Re-opener Report

MSIP – ESO Driven Works

Project: Frodsham 400kV Customer Connection

January 2022

nationalgrid

Contents

1. Executive summary

1. This submission requests additional allowance to provide a connection for Mersey Reactive Power LTD's (MRP) user-owned 200MVAr reactor at NGET's Frodsham 400kV substation.
2. MRP have submitted a connection application which is an output from NGESO's NOA High Voltage Pathfinder – Mersey tender process. The customer asset being connected will be providing ancillary services only and hence does align with typical demand or generation connections. As such established uncertainty mechanisms (UM) for these investment categories do not apply. Funding is therefore requested under the ESO Driven Requirements category of the Medium Sized Investment Project (MSIP) reopener mechanism.
3. The preferred connection solution is to use an existing spare bay at Frodsham 400kV substation thereby minimising cost to the consumer, minimising environmental impact and achieving the desired customer connection date.
4. Other options such as do nothing, market, and whole system solutions did not satisfy the need. The option to provide the customer a connection via construction of a new bay at Frodsham 400kV was considered and it was concluded this option would result in greater costs and a later connection date than the preferred option.
5. The option to provide a connection at the existing spare bay was identified as offering the lowest cost and earliest connection date. The chosen connection option satisfies the technical requirements of the customer.
6. NGET are therefore seeking funding for these works via the MSIP reopener mechanism under the 'ESO Driven Requirements' category.
7. The proposed delivery date for the works is 31/03/2022 and all spend will be within the RIIO-T2 period. The funding requested is xxxxxxx in 18/19 price base and 84% of the total costs are either incurred already or have been contracted, giving high confidence in our cost submission.

2. Introduction

8. This document is the formal MSIP submission to Ofgem by NGET for the Frodsham 400kV Customer Connection during RIIO T2. This is submitted under the MSIP re-opener provided for in Special Condition 3.14 of the NGET Transmission Licence.

9. The MSIP re-opener was introduced by Ofgem to allow Transmission Owners (TOs) to apply for funding for investments under £100m in the network not included in baseline funding. TOs MSIP submissions allow for Ofgem to carry out an assessment of the need and cost of the proposed investment.

10. This submission is made in accordance with the 'RIIO-2 Re-opener Guidance and Applications Requirements' published by Ofgem in February 2021. The contents of the submission have also been informed by engagement between NGET and Ofgem with the aim of ensuring that this submission enables the Authority to make a positive timely decision on funding.

11. NGET have clearly evidenced that the proposed investment represents that lowest cost option for consumers and is the only feasible connection option that can facilitate the customer's desired connection date. The submission provides a comparison of capital costs of options but does not include a detailed cost benefit analysis (CBA). It is our view that a CBA is not required in order to make an informed investment decision and as such one has not been provided.

12. The works described in this submission are required to provide a connection for a customer Mersey Reactive Power LTD (MRP) who are seeking to connect a 200MVAr reactor at the existing 400kV Frodsham substation.

13. MRP have a signed connection agreement that specifies a connection date of 31/03/2022.

14. This customer's connection is an output of the National Grid Electricity System Operator (NGESO) NOA High Voltage Pathfinder – Mersey tender process. The pathfinder sought to find the most cost-effective way to address high voltage issues on the transmission system created by the closure of transmission connected large synchronous power stations, the increase in embedded generation (i.e., connected to distribution networks), the reduction in reactive power demand, and periodic low loading levels on the transmission system. The solution tendered by MRP was selected as being beneficial for consumers and hence the customer subsequently submitted a formal application to connect to the transmission system.

15. This connection was not included in NGET's RIIO-T2 baseline plan because the NOA High Voltage Pathfinder – Mersey was not concluded until May 2020 and hence there was insufficient certainty around the investment requirements to allow the project to be included in the baseline RIIO-T2 investment plan.

16. Connections of this type do not provide output against the typical metrics of Mega Watts (MW) or Megavolt Amperes (MVA). They will not export power in the form of MW as a generator would or import power which is measured in MVA via a super grid transformer (SGT) like a typical demand customer. Hence, neither the demand nor generation uncertainty mechanism can be applied as there is no output upon which to calculate the allowance. The primary function of this customer connection is to support system stability through providing reactive power (Megavolt Ampere of reactive power, MVAr) as required by NGESO.

17. NGET are therefore seeking allowance for this connection via the Medium Sized Investment Project (MSIP) reopener mechanism under the 'ESO Driven Requirements' category.

