Scottish & Southern Electricity Networks

SSEN Transmission

RIIO-T2 Business Plan T2BP-EJP-0006

Transmission Communications Upgrade

Engineering Justification Paper

1. Executive Summary

SHE-Transmission has received detailed feedback from Ofgem and their consultants at draft determination stage. As an outcome of this feedback, and through the questions asked and responses provided in the SQ process this EJP has been revised. Options have been re-assessed in accordance with draft determination feedback and are now more proportionate, incremental and based around addressing specific identified needs cases.

It is assumed that the reviewer of this EJP has a knowledge of telecommunications technologies, most specifically knowledge of how telecommunications technologies are used within the UK electricity industry and therefore an understanding of why reliable telecommunications systems is required.

The secure operation of a power system relies on the prompt and reliable exchange of information between electrical installations and decision platforms. Facilities are generally spread over a wide area and may include various economic and technical feasibility contexts leading to a network implemented through multiple technologies. The overall telecommunication network must constitute a well-coordinated, maintainable, stable and standard based infrastructure delivering a predictable and secure communication service for the operational mission critical applications of the power system.

This Engineering Justification paper sets out the need for a reinforcement of our existing Communications network that comprises of a mixture of operational communications mediums. [redacted]

SHE-Transmissions area of operation covers a land mass equivalent to one quarter of the United Kingdom or an area twice the size of Belgium. As a result of this there is an average of 44.5-kilometre gaps that separate SHE-Transmission sites. This rules out the use of 3rd party communications products, as most have maximum distance restrictions. In addition, this means that when microwave radio technologies are used there are several radio “hops” required to cover the distance, which are all points of potential failure. This is compounded by the fact that there is no option but to rely on 3rd party intermediate radio repeater stations. SHE-Transmission don’t own these 3rd party radio sites and are therefore unable to ensure they would remain operational during a black start scenario. This is a critical issue around security of supply and resilience.

SHE-Transmission operates in the far north of Scotland and in extremely rural environments, Weather within this area is poor for at least 6 months of the calendar year which is extremely troublesome for wireless communication mediums. [redacted]

[redacted]1[redacted]

[redacted]

Significant increases in the quantity of system data available, a rise in the volume of required asset and network monitoring being undertaken and the growth of Internet-protocol (IP) based technologies all necessitate the installation of upgraded telecommunications infrastructure to provide secure, resilient and high capacity communications mediums to all substations sites. In addition to being less reliable than a fibre optic communications medium, current wireless technologies also restrict capacity levels. This is compounded by the earlier mentioned distance between SHE-Transmission sites and the number of repeater stations required. With each repeater station used, as well as being an additional, unmanaged point of failure, capacity is reduced significantly. The result of this means that SHE-Transmission are unable to provide capacity levels required to sites that currently don't utilise a fibre optic communications medium.

[redacted]

Service	Min BW (Mb/s)
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
	[redacted]

[redacted] 2 [redacted]

[redacted]

The on-going "smart" evolution of the power grid further requires the network to be 'future-open' while assuring optimal operation of legacy systems during the long phase of migration. Particularly challenging issues in this operational network are:

- Prompt information transfer – Protection & control services require low latency and low delay variation
- Deterministic operation– Keeping tight control of time and path across the network and fast restoration of services after disruption
- High operational service availability in harsh conditions and despite very low active-to-idle state
- Long power autonomy in case of power outage for dependable communications
- Preserve the level of cyber-security of the information system across the network

- Maintain the complexity of substation telecom network at a level compatible with field-worker skills
- Assure life-cycle stability for network components installed at substations to avoid continual upgrades and updates disturbing critical applications

This proposal received strong support from our Stakeholders at a Stakeholder Engagement Workshop which took place on the 5th of March 2019 at the International Conference Centre in Edinburgh.

SHE-Transmission has outlined the following deliverables for this approach.

- Upgrade to a fibre optic communications medium on the replacement / refurbishment of existing protection and control systems to increase network Reliability.
- Completing a full fibre network to all Transmission substations with interconnections to adjoining Transmission Operators to increase network Reliability.
- Install secure data network connections into all Transmission substations to increase network data transfer capacity.

