

Open Networks Project

Whole System Cost- Benefit Analysis User Guide

December 2020 | Version 1

WS4 P1

DOCUMENT CONTROL

Authorities

Version	Issue Date	Authorisation	Comments
1.0	01/12/2020	Marina Charalambous	Version released to ENA WS4 for sign-off

The whole system CBA is freely available on the ENA's website. In order to support users of the model and gather feedback for subsequent updates, we would kindly request those using the model to contact opennetworks@energynetworks.org.

TABLE OF CONTENTS

1	Introduction	5
1.1	About ENA	5
1.2	Our members and associates.....	5
1.2.1	ENAs members	6
1.2.2	ENAs associates.....	6
2	Whole System CBA Introduction.....	7
2.1	Populating the tool.....	7
3	User Controls section	9
3.1	Use Case Description tab.....	9
3.2	Control tab	9
4	Strategies section.....	14
4.1	Stakeholder impacts	16
4.2	Societal Impacts.....	16
	Table 1 Societal Impacts included in the tool	17
4.3	Customer Impacts	18
	Table 2 Customer Impacts included in the tool	18
5	Strategies Summary section	20
6	Outputs section	21
6.1	Output Charts.....	21
	Table 3 Output Charts tabs	21
6.2	Additional Reporting Metrics	21
6.3	Distributional Analysis	22
7	Qualitative Inputs section.....	23

8	Inputs section	24
9	Non-functional section	25

1 Introduction

1.1 About ENA

Energy Networks Association (ENA) represents the owners and operators of licenses for the transmission and/or distribution of energy in the UK and Ireland. Our members control and maintain the critical national infrastructure that delivers these vital services into customers' homes and businesses.

ENA's overriding goals are to promote UK and Ireland energy networks ensuring our networks are the safest, most reliable, most efficient and sustainable in the world. We influence decision-makers on issues that are important to our members. These include:

- Regulation and the wider representation in UK, Ireland and the rest of Europe
- Cost-efficient engineering services and related businesses for the benefit of members
- Safety, health and environment across the gas and electricity industries
- The development and deployment of smart technology
- Innovation strategy, reporting and collaboration in GB

As the voice of the energy networks sector, ENA acts as a strategic focus and channel of communication for the industry. We promote interests and good standing of the industry and provide a forum of discussion among company members.

1.2 Our members and associates

Membership of Energy Networks Association is open to all owners and operators of energy networks in the UK.

- ▶ Companies which operate smaller networks or are licence holders in the islands around the UK and Ireland can be associates of ENA too. This gives them access to the expertise and knowledge available through ENA.
- ▶ Companies and organisations with an interest in the UK transmission and distribution market are now able to directly benefit from the work of ENA through associate status.

1.2.1 ENA members



1.2.2 ENA associates

- [Chubu](#)
- [EEA](#)
- [Guernsey Electricity Ltd](#)
- [Heathrow Airport](#)
- [Jersey Electricity](#)
- [Manx Electricity Authority](#)
- [Network Rail](#)
- [TEPCO](#)

2 Whole System CBA Introduction

The Whole Systems CBA tool aims to enable the comparison of costs and benefits across different sectors, across a number of stakeholders (regulated and non-regulated) as well as across a number of scenarios.

This chapter outlines the required inputs, the steps to populating the tool, as well as how to update the tool where appropriate.

The tool is split in seven sections as per below:

1. **User Controls, green section:** where the user can define the Use Case, the number of Strategies, Scenarios, and Stakeholders. This section includes toggles for updating the tool i.e. applying depreciation, updating charts and updating the tool
2. **Strategies, blue section:** this is the key section for the user where they can input costs and benefits for each of the Strategies and Scenarios, for each relevant Stakeholder including the stakeholders' Customers and Society
3. **Strategies Summary, purple section:** this section provides a summary of key impacts in each Strategy, for ease of reference i.e. no inputs are required by the user
4. **Outputs, grey section:** where the outputs of the CBA are reported, using several reporting metrics that can be used to inform a preferred Strategy. This section also includes the distributional impact analysis
5. **Qualitative Inputs, orange section:** where the user can input qualitative information such as the long list of Strategies considered, qualitative (i.e. non-monetised) impacts and risks
6. **Inputs, yellow section:** this section includes the fixed and time series inputs which support the calculation of some of the costs and benefits in the Strategies section such as carbon prices and value of losses. These inputs are pre-populated with values determined by the WS4 Product Team, and should be updated only if appropriate along with justification
7. **Non-functional section, dark grey section:** this section is not functional from the user perspective i.e. it does not require inputs and/or manipulation. Its purpose is to support the capabilities of the tool in terms of, for example, producing output charts and calculating the depreciated cost/benefit profiles

