

T2BP-EJP-0023 Kinardochy Reactive Compensation Consultation Response

Kinardochy Reactive Compensation - Consultation Response

1. Introduction

In our RIIO-T2 business plan (BP), we proposed the establishment of reactive compensation at a new substation at Kinardochy. We included the Kinardochy Reactive Compensation (RC) project, for delivery 2024, in our baseline plan and therefore in our Certain View as this scheme has a high degree of certainty, strong justification and is sufficiently developed to be included for ex-ante funding. Following optioneering and detailed analysis, the proposed scope of works for the Kinardochy RC project is:

- Establish a new substation on the Beauly – Denny 275kV circuit at a site 3km south east of the existing Tummel 275kV substation, Kinardochy substation.
- Equip the substation with 400kV capable switchgear and busbar, operating initially at 275kV with the intention to upgrade to 400kV when the Beauly – Denny line is uprated to 400kV.
- Install reactive compensation at the new Kinardochy substation comprising of a Static Synchronous Compensator (STATCOM) with a range of +/-225MVar, and a 100MVar MSCDN.
- Overhead line (OHL) diversion works and installation of two terminal towers to turn the Beauly – Denny 275kV circuit into Kinardochy substation.

The Kinardochy RC project is required to provide sufficient voltage support in the local Tummel and Fort Augustus area on the Beauly – Denny 400/275kV line¹ to aid wider system operation, ensure compliance with the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS), support increased power flow on the Beauly – Denny line, and therefore facilitate further generation connection on the wider SHE Transmission network. The power flow on the Beauly – Denny OHL will increase as more generation connects on the wider system; namely generation towards the west coast, north of Beauly substation in and around Caithness and east of Beauly substation in and around Moray and Aberdeenshire. In addition to the wider system need for the Kinardochy RC project, there are a number of contracted generators in the area local to Tummel and Fort Augustus that require the Kinardochy RC project as enabling works for connection.

In summary the need and timing for the scheme has two key and established drivers;

1. maintaining network voltage operability and compliance under increasing wider generation growth without delay
2. enabling the connection of local contracted generation by August 2024

The ESO provided a statement of support on the Kinardochy RC project in which they state that “under certain generation scenarios including the existing and contractual ones in that region, when exporting a credible level of generation from the north west of Scotland, especially with 400kV circuit outages between Fort Augustus and Denny North, the system operation would benefit from the reactive power support from this new Reactive Power Compensation”.

Ofgem state that SHE Transmission have made a strong case for a need to invest in reactive compensation at Kinardochy. Atkins, upon reviewing the Economic Justification Paper (EJP) for Kinardochy RC, state that the EJP has presented a clear and unambiguous needs case. As such, Ofgem confirmed that the Kinardochy Reactive Compensation (RC) project has been included in their baseline case for the RIIO-T2 Draft Determination (DD). However, Ofgem believe there is some uncertainty around exactly when the project will be required and have questioned whether the project should receive baseline funding or be considered under the LOTI re-opener. Ofgem go on to state that “the LOTI process will allow for our assessment to consider an updated view of what generation has been connected in RIIO-ET1, an updated assessment of the progress of local generation projects. It may also allow for greater clarity on the status of the NorthConnect interconnector, which interacts with the proposed investment”. Ofgem have invited SHE Transmission, in response to this consultation, to demonstrate that either:

- Glenshero wind farm will connect before 2024; or

¹ The Beauly – Denny 400/275kV OHL is a key west corridor of the SHE Transmission network for the transfer of power, originating mainly from low carbon generation, from the north and west of Scotland to Scottish Power Transmission's (SPT) area in the central belt of Scotland.

- A LOTI Final Needs Case in 2021 will put at risk the meeting of the wider system need.

In response, SHE Transmission have prepared this paper which provides;

1. additional evidence which shows that the Kinardochy RC project is required for wider system operation and to maintain wider system compliance in accordance with the NETS SQSS as early as possible (by end 2023) and, indeed, argues that we should explore options for acceleration;
2. an update on the local generation, confirming that the Kinardochy RC scheme is required to enable connection by 2024, with the developers of Glenshero and Cloiche wind farm (who have recently advanced their connection date) both remaining committed to meeting their connection dates of August 2024 and July 2025 respectively. In order to meet the connection date for Glenshero, construction of the Kinardochy RC project must commence by the beginning of 2022, with development work including planning consent and contractor engagement already underway to deliver this.

