Northern Ireland Electricity Networks

FACILITATION OF ENERGY STORAGE SERVICES (FESS)

Consultation

04/06/2021

Contents

1. EXECUTIVE SUMMARY

The Facilitation of Energy Storage Services (FESS) project is seeking to identify and remove any barriers that exist to customers deploying energy storage devices on the Northern Ireland distribution network. This consultation paper is the second stakeholder engagement exercise that NIE Networks is undertaking as part of the project. The market survey, undertaken in summer 2020, was the first stakeholder engagement activity, which sought to gather wider feedback from parties engaged with electricity storage technologies. The results of the market survey were taken into account when undertaking subsequent activities in the FESS project around identifying barriers to distribution connected storage in Northern Ireland (NI) and proposing solutions to those barriers.

This paper puts forward a more focused set of questions that aim to gauge stakeholders' opinion of the specific solutions put forward in the FESS programme of work and of the FESS project as a whole. NIE Networks invite interested parties to respond to this consultation, which will be open to respondents until 4pm on Friday 16th July 2021.

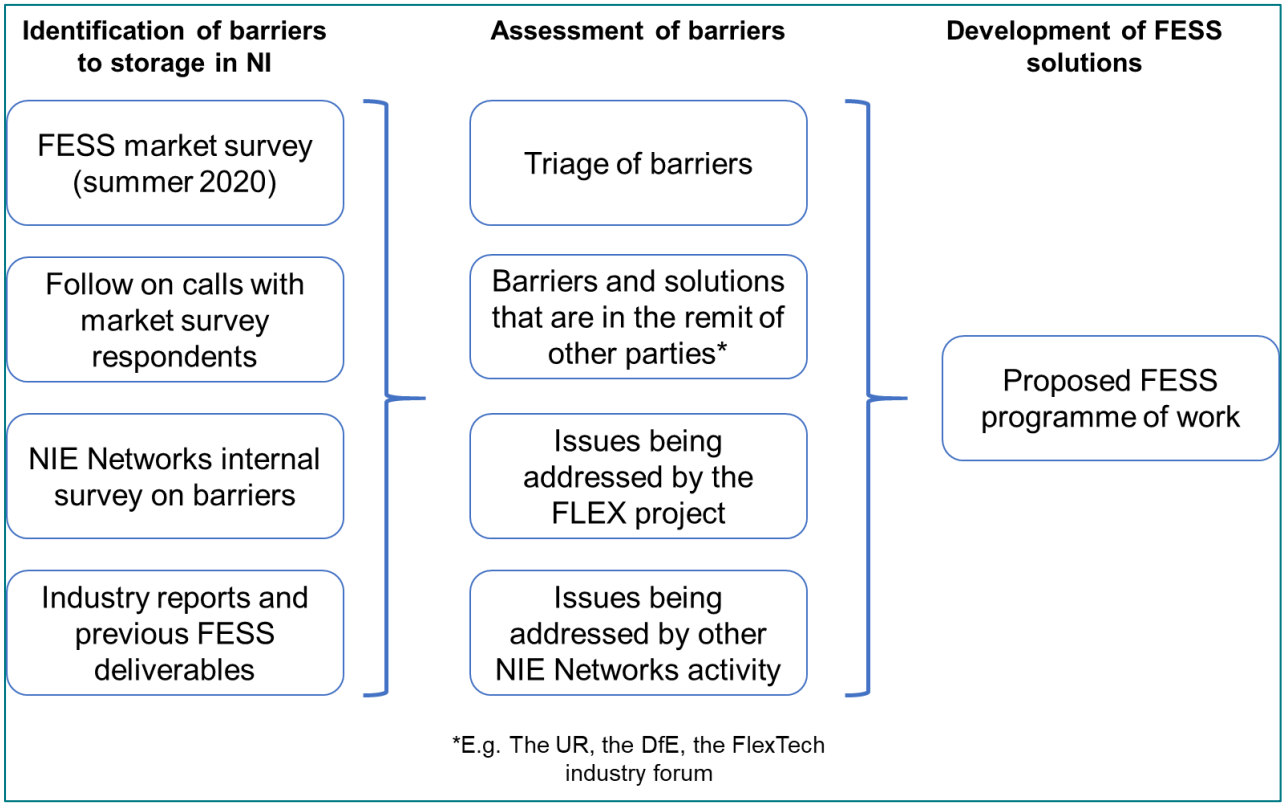
Electricity storage can be beneficial for network stability, for unlocking additional capacity on the network and for increasing the utilisation of renewable energy. The FESS project established potential use cases for electricity storage on the NIE Networks distribution network. Two broad categories of use cases for storage that are relevant for NIE Networks were identified:[1]

- Addressing network constraints - storage can address voltage, thermal and security of supply constraints that occur on the network due to high loads or excess generation.
- Facilitation of generator connections – storage can manage exports to within network limits and thus prevent costly reinforcement of the network.

A number of barriers to the deployment of electricity storage have been identified around industry codes and regulations, availability of information, commercial arrangements for procuring storage services and the grid connection and application process. However, not all the solutions to the identified barriers are within the remit of the FESS project and indeed NIE Networks. Some of the barriers fall within the remit of NIE Networks but are already within the scope of other internal projects and activity. Other solutions fall within the remit of government departments. Figure 1 shows the process used by the FESS project to identify barriers and subsequently progress solutions to the relevant barriers.

[1] Note that the use cases for storage identified for NIE Networks could not necessarily be implemented immediately, as the processes, charging arrangements etc. for procuring such services do not yet exist. The FESS use cases were about identifying ways in which distribution-connected customer owned storage could bring mutual benefit to both NIE Networks and customers.

FIGURE 1. PROCESS IN THE FESS PROJECT TO IDENTIFY BARRIERS AND SOLUTIONS



The solutions that are within the remit of NIE Networks but are not already part of business-as-usual activities or other projects form the proposed FESS programme of work. They involve:

- A review of the current structure of Use of System charges that are levied on storage facilities.
- Addressing barriers to connection. This includes drafting an internal policy document on storage connections and potentially considering prioritisation of storage connections where it could be beneficial to the distribution network.
- Improving provision of information for storage. This is likely to include a dedicated webpage for storage connections on the NIE Networks website. There will also be FESS stakeholder events later this year.
- Operational matters and other activities.

To respond to this consultation, please answer the questions in Section 4.5. Responses should be sent electronically to Josh.Watson@nienetworks.co.uk by 4pm on Friday 16th July 2021.