3. Structure of the reopener submission

18. The table below signposts the structure of the document and sets out the purposes of each of the sections. This also lists the appendices. We invite Ofgem to consider the proposals set out in this submission and raise queries against anything that may require further clarification.

Chapter	Description
1. Executive Summary	A high-level summary of the submission
2. Introduction	High level overview of the project
3. Document structure	Navigation tool
4. Alignment with overall business strategy and commitments	The strategic context and overview
5. Demonstration of the needs case	Sets out the drivers for the project,
6. Options analysis	Describes the range of options considered and shortlisted options
7. Preferred option and detailed costs	Summarises the scope of works and benefits the efficient costs of the project, setting out the assumptions and methodology used and the evidence to support cost confidence including risks and contingency
8. Project delivery	Details the proposed pathway to completion
9. Stakeholder engagement	Details the engagements with stakeholders
10. Price control deliverable	Obligation to deliver the works detailed
11. Overview of assurance and point of contact.	Assurance statement
Appendices	
Ref.	**Title**
Appendix A	Assurance statement letter
Appendix B	Ofgem ET UM submission template
Appendix C	Ofgem document guidance

4. Alignment with overall business strategy and commitments

The strategic context

19. NGET is required by our licence to provide connections for customers. Our baseline RIIO-T2 business plan included the customer connections we had sufficient understanding of and certainty about at that time. Over the course of a price control period, it is expected that existing customers may change their plans or new customer may apply for connections that can require investment within the price control period. These changes are managed through the agreed uncertainty and reopener mechanisms.

20. As part of the transition towards a Net Zero network, National Grid Electricity System Operator (NGESO) is seeking to develop new markets to procure the services required to ensure the GB Transmission System can continue to be operated securely and economically.

21. These new markets are being developed through "pathfinder" projects, run by NGESO, which identify service requirements in specific areas of the network and invite existing and new providers to submit commercial bids to provide these services. NGESO carries out cost benefit analysis and recommends solutions to move forward either via commercial contracts or regulated arrangements.

22. If those solutions are not already connected, or do not already have a connection agreement or offer, then they will be required to apply for a new connection. This leads to a situation where new customers apply for a connection seeking very specific connection dates to comply with the terms of the contract offered by NGESO through the pathfinder process.

23. The relevant Transmission Owner (TO) will then seek to determine an economic and efficient connection option for these customers that balances the desire for connection by a specific date (normally as quickly as possible) with the costs that would be borne by consumers of different connection options.

24. The closure of transmission connected large synchronous power stations, the increase in embedded generation (i.e., connected to distribution networks), the reduction in reactive power demand, and periodic low loading levels on the transmission system can result in system conditions where voltages may exceed the upper limits specified in the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS). System voltages must be managed within these limits to avoid safety risks and damage to assets. High system voltages can be manged by increasing the levels of reactive power absorption on the network.

25. In 2019, NGESO undertook a pathfinder tender process for long-term reactive power absorption services (to manage high voltage conditions) in the Mersey region. This pathfinder project was referred to as the NOA High Voltage Pathfinder - Mersey. The pathfinder tender sought to find the most cost-effective way to manage high voltage issues in the electricity system.

26. The customer connection described in this submission is an output of NGESO's NOA High Voltage Pathfinder - Mersey process[1].

Future and forecast data

27. The investment proposed in this submission is driven by a single customer connection. That customer has a contracted connection agreement and was awarded a contract to provide reactive power absorption services to NGESO as part of the NOA High Voltage Pathfinder - Mersey process.

28. These works are not dependent on any wider scenario forecasts or outcomes. The Stakeholder Engagement section details the status of the customer's project, evidencing that there is a high degree of certainty that this customer will connect regardless of any other wider system developments.

29. Therefore, this submission does not present any analysis of wider scenario forecasting or outcomes as the contractual position and latest project status are the primary measures of need case certainty for this investment.

[1] Mersey Pathfinder | National Grid ESO

5. Demonstration of the Needs Case

Needs Case

30. In November 2019 NGESO invited tenders for the provision of reactive power absorption services through the NOA High Voltage Pathfinder - Mersey project. Participants submitting tenders, who did not already have existing connections or connection agreements, were not required to engage with NGET to define the expected connection timescales and costs ahead of the submitting a tender to the pathfinder process. Instead, NGET worked with NGESO to provide connection cost and lead-time information ahead of the process for all potential tenderers to utilise.

