to the fault location, the higher the fault current that will flow.

As more renewable energy sources are connected to the UK distribution system as Distributed Generation (DG), fault current levels increase. In locations where DG capacity exceeds local demand, the conventional 'top-down' system design may be modified by the introduction of additional interconnection, further increasing fault current levels.

To manage these increasing fault current levels, a number of 'passive' techniques can be deployed, typically being:

- the installation of higher-rated switchgear (where the fault current rating of existing switchgear would be exceeded) and/or other equipment such as cables, lines and transformers (where the transient current ratings of existing equipment would be exceeded),
- the connection of generation at higher voltages,
- the incorporation of modified power system components, such as high impedance transformers,
- the imposition of operational restrictions to limit fault current levels to manageable levels, such as the splitting of networks and their automated restoration.

These 'passive' techniques have the disadvantage of introducing considerable additional cost and can have a negative impact on operational complexity, power quality, power system stability, reliability and security of supply. A significant number of new DG projects do not proceed as a consequence, and fault current levels are becoming a major barrier to DG installation.

New 'active' Fault Current Limiter (FCL) technologies, involving devices which normally have a low impedance but which can increase impedance when fault current flows, have the potential to provide a more flexible and lower cost solution to this issue. However, these require accelerated further technology development and demonstration before being suitable for UK applications.

FCL technologies would also facilitate efficient network operation, reducing power losses by enabling more efficient interconnection, increasing flexibility in the configuration and operation of the network, and increasing capacity and security of supply.

1.2.2. Development, Demonstration and Deployment Opportunities through the ETI

Much research and development work has already been carried out on specific types of devices designed actively to manage distribution system fault current. However, no appropriate device has yet reached the stage of commercial demonstration.

To date, there has been evidence that the development and UK demonstration of these devices has been hampered by the simultaneous lack of market 'pull' (due to the absence of a proven device) and of manufacturer development 'push' (due to the absence of a definite market). The ETI is uniquely placed to overcome this 'chicken & egg' problem by bringing together device developers and Distribution Network Operators (DNOs) in high quality project partnerships, and by providing direct access for the device developers to demonstration sites on the distribution networks with genuine in-service application (something which has so far proved extremely difficult for most device developers to obtain).

The ETI's industrial and public-sector members bring invaluable skills and capabilities to these projects, including: systems integration expertise; knowledge and experience of FCL technology development; end-user deployment, performance assessment, future specification development and operational expertise of two DNOs; access to and influence with the organisations setting and carrying out UK policy, standards and regulation.

The ETI is commissioning FCM projects at sufficient scale, firstly, to stimulate a step-change 'push' in technology development & demonstration from the supply chain, and secondly to provide a substantial market 'pull'. These projects will thus accelerate the commercialisation and widespread deployment of the technology.

1.2.3. ETI Projects

The ETI is therefore commissioning two projects, each with a separate Request for Proposal (RfP). Each project will develop, test, demonstrate and evaluate the performance of one of the two leading FCL technology concepts, namely:

- a Resistive Superconducting Fault Current Limiter (RSFCL), and
- a Pre-saturated Core Fault Current Limiter (PCFCL).

(For clarity, the ETI is NOT seeking proposals for any other FCL technologies at this time).

Specific distribution substation sites have been selected for each demonstration project.

The ETI's highest priority for initial application of FCL technology is on the UK's electricity distribution networks at 11kV, with the objective of expanding the technology capability thereafter to be applied also at 33kV. Two specific applications will be demonstrated, one in each project, namely installation of a FCL:

- at a bus-section position on the switchboard, and
- at an incoming transformer (LV-side) position on the switchboard.

These two applications each have the advantage (over other possible applications) that they enable the interconnection of two or more networks.

If one or both technologies can be successfully developed and demonstrated to have the required performance, then these projects will provide invaluable sources of ongoing support and marketing references from key players in the UK market. Indeed, there is a very significant market opportunity and the potential to build new partnerships.

1.3. Outline Scope of the Project

This project covers the development, build, factory testing, type testing, and in-field network demonstration of a **Resistive Superconducting Fault Current Limiter (RSFCL) device**.

The first stage of the project comprises the development of the FCL, from the present state-of-the-art, addressing the development priorities identified in this RfP and building a device which can meet the specification detailed in this RfP, (both of which can be found in Section 3).

Once complete, the FCL will be factory tested and then type tested, before being installed and commissioned in a substation on the DNO's network.

The FCL device will be demonstrated for an initial period of 12 months operation, and dependent on the results this may be followed by a further 12 months of operation before decommissioning.

A specific UK distribution substation site has been selected for this demonstration, hosted by Central Networks. Data relating to operational performance and condition monitoring of the FCL on the network will be gathered and analysed by E.ON Engineering, supported by the FCL manufacturer.

A detailed description of the scope of work is included in Section 3.

1.4. Required Outcomes and Critical Success Factors for the Project

The key outcomes required from this project are:

- A RSFCL device developed and advanced from the present state-of-the-art to the point at which it meets the specifications required by the DNOs for genuine network application in the UK;
- A RSFCL device proven to operate and manage fault currents in an application representative of a large UK opportunity;
- Knowledge of the technical performance, cost, operational issues (including impact on existing switchgear, optimum operational control philosophy and any interactions between the FCL and the network protection or control systems), and commercialisation pathway (see Section 3.6) of the RSFCL device;
- A detailed understanding of the technical and operational issues and impacts of locating FCL devices at the bus-section position within UK distribution substations;
- A detailed understanding of the designs and methods for the installation of a FCL in the bus-section position and the particular challenges presented by this location, to inform future FCL design;
- A major contribution towards a draft IEC standard for the manufacture and testing of FCL devices, most likely derived from existing circuit breaker and other electrical equipment standards;
- Operating experience of a FCL in a real application for which design and operating guides would be produced;
- Understanding of the failure modes, degradation characteristics and reliability of the FCL device and its auxiliary systems, based on both thorough design analysis and operational experience, informing the development and refinement of servicing, maintenance, condition monitoring, prognostic and asset management methodologies;
- A detailed understanding of the range of achievable specifications, both at the time of device build and for the future; and
- IP generated and value delivered to the ETI, as discussed further in Section 4.1 of this RfP.

Critical Success Factors, which either characterise a successful Project outcome or which are required to facilitate a successful Project outcome, include the following. Any additional factors identified should be described in the Proposal.

- The FCL Device Developer must be able to demonstrate the credibility and ability firstly to develop, build and test the device for demonstration, and secondly then to further develop and commercialise the resultant device, including scale-up of manufacture (particularly of specialist components or materials). Respondents should address this in Section 3 of their Proposals.
- As a minimum, prototype devices (possibly at small scale or with limited performance) must have been successfully tested in a laboratory environment, resulting in a Technology Readiness Level (see Glossary) of approximately TRL4. Academic theory without the actual construction and testing of industrial devices is not sufficient. Respondents should state in their proposals the TRL of their devices and include justification evidence for this assessment.
- All the key outcomes listed above must be achieved.
- A significant step-change improvement must be demonstrated in achievement of the priority development areas identified in Section 3 of this RfP.
- The demonstration must clearly prove that a tangible solution to the management of fault currents in the defined application has been developed, its performance understood, and a commercialisation pathway defined, so that commercialisation activities can be commenced.

