Cost model of Ethernet transport

User manual

June 2022

Contents

1. Introduction

This report describes how to use the cost model ('the model') for Ethernet transport commissioned by the Belgian Institute for Postal services and Telecommunications (hereinafter, BIPT).

A descriptive manual of the model has also been produced, which is provided as a separate document.

The present document contains the following sections:

- **General overview of the model**, describing the structure of the cost model Excel file.
- **Getting started**, detailing the main considerations and specifications to run the model.
- **Understanding the control panel**, describing the Control Panel of the model, which is the main user interface where the main options and scenarios are selected. Additionally, this worksheet contains a 'RUN' button to execute the model.
- **Definition of new parameters**, describing the guidelines needed for the introduction of new services or resources into the model.
- **Description of checks**, explaining the meaning of the checks introduced in the model.

2. General overview of the model

The model file is comprised of worksheets grouped in the following blocks or calculation steps:

- Support and control worksheets
- Step 0: Parameters
- Step 1: Main inputs
- Step 2: Advanced inputs
- Step 3: Drivers and Routing Factors mappings
- Step 4: Resources unit costs calculation
- Step 5: Drivers calculations
- Step 6: Network dimensioning
- Step 7: Consolidation of network dimensioning results
- Step 8: Resource Costing
- Step 9: LRIC calculation
- Step 10: Common and G&A costs calculation
- Step 11: Outputs

The model has been developed based on a linear architecture in order to improve the execution performance and to reproduce the calculation flow logic.

The exhibit below shows the model calculation flow:

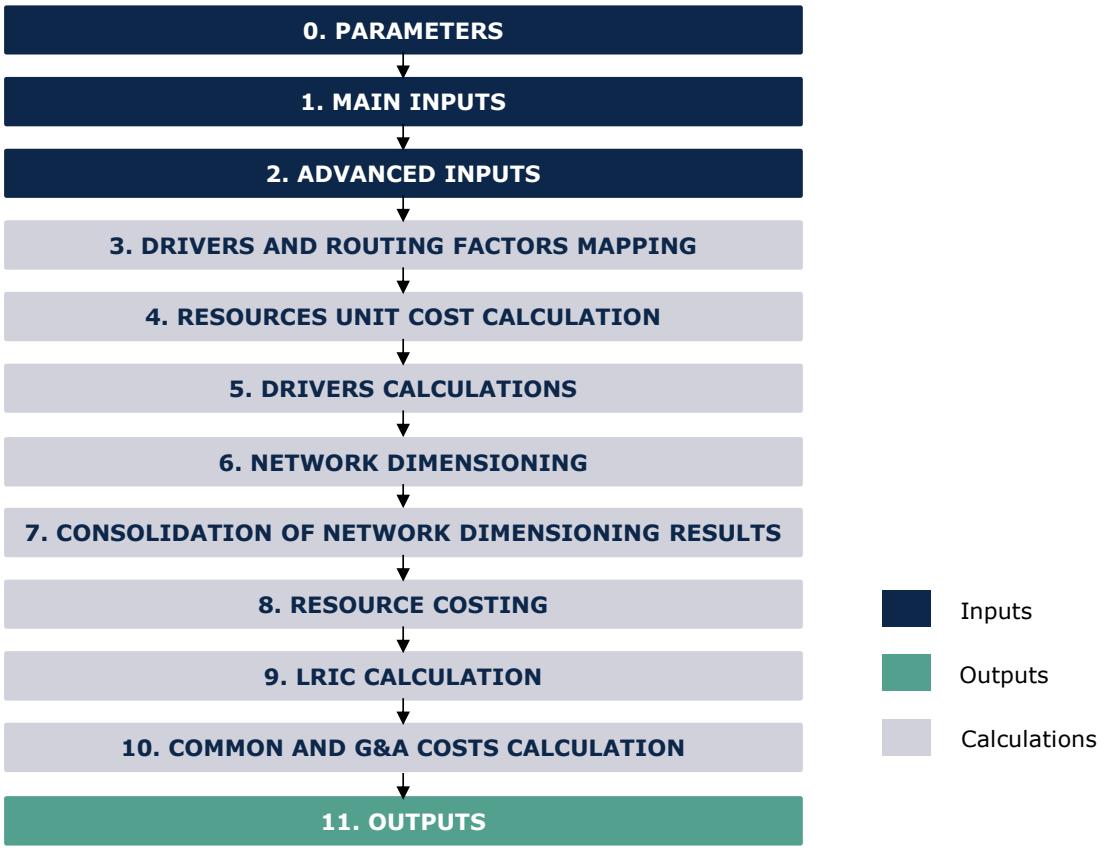

Exhibit 2.1: Calculation flow of the model [Source: Axon Consulting]

The block "Support and Control Worksheets" has not been represented in the previous exhibit for clarity purposes. Each block, or calculation step, is introduced in the section 2.1.