31. The outcome of the NOA High Voltage Pathfinder - Mersey tender assessment process was published by NGESO in May 2020[2].

32. Following NGESO's tender assessment process, MRP's proposed solution was identified as offering the greatest value for the consumer and they were therefore awarded the tender to provide reactive power absorption services to NGESO over a nine-year period.

33. MRP's solution proposed the connection of a 200MVAr 400kV shunt reactor connecting to the existing Frodsham 400kV substation. Table 1 summarises the results spreadsheet[3] published by NGESO showing the outcome for MRP's proposed project at Frodsham.

Company	Option	Reactive Volume	Effective MVAr	Availability Fee £/SP	£/SP/MVAr	Infrastructure Cost	Total Present Value	Cost/Effective MVAr	Accept/ Reject
PeakGen Top Co Ltd	PeakGen (FROD4)	200	200	£39.93	£0.20	Spare Bay	£5,706,783	£28,534	Accept

Table 1 – NOA High Voltage Pathfinder – Mersey results for MRP's solution at Frodsham

34. As a result of MRP's success in the pathfinder process they next submitted a formal connection application for a 400kV connection at Frodsham substation.

35. NGET is obligated by our licence to provide a connection for this customer. Therefore, the results of the NOA High Voltage Pathfinder - Mersey tender assessment, which identified the MRP solution of a 200MVAr 400kV shunt reactor connecting to the Frodsham 400kV substation as offering benefit for the consumer, and the subsequent formal application to connect these assets are the basis of the need case for the investment works proposed in this submission.

36. The primary criteria for success in this connection project is to provide the customer with a connection date that aligns with their programme.

Section Summary – Need Case

- **The need case is driven by the NGESO NOA High Voltage Pathfinder – Mersey.**
- **The customer's proposed connection was identified as being beneficial for consumers in the pathfinder assessment.**
- **The customer has a contract in place to deliver reactive power services to NGESO.**
- **The energisation date for the customer is 31/03/2022.**

[2] NOA High Voltage Pathfinder - Mersey Results | National Grid ESO
[3] NOA High Voltage Pathfinder Results Spreadsheet | National Grid ESO

6. Options analysis

Frodsham Substation

37. Frodsham was identified by NGESO in the NOA High Voltage Pathfinder – Mersey Invitation to Tender (ITT) pack[4] as being a connection option for reactive power assets in the Mersey area. NGESO determined that reactive power services connected at Frodsham would have a high degree of effectiveness as shown in figure 1 below.

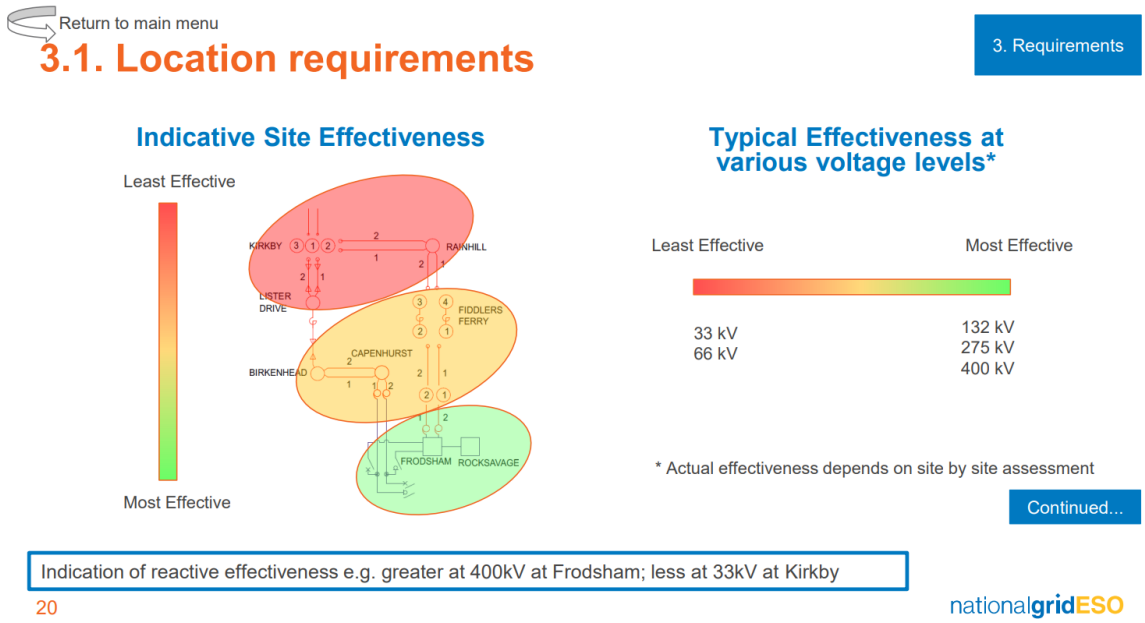

Figure 1 – Extract from NGESO ITT pack identifying Frodsham as a connection location