1.5. Anticipated Project Organisation Structure

Respondents to this RfP should be organisations which can deliver FCL Device Developer's scope, namely the development, build, factory testing, type testing, and manufacturer support to the in-field network demonstration, of a Fault Current Limiter device as specified herein. The scope of each Respondent's Proposal should be limited to these activities, excluding in particular the scope and associated costs for the DNO activities. This will enable the ETI to select an FCL Device Developer.

The selected FCL Device Developer's proposal will then be integrated with those of the other project participants (namely E.ON Engineering Ltd and Central Networks East plc) to form an integrated project.

The Participants will form a Consortium, governed by a Consortium Agreement drawn up by the Participants (and approved by the ETI). The Consortium Agreement will govern how the Participants collectively deliver the Project, and for example will include issues such as: warranties and liabilities between the FCL Device Developer and the DNO; conditions for the DNO's acceptance of the tested FCL prior to site installation; etc.

The Consortium will enter into a Project Contract with the ETI (which will be drawn up by the ETI in consultation with the Participants) to deliver the integrated Project scope.

The Consortium will be led by a 'Lead Coordinator' to provide overall project management of the Project and to act as primary interface with the ETI. This Lead Coordinator will be E.ON Engineering Ltd. The Lead Coordinator will appoint a Project Manager to lead and coordinate all activities of the Project Participants, and to liaise regularly with the ETI's Programme Manager to whom he/she is accountable on behalf of the Participants. Within the consortium each Participant will be accountable to the Lead Coordinator for the management and delivery of their own activities.

The demonstration site will be hosted by Central Networks East plc, who will be a party to the Consortium. They will manage the site activities, supported by the FCL Device Developer, and will accept (or reject) the tested device as having suitable performance and demonstrated safety to be installed on their network for the purposes of the Project.

The analysis of performance and condition monitoring data will be carried out by E.ON Engineering Ltd, supported by the FCL Device Developer.

If the FCL Device Developer considers that it adds significant value to their team, they may choose to subcontract additional organisations (e.g. an academic institution) in order to provide all the necessary knowledge, skills, experience and inputs to complete the Project (as detailed in Section

2.2). In the event that a large scope of work is to be carried out by such an organisation then they may even be another party to the Consortium, rather than being sub-contracted. However, for the avoidance of doubt, the inclusion of any academic institution or small / medium sized enterprise, of itself, is not a criterion used by the ETI in its selection.

2. Request for Proposals Process and Terms

2.1. Content and Format of Proposals

Any interested FCL Device Developer (“Respondent”) is requested to submit a Proposal which shall be arranged according to the structure detailed in Appendix A and shall include all the information listed therein.

The Proposal must be written in a succinct manner and must not include imprecise statements, generalities or repeated information. The Proposal must be easily readable with appropriate font sizes, margins, etc, and **shall not exceed a maximum of 30 pages** (excluding the due-diligence information required under Section 12 of Appendix A and any other information explicitly stated in Appendix A to be exempt from this limit).

Additional information (such as organisational brochures, etc) may be provided to accompany the Proposal if this is expected to add value (although it is not necessarily required by the ETI), but such additional information will not usually be taken into account when reviewing Proposals.

The Proposal shall consist of **three (3) complete hard copies and one (1) complete electronic copy**. The latter shall be provided in both PDF and Microsoft Word formats.

2.2. Acceptance, Review and Selection of Proposals

Proposals will be reviewed and judged primarily against the criteria listed below.

- Completeness of information content, structure and quality of Proposal (against areas listed in Appendix A)
- Extent of proposed advancement of the priority development areas identified in Section 3.3 of this RfP, compliance with technical specification (i.e. Sections 1.3, 1.4 and 3 of this RfP), and of any shortfalls or proposed performance exceeding specification
- Knowledge, skills and experience, which must include ALL of the following criteria:
 - (a) Generic Criteria:
 - Availability and stability of deployable resources to mobilise sufficiently rapidly and for sufficient durations
 - Record and ability in quality, timely and on-budget delivery (of technology development programmes) to the full satisfaction of their main stakeholders
 - Knowledge and previous experience of the electrical equipment engineering and electricity supply industries, environment, technologies, etc
 - Ability and experience in collaborative working
 - Project management expertise, specifically for complex equipment development and demonstration projects
 - Health, Safety and Environmental (HSE) management expertise, specifically for complex equipment development, manufacture, test, site installation, commissioning, operation and maintenance activities
 - (b) Specific Technical Criteria:
 - Track record of FCL device development, including existing device TRL and status; Refer to Critical Success Factors in Section 1.4.
 - Understanding and technical capability in respect of relevant electrical equipment, the underlying physics, engineering and technologies, and particularly superconductivity
 - Understanding and technical capability in respect of the FCL’s auxiliary systems, including where applicable cryogenics, and control and protection systems
 - Capability in the integration of complex systems (e.g. devices and their auxiliary systems) to form safe, reliable, holistically-engineered solutions
 - Degree of interaction with electricity utilities, background in utility industry, understanding of market and applications
 - Supply chain history, capability and capacity, including expansion potential as appropriate, to supply and support FCL devices in future to the UK market, and associated commercialisation plans

- Expertise in protection and control of both the device and the network (application understanding)
- Project approach and plan, including proposed management of specific risks and issues, approach to overcoming technical barriers to development and commercialisation, Gantt chart and suitable payment milestones (if appropriate)
- Compliance with terms and conditions, including any intellectual property issues (such as acceptance of ETI IP terms, or the existence of any IP issues which may affect the ability to carry out the Project and exploit the results)
- Value proposition to the ETI and Respondent's business model requirements (as discussed in Section 4 of the RfP)

The ETI at its discretion may request further information in order to assess a Proposal, and may reject any Proposal which does not provide sufficient information.

This RfP is not an agreement to purchase goods or services, and the ETI is not bound to enter into a Contract with any Respondent. All decisions made by the ETI relating to the acceptance, review and selection or otherwise of Proposals are final. The ETI will be under no obligation to explain or justify any such decisions at any time.

2.3. Estimated Time-Frames

Respondents shall notify the ETI of their intention to submit a proposal. This notification shall be in writing to the Address for Submission of Proposals, no later than the Deadline, all as listed on the front cover of this RfP.

The ETI will then invite all those who have notified such intention to a Bidder Engagement Workshop, as described in Section 2.4 below.

