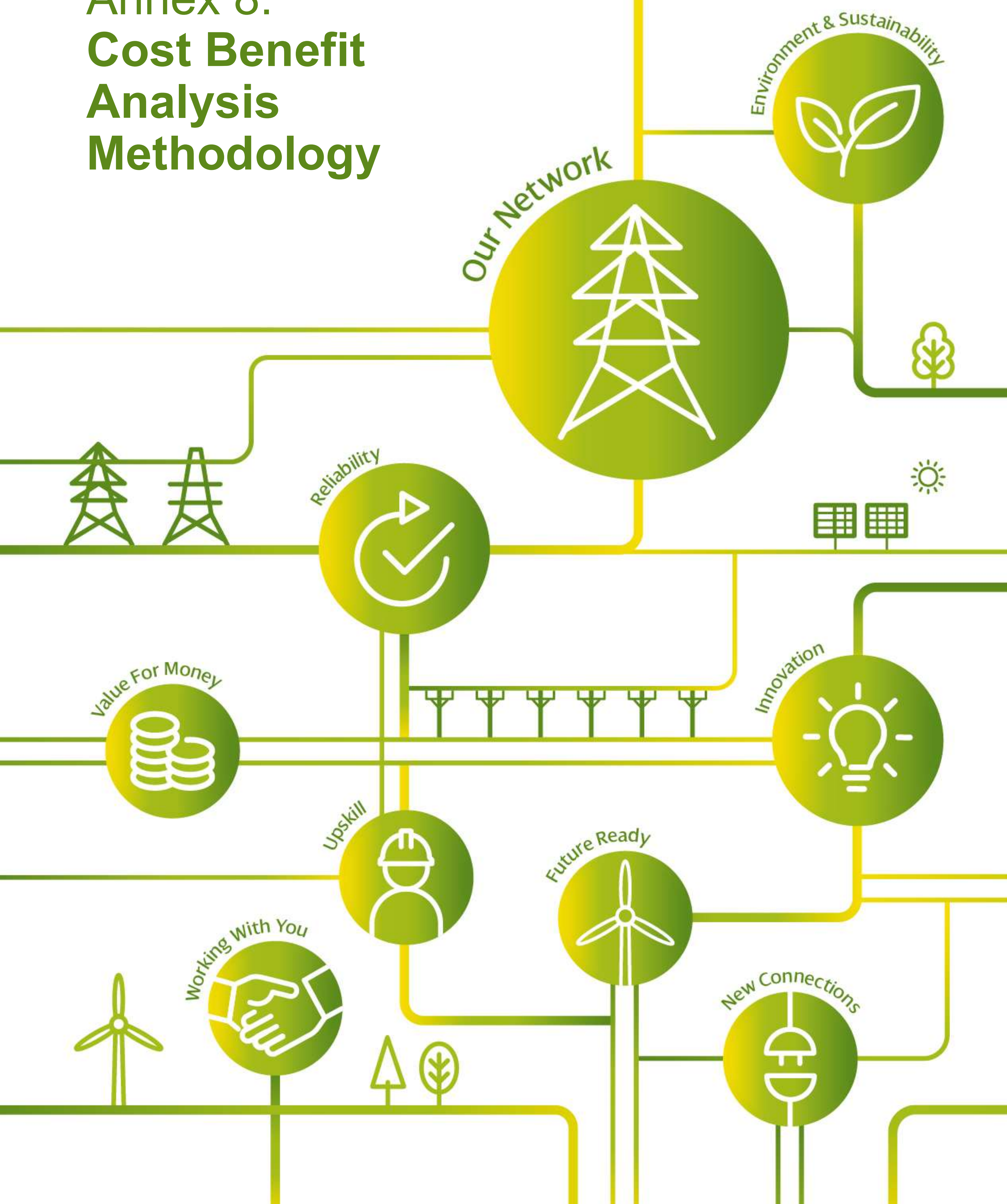
SP Energy Networks, RIIO-T2 Business Plan
December 2019 Submission

Annex 8:
Cost Benefit Analysis Methodology



CONTENTS

1. OVERVIEW

Cost benefit analysis (CBA) is a set of practical procedures for guiding investment decisions. This informs the selection of optimal investment choice through analysing costs, benefits and risks. The analysis provides decision makers with an understanding of the potential effects, trade-offs and overall impact of options.

A common approach to investment appraisal can be reached through the use of cost benefit analysis. Cost benefit analysis, simplistically, is where the expected costs and benefits of an intervention are estimated and the trade-offs considered. This requires all impacts to be accounted for including social, economic and financial. Costs and benefits are then analysed and discounted over a specified time period to provide an output in the form of a net present value (NPV). Utilising this appraisal process provides a greater level of clarity of the different options available.

Why use cost benefit analysis?

Cost benefit analysis models were used in RIIO-ED1 to support a significant number of investment proposals, e.g. asset modernisation programmes. A common model was created that was utilised across all of the Distribution Network Operators, this ensured consistency around assumptions and approach to analysis. For RIIO-T2, a common CBA provided by Ofgem will be used in a similar manner. The analysis will aid in the decision-making process for a variety of investment proposals including but not limited to: demand related investment, asset modernisation and wider network reinforcement.

The model provides the means of evaluating multiple investment options which have different costs and benefits. The process was particularly valuable where the lowest cost option was not the recommended approach and provided justification for the increased investment based on the total life of the project. This is particularly relevant in how we have considered changes that are required in light of the transition to a Net Zero energy system.An example of this evaluation is proposing to invest in a lower loss Transformer which has a higher capital cost but provides lower lifetime costs to consumers.

2. PREVIOUS CBA MODELS

RIIO-ED1 CBA model was based on guidance from “HM Treasury: Green Book”[1] and was standard across all the Distribution Network Operators. In this model, a longlist of options were identified based on engineering knowledge for each intervention. This was then reduced to a shortlist of options through engineering judgement and historical performance.

The shortlisted options were evaluated against a baseline scenario which represented the “Do Minimum” option. The “Do Minimum” option could either be to do nothing or the minimum intervention required. This was dependent on specific project circumstances. The main benefits monetised were customer interruptions (CI) savings, customer minutes lost (CML) savings and capital cost savings compared with the baseline option. Wider benefits were not given consideration in the ED1 model

A deterministic approach was used in ED1. Direct costs and benefits of each option were estimated and assigned single monetary values over the life of the intervention. A discount rate was then applied to future values to derive a net present value (NPV) at 10, 20, 30, 45 and 52 year periods. Furthermore, equal weighting was given to the likelihood of outcomes.

3. DEVELOPING THE RIIO-T2 MODEL

Working with the Transmission Owners, OFGEM have developed the CBA model for use in the RIIOT-2 business plan process. The model utilises the “Spackman” approach annualising capital costs using the weighted average cost of capital (WACC) and utilising the social time preference rate (STPR) to discount all costs and benefits - excluding Health and Safety which is subject to its own separate discount rate.

One of the main developments featured in the RIIO-T2 model is the inclusion of a wider set of benefits. Only a small subset of benefits was considered in the ED-1 model with wider societal benefits not included in analysis. The RIIO-T2 CBA model

[1] https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

includes several additional wider benefits both quantitatively and qualitatively. The benefits considered are discussed in subsequent sections.

The Cost Benefit Analysis will accompany an Engineering Justification paper. Where projects are similar in scope and cost they may be grouped together for assessment. All of these are provided in Annex 1: Investment Packs.

Most engineering justification papers have a supporting Cost Benefit Analysis except for the following projects:

- All non-load projects where the main driver is a non-lead asset (i.e. protection works, civil works, cyber-security) as these have no monetised benefits in the existing CBA model.
- Live projects rolling over from T1 since they have already initiated, and decision was made during the previous price control.
- Customer connection projects as the proposed approach is based on agreement with the connecting party as they will bear a significant proportion of the costs incurred and in some instances, they will prefer a more expensive solution to allow for an earlier connection date, for example through the use of cable in place of overhead lines.
- TO Reinforcements associated with new connections, where the options considered are evaluated purely on the basis of the lowest cost solution as the benefits are all comparable.
- Projects justified through the Network Options Assessment Process as these are subject to a more extensive and rigorous CBA process by the Electricity System Operator who can consider market options, and different options which may be offered by different TOs.

Those projects in these categories above have an Engineering Justification Paper explaining all possible options and the reasoning behind the selection of the preferred investment option.

4. OPTIONEERING PROCESS

OFGEM require us to “clearly identify the range of options that were considered to meet the stated aim”. To ensure consistency in the optioneering process we follow a standard Transmission Investment Decision Process – provided separately in Annex 13.

For each investment decision a longlist of options is required to ensure all possible solutions are put forward for consideration leading to the creation of a longlist. A range of contributors involving stakeholders, design and health and safety are involved at this stage. The longlist will include options that may be less mature such as emerging innovation to demonstrate their consideration. Each project identified will include a description of its impact on key performance areas and obligations we have to our stakeholders

At this point a robust selection criterion is applied to the longlist candidates. The criteria look at a range of critical success factors and has been developed in alignment with the “Green Book”.

The following Critical Success Factors have been identified:

- Fits in to overall business strategy
  - Creation of Sustainable Value
  - Safety and Reliability
  - Quality
  - Innovation
  - Customer Focus
- Deliverability/Achievability
  - Is the project deliverable with existing/planned resources?
  - Is it feasible within our known supply chain?
- Value for money
  - Are the capital costs reasonable?
  - Does the project represent value to consumers?

- Operation and Maintenance
  - Does the project provide a reasonable degree of system operability?
- (Load Specific) Network Capacity
  - Does the project provide the required level of network capacity?
- (Non-Load Specific) Network Risk
  - Does the project leave an acceptable level of network risk?

Each project is evaluated to understand to what extent it meets the requirements of the Critical Success Factor.

There is a section in the CBA to provide the full list of options considered for each investment decision. The list of options clearly indicates the options that have been considered but rejected before full costing, and the short list of options that has been considered and costed together with a comment summarising the reasons. Full details are available in the Engineering Justification Paper related to every proposed investment.

The optioneering process will help to inform the Concept Approval (IP1) stage of the wider SPT investment decision making process. This is to ensure all appropriate solutions have been considered and select the options that will be subject to further appraisal. Normally 3-4 options will be taken forward for further appraisal via cost benefit analysis.

5. ASSIGNING VALUES FOR SHORT LISTED OPTIONS

Costs

The capital costs associated are well understood and are sourced from an engineering design process. Operational and maintenance cost has been quantified and included when and where appropriate to the CBA. All costs are checked as part of SPTs own assurance process. We have included the replacement cost for assets which may need to be replaced during the 45-year assessment window where appropriate. The timing for replacement of those assets has been estimated at the end of their operational life as per the NARMS methodology.

We have worked closely with National Grid ESO to obtain forecasts of generation constraints caused by our works where an option would have fewer outages incurring constraints but a higher capital cost. The constraint cost can vary depending on the Future Energy Scenario considered; therefore, we have performed a Least Worst Regret analysis to identify the preferred option where applicable. Additional sensitivity around the timing of completion of other projects that may have an impact in the constraint cost associated with our interventions has been considered in the assessment.

Benefits

Once the costs have been identified, the next stage is outlining the benefits associated with each option. The types of benefits included in the cost benefit analysis will vary depending on the area of investment.

Load Related Investment

For network fault level reinforcement schemes the main driver behind the associated Grid Supply Point (GSP) reinforcement work is capacity released which allows low carbon generation to connect to the network. Through more low carbon generation connecting to the network it is proposed that this will offset generation from more carbon intensive sources. This is differentiated from the direct carbon impact associated with each proposed solution; which has been considered qualitatively as part of the optioneering process.

Key to this is the scenario work we have undertaken showing growth of generation (by type and by scenario) across all GSPs on the SPT network. This provides a credible range of generation uptake at each GSP. Then, utilising historic generation data, an indication of low carbon generation output per year can be forecasted. This can then be used to calculate a CO_2 offset and, from the traded carbon price, an overall benefit of the proposed solution. The BEIS traded (central) carbon values have been used as the basis for calculations - data provided by OFGEM.

A monetised value for CO2e offset of the generation able to connect to the network as a result of the proposed intervention can then be quantified. The value illustrates the wider societal benefit of the proposed solution and is the main quantifiable benefit associated with the load related reinforcement projects. An assessment of the carbon impact of each proposed solution is not quantified within our CBA approach for this area.

For reinforcement projects, commercial alternatives have also been considered. Estimated costs are detailed in the respective CBAs and are based on estimates provided by the ESO or other market data.

Non-Load Related Investment

Deteriorating assets have a higher probability of failure. There are environmental, safety, financial and system consequences associated to the failure of those assets. For lead assets, those risks have been quantified in monetary terms using the NOMS methodology. We have used the longer-term risk benefit in the CBA when comparing different intervention options. The monetised risk benefit has been defined by Ofgem as the key output of any proposed intervention on a Lead Assets. The monetised risk benefit of an intervention compares the new, lower risk value with the risk value if no work is done. This is calculated over a timescale intended to reflect the average life of a new asset and 45 years is used, consistent with the financial depreciation period. The monetised risk benefit has been applied from the last year of the T2 period, when the intervention is complete and consistently with the risk targets defined at the end of the T2 period, regardless of the year of delivery of the intervention. The capital investment of the intervention has been applied on the same year to avoid different discounting rates.

SF_6 has been widely used in high voltage circuit breakers for decades worldwide due to its excellent dielectric performance and interruption capability. It is also commonly used in gas-insulated substations (GIS). The equipment using SF_6 has very low leakage rates, below 1% of its volume per year. However, SF_6 is recognised as a very potent greenhouse gas with a global warming potential (GWP 100-year horizon) of 23,500 times greater than CO2.

When an intervention is required in any of our assets containing SF6 gas, we have quantified the environmental benefits of reducing the SF6 leakage when compare to the baseline option. We have proposed any available alternatives to SF_6 equipment and calculated the benefits of that when comparing with the convention solution, usually SF_6 equipment. The benefits are calculated in the template by using the CO2 equivalent latest conversion and non-traded carbon prices as a common reference. Any SF_6 alternative gas has very low GWP, close to zero and not significant when compared to SF_6, therefore an assumption has been made to use zero when proposing an alternative gas. The Cost Benefit Analysis indicates that the benefits associated with the reduction of the fugitive emission of the gas may not compensate the additional cost of the equipment when compared to most commonly used SF_6 equivalent in all cases. In those cases, we have tested the sensitivity of the CBA outcome to higher carbon prices using reference values as provided by Ofgem in the CBA template.

6. APPRAISING THE OPTIONS

Net present value (NPV)

The model allows for the NPV to be analysed over the lifetime of the project and at 10, 20, 30 and 45 year time intervals. This allows decision makers an understanding of how the costs and benefits interact over time.

This analysis enables the preferred option to be identified, which is generally the option with the highest Net Present Value over the lifetime of the assets. There may be cases where the recommended option is not the one with highest NPV, in those cases the qualitative costs and benefits will justify the difference in the NPV and will be discussed in the engineering justification paper.

“Option” Comparison

In line with OFGEM guidance the “Baseline Option” for all cost benefit analysis will be “the minimum level of intervention that would be required to remain compliant with all relevant safety regulations”. We have used the deferral of the minimum investment to the next price control, when appropriate, as a baseline option for the non-load investments.

For each “Baseline Option” there could be no direct benefits however there will be societal benefits accrued which are taken into consideration. The NPV of all other “Options” will be compared against the “Baseline Option” NPV.

For each “Option” an engineering justification is provided to outline key information and arguments for each “Option”.

Identifying Preferred “Option”

The output for each Option will be a net present value over the specified time periods. These can then be compared to highlight the preferred solution. Where a scheme has a marginal NPV difference, a sensitivity analysis will be carried out to obtain a more thorough understanding of cost and timing changes and consideration will be given to the capital cost, risks and other relevant factors.

The results of the CBA will aid in the Technical Approval (IP2) stage for each investment decision and ensure the best available option is selected. Additionally, the CBA and its outcomes will form an Investment Decision Pack alongside an Engineering Justification paper. Where projects are similar in scope and cost they have been grouped together for assessment

7. CONCLUSION

This document has provided an overview of the approach taken to evaluate options using a Cost Benefit Analysis. A range of papers have also been provided as part of our RIIO-T2 business plan, but these papers may be revised as projects are further developed should the costs or benefits change over time.

Further details on the internal governance process of expenditure can be found separately in the Investment Decision Process, Annex 13.