2. INTRODUCTION

2.1 Innovation at NIE Networks

NIE Networks is currently trialling six innovation projects in Northern Ireland. These are:

1. LV ANM - The Low Voltage Active Network Management (LV ANM) project will investigate how reconfiguring the network will provide additional capacity for Low Carbon Technologies (LCTs).
2. DRVC - By dynamically reducing network voltage, electrical demand can be reduced locally. The Demand Reduction through Voltage Conservation (DRVC) project will seek to manage network constraints.
3. FESS - The Facilitation of Energy Storage Services (FESS) will seek to identify and remove any barriers that exist to customers deploying energy storage devices such as batteries.
4. FLEX - This Demand Side Response (DSR) project will establish a DSO flexibility market.
5. SAM - Using real time thermal rating technology for plant and equipment, instead of a static nameplate rating approach, the Smart Asset Monitoring (SAM) project will seek to increase network headroom.
6. STATCOM - This project will actively manage network voltage through the installation of a static compensator on an 11kV circuit. This will accommodate further demand and micro-generation which would otherwise be constrained by voltage levels.

More information can be found on these projects on the NIE Networks website[2].

2.2 Background

Along with many network operators across the globe, Northern Ireland Electricity (NIE) Networks is facing challenges with the increased penetration of intermittent renewable generation, as well as changes in customer behaviour in response to the uptake of Low Carbon Technologies (LCT). For NIE Networks these changes are manifesting themselves as constraint challenges on the distribution network – largely thermal constraints, but also challenges around maintaining voltages within statutory limits. NIE Networks recognises that electricity storage can be a means of alleviating network constraints and facilitating the connection of distributed generation and other LCTs. The aims of the Facilitation of Energy Storage Services (FESS) project are to overcome barriers which may exist to electricity storage deployment in Northern Ireland, to explore the potential for NIE Networks to procure network services from storage, and to ultimately make changes and recommendations to enable this to happen.

The FESS project has been running since May 2020. Activities to date include:

- A technology assessment for electricity storage
- A market evaluation survey to gauge the current levels and appetite for participation in energy storage markets and gather feedback on barriers to storage in Northern Ireland (NI)
- Network constraints analysis and assessment of storage benefits against conventional reinforcement
- Development of potential Use Cases for distribution connected storage in NI
- Identification of barriers to deployment of storage in Northern Ireland

The FESS project is currently developing solutions to the barriers identified to storage in Northern Ireland (NI) that are within the remit of NIE Networks; this is the focus of this consultation paper.

[2] https://www.nienetworks.co.uk/future-networks/level2/our-innovation-projects

The remaining FESS activities are:

- Implementation of proposed solutions (following consultation feedback)
- Project dissemination events and close down report

2.3 Benefits of Electricity Storage

Electricity storage has the capability to provide a number of grid and network system services, including frequency response, voltage control, congestion relief, load shifting, reserve and black start. The potential benefits of electricity storage include:

- Contributing to the deployment of renewable generation to meet renewable energy targets in an efficient way;[3]
- Lower total cost of system services compared with fossil fuel generation;
- Lower emissions associated with system services compared with fossil fuel generation;
- Reduced curtailment of renewable generation;
- Provision of network services (e.g. reduce peak demand) to defer network reinforcement;
- Provision of balancing services – storage has relatively rapid response times; and
- Support to network reliability.

According to a study completed by Piclo[4] in April 2020, network savings are maximised by widescale deployment of distributed storage. A large, distributed asset base is required to maximise the benefits of flexibility, especially on the LV network.[5]

2.4 Purpose of this paper

The purpose of this consultation paper is to summarise:

- The Use Cases that have been identified by the FESS project and the barriers identified to storage in NI
- The proposed programme of work of the FESS project
- Other storage related activity in NI that is taking place outside of the FESS project

Responses to this consultation will be reviewed and considered for the implementation of solutions in the FESS project to address barriers to distribution connected storage. This will be followed by a stakeholder event for the storage community and other interested parties.

3. SUMMARY OF FESS ACTIVITY

3.1 Potential use of electricity storage connected to NIE Network's system

Following the early activities of a technology assessment and market survey the FESS project developed potential use cases for distribution connected storage. These can be broadly categorised as addressing constraints on the network and facilitating the connection of generation.

[3] Energy Storage Ireland; Our Energy Storage Future: Recommendations for an All-Island Storage Roadmap; December 2019
[4] https://piclo.energy/publications/Central+Distr+Storage.pdf
[5] Low Voltage is defined in the NIE Networks Distribution Code as "A voltage not exceeding 250 volts".

Note that the commercial and market arrangements for NIE Networks to procure these services do not exist currently. NIE Networks is exploring the procurement of flexibility services through its FLEX project.[6]

It is worth noting that these services are not unique to storage and could be provided by other customers. However, electricity storage is well-suited to provide these services and has therefore been investigated as part of the FESS project.

3.1.1 Addressing constraints on the network

Substation overload

The growth in electric vehicles and heat pumps could lead to overloads on substations and feeders. This constraint in capacity is likely to happen only during peak times. Electricity storage could be used to manage peak loads and keep the demand within the available capacity constraints, to defer or avoid network reinforcement.

EREC P2 Constraint

Engineering Recommendation (EREC) P2 is a distribution network planning standard, which sets out the minimum levels of security of supply for DNOs. NIE Networks currently uses EREC P2/6 (more on this in 4.3.2). EREC P2 uses a term “Group Demand”, which determines the minimum level of security of supply required for an area of the network. In situations where Group Demand has increased to such a level that security of supply requirements have increased, electricity storage could be connected to the primary substation or the feeder supplied by the primary substation to export to meet peak demand. The storage could discharge at times of peak demand so that the security of supply requirements are met.

Voltage constraints

Another role that electricity storage could play is in alleviating voltage constraints. Long rural feeders in particular may experience voltage constraints due to incremental growth in both generation and load. Generation is likely to cause high voltages and load is likely to cause low voltages. Storage facilities could be used to counteract voltage spikes and drops by exporting or drawing real and reactive power.

3.1.2 Facilitation of generator connections

EREC G99/NI Generation connections

In some cases the amount of generation a generator wishes to connect to a certain point in the network exceeds the network capacity to accept generation, for example due to generation export exceeding the thermal capacity of the substation. Storage could be used to manage the generation export. Storage would charge from the generation when there is no capacity to export to the network and discharge into the network when there is available capacity.

EREC G98/NI Generation connections (micro generation)

A high number of EREC G98/NI generation sources[7] connecting in one area has the potential to cause reverse power or thermal constraints at the secondary or primary substation. If reinforcement is required, the cost of the work will be borne by the NI customer through system charges, as these costs cannot be passed on to the individual G98/NI generation customer. A storage facility could charge to mitigate the constraint by increasing demand at times of peak generation or increasing overall minimum demand.

[6] https://www.nienetworks.co.uk/flexibility

[7] Generation up to and including 16 Amps per phase, i.e. up to 3.68 kW single-phase connected at 230 V or 11.04 kW three-phase connected at 400 V

Connection prioritisation for EREC G99/NI connections

Where there is more than one applicant for a connection at a given location, a connection queue is formed. Storage has the potential to unlock additional capacity for other generators wishing to connect. If such opportunity is identified in a connection queue, storage could be prioritised (allowed to jump the queue) to allow other generators in the queue to connect without the need for reinforcement. This would require the introduction of flexibility in the current approach, which is a first-come first-served basis. This is discussed further in section 4.2.2.