The following timetable outlines the anticipated schedule for the contract process. The timing and the sequence of events resulting from this Request for Proposals may vary and shall ultimately be determined by the ETI.

Event	Anticipated Date(s)
Deadline for Notification of Intention to Submit a Proposal	18 th January 2010
Bidder Engagement Workshop	25 th & 26 th January 2010
Closing Date for Responses to RfP	4 th February 2010
Clarification Meetings (as required)	between 17 th Feb and 2 nd March 2010
Preferred Bidder Identified	22 nd March 2010
Project Detailing and Contract Agreement	from 22 nd March 2010
Contract Approval	May 2010
Project Start	1 st June 2010
Project Duration	Approx 4 years (TBD)

2.4. Bidder Engagement Workshop

All bidders must register their intention to submit a proposal, prior to the deadline in Section 2.3 above. The ETI will then invite all those who have so registered to a Bidder Engagement Workshop.

The purpose of this workshop is:

- to ensure that all bidders (and their teams) fully understand the project's requirements as described in this RfP, and
- to enable all bidders to explore the key technical and commercial aspects of their Proposal with the ETI and with the other parties in the project.

The day will comprise sessions for each bid team individually to talk with the ETI and the other project partners (identified in Section 1.5). There will also be opportunity during the day for each bid team to further develop their proposal, before a second session with the ETI later in the day at which the bid team will be expected to present an outline of the key points of their intended proposal.

The event will include discussion on:

- the project's purpose, scope, required outcomes and deliverables,
- the technical specification for the FCL device and application, including achievable values of certain parameters and optimum values for this project,
- ownership of arising IP and value proposition to the ETI,
- contract structures and terms,
- aspects of working with the ETI – such as project governance & reporting (including financial management & reporting), etc.

2.5. Ownership of Proposals and Confidentiality of Information

All documents, including Proposals, submitted to the ETI become the property of the ETI. They will be received and held in confidence by the ETI, subject to the ETI reserving the right to provide such documents to third parties engaged by the ETI in its assessment of them. Organisations selected by the ETI to be taken forward to the Project Detailing Stage will be required to sign non-disclosure agreements.

3. Specification of Project Scope of Work, Fault Current Limiter and Deliverables

The background to the project is described in Section 1.2 of this RfP; the scope is summarised in Section 1.3; and the required outcomes and critical success factors are listed in Section 1.4. This Section 3 now describes the scope in more detail.

3.1. Project Scope

This project covers the development, build, factory testing, type testing, and in-field network demonstration of a **Resistive Superconducting Fault Current Limiter (RSFCL)** at a **bus-section position** on the switchboard.

The anticipated project timescales are listed in Section 3.2 below.

Stage 1: FCL Device Development and Build

The first stage of the project comprises the development of the FCL, from the present state-of-the-art, addressing the development priorities identified in Section 3.3 and building a prototype device for demonstration purposes which can meet the specification detailed in Section 3.5.

During this stage the commercialisation pathway shall also be defined. This shall identify further technical developments required, manufacturing improvements and manufacturing scale-up, commercial developments required, prioritised market applications to be addressed, etc, with clear timelines for each aspect. This may be updated later in the project based on test and demonstration results.

Stage 2: Factory and Type Testing

The second stage of the project comprises the testing of this device, firstly in the factory to verify design and manufacture, and then in a certified third-party testing laboratory to carry out type tests, verify its performance, safety and fitness for purpose to the full satisfaction of Central Networks, E.ON Engineering and the ETI.

Stage 3: Installation and Commissioning

The third stage of the project, led by the DNO and supported by the FCL Device Developer, comprises the installation and commissioning of the device in a substation on the DNO's network, after it has been type tested to the satisfaction of the DNO. This installation and commissioning will be led by the DNO with support from the FCL Device Developer. Design, planning and preparatory site work should be carried out during Stages 1 & 2, to enable installation to commence immediately following type testing.

Stages 4 and 5: Demonstration on the Network

The fourth stage of the project, led by the DNO and supported by the FCL Device Developer, comprises the demonstration of the device on the DNO's network. The FCL device will be operated for an initial period of 12 months to assess its performance.

A fifth stage, comprising a further 12 months of operation, may be carried out dependent on the results from the first phase. This will provide the opportunity to resolve any early settling-in difficulties after commissioning, before acquiring settled reliability data and maintenance experience, as well as subjecting the FCL to further network faults.

A specific UK distribution substation site has been selected for this demonstration, hosted by Central Networks. Data relating to operational performance and condition monitoring of the FCL on the network will be gathered and analysed by E.ON Engineering and the FCL Device Developer.

Stage 6: Decommissioning and Concluding Activities

Finally, the sixth stage of the project comprises the decommissioning of the demonstration, removal of the FCL device, post-demonstration testing and examination, site restoration and project concluding activities.

Stage Gates

Project Stage Gates will be held, as a minimum, at the end of each of the above Stages. Additional Stage Gates may be proposed by the Respondents or by the ETI, and additional Stage Gates may be called by the ETI during the project if appropriate.

Project Management

The overall project will be managed within the Consortium by the Lead Coordinator. However, each Participant is responsible for the day-to-day management of their own scope, including scheduling, resourcing, reporting to the Lead Coordinator, risk management, and the definition and operation of Health, Safety and Environment management systems.

Data Management and Analysis

The FCL Device Developer, supported by E.ON Engineering, shall retrieve operational and condition data from the unit's data logger, analyse the data and report the unit's performance, condition, prognosis and other relevant factors. E.ON Engineering will collect and analyse electrical performance data from the demonstration site and surrounding network. The FCL Device Developer shall provide all data and analysis to E.ON Engineering and to the ETI, and shall regularly review it with them to ensure that all parties have confidence in the conclusions. Central Networks will provide support in establishing site communications.

3.2. Anticipated Project Timescales

The anticipated duration of each stage of the project is listed in the table below. However, the durations of the early stages in particular are highly dependent on the Respondents' Proposals.