2.1 Populating the tool

The user should populate the light yellow cells only, where some of these are free entry and others are dropdown lists. A legend in the Guidance tab of the tool describes the purpose of cells with other colours than light yellow, including cells for calculations, outputs from VBA code and descriptors.

The User Controls and Strategies sections will be the focus of the typical user of the tool, noting that the Inputs section includes pre-populated values as determined by the WS4 Product Team, and should only be updated if appropriate along with justification of updates. Should the user wish to also add qualitative inputs, they would also populate the Qualitative Inputs section.

The Whole Systems CBA tool should be populated using negative values to reflect costs and positive values to reflect benefits (including avoided costs). The same approach should be taken for societal impacts such as losses, carbon emissions, etc. For example, a reduction in losses or carbon emissions should be populated using positive values since these represent a societal benefit. Equally, if the user populates the tool with gross impacts i.e. with gross volumes of losses or carbon emissions relevant to each Strategy, they should input these volumes as negative values to reflect that these impacts are a cost to society.

The user should ensure that all costs and benefits they populate the tool with are expressed on the basis of a common price base year i.e. in 2019/20 prices. The choice of the price year is up to the user, as long as this is

common across all the costs and benefits inputs. The tool includes the capability to express outputs at a price year basis which is also a choice of the user. This can be done in the Control tab. The tool also allows for the discounting year to be selected by the user in the Control tab.

The next sections describe how to populate the tool for each section in more detail.

3 User Controls section

3.1 Use Case Description tab

The user should describe the investment aim by defining the Use Case in this tab. They should consider what assumptions underline their analysis and what input drivers are appropriate. If some of these inputs are different to the ones pre-populated in the Fixed Inputs and/or Time Series Inputs tabs, the user should list these along with the source of the alternative inputs and a justification. For example, the tool values carbon at the Central BEIS carbon price (2018 publication) and the user may determine that the High BEIS carbon price is more appropriate for the Use Case being considered hence they would need to indicate this here.

Moreover, the user should indicate whether they assume that a given input and/or input driver is endogenous to a Use Case or Strategy and also indicate this in this tab. For example, a Strategy may involve the repurposing of a GDN network to hydrogen, which may represent a significant proportion of the total UK hydrogen demand which may in turn mean it is more appropriate to assume a higher hydrogen price under this Strategy than others. This would be an example of an endogenously determined input.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Use Case Description															
2																
3	Use Case considered in this CBA: Describe the Use Case and the boundary assumed in the analysis															
4																
5																
6																
7	List below the relevant inputs/ input drivers and their assumed endogeneity/exogeneity according to the Use Case															
8		Input Driver No.		Input / Input driver		Endogenous / Exogenous		Source		Justification						
9		1														
10		2														
11		3														
12		4														
13		5														

3.2 Control tab

As a first step, the Reference Year section of the Control tab should be populated. The user can select the horizon for which the tool presents outputs in the Outputs section, by populating the NPV Horizon (years) cell. The discounting year is also a user choice, which drives the NPV calculations i.e. an input of 2019/20 means that costs and benefits are discounted back to 2019/20. The discount rates are pre-populated in the tool using the Green Book discount rates. The user should indicate the price basis of the input data they populate the tool with. This allows the tool to dynamically change the price basis of the output data to the one chosen by the user or indeed anyone who is reviewing the CBA outputs. The depreciation method provides the user the choice to use either the Straight-line or the Sum of Year Digits (SOYD) methods, which are currently used in the RIIO sector-specific CBA templates for the electricity and gas sectors respectively¹.