3.2 Identification of barriers to storage

As a relatively new and developing technology, the connection of electricity storage in NI can face certain barriers. These can be categorised as barriers within and outside of the control of NIE Networks. While all barriers identified will be listed here, the focus of this consultation paper is on the barriers that are within the control of NIE Networks.

The barriers to storage were identified from a number of sources, including:

- The FESS market survey responses, and a number of follow up calls with representatives from organisations that participated in the survey and indicated that they were willing to be contacted.
- The experience of NIE Networks staff.
- Other FESS deliverables, including the FESS Technology Assessment and the FESS Use Cases activity.
- Industry reports, such as the Energy Storage Ireland (ESI) all-island storage roadmap.[8]

The barriers were grouped into a number of categories. While the focus of the FESS project is on addressing barriers to storage that are within the remit of NIE Networks, the opportunity was taken to summarise barriers to storage identified that are in the remit of other parties. These are summarised in Annex A.

The following sub-sections outline the barriers identified using the sources listed above. Potential solutions to all barriers identified are discussed in section 4. Note that once barriers were identified, the FESS project went through a process of assessing these barriers and determining a programme of work for developing solutions, as illustrated in Figure 1.

3.2.1 Industry codes and regulations

The industry codes and regulation barriers identified are summarised in the following table.

TABLE 1. BARRIERS TO STORAGE RELATING TO INDUSTRY CODES AND REGULATIONS

Issue	Barrier to storage
Regulatory definition of electricity storage within primary legislation and licences	Clarity and appropriateness of the application of certain charges to storage (e.g. the Climate Change Levy), as determined by whether or not storage is legally classed as a Generator. Clarity on the number of licences required (and associated fees) for storage that is co-located with generation.

[8] Energy Storage Ireland (ESI); Our energy storage future – recommendations for an all-island energy storage roadmap; December 2019

Lack of specific treatment of electricity storage in the industry codes	The treatment of storage is not always explicit in industry codes, and where storage is required to meet generation conditions, these are not always suitable for storage facilities. EREC G83 generation that was installed prior to 2014 with a capacity that exceeds 16 Amps per phase is not eligible for the EREC G99/NI procedure for integrated micro-generation and storage installations (previously known as the G59 storage fast track).
Charges to storage	The characteristics of storage mean it can behave as generation, demand or a network asset depending on the function it is carrying out at any one time. Tariffs that currently focus on recovering network costs from generation or demand only customers may not be appropriate for storage. The issue of double charging for storage was raised by two respondents to the FESS market survey and identified as an issue in the Energy Storage Ireland (ESI) all-island storage roadmap. The term “double charging” is used, as storage could be seen to be paying for the same network assets twice, through import and export Use of System (UoS) charges.
Other issues around regulations and codes	A lot of piecemeal changes to regulations for storage and flexibility, but without a clear and published vision of what the “end point” looks like can lead to high uncertainty. Restriction of preferential treatment of technologies (with regard to prioritising storage in the connection queue which could facilitate further generation connections). In one of the FESS Use Cases storage is used to avoid the need for reinforcement to meet the security of supply standard EREC P2. This would require the adoption by NIE Networks of EREC P2/7 (NIE Networks currently uses EREC P2/6), which allows for storage (and other service providers) to be considered in group demand calculations.

3.2.2 Information Transparency

The barriers to storage related to information transparency are summarised in the following table.

TABLE 2. BARRIERS TO STORAGE RELATING TO INFORMATION TRANSPARENCY

Issue	Barrier to storage
Network information	Developers rely on information provided by network operators to assess their options for connection. While much of the network information made available is relevant to storage, there is currently not an option providing information on connections for electricity storage on either the NIE Networks connections page or generations connections page.

Pace of policy changes	Stakeholders can find it difficult to keep up with policy changes in this area considering how fast the arena is changing.

3.2.3 Commercial arrangements

NIE Networks does not have an established mechanism for procuring storage services that can defer traditional reinforcement. The procurement of distribution network services from flexibility service providers is currently being explored as part of an NIE Networks innovation project, FLEX[9].

Such a mechanism for procuring storage services would need to consider the following:

- Publication of flexibility opportunities, so that potential participants could evaluate this in revenue stacking / cost recovery. Note that storage and flexibility services will not always be the lowest cost solution; there will be circumstances where the optimal solution is network reinforcement.
- Provision of clarity to storage operators about the specification of the services needed (e.g. expected frequency, magnitude, duration, time / season of the requirement).
- Ensuring that storage is not prevented from connecting in high demand areas where additional import capacity is not available at the time of peak demand, when that is the constraint the storage facility is aiming to resolve i.e. through a contract to export (or to not import) at the time of peak demand.
- Putting in place a mechanism to recuperate the cost of procuring storage services.
- Allowing storage operators to pursue other revenue streams and stack services.
- Ensuring there is clarity on any penalty clauses for failure of storage operators to provide a service.

3.2.4 Grid connection process

The grid connection process involves an exchange of information between NIE Networks and the developer. Stages include the submission of a connection application by the developer, and an assessment of the application and an offer of terms of connection by NIE Networks.

A number of barriers were identified to the process of network connection from internal and external stakeholders. The issues that were identified are summarised in the table below.

TABLE 3. BARRIERS TO STORAGE RELATED TO THE CONNECTION PROCESS

Issue	Barrier to storage
Connection process barriers	• Concerns around offer of terms for connection expiring before planning approval is obtained. • Limited network capacity for connection which can result in high grid connection costs. • A lack of recognition of the flexibility offered by behind the meter storage. • The over-install limit being 20%, which is a particular hindrance where storage is co-located with generation. • Desire for an easier procedure to co-locate storage with generation.

[9] https://www.nienetworks.co.uk/flexibility

	• Separate connection policies exist for generation and demand customers, but not for storage. • TSO / DNO links and interactions, particularly in relation to distribution connected storage that participates in the DS3 markets. • Further information that NIE Networks could make available e.g. on their website (particularly if NIE Networks proceeds with the procurement of network services following the FLEX project).
Technical and operational considerations	• How storage is presented/recorded in internal systems. • The treatment of storage during network outages. • How storage is forecast in future DSO operations (network capacity allocations). • How storage 'mode of operation' is recorded and managed.

4. PROPOSED SOLUTIONS

4.1 Potential Solutions

Potential solutions to the barriers identified are listed in the tables below. The solutions have been categorised as follows.

TABLE 4. CATEGORISATION OF POTENTIAL SOLUTIONS

Remit of potential solutions	Table	Further covered in this paper
NIE Networks	Table 5	Yes – focus of this consultation paper (section 4.2 and 4.3)
NIE Networks FLEX project	Table 6	No
The FlexTech industry forum[10]	Table 7	No
Others e.g. government departments	Table 8	No

[10] The FlexTech industry forum or FlexTech integration initiative has been set up to help to break down barriers for renewables integration and system flexibility, as Ireland works towards a 70% renewable energy target. FlexTech is co-ordinated by EirGrid and SONI, and supported by ESB Networks and NIE Networks. A number of working groups have been set up in the FlexTech initiative, including an energy storage working group.