Stage	Anticipated Timescales
Project Start	1 st June 2010
Stage 1: Development and Build of Device	To be advised by Respondents in their Proposals
Stage 2: Testing (Factory and Type Testing)	1 month Factory Testing, plus 3 months Type Testing
Stage 3: Site Installation and Commissioning	4 months
Stage 4: Demonstration of Performance on a Distribution Network	12 months
Stage 5: Further Demonstration of Performance on a Distribution Network (as required)	12 months
Stage 6: Decommissioning and Concluding Activities	3 months

3.3. FCL Device Development Priorities

High priority areas for development of RSFCL devices beyond the present state-of-the-art are as follows:

- Technology Readiness Level (TRL), (presently judged to be TRL 3-4), to be enhanced through development, test and demonstration
- Voltage and load current rating improvement (focusing on achieving 10 - 35kV and 1 - 2.5kA, with potential extension to 10kA)
- Full load recovery time to be reduced or eliminated, i.e. the capability to resume normal operation immediately whilst carrying full load current without interruption, (obviating the need to open the circuit or to operate temporarily without FCL protection)
- Material development specifically targeting cost reduction
- Limitation, so far as practicable, of the increase in the DC (aperiodic) component of AC fault current
- Mitigation of any 'transition' stresses, whether electrical, mechanical, thermal or otherwise, resulting from transitions between superconducting and non-superconducting states
- Failure modes to be better understood, including any effects of duty cycle or other factors on lifetime and degradation characteristics
- Reliability / availability improvement and validation through test / demonstration
- Unit cost to be improved and route to commercialisation developed

Medium priority areas for development of RSFCL devices beyond the present state-of-the-art are as follows:

- Improvement in fault current limitation performance
- Size and weight reduction
- System complexity reduction
- Service / maintenance requirements to be developed and improved
- DfX (design for manufacture, assembly, operation, maintenance, disposal, etc)

Consideration should also be given to consultation with one or more switchgear and/or transformer manufacturers to assist, firstly the development of the installation design for this demonstration in the short-term, and secondly the development of the optimum installation design and possible integration into the switchboard and/or transformer for each of the bus-section and transformer infeed applications in the long-term as part of the commercialisation pathway. This long-term design is not required to be completed during this project, but informed views of the optimum approaches are required to be included in the commercialisation pathway definition.

Additionally, the following areas are anticipated for further development as part of the commercialisation activity:

- Extension to 33kV applications
- Reliability and availability to be increased to match those of a typical 33/11 kV power transformer
- Service life to be increased to 40 years and 1000 fault operations
- Unit capital costs (including installation) to be competitive in the long term with typical capital cost of switchgear replacement, targeting \leq £500k for 11kV applications
- Through-life cost to be minimised
- Reduction in cost of switchgear required to connect the FCL to the network, e.g. by replacing in-line and/or bypass circuit breakers with isolators in some cases (refer to Section 3.5.1 describing scope)

3.4. Host Demonstration Site

A specific UK distribution substation site has been selected for this demonstration, hosted by Central Networks East. This is located in Loughborough, Leicestershire. The site is equipped with existing 11kV switchgear, and there is space close to the switchgear for the outdoor installation of the FCL within the site perimeter.

Loughborough town is partly fed by a two-section switchboard. Due to fault current limitations the site is run with an open bus-section. It is proposed to install the FCL in series with the bus-section breaker to enable the switchboard to be run solid.

This site has been selected to provide appropriate exposure to faults, whilst limiting the risk to the distribution system in the event of a failure of the FCL. However, the ETI and DNO reserve the right to change the demonstration site at their discretion, should the need arise.

3.5. FCL Device Specification

3.5.1. FCL Scope

The scope of the FCL shall include but not be limited to:

- The main FCL device
- If applicable, auxiliary systems for coolant storage, circulation, re-cooling and processing
- FCL device and/or auxiliary/ancillary system protection and control systems
- Instrumentation and data logging equipment, for which specifications will be agreed with the ETI and project participants
- Skid and/or pre-fabricated enclosure for the device and all auxiliary systems, suitable for rapid installation onto a prepared concrete base
- Input and output power connections, with bushing spec to be agreed and bolted securing arrangements for separable connectors
- Provision for an earth connection to the substation earthing system, to enable safe device maintenance once isolated from the network

The scope of the FCL shall exclude the following items which will be provided by others:

- Foundations at the demonstration site and foundation bolts
- Switchgear at the demonstration site
- In-line breaker on each side of FCL
- Bypass breaker parallel with FCL
- Cabling between FCL and switchgear
- Remote communications equipment

3.5.2. FCL Functional Requirements

The key functional parameters for the FCL device are specified in the table below. These are based primarily on the specific requirements of the host demonstration site. Further details will be agreed as appropriate during the project shaping and contract formulation activities, after selection of the preferred bidder.

The specified parameters should be discussed with the ETI and DNOs at the Bidder Engagement Workshop (refer to Section 2.4 of this RfP), in order to optimise the device specification. This will enable the Respondents to discuss with the ETI the relative ease / difficulty of achieving the specified values.

The ETI need to understand better what is achievable, and it may be possible to agree less onerous values for a limited number of parameters, provided that there is a clear route to the achievement of these values in the future (although this will require justification and prior agreement). Equally, it may be advantageous for a Respondent to be able to achieve more onerous values for certain parameters than are strictly necessary for the particular demonstration site to be used for this project, in order to demonstrate the FCL's suitability for a greater range of applications for the future. For example, the lowest achievable ratio between the maximum limited current and the maximum unlimited current may be a key factor in determining the range of applicability of the device.

The ETI require the development of technologies / devices which can be applied in a wide range of applications, not just a one-off demonstration unit, (although the demonstration device itself does not necessarily have to achieve everything in this first step). This potential for wide market application of the demonstrated device and/or subsequent devices will be a discriminating factor in the selection of the preferred bidder, leading to future partnership opportunities.

FCL Functional Requirements	
Item	Rating
Number of transformer in-feeds to switchboard	2
Nominal operational voltage and frequency	11kV, 50Hz
Insulation requirements	Rated voltage: 12kV Lightning impulse withstand voltage: 95kV
Maximum load current under normal (un-faulted) operating conditions	1250A
Existing switchgear ratings	Peak: 33.4kA Symmetrical rms: 13.1kA Short term fault duration: 3 secs Asymmetrical break rms: 16.4kA (%dc not available for this old gear)
Total site fault current without the limiter in service	Initial Peak: 42.6kA Symmetrical rms: 14.4kA X/R: 13.8
Total site fault current with the limiter in service	Initial Peak: 80% of switchgear rating (= 26.7kA) Symmetrical rms: 80% of switchgear rating (= 10.5kA) Max Asymmetrical Break: within 80% of switchgear capability (above)
Maximum fault current through each transformer without the limiter in service	Initial Peak: 19.5kA Symmetrical rms: 7.1kA
“Initiating” current (at which current limiting is triggered) – Respondent to advise operating tolerance such that FCL must never trigger below min of range and must always trigger above max of range	2.83kA (= 2kA rms = 1.6 x 1250A i.e. 1.6 x max load current under normal operating conditions)
Maximum “Limited” fault current through the transformer on the un-faulted side of the board	Initial Peak: 7.2kA Symmetrical rms: 3.5kA
Minimum “Limited” fault current through the transformer on the un-faulted side of the board (let-through to enable protection to operate correctly)	Initial Peak: n/a Symmetrical rms: 3.0kA
Calculated reduction in fault current through the transformer on the un-faulted side of the board	~50%
Prospective short-time current (to equal switchgear rating)	Symmetrical rms: 13.1kA Device shall be tested with the maximum current which could be developed under any excitation condition
Maximum duration of fault current	3 secs
Maximum acceptable device reactance in normal (un-faulted) operation with maximum normal load current	5% (100MVA base)

Maximum acceptable device resistance in normal (un-faulted) operation with maximum normal load current	0.2% (100MVA base)
Full load recovery time (from “limited” current)	Target Zero Max 3 mins
Applicable standards	IEC 60076-6 IEC 60529 EN 50181
Reliability and Availability (after completion of commissioning)	Reliability: 98% Availability: 95%
Service life	Min 5 years Min 100 fault operations
Environmental considerations (e.g. indoor or outdoor location) and Ingress Protection	Outdoor, with normal service conditions per IEC 60076-1 Minimum IP 55
Max sound power level when carrying rated load current	63 dBA
Sound power level when carrying fault current	Manufacturer to advise
Device protection	To be agreed

In their Proposal, the Respondent should indicate the anticipated size and weight of the complete FCL (including all items in the scope) and any installation constraints, required lay-down areas, recommended access exclusion zones or containment measures (whether for electromagnetic fields, fluids, blasts, noise or other factors, whether arising from the FCL device or auxiliaries).