38. Frodsham substation is located in the North West of England, close to the town of Runcorn. The substation forms part of an area of the transmission system known as the Mersey 400kV ring.

39. The substation was constructed in the early 1960s and uses Air Insulated Switchgear (AIS) technology and is a double busbar design. The substation is outdoors, a general view of which is shown in Figure 2. It can be observed that Frodsham substation is enclosed by the river Weaver and Weaver Navigation and is space constrained for any possible expansion, however it does have an existing spare bay.

[4] NOA High Voltage Pathfinder - Mersey ITT | National Grid ESO (Page 20)

Figure 2 – General view of Frodsham 400kV Substation

40. Figure 3 shows the location plan for Frodsham 400kV substation and the proposed area for MRP's facility. Figure 4 provides a layout plan showing the existing spare bay at Frodsham substation and MRP's infrastructure connecting to it.

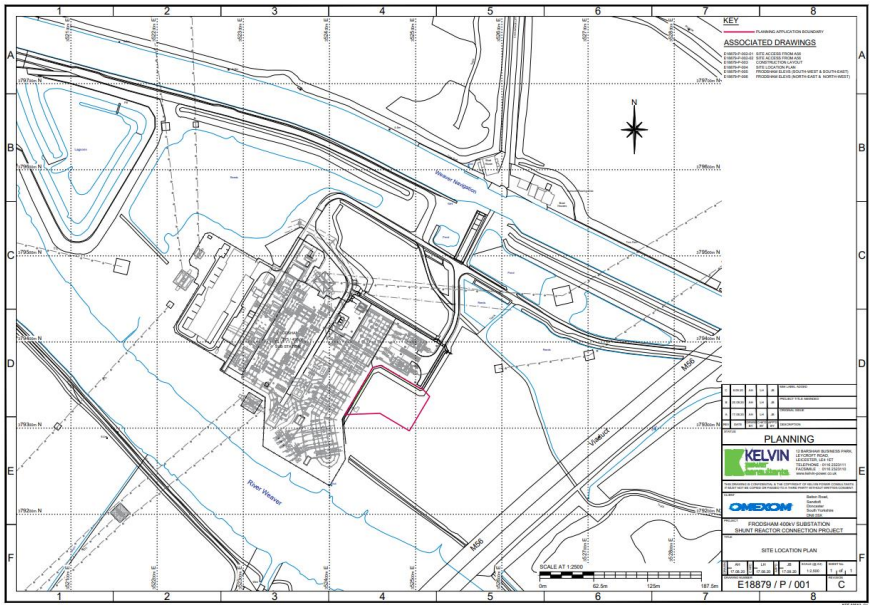

Figure 3 – Frodsham 400kV substation location plan and proposed MRP facility area (within red boundary)[5]