TABLE 5. SUMMARY OF POTENTIAL SOLUTIONS TO STORAGE BARRIERS IN NI UNDER THE REMIT OF NIE NETWORKS

Issue / Potential Solution	Remit
Consider whether a fast track storage process is possible for pre-2014 generation that is greater than 16 Amps per phase	NIE Networks
Review network charges for storage	The Utility Regulator (UR) and NIE Networks
Provide an overview of activity relevant for storage	NIE Networks
Consider prioritisation of storage / flexibility in connection queues	NIE Networks
Consider adopting EREC P2/8[11]	NIE Networks
Provide clarity for storage connections on the NIE Network's website connections page	NIE Networks
Use workshops and interactive events to engage with the storage community, and in future to communicate needs for services to developers	NIE Networks
Apply to the UR for approval for distribution reinforcement to create capacity in constrained areas	NIE Networks
Provide clarity on the options for discussions before submitting a formal application	NIE Networks
Consideration of storage solutions when generation application is rejected	NIE Networks
Review internal connection processes for storage (small and large scale) and consider developing a document or suite of documents for storage connection assessments.	NIE Networks
Review how storage is presented/recorded in systems (e.g. is a new storage symbol required in control systems)	NIE Networks
Review the treatment of storage during network outages	NIE Networks
Review how storage is forecast in future DSO operations (network capacity allocations)	NIE Networks
Review how storage 'mode of operation' is recorded and managed	NIE Networks

[11] Note that NIE Networks is planning to consult on adopting EREC P2/7 in 2021 – see section 4.3.2 for more information.

TABLE 6. SUMMARY OF POTENTIAL SOLUTIONS TO STORAGE BARRIERS IN NI BEING CONSIDERED BY THE FLEX PROJECT

Issue / Potential Solution	Remit
Provide procurement documents for flexibility services	FLEX project
Indicate the location and details of network constraints (e.g. via a platform such as Piclo)	FLEX project
Transparent procurement processes	FLEX project
Consider the requirement for longer term contracts to improve the business model of storage projects	FLEX project

TABLE 7. SUMMARY OF POTENTIAL SOLUTIONS TO STORAGE BARRIERS IN NI UNDER THE REMIT OF FLEXTECH

Issue / Potential Solution	Remit
Provide clarity on storage requirements in industry codes	FlexTech energy storage working group
Review the 20% over-install limit, particularly with reference to storage co-located with generation	FlexTech

TABLE 8. SUMMARY OF POTENTIAL SOLUTIONS TO STORAGE BARRIERS IN NI UNDER THE REMIT OF GOVERNMENT DEPARTMENTS

Issue / Potential Solution	Remit
Provision for storage in legislation and licences	DfE for legislation – note that the Transposition of 2019 Electricity Directive Consultation[12] covered storage and the Energy Strategy will set the direction of travel on this. The UR has determined an approach to licences for storage, by granting electricity generation licences to storage facilities.[13]

[12] https://www.economy-ni.gov.uk/consultations/transposition-2019-electricity-recast-directive
[13] https://www.uregni.gov.uk/sites/uregni/files/media-files/Decision%20-%20Licence%20Grant%20-%20Drumkee%20Energy%20Ltd.pdf

Review network charges for storage	The UR is planning to consult on this issue. NIE Networks is reviewing internally.
Provide clarity on the interaction of storage (particularly co-located with generation) with other policies (e.g. renewable generation incentive schemes)	DfE
Make more information available on the economics of storage, e.g. develop case studies	Potentially the DfE, although may be more appropriate for wider industry.
Review and address resistance to storage projects due to perceived negative impact on the surrounding area, including health and safety concerns	DfI and the Health and Safety Executive Northern Ireland may have a role in providing guidance, developers have a role in undertaking pre-application stakeholder engagement.
Review planning arrangements for storage	DfI has released a Call for Evidence on implementation of the Planning Act,[14] to which NIE Networks will contribute. DfI has also announced an upcoming review of the strategic planning policy on renewable and low carbon energy.[15]
Review and address potential difficulties in accessing storage technologies at competitive prices	The government and policy makers are responsible for giving direction for the sector. However, it is important that a competitive market exists, which will be impacted by the supply chain, operational experience, demand, etc. Any concerns about competitive pricing can be taken to the Competition and Markets Authority.

The FESS project has engaged with the Utility Regulator (UR) and the Department for the Economy (DfE) and will continue to do so, to support progress on the above points (Table 8). Future engagement will include discussions on FESS project learnings, particularly on the barriers and potential solutions identified, and seek to further understand the UR / DfE plans in these areas. The DfE is currently consulting on policy options for the new energy strategy for NI, which refers to electricity storage as being a potential means of achieving network flexibility.[16]

4.2 Proposed FESS programme of work

THE NIE NETWORKS POTENTIAL SOLUTIONS IDENTIFIED IN

[14] DfE Call for Evidence: https://www.infrastructure-ni.gov.uk/consultations/review-implementation-planning-act-ni-2011-call-evidence
[15] https://www.infrastructure-ni.gov.uk/news/mallon-gives-green-light-renewable-energy-planning-review
[16] https://www.economy-ni.gov.uk/consultations/consultation-policy-options-new-energy-strategy-northern-ireland

TABLE 5 WERE DISCUSSED IN A WORKSHOP WITH NIE NETWORKS INTERNAL STAKEHOLDERS. NOT ALL OF THE SOLUTIONS WERE CONSIDERED SUITABLE TO BE DEVELOPED BY THE FESS PROJECT. THIS IS PRIMARILY BECAUSE THEY ARE BEING, OR WILL BE, ADDRESSED ELSEWHERE WITHIN NIE NETWORKS. THIS SECTION SUMMARISES THE PROPOSED PROGRAMME OF WORK FOR THE FESS PROJECT. THE SOLUTIONS IN

Table 5 that are not being addressed by the FESS project are discussed in section 4.3.

4.2.1 Review DUoS charges for storage

NIE Networks is conducting an internal review on tariff reform, reviewing distribution network use of system tariffs. The FESS project will liaise with staff involved and consider appropriate options (both interim and enduring) for electricity storage network charges. This will include a review of how electricity storage is charged for its use of the network in other jurisdictions. This will support NIE Networks in proposing an interim approach to network charges for storage, while wider reviews (i.e. by the UR) are taking place. It is noted that NIE Networks does not currently levy DUoS charges on export, i.e. storage will not, in any immediate approach to charging, be charged both import and export unit charges.

4.2.2 Consider prioritisation of storage in connection queues

One of the storage Use Cases identified in the FESS project proposed that NIE Networks could consider promoting flexibility providers, including storage projects, in the connection queue where the flexibility provider can create additional capacity that can be used to connect other applicants in the queue. This differs from the current process, whereby generators are connected on a first-come first-served basis and the connection queue is ordered based on the date of a complete application. The connection prioritisation approach is based on work from the Energy Networks Association (ENA) Open Networks project – see the summary box below for more information (Figure 2). Note that connection prioritisation on this basis is not allowed under NIE Networks current queuing principles.