The Respondent should therefore detail in their Proposal the range of values, for each specified parameter and development priority, which they believe to be achievable (a) for this demonstration unit and (b) for any follow-on unit resulting from further development and commercialisation activities. The range of applications to which each of these units could be deployed should be stated, relating each application to these parameters. This should be supported with evidence giving credibility to the claims of anticipated values achievable, including results achieved to date and clear justification as to why and how these could be extended.

3.6. Deliverables

The required Outcomes and Critical Success Factors for the Project are listed in Section 1.4.

A detailed list of specific deliverables will be developed during project shaping and contract formulation. However, at a high level, the key deliverables are anticipated to be:

- Design information including specifications, drawings, performance analysis (supporting anticipated performance of the demonstration unit and the subsequent performance extension capability), FMECA (Failure Modes, Effects & Criticality Analysis), etc. This should be assessed by the Project Participants, the ETI and others it may nominate at a Design Review during Stage 1.
- The FCL device as specified in Section 3.5.
- Test reports (FAT, type, site commissioning).
- Operational performance reports (during site operation, post-fault inspection & test, post-decommissioning inspection & test), accompanied by the raw data files and including all analysis, supported by additional data management and analysis carried out by E.ON Engineering.
- Report of observed failure modes, degradation characteristics and reliability of the FCL device and its auxiliary systems, with updated analysis, accompanied by the raw data files.

- Servicing, maintenance, condition monitoring, prognostic and asset management methodologies.
- Detailed definition of the Commercialisation Pathway, including details of the range of potential applications which could be met by the demonstrated performance, and details of the possible integration into the switchgear and/or transformer.
- Report detailing appropriate content for a draft IEC standard for the manufacture and testing of FCL devices (most likely derived from existing circuit breaker and other electrical equipment standards).
- Monthly progress and financial data provided to the Lead Coordinator for reporting to the ETI.
- Risk assessments and other HSE reports as appropriate at each stage of the project.

3.7. Exclusions

The following are excluded from the scope of this Request for Proposals:

- Design and management of the host site, including preparatory work (at the site or elsewhere on the distribution network) to modify switchgear, install cabling, foundations, etc; installation, commissioning, day-to-day operation and decommissioning of the FCL (although on-site support from the FCL Device Developer is included in the scope).
- Analysis of the impact of altered waveforms (resulting from FCL operation) on existing switchgear (operation, arc calculations, etc).
- Project Management of the overall integrated Project (although day-to-day project management of the Device Developer's scope as defined in this RfP is included in the scope).

4. Value Proposition, Price and Payment

4.1. Value Proposition

The ETI, host DNO and E.ON Engineering are offering a unique opportunity for the FCL Device Developer to demonstrate a device on the network, supported by all the benefits and opportunities described in Sections 1.2.2 and 1.2.3.

The ETI wish to achieve substantial value in return, and the Respondent should therefore clearly describe and quantify in their proposal the specific elements of the value proposition which they are offering to the ETI, its members and the host DNO.

This value proposition and the needs of the Respondent's business model should be discussed with the ETI at the Bidder Engagement Workshop prior to submitting a Proposal; (refer to Section 2.4).

The commercial credibility and value proposition of the Proposal, in addition to its technical content, are key deciding factors for the ETI in judging the Proposal. The proposal should therefore be specific and detailed. Factors to be considered will include:

- The value of resources contributed by the FCL Device Developer, including expertise, labour, materials, etc;
- The level of funding sought from the ETI (and particularly this level relative to the Developer's contribution);
- The potential for royalties to the ETI from future unit sales, following this development and demonstration project;
- The basis for access to future units (such as preferential access to manufacturing slots and/or guaranteed delivery times, preferential unit prices, preferential operational support packages, etc);
- Other value mechanisms to be proposed by the Respondent, including any Intellectual Property Rights, etc.

4.2. Price and Payment

Any funding to be paid by the ETI for this Project will be paid on a **“capped cost” basis**. The Project Contract will include defined deliverables, with acceptance criteria, and defined Payment Milestones by which one or more deliverables will have been completed. Payments will be made against each defined Payment Milestone according to **actual costs incurred** by the Participants, up to the agreed **cap for each Payment Milestone**, subject to ETI acceptance of the Milestone Completion Report. Unless otherwise agreed as part of a formal contract variation process, the ETI shall not be liable for any payments above the maximum stated in the Project Contract.

Further information is contained in the Summary of Terms contained in Appendix B.

An Accountant's report shall be required to support selected financial reports and invoiced amounts, dependent upon the total contract value to be paid to each Participant. Details of these requirements will be agreed during the Project Detailing phase.

5. Terms and Conditions for Project Contract

During the Project Detailing phase, a Project Contract will be drawn up by the ETI based on its standard contracts for such work and incorporating appropriate information from the ETI's RfP and the Respondent's Proposal. Full terms and conditions will be agreed at that time, but a Summary of Terms is included in Appendix B.

The Consortium members will be required to execute a Consortium Agreement between themselves prior to signature of the Project Contract with the ETI. The ETI will request a copy of this Agreement for review and approval.

Appendix A – Content and Format of Proposals

The Proposal shall be arranged according to the structure defined below and shall explicitly include all the information listed.

1. Executive Summary *[maximum 1 page]*

A summary of the Proposal, describing briefly:

- The organisation undertaking the work
- Summary of the technical approach and **key** deliverables
- Confirmation of compliance with the Specification detailed in the Request for Proposals and/or brief summary of **key** exceptions/deviations
- Duration to deliver type tested FCL to the host site for demonstration
- Value proposition.

2. Project Objectives *[typically ≤ ½page]*

The overall Project objectives will be as specified in the Request for Proposals. The Respondent may provide subsidiary objectives if they think this is appropriate. The Respondent should also describe any Critical Success Factors which either characterise a successful Project outcome or which are required to facilitate a successful Project outcome.