¹ The SOYD depreciation method differs to the Straight-line method in terms of ‘front-loading’ the amount to be depreciated, therefore the NPV of a cost item under a SOYD depreciation method will be higher than the NPV of the same cost item under the Straight-line method. This, however, would not affect the comparison of NPVs between Strategies since the tool applies the same depreciation method across all Strategies, although it would affect the Absolute NPVs.

REFERENCE YEAR			
NPV Time Horizon			
NPV Horizon (years)		11	
Benefit calculated to:		2031	
Discounting Year			
	Reference Year		
Discounting Reference Year		2019/20	
Discounting Reference Calendar Year		2020	
Price Base Year			
	Reference Year		
Inputs Price Base Reference Year		2019/20	
Inputs Price Base Reference Calendar Year		2020	
Outputs Price Base Reference Year		2019/20	
Outputs Price Base Reference Calendar Year		2020	
Price Base Adjustment Factor		1	
DISCOUNTING RATES			
	Discount type	Discount rate	Source
	Discount rate for safety <= 30 years	1.50%	https://assets.publishing.se
	Discount rate for safety > 30 years	1.29%	https://assets.publishing.se
	Discount Rate <= 30 years	3.50%	https://assets.publishing.se
	Discount Rate > 30 years	3.00%	https://assets.publishing.se
DEPRECIATION METHOD			
	Sum of Year Digits		

The user should list the names of up to seven Strategies they will be assessing as well as the names of up to five Scenarios they would like to consider. It is generally suggested to keep Strategy and Scenario names to reasonable character length for ease of reference across the tool and the output charts.

It is important that the user indicates which of the named Strategies the Reference Strategy is. This can be a business-as-usual or do-nothing Strategy, or what one may also refer to as the counterfactual. The Outputs section provides results on an Absolute as well as a Relative basis i.e. absolute NPVs for each Strategy and NPVs of the Strategies relative to the (user-determined) Reference Strategy.

The user should also indicate which of the named Scenarios the Reference Scenario is. The significance of this is that the Outputs section provides a separate tab with outputs charts only for the Reference Scenario for ease of reference to the user, alongside another set of outputs charts that present the full list of active Scenarios.

SCENARIO NAMES	
Scenarios	
1	Leading the Way
2	
3	
4	
5	
Count	1
REFERENCE SCENARIO	
Reference Scenario	
Leading the Way	
NAMES OF STRATEGIES	
Strategies	
1	Counterfactual
2	Integrated
3	
4	
5	
6	
7	
Count	2
REFERENCE STRATEGY	
Reference Strategy	
Counterfactual	

Once the full list of Strategies and Scenarios is populated, the user should click on the “Remove unused tabs and rows” button (this may take 1-2 minutes to complete). The tool is then updated to hide any sections that relate to ‘inactive’ Strategies and Scenarios i.e. if two Strategies are being considered by the user, the tool will hide the tabs in the Strategies section that relate to Strategies 3 to 7. The other two buttons at the top of the Controls tab, “Apply depreciation” and “Update charts” are relevant for the user after the Strategies section is populated, to apply the depreciation treatment to the relevant costs and update the output charts respectively.

VBA BUTTONS	
<p>Remove unused tabs and rows</p> <p>This button removes unused tabs and rows across the tool for any Strategies and Scenarios which are inactive i.e. the ones not populated by the user below. Should the user only want to consider 2 Scenarios, the tool will be updated to show 2 Scenarios and not the full list of 3 Scenarios.</p>	<p>Apply depreciation</p> <p>Click this button to Depreciate the relevant costs/benefits across all active Strategies and Scenarios. Note: This button can also be found at the top of the StrX CB Input tabs</p>
<p>Update charts</p> <p>After populating the costs and benefits in the StrX CB inputs tabs and/or making any changes to the input data in the Inputs section, please click this button to update all charts in the Outputs section</p>	

The next step is for the user to list the relevant Stakeholders. All the regulated energy networks are pre-populated, therefore the user is required to list any non-regulated stakeholders that are relevant to the Use

Case, such as Local Authorities or generators. Note that the relevant Stakeholders for each Strategy (they can differ across Strategies) need to be listed in the Strategies section described further below.