Section 2 discusses the network compliance from a wider system perspective. This is followed in Section 3 by an update on the position of local generation that requires the project in order to enable connection. Section 4 considers the programme for the project.

2. Wider System Requirement

SHE Transmission carried out a wider system study for the Kinardochy RC EJP (for the RIIO-T2 business plan submission) to determine what level of generation (large, embedded and small) on the SHE Transmission network causes a voltage step violation² at the existing Tummel 275kV substation on the Beaulay – Denny 275kV circuit. This was to determine when voltage support is needed for the wider system. The most significant negative voltage step change violation occurs at the existing Tummel 275kV substation when switching out the adjacent Melgarve – Denny North 400kV circuit. As such, the study was based on monitoring voltage step change at Tummel for the same single circuit outage.

A forecast using the ESO GB 2020 Future Energy Scenarios (FES) of the generation and demand background at the beginning of the RIIO-T2 period was used in conjunction with the planned network for the same time as a base case for the study. All transmission and distribution connected generation was then scaled up uniformly across the SHE Transmission area, and the voltage step change at Tummel calculated for the single circuit outage of Melgarve – Denny 400kV. The study was carried out for the winter and summer season, with conditions on the system set to those which ought reasonably to be foreseen to arise during a year of operation. For this paper, we have carried out an updated study using an updated network base case for the beginning of the RIIO-T2 period to capture changes in the network background since last year. As with the previous study for the Kinardochy RC EJP, the following should be noted:

- the local generation schemes which require Kinardochy RC scheme to enable connection (as detailed in Table 1 in Section 3) are not included in the network background due to their connection dates falling after the base case year;
- the NorthConnect interconnector is not included in the network background as the connection date is too late for inclusion in the base case; and
- generation is therefore uniformly scaled up from network locations where generation is already either connected or is about to start / is already under construction.

The results of the updated study are shown in Figure 1. As before, under summer ratings and a summer lightly loaded system we have highlighted the limit of total generation in the SHE Transmission network for the -3% voltage step limit and highlighted under winter ratings the total generation limit for a more onerous -6% voltage step limit when there is more generation on the system which can provide background voltage support. As can be seen in Figure 1, the limit of total generation in the SHE Transmission network before a negative voltage step change violation occurs at Tummel remains at 9.8GW in the winter, but has decreased to 9.1GW in the summer (from 9.7GW as per the previous study for the EJP). This is the result of an increase in generation in the updated network base case. As in the EJP, these generation totals are above both the total current connected generation in the SHE Transmission area and our forecast for the end of the RIIO-T1 period (8.1GW). However, they are significantly below our Certain View RIIO-T2 scenario of 11.2GW total generation.

² in accordance with the NETS SQSS

In the Kinardochy RC EJP for the RIIO-T2 submission, we looked at total generation (transmission and distribution connected) in the SHE Transmission area according to FES 2019. For FES 2019, none of the scenarios meet the legislative UK Net Zero targets, and only the Two Degrees and Community Renewables scenarios meet the previous legislative target of an 80% reduction in Greenhouse Gas (GHG) emissions by 2050 (compared to 1990 levels). A key focus of FES 2020 is the inclusion of the now legally binding UK Government Net Zero target, to bring all GHG emissions to net zero by 2050. FES 2020 includes a scenario (Leading the Way) that will meet the Net Zero target earlier than 2050, two scenarios (Consumer Transformation and System Transformation) which meet the Net Zero target in 2050, and only one scenario (Steady Progression) which does not meet the Net Zero target. We have updated the analysis, as detailed in Figure 2, to look at total generation (transmission and distribution connected) in the SHE Transmission area according to FES 2020.