3. Background to Proposed Participants *[typically 2 – 3 pages]*

The Respondent should provide a brief description of the organisation, including:

- Key skills, knowledge, experience and previous track record in the area (technical, commercial and project management, including any UK-specific issues such as technology applicability to UK systems, UK industry practice, UK market/industry knowledge, etc) including status and TRL of existing FCL technology development & demonstration activities – Refer to Section 2.2 of this RfP for assessment criteria
- Capabilities firstly to develop, build and test the device for demonstration, and secondly then to further develop and commercialise the resultant device, including scale-up of manufacture (particularly of specialist components or materials)
- Key staff members involved (including a designated Project Manager), with the amount of each individual's time which will be dedicated to the Project, and detailing their experience – with CVs included in an Appendix (maximum 2 pages per individual)
- Alternate resources available to be deployed in the event that the above key members become unavailable
- Any major Subcontractors
- Relevant quality, health, safety and environment management systems.

If the FCL Device Developer proposes to involve additional organisations (as described in Section 1.5 of the Request for Proposals), then a table should also be provided to identify which Participant(s) is/are proposed to satisfy each of the specific criteria (skills, experience, etc) listed in the 'Criteria for Review and Selection of Proposals' in Section 2.2 of the Request for Proposals.

Evidence of previous collaborative working (or subcontract management as appropriate) should be provided, preferably between the FCL Device Developer and the other Project Participants .

The Respondent should identify in their Proposal any foreseen issues or difficulties in executing a Consortium Agreement and/or subcontracts (as appropriate).

4. Device Specification *[typically 1 – 5 pages]*

The Respondent should provide a commentary against the device development priorities listed in Section 3.3 of the RfP and the device specification in Section 3.5 of the RfP. This should include all information requested in the respective sections of the RfP, such as the range of achievable values for certain parameters and recommended values for the demonstration unit.

5. Programme of Work *[typically 5 – 10 pages]*

The Respondent should provide a summary of the overall approach to delivery of the FCL Device Developer's Scope, and a Task-by-Task breakdown of the proposed work, identifying for each Task:

- the Task leader
- other Participants involved
- key dependencies
- the technical approach (including use of any specific methodologies, techniques or tools)
- Task objectives
- deliverables, including for each deliverable a specification (e.g. quality, appearance, scope, function and purpose as appropriate) and proposed Acceptance Criteria

The Respondent should be specific about the activities within the Task, e.g. including test/simulation matrices or stating a number of tests/simulations.

Any issues or assumptions in defining the programme or schedule (e.g. inputs required from the ETI or other projects) should be explicitly stated.

A specific project management Task (or Tasks) should be identified describing all the activities in this area for the FCL Device Developer's scope (e.g. regular meetings, reporting, Stage Gates etc). **Note that throughout Project delivery the ETI will require reports of monthly progress with supporting financial data, reports to substantiate completion of each milestone, etc. These will be provided by the Lead Coordinator, and all Participants will be required to supply information to support this activity.**

If appropriate, a work flow diagram should be provided to illustrate the relationships between Tasks.

Any relevant activities related to but not included within this Project, and the relationships with these activities, should also be described.

6. Deliverables & Payment Milestones *[typically 1 page]*

Following the detailed specifications of each deliverable in the previous section, a summary table should be provided here listing all the Project Payment Milestones (i.e. key points in the Project where one or more Deliverables will have been provided and payment is requested from the ETI), and their constituent deliverables, with due dates for each deliverable and Payment Milestone.

Refer also to Section 11.

7. Project Schedule *[typically 1 page]*

The Respondent should provide a time schedule for the Project (e.g. in the form of a Gantt chart) showing the main Work Packages, Project stages and main Tasks within each Work Package and stage. This should clearly identify:

- Task durations and dependencies (including any inputs required from the ETI or other parties and any other external dependencies)
- Project Deliverables
- Payment Milestones and other relevant milestones
- Project Stage Gates, Design Reviews and other review points.

8. Risk and Health, Safety & Environment (HSE) Management *[typically 3 pages]*

The Respondent should describe the proposed Risk Management Strategy (i.e. how risks to the successful delivery of the Project will be identified and managed throughout the Project). They should also provide a Risk Register, identifying the key challenges, risks (including any assumptions or dependencies identified earlier), issues and opportunities which may affect the successful delivery of the Project outcomes and identifying planned activities to address / mitigate each item.

Further to the summaries of the Respondent's HSE management systems provided in Section 3 of the Proposal, The Respondent should provide here a register summarising the main anticipated HSE issues potentially affecting the Project and proposed strategies to address / mitigate each item.

9. Statement of Compliance *[typically 1 page or less]*

The Respondent shall provide a statement that the Proposal is fully compliant with the Specification and all other aspects of the Request for Proposals (including the Summary of Terms in Appendix B), or shall state clearly any exceptions, deviations, alternative approaches or additions to the required Specification, with justification. **Note that in the absence of any specifically-stated deviation in this section of the Proposal, in the case of any subsequent dispute, the ETI's specification will take precedence over the Proposal.** Additional comments and clarifications should also be listed where appropriate (for example to clarify interpretation of requirements), but these must be differentiated from any deviations / exceptions above.

10. Intellectual Property (IP) *[typically 1 – 2 pages]*

Any Project commissioned by the ETI will be subject to the appropriate ETI terms and conditions, (a summary of which is included in Appendix B).

Arising IP

The Respondent should provide a brief overview of the nature of any anticipated IP Arising from each stage of the Project. The Respondent should identify the Participant proposed to own each item of Arising IP and the reasons why such Participant should be the owner, including details of:

- the overall contribution of such Participant;
- the Intellectual Property experience and capabilities of such Participant which would justify granting it the rights and obligations of ownership, protection and maintenance of such Arising IP; and
- any other reasons why such Participant should be the owner of the Arising IP.

Details of the anticipated use or licences (if any) of Arising IP by the Participants and ETI Members should also be provided.

Background IP

The Respondent should describe any Background IP (e.g. patents, proprietary data, computer algorithms, knowhow or other IP):

- which is needed to carry out the Project or which may be used during the Project; or
- which may be needed by any ETI member granted access to exploit the Arising IP (if any).

The description of any such Background IP should detail:

- the nature of the IP,
- rights to that IP, and
- ownership and control, whether this is by any of the Project Participants or by any third parties.

Please note that detailed due diligence on Background IP will be required during the Project Detailing stage; (please see the Due Diligence section below).

11. Value Proposition and Project Payment *[typically 1 – 2 pages]*

Value Proposition

Details of the value proposition (as required by Section 4 of the RfP) should be described and quantified.

Project Payments

In respect of any proposed payments by the ETI, the following information should be provided:

The Respondent should provide:

- a figure for the **maximum (capped) total contract value** for the FCL Device Developer, and
- a **breakdown** between Tasks.

If there are any assumptions or limitations to this price, these should be clearly stated.