The WACC, capitalisation rate and depreciation period need to be populated for each of the relevant Stakeholders. For the regulated energy networks these should reflect the relevant RIIO price control; this way the tool can apply the Totex treatment to the costs/benefits of these stakeholders. Regarding the non-regulated stakeholders, should it be appropriate to depreciate their costs and take financing costs into account, the user can set a WACC and appropriate depreciation period for each. It may be appropriate for the capitalisation rate to be set to 100% for non-regulated stakeholders i.e. 100% of the costs/benefits are depreciated.

REGULATED STAKEHOLDERS (ACROSS ALL STRATEGIES)					
	Type	WACC	Capitalisation Rate	Depreciation period	
UK Power Networks	DNO				
Electricity Northwest Limited	DNO				
Scottish and Southern Energy	DNO				
Northern Powergrid	DNO				
Scottish Power Energy Networks	DNO				
Western Power Distribution	DNO				
Cadent Gas Ltd	GDN				
Northern Gas Networks Limited	GDN				
Wales & West Utilities Limited	GDN				
SGN	GDN				
National Grid Gas (GTO)	GTO				
National Grid Gas (GSO)	GSO				
National Grid Electricity System Operator	ESO	4%	10%	10	
National Grid Electricity Transmission	ETO	4%	60%	25	
Scottish Power Transmission Limited	ETO	4%	60%	25	
Scottish Hydro Electric Transmission PLC	ETO	4%	60%	25	
NON-REGULATED STAKEHOLDERS (ACROSS ALL STRATEGIES)		WACC	Capitalisation Rate	Depreciation period	
1 Generators	Non-regulated				
2					
3					
4					
5					
6					

Finally, the user can specify any stakeholder and societal impacts that are not already explicitly included in the Strategies section of the tool. Listing any additional impacts in this section means that they become enabled as dropdown selections in the Strategies section. How many additional impacts the user adds depends on the level of granularity they would like to incorporate in reporting costs and benefits in this CBA.

ADDITIONAL COST AND BENEFIT CATEGORIES							
Additional, user-defined stakeholder impact categories	DNO	GDN	GTO	GSO	ESO	ETO	Non-regulated stakeholders
			Boundary costs			Generation costs	
			System costs				
[Large yellow rectangular area covering the main body of the table for stakeholder impact categories]							
Additional, user-defined societal impact categories							
[Large yellow rectangular area covering the main body of the table for societal impact categories]							

4 Strategies section

The Strategies section includes two tabs per Strategy with the key tab being the “StrX CB inputs” tab. The second tab, “StrX User Workings”, is provided to enable the user to provide any background workings that drive the costs and benefits as populated in the main “StrX CB inputs” tab and it is designed to be user-driven. For example, the user could show their workings behind an assumption of the cost of DNO reinforcement based on the year a site is expected to experience positive exceedance and/or the size of the reinforcement required. This section describes how to populate the “StrX CB inputs” tab.

We should note that the “StrX CB inputs” tabs include >1,000 rows depending on the number of active Scenarios. By clicking the “Remove unused tabs and rows” button in the “Control” tab the non-active rows are hidden to aid the user i.e. if the user only considers three Scenarios for a given CBA, the rows corresponding to the fourth and fifth Scenarios are hidden.

The button at the top of each StrX CB inputs tab that reads “Clear input data” aims to help the user to delete all the inputs they have populated the tab with, should they wish to, which, given the size of the tab can be difficult to ensure all inputs are deleted.

The first step in populating the impacts of a given Strategy is to list the Stakeholders that are relevant to that particular Strategy. These can be up to six Stakeholders for each Strategy and could include regulated stakeholders, such as DNOs, as well as any non-regulated stakeholders such as a Local Authority, a Generator, etc. The tool already includes Society as a relevant stakeholder, as well as the Customers of the stakeholders.