FIGURE 2. OPEN NETWORKS DEVELOPMENT ON FLEXIBILITY IN CONNECTION QUEUES

Open Networks – Treatment of flexibility in connection queues

The ENA Open Networks project Queue Management Process Guide recognises that opportunities to implement flexible resources to address network constraints that underlie connection queues should be considered.[17] If projects can demonstrate that they would positively benefit the constraint on the network, they should be given preferential treatment by being moved up the queue (a high level example of this is given in the ENA Guide document). The alleviation of grid constraints caused by the connection of the flexible resource would thereafter defer reinforcement and allow further projects to connect. The detailed market mechanism required to allow for this has not yet been specified by the ENA, but network companies are encouraged to consider the opportunity to promote flexible resources in connection queues as a means to address queue constraints. The Guide notes that this sort of treatment would require a contractual agreement with a commitment that the flexible resource customer would act to alleviate the specific network constraint:

"Queue Management can result in flexible resources being promoted in connection queues on the basis that additional capacity is then enabled for other connectees. The processes described in this

[17] ENA Open Networks Project; Queue Management Process Guide; 15th April 2020; WS2 P2 (Work Stream 2, Product 2)

guide do not consider the detailed market mechanisms required to drive this behaviour in an economic and efficient manner, but opportunities for the promotion of flexible resources should be considered by network companies as a means to address the network constraints that underlie connection queues.

The promotion of flexible resources in the connection queue would require the contractual agreement of a suitable form of commitment or surety that the customer concerned will act to alleviate the specific network constraint. Such arrangements will depend on the particular circumstances that give rise to the connection queue including the nature of the network constraint, the timing of any agreed network reinforcement and the availability and location of other flexible resources."

Implementing this queue flexibility and prioritisation would be complex, and issues that would need to be considered include:

- An update would be required to the NIE Networks connection queue principles and connection process to allow for the prioritisation of applicants who can facilitate subsequent connection of other applicants in the queue. NIE Networks is currently required to ensure no preferential treatment is given to one connection over another. Consideration would need to be given to whether this approach to queue prioritisation contravenes any of NIE Network's licence conditions.
- There will be a contract duration issue to manage; the storage facility end of life is likely to come before the generation (e.g. wind turbine). A review may be required (e.g. after 7 – 12 years) to assess whether the requirement still stands.
- Clarity on any penalty clauses for failure of storage operators to provide a service, and a process in place for any longer-term issues, such as storage operators ceasing operations within the contract term.[18]
- Clear and available commercial arrangements (clear remuneration for storage service) e.g. do all subsequent applicants facilitated by the storage facility pay the storage for the required services?
- Agreed technical approach (e.g. fixed requirement to be reviewed at annual intervals or dynamic requirement based on real-time monitoring).
- Agreement (and costs) of monitoring the storage response and managing non-delivery of the response from both a commercial and technical perspective.
- Future increase in network capacity through wider system reinforcement – what impact does this have on the use and revenue of the storage facility? How is this risk addressed in commercial contracts?
- Sufficient network demand capacity to allow a suitable Maximum Import Capacity (MIC) for the storage to relieve the constraint.
- What information would need to be provided in advance to the connecting applicants in order to allow them to assess their options? What information needs to be provided to the storage facility to allow the stacking of services?
- Under current connection charging arrangements NIE Networks would see no financial benefit from connecting additional generation, which may prove challenging to the business case for NIE Networks

[18] The Open Networks standard Flexibility Services Agreement, for example, has clauses on insurance, termination and service failure.

to facilitate this service. It is worth noting that charging principles for all connections will be considered in a full connection charging review which will involve a full consultation process.

Consultation Q1. Do you think that NIE Networks should give further consideration to connection queue priority? i.e. Where flexible connections (e.g. storage) are given priority in a connection queue if they can facilitate the connection of other customers.

Consideration should also be given to ensuring that storage is not prevented from connecting in areas of high demand with limited import capacity, when storage is aiming to resolve that constraint.

NIE Networks currently offers secure import connections – i.e. a connection with a single Maximum Import Capacity (MIC), with no variation for time of day. Under these current arrangements, storage would be prevented from connecting in a demand constrained area with limited import capacity, even if the purpose of the storage is to export at peak time. This is because contractual arrangements are not in place to prevent the storage from importing at peak time.

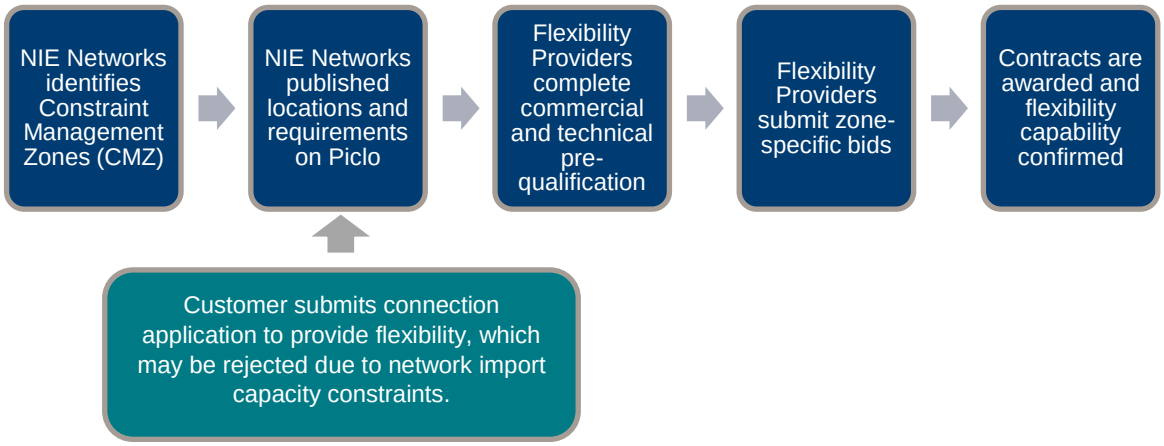
NIE Networks is currently considering whether it would be possible (and beneficial) to offer a “two-tier” or flexible MIC. This would, for example, allow connections to have a different MIC for day and night (to align with existing tariff times). There is a significant amount of complexity to move to such a two-tier approach, however, this would provide considerable benefits to customers who are able to be flexible with their time of use, such as those wishing to charge a fleet of electric vehicles overnight. This would also be beneficial for storage, by facilitating connections in areas where there is currently limited capacity to import at peak times, as storage could discharge at peak times to support the network at times of high demand and charge overnight. This approach would represent better utilisation of existing network capacity by incentivising use of the network at times of lower demand and reducing potential network reinforcement needs as the demand increase is limited to existing overnight headroom.

It is expected that this would be developed in a phased approach and would initially only be made available to 33kV (Extra High Voltage, EHV) and 11kV (High Voltage, HV) connected customers, with consideration to be given to implementing this for low voltage (LV) connections at a later stage. It is worth noting that the extension of this development to LV connections may be dependent upon the roll-out of smart meters to enhance metering capability.

Consultation Q2. Do you agree that NIE Networks should further consider offering a ‘two-tier’ MIC, allowing connections to have a different MIC for day and night?

The NIE Networks FLEX project is currently tendering for flexibility services. The FLEX tender pathway is illustrated below (Figure 3). This process is likely to be developed to take account of learning from the FLEX trials. The issue of connecting in a constrained area to provide flexibility is shown on the diagram in the customer (green) box.

FIGURE 3. FLEX TENDER PATHWAY TO PROVIDE FLEXIBILITY SERVICES TO NIE NETWORKS



Consultation Q3. Do you agree that NIE Networks should give consideration to facilitating the connection of storage (and other flexibility providers) in constrained areas (e.g. areas of high demand with limited import capacity) provided that the storage will act to resolve the network constraint?

4.2.3 Provide clarity for storage connections on the NIE Network's website

There is currently no dedicated page for storage connections on the NIE Networks website (Figure 4).

FIGURE 4. CURRENT CONNECTIONS PAGE ON NIE NETWORKS WEBSITE

The FESS project has reviewed GB and Ireland DNO websites for provision of information related to storage. From this review, the range of provisions for information on storage ranges from:

- No reference to storage
- No storage headings, but links to the storage fast track application form on the generation webpage
- Dedicated storage pages with further information, such as links to relevant application forms and guidance documents
- Best practice for provision of information to storage includes:
    - Guidance on likely connection voltage level for different storage capacities
    - Highlighting technical considerations that are likely to be the limiting factor for connection capacity (voltage step changes)
    - Overview of information required with application
    - Links to network capacity maps

The FESS project will draft proposed alterations to the connections web page, to be agreed with the NIE Networks Connections team. For example, this could include a dedicated storage page (with a clear link from the connections page) signposting the relevant forms and documents for storage projects (including V2G), and providing additional storage-specific guidance where appropriate.

Note that in terms of sharing information on the location of network constraints, the NIE Networks FLEX project is using the Piclo platform to advertise Flexibility Trial Zones for the FLEX project trial.

Consultation Q4. Do you agree that enhancement of the Connections webpages on the NIE Networks website to include storage would be of value?

4.2.4 Use workshops and interactive events to engage with the storage community

The FESS project will be hosting dissemination events to present the learning and outcomes of the project. These events can be used to canvas the appetite from storage stakeholders for future storage-focussed events.

Consultation Q5. Would further workshops for storage customers and ongoing engagement be of value? If so, can you give an indication of the types of topics that would be beneficial to cover?

4.2.5 Provide clarity on options for discussions before submitting a formal application

The development of an internal connection process for storage is discussed in 4.2.6. The FESS project will produce an external facing summary of the key points of this internal process, which could be included in a dedicated storage webpage on the NIE Networks website (4.2.3). This could also include clarification or guidance on the options that are available prior to submitting an application for discussions and studies.

4.2.6 Review internal connection processes for storage

NIE Networks has internal policy documents that set out the connection assessment and design process for generation and demand connections. While most of the stages in a storage connection assessment are covered in these, there are some storage specific issues that would be helpful to clarify. The FESS project is developing a storage connection policy document. Once this activity is complete, consideration will be given to identifying aspects that might be helpful to storage developers in the development of their projects and application form. This could form part of the website update content (4.2.3).

4.2.7 Operational matters

A number of internal topics regarding storage operation were identified for consideration. These include:

- Review how storage is presented/recorded in NIE Networks internal systems
- Review the treatment of storage during network outages
- Review how storage 'mode of operation' is recorded and managed
- Review how storage is forecast in future DSO operations (network capacity allocations)

While much of this is taking place under Business as Usual (BAU) activity, the FESS project will liaise with relevant NIE Networks staff to raise particular areas of consideration, so that any changes required for storage can then be taken forward by those individuals or teams. The FESS project will also review the suitability of Connection Agreements and prepare draft modifications for storage where necessary. The NI Standard Application Form will also be reviewed and, if necessary, modifications proposed, which could be shared with the relevant ENA working group.

Consultation Q6. Do you have any comments on the proposed FESS programme of work (section 4.2)? Is there anything missing from the FESS programme that is within the remit of NIE Networks and is not covered in section 4.3?

Consultation Q7. Do you have any comments about the FESS project as a whole?

4.3 Barriers being addressed by other NIE Networks activity

AS MENTIONED IN SECTION 4.1, A NUMBER OF THE NIE NETWORKS SOLUTIONS IDENTIFIED IN

Table 5 are already being addressed as BAU activity. The activity in these areas is summarised here.

4.3.1 Fast track storage process for pre-2014 generation

As noted in Table 1, EREC G99/NI contains a connection procedure for integrated micro-generation and storage installations (previously known as the G59 storage fast track). However, this does not cover EREC G83 generation that was installed prior to 2014 with a capacity that exceeds 16 Amps per phase, which is a barrier to those existing PV installations installing small storage devices. The limiting factor here is the 16 Amps per phase threshold in ESQCR(NI).

A potential solution to resolve this issue is for the customer to install an export limiting scheme, limiting export to 3.68 kW. However, this may not be an attractive solution to customers with generation capacity that exceeds this. The ENA is currently reviewing fast track modifications in GB, which may address this problem. The proposed modifications would increase the export limit to 32 Amps per phase; permission would be required from the DNO to proceed, but this should be provided within 10 days. NIE Networks will remain cognisant of this review work and progress any modifications outside of the remit of the FESS project.

4.3.2 Consider adopting EREC P2/8

NIE Networks currently uses EREC P2/6 as the security of supply standard (with supporting document EROP 130). Updates to these two documents (EREC P2/7 and EROP 130) were published in 2019. They were updated to take account of developments in Distributed Energy Resources (DER), including Demand Side Response (DSR) and storage. Prior to 2019 neither EREC P/6 nor EROP 130 took account of DSR or storage as contributing to security of supply.

In EREC P2/7:

- The definition of Group Demand, which determines the minimum level of security of supply required for an area of the network, has been amended to allow DNOs to take Latent Demand (below) into consideration; and
- A new definition, Latent Demand, has been added: "*Demand that would appear as an increase in Measured Demand if the DG was not operating, the DSR was not implemented or other means (eg time of use tariff, export from electricity storage devices) of suppressing the Measured Demand within the network (for which the Group Demand is being assessed) was not operating.*"

Following the publication of EREC P2/7, EROP 130 was amended to provide guidance to DNOs on assessing the contribution to security from electricity storage (among other things) that is contracted with the DNO to provide a security service. EROP 130 contains guidance and examples on determining Group Demand for contracted and non-contracted electricity storage.

NIE Networks is planning to consult on adopting EREC P2/8 in Q3 2021. There are no changes from EREC P2/7 to P2/8 that impact storage.

4.3.3 Network constraints

The issue of limited capacity for grid connections was raised numerous times in the FESS market survey. Limitations can be in the distribution network and/or the transmission network, and this is a particular issue in certain geographic areas (e.g. north and west of NI). A specific issue for storage which was raised by industry is the limited availability of symmetrical connections, where import and export capacities match. This could diminish the ability of storage facilities to participate in the wholesale market for energy arbitrage activity. For example, if a storage facility had a 20 MW Maximum Export Capacity (MEC) and a 5 MW Maximum Import Capacity (MIC), this could limit the ability of the storage to charge quickly at times of low or negative electricity price.

The issue of limited grid capacity is not specific to electricity storage and comes as a result of significant progress in connecting renewable generation. In 2010 The Department of Enterprise, Trade and Industry (DETI) issued an ambitious target for Northern Ireland, that by 2020, 40% of the electricity consumed in the country would be generated by renewable resources[19]. NIE Networks played a key role in facilitating this change and by the summer of 2019 the target had been exceeded, with 44.9% of electricity consumption in Northern Ireland generated from renewable sources located in Northern Ireland, a figure which had risen to 47.7% by September 2020, with 84.5% of the total renewable electricity generated being from wind. When the level of connected renewable generation is viewed in the context that Northern Ireland experiences a summer minimum electrical demand of approximately 0.5GW and a winter maximum of around 1.8GW, it is easy to appreciate the challenge of such a proliferation of connected renewables. In practice, this means that during times of minimum electrical demand in the summer, the capacity of connected (or committed to connect) renewable generation can be up to 400% that of the electrical demand on the system.

Over the period 2010 – 2013, NIE Networks introduced a "cluster methodology". The cluster methodology improves access to the network for remote renewable generation by extending the 110 kV transmission system, in the form of a 110/33 kV substation (referred to as a cluster substation), to a point more central to a group of renewable generation projects. This has been very successful in facilitating the connection of renewable generation. The cluster methodology currently only allows generation connections; it excludes demand (including storage). NIE Networks has issued a Call for Evidence on reviewing the cluster methodology, which includes widening the remit to demand connections.[20]

[19] https://www.economy-ni.gov.uk/sites/default/files/publications/deti/sef%202010.pdf
[20] NIE Networks; Cluster Methodology Review – Call for Evidence; 05 October 2020 https://www.nienetworks.co.uk/documents/regulatory-documents/cluster-methodology-review-cfe.aspx

NIE Networks together with the TSO have worked with industry to progress connection policy and steps have been taken to enable the connection of generators 5 MW and above to the distribution system with non-firm market access. Connection Offers with non-firm market access are reflective of the transmission capacity or lack thereof, available to the generator. Issuing a connection offer with non-firm market access does not create more capacity or address the need for reinforcement; rather it allows generators to connect in anticipation of network reinforcement. We continue to work together to address connection policy for generators of less than 5 MW seeking to connect (and export) to the distribution system.

A SONI and NIE Networks Joint Working Group (JWG) produced a common electricity roadmap for NI to inform the DfE consultations on developing an energy strategy.[21] As part of one of five thematic working groups, this one focussing on power, the JWG roadmap contains an assessment of network development needs and associated costs for different 2030 renewable energy targets (60%, 70% and 80%), for both transmission and distribution systems. The roadmap notes that an increase in flexible technologies, including storage, is needed for increased renewable energy targets.

4.3.4 Consideration of storage solutions when generation application is rejected

One suggestion raised in the FESS market survey was that storage solutions could be recommended when a generation application is rejected. However, given that NIE Networks has a technology-agnostic role, it is not considered appropriate to nominate one generation technology (i.e. storage) over another. The preferred route would be to point towards other options e.g. zero export or limited export connections. Customers also have the option of requesting feasibility studies for a connection prior to submitting an application.

4.4 Overview of activity relevant to storage

One of the potential solutions identified was the development of a long-term vision for addressing storage barriers in order to avoid a piecemeal approach to changes.

Whilst the development of a long-term vision for storage in NI should be addressed by the DfE in developing the energy strategy, NIE Networks has a role to ensure that the industry codes and processes facilitate the connection of storage fairly. NIE Network's view on procuring network services from storage and other flexibility service providers is not fully formed yet, as it will be shaped by the results and learning of the FLEX project. However, the FESS project has summarised the activity within NIE Networks and elsewhere that could impact storage connections. This activity is summarised in Figure 5.

[21] SONI and NIE Networks; Insight Paper: Energy Scenarios to Inform Developing Energy Strategy in Northern Ireland; 10 December 2020

FIGURE 5. SUMMARY OF ACTIVITY RELEVANT TO STORAGE

Barrier/Solution	Remit	Feb				Mar					Apr				May					Jun				Jul				Aug				Sep				Oct				Nov					Dec	
		01/02/2021	08/02/2021	15/02/2021	22/02/2021	01/03/2021	08/03/2021	15/03/2021	22/03/2021	29/03/2021	05/04/2021	12/04/2021	19/04/2021	26/04/2021	03/05/2021	10/05/2021	17/05/2021	24/05/2021	31/05/2021	07/06/2021	14/06/2021	21/06/2021	28/06/2021	05/07/2021	12/07/2021	19/07/2021	26/07/2021	02/08/2021	09/08/2021	16/08/2021	23/08/2021	30/08/2021	06/09/2021	13/09/2021	20/09/2021	27/09/2021	04/10/2021	11/10/2021	18/10/2021	25/10/2021	01/11/2021	08/11/2021	15/11/2021	22/11/2021	29/11/2021	06/12/2021	13/12/2021
FESS project: Briefing note on UoS charges for storage	NIE Networks																																												
NIE Networks consultation on adopting EREC P2/8	NIE Networks																																												
FESS project: Draft proposals for modifications to the NIE Networks connections webpage for storage	NIE Networks																																												
FESS project: Storage stakeholder events	NIE Networks																																												
NIE Networks implementation of Maximum Import Capacity (MIC) / Chargeable Service Capacity (CSC) charges review	NIE Networks																																												
Two-tier Maximum Import Capacity (MIC) review	NIE Networks																																			Implementation likely to be in 2022									
FESS project: Produce customer-facing summary of key points of connection process for storage	NIE Networks																																												
FESS project: Review and document internal connection process for storage	NIE Networks																																												
FESS project: Review how storage is presented / recorded in systems	NIE Networks																																												
FESS project: Review the treatment of storage during network outages	NIE Networks																																												
FESS project: Review how storage mode of operation is recorded and managed within NIE Networks	NIE Networks																																												
FESS project: Meetings with the UR / DfE	NIE Networks																																												