The Respondent should also provide a **breakdown of the total contract value (only) by category**, as specified in the Table below.

Number of Person-days	
Base Labour	
Materials	
Capital	
Subcontractors	
Travel & Subsistence	
Overheads	
Other	
Profit	
TOTALS	
Profit Margin, %	

Notes on Category Breakdown table:

1. Base Labour should include direct add-ons (eg NI, pension etc)
2. Capital costs should be based on depreciation during the Project x % usage on Project
3. Participants will be required to provide justification of overhead calculations during the Project detailing stage. ETI can provide a spreadsheet to calculate overheads on request
4. Participants are required to declare their profit margins
5. Academic Participants should determine their costs using the JeS system. Note that ETI funds Academic Participants at 100% Full Economic Cost.

Please note that during Project Detailing (prior to contract signature) the ETI will require more detailed cost breakdowns, including a schedule of payments against the Payment Milestones identified in Section 5 above.

12. Due Diligence Information [this is excluded from the page limit]

The ETI requires due diligence information in two stages. Certain information is required with the proposal (part A) and further information is required if any proposal is selected to proceed to the Project Detailing stage (part B).

Please note that successful completion of all elements of the due diligence is a pre-requisite to any contract award. Even if a proposal is selected to move to the Project Detailing stage, failure to meet due diligence requirements at that stage may result in the exclusion of that Participant or the proposal from the ETI's selection process.

Part A (to be included with Proposal)

1. State Aid

The Respondent should confirm that there are no potential, threatened, pending or outstanding recovery orders by the European Commission in respect of any funding received by it.

2. Insurance

The Respondent should confirm that insurance cover for the following risks is held, and should confirm levels of cover and expiry for each. The ETI will require evidence of these during the Project Detailing phase.

- Property damage
- Business interruption
- Employer's liability
- Public liability
- Product liability (or justify its exclusion if not appropriate)
- Professional Indemnity

The respondent should identify if it self-insures for any of these risks.

3. Patent Study

The Respondent should identify the name of a proposed Patent Attorney that the Respondent proposes to use to carry out a patent study if successfully selected to proceed to the Project Detailing stage.

4. General

The Respondent (unless an ETI Member, university / higher education institution or UK/EU government laboratory / agency) shall provide the additional information listed in the table below.

Details of organisation
Full name:
Registered Office:
Type of Business (sole trader, limited company, partnership etc):
Names of directors/partners/owner:
VAT number:
Details of directors, partners or associates
Have any directors, partners or associates of the organisation been involved in any organisation which has been liquidated or gone into receivership? (Yes/No)
Have any directors, partners or associates of the organisation been convicted of a criminal offence relevant to the business or profession? (Yes/No)
Please give (and attach if necessary) full details if you have answered 'Yes' to either of the two previous questions.
Audited Financial Accounts
Please supply Audited Financial Accounts for the last 3 years for the organisation, or relevant part thereof.
Claims or litigation
Please provide (and attach if necessary) details of any claims or litigation against the organisation, outstanding and/or anticipated.

Part B (during the Project Detailing stage)

Please note that the following information will be required for part B of the due diligence during the Project Detailing stage, if a proposal is selected to proceed to that stage.

1. A full health and safety competency assessment will be carried out, to assess the organisation's health & safety management systems and specific technical competence to manage the risks in this project.
2. Full IP due diligence, consisting of:
 - (a) A detailed Background IP questionnaire, which the Respondent will be required to complete, identifying the relevant Background IP for the project, and which the Respondent will be required to support with evidence of either ownership or rights to use.
 - (b) A patent study (Freedom to Operate Search) relating to the Project, which the Respondent will be expected to submit to the ETI. This shall be carried out by patent attorneys and will determine whether the proposed Project can be carried out without infringing valid intellectual property rights (IP) of others. Full instructions will be given at the Project Detailing stage.
3. Copies of insurance policies.
4. Any other information that the ETI reasonably requires in order to fund the proposed project.

Appendix B – Summary of Terms and Conditions for Project Contract

Introduction

The following represents a summary of the key contractual terms which the ETI would expect to be included in the Project Contract for an ETI project.

Structure

1. The project participants shall be represented in dealings with the ETI by a Lead Coordinator, who shall, in the majority of instances, be the intermediary for any communication between the ETI and the project participants. This role includes providing notices of meetings and other activities to the ETI, reviewing and commenting on project reports (as required under the project) and administering payment of invoices for all project participants.
2. The Lead Coordinator for this project will be E.ON Engineering Limited.

Project Management

3. The Lead Coordinator will appoint a Project Manager for the day-to-day management of the project. The ETI will appoint a Programme Manager to act on behalf of the ETI with regards to the project.
4. The ETI and its members shall be entitled to attend any management meetings of the Consortium.
5. The project participants must fulfil various reporting obligations which will include monthly reports, milestone reports, annual reports and a final report. Each report must address a specified list of topics required by the ETI.
6. The ETI will require the right to carry out a stage gate review on completion of a "stage" in order to assess whether the project continues to deliver against ETI outcomes and also in order to carry out a validation exercise against the business case. The ETI may carry out stage gate reviews more frequently if the project is in jeopardy.

Finance

7. The ETI will pay against milestones and only in respect of actual costs incurred (or at pre agreed profit margin, if appropriate) for the work done under the project. Only eligible costs will be payable. Ineligible costs include interest charges, bad debts, advertising costs and legal costs incurred in finalising contracts and carrying on the project. Acceptance of milestones will be determined by the ETI, against agreed acceptance criteria. Any increase in costs in carrying out the project over and above the agreed contractual amounts will only be payable by the ETI if and when such charges are agreed in accordance with the contractual variation control procedure.
8. Costs are payable in Sterling. The ETI will pay valid invoices within 30 days of receipt of invoice following acceptance of a milestone. An accountant's report will be required to support selected financial reports and invoices, in accordance with a standard ETI matrix.
9. The ETI reserves the right to require the return of funding in certain circumstances (such as in the event of corruption or fraud, overpayment, costs incurred in respect of unapproved project changes and failure to comply with State Aid obligations).

Confidentiality

10. Restrictions on disclosure of any other party's confidential information will apply. Any publication of results (if appropriate) will be subject to the confidentiality provisions in the agreement.

Audits and Records

11. The ETI will require the right to audit the project and project participants during the project and, in certain circumstances, up to 7 years from the end of the project on financial or technical grounds.
12. The parties will be required to maintain the majority of project records for a minimum of 10 years from the project end date and for potentially more than 20 years where the records relate to registered intellectual property rights.

Sub-contracting

13. Sub-contracting is not permitted without consent. However, details of known sub-contractors (and therefore the requisite consent) can be given in the agreement at signing.