Strategy I Cost and Benefit Inputs			
Clear input data		Apply depreciation	
RELEVANT STAKEHOLDERS			
	Stakeholder	Participant type	
1	Stakeholder One National Grid Electricity Transmission	ETO	
2	Stakeholder Two Scottish Hydro Electric Transmission PLC	ETO	
3	Stakeholder Three Scottish Power Transmission Limited	ETO	
4	Stakeholder Four National Grid Electricity System Operator	ESO	
5	Stakeholder Five Generators	Non-regulated	
6	Stakeholder Six	Non-regulated	

Each tab is separated in three distinct sections according to the three key parties, namely Stakeholder Impacts, Customer Impacts and Societal Impacts. Relevant costs and benefits can be populated for each party under the relevant section, for each of the active Scenarios.

Strategy I Cost and Benefit Inputs		
Clear input data		Apply depreciation
RELEVANT STAKEHOLDERS		
	Stakeholder	Participant type
1	Stakeholder One National Grid Electricity Transmission	ETO
2	Stakeholder Two Scottish Hydro Electric Transmission PLC	ETO
3	Stakeholder Three Scottish Power Transmission Limited	ETO
4	Stakeholder Four National Grid Electricity System Operator	ESO
5	Stakeholder Five Generators	Non-regulated
6	Stakeholder Six	Non-regulated
STAKEHOLDER IMPACTS		
Scn1	Leading the Way	Reference Scenario
Scn2		2
Scn3		3
Scn4		4
Scn5		5
SOCIAL IMPACTS		
Scn1	Leading the Way	Reference Scenario
Scn2		2
Scn3		3
Scn4		4
Scn5		5
CUSTOMER IMPACTS		
Scn1	Leading the Way	Reference Scenario
Scn2		2
Scn3		3
Scn4		4
Scn5		5
end		

The Strategy impact is defined as the sum of Stakeholder, Customer and Societal impacts. We describe below how to populate each of these three sections.

4.1 Stakeholder impacts

The costs and benefits (or avoided costs²) of a Strategy can be inserted in the light-yellow rows that correspond to each of the Stakeholders and Scenarios. The user can either provide a single line item or they can add more line items to provide a breakdown of the costs/benefits. To insert a new line item, select the bottom light-yellow row, right-click and click on “Insert”.

Column F is a dropdown list of some pre-populated cost/benefit categories as well as any that are listed by the user in the Control tab (see section 0 above). Column G allows the user to select which cost/benefit items should be depreciated over time i.e. do not accrue the year they materialise and incur financing costs (for the regulated networks this corresponds to the totex regulatory treatment). The Pass-through dropdown means that the given cost accrues the year it materialises and does not incur financing costs. The blue line item provides the depreciated cost profile including the financing costs, this is provided by the tool once the user clicks on the “Apply depreciation” button at the top of the tab (it can also be found in the Control tab). The calculation is based on the depreciation parameters as determined by the user for each Stakeholder in the Control tab.

Column H allows the user to select which costs/benefits are subject to the Sharing Factor. The Sharing Factor indicates the proportion of costs/benefits that will be or can be passed down to the customers of each Stakeholder. For regulated network companies this is the Sharing Factor according to the relevant RIIO price control and by definition, any costs that are subject to Depreciation (i.e. the totex regulatory treatment) are also subject to the Sharing Factor hence the tool does not enable a choice dropdown for in Column H for the costs/benefits where Column G is selected as “Depreciate capitalised cost”. For non-regulated stakeholders this can be the extent to which an investment cost can be covered through revenue or the extent to which a cost can be passed down to the Stakeholder’s customer i.e. costs of a generator passed down to customers according to assumptions such as the price elasticity. The Sharing Factor is relevant to the Distributional Analysis and its value can be inserted by the user in the Distributional Analysis tab, which is described further below in section 0.

4.2 Societal Impacts

The tool includes input rows for a set of societal impacts which are listed in Table 1 below. The user however is not limited to the below types of societal impacts, indeed the capability exists for the user to define and add as many additional societal impacts as appropriate. This is the purpose of the last set of input rows in the societal impacts section of the tab, called “Additional, user-defined societal impacts”; the user can add the name of the impact under column F and the cost/benefit of that in the same row. Two rows have been provided in the tool, however the user can add more by selecting the bottom input row, right-clicking on it and selecting “Insert”.