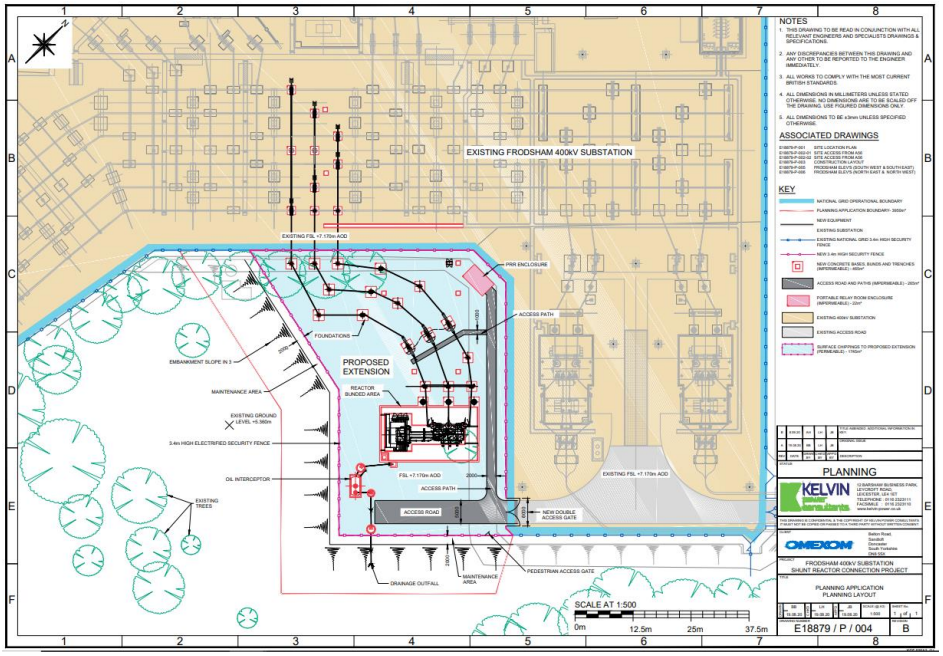

Figure 4 – Frodsham 400kV substation site layout plan showing the spare bay and MRP connection.[6]

Minimum Technical Requirements

41. The level of security to which connections that solely provide stability or voltage services (i.e., without exporting or importing real power (MW's) to/from the transmission system) must be designed to, is not defined in the National Electricity Transmission System Security of Supply Standard (NETS

[5] Planning Application Supporting Evidence: 'The Location Plan'
[6] Planning Application Supporting Evidence: 'Site Layout'
Application reference 20/03405/FUL

SQSS). Therefore, there is not a definable minimum level of compliant connection that can be prescribed for these customers.

42. As such, NGET has applied the same connection design requirements to these customers as would be applied to a TO owned reactive compensation asset (e.g., an SVC or reactor).

43. In lieu of a defined compliant connection requirement from the SQSS, the following connection options are considered to represent minimum technically sufficient connections for customers that are following the pathfinder process:

- a direct connection to a single bay
- a connection to the tertiary winding of an existing Super Grid Transformer (SGT)
- a tee'd connection onto an existing circuit

44. None of these connection options provide N-1 security at the point of connection, a fault on any transmission asset to which the customer is connected i.e., a single bar, transformer, or circuit fault would result in the customer being disconnected.

45. The specific terms of the contracts for providing network services that NGESO may award as part of future pathfinder projects could require higher levels of connection design security to be provided. However, in this case there is nothing specific in the customer or NGESO's requirements that dictate investigation of connection designs beyond those listed above.

Long list of options

Generally, NGET will assess the following categories of option when assessing how to facilitate connections for new customers.

- Do nothing
- Whole system / market-based solution
- Use / enhancement of existing assets
- Construction of new assets

Do nothing

46. This option is not applicable to this need case as NGET is obligated to provide a connection for this customer. There is no way to facilitate the customers application without providing some form of direct access to the transmission system. This option is referred to as No.1 in Table 2.

Whole system / market-based solution

47. In this case MRP's proposed connection is already a market-based solution to the high voltage problem identified by NGESO and the solution was identified as offering benefit for the consumer through a market-based tender exercise run by NGESO (NOA High Voltage Pathfinder - Mersey). Therefore, as a connection to the transmission must be provided for this customer in order for them to supply their contract service to NGESO there is no whole system or market-based alternative to providing a physical connection to the transmission network. The connection of the MRP shunt reactor does not trigger any other works in the local transmission network (e.g., there is no requirement to replace circuit breakers due to increased fault levels or to increase circuit ratings to manage higher loadings. Therefore, no whole system or market-based solutions need to be investigated as alternative to any infrastructure works required beyond the customer connection point.

48. This option is referred to as No.2 in Table 2.

Use / enhancement of existing assets

49. NGET has investigated options to utilise existing assets at Frodsham 400kV substation to reduce the cost and timescales for MRP's connection. A spare bay, which NGET has no future requirement for, was identified. This option will be considered further.

50. This option is referred to as No.3 in Table 2.

Construction of new assets

51. For completeness, NGET has considered the option of constructing new assets to provide a connection for MRP.

52. A new bay could be constructed to provide the connection for MRP. However, there is not sufficient space within the existing compound to accommodate the construction of the busbar extension that would be required to provide the new bay. The substation compound would have to be extended as denoted in figure 5 below as 'Option 4 – Bus bar extension.' The option would have the following implications:

    - Require fundamental re-design of the customers project, which is already consented. Possibly requiring relocation to move the reactor adjacent to the extended area, or the introduction of a cable connection if it were to remain in its current position. It should be noted that introducing a cable within the reactor circuit reduces the effectiveness of the services that the customer can provide the ESO.
    - NGET to further modify and extend the flood defence scope.
    - Additional planning consent required for NGET works.
    - Additional environmental and ecological impact on sensitive priority habitats and habitats of principle importance.
    - Working in proximity to double circuit OHL

Figure 5 – Option 4 extension sketch

53. Based on the fact that an existing suitable spare bay was available at Frodsham, it was considered clear that the option of constructing a new bay would involve higher costs, greater environmental impacts, and a later connection date for MRP than the use of the spare bay. Therefore, the option of extending the substation to provide a new connection bay was not taken forward.

54. Further justification of not taking this option forward can be found on the planning website of Chester West and Chester website under 'Further Justification Information'[7]

55. This option is referred to as No.4 in Table 2.

Selection of the preferred option

56. NGET initially identified a range of options that could potentially fulfil the needs of MRP and provide a connection in the timescales required to facilitate the provision of reactive power services to NGESO in a timely manner. The approach of determining the preferred option has been based on minimising costs, environmental impacts, and achieving the connection date for the customer.

No.	Option	Total Cost (£m) in 18/19 price base	Timescale	Selected (Y/N)
1	**Do Nothing**	n/a	n/a	N
2	**Whole System / Market-Based**	n/a	n/a	N
3	**Existing Assets – Spare Bay**	[redacted]	March 2022	Y
4	**New Assets – New Bay**	[redacted]	18-24 months	N

57. Table 2 – Option summary

58. Investigation of the long list of options quickly identified that whole system and market-based options were not applicable in this case due to the need for the customer to have direct access to the transmission system in order to provide the contracted reactive power services. The option to construct a new bay was not taken forward due to there being a clear expectation that this option would results in increased costs, environmental impacts, and a later connection date than the use of the existing spare bay.

59. The option to provide a connection using the existing spare bay at Frodsham was identified as being able to offer the quickest and lowest cost connection option with the lowest environmental impact and hence it was selected as the preferred option and taken forward for further development.

Section Summary – Options and Option Costs

- **Do Nothing, Market, and Whole System solutions were considered and ruled out as being inappropriate to satisfy this need case.**
- **The option to provide the customer a connection via construction of a new bay at Frodsham 400kV was considered and it was concluded this option would increase costs and result in a later connection date.**
- **The option to provide a connection at the existing spare bay was identified as offering the lowest cost and earliest connection date.**
- **The chosen connection option satisfies the technical requirements of the customer.**

[7] Planning Application Supporting Evidence
Application reference 20/03405/FUL, 'Further Justification Information' document

7. Preferred option and detailed costs

Using the existing spare bay at Frodsham 400kV Substation

60. The preferred option is using the existing spare bay between SGT5 and SGT6. This option presents the lowest cost, lowest environmental impact, shortest connection time and achieves the required connection date. Utilising the spare bay between SGT5 and SGT6 means that there is no impact on the existing network other than the need for busbar protection modifications.

61. The layout of the spare bay and customer proposed connection is shown in Figure 5.

Figure 5 – [redacted]

62. [redacted].

Detailed Scope

63. [redacted]

- [redacted].
- [redacted].
- [redacted]

Detailed costs

64. Since selection of the preferred option, NGET's scheme team has continued to develop the proposed works to fully understand scope, prepare detailed delivery plans, and engage with suppliers to refine costs.

Latest Cost Estimate

65. The following cost breakdown represents our latest view of costs for the proposed investment. 18/19 price base.

Classification	Activities	Source	Prev. Yrs	FY22	FY23	Cost (£k)
	Total					
		Direct Allowances Requested				

Table 3 – Cost summary

66. The table below shows the assessment of cost firmness using the classification outlined in the Ofgem LOTI reopener guidance document published on 29th March 2021. This shows that 84% of the total costs are either incurred already or have been contracted, giving high confidence in our cost submission.