Variation

14. Any variations to the project must be made via the variation control procedure.

Liability

15. The liability provisions relating to project participants will be tailored on a case-by case basis but are likely to be several and capped at (or at a multiple of) the amounts payable or received under the project (except in the case of IP infringement claims, certain third party claims or other liabilities which cannot be limited or excluded by law). For these claims, no cap will apply. Recovery of indirect, consequential etc. damages will usually be excluded. The ETI will require an indemnity in respect of certain claims brought by any third parties against the ETI as a result of the acts or omissions of the project participants under the project, the terms of which will be determined on a case by case basis.

Withdrawal

16. Withdrawal from the project is only possible with the unanimous consent of all other contracting parties. Withdrawing participants cannot recover outstanding costs, unless otherwise agreed.

Termination and Suspension

17. The ETI reserves the right to terminate the agreement in certain circumstances (such as breach by a participant, withdrawal of a participant, insolvency, change of control of a participant etc). The ETI also reserves the right to terminate the agreement unilaterally upon giving a period of notice (to be agreed) to the project participants. Upon termination, the ETI will pay the eligible costs incurred by the project participants up to the date of termination.
18. The ETI will reserve the right to suspend the project in certain defined circumstances.

Intellectual Property

19. The ownership of Arising IP will be agreed. Appropriate licence provisions will be put in place to ensure adequate rights are granted to the ETI members and, where relevant, project participants.
20. The project participants will be required to licence their Background IP: (i) to other project participants on a royalty free basis where required for the purposes of the project; and (ii) to the ETI or sub-licensees of the ETI, on fair and reasonable terms, where required for the use or exploitation of the Arising IP.

Appendix C – Glossary

Term	Definition
Consortium	The group of organisations described in Section 1.5 which may decide together to submit a Proposal to carry out the Project and be governed by a Consortium Agreement between themselves. This will not include the ETI itself.
Consortium Agreement	The agreement to be entered into between the organisations together forming a Consortium, as described in Section 1.5, which governs the execution of the Project within the Consortium.
Distributed Generation (DG)	Generation plant which is decentralised and connected to the distribution rather than transmission systems.
Distribution Network Operator (DNO)	An organisation responsible for the operation of a specific electricity distribution network. The host DNO for this project is Central Networks East Ltd.
ETI Project Manager	The individual who may be appointed by the ETI to manage the ETI's interaction with the project team. (via the Project Manager of the Lead Coordinator or Prime Contractor), or is otherwise agreed by the Project Participants, to carry out its responsibilities.
Fault Current Limiter (FCL)	An 'active' device of the type required by this RfP, which passes the normal operating current at the location at which it is installed in the distribution network and which, in the event of a network fault, limits the current at the installation location to a pre-determined value. The scope of the FCL includes the main FCL device and all its associated auxiliary / ancillary systems, as defined in Section 3 of this RfP.
FCL Device Developer	The organisation responsible for the design, development, build and test of a Fault Current Limiter (FCL) for this Project and with the potential to commercialise an FCL device thereafter.
Fault Current Management (FCM)	The engineering challenges, techniques and technologies associated with the limitation and management of fault currents on an electricity network.
Lead Coordinator	The organisation which is a member of the Consortium, and which manages and coordinates the activities of all the Consortium members, and which acts as the primary interface between the Consortium and the ETI, as described in Section 1.5.
Participant	An organisation which is responsible for the delivery of part of the Project scope and which is therefore a member of the Consortium, or is a subcontractor to any of these organisations, as described in Section 1.5.
Payment Milestone	A contract milestone with defined constituent deliverables, associated deliverable acceptance criteria, and milestone value (all to be detailed in the Respondent's Proposal and agreed in the Project Contract) which should be completed in order to reach the said milestone, and at which, subject to acceptance by the ETI that the milestone has in fact been reached, payment may be claimed from the ETI on the basis described in Section 4 and on the Terms in Appendix C,
Pre-saturated Core Fault Current Limiter (PCFCL)	A device which provides a low impedance path to normal network operating current by means of an iron core maintained in saturation by a DC current coil (usually superconducting), and which provides a high impedance path to fault currents as these drive the iron core out of saturation and thus increase its inductance.
Prime Contractor	The organisation which manages and coordinates the activities of all the Subcontract Participants, as described in Section 1.5.
Programme	The ETI's Energy Storage and Distribution (ESD) Programme.
Programme Manager	The individual appointed by the ETI to manage the overall ETI programme to which this Project is affiliated, and to whom the Project Manager is accountable. An ETI Project Manager may also be appointed by the Programme Manager to manage the ETI's interaction with the project team.
Project	The project for which the purpose, scope of work and other details are described in this Request for Proposals.
Project Contract	The contract, as described in Section 5, to be entered into between the ETI and the Participants (whether as a Consortium, Prime Contractor or single contractor)

Project Detailing Stage	The stage of Project commissioning carried out by the ETI if and after it has decided to take forward a Proposal, during which full and final Project details are established and a Project Contract is agreed.
Project Manager	The individual who is appointed by the Lead Coordinator or Prime Contractor, or is otherwise agreed by the Project Participants, to carry out its responsibilities. This individual is accountable to the ETI's Programme Manager and to the ETI Project Manager if one is appointed by the ETI.
Project Organisation	The entity or group of entities / organisations, and the contracting and management structure which they adopt, as described in Section 1.5, which together will carry out the Project if commissioned by the ETI.
Proposal	The proposal for the Project submitted to the ETI, as described in Section 2.1, in response to this Request for Proposals.
Resistive Superconducting Fault Current Limiter (RSFCL)	A device in which normal network operating current passes through the superconductor with low impedance, and in which the superconductor quenches rapidly to offer high resistance to fault currents.
Respondent	The organisation submitting a Proposal to the ETI, as described in Section 2.1, on behalf of themselves and of any Consortium or Subcontract Participants.
Stage	A group of activities within the Project leading to specific deliverables and/or outcomes which are normally required to be completed before commencing subsequent Stages.
Stage Gate	A project review at which the ETI, supported by the Project Participants, can determine whether or not a Stage has been satisfactorily completed, whether or not activity on subsequent Stages should be commenced, what if any remedial actions are required, and in extremis whether the project should be terminated.
Subcontract	A contractual arrangement between the Prime Contractor (described in Section 1.5) and another Participant organisation to which work has been subcontracted. This includes Participant organisations subcontracted in turn by other Participant organisations, but the Prime Contractor is not defined as a Subcontractor to the ETI.
Task	A significant activity or group of activities (within a Work Package) which results in completion of a deliverable or a significant part of one, or which represents a significant step in the process towards one.
Technology Readiness Level (TRL)	A scale, originally devised by NASA and now in widespread use, to quantify the status of development of a technology from concept definition, through laboratory and full scale demonstration in a range of environments increasingly close to final application conditions, finally reaching mature technology.
Work Package (WP)	A major section of the Project scope of work, which may be identified in this RfP or in the Respondent's Proposal, in order to break up the scope of work into separate manageable parts. A Work Package will usually consist of a number of Tasks.