² Avoided costs relevant to a Strategy should be taken into account only if these costs are not already included as part of another Strategy that is being assessed in the same CBA otherwise this would lead to double counting.

Table 1 Societal Impacts included in the tool

Societal Impacts	Impacts included in the tool	Tool Capability
Safety	Fatality Non-fatal injury	User inputs the volume, tool calculates the monetised impact
Environmental	CO2 Emissions - User-defined (valued at traded carbon price) - User-defined (valued at nontraded carbon price) - CO2 Emissions associated with final gas/electricity/hydrogen demand - CO2 Emissions associated with elec. losses Elec. Losses GHG emissions - AirPlus TM, G3, H2, SF6, Methane Nox Emissions Oil leakage Leakage - CH4 Shrinkage - theft of gas and own use gas	User inputs the volume, tool calculates the monetised impact
Transport	Societal benefit of reduced vehicle journeys Impact of a switch to LEVs (Low Emission Vehicles) Vehicle journey related carbon emission reduction	User inputs the volume and links with appropriate unit price/value (common inputs are listed in the Input Depository)
Disruption	Disruption from road works Disruption from replacement of boilers in homes	User inputs the volume and links with appropriate unit price/value (common inputs are listed in the Input Depository)
Heat	Carbon impact of changing heat technology and/or fuel of consumers Bill impact to consumers from a change in heat technology and/or fuel	User inputs the volume and links with appropriate unit price/value (common inputs are listed in the Input Depository)
Additional, user-defined societal impacts	Ability for user to define more societal impacts	User inputs the volume and links with appropriate unit price/value (common inputs are listed in the Input Depository)

The input structure for the Safety³ and Environmental impacts is similar to the sector-specific RIIO CBA tools, where the user inputs the volume i.e. MWh of losses or number of major injuries per year, and the tool links the

³ It should be noted that for the purposes of the Whole System CBA, the gas sector monetisation methodology for Fatalities (scaling the NOMS unit cost by a factor of 10) has been adopted across all sectors to ensure that life is valued in a consistent way within the Whole Systems CBA.

input volume with the appropriate unit value in the Input section to return the monetised impact in £m. This is different for the Transport, Disruption and Heat impacts where the input rows are designed to take the monetised impact as estimated by the user, using the data and sources in the Input Depository and providing their workings in the “StrX User Workings” tab.

4.3 Customer Impacts

The Customer Impacts section is designed to take into account the impacts, such as the impact of an interruption to supply, of the customers of each sector (Electricity Distribution, Electricity Transmission, Electricity System Operation, Gas Distribution and Gas Transmission). This section also includes the impact of electricity, gas and hydrogen consumption costs to customers. The table below outlines the structure of this section and the Customer Impacts included in the tool. As with societal impacts, the tool allows the user to define and add additional impacts to the ones listed below.

Table 2 Customer Impacts included in the tool

Customers of Energy Networks	Impacts included in the tool	Tool Capability
<i>DNO customers</i>	Customer Interruptions (Cis) Customer Minutes Lost (CMLs) ⁴ Guaranteed Standards of Performance (GSOP) Additional, user-defined	User inputs the volume, tool calculates the monetised impact
<i>GDN customers</i>	Guaranteed Standards of Performance (GSOP) Additional, user-defined	User inputs the volume, tool calculates the monetised impact
<i>ETO customers</i>	User-defined	User-defined and calculated
<i>ESO customers</i>	User-defined	User-defined and calculated
<i>GTO/GSO customers</i>	User-defined	User-defined and calculated

For the purposes of the Distributional Analysis, the tool differentiates between the Direct Impact to the customer from, for example, a supply interruption, and the Monetised Impact. Regulatory frameworks aim to incentivise the network companies to minimise customer impacts such as supply interruptions, therefore the network companies face a cost, such as the unit cost of Customer Interruptions in the case of DNOs, which is removed from the regulatory allowances of the DNOs. The tool includes an input row for the user to add the volume of Customer Interruptions and the tool uses the appropriate unit cost of Cis to “monetise” the impact. This is what the Monetised Impact represents; the transfer from DNOs to DNO Customers in the form of reduced regulatory allowances by the monetised value of Cis which translate to lower DUoS passed on to the DNO’s customers.