[redacted]

Upon project delivery SHE-Transmission will mitigate unacceptable operational risks caused by the existing telecommunication infrastructure and will address requirements related to the RIIO-T2 business goals, such as:

- Have a secure, resilient backbone for the transmission communications network that will allow SHE-Transmission to remotely access various plant and accommodate system monitoring elements to support long-term Risk Based Asset Management Strategy. Both are key contributors for delivering “100% network reliability for homes and businesses” stated in the “Network for Net Zero” Business plan.
- Provide high speed and high bandwidth data connections to each SHE-Transmission substation site would enable and accelerate the drive towards eventual protection over IP and the wider digital substation strategy. This helps to work towards the goal of “£100 million in efficiency savings from innovation” outlined in the “Network for Net Zero” business plan.

Additionally, this will enable alignment with the recommendations from the Energy Data Taskforce report which sets an expectation that SHE-Transmission would digitise their network, and this requires installation of high speed, high bandwidth data connections communication infrastructure.

Name of Scheme/Programme	Transmission Communications Upgrade
Primary Investment Driver	Security of supply, reliability and compliance
Scheme reference/ mechanism or category	SHNLT2038
Output references/type	NLRT2SH2038
Cost	[redacted]
Delivery Year	2021 - 2026
Reporting Table	C2.25
Outputs included in RIIO T1 Business Plan	No

2. Introduction

This Engineering Justification Paper sets out our plans to undertake Transmission Communication upgrades work during the RIIO-T2 period (April 2021 to March 2026).

The Engineering Justification Paper is structured as follows:

Section 3: Need

This section provides an explanation of the need for the planned works. It provides evidence of the primary and, where applicable, secondary drivers for undertaking the planned works. Where appropriate it provides background information and/or process outputs that generate or support the "need".

Section 4: Optioneering

This section presents all the options considered to address the "need" that is described in Section 3. Each option considered here is either discounted at this Optioneering stage with supporting reasoning provided or is taken forward for Detailed Analysis in Section 5.

Section 5: Detailed Analysis

This section considers in more detail each of the options taken forward from the Optioneering section. Where appropriate the results of Cost Benefit Analysis are discussed and together with supporting objective and engineering judgement contribute toward the identification of a selected option. The section continues by setting out the costs for the selected option.

Section 6: Conclusion

This section provides summary detail of the selected option. It sets out the scope and outputs, costs and timing of investment and where applicable other key supporting information.

Section 7: Price Control Deliverables and Ring Fencing

This section provides a summary of what should happen to funds specifically related to this project should it not progress. In addition, it highlights that SHE-Transmission are committed to delivering the full proposed option for the budget that is highlighted.

Section 8: Outputs included in RIIO-T1 Plans

This section identifies if some or all the outputs were included in the RIIO-T1 Business Plan and provides explanation and justification as to why such outputs are planned to be undertaken in the RIIO-T2 period.

3. Draft Determination

[redacted]

The paper was fully reviewed to address the issues identified in the Atkins review and the SQ's received following the submission of the business plan.

This review has consisted of re-assessing the needs case such that it is better defined, with a specific and detailed needs case for each technology type and class deployed and outlining how this links to network security, reliability and bandwidth capacity required to comply with imposed changes in operation.

A full optioneering process was then completed for this re-defined need case with 3 detailed options proposed – minimum requirements, responsible operator and progressive enabler, as well as assessing the impact of a 'do nothing' option.

The independent specialist consultant has helped to produce a risk benefit analysis that shows the benefits of the chosen options and provides a comparative analysis to show the option that provides best value for money. This has been done using the PROSORT risk benefit analysis tool and methodology, which the paper and the appendices explain in detail.

4. Need

As part of the transition to the low carbon economy, four societal shifts are changing the way we operate our network: Network Reliability, Decarbonisation, Decentralisation, Digitisation and Democratisation. The RIIO-T2 TCU plan covers both Network Reliability and Digitisation. Further details of how these aspects are covered can be found listed below.

1.1. Addressing Reliability Challenges

Reliability refers to the extent to which customers have a continuous supply of electricity. As electricity cannot be easily stored, a reliable supply of electricity requires generators to produce electricity and the transmission and distribution networks to transport the electricity to customers in real time. As a result, a reliable supply of electricity to customers requires adequate planning, capacity, and maintenance of all components of the electricity supply chain to ensure electricity can be delivered to customers when it is required.

Transmission networks are an important component of the electricity supply chain. Transmission networks transport electricity across the country from generators to major demand centres. Electricity is then transported by distribution networks to customers. Transmission networks also play a key role in maintaining the safe and secure operation of the electricity system. Given these roles, an outage on the transmission network could cause widespread and severe disruptions to the supply of electricity. As a result, transmission networks are designed and built to provide a high level of reliability to ensure that the number of unplanned outages is low.