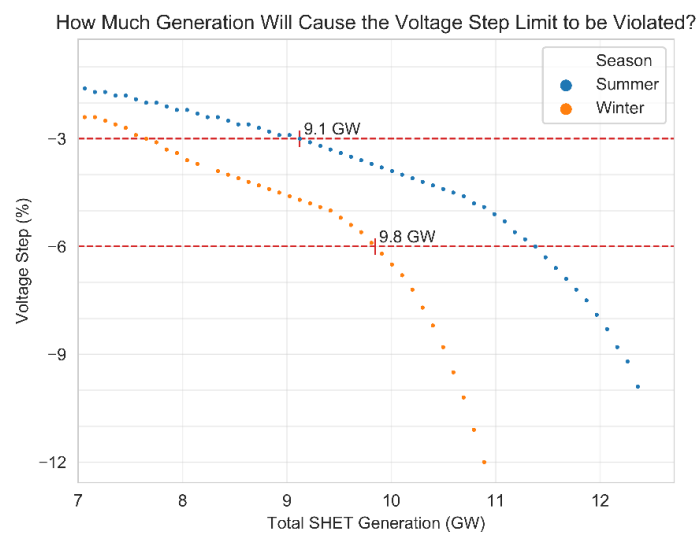


Figure 1: Voltage step at Tummel as a result of total generation in the SHE Transmission area (updated)

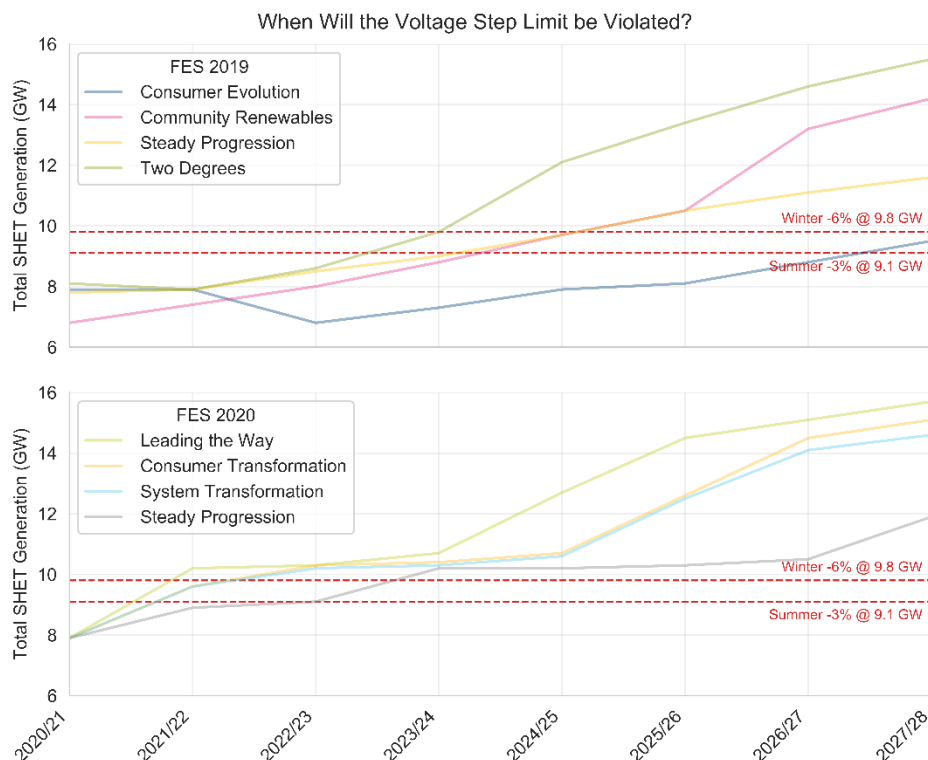


Figure 2: Total generation in the SHE Transmission area according to FES 2019 and FES 2020

The analysis set out in the EJP based on FES 2019 showed that to maintain compliance for three out of the four FES 2019 scenarios we would need to complete the Kinardochy RC project by 2024 as this was when total generation exceeded the 9.7-9.8GW (summer/winter season) limit determined from the wider system study

Figure 2 shows that with the revised limit of total generation of 9.1GW in the summer in the SHE Transmission network (before a negative voltage step change violation occurs at Tummel), in order to maintain NETS SQSS compliance for two out of the four FES 2019 scenarios (namely Two Degrees and Steady Progression) we would need to complete the Kinardochy RC project by 2023.

For FES 2020 in order to meet UK Net Zero targets, by 2021/22 total generation in the SHE Transmission network reaches 10.2GW in Leading the Way and 9.6GW in Consumer Transformation and System Transformation, which is an increase of 1.7-2.3GW compared to three out of the four FES 2019 scenarios (Two Degrees, Consumer Evolution and Steady Progression). Figure 2 shows that to maintain NETS SQSS compliance for the three scenarios which meet UK Net Zero targets (Leading the Way, Consumer Transformation and System Transformation) we would need to complete the Kinardochy RC project by the end of 2021 and by end of 2023 for all scenarios. Thus, under the FES 2020, the case for investment in Kinardochy RC is strengthened and, indeed, argues that we should explore options for acceleration.

It should be noted that the earliest entry date for the NorthConnect interconnector in FES 2019 and FES 2020 is 2024 (in Two Degrees) and 2025 (in Leading the Way) respectively – the interconnector therefore appears a year later in FES 2020 and did not appear in the Community Renewables and Steady Progression FES 2019 scenarios until 2026 and 2028 respectively.

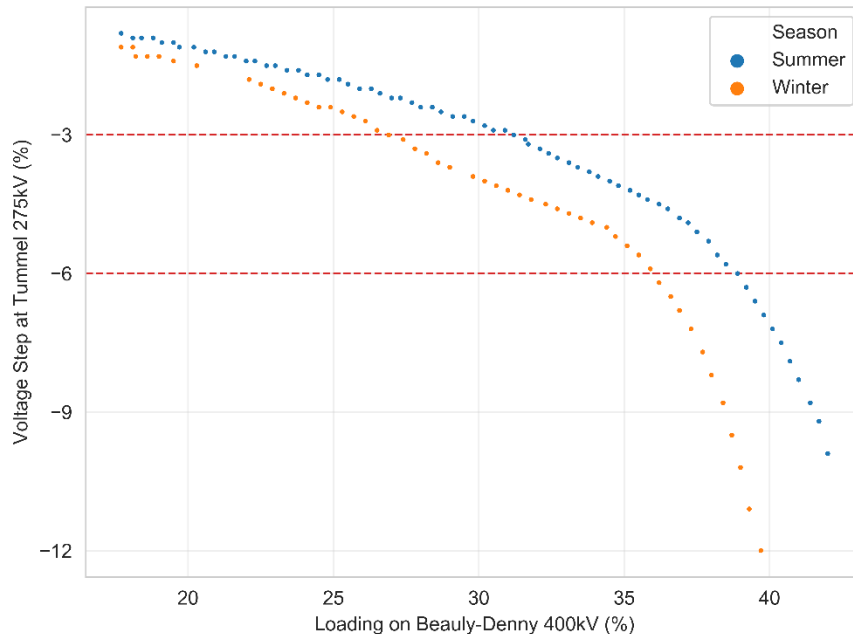


Figure 3: Voltage step at Tummel as a result of the 'intact' loading on the Beaulay – Denny 400kV circuit

We have also carried out further analysis for this paper to determine the loading limit on the Beaulay – Denny 400kV circuit on the intact network before a negative voltage step change violation occurs at the existing Tummel 275kV substation (for the same single circuit outage of Melgarve – Denny 400kV). As detailed in Figure 3, in the summer against a -3% voltage step limit the 'intact' loading on the 400kV circuit cannot exceed ~31.5% of the summer OHL rating, and in the winter against a -6% voltage step limit the 'intact' loading on the 400kV circuit cannot exceed ~36% of the winter OHL rating. As more generation connects in the SHE Transmission area the loading of the Beaulay – Denny line will increase, and it is highly likely and credible that loading will exceed these seasonal limits in the near-term at several instances across the year.

Figure 4 details loading on the Beaulay – Denny 400kV circuit since completion of the Beaulay – Denny line up to present day (based on monitored data). To remove outliers where loading is occasionally unusually high or low, and to account for the varying nature of power flow down the Beaulay – Denny line, we have plotted loading on the 400kV circuit using a weekly summary of the 95th percentile – where 95% of weekly power flows is therefore lower than the loading level. We have also included a linear trend of the weekly 95th percentile data and projected this forward to estimate likely future loading of the 400kV circuit. Figure 4 shows that loading on the 400kV circuit has been increasing and if this continues as expected the loading level, at several instances across the year, will reach ~31.5% by the end of 2021 (this is within the confidence interval of the linear trend). As such, it is likely that loading levels of the 400kV circuit will exceed ~31.5% in the summer of 2022 and may exceed ~36% by winter 2023.

Our updated wider system analysis, where we have considered the impact of FES 2020 and examined the loading of the Beaulay – Denny 400kV circuit since completion of the Beaulay – Denny line, demonstrates that the Kinardochy RC project is needed for wider system operation and to meet wider system compliance by end 2023, and delivery of the scheme should therefore not be delayed.

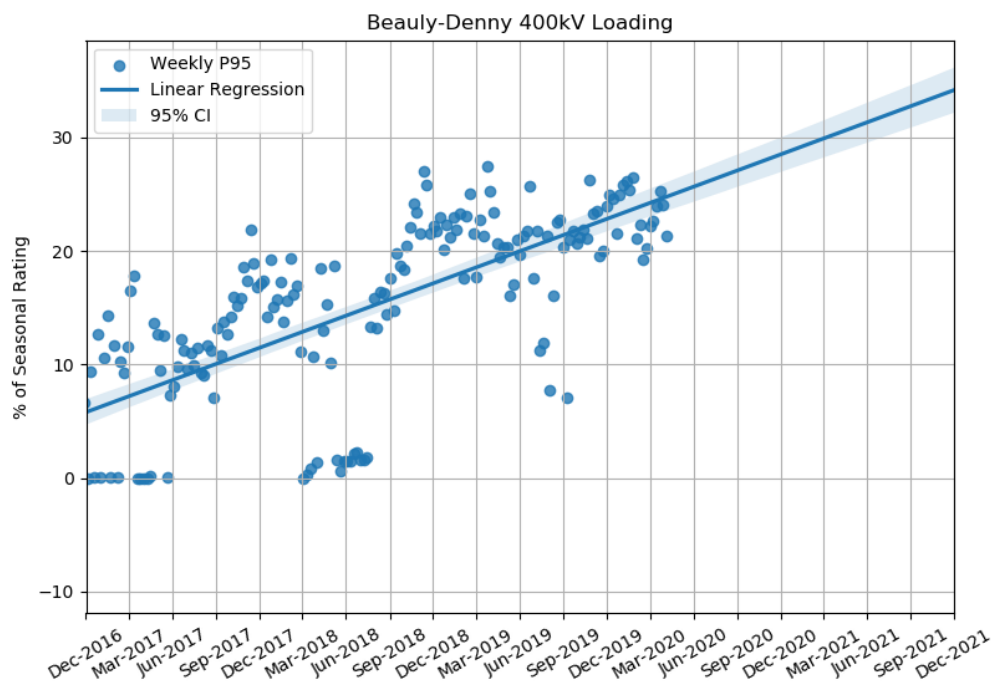


Figure 4: Loading (% of seasonal rating) on the Beaulay – Denny 400kV circuit

3. Local Generation

There are a number of contracted generators in the area local to Tummel and Fort Augustus that require the Kinardochy RC project as enabling works for connection. At the time of our RIIO-T2 BP submission we had three contracted schemes in the local area driving a requirement for Kinardochy RC; Glenshero wind farm, Coire Glas pumped storage hydro and Cloiche wind farm.

Since the BP submission we have seen an increase in contracted schemes which require Kinardochy RC for connection, with Dell wind farm signing a connection offer to connect at Melgarve. This generator, as with the other schemes, is therefore contingent on the completion of this project before they can connect to the network. There have also been updates to the original three contracted schemes. The updated generation background for local schemes that have Kinardochy RC as enabling works is detailed in Table 1 below.

Table 1: Generation schemes with Kinardochy RC project as enabling works

Name	Generation Type	Location	TEC (MW)	Contracted Date
Glenshero	Wind	Melgarve	168	31 August 2024
Cloiche	Wind	Melgarve	200	01 July 2025
Coire Glas	Hydro	Fort Augustus	612	31 October 2025*
Dell	Wind	Melgarve	49.8	30 April 2026

* Coire Glas have applied to modify their connection. They have applied for an increase in export capacity to 1296MW, and to move the connection date to December 2027. This offer has been issued to Coire Glas and is currently open for acceptance.

Glenshero have a signed connection offer with a contracted connection date of August 2024. Glenshero wind farm is included in our certain view. An EJP was submitted for this wind farm connection and has been included in the baseline in the RIIO-T2 DD. SHE Transmission have recently consulted with Glenshero to get a further update on their project and the key dates in their programme. They have confirmed that public consultations for the Section 36 planning application have been held, and that the planning application has been submitted for consideration by the relevant authorities. Approval of planning

consents is expected in 2021, with a start date for construction of the wind farm site in early 2023 to enable connection in August 2024.

Since the submission of the RII0-T2 BP in December 2019, Cloiche wind farm submitted a modification application to their existing connection offer to get an earlier connection date. The connection date in their original application was October 2026. Based on the local connection works they require, along with substation works at Melgarve, an earlier date of July 2025 has been offered. The developer has recently (July 2020) signed up to this new 2025 connection date. As part of the application for an earlier connection date, the developer provided an update on some of the key dates for their project. A Section 36 planning application has been submitted, with consent approval anticipated in 2021. On site construction would be mid-2022 to ensure user works are complete with an allowance for winter shutdown and to enable connection in July 2025.

Both developers remain committed to these connection dates and will underwrite the required local and wider enabling works, including the Kinardochy RC project, through security payments facilitated by the ESO.

4. Kinardochy RC Project Delivery Timeline

A timeline for project delivery of the Kinardochy RC scheme is provided in **Error! Reference source not found.** below. Development work including submissions for planning consent and contractor engagement is already underway to meet the delivery date of Q3 2024. This is the earliest achievable date at which we can deliver this scheme and aligns with the contracted date for Glenshero wind farm of August 2024, which requires the Kinardochy RC scheme to enable connection (described further in Section 3) and the pressing updated wider system need pointing to a requirement for the project by end of 2023.

The project has undertaken extensive public and stakeholder consultation between 2019 and 2020 over three public events. We have taken onboard this feedback, and this has informed the design and siting considerations pertinent to successful consent applications. Concurrent to the consultations the substation was deemed to require an Environmental Impact Assessment (EIA), due to its geographical setting. This was triggered by receipt of a Screening Opinion from Perth and Kinross Council. The EIA process, including surveys and drafting, was programmed by our specialist consultants to take twelve months to prepare for submission, allowing for external stakeholder engagement to inform impact assessment methodologies and mitigation. The substation EIA is targeted for submission within Q4 2020 and planning consent due to be granted at the end of Q2 2021. The OHL diversion works requires a Section 37 of The Electricity Act 1989 licence application and a request for a Screening Opinion is to be submitted to the Scottish Government's Energy Consents Unit with an expected decision in Q3 2020 and submission to follow in Q4 2020.

In parallel to our consent campaign, a procurement event is ongoing to secure a competent contractor to design, supply and deliver the works associated with this reinforcement. The contractor will be required to undertake detailed system studies and analysis due to the nature of the STATCOM design and the requirement for up to date harmonic studies to determine the optimal harmonic filtering arrangement which we have drawn from previous experience of installing Flexible Alternating Current Transmission System devices on our network. This drives a requirement for a design contract period of 12 months across all work packages including early contractor involvement and the submission of formal technical, contractual and governance design deliverables. Therefore, to meet the programme of events and ensure compliance with the NETS SQSS as early as possible or for when Glenshero and Cloiche (contracted to connect and which also requires Kinardochy RC scheme) wind farms are due to connect, the initial contractor design is required to be completed by Q4 2021. This allows construction to commence Q1 2022, with a 24-month construction programme until commissioning of the substation. Potential bad weather at the site during winter months and the associated unpredictability of the local weather has driven the need for an appropriate level of flexibility to be provisioned into the construction programme. Furthermore, yearly winter outage restrictions between October and March restrict live commissioning of the substation until March 2024 and this must be complete in advance of Glenshero wind farms contracted connection in August 2024. The programme for energisation is optimised for both Glenshero and Cloiche connections due to their proximity. Though Cloiche are contracted to connect in July 2025, the aforementioned yearly outage restrictions determine the optimal connection for the Kinardochy RC substation to be in August 2024, and we would look to energise on this date even if the connection of Glenshero wind farm was delayed, in order to meet wider system requirements over the 2024 winter period.

To meet near term wider system need and ensure sufficient voltage support in the local Tummel and Fort Augustus area on the Beaulay – Denny line in accordance with the NETS SQSS (as detailed Section 2) we need to commence works and complete the Kinardochy RC project as early as possible.

SHE Transmission has assessed that if the Kinardochy RC project was to be considered under a LOTI re-opener, as opposed to receiving baseline funding, with a Final Needs Case submission in late 2021 as proposed, this would lead to inevitable delay to this project programme and to the completion date, impacting the connection of both Glenshero and Cloiche wind farms and delivery of wider system compliance.

Table 2: Project Delivery Timeline for the Kinardochy RC project.

Stage	Timeline
Public consultations	Q3 2019 – Q3 2020
EIA start	Q4 2019
Tender Event for Design and Construction Works	Q3 2020 – Q1 2021
Planning and Section 37 Submission	Q4 2020
Appoint Contractor(s) and Identify Not to Exceed Price for Construction	Q1 2021
Expected Planning and Section 37 Consent	Q1/2 2021
Completion of Initial Contractor Design and Confirmation of Final Price for Construction	Q4 2021
Construction Start	Q1 2022
Energisation	Q3 2024

5. Conclusion

The Kinardochy RC project is required to provide sufficient voltage support in the local Tummel and Fort Augustus area on the Beaulay – Denny 400/275kV line to aid wider system operation, ensure compliance with the NETS SQSS, enable increased power flow on the Beaulay – Denny line, and therefore enable further generation connection on the wider SHE Transmission network. Ofgem state that SHET have made a strong case for a need to invest in reactive compensation at Kinardochy and have confirmed that the Kinardochy RC project has been included in their baseline case for the RIIO-T2 DD. However, Ofgem believe there is some uncertainty around exactly when the project will be required and have questioned whether the project should receive baseline funding or be considered under the LOTI re-opener.

In response SHE Transmission have updated and refreshed the wider system analysis that was set out in the EJP. We have considered the impact of FES 2020 and examined the loading of the Beaulay – Denny 400kV circuit since completion of the Beaulay – Denny line. This analysis reinforces the conclusion that the Kinardochy RC project is needed for wider system operation and that it is required by end of 2023 in order to maintain wider system compliance. The delivery of the scheme should therefore not be delayed.

SHE Transmission have also provided an update on the local generation schemes that require the Kinardochy RC scheme to enable connection. The developers of Glenshero and Cloiche wind farm both remain committed to meeting their respective connection dates of August 2024 and July 2025.

Where the need is uncertain at the start of a price control period, the LOTI process will be in place to allow assessment of need then allowances. For investments where the need and timing is known, as with the Kinardochy project with further evidence presented in this paper, the appropriate cost recovery and funding route is through ex-ante funding as currently proposed by Ofgem.

In conclusion, the Kinardochy scheme has a strong need case for both system performance and to enable timely connections. The project is well developed, with the timeline cognisant of both planning requirements and technical analysis required for the specialist equipment that is to be installed. Accordingly, it is well justified for ex-ante costs and outputs under the RIIO-T2 settlement. The LOTI approach is for uncertain schemes, which is not the case for Kinardochy.