The worksheets contained in the blocks or calculation steps have been labelled according to the following structure (except "Support and Control Worksheets" block):

- Step number and ordinal: It is composed of the number of the step (i.e. 0, 1, 2…) and the order in letter format (i.e. A, B …)
- Type of worksheet indicators:
  - PAR: Definition of parameters
  - INP: Input worksheet
  - MAT: Matrix obtaining the relationship between two dimensions
  - MAP: Mapping between two dimensions
  - CALC: Other Calculations
  - OUT: Results worksheet
- Name of the worksheet

As an example, the worksheet '1A INP DEMAND' is the first (A) worksheet of the Step 1. It represents an input (INP) related with the demand (DEMAND).

2.1. Relationship between model calculation flow and worksheets

This section describes the calculation blocks, including a detailed description of the worksheets contained in each block. It should be pointed out that sub-section 2.1.1 does not strictly describe a block of the calculation flow, but the supporting and control worksheets used within the model.

2.1.1. Support and control worksheets

In the model there are six (6) worksheets providing general information, supporting the calculation process and checking that execution has been performed correctly.

Sheet name	Description
CONTROL	▶ This worksheet includes main model options that may be adjusted to execute the model (e.g. WACC or the service for which results are shown in the chart). At the same time, it includes the controls for the execution of the model.
CONTENTS	▶ Shows overall information about the model file (i.e. version, status and contacts) ▶ Provides a list and a brief description of the model worksheets
MAP	▶ Map that represents the relationship between worksheet blocks and the calculation flow employed. ▶ Colors have no meaning and have been selected to ease the identification of the blocks through the model labels.
QUICK LINKS	▶ This worksheet contains several useful links to navigate through the main input & output worksheets of the model.
COLOUR CODE	▶ It contains the color code used throughout the model.
CHECKS	▶ Diverse check calculations are contained in this worksheet to ensure that the model is working properly. Further details on these are provided in section 6 of this document.

Exhibit 2.2: Support and control worksheets. [Source: Axon Consulting]

In addition to the above worksheets, the model also includes at the end, as support, the calculation of the WACC employed for the estimation of the Cost of Capital (see worksheet "WACC calculation").

2.1.2. **Step 0: Parameters**

The four (4) worksheets concerning the parameterisations taken into consideration in the model are defined in the table below:

Sheet name	Description
0A PAR SERVICES	▶ The list of services considered in the model is introduced in this worksheet. ▶ In case that the user wants to define a new service, the following parameters must be filled: • Category: This displays the main category of the service, for instance Broadband or Voice. In the case that the service cannot be defined within one of the categories employed, the user can create a new one for the service. • Subcategory: This allows for a more specific differentiation of the services within the same category. • Segment: 'Retail' or 'Wholesale'. • Description: Name of the service. • Unit: Units used to measure the service, for instance lines or Mbps. • Increment: Increment used to calculate the incremental cost of the service. • Monetary unit display: Subunits (EURCents) may be used as alternative to main units (EUR). • To display the cost: 'Yes' or 'No' may be selected to display or not the cost of the service in the results block (final block of the model). • Time period for costing: Used typically for subscription services that are billed monthly. • To apply factor of traffic consumption?: `Yes´ or `No´ must be selected if the service refers to a traffic consumption service.

Sheet name	Description
0B PAR RESOURCES	▶ Network resources are listed in this worksheet. Other parameters related to the resources and cost items are also defined here. ▶ In case that the user wants to define a new resource, the categories that need to be defined for each resource are as follows: • Category: Main classification of the resource, typically one of the already defined categories should be used for any new resource. • Name: Complete name of the resource. • Short Name: Shorter version of the name for abbreviation purposes throughout the model. • Cost Component: Separates costs for different types of resources. • Unit: Unit in which the resource is measured. • Equivalent Equipment: used to group resources whose costs are allocated to services using the same Routing Factors.
0C PAR DRIVERS	▶ The drivers are the variables used for the dimensioning of the network (e.g. Connections, Mbps). The list of drivers considered are listed in this worksheet. ▶ The rationale of the dimensioning drivers is to express traffic and demand (at service level) in a way that facilitates the dimensioning of network resources.
0D PAR OTHER	▶ Other parameters needed in the model are defined in this worksheet.

Exhibit 2.3: Parameters worksheets. [Source: Axon Consulting]

2.1.3. Step 1: Main inputs

The main inputs are those that need to be regularly updated to better represent the current characteristics of the operator under study. A total of four (4) worksheets have been defined in this calculation block and are defined in the following table.

Sheet name	Description
1A INP DEMAND	▶ The demand (subscribers and traffic) that needs to be supported by the network is input in this worksheet. ▶ This demand is provided disaggregated based on the list of services defined in sheet "0A PAR SERVICES".
1B INP UNITARY COSTS	▶ Unitary costs (differentiating CAPEX and OPEX) are defined in this worksheet for each resource introduced in sheet "0B PAR RESOURCES".
1C INP COST TRENDS	▶ Cost trends of the unitary costs by resource are input in this worksheet. ▶ They are employed to forecast unitary costs in the future period.
1D G&A AND IT COSTS	▶ G&A and IT costs considered in the model are defined in this worksheet.

Exhibit 2.4: Main inputs worksheets. [Source: Axon Consulting]

2.1.4. Step 2: Advanced inputs

The second type of inputs, named as Advanced Inputs, is not expected to be updated regularly by the user, as it is expected that the parameters they contain will usually remain unchanged. They are related to infrastructure information, technical parameters, etc. Three (3) worksheets have been defined in this step, and they are detailed in the table below:

Sheet name	Description
2A INP NW	▶ Network parameters needed for the dimensioning of the network (for instance, equipment's capacity, standard constants) are introduced in this worksheet.

Sheet name	Description
2B INP NW CHARACT	▶ The information related to the characterisation of the network is introduced in this worksheet for each network level. ▶ This information illustrates, on the one hand, the characterisation of the cable and the civil infrastructure. For instance, the proportion in which each fibre cable configuration is present in the network over the total. ▶ On the other hand, this information also includes the relationships or connections that exist between the different nodes by hierarchical level of the network (Regional Nodes, Aggregation Nodes, etc.), as well as the distribution of traffic and number of lines by geotype.
2C INP RESOURCES LIVES	▶ Useful lives for the annualization of resources costs are introduced in this worksheet.

Exhibit 2.5: Advanced inputs worksheets. [Source: Axon Consulting]

2.1.5. Step 3: Drivers and Routing Factors mappings

The four (4) worksheets contained in this step are used to map the services with the drivers used for dimensioning and the definition of the routing factors. These worksheets are defined in the table below:

Sheet name	Description
3A MAP SERV TO DRIV	▶ Relationships between services and dimensioning drivers based on the conversion factors and the use of the drivers by each service is defined in this worksheet. ▶ It must be noted that to obtain the drivers, it is necessary to indicate which services are related to them. ▶ It should also be noted that a service is generally assigned to more than one driver as drivers represent traffic in a particular point of the network.
3B MAT SERV TO DRIV	▶ This worksheet calculates a relationship matrix between services and drivers based on the definitions established in worksheet "3A MAP SERV TO DRIV".

Sheet name	Description
3C MAP ROUTING FACTORS	▶ In this worksheet, the cost allocation of resources to services is defined through Routing Factors. The Routing Factors are calculated considering network statistics. ▶ The Routing Factor is a measure of how many times a resource is used by a specific service during its provision. Hence, the more traffic a service generates, the higher the cost will be charged from the asset considered; and the higher utilisation of the asset, the higher cost taken.
3D MAT ROUTING FACTORS	▶ This worksheet calculates a relationship matrix between services and resources based on the definitions established in worksheet "3C MAP ROUTING FACTORS".

Exhibit 2.6: Drivers and routing factors mappings worksheets. [Source: Axon Consulting]

2.1.6. Step 4: Resources unit costs calculation

The two (2) worksheets introduced in this section are responsible for calculating the unitary OPEX and CAPEX costs of the resources for the years the model is being simulated. These worksheets are defined in the table below:

Sheet name	Description
4A CALC UNIT CAPEX CONSOL	▶ In this worksheet, CAPEX unitary costs are consolidated in a table with the format that needs to be used in the model. ▶ This calculation is performed taking into consideration the historic cost (from worksheet "1B INP UNITARY COSTS") and the future trends (from worksheet "1C INP COST TRENDS").
4B CALC UNIT OPEX CONSOL	▶ In this worksheet, OPEX unitary costs are consolidated in a table with the format that needs to be used in the model. ▶ This calculation is performed taking into consideration the historic cost (from worksheet "1B INP UNITARY COSTS") and the future trends (from worksheet "1C INP COST TRENDS").

Exhibit 2.7: Resources unit costs calculation worksheets. [Source: Axon Consulting]

2.1.7. Step 5: Drivers calculations

The following two (2) worksheets are related to the calculation of the dimensioning drivers. These worksheets are detailed in the table below:

Sheet name	Description
5A CALC ADJUSTED DEMAND	▶ The adjusted demand is calculated in this worksheet, considering the average consumption in the busy hour of the lines. ▶ The rationale of the adjusted demand is to express traffic in a way that facilitates the dimensioning of network resources.
5B CALC TOTAL DRIVERS CONSOL	▶ Total volume of dimensioning drivers is calculated in this worksheet, by considering the demand (worksheet "1A INP DEMAND") and the unit conversions defined (sheet "3B MAT SERV TO DRIV"). ▶ The rationale of the dimensioning drivers is to express traffic and demand (at service level) in a way that facilitates the dimensioning of network resources.

Exhibit 2.8: Drivers calculation worksheets. [Source: Axon Consulting]

2.1.8. Step 6: Network dimensioning

This worksheet is responsible for dimensioning the transmission and core Network. The one (1) worksheet defined in this step are described in the following table:

Sheet name	Description
6A CALC DIM NETWORK	▶ This worksheet dimensions the network following the algorithms defined in the descriptive manual.

Exhibit 2.9: Transmission and Core Network dimensioning worksheets. [Source: Axon Consulting]

2.1.9. Step 7: Consolidation of network dimensioning results

The results of the previous step are consolidated in one (1) worksheet included in this block. The description of this worksheet is provided in the table below:

Sheet name	Description
7A CONSOL RES	▶ This worksheet consolidates the resources obtained in the previous dimensioning worksheet.

Exhibit 2.10: Consolidation of network dimensioning results worksheets. [Source: Axon Consulting]

2.1.10. Step 8: Resource Costing

This step contains two (2) worksheets related with the costing of resources. A detailed explanation about these worksheets is provided in the following table:

Sheet name	Description
8A CALC RES COST	▶ Resources' cost is annualised in this worksheet using the Economic Depreciation as annualisation method. ▶ For the calculation of costs, the number of resources is extracted from sheet "7A CONSOL RES" and the unitary costs from sheet "4A CALC UNIT CAPEX CONSOL" and "4B CALC UNIT OPEX CONSOL". Costs are annualised by employing the useful lives from sheet "2C INP RESOURCES LIVES".
8B CALC RES COST CONSOL	▶ Resources' costs are consolidated in this worksheet for each increment.

Exhibit 2.11: Resource costing worksheets. [Source: Axon Consulting]

2.1.11. Step 9: LRIC calculation

This step contains three (3) worksheets related with the allocation of incremental costs to services. A detailed explanation about these worksheets is provided in the following table:

Sheet name	Description
9A CALC ALLOC DEMAND	▶ The demand employed for the allocation of incremental costs is calculated in this worksheet.

Sheet name	Description
9B CALC SERV INCR COST	▶ This worksheet allocates resources' costs (from sheet "8B CALC RES COST CONSOL") to services through the use of Routing Factors (extracted from sheet "3D MAT ROUTING FACTORS").
9C CONSOL SERV INCR COST	▶ Incremental costs of each service are calculated in this worksheet as the sum of the cost associated to each increment, extracted from the previous sheet "9B CALC SERV INCR COST".

Exhibit 2.12: LRIC calculation worksheets. [Source: Axon Consulting]

2.1.12. Step 10: Common and G&A costs calculation

This step is responsible for obtaining the LRIC+ costs of services. The four (4) worksheets contained in this step are detailed below:

Sheet name	Description
10A CALC RES COMMON COST	▶ Resources common network costs are calculated in this worksheet. ▶ Common costs by resource are obtained as the difference between the total cost base obtained under FAC standard (considering all the demand) and the total incremental costs.
10B CALC SERV COMMON COST	▶ This worksheet attributes the common costs, calculated in the previous worksheet "10A CALC RES COMMON COST", to services through the Effective Capacity method.
10C CALC SERV G&A AND IT COST	▶ This worksheet calculates the G&A and IT costs, based on the mark-ups defined in worksheet "1D G&A AND IT COSTS"
10D OUT SERV RES COST	▶ This worksheet provides a disaggregation of services' unit cost for each network resource included in the model. ▶ Results presented in this worksheet correspond to the year selected below.

Exhibit 2.13: Common and G&A costs calculation worksheets. [Source: Axon Consulting]

2.1.13. Step 11: Outputs

The two (2) worksheets contained in this step offer concise information about the results of the model. Further detail of these worksheets' content is provided in the table below:

Sheet name	Description
11A OUT SERV LRIC+ TOT COST	▶ This worksheet consolidates the total costs per service. ▶ Costs are disaggregated for incremental and common costs.

Sheet name	Description
11B OUT SERV LRIC+ UNIT COST	▶ This worksheet consolidates the unitary LRIC+ costs per service. ▶ Costs are disaggregated for incremental and common costs.

Exhibit 2.14: Outputs worksheets. [Source: Axon Consulting]

3. Getting started

Computer requirements

The BULRIC model is an Excel file. To run the model, a computer with at least 1 GB of RAM memory and with Microsoft Excel version 2007 (or a newer version) is required. For enhanced performance, it is recommended to run the model on computers with 2 GB of RAM Memory.

Opening the model

The execution of the model makes use of Macros (embedded programs in Visual Basic). Therefore, they need to be enabled to run the model. If Macros are not enabled when opening the model, the following warning will appear[1]:

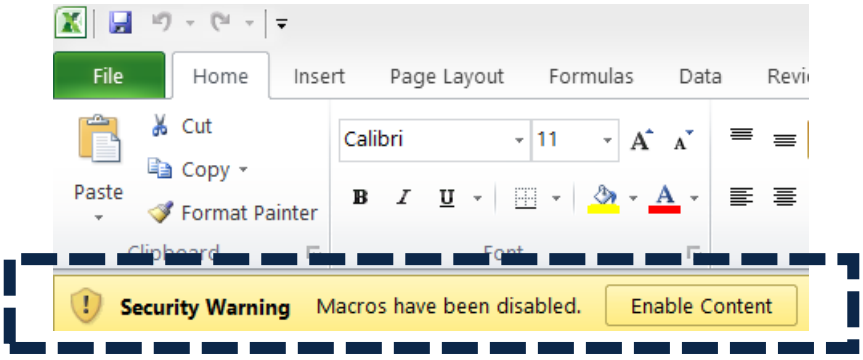

Exhibit 3.1: Warning appearing in Microsoft Excel 2010 when model is open and Macros are not enabled. [Source: Axon Consulting]

In case the warning shown above appears, clicking the "Enable Content" button will enable Macros and will allow the user to execute the model.

[1] In case the warning shown in Exhibit 3.1 does not appear, disregard further steps described in this section.

4. Understanding the control panel

The control panel represents the main interface user-model. It is used to select the model's main available options, configure the execution mode and run the model. The following figure shows a snapshot of the control panel.

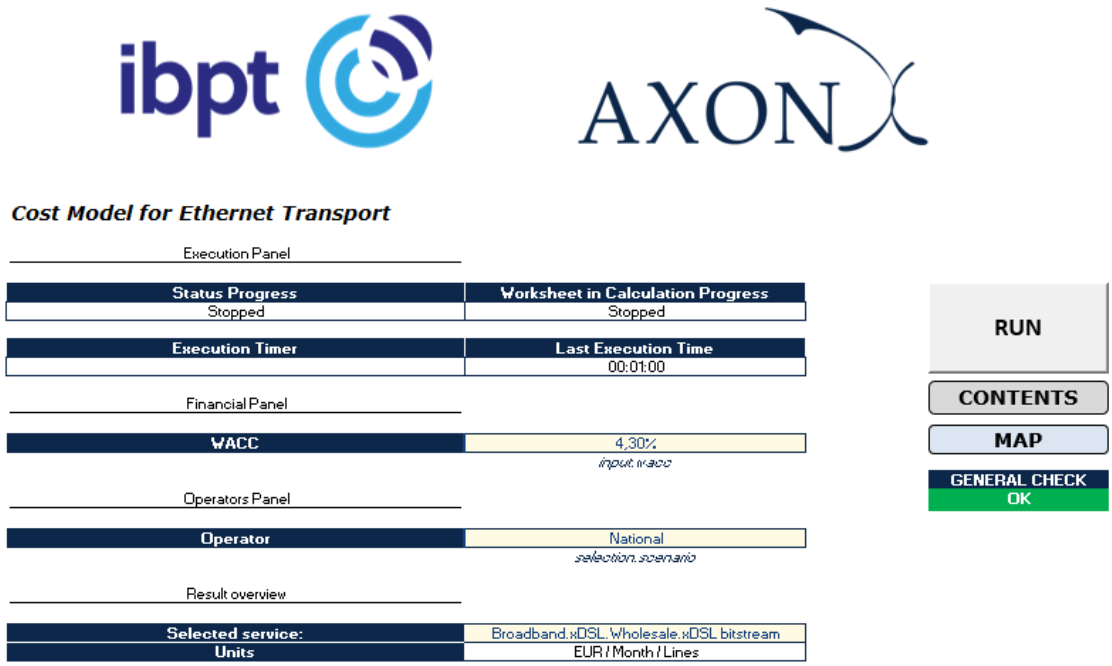

Exhibit 4.1: Snapshot of the control panel [Source: Axon Consulting]

The control panel is divided into the following blocks:

- Execution panel
- Financial panel
- Operators panel
- Result overview

The four blocks are covered in the following paragraphs.

Important warning: the model needs to be run (execution of the macro) to see the impact on the results of any change made in the control panel.

In order to increase the model's efficiency in terms of execution time, we also recommend the setting of the "Calculation Options" from "Automatic" to "Manual" in the Excel "Formulas" menu, as illustrated in the following exhibit:

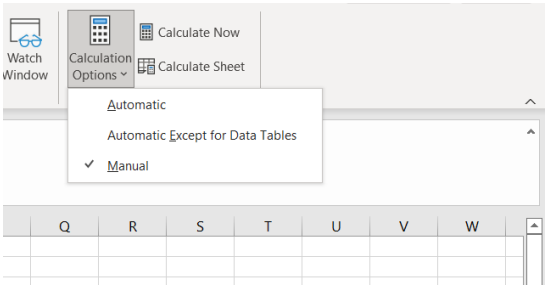

Exhibit 4.2: Setting of the "Calculation Options" from "Automatic" to "Manual" [Source: Axon Consulting]

4.1. Execution panel

The Execution Panel displays information regarding the status and progress of the execution of the model. The following information is shown in this Panel:

- **Status Progress**: It displays the status of the execution of the model. If the calculation is being performed, this cell will show the indication 'Running'.
- **Worksheet in Calculation Progress**: It displays the worksheet that is running during the execution of the model.
- **Execution Timer**: It displays the duration of the current model execution.
- **Last Execution Time**: It displays the duration of the last execution of the model.

4.2. Financial panel

The Financial Panel includes the options affecting the way in which costs are calculated and presented. The following option is available:

- **WACC (Weighted Average Cost of Capital)**: This parameter represents the average minimum remuneration required for the capital employed. The WACC is employed for the calculation of the cost of capital associated to fixed investments. A percentage must be introduced here by the user.

4.3. Operators panel

The Operators Panel presents the options with regards to the operators considered for the execution of the model. The following option is available:

- **Operator**: It displays the name of the operator for which the model will be run. The definition of operators can be done in worksheet `OD PAR OTHER´ in the table `PARAMETERISATION OF SCENARIOS´.

4.4. Result overview

This panel displays graphically the unitary LRIC+ cost results associated with a selected service along the years. The following options are available:

- **Selected service**: This parameter represents the service for which the unitary LRIC+ cost results will be shown in the chart below.
- **Units**: It displays the units associated with the selected service.

5. Definition of new parameters

This section explains how to define new parameters into the model. The parameters include:

- Definition of new services
- Definition of new resources

5.1. Definition of new services

The process of creating a new service in the BULRIC Model involves the addition of the service to the existing list, as well as the definition of the service inputs and the mapping of the new service in the different sections of the model. This section outlines the steps that need to be followed to achieve this purpose.

Step 1: Definition of the service

The first step is to add the new service to the existing list of services in worksheet '0A PAR SERVICES' in table 'SERVICES PARAMETRISATION'

CATEGORY	SUBCATEGORY	SEGMENT	DESCRIPTION	UNIT	INCREMENT	MONETARY UNIT DISPLAY	TO DISPLAY THE COST?	TIME PERIOD FOