SP ENERGY NETWORKS

RIIO-T2

August 2018

Cost Benefit Analysis

Why are we considering CBAs?

CBA models were used extensively in ED1 to support investment proposals

Common model was developed to ensure consistency around assumptions

Provided a means of evaluating multiple options which had different benefits and costs for a single project/or scheme

Particularly valuable where the lowest cost option within the price review period is not the recommended approach

- Example 1. Investing in a lower loss transformer which has a higher capital cost but lower lifetime cost
- Example 2. Offline asset replacement to minimise constraint costs

Applications of Cost Benefit Analysis in T2

Load Investment

- Limited relevance to NOA (separate CBA process) or Connection Projects (where contract has been accepted by customer).
- Primarily used for interventions with multiple possible solutions (including those with potential distribution solution)
- Flexible/commercial solutions v build

Non-Load Investment

- Interventions with different capital and operational costs
- Interventions with different risk reductions
- Interventions where components have differing expected lives

Project cost threshold may apply to lower value solutions, subject to cost assessment

Example: Australian Regulatory Investment Test involves a materiality threshold for investment of AUD$5m

Existing ED-1 Cost benefit analysis model

- Based on guidance from “HM Treasury: Green Book”
- Standard across all DNOs for specific programme/scheme categories
- NPV analysed over 4 main time periods - 16, 24, 32 and 45 years to coincide with price reviews
- Short list of options was built from engineering judgement.
- Deterministic values used for cost benefit analysis:

  Main Cost Inputs
    - Capital investment
    - Inspection and Maintenance

  Main Benefit Inputs
    - Customer Interruptions/Customer Minutes Lost savings
    - Capital cost savings
    - Losses savings
- A standard discount rate applied to future values
- Likelihood of outcomes are given equal weighting
- All options evaluated against the baseline option which represents the “Do Minimum” approach
- NPVs evaluated and used to inform investment decision

Structured Optioneering Process

The optioneering process may benefit from a more structured approach to long list and short list creation

Each option can be evaluated consistently to ensure the most appropriate options are then subject to the appraisal process

Whole System Approach

In line with recent OFGEM consultation a whole system approach will be used when analysing potential solutions as part of the cost benefit analysis process to ensure not only Transmission solutions are considered

Probabilistic Approach

Most inputs, outcomes and impacts of projects are not known with a great deal of certainty

Utilising probability distributions instead of single point values can provide a better representation of potential outcomes

Wider Societal Benefits

The ED1 CBA model did not feature the wider societal benefits of each investment option

The T2 model will look to include more benefits, including wider societal benefits, as part of the appraisal process

Assessing the Intervention Options

Long List

- Long list of intervention options required to ensure all possibilities are analysed
- Structured framework used to ensure different types of solutions put forward for consideration. Framework aligned with "Green Book"

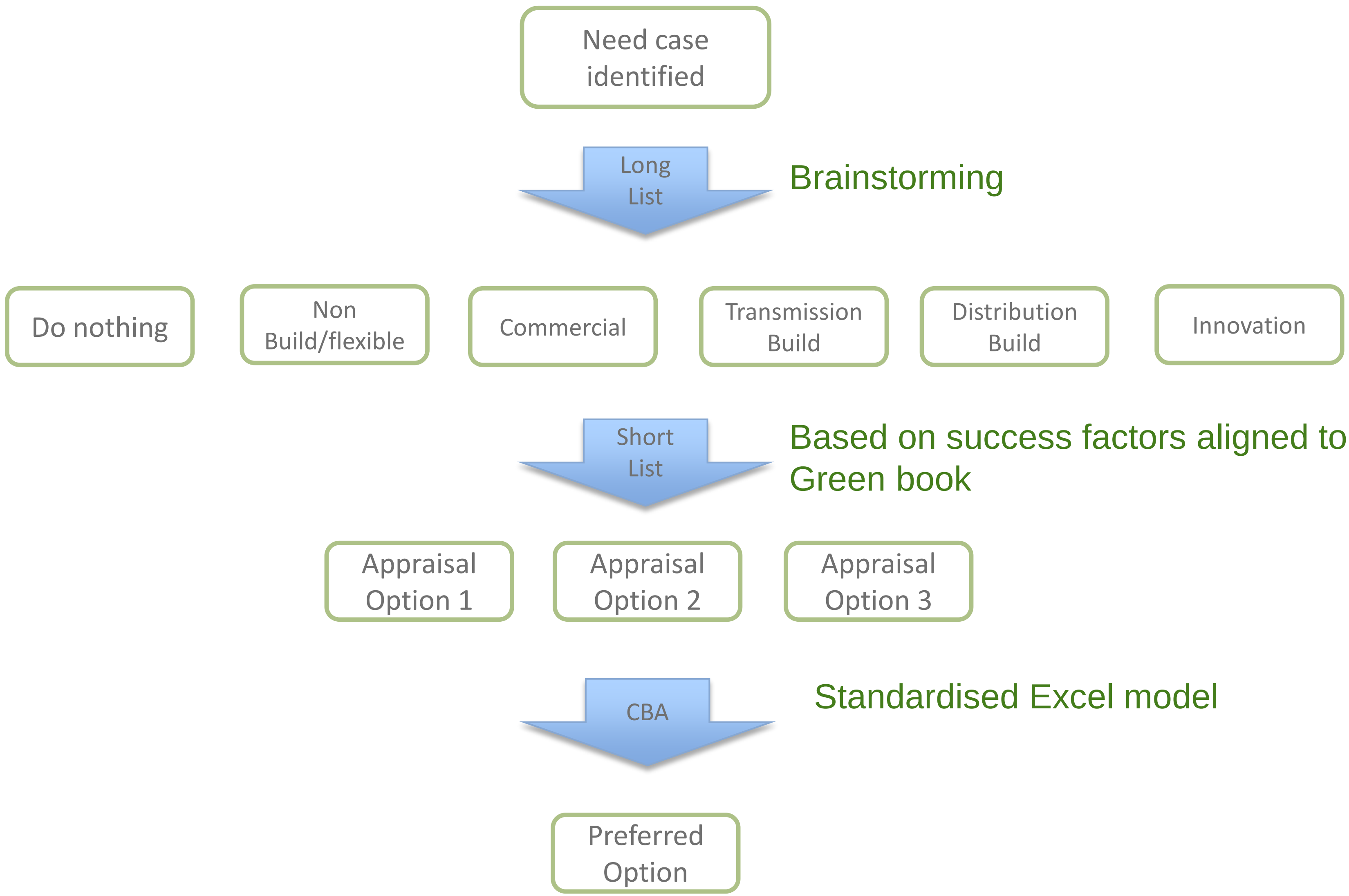
Short List

- Short list created to be subject to further appraisal
- 3-4 Options

Cost Benefit Analysis

- Costs and benefits monetised for each short-listed option
- Net Present Value comparison – 45 year period

Options Framework Example



Deterministic Approach

Direct costs and benefits of each option are estimated and assigned single values or deterministic monetary values for each period, over the life of the intervention. A discount rate is applied to future values to derive a net present value (NPV) at a specified point in time.

The likelihood of outcomes are given equal weighting

Probabilistic Approach

Utilises simulation-based risk modelling. A random sampling is performed by using uncertain risk variable inputs to generate the range of outcomes with a confidence measure for each outcome. The outputs are the result of numerous simulations that model the collective impact of a number of uncertainties.

Confidence levels are obtained for likelihood of outcomes

Costs & Benefits Considered

Costs

Major

- Initial investment
- Penalties
- Generation Constraints

Minor

- Natural capital
- Inspection & Maintenance
- Losses
- Commercial arrangement

Benefits

Major

- Carbon offset equivalent
- Risk reduction

Minor

- Societal/customer impact
- Wider environmental impact

Example GSP Fault Level Reinforcement

- Fault level at 33kV switchboard forecast to exceed system design limit
- Provide network capacity and address H&S risk
- Three proposed short list options compared against the “Do Minimum” option

Option	Description	T2 CAPEX (£m)	T3 CAPEX (£m)	Total Lifetime Cost	Total Lifetime Benefit*	Net Present Value
Change Tx at End of Life (Do Minimum – Baseline Option)	Replace Tx at end of life in year 2032 with more efficient Tx to increase fault level and thermal capacity	£0m	£4.5m	£5m	£5m	-
33kV Series Reactor	Series reactors on 33kV side of existing Tx to increase impedance and provide fault level and thermal capacity	£2.0m	£4.5m	£7m	£11m	£1.33m
33kV Bus Section Reactor	Install a bus section reactor and opening of the bus section breaker would provide suitable fault level and thermal capacity	£2.5m	£4.5m	£7.5m	£8m	-£0.66m
Tx Early Replacement	Replace Tx early in year 2021 with more efficient Tx to increase fault level and thermal capacity	£4.5m	-	£5m	£11m	£1.79m

Replacement of Transformers early provides the greatest net present value at the end of the 45 year regulatory asset life period

*Benefits considered in this example:
- Carbon offset equivalent – additional generation capacity
- Community Benefit (Societal)

Analysing the Results

Each option was appraised using the additional benefits considered for the T2 model

The model was then run again with benefits excluded to analyse the sensitivity of the net present value results

Option	NPV (without Benefits)	NPV (with Benefits)
Change Tx at End of Life - Baseline Option		
33kV Series Reactor	-£5.6m	£1.33m
33kV Bus Section Reactor	-£5.85m	-£0.66m
Tx Early Replacement	-£5.13m	£1.79m

The addition of benefits in to the CBA model does not change the result in this scenario and has been found to have little effect on the outcome for lower value projects.

Higher value benefits, such as constraint costs, may have a much larger effect on which option is chosen.

TO Working Group

We propose a working group with all TOs develop a common model which can be adopted, building on the ED1 model.

Financial Parameters

Finalise cost benefit analysis financial parameters (WACC, discount rate, etc.)

Development of Probabilistic Approach

Further development required consider the use of probability in costs and benefits used for appraisal

Benefits categorisation

Agree benefits categories and consistent approach to evaluating these.