The Direct Impact to the customers is estimated in the tool using a scalar, which enables the user to reflect a different “experience” value to the customer from experiencing a supply interruption. The scalar values can be inputted in the “Fixed Inputs” tab, and are pre-populated with the value of 1 i.e. assuming that the Direct Impact

⁴ It should be noted that the tool assumes the RIIO1 incentive value of Cis and CMLs applies across the horizon to enable the monetisation of Cis and CMLs which may materialise post-2023. These are included in the “Time Series Inputs” tab, with values post-2023 marked as red to indicate that they represent RIIO1 values. The tool should be updated with RIIO2 values as and when they are published.

is equal to the Monetised Impact. By incorporating this scalar, we enable the user to not be bound by a simplistic assumption that the Direct Impact to a customer is one and the same as the Monetised Impact. However, we expect that this scalar would be subject to an economic assessment before it can be updated to a different value. It could also be part of a sensitivity analysis.

5 Strategies Summary section

This section provides a summary of key impacts in each Strategy, for ease of reference, therefore no inputs are required by the user. The price base adjustment is calculated in this tab, as the impacts calculated in the “StrX CB Inputs” tab are multiplied by the Price Base Adjustment Factor as calculated in the Control tab. Therefore, this tab reports impacts in terms of the price base selected by the user for the tool outputs.

The discounting calculation is also calculated in this tab, indicated by the rows with “Discounted” reported under Column D. The discounting is based on the Discounting Reference Year as selected by the user in the Control tab.

6 Outputs section

Once the User Controls and Strategies sections are completed, the Outputs section is populated with the CBA outputs. The user should ensure they click the “Update Charts” button in the Control tab before referring to the Outputs section, to ensure that the charts reflect all the inputs and Stakeholders populated in the User Controls and Strategies sections.

6.1 Output Charts

There are four different tabs designed for the outputs charts, to enable the user to obtain the Absolute NPV as well as the Relative NPV across all active Strategies. The Absolute NPV is the NPV of all costs and benefits of each Strategy, whilst the Relative NPV is the NPV of the active Strategies over and above the NPV of the Reference Strategy (hence why the Relative NPV of the Reference Strategy is always zero). The Absolute and Relative NPVs are provided both for the entire set of active Scenarios, as well as for the Reference Scenario only for ease of reference. The table below describes each output chart tab.

Table 3 Output Charts tabs

Tab	Contents
Ch Under Ref Scn	Absolute NPVs under the Reference Scenario
Ch Under Ref Scn rel to Ref Str	Relative NPVs under the Reference Scenario
Ch Under All Scns	Absolute NPVs under all active Scenarios
Ch All Scns Rel to Ref Str	Relative NPVs under all active Scenarios

The user can select the time horizon for which the charts report outputs in the Controls tab, under NPV Horizon (years). This is reported in the Chart Title for the avoidance of doubt.

The NPVs are also provided as a breakdown per Stakeholder, whereas the Carbon Volumes for each Strategy are also plotted for ease of comparison with the NPVs of Strategies. Finally, the tabs also report any Qualitative Impacts that are reported by the user (by populating the Qualitative Impacts tab).

The data underpinning the outputs charts are provided in the Outputs Table tab for ease of reference.

6.2 Additional Reporting Metrics

Additional reporting metrics are provided to the NPVs to support the analysis and to aid the user in performing sensitivity analysis on the NPV outputs. The Payback and LWR tab provides the payback period of each active Strategy under each active Scenario, as well as a Least Worst Regrets analysis of NPVs of all active Strategies under all active Scenarios.

The Tipping Point Analysis tab, enables the user to test the percentage change required for a given input to alter the ‘merit order’ of Strategies in terms of NPV. The user needs to select the scenario they would like to perform tipping point analysis for at the top of the tab. They can then look at the tipping point analysis for the Absolute NPV of the Strategies, the Carbon volume of the Strategies, as well as a societal impact of stakeholder cost/benefit of their choice.

6.3 Distributional Analysis

The Distributional Analysis tab takes into account the transfers of costs and benefits between Stakeholders. The user should select the Scenario and Strategy they want to see the distributional analysis for, and then click on “Update distributional analysis charts” as a first step.