- Black Start Communications - Currently SHE-Transmission relies on a 3rd party Public Switched Telephone Network (PSTN) service that is planned to be ceased by British Telecommunications in 2025. To enable the replacement of this service the only alternative is VOIP (Voice Over IP). Utilising the SHE-Transmission owned Operational technology network, a voice service can be provisioned. However, there must be an Optical Transport Network (OTN) presence at each substation site to enable this.

- Protection services – Reliable and fast Telecoms services play an integral part in the complex protection schemes that provide protection against faults. Modern protection scheme design - utilising high speed differential relays and complex acceleration, blocking and intertripping arrangements are very sensitive to even minor disruption in telecoms circuit provision. Poor performance of the telecoms system in the event of a fault can and has led to much wider areas of impact than the initial faulted circuit being tripped – with multiple circuit trips or cascading circuit trips possible. Poor Telecoms performance or poor clearance times and possibly in the worst cases no effective fault clearance.

- Scada services – Currently across the SHE-Transmission network RTU's are commonly connected serially via microwave or other radio technologies. Recent fault experience during the winter months of 2020 has highlighted the severity of this issue. Fibre based IP connectivity offers a resolution to this and subsequently boosts network reliability.

1.2. Increased Digitisation

Our network is undergoing significant changes in both the quantity of system data available and the way that information is collated, with increasing levels of data capture and transfer for both existing and new power system monitoring, and IP based networks equipment to support the various dependent functions shown below,

- [redacted]

- STCP 27.1 - Recently finalised grid code requirement is for the provision of PMU data streams of current and voltage readings from all agreed sites with NGESO. The understanding is that this would look to include every generation input, every GSP and MITS sites – requiring low latency, and at least 5MB/s bandwidth IP connections at most sites.

- Integrated Condition & Performance Monitoring – Made possible by the growth of our fibre optic and data network presence to each SHET substation site.

New procedures agreed with the System Operator and the modernisation of our protection systems are both placing a significant and increasing demand on information transfer capacity and reliability. To fully support this digitisation, we require a communications network that is high speed (low latency), high bandwidth, secure and reliable to ensure the integrity of protection, control and monitoring of the transmission system.

1.3. Interdependencies

The works identified in this paper are interlinked with and will support the following programmes of work:

- Protection Modernisation (T2BP-EJP-0005), which is replacing gaining protection schemes and modernising the technologies used to ensure they still perform as required given the changes on the network with the integration of large amounts of renewable energy.
- SCADA Upgrades (T2BP-EJP-0007), which intends to develop each substation in its target list to become enhanced with the latest cyber security and operate in line with the IEC 61850 Standard, A communications protocol for intelligent electronic devices that requires fibre network connections inside substations.
- Integrated Condition & Performance Monitoring (T2BP-EJP-0012), which outlines the work required to allow real time monitoring of asset condition and performance to enable improved decision making and investment planning.
- Personnel Communications (T2BP-EJP-0009), which outlines the requirement for the implementation of a Voice over Operational Technology Network (VoTN).

Successful implementation of these projects is dependent on the provision of a reliable and high capacity communications network between our assets and our Operations Centre facilities.

Without delivery of the communications upgrade detailed in this paper the benefits of these projects cannot be fully realised.

5. Optioneering

When reviewing our options in this area, we produced a three-tier approach to our development, in addition to a “Do Nothing” option:

- Minimum Requirements
    - The bare minimum required to “keep the lights on” & maintain legal/regulatory compliance
- Responsible Operator
    - A more resilient network for longer term customer benefit
- Progressive Network Enabler
    - An adaptable, sustainable and flexible network providing enhanced value to current and future customers

2.1. Do Nothing

This option would entail no reinforcement of our Operational Communications Network over the course of RIIO-T2, even where other capital works were being carried out. This does not address any of the following risks:

- After 2025 there would be no black start communications method available to 89 substation sites. As previously mentioned above BT plan to cease their PSTN service that our network currently utilises. A data connection is required at every site to provide a replacement voice over IP service.
- There would be no improvement to current fault rates to do with less reliable communications infrastructures. Fault levels would be likely to increase over time due to the ageing of current telecommunications hardware.
- SHE-Transmission would continue to be exposed to third-party service performance and cost inflation causing an increase in operating costs. As mentioned previously, all SCADA and Protection circuits are provided by the 3rd party over a mixture of infrastructure. This also adds a level of unreliability as SHE-Transmission don’t possess full control of daily operations within the telecommunications area.
- In addition, there would be an inability to ensure compliance within the cyber security area, as most technologies require an IP connection of a moderate bandwidth to be able to send and receive security data.

