Decision

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Dinorwig-Pentir – Decision: Final Needs Case

Subject	Details
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Following our 1 June 2022 consultation on the Final Needs Case, this document confirms our decision to approve the Final Needs Case for the Dinorwig-Pentir cable and substation replacement project. This document also confirms our decision on the regulatory delivery model for the Dinorwig-Pentir and includes an update on the Large Project Delivery arrangements.

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Executive summary

Needs case

In December 2021, National Grid Electricity Transmission (NGET) (the electricity transmission owner (TO) and operator of the transmission network in England and Wales) submitted a Final Needs Case (FNC) for the proposed Dinorwig-Pentir cable and substation replacement project (the "Dinorwig-Pentir" project). In June 2022[1], we consulted on our views in relation to the FNC and our minded-to position to approve the needs case and NGET's preferred option (option 1).

The Dinorwig-Pentir project is driven by two factors: firstly, Dinorwig power station's critical role in mitigating circuit loss on the wider GB system and the emergence of increased generation proposed over the next decade that will need managing by the Electricity System Operator (ESO)[2]; and secondly, the asset health condition of two 400kV cable circuits at Dinorwig in North Wales and the 400kV Dinorwig substation. NGET states that the total cost to develop and deliver the project is £184m. NGET is requesting £166m which excludes preconstruction work funding that was provided across RIIO-1 and RIIO-2[3].

In accordance with the RIIO-T2 price control arrangements, we have assessed the need for the proposed project under the Large Onshore Transmission Investment (LOTI) mechanism[4] and its suitability for delivery through a competition model.

LOTI FNC assessment

We are satisfied that there is sufficient evidence of a clear needs case for the Dinorwig-Pentir project. Having taken in consideration the consultation responses received, we are content that NGET has made the case that its proposed intervention is required. We have not identified any material changes to the evidence underpinning the needs case through the consultation responses we received and as such, this decision confirms our proposed decision on the FNC assessment as set out in our June 2022 consultation.

[1] Dinorwig-Pentir – Consultation on the project's Final Needs Case and suitability for competition
[2] In April 2019, National Grid ESO became a legally separate business within National Grid plc
[3] Costs incurred in RIIO-1: £7m; costs allowed in RIIO-2 baseline: £11m
[4] This is set out in Special Condition 3.13 of the Electricity Transmission Licence

We are content that the cost benefit analysis (CBA) undertaken by NGET ultimately considered a broad enough range of potential options. We noted that the results were marginal between option 1 versus option 2 (i.e. replacing the circuits and substation now versus delaying the project by two years). NGET did note that the timing of its preferred option, option 1, addressed the reliability of the cables and offered the most economic and efficient cost to consumers whilst also accelerating the pace of SF_6[5] inventory reduction and leakage at the Dinorwig substation when compared to option 2. We recognise that the CBA results were finely balanced; however, we are satisfied that NGET's preferred option is likely to provide the optimal solution.

We consider that option 1 better protects the interests of consumers than option 2 as it presents a marginally lower risk.

Delivery model

In line with our Final Determinations for the RIIO-T2 period, and as the Dinorwig-Pentir project is being considered under the LOTI mechanism, we have assessed the suitability of the project for 'late model' competition[6]. Our view is that the Dinorwig-Pentir project meets the criteria for delivery via a late model competition (new, separable, and high value).

However, as explained in paragraph 3.17 of our consultation, we do not envisage being able to implement either the Competitively Appointed Transmission Owner (CATO) or the Special Purpose Vehicle (SPV) model for this project without causing delay. In addition, we do not have sufficient confidence in the benefits to consumers that would be delivered by applying the Competition Proxy Model (CPM). Following our FNC consultation, our decision is that the Dinorwig-Pentir project will be delivered by LOTI under the RIIO-T2 framework.

Large project delivery

To ensure NGET will not benefit from delay in the delivery of this project, we are satisfied that either reprofiling or a milestone approach should be applied. To protect the interests of

[5] Sulphur hexafluoride (SF_6) is a man-made gas comprising of one sulphur and six fluoride atoms. It is a potent greenhouse gas

[6] 'Late model' competition refers to the late models of competition (i.e. run for delivery once a project is sufficiently developed) identified for consideration for LOTI projects within the RIIO-2 period (the CATO model, the SPV model and the CPM). For further information, see RIIO-2 Final Determinations for Transmission and Gas Distribution network companies and the Electricity System Operator | Ofgem, Core Document (REVISED), chapter 9

existing and future consumers, we are also satisfied that a Project Delivery Charge (PDC) to the Dinorwig-Pentir project should be applied. We expect any decision on the level of PDC to be made at the Project Assessment (PA) stage[7]. We will continue to engage with NGET on both approach to reprofiling/milestone and application of PDC.

Decision and next steps

This document confirms our approval of the FNC for the Dinorwig-Pentir project. We expect to continue engagement with NGET regarding the PA stage and to monitor the progress of the delivery programme.

[7] This stage involves assessing the project's proposed costs and delivery plan with a view to potentially specifying in the TO's licence a new LOTI output, a LOTI delivery date, and setting the efficient cost allowances.

1. Introduction

Context

1.1. The GB onshore electricity transmission network is currently planned, constructed, owned, and operated by three TOs: NGET in England and Wales, Scottish Power Transmission (SPT) in the south of Scotland, and Scottish Hydro Electric Transmission (SHET) in the North of Scotland. We regulate these TOs through the RIIO (Revenue = Incentives + Innovation + Outputs) price control framework. For offshore transmission, we appoint offshore transmission owners (OFTOs) using competitive tenders.

1.2. NGET is currently regulated under the RIIO-T2 price control, which took effect on 1 April 2021 and will run for 5 years. Under NGET's licence conditions, the LOTI mechanism allows us to assess the need for, and efficient cost of, large and uncertain electricity transmission reinforcement projects. All projects that are submitted for assessment via LOTI during the RIIO-T2 period are to be considered for their suitability for delivery through one of the late competition models.

1.3. Network investment is informed by the Future Energy Scenarios (FES)[8], and the Network Options Assessment (NOA)[9], which are developed and published annually by the ESO. A key focus of the FES is the inclusion of the legally binding[10] UK Government Net Zero targets, to be achieved by 2050. The transition to a Net Zero economy will see increased demand on transmission boundary capability, which will need to be facilitated by critical network reinforcements.

Overview of the LOTI reopener mechanism

1.4. The LOTI re-opener mechanism provides TOs with a route to apply for funding for large investment projects that can be shown to deliver benefits to consumers, but that were uncertain or not sufficiently developed at the time we set costs and outputs for the RIIO-2 price control period. The LOTI mechanism provides a robust assessment process

[8] The FES is the ESO's representation of a range of different, credible ways to decarbonise the energy system to strive towards the 2050 target
[9] The NOA is the ESO's recommendation for which reinforcement projects should receive investment during the coming year
[10] The Climate Change Act 2008 (2050 Target Amendment) Order 2019 amended the Climate Change Act 2008 to commit the UK to achieving net zero by 2050.

through which we can ensure that TO proposals represent value for money for existing and future consumers.

1.5. To qualify for the LOTI mechanism, TO proposals must meet the following criteria:

a) be expected to cost £100m or more of capital expenditure; and
b) be, in whole or in part, load related[11].

Stages of our LOTI assessment

1.6. Following the approval of eligibility, our LOTI assessment process is made up of three main stages:

1. **Initial Needs Case (INC)** - The usual focus of our assessment at this stage is to review the technical and/or economic requirement for projects, the technical options under consideration, and the TO's justification for taking forward its preferred option for further development.

2. **Final Needs Case (FNC)** – The focus of our assessment at this stage is to confirm the need for the Dinorwig-Pentir project, by checking that there have been no material changes in technical and/or economic drivers that were established at INC.

3. **Project Assessment (PA)** – If the FNC is approved, the TO will then need to apply for a Project Assessment Direction. The focus of our assessment at this stage is the assessment of the proposed costs and delivery plan that the TO has in place for the Dinorwig-Pentir project, with a view to potentially specifying in the TO's licence a new LOTI output, a LOTI delivery date, and setting the efficient cost allowances that can be recovered from consumers for delivery of the Dinorwig-Pentir project.

[11] Part (b) of this criterion used to be either "wholly or partly load related" or "shared-use or sole-use generator connection project related". As a result of a licence modification, which came into effect on 24 July 2021, the "shared-use or sole-use generator connection project" criterion no longer applies. However, this does not impact the project as this is in part a load related project. For further information on the licence modification, see the Decision on the proposed modifications to the RIIO-2 Transmission, Gas Distribution and Electricity System Operator licence conditions

1.7. NGET was relieved by the Authority, via a direction[12], of the requirement to obtain approval of eligibility to apply and to submit an INC for the Dinorwig-Pentir project. Our direction was issued under the condition that an FNC that meets the submission criteria for a project's eligibility to apply and of both an INC and FNC as per the LOTI Guidance would instead be submitted to us for consideration. NGET submitted its FNC for the Dinorwig-Pentir project in December 2021. We consulted on our assessment of the FNC in June 2022.

Related publications

1.8. RIIO-2 Final Determinations: RIIO-2 Final Determinations for Transmission and Gas Distribution network companies and the Electricity System Operator | Ofgem

1.9. LOTI Re-opener Guidance: Large Onshore Transmission Investments (LOTI) Re-opener Guidance | Ofgem

1.10. Dinorwig-Pentir Final Needs Case consultation: Dinorwig-Pentir - Consultation on the project's Final Needs Case and suitability for competition | Ofgem

[12] Dinorwig-Pentir - Direction, Subsidiary document

2. Final Needs Case and our views

Section summary

This chapter summarises the key design choices NGET has made on the Dinorwig-Pentir project and the Cost Benefit Analysis (CBA) underpinning the need for, and design of, the Dinorwig-Pentir project. It also summarises our views on these as presented in our June 2022 consultation and the consultation responses. Finally, it sets out our decision to approve the FNC and our reasons for that decision.

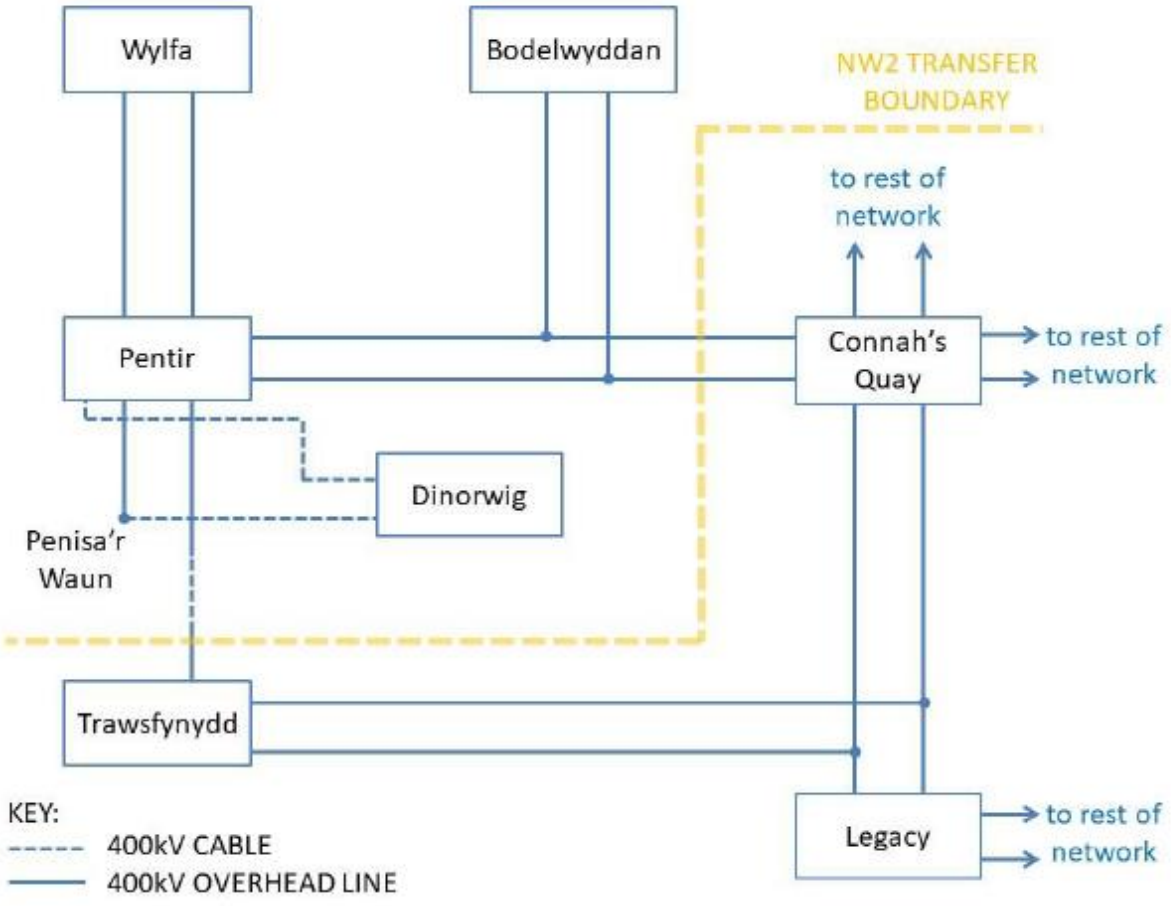
Overview of NGET's proposal

2.1. Dinorwig Power Station[13] in Snowdonia, North Wales, is a pumped storage generation facility owned by Engie providing energy to the market, system critical response, and balancing services to the system operator. It is located inside a man-made cavern within the mountain of Elidir Fawr.

2.2. The manmade cavern also contains the Dinorwig substation. Dinorwig substation is connected to the wider transmission network via two 400kV cable circuits to Pentir substation. Figure 1 below outlines the Dinorwig-Pentir cable circuits within the 400kV network in the North Wales area.

Figure 1: Outline diagram of the 400kV network in North Wales

[13] Dinorwig Power Station will continue to operate for the foreseeable future. The Electricity System Operator's (ESO) Future Energy Scenarios (FES) demonstrates that in all four FES, the power station will remain in operation until 2050



2.3. Both the Dinorwig substation and the two existing 400kV cable circuits between the Dinorwig and Pentir substations are the subject of this LOTI assessment and are collectively referred to as the 'Dinorwig-Pentir project'.

2.4. Appendix 1 of this document replicates the information provided in our June 2022 consultation on why the project has been brought forward, how NGET arrived at its preferred option for reinforcement, and the options that were considered in the CBA. The result of the CBA is also included, along with justification for NGET's preferred option.

Consultation position, responses, and our overall decision on the project

2.5. Three stakeholders responded to the consultation. All responses were non-confidential[14]. The respondents included the ESO, an investor[15], and a power station.

2.6. The rest of this chapter sets out the project's drivers, the optioneering, the cost benefit analysis, and our overall view and decision.

Project need drivers

Consultation position

2.7. We considered that the Dinorwig-Pentir project has clear asset health drivers requiring intervention, particularly in terms of asset health and SF_6 emissions.

Consultation responses and our views on them

2.8. All three stakeholders agreed with our provisional conclusion on the drivers for the Dinorwig-Pentir project. This is in line with our original view.

2.9. The ESO highlighted that the replacement works lead to a significant reduction in SF_6 emission leakage and would be a key step in ensuring the safety, reliability, and efficiency of the network. The ESO also notes that it would help facilitate the transition to Net Zero.

2.10. One respondent highlighted that there have been significant cable outages to date that have led to single circuit operation of the substation for significant periods of time, thereby providing no redundancy if a fault occurs. The respondent also noted that the general condition of the assets continue to deteriorate given the installation method and age of the cables, with limited availability of parts as well as manufacturer expertise.

Updated view

[14] Responses to our June 2022 Dinorwig-Pentir FNC consultation – see 'Response documents'
[15] The investor respondent is an independent transmission investing company

2.11. We remain satisfied that the project drivers underpin the need for the replacement works required by the Dinorwig-Pentir project.

Optioneering

Consultation position

2.12. We explained that we are satisfied that NGET has considered a suitable range of technical options, noting that an SF_6-free solution was eventually included to provide a suitably broad enough range of options for consideration.

Consultation responses and our views on them

2.13. One stakeholder agreed with our conclusion on optioneering. This is in line with our original view. Two expressed no view.

2.14. The single respondent on this question agreed that the three final options represent the main design choices that are available for this project. The respondent also agreed that option 1 is the preferred technical solution while highlighting that options 2 and 3 provide sub-optimal results in terms of project delay and economic efficiency, respectively.

Updated view

2.15. We remain satisfied that the optioneering phase considered a suitable range of technical options, and that it was important that this included a SF_6-free option.

Cost Benefit Analysis

Consultation position

2.16. We agreed that the CBA supports the need for investment on this part of the network and that it also supports NGET's progression of a reinforced option for the Dinorwig-Pentir project. We were also satisfied that the supplementary CBA considered a suitably wide range of options.

Consultation responses and our views on them

2.17. Two respondents agreed with our conclusion on the CBA and the appropriateness of the options taken forward. This is in line with our original view. One expressed no view.

2.18. The ESO stated that their economic analysis sees a strong need for this work. They also noted that the replacement work needs to be aligned with all parties so that the sequencing is completed in the most efficient manner thereby causing the least disruption to all parties and thus maximising consumer value.

2.19. One respondent agreed that option 1 is its preferred option. Its reasoning was that it will provide an appropriate level of redundancy for system faults, the substation will be likely to greatly reduce the SF_6 emissions leakage rate, and that this was also the lowest cost option for consumers.

Updated view

2.20. We remain satisfied that NGET included an appropriate range of options in the CBA.

Overall view and decision

2.21. Following consideration of the consultation responses, we remain satisfied of the need, optioneering, and CBA for the Dinorwig-Pentir project. We noted in paragraph 2.55 of the FNC consultation that the CBA results were finely balanced and that our minded-to view therefore considered, as per Table 9 of the FNC consultation, a broader range of factors in assessing the cost and benefits to GB consumers.

2.22. Our decision is to approve the needs case for the Dinorwig-Pentir project, and that on balance, option 1 represents the preferred solution as it presents a lower overall risk for consumers when compared against option 2.

3. Delivery model

Section summary

This chapter summarises our views as presented in our June 2022 consultation on whether the Dinorwig-Pentir project meets the criteria for competition and whether to apply a late competition model and summarises the key responses to that consultation. Finally, it sets out our decision to retain the Dinorwig-Pentir project within the LOTI mechanism as part of the RIIO-2 framework.

Background

3.1. Competition in the design and delivery of energy networks is a central aspect of our RIIO-T2 price controls. Competition has a key role to play in driving innovative solutions and efficient delivery that can help meet the decarbonisation targets at the lowest cost to consumers. All projects that meet the criteria for competition and are brought forward under an uncertainty mechanism will be considered for potential delivery though a late competition model.

Does the Dinorwig-Pentir project meet the criteria for competition?

3.2. The criteria for a project to qualify for late model competition[16] is that the project is:

- New
- Separable
- High value: projects of £100m or greater expected capital expenditure.

3.3. Following consideration of consultation responses, we remain satisfied that, as per paragraph 3.3 of the FNC consultation, the Dinorwig-Pentir project still meets all the above criteria.

[16] Guidance on the criteria for competition

3.4. Appendix 2 of this document replicates the information provided in our June 2022 consultation, which sets out an explanation of our late competition models.

Consultation position, responses, and decision

Consultation position

3.5. We did not consider that implementing either the Competitively Appointed Transition Owner (CATO) or Special Purpose Vehicle (SPV) model for the Dinorwig-Pentir project would be possible without causing delay to its delivery, and we did not have sufficient confidence in the benefits to consumers that would be delivered by applying the Competition Proxy Model (CPM). In light of this, our minded-to decision was to retain the Dinorwig-Pentir project within the LOTI mechanism of the RIIO-2 framework.

Consultation responses and our views on them

3.6. One respondent agreed with our minded-to view to retain the Dinorwig-Pentir project within the LOTI mechanism. One respondent disagreed. The third respondent expressed no view.

3.7. The respondent that agreed stated that the project should be retained within the LOTI arrangements and that not doing so would likely lead to significant implications for delivery time scales. Our view is that this stakeholder is supportive of our position.

3.8. The respondent who disagreed highlighted the need for Ofgem to finalise the SPV model, noting that consumers are missing out on significant benefits from competition in terms of both delivery quality and efficiency. The respondent stated that Ofgem has concluded that there is no alternative other than to continue with NGET's proposed delivery, which they disagree with. They noted that Ofgem does not consider that option 2 provides a 2-year delay which would provide sufficient time to run a SPV competition and that Ofgem's Impact Assessment estimates competition savings. They conclude that it therefore appears reasonable that implementing the SPV model with option 2 would deliver a lower cost to consumers than option 1, even if only a small proportion of the competition benefits are realised. The respondent also noted that for the Dinorwig-Pentir project, procurement had occurred prior to the FNC being submitted and that in future Ofgem could look at requiring an approved needs case before procurement is initiated to better facilitate the use of competition.

3.9. Our view is that we recognise the benefits associated with competition. However, in the case of Dinorwig-Pentir, the asset health condition combined with the SF_6 emission leakage are key factors that are driving the need and timing of this project and need to be considered. Given that the CBA results were finely balanced, we did examine a broader range of factors when assessing the costs and benefits to GB consumers that were associated with the final three considered options. The increased probability of failure caused by a two-year delay, higher forecasted overall cumulative tCO2e emissions, higher outage costs due to greater constraint costs because of a misalignment with Engie's work, and stakeholder management issues around changing delivery partners and trying to still ensure timely project delivery suggested a greater level of risk associated with option 2 versus option 1. In particular, lowering cumulative tCO2e emissions and avoiding misalignment costs go some way to alleviating the concerns associated with option 2 and is why when all things are considered, we concluded that option 1 presented a marginally lower risk for consumers when compared against option 2.

3.10. We note the issue around the timing between procurement completion and needs case submission. The Dinorwig-Pentir project was idiosyncratic in this respect and had we deemed that it was in the best interests of consumers for NGET to reinitiate the procurement process, we would have been comfortable to state this. We aim to provide flexibility to the LOTI process in order to progress LOTI submissions in a timely manner and we will take the timing issue raised into consideration.

Decision

3.11. For the reasons set out above, we have decided that the Dinorwig-Pentir project should remain within the LOTI mechanism for delivery.

4. Large project delivery

Section summary

This chapter sets out our views as presented in our June 2022 consultation on large project delivery options for the Dinorwig-Pentir project (i.e. the arrangements we might put in place should NGET deliver the Dinorwig-Pentir project late) and summarises the consultation responses. It sets out that we will continue to engage with NGET on large project delivery and to finalise the LPD arrangements at the PA stage.

Background

4.1. In our RIIO-2 Final Determinations[17], we set out our approach to late delivery of large projects (>£100m) by TOs. We said that we will ensure TOs will not benefit from delay to delivery of those projects by using one of the following options:

i. If a project is delivered late, we will re-profile the allowances to reflect actual expenditure to avoid the network company benefitting from the time value of money; or
ii. Milestone-based approach – we will set project allowances based on the delivery of specific, pre-agreed, milestones. The allowances would only be granted following confirmation that a milestone had been delivered.

4.2. We stated that we will ensure consumers are protected from delay in delivery. We said that we may therefore set a pre-agreed Project Delivery Charge (PDC) for each day a project is delivered late.

Consultation position, responses, and updated view

Consultation responses

[17] RIIO-2 Final Determinations, ET Annex (REVISED), page 32 onwards

4.3. In the consultation, we stated that the Dinorwig-Pentir project will include distinct milestones such as the replacement of the two existing cables and as such we consider that using a milestone-based approach for allowances should not be ruled out in favour of re-profiling at this stage.

4.4. We also stated that we remain of the view that there is a need to protect the interests of existing and future consumers from the impact of a delayed delivery to the project and therefore we are considering the application of a PDC to be made as part of the PA assessment stage.

Consultation responses

4.5. One respondent agreed with our proposed approach to LPD. This is in line with our original view. Two respondents expressed no view.

4.6. The respondent agreed that NGET should be incentivised to deliver value for money to all consumers. They also stated that although the current milestone approach looks reasonable given the project's nature, they support our stance of considering alternative methods to achieve the same effect.

Updated view

4.7. To ensure NGET does not financially benefit from delay, we are satisfied that the re-profiling of allowances to reflect actual expenditure is an appropriate mechanism in the event of a delay. However, due to the nature of the project, we are not at this stage ruling out a milestone-based approach.

4.8. We are also satisfied that a PDC for Dinorwig-Pentir should be applied at PA stage. We recognise the importance of ongoing engagement with NGET on the level and calibration of a PDC. We will continue our engagement with NGET on the matter.

4.9. The LPD method and specifically the PDC will be confirmed following consultation as part of our Project Assessment.

5. Next steps

Section summary

This chapter sets out the next steps in our assessment of the Dinorwig-Pentir project under the LOTI mechanism.

5.1. The next stage of our assessment will be the Project Assessment where we assess the project's proposed costs and delivery plan with a view to potentially specifying in the TO's licence a new LOTI output, a LOTI delivery date, and setting the efficient cost allowances.

5.2. As set out in chapter 4, we will continue to engage with NGET on finalising the LPD arrangements during the Project Assessment stage and we will also continue to monitor the progress of NGET's delivery programme.

Appendices

Appendix 1 – Extract from the FNC consultation: NGET's justification of Dinorwig-Pentir's needs case

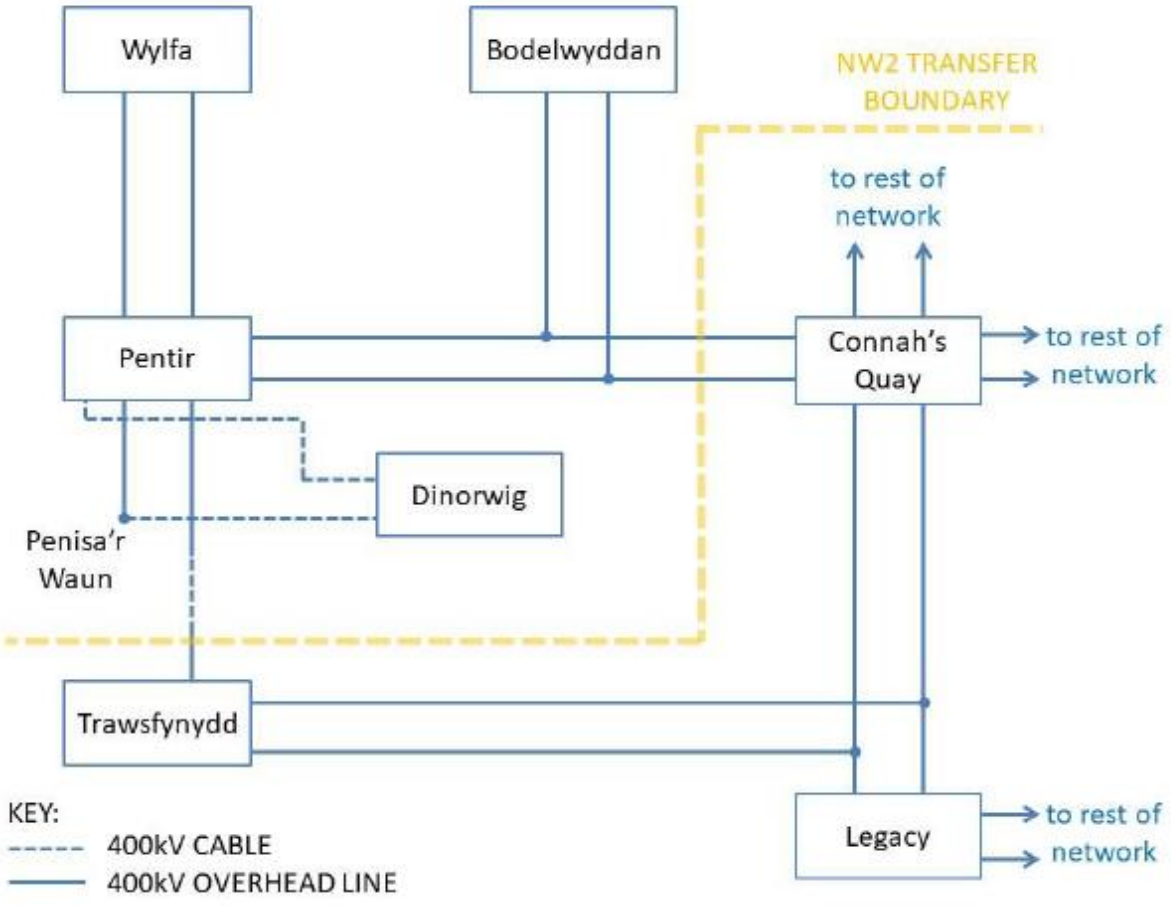
Overview of NGET's proposal

5.3. Dinorwig Power Station[18] in Snowdonia, North Wales, is a pumped storage generation facility owned by Engie providing energy to the market, system critical response, and balancing services to the system operator. It is located inside a man-made cavern within the mountain of Elidir Fawr.

5.4. The manmade cavern also contains the Dinorwig substation. Dinorwig substation is connected to the wider transmission network via two 400kV cable circuits to Pentir substation. Figure 1 below outlines the Dinorwig-Pentir cable circuits within the 400kV network in the North Wales area.

Figure 1: Outline diagram of the 400kV network in North Wales

[18] Dinorwig Power Station will continue to operate for the foreseeable future. The Electricity System Operator's (ESO) Future Energy Scenarios (FES) demonstrates that in all four FES, the power station will remain in operation until 2050



5.5. Both the Dinorwig substation and the two existing 400kV cable circuits between the Dinorwig and Pentir substations are the subject of this LOTI assessment and are collectively referred to as the 'Dinorwig-Pentir project'.

Cable condition

5.6. The Dinorwig-Pentir cable circuits were installed in 1980 and are the connection between Dinorwig Power Station and the wider transmission network.

5.7. NGET has outlined that over a ten-year period to December 2019, the Dinorwig-Pentir cable circuits have been out of service for a total of 989 days on circuit 1 and 759 days on circuit 2. These figures, covering both planning and unplanned outages, represent an average time in operation of 77%. These outages are linked to known condition and route-specific issues associated with the cables.

5.8. NGET has cited that the key issues with the cable condition are:

- Cable duty factor – the cables routinely experience thermal cycling and high loads. This is known to have a bearing on cable condition and anticipated asset life.

- Joint failures – thermo-mechanical forces have accelerated the rate of cable degradation and affected cable joints.

- Cable over-sheath – the cables have incurred a significant number of sheath faults given their type and age. This deterioration leads to damage and defects of the metallic sheath leading to oil leaks and increased cable failures.

- Circuit proximity – the existing circuits run side by side in a single cable trench for significant parts of the route. This means that any maintenance, repair, or replacement of one cable would require both cable circuits to be out of service.

- Civil installation of cable – the cable route is installed in a cement rich mixture. This mixture presents problems for identifying and repairing cable faults as it is time consuming, requires specialist equipment, and is thought to be a contributing factor in causing cracking in the outer sheath of the cables.

- Cable cooling system reliability – water cooling pipes laid between, and parallel to, the cables are surrounded by the same cement rich mixture mentioned above. This makes performing repairs both difficult and time consuming.

- Stakeholder engagement – the cable route sits just outside Snowdonia National Park and runs alongside a Site of Special Scientific Interest[19]. Natural Resources Wales had raised a concern of oil leaks associated with the cables posing an environmental risk, especially when they are removed. These concerns have been substantially alleviated by the contracting of a specialised company by NGET to carry out the works.

Asset health scoring

[19] Sites of Special Scientific Interest form a set of nationally important natural areas in the UK. See the Scottish Government website for further details: Sites of Special Scientific Interest

5.9. NGET has used the approach detailed within its Network Asset Risk Annex (NARA)[20] to identify and prioritise assets in need of intervention across its network. This employs a mechanistic assessment methodology for asset health condition using standardised measurement for all cables across NGET's network area. This standardised measurement is called the End of Life (EoL) modifier.

5.10. The EoL modifier is a score ranging from 0 to 100. An asset with a high EoL score is considered to be close to requiring replacement. The EoL modifier is a proxy for the Probability of Failure (PoF) value. Where the PoF of the asset wil reach 10% in the next twelve months, the asset has come to its "end of life" as defined in the NARA.

5.11. NGET reported EoL modifier scores for both cables in its December 2019 RIIO-2 Business Plan submission. These scores were revisited by NGET in 2020, at Ofgem's request, to reflect known issues (i.e. that historical asset health condition was not being captured by NARA scoring) into the proposed changes to NARA scoring to ensure a consistent asset health assessment for NGET's cable population. Table 1 below summarises the asset health scores of the Dinorwig-Pentir cable circuit assessments from December 2019 and September 2020.

Table 1: Asset health scores of the cable circuit assessments from December 2019 and September 2020

Circuit	2019/20 Asset health scoring (December 2019 evaluation)	2020/21 Asset health scoring (September 2020 evaluation)
	EoL modifier score	EoL modifier score
Cable 1	40/100	70/100
Cable 2	25/100	55/100

5.12. NGET also highlighted the equivalent age values for the cables as set out below in Table 2.

Table 2: Probability of Failure and Equivalent age of cables

Circuit	Assessed in March 2020		Projected to March 2026	
	PoF score	Equivalent age	PoF score	Equivalent age
Cable 1	4.8%	60.5	9.9%	66.5

[20] NGETs Network Asset Risk Annex (NARA) Consultation

Cable 2	2.9%	56.4	6.2%	62.4

5.13. For Cable 1, EoL will be reached around 2026; for Cable 2 this value is expected to be reached around 2029.

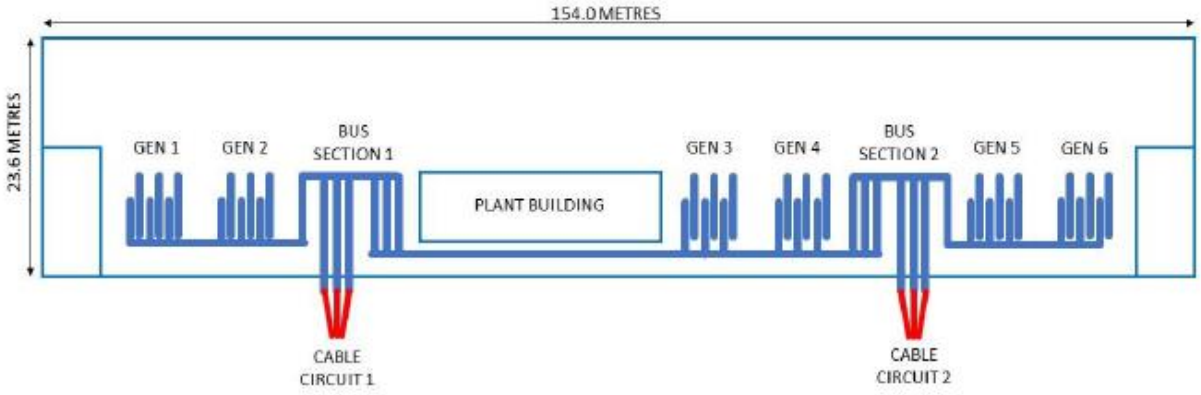
Substation condition

5.14. Dinorwig power station represents the single largest demand loss on the system during pumping. Looking forward there is a large amount of offshore wind and tidal generation proposed over the next decade in North Wales.

5.15. There is a need for the Electricity System Operator (ESO) to hold generation reserve to mitigate the negative effects of the loss of circuit(s) on the wider system. This represents a cost for end consumers which historical data shows at worst case can reach c.£500k per day meaning that outages on either or both cable circuits must be carefully managed. The introduction of a third cable would help alleviate the level of constraint costs and improve the availability of power to provide greater resilience for managing load balancing services.

5.16. Dinorwig 400kV substation is a single bus substation with gas insulated switchgear (GIS) built in 1984. There are three substation sections, each connecting two generator circuits from Dinorwig Power Station, totalling six generator units. The substation has a single busbar and comprises six generator bays, two cable feeder bays, and two bus section bays. The basic layout is shown in Figure 2 below:

Figure 2: Dinorwig substation layout



5.17. The majority of the equipment at Dinorwig substation is 40 years old and has a history of known issues associated with hydraulic leaks on some of the circuit breaker mechanisms.

5.18. Several circuit breakers of the GIS substation have been reconditioned, enabling their asset life to be extended to 2032, as set out in Table 3 below. NGET has highlighted that the ability to complete further reconditioning is limited by the support available from the original equipment manufacturer to supply components and technical expertise beyond 2028.

5.19. There have been a number of defects on the Dinorwig GIS. The most common defect has required SF_6 'top-up events' due to high leakage rates and there have also been other defects involving hydraulic mechanisms and control systems.

Asset health scoring

5.20. Table 3 below shows that the EoL scoring process (EoL modifier) presently puts the forecasted EoL for circuit breakers X120 and X205 sometime before the end of RIIO-2 (on 31 March 2026). This is driven by age versus expected life and SF_6 emissions.

Table 3: Reconditioned GIS substation circuit breakers enabling asset life to 2032

Circuit breaker	Asset life	EoL modifier score	PoF (March 2021)	Equivalent age (March 2021)[21]	PoF (March 2026)	Equiv. age (March 2026)
X105	2032	36/100	0.5%	37.9 / 50	2.0%	42.9 / 50
X120	EoL reached[22]	100/100	10.7%	27.7 / 30	19.8%	32.7 / 30
X205	2032	75/100	5.0%	46.7 / 50	14.5%	51.7 / 50
X220	2032	33/100	0.4%	37.0 / 50	1.4%	42.0 / 50

5.21. NGET stated that to maintain the PoF of all circuit breakers below 10% through the expected remaining life of the substation (2032), reconditioning works of circuit breakers X120 and X205 and SF_6 leak repairs would need to take place.

[21] The expected life of the circuit breakers X105, X205 and X220 is 50 years, whereas X120 is only 30 years
[22] For circuit breaker X120 this PoF value has already been reached. For circuit breaker X205 this value will be reached in the year 2025 and for X105 and X220 this value will be reached around 2030

SF_6 emissions and ongoing intervention

5.22. SF_6 'top-up' events have been recorded for both of the circuit breakers, switchgear, and GIS busbar. The volume of gas top-ups required has fluctuated from 332kg in 2013 to 62kg in 2018.

5.23. The SF_6 emission sources are predominantly from the seals between flanges. The known emission sources are being addressed through interventions which are taking place during the RIIO-2 period to target the worst affected components at Dinorwig until asset replacement in 2026. NGET predicts that without SF_6 intervention measures, asset leakage rates at Dinorwig will continue to increase annually until appropriate intervention or a full substation replacement is completed.

Our view on the asset replacement drivers

5.24. We agree with NGET that the project has clear drivers requiring intervention, particularly in terms of asset health and SF_6 emissions.

Optioneering

5.25. NGET has considered, through a three-stage process, a range of options to address the issues set out above.

1. Options identification – ensures NGET considers a wide range of possibilities. Solutions were considered independently for the cable and substation assets before shortlisting credible options to take forward for further consideration and development.
2. Shortlist appraisal – evaluates the viability and high-level merits of each of the shortlisted options against a defined set of criteria to ensure its suitability to the requirements of the technical need.
3. Economic assessment – considers the scope, timing, and consumer value of the whole solution as part of a detailed CBA.

5.26. Options were filtered based on shortlisting criteria such as consumer value, system requirements, operability, third party impact, responsible business (e.g. socio-economic and environmental impact), and deliverability.

Options identification and shortlisting

Cables

5.27. NGET identified the cable options based on the following principles:

- Do nothing – undertaking no intervention and avoiding any additional expenditure, e.g. just continuing basic maintenance.
- Do minimum - undertaking the minimum level of intervention such that any associated expenditure is minimised, e.g. enhanced maintenance through the replacement of specific sections or cable joints to extend asset life.
- Do something – undertaking intervention to meet the identified technical need, e.g. replacement of the existing cable circuits.

5.28. The cable options were considered against system considerations including constraint costs associated with construction outages, outage availability (options will require outages of varying duration) and circuit ratings (circuits will need to meet the minimum rating requirements based on system studies). All three considerations were included in the economic analysis.

5.29. The cable route options were also considered against a number of factors including whether overhead or underground lines is more suitable, how to pass obstacles such as mountainous terrain, and alternative connections points. The circuit technology was also considered by looking at whether oil filled cables, gas insulated lines, or cross-linked poly-ethylene cables are appropriate.

Substation

5.30. NGET assessed the substation options according to the following principles:

- Do nothing – undertaking no intervention and avoiding any additional expenditure, e.g. with the exception of reconditioning two circuit breakers and SF_6 leak repairs, Dinorwig substation can remain operational in its current condition until end of life in 2032.

- Do minimum - undertaking the minimum level of intervention such that any associated expenditure is minimised, e.g. allowing the connection of an additional third circuit by replacing part of the substation to cater for this.

- Do something – undertaking intervention to meet the identified technical need, e.g. replacing the substation to allow for either a two or three circuit option.

5.31. The substation options considered whether an offline build or in situ build would be appropriate, taking into account the practicalities of constructing within the existing cavern, the civil works that would be required, and the option to construct the substation in stages. The substation options were also considered in relation to timing, particularly in respect of whether the substation replacement should be "deferred" and replaced at the end of life in 2032 and therefore not align with the cable replacement options or whether the substation replacement should occur earlier to align with cable works[23].

Shortlisted circuit and substation whole solution options

5.32. Table 4 below sets out NGET's consideration of the viable options identified for the cable circuits and substation (note: option 1-A was not considered viable due to there being several clear asset health drivers requiring intervention but is included in table 4 for comparison purposes).

Table 4: Options considered

Option	Description
1-A	**Do nothing** Though discounted at the shortlisting stage, the "do nothing" option has been included in elements of the analysis for comparison purposes. Comprises: ▪ Undertaking no intervention on the cable circuits, just the continuation of basic maintenance. ▪ Undertaking no intervention at the substation, except for the reconditioning of circuit breakers X205 and X120 and SF_6 leak repairs. ▪ Continuation of basic maintenance.

[23] This would mean the substation replacement is brought forward by 6 years from 2032 to 2026 to align with cable works

Option	Description
5-D	**Two circuits with deferred substation replacement** Comprises: ▪ Two circuits, introduce an additional cable circuit in 2024, then replace one of the two existing cable circuits between 2025 and 2026. ▪ Use XLPE cables, one cable per phase, partly new routeing, terminating at existing connection points. ▪ Replace one third of Dinorwig substation to accommodate new cables with maintenance of the existing substation assets continuing until replacement is completed in 2032. ▪ Return in 2040s to replace circuit breakers in the earlier replaced third of the substation with SF_6-free technology.
5-E	**Two circuits with early substation replacement** Comprises: ▪ Two circuits, introduce an additional cable circuit in 2024, then replace one of the two existing cable circuits between 2025 and 2026. ▪ Use XLPE cables, one cable per phase, partly new routeing, terminating at existing connection points. ▪ Replace Dinorwig substation in line with cable replacement works. ▪ Return in 2040s to replace circuit breakers in the earlier replaced third of the substation with SF_6-free technology.
6-D	**Three circuits with deferred substation replacement** Comprises: ▪ Replace two existing circuits between 2025 and 2026. Introduce an additional new cable in 2024. ▪ Use XLPE cables, one cable per phase, partly new routeing, terminating at existing connection points. ▪ Replace one third of Dinorwig substation to accommodate the third cable circuit, with maintenance of the existing substation assets continuing until replacement is complete in 2032. ▪ Extend Pentir substation to accommodate the additional circuit. ▪ Install an additional shunt reactor on the network. ▪ Return in 2040s to replace circuit breakers in the earlier replaced third of the substation with SF_6-free technology.
6-E	**Three circuits with early substation replacement** Comprises:

Option	Description
	▪ Replace two existing circuits between 2025 and 2026. Introduce an additional new cable in 2024. ▪ Use XLPE cables, one cable per phase, partly new routeing, terminating at existing connection points. ▪ Replace Dinorwig substation in line with cable replacement works. ▪ Extend Pentir substation to accommodate the additional circuit, ▪ Install an additional shunt reactor on the network. ▪ Return in 2040s to replace circuit breakers in the earlier replaced third of the substation with SF_6-free technology.

Our view on optioneering

5.33. We are satisfied that NGET's optioneering process has followed a logical approach; however, we identified several options that we consider had been inappropriately excluded.

5.34. Through further engagement following submission of the FNC, NGET provided further supplementary information and analysis which included a broader range of options. Option 1 (i.e. option 6-E from Table 4) was part of this broader options set as it performed best in the initial CBA when considering early substation replacement and therefore, we asked NGET to compare this option to SF_6-free substation replacement options as part of NGET's supplementary information. These SF_6 and SF_6-free options, as summarised in Table 5 below, were directly compared to each other in the supplementary CBA analysis.

Table 5: Options considered in the supplementary CBA

Option	Description
Option 1 (as per 6-E in the FNC submission)	**Three circuits with early substation replacement** Comprises: ▪ Replace two existing circuits between 2025 and 2026. Introduce an additional new cable in 2024. ▪ Use XLPE cables, one cable per phase, partly new routeing, terminating at existing connection points. ▪ Replace Dinorwig substation in line with cable replacement works. ▪ Extend Pentir substation to accommodate the additional circuit. ▪ Install an additional shunt reactor on the network. ▪ Return in 2040s to replace circuit breakers in the earlier replaced third of the substation with SF_6-free technology.

Option	Description
Option 2	**Delay by 2 years: three circuits with SF_6-free substation replacement** Comprises: ▪ Delay the entire project (both circuit and substation works) by two years to allow a SF_6-free technology option to become commercially available. ▪ Replace two existing circuits; introduce an additional new cable. ▪ Use XLPE cables, one cable per phase, partly new routeing, terminating at existing connection points. ▪ Replace Dinorwig substation in line with cable replacement works. ▪ Extend Pentir substation to accommodate the additional circuit. ▪ Install an additional shunt reactor on the network.
Option 3	**Delay substation works by 2 years: three circuits now with SF_6-free substation replacement later** Comprises: ▪ Delay substation works by 2 years to allow a SF_6-free technology option to become commercially available. ▪ Replace two existing circuits; introduce an additional new cable. ▪ Use XLPE cables, one cable per phase, partly new routeing, terminating at existing connection points. ▪ Replace Dinorwig substation after cable replacement works. ▪ Extend Pentir substation to accommodate the additional circuit. ▪ Install an additional shunt reactor on the network.

5.35. We consider that NGET should have included a SF_6-free solution in its original December 2021 FNC submission. NGET's contracting strategy saw early contractor involvement which resulted in NGET being tied to a preferred contractor ahead of our assessment. We considered that NGET's choice not to include a SF_6-free solution at the start of its procurement process meant that consumers may have potentially missed out on greater environmental benefits. We consider this inappropriate and through further engagement with NGET, we instructed NGET to include a broader range of options including a SF_6-free solution in its CBA. NGET complied with this request through the addition of Option 2.

5.36. We consider it important that the option of proceeding with a SF_6-free substation at Dinorwig-Pentir is fully considered and we are now satisfied that the range of options included in the supplementary CBA, as set out in Table 5, is appropriate.

CBA process and methodology

5.37. For the majority of submissions under the LOTI mechanism, the relevant TO (in this case NGET) works with the ESO to develop and run a CBA to assess the performance of each shortlisted network design option in order to support the optioneering decisions presented in the FNC submission. The ESO is involved in this process as it has visibility about the impact of local electricity transmission network designs on the rest of the GB electricity transmission network.

5.38. The ESO is primarily concerned with the optimisation of constraints at a network level rather than the stability implications of a single plant. The reinforcement of the Dinorwig-Pentir network presents some challenges to the ESO's standard CBA modelling approach adopted to date. As such, operational expenditure for Dinorwig-Pentir has been derived from the Frequency Risk and Control Report (FRCR)[24] analysis. This analysis is based on historic 'Bid Offer Actions' profiles and network wide inertia values and thus better serves to account accurately for both ancillary services and the dynamic generating and pumping behaviour of Dinorwig. To confirm, boundaries are not considered in this analysis because the boundary capability is not affected.

5.39. The CBA for Dinorwig-Pentir included in the FNC submission compares the net present value (NPV) of the total expenditure (TOTEX), made up of capital expenditure (CAPEX) and operational expenditure (OPEX), for each of the options brought forward for assessment. As such, there is no least worst regret (LWR)[25] analysis as the Future Energy Scenarios (FES)[26] were not used. This is because none of the costs are scenario specific and

[24] The FRCR analysis approved by Ofgem on 12 May 2021 details the costs of the four main controls associated with mitigation transient frequency deviations. This model more accurately represents the costs associated with the dynamic pumping and generation behaviour of Dinorwig which cannot be captured within the current BID3 system (i.e. the traditional network constraint model)
[25] LWR is a decision-making tool that makes recommendations based on which options/strategy produce the least 'regret' across all analysed scenarios
[26] The FES is the ESO's representation of a range of different, credible ways to decarbonise the energy system to strive towards the 2050 target

are therefore either based on historic data (for example the FRCR) or on capital costs from NGET.

5.40. The CBA model considers several key elements:

- CAPEX budgets – the CAPEX assumptions for the different engineering options.
- Capitalisation rate[27] – determines the split of investment to be funded within period by consumers versus that which will be recovered over the regulatory asset life.
- Circuits installed – to calculate the number of outage days which in turn feeds into the operational costs incurred by the ESO for frequency control under a single circuit operation[28].
- Outages – during the construction phase outages are required and these vary in duration depending upon the work involved. The cost of outages is included within the operational expenditure estimates.
- Scope element selection - for each option, scope packages have been priced enabling all engineering solutions to be carried forward to the point of CBA analysis.

CBA Results

5.41. Table 6 shows the CBA results[29] for the four shortlisted options that were tested. Based on this, the three cable circuit options are found to have the least regret.

Table 6: CBA results

[27] There are some judgements required in setting capitalisation rates in a price control where the level of totex (and therefore the split of capex to opex) cannot be predicted with certainty at the outset. The split capitalisation rate with one rate applying to baseline (for NGET RIIO-2 this is set to 78%) and one rate applying to uncertainty mechanisms, such as LOTI projects, (for NGET RIIO-2 this is set to 85%) goes some way to alleviating concerns that setting the capitalisation rate on the basis of one potential totex scenario could lead to significant and persistent under or over capitalisation during RIIO-2

[28] The number of single circuit days is 213 days for option 5-E and 334 days for option 5-D. None of options 1-A, 6-E, or 6-D result in any single circuit days occurring

[29] To note: the CBA does not capture specific operational loads on the circuits, operational outage costs due to circuit failures, detail from the ESO's NOA Pathfinder Stability Phase 3 tender, or variations in SF_6 leakage rates

Option	TOTEX (£m)	Regret (£m)
5-E: 2 cable circuits, early substation replacement	302.29	62.48
5-D: 2 cable circuits, deferred substation replacement	262.18	22.37
6-E: 3 cable circuits, early substation replacement	239.81	0.00
6-D: 3 cable circuits, deferred substation replacement	241.71	1.89

5.42. NGET stated that the construction programme for the options considered has been optimised and streamlined to minimise the construction outage periods; however, an unavoidable single circuit risk exists at certain times in the programme for the two-circuit options (5-E and 5-D) which does not occur in the three-circuit options (6-E and 6-D). This drives a differential in the operational costs associated with the two-circuit options over the three-circuit options because the ESO would need to procure additional system balancing services to protect against a potential fault on a single circuit.

5.43. NGET recognised the close outcome between options 6-D and 6-E; however, NGET considers that its preferred option 6-E reduces the overall SF_6 inventory by 68% whilst reducing the leakage at Dinorwig substation. NGET considers that deferring the substation works, as per option 6-D, results in a second construction phase being required in 2032 when the assets reach end of life which results in additional outages and disruption to Dinorwig Power Station.

Our view on the CBA

5.44. Our view is that the CBA supports the need for investment on this part of the network and supports NGET's progression of a reinforcement option for the Dinorwig-Pentir project. However, as referenced in paragraph 2.35, we were not satisfied that NGET included an appropriate number of options in its December 2021 FNC CBA submission and as such required further analysis by NGET.

5.45. The results of this further analysis which offered a broader range of options for consideration in the supplementary CBA carried out by NGET are outlined in Table 7 below.

Table 7: CBA results: supplementary analysis

Description	Option 1	Option 2	Option 3
	Three circuits with early substation replacement	**Delay by 2 years:** three circuits with SF_6-free substation replacement	**Delay substation works by 2 years:** three circuits now with SF_6-free substation replacement later
Total NPV (£m)	286.96	297.13	309.60
tCO2e SF_6 (kg)	37,570	45,930	48,062
Total forecast expnd. (£m)	194.91	198.93	188.91
NPV regret (£m)	0.00	10.25	22.16

5.46. Based on the supplementary CBA, NGET concludes that option 1 (i.e. 6-E) remains the optimum solution, echoing the results of the CBA originally included with the FNC submission.

5.47. NGET highlights that it considers progressing either option 2 or 3 would present a number of risks centred around the use of SF_6-free technology and the impact on delivery of the Dinorwig-Pentir project, both in terms of costs (predominately associated with outage durations and associated constraints) and timing. NGET considers there are key timing risks associated with moving away from the current programme of works associated with option 1 and that this would mean outages no longer align with the planned maintenance outages Engie has highlighted for the Dinorwig Power Station[30].

5.48. In general, we are satisfied that the supplementary CBA considers a suitably wide range of options. However, we note that NGET has proposed including some areas of additional project costs for options 2 and 3 which are associated with terminating current procurement contracts[31]. Removing these costs produces the CBA results set out in Table 8 below.

Table 8: CBA results: supplementary analysis with contract costs removed

[30] NGET considers there would be additional balancing costs associated with the misalignment of works between options 2 and 3 and the planned works by Engie on the Dinorwig Power Station. NGET highlighted that delaying works would lead to higher constraint costs; these costs are not included within the supplementary CBA

[31] Procurement activities for the Dinorwig-Pentir project are relatively advanced. Tendering took place in 2019 with the contract being awarded in 2020. This occurred because NGET had progressed the project in advance of the RIIO-2 Final Determination that it be considered through the LOTI re-opener mechanism

Description	Option 1	Option 2	Option 3
£m	**Three circuits with early substation replacement**	**Delay by 2 years:** three circuits with SF_6-free substation replacement	**Delay substation works by 2 years**: three circuits now with SF_6-free substation replacement later
Total NPV	286.96	288.32	308.19
Total forecast expenditure	194.91	189.53	187.41
NPV regret	0.00	1.36	21.23

5.49. We do not consider it appropriate for procurement costs associated with NGET progressing option 1 to be included within the supplementary CBA as this would suggest that consumers would be exposed to costs associated with NGET progressing procurement activities in advance of receiving project need confirmation. As shown in Table 8, applying this sensitivity means the NPV results of the supplementary CBA are marginal between options 1 and 2.

5.50. We also consider it important to note that the supplementary CBA does not include any balancing costs as a result of the ESO needing to secure associated with additional outages for options 2 and 3 due to programme misalignment with the planned Engie works. If these costs were included in the CBA, then the impact would be to increase the regret associated with options 2 and 3 in relation to option 1 thereby making it more favourable.

5.51. We note that there is a range of major interactive elements in the future constraint cost assumptions in the CBA. We observe that the Dinorwig Power Station will, on commissioning of Hinckley Point C Nuclear Power Plant, no longer need to be secured for the loss of infeed risk. Therefore, we consider it reasonable to assume the benefits of these works will be reduced over time. We also note the historic and near future contributions that Dinorwig Power Station provides to system stability and frequency response; however, we consider that these will likely be supplemented by similar additional services in the future.

5.52. NGET highlights in its FNC submission that optimal timing should be a key consideration in the assessment of the Dinorwig-Pentir project. NGET considers that the cables and substation replacement should be aligned and that the timing of its preferred option, option 1, addresses the reliability of the cables and offers the most economic and

efficient cost for consumers as well as reducing the SF_6 inventory and leakage at Dinorwig substation.

Costs

5.53. NGET's current costs for the three shortlisted options are set out in Table 7; the cost of its preferred option, option 1, is £194m. The project costs are at a mature stage; this provides us with a high level of cost certainty due to a proportion of the costs having been incurred to date and a significant proportion of the costs having been contracted.

5.54. The cost of each of the options considered in the CBA and associated sensitivity tests are based on capital and operational expenditure as well as on the cost of future SF_6 replacement.

Our view on costs

5.55. We consider these costs provide an appropriate basis against which to robustly compare the options at this stage and we are satisfied that the costs have been applied in a consistent manner that allows for the shortlisted options to be objectively compared.

5.56. We note that there has been a significant increase in costs from NGETs RIIO-T2 business plan submission and we will carefully consider this during the PA stage so that the final allowed costs are economic and efficient.

Our minded-to view

5.57. Given that the CBA results are finely balanced, we have considered a number of broader factors in assessing the costs and benefits to GB consumers. The key factors we have considered are outlined in Table 9 below.

Table 9: Additional considerations

Considered	Details
Asset health	▪ We agree that the Dinorwig-Pentir cables require replacement; however, we note EoL is forecast as 2026 (cable 1) and 2029 (cable 2). The Dinorwig substation has a forecast EoL of 2032. Early replacement of the substation is driven by the interaction with the cables works.

Considered	Details
Cumulative tCO2e[32] emissions	▪ Overall, NGET forecasts that option 1 would result in the lowest cumulative tCO2e being emitted. ▪ This is due to the work taking place for option 1 earlier than for options 2 and 3 in the supplementary CBA. ▪ However, option 1 would result in SF_6 technology being added to the network, which could compromise NGETs Net Zero ambitions. ▪ We also have limited visibility of how any future technology containing SF_6 will perform in terms of future leakage rate.
Outages and associated constraint costs	▪ NGET forecasts that the programme of works associated with option 1 would minimise the number of outages required to carry out the Dinorwig-Pentir project, in part due to alignment of works with Engie's planned refurbishment works for Dinorwig Power Station. ▪ We have no visibility of how likely it is that option 1's programme of works would remain on track ensuring that outages are minimised. ▪ We have no visibility of whether there may be future outages that are required which are associated with other reinforcement works needed on the network nearby. This would result in further outages for the Dinorwig Power Station and further constraint costs.
Procurement process	▪ While we note that NGET has already substantially progressed the procurement process for its preferred option, option 1, we do not consider that this should be a factor in our decision making. ▪ NGET has chosen to take procurement activities to a relatively advanced stage prior to its FNC. We consider that consumers should not bear the risk and costs associated with this decision. ▪ We are aware that there may be risks associated with procuring an SF_6-free technology when there are limited suppliers available. However, we would encourage NGET to engage proactively with a range of contractors to ensure it has full visibility of the market.

[32] tCO2e stands for tonnes (t) of carbon dioxide (CO2) equivalent (e). 'Carbon dioxide equivalent' is a standard unit for counting greenhouse gas (GHG) emissions regardless of whether they are from carbon dioxide or another gas, such as methane

5.58. In our RIIO-2 Final Determinations,[33] we agreed that the Dinorwig-Pentir cable circuits are in poor health and recognised that intervention is required.

5.59. We agree that a three-circuit solution would be optimal because of the expected reduction in constraint costs as a third cable are generally accepted to comfortably offset the cost of installation during the asset's life.

5.60. We are disappointed that it took our suggestion for NGET to instigate the NARA update to facilitate this LOTI submission. The reported cable risk suggested that intervention was not necessary when historical performance during RIIO-1 suggested otherwise, and we are therefore unconvinced by NGET's decision to delay the works from RIIO-1 until RIIO-2. We have considered NGET's narrative around its RIIO-T1 cable asset management decisions and are concerned at the responses given regarding asset health scoring decision making and circuit intervention need; however, we believe the risk of a prolonged review to understand NGET's historic asset management decisions would not be in consumers' interests. It is important to note that the NARA is a decision support tool and not a decision-making tool, and in future NGET should consider the need to align the identified risks with the reported risk score in its narrative as well as take a more proactive overall approach to asset health intervention. We will review NGET's scoring changes as part of our RIIO-T1 performance report.

5.61. We have also carefully considered NGET's long-term SF_6 strategy and the interaction with these works. We accept that there is a potential risk to consumers of the costs being higher than currently estimated for this project in relation to implementing a future SF_6-free solution; however, we consider that there is greater benefit to consumers from this work going ahead now rather than delaying it. Nevertheless, for the avoidance of doubt, our expectation on SF_6 use going forward is that all TOs should thoroughly consider SF_6 alternatives for every project given the imminent arrival of SF_6 alternatives to the market. We note that others within the transmission sector, as well as NGET's itself in other projects, have provided commitments to utilise SF_6-free technology in 400kV projects.

5.62. The increased probability of failure caused by a two-year delay, higher forecasted overall cumulative tCO2e emissions, higher outage costs due to greater constraint costs because of a misalignment with Engie's work, and stakeholder management issues around

[33] RIIO-2 Final Determinations, NGET Annex (REVISED), section 3.60, page 53

changing delivery partners and trying to still ensure timely project delivery suggests a greater level of risk associated with option 2 versus option 1. Option 1 goes some way to alleviating these risks by forecasting the lowest cumulative tCO2e emissions, avoiding misalignment costs by aligning to Engie's programme of works, and by keeping the procurement and delivery partner in line with NGET's existing programme strategy.

5.63. Overall, we believe option 1 presents marginally lower risk for consumer when compared against option 2.

Appendix 2 – Extract from the FNC consultation: Delivery model considerations

Delivery model considerations

5.64. Since we consider that the Dinorwig-Pentir project meets the criteria for late model competition, we have also considered whether it would be in the interests of consumers for the project to be delivered through a late model of competition rather than via the prevailing LOTI mechanism under the RIIO-2 arrangements.

Relevant consideration of models

5.65. The late competition models that are available for consideration for the Dinorwig-Pentir project are:

i. Competitively Appointed Transmission Owner (CATO) Model
ii. Special Purpose Vehicle (SPV) Model
iii. Competition Proxy Model (CPM)

5.66. Below we set out details of each of these models and our views on how applicable each might be to the Dinorwig-Pentir project.

CATO Model

5.67. Under the CATO model, a competitive tender would be run for the financing, construction, and operation of the proposed assets that make up the Dinorwig-Pentir project, with a transmission licence provided to the winning bidder setting out the outputs, obligations, and incentives associated with delivering the project.

5.68. NGET's procurement activities for the Dinorwig-Pentir project are relatively advanced. Tendering took place in 2019 and the preferred bidders were selected in 2020. While the merits of such an approach is debatable, the high-level delivery plan for the Dinorwig-Pentir project indicates that NGET's preferred option would have works needing to be completed between 2024 to 2026 to meet its required delivery dates.

5.69. The CATO model requires legislative changes to allow for new parties to be able to be awarded a transmission licence following a competitive tender. The government has set

out its intention to introduce the required legislation[34] to enable competitive tendering but it is currently uncertain when that will be in place. Given this, and the required delivery dates set out by NGET, we do not consider it feasible to apply the CATO model to the Dinorwig-Pentir project in a manner that delivers benefits to consumers without impacting on the delivery dates of the project.

SPV Model

5.70. Under the SPV model, NGET would run a tender to appoint an SPV to finance, deliver and operate a new, separable, and high-value project on the licensee's behalf through a contract for a specified revenue period. The allowed revenue for delivering the Dinorwig-Pentir project would be set over the period of its construction and a long-term operational period (currently expected to be 25 years). The SPV model was originally developed for consideration for projects where the CATO model had been discounted due to a clear expectation that underpinning legislation would not be in place in time to allow the delivery of specific projects.

5.71. Given the additional work needed to finalise the SPV model and that NGET has tied itself to a preferred contractor ahead of our FNC assessment, we do not consider that the SPV model can be applied to this project without leading to delays. For this reason, we consider that the SPV model is not an appropriate model to utilise for this project.

CPM

5.72. The CPM involves setting a largely project-specific set of regulatory arrangements to cover the construction period and a 25-year operational period for an asset (in contrast with setting arrangements for a portfolio of assets under a price control settlement). It is intended to replicate the efficient project finance structure that tends to be used in competitive tender bids for the delivery and operation of infrastructure projects.

5.73. Importantly, NGET would retain the delivery of the Dinorwig-Pentir project under CPM. This means that there is not the requirement to allow for the running of a full tender

[34] Energy White Paper: Powering our Net Zero Future, December 2020, pages 76-77

for delivery of the Dinorwig-Pentir project in the same way as the CATO or SPV models, and the CPM assessment stages follow the same process as the LOTI mechanism.

5.74. In the RIIO-2 Final Determinations[35], we explained that due to recent market conditions and our allowed financing arrangements for RIIO-2, we may not have sufficient confidence that the application of the CPM to projects that need to start construction at the start of the RIIO-2 period would deliver benefits to consumers. This position was informed by our decision on the Hinkley-Seabank project in May 2020[36].

5.75. Since our decision on Hinkley-Seabank and RIIO-2 Final Determinations in 2020, we have seen some variability in the cost of debt benchmarks used to set the financing arrangements under CPM. However, at this stage, we have not seen movements that give us confidence that CPM is likely to deliver a benefit to consumers relative to the counterfactual LOTI arrangements under RIIO-2.

5.76. There is some scope for potential market movements between now and the point at which the financing arrangements would be finalised for CPM, in parallel to the final setting of the cost allowances for the project. Notwithstanding this, we do not have sufficient confidence at this stage that application of the CPM to the Dinorwig-Pentir project would deliver benefits to consumers.

[35] RIIO-2 Final Determinations, Core Document (REVISED), Chapter 9, section 9.8
[36] Hinkley - Seabank: Updated decision on delivery model