Two transfers are taken into account. First, the costs and/or benefits associated with a Stakeholder may eventually be passed down to its customers. A sharing factor is a percentage that the user can input in the tool to take into account such a transfer (the StrX CB Inputs tab allows the user to tag some costs/benefits as not subject to the sharing factor). For regulated network companies the sharing factor takes into account the regulatory allowances and the sharing factor that applies for overperformance and underperformance. Similarly for non-regulated stakeholders, such as a Local Authority or a generator, some of the costs involved with an investment may be shared and/or passed down to their constituents/customers.

The second transfer that is taken into account is the one involved with Customer Impacts. The charts report the Direct and Monetised Impact on the Customer from, for example, a supply interruption (for more detail refer to the Strategies section above).

It should be noted that the output of the distributional analysis does not have an impact on the Absolute and Relative NPVs for each Strategy, rather it presents the impact on the Stakeholders and their Customers before and after taking these transfers into account. It may help to identify where there is a mismatch between the Stakeholders and Customers in terms of who bears the costs and benefits involved in each of the Strategies, and any additional transfers which may make a preferred Strategy possible by aligning the incentives for the Stakeholders involved. For example, a Stakeholder may be bearing the majority of costs to deliver a given Strategy yet the benefits lie with other Stakeholders (i.e. benefits to customers, or society or other Stakeholders in the form of avoided costs) with the result being that progressing with the given Strategy is not in the interests of the Stakeholder who can/should deliver it.

It is also important to note that the Distributional Analysis tab does not report the Societal Impacts and does not show the full picture in terms of Whole System impacts, it merely shows the distribution of costs and benefits between Stakeholders and their Customers.

7 Qualitative Inputs section

In this section the user can input and/or report some qualitative information such as the long list of Strategies, qualitative i.e. non-monetised impacts as well as risks and mitigations involved in the Strategies.

In the Strategies Long List tab, the user can list all Strategies that were considered ahead of the CBA along with a justification for including/excluding each from the Whole Systems CBA.

The Qualitative Impacts tab enables the user to capture any impacts which are difficult to monetise either due to lack of data or due to the CBA analysis being at an early stage ahead of more detailed estimations of impacts. A RAG assessment is enabled and this links as an output table in the Outputs section, to be reported alongside the monetised impacts (NPVs) of the Strategies.

The user can also report the Risks and Mitigations that are involved in the Strategies and could choose to do so either for the entire set of Strategies or for a subset or indeed only for the preferred Strategy.

The BP Cost Categories tab can be used by the user as a reference list of the Business Plan cost categories that correspond to each sector under the RIIIO price controls, should they want to provide a detailed cost/benefit breakdown in the Strategies section. To do so, they can select the relevant cost categories and add them under the Additional Cost and Benefit Categories section of the Controls tab so that it shows up as a dropdown option in the StrX CB Inputs tab where the individual cost/benefit items are populated.

8 Inputs section

This section includes the fixed and time series inputs which support the calculation of some of the costs and benefits in the Strategies section such as carbon prices and value of losses. These inputs are pre-populated with values determined by the WS4 Product Team, and should be updated only if appropriate along with justification.

The Input Depository is intended to act as a reference source for additional impacts the user may want to define and add over and above the ones already included in the tool, whether Stakeholder, Customer or Societal Impacts. A list of such potential impacts as well as recommended sources of data is provided, aiming to drive consistency across users.

9 Non-functional section

This section is not functional from the user's perspective as it does not require inputs and/or manipulation, nor does it report any analysis outputs. Its purpose is to support the capabilities of the tool in terms of, for example, producing output charts and calculating the depreciated cost/benefit profiles.



Energy Networks Association

4 More London Riverside

London SE1 2AU

t. +44 (0)20 7706 5100

w. energynetworks.org

 [@EnergyNetworks](https://twitter.com/EnergyNetworks)

© ENA 2020

Energy Networks Association Limited is a company registered in England & Wales No. 04832301
Registered office: 4 More London Riverside, London, SE1 2AU

The voice of the networks