- SHE-Transmission would be unable to conduct any risk-based asset management as this has a large requirement on bandwidth availability. This is also the case for STCP 27.1, SHE-Transmission would not be able to comply with this at any of our 89 of our substation sites.

[redacted]

NOT PROGRESSED

2.2. Minimum Requirements

The minimum requirements option would be the provision of at least one fibre optic communications medium to each substation site and the installation of the associated multiplexor (MUX) hardware only, to enable basic utilisation of the fibre. [redacted].

This scope of works alone would hugely increase reliability of protection and control services by enabling the move away from the use of 3rd party provided circuits and microwave radio technologies instead utilising SHET owned hardware and fibre optic cable. This option would also provide significant cost savings over time by enabling the termination of 3rd party savings once they were no longer in use.

However, it must be noted that as this option negates an IP network presence, it would make the following services unavailable.

- Enhanced Cyber security – Innovative products that require an IP connection to enable the transfer of information back to our operations centre could not be utilised

- STCP-27.1 – Could only be applied at 42 of our 133 substation sites due to current IP network reach.

- Voice - Our current primary black start voice service is due to be ceased by British Telecom in 2025. An IP connection is required at every site to enable a replacement voice over IP service as detailed in T2BP-EJP-0009. Currently SHE-Transmission do not have IP connectivity at 89 sites. This means that BT’s PSTN replacement service would need to be utilised to connect the remaining sites. Due to this replacement service being unknown this cost is currently unquantifiable and a re-opener mechanism would need to be utilised once costs were known, potentially increasing the value of this minimum requirements option significantly at a later date.

- Risk based Asset Management - Is not possible without an IP network presence.

[redacted]

[redacted]

PROGRESS TO DETAILED ANALYSIS

2.3. Responsible Operator

The “Responsible Operator” option would include the scope of work that is required to achieve “Minimum Requirements” detailed in section 4.2, but would also include the installation of IP/Data network hardware [redacted]

- Enhanced Cyber security – The most up to date, best in market solutions could be utilised with less concern over bandwidth availability.
- STCP-27.1 – Could be applied at all SHET substation sites in line with National Grid Requirements.
- Voice – A replacement voice over IP service could be implemented, providing a resilient secure voice communications medium that would be available during a black start scenario, as further described in T2BP-EJP-0009.Implementation of this self-provided voice over IP service would negate the need to pursue BT’s PSTN replacement solution reducing unquantifiable risk and guaranteeing costs from the start, at the beginning of RIIO-T2.
- Risk based Asset Management – In depth analysis would be enabled on SHET assets in line with the requirements set out in T2BP-EJP-0012.

[redacted]

PROGRESS TO DETAILED ANALYSIS

2.4. Progressive Network Enabler

The “progressive network enabler” option would include the scope of work for both the “minimum requirements” option and the “responsible operator” option. In addition to this work a dual diverse fibre network is proposed, ensuring at least two diverse fibre optic communications mediums are made available at each SHET substation site.

First and foremost, this would provide a significantly higher level of Reliability to each substation site regardless of voltage with two separate ultra-low latency communications paths being available for protection and control services. In addition to this ultra-high bandwidth would be available at all sites due to the “ring network topology” that this option would naturally enable.

[redacted]

[redacted]

PROGRESS TO DETAILED ANALYSIS

6. Detailed analysis

This section considers in more detail each of the options taken forward from the Optioneering section. It examines three comparative factors in order to determine the preferred option:

- Risk,
- Stakeholder Requirements
- Cost.

3.1. Risk & Benefit Analysis

Due to the nature of this project, risks and benefits involved are not easily quantifiable and, as agreed with Ofgem, are not suitable for traditional Cost Benefit Analysis. To deal with this challenge and to ensure consistency in assessing the 3 options progressed to the detail analysis, SHET used KINECTRICS PROSORT tool. This tool has been used by several utilities in North America for 3 purposes:

- To compare different alternatives for meeting identified need(s)
- To prioritize "one off" major projects
- To allocated funds to annual programs across different lines of business

The approach used in PROSORT for all these applications involves first assessing existing Total Risk Score (TRS) to Corporate Business Values, and then normalizing investment cost over the total amount of risks this investment mitigates and additional benefits it provides as compared to the exiting situation. This allows SHET to prioritize options based on the ratio of their cost vs mitigated risk plus incremental benefits, from the lowest to the highest, so that the option with the lowest cost per mitigated unit of TRS is selected as the most cost-effective. Additionally, options are deemed feasible only if ALL the resultant individual Business Value risks move outside of the defined "red zone" representing unacceptable level of risk.

The PROSORT methodology ensures that all feasible options are assessed using a consistent approach by comparing their cost-effectiveness in reducing overall Corporate Risk and, at the same time, ensures that individual Corporate Risks are reduced to acceptable levels.

Identifying Corporate Values and their Weights

SHE-Transmission has identified 9 Core Business Values and these Business Values along with the corresponding weights representing their relative importance to SHET are shown in the Table 1 - SHET Corporate Values and Weights below.

Number	Weight	Business Value	Description of Risk
1	12	**Cost Efficiency**	Impact of unplanned failures leading to reactive replacement work.
2	10	**Environment**	Impact of SF6 Leakage, and of environmental impact of unplanned failures.
3	15	**Health and Safety**	Impact of Disruptive Failure and Reduced Reactive Fault Work.
4	10	**System Reliability**	Impact on wider system reliability e.g. System Constraints, Energy Not Supplied and DNO CI/CML
5	11	**Stakeholder Engagement**	Impact on Stakeholders - Generators, DNO, Local Communities, ESO, Other TO's of unreliable or failed assets.
6	10	**Sustainability**	Impact on SHE Transmission Business sustainability and Business Planning, wider societal sustainability (net-zero)
7	14	**Compliance**	Impact on compliance with our license conditions and statutory and legal requirements (e.g. ESQCR) and delivery of agreed price control items and new connections.
8	8	**Reputation**	Impact on SHE Transmission Reputation of Failure of Assets leading to ENS, Generation Constraints, Disruption to Public and/or wider negative media coverage.
9	10	**Innovation**	Impact on SHE Transmission Innovation Goals, Identifying and integrating new ways of working. Becoming a Leader in Asset Management as measured by ITAMS/ITOMS, Delivery of Smart Grid and EDTF Goals.

Figure 3 - Business Values and Weighting

Determining Risk Scores Using Risk Matrix

This Risk Matrix is designed so that Consequences increase exponentially from "Minor" to "Catastrophic" depending on the expected impact whereas Likelihoods increase linearly from "Hardly Ever" to Almost Certain" depending on the expected likelihood of a consequence. The intersection of expected Consequence and its Likelihood determines the resultant Risk Score.

Additionally, the “red zone” of the Risk Matrix highlights unacceptable levels of risk that need to be lowered. This exercise is repeated for each of the Business Values in

For each option taken forward to Detailed Analysis, we have performed Risk vs Cost analysis. This analysis involves normalizing cost of each option over the total amount of risks it mitigates (as compared to the existing risks) and additional benefits it provides. The options were then prioritized based on the ratio of their cost vs mitigated risk plus incremental benefits, from the lowest to the highest so that the option that had the lowest cost per mitigated unit of risk was selected as the most cost-effective. The approach used in the KINECTRICS PROSORT for all these applications involves first assessing existing Total Risk Score (TRS) to Business Values, and then normalizing investment cost over the total amount of risks this investment mitigates and additional benefits it provides as compared to the exiting situation. Additionally, options are deemed feasible only if ALL the resultant individual Business Value risks move outside of the defined “red zone” representing unacceptable level of risk.

Figures 4 & 5 clearly highlight that the responsible operator option is recommended as the best solution for investment after CRFB analysis. It presents the most benefits, Savings and reduced risk for the funding required. In turn presenting the lowest CRFB score by quite a margin as can be noted below. It is thought that the vast difference in score is because there are far more benefits to be realised in option for the RO option as appose to the MR option, for little extra investment.

3.2. Stakeholder Engagement

On 5 March 2019, SHE Transmission hosted a stakeholder workshop, aimed at gathering feedback from its stakeholders on its approach to network resilience and reliability for the RIIO-T2 plan. A total of 46 stakeholders attended the workshop, representing 31 organisations.

During the discussions, it was generally agreed that SHE Transmission should take the ‘Progressive Network Enabler’ approach to communications. Stakeholders felt that it was important for SHE Transmission to use the latest technologies and achieve the highest level of Reliability feasibly possible. There was a feeling that it was right to invest now in order to have a better performing network in future – and that there would be a financial benefit to doing so, even if it was hard to quantify.

Deliverability was also highlighted as a key consideration. The stakeholders in general praised the ambition of SHE-Transmissions optioneering but put an emphasis on choosing the option that was most deliverable within the timescale, but also the option that provided the most benefit within the timescale. In summary satisfying imposed requirements and increasing reliability as soon as possible, but with a view on to RIIO-T3 and how this could be improved further.

Stakeholders also noted that the delivery of other programmes of work (listed in interdependencies) were dependant on this package of work, and that should be widely considered. More information can be found in our Stakeholder Engagement Report.

3.3. [redacted]

[redacted]

3.4. [redacted]

[redacted]

3.5. [redacted]

[redacted]

[redacted]

Category	MR	RO	PNE
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]			

3.6. [redacted]

[redacted]

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

[redacted]

[redacted]

[redacted]

[redacted]

7. Conclusion

The significant changes to the transmission network and the increasing levels of data capture and transfer, along with the wider deployment of IP based equipment, has placed higher demand on our communications network and requires a medium which is high speed, high bandwidth, secure and reliable to ensure the integrity of protection, control, monitoring and the enhanced security of the transmission system. These factors are driving the need to replace legacy communications technologies with a secure and reliable fibre optic connection to each substation.

We have determined a need to increase the quantity of data that can be received from our assets and way that data can be used within internal systems to more accurately recognize asset operation and condition. This data can then be used for failure prediction and better real time monitoring for the transmission control room and the System Operator.

An optioneering assessment took place which investigated 4 options. Three options were taken forward for detailed analysis.

During the detailed analysis review, specific substations and circuits were highlighted for replacement. The project scope also outlined upgrades required to perform local network enhancements at each substation.

Given the preceding information, a decision has been made to deploy the “Responsible Operator” option, which will ensure at least one fibre optic communications bearer is made available to each SHE-Transmission substation, in addition to local network enhancements at each site. This will be achieved by the installation of our approved communications hardware stack and will clearly provide the following benefits,

- A replacement black start voice communications service (Vo-OTN)
- Vastly reduced communications network fault rates, in turn providing increased network reliability for protection, control and monitoring services
- Enhanced network security enabling the use of IP based cyber security technologies that have bandwidth requirement
- Compliance with STCP 27.1, enabled by providing the required bandwidth at each SHE-Transmission site
- A reduction in 3rd party risk, including negating the use of 3rd party radio sites and 3rd party provided circuits

[redacted]

8. Price Control Deliverables and Ring Fencing

As set out in our Regulatory Framework paper (section 1.12 and Appendix 3) we support a key principle from Citizens Advice – one that guarantees delivery of outcomes equivalent to the funding received - to ensure that RIIO-T2 really deliver for consumers. At the project level this means that if we don't deliver the output, or a materially equivalent outputs, we commit to returning the ex-ante allowance for the output not delivered.

[redacted]

[redacted]

9. Outputs included in RIIO-T1 Plans

There are no outputs associated with this scheme included in our RIIO-T1 plans.

10. References

- SCADA Upgrades (T2BP-EJP-0002)
- Protection Upgrades (T2BP-EJP-0004)
- Asset Condition Monitoring (T2BP-EJP-0012)
- Personnel Communications (T2BP-EJP-0009)
- Stakeholder Engagement Report
- Appendix A Costs
- Appendix B C/RBA

Appendix C – PROSORT Tool and Risk Benefit Analysis Detail

Due to the nature of this project, risks and benefits involved are not easily quantifiable and, as agreed with Ofgem, are not suitable for traditional Cost Benefit Analysis. To deal with this challenge and to ensure consistency in assessing the 3 options progressed to the detail analysis, SHET used Kinectrics PROSORT tool. This tool has been used by several utilities in North America for 3 purposes:

- To compare different alternatives for meeting identified need(s)
- To prioritize "one off" major projects
- To allocated funds to annual programs across different lines of business

The approach used in PROSORT for all these applications involves first assessing existing Total Risk Score (TRS) to Corporate Business Values, and then normalizing investment cost over the total amount of risks this investment mitigates and additional benefits it provides as compared to the exiting situation. This allows SHET to prioritize options based on the ratio of their cost vs mitigated risk plus incremental benefits, from the lowest to the highest, so that the option with the lowest cost per mitigated unit of TRS is selected as the most cost-effective. Additionally, options are deemed feasible only if ALL the resultant individual Business Value risks move outside of the defined "red zone" representing unacceptable level of risk.