Northern Ireland Electricity Networks

Barrier/Solution	Remit	Feb				Mar				Apr				May				Jun				Jul				Aug				Sep				Oct				Nov				Dec	
		01/02/2021	08/02/2021	15/02/2021	22/02/2021	01/03/2021	08/03/2021	15/03/2021	22/03/2021	29/03/2021	05/04/2021	12/04/2021	19/04/2021	26/04/2021	03/05/2021	10/05/2021	17/05/2021	24/05/2021	31/05/2021	07/06/2021	14/06/2021	21/06/2021	28/06/2021	05/07/2021	12/07/2021	19/07/2021	26/07/2021	02/08/2021	09/08/2021	16/08/2021	23/08/2021	30/08/2021	06/09/2021	13/09/2021	20/09/2021	27/09/2021	04/10/2021	11/10/2021	18/10/2021	25/10/2021	01/11/2021	08/11/2021	15/11/2021	22/11/2021	29/11/2021	06/12/2021	13/12/2021
FlexTech: Develop a strategy on Transmission and Distribution Code updates	FlexTech																																								
FlexTech: Review over install limits (20%) for Renewable Hybrid plants	FlexTech																																								
Tariff reform - Call for Evidence	UR																																								
DfE Energy Strategy - Consultation	DfE																																								
DfE Energy Strategy - Final Energy Strategy	DfE																																								
DfI Call for Evidence - Review of the implementation of the Planning Act	DfI																																								

4.5 Consultation questions

Q1. Do you think that NIE Networks should give further consideration to connection queue priority? i.e. Where flexible connections (e.g. storage) are given priority in a connection queue if they can facilitate the connection of other customers.

Q2. Do you agree that NIE Networks should further consider offering a 'two-tier' MIC, allowing connections to have a different MIC for day and night?

Q3. Do you agree that NIE Networks should give consideration to facilitating the connection of storage (and other flexibility providers) in constrained areas (e.g. areas of high demand with limited import capacity) provided that the storage will act to resolve the network constraint?

Q4. Do you agree that enhancement of the Connections webpages on the NIE Networks website to include storage would be of value?

Q5. Would further workshops for storage customers and ongoing engagement be of value? If so, can you give an indication of the types of topics that would be beneficial to cover?

Q6. Do you have any comments on the proposed FESS programme of work (section 4.2)? Is there anything missing from the FESS programme that is within the remit of NIE Networks and is not covered in section 4.3?

Q7. Do you have any comments about the FESS project as a whole?

5. NEXT STEPS AND HOW TO RESPOND

5.1 Next Steps

This consultation paper is the second step in engaging with storage stakeholders, the first being the FESS market survey. The paper has summarised the barriers to storage that were identified in this project, potential solutions and a proposed programme of work for developing solutions in the FESS project. Where solutions are being undertaken elsewhere in NIE Networks, or are not considered appropriate, this has been stated. NIE Networks is keen to ensure that interested stakeholders have an opportunity to comment on the FESS programme of work, as well as seeking responses on other specific points. Responses to this consultation paper will help to shape the FESS programme of work and will provide valuable feedback for NIE Networks on storage related activity that sits outside of the FESS project.

An indicative timeframe for this consultation is shown below.

TABLE 9. KEY MILESTONES AND PROPOSED DATES FOR THE FESS CONSULTATION

Key Milestones	Proposed Dates
Publication of consultation paper	Friday 4th June 2021
Consultation paper close	4pm on Friday 16th July 2021
Stakeholder workshops	September 2021 (tbd)

5.2 How to Respond

NIE Networks invites interested parties to respond to this Consultation Paper. Whilst NIE Networks welcomes all comments, responses are particularly welcome on the questions that are embedded within this document (section 4.5). Responses should be sent electronically to Josh.Watson@nienetworks.co.uk by 4pm on Friday 16th July 2021.

NIE Networks will handle all information in accordance with the NIE Networks Privacy Statement. (http://www.nienetworks.co.uk/privacy)

Please note that it is intended to publish all responses to this paper on the NIE Networks website (www.nienetworks.co.uk). Respondents who wish that their response remains confidential should highlight this when submitting the response.

NIE Networks may share responses with UR. Respondents should be aware that as UR is a public body and non-ministerial government department, the UR is required to comply with the Freedom of Information Act (FOIA)[22].

[22] The effect of FOIA may be that information contained in consultation responses that is shared with UR is required to be put into the public domain. Hence it is possible that all responses made to this consultation that may be shared with UR will be discoverable under FOIA, even if respondents ask for the responses to be treated as confidential. It is therefore important that respondents take account of this and in particular, if asking that the responses are treated as confidential.

ANNEX A: BARRIERS OUTSIDE OF NIE NETWORKS' CONTROL

The barriers that were identified to storage in NI that are considered to be outside of the remit of NIE Networks are summarised in the table below.

TABLE 10. BARRIERS TO STORAGE THAT ARE OUTSIDE NIE NETWORK'S REMIT

Issue	Barrier to storage
Connection process	Feedback from the FESS market survey included views that the connection application process is slow and is not uniform across the Single Electricity Market (SEM), which operates across NI and Ireland. The NIE Networks process is governed by timeframes as set out in the distribution licence. The issue of uniformity across the SEM is a consequence of the situation NIE Networks is in, wherein there is close regulatory alignment (in terms of technical requirements for the connection of generation to distribution networks) with GB, and close cooperation with EirGrid through the SEM.
Grid balancing products and markets: Lack of long-term frameworks that enhance business cases	To ensure a robust business case can be developed, storage operators need clarity and a level of certainty around the time horizons of the services they provide. Long-term frameworks and contracts for services provide a guarantee that certain revenue streams will be maintained for a significant proportion of the lifetime of the asset. The DS3 schedule of providing agreements is a process that happens every six months and could lead to several months of lost revenue if the agreement gate is missed.
Economics of electricity storage	There is little information available about the economics of storage facilities, which has been identified as a deterrent to storage market entry.
Planning and construction	Like other developments, battery storage facilities need to demonstrate that they will not have a significant adverse effect on the surrounding area to gain planning permission. Battery storage facilities are made up of containerised battery packs, inverters, HVAC units, and fire suppression technologies. Additionally, a substation could be present at the site. The site needs to be fenced off and an access track needs to be built. There can be resistance to storage projects in the planning process due to perceived negative impact on the surrounding area.
Difficulty in accessing finance	Electricity storage is still classed as a relatively novel technology. However, it is already transitioning away from government R&D funding, while the perceived uncertainty surrounding it poses an obstacle to obtaining conventional debt financing. This is reflected in the 7.3%

	hurdle rate proposed for storage projects by Europe Economics.[23] Within this gap, storage projects have a limited access to finance that is mainly sourced from venture capital or crowd funding.
Supply chain considerations	The global lithium-ion batteries supply chain has developed and continues to do so quickly to meet demand from the automotive industry and for grid scale and domestic electricity storage. Most of the manufacturing capacity is situated in China, Japan and South Korea, but there is significant capacity in the USA and Europe. The UK is already well positioned in this supply chain. It should be noted that supply chain companies need to be held to high technical, environmental and ethical standards. Batteries require several rare earth metals, some of which (e.g. cobalt) could be associated with exploitative working conditions and low environmental standards.

23 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/910814/Cost_of_Capital_Update_for_Electricity_Generation_Storage_and_Demand_Side_Response_Technologies.pdf