Cost Firmness	Project Management	Optioneering /Develop't	Contractor Costs	Commission	Contingency	Closeout	Totals
Total							

Table 4 – Cost firmness

Risk & Contingency

67. The following key programme and project risks have been identified and incorporated into the analysis to produce the contingency provided within Table 5:

Cause	Description	Impact	Probability	Mitigation

Table 5 – Key Risks

Procurement Strategy

[redacted]

Cost benefit analysis

69. Our assessment of options has shown that the preferred option (use of the existing spare bay) offers the lowest cost option for consumers, the earliest connection date for the customer, and the lowest level of technical and project risk.

70. As such, in line with Ofgem's guidance to develop MSIP submissions that are proportional to scale and cost of the investments proposed, it is not considered necessary or efficient to undertake a CBA process as part of this submission. The reasoning behind the selection of the preferred option is considered to be clear based on the information presented in previous sections.

Total Allowance Request

71. NGET requests that the following allowance is provided through the MSIP reopener mechanism to deliver the works described above. These allowances will be subject to the Opex Escalator mechanism

	Prev. Yrs	FY22	FY23	Cost (£k)
Direct Allowances Requested	[redacted]	[redacted]	[redacted]	[redacted]

Section Summary – Preferred Options and Detailed Costs

- **The preferred option consists of a connection into an existing spare bay at Frodsham 400kV substation**
- **The connection of this customer requires modification of an already planned flood protection scheme, the costs of which will be borne be by MRP.**
- **The total cost of the connection is [redacted] in 18/19 price base.**
- **84% of the total costs are either incurred already or have been contracted, giving high confidence in our cost submission.**

8. Project delivery and monitoring

72. A detailed project delivery plan has been prepared by the NGET scheme team. This plan facilitates the customer's contracted connection date of 31/03/2022.

73. The key project milestones are summarised below:

MILESTONE	DATE

9. Stakeholder engagement

74. The key stakeholders identified by NGET in this project are: MRP (the customer) and NGESO.

MRP

75. NGET has worked closely with the customer to develop options and agree a programme that meets the customers need to achieve as early as possible a connection date. To ensure our investment is efficient, we have closely tracked the progress of the customer in developing their aspects of the connection to ensure that NGET does not invest ahead of need.

76. The latest status of the customer project is summarised below:

[redacted]

78. The progress of the customer indicates that they will be ready to connect by the contracted date and hence our investment should continue as planned to meet this agreed date.

NGESO

79. NGESO are currently investigating methods for operational control of the MRP assets via their IEMS (Integrated Energy Management System). This will enable them to control and call on the MRP assets directly. The outcome of these investigations may impact elements of design for the NGET site SCS (Substation Control System) and NGET and Customer protection and control methodology.

10. Price Control deliverables

80. As there is no measurable output in terms of contracted Transmission Entry Capacity or transformers to be delivered for this project, it is proposed that an evaluative Price Control Deliverable is defined.

81. Provide a connection for MRP at Frodsham 400kV substation by 31st March 2022.

11. Overview of assurance and point of contact

82. Appendix A the assurance statement letter is the written confirmation in line with the assurance requirements set out in Ofgem's Re-opener Guidance[8] and Data Assurance Guidance document (currently under review).

83. This confirmation is provided by the Director of Regulation, Electricity Transmission where they are accountable for the RIIO-2 regulatory allowances for National Grid Electricity Transmission (NGET) including any changes to these allowances. They provide the following statements below regarding how this MSIP application has been prepared and submitted in relation to each of the three assurance points requested by Ofgem:

- It is accurate and robust, and that the proposed outcomes of the MSIP submission are financeable and represent good value for consumers.
- There were quality assurance processes in place to ensure the licensee has provided high-quality information to enable Ofgem to make decisions which are in the interests of consumers.
- The application has been subject to internal governance arrangements and received sign off at an appropriate level within the licensee.

84. NGET's designated point of contact for this MSIP application is Mohammed Farooq, Regulatory Development Manager, email mohammed.farooq@nationalgrid.com, telephone 07973 979 536.

[8] RIIO-2 Re-opener Guidance and Application Requirements Document: Version 1, 26 February 2021

Appendices

Appendix A – Assurance statement letter

APPENDIX A - Frodsham Assurance

Appendix B – Ofgem ET UM submission template

Redacted

Appendix C – Ofgem document guidance

APPENDIX C - Ofgem Document G

National Grid plc
National Grid House,
Warwick Technology Park,
Gallows Hill, Warwick.
CV34 6DA United Kingdom
Registered in England and Wales
No. 4031152

nationalgrid.com

nationalgrid