The PROSORT methodology ensures that all feasible options are assessed using a consistent approach by comparing their cost-effectiveness in reducing overall Corporate Risk and, at the same time, ensures that individual Corporate Risks are reduced to acceptable levels.

PROSORT STEPS

Identifying Corporate Values and their Weights

SHET has identified 9 Core Business Values and these Business Values along with the corresponding weights representing their relative importance to SHET are shown in the Table 1 - SHET Corporate Values and Weights below. These were developed as part of SSEs ITAMS submission.

Table 1 - SHET Corporate Values and Weights

Number	Weight	Business Value	Description of Risk
1	12	**Cost Efficiency**	Impact of unplanned failures leading to reactive replacement work.
2	10	**Environment**	Impact of SF6 Leakage, and of environmental impact of unplanned failures.
3	15	**Health and Safety**	Impact of Disruptive Failure, And Reduced Reactive Fault Work.
4	10	**System Reliability**	Impact on wider system reliability e.g. System Constraints, Energy Not Supplied and DNO CI/CML
5	11	**Stakeholder Engagement**	Impact on Stakeholders - Generators, DNO, Local Communities, ESO, Other TO's of unreliable or failed assets.
6	10	**Sustainability**	Impact on SHE Transmission Business sustainability and Business Planning, wider societal sustainability (net-zero)

7	14	**Compliance**	Impact on compliance with our license conditions and statutory and legal requirements (e.g. ESQCR) and delivery of agreed price control items and new connections.
8	8	**Reputation**	Impact on SHE Transmission Reputation of Failure of Assets leading to ENS, Generation Constraints, Disruption to Public and/or wider negative media coverage.
9	10	**Innovation**	Impact on SHE Transmission Innovation Goals, Identifying and integrating new ways of working. Becoming a Leader in Asset Management as measured by ITAMS/ITOMS, Delivery of Smart Grid and EDTF Goals.

Determining Risk Scores Using Risk Matrix

Risk Score for each of these Business Values is determined using the Risk Matrix shown below in Table 2. This Risk Matrix is designed so that Consequences increase exponentially from “Minor” to “Catastrophic” depending on the expected impact whereas Likelihoods increase linearly from “Hardly Ever” to Almost Certain” depending on the expected likelihood of a consequence. The intersection of expected Consequence and its Likelihood determines the resultant Risk Score. Additionally, the “red zone” of the Risk Matrix highlights unacceptable levels of risk that need to be lowered. This exercise is repeated for each of the Business Values in Table 2 - Risk Scoring Matrix.

Table 2 - Risk Scoring Matrix

	Almost Never	Hardly Ever	Unlikely	Possible	Likely	Almost Certain
Catastrophic	134	366	994	2701	7342	19958
Severe	49	134	366	994	2701	7342
Major	18	49	134	366	994	2701
Serious	7	18	49	134	366	994
Minor	2	7	18	49	134	366
Incidental	1	2	7	18	49	134

Table 3 - Risk Scoring Matrix with SHE Transmission Risks

	Almost Never	Hardly Ever	Unlikely	Possible	Likely	Almost Certain
Catastrophic	High	High	Severe	Severe	Severe	Severe
Severe	Medium	High	High	Severe	Severe	Severe
Major	Medium	Medium	High	High	Severe	Severe
Serious	Low	Medium	Medium	High	High	Severe
Minor	Low	Low	Medium	Medium	High	High
Incidental	Low	Low	Low	Medium	Medium	High

<u>Comparing Different Options</u>

The TRS is then calculated by first multiplying each Risk Score by its corresponding weight to calculate Weighted Risk Score (WRS) and then adding up all the WRSs. This was done for the existing situation which represents "Do Nothing" and for the 3 options that progressed to the detail analysis.

For each of these 3 options a change in the TRS or ΔTRS as compared to the "Do Nothing" option was then calculated by subtracting its TRS from the "Do Nothing" TRS and adding incremental weighted benefit (which for this project was associated with innovations capabilities). Finally, Cost per Risk Benefit Factor (CRBF) was determined for each option using the following equation:

$$CRBF = \text{Project Cost} / \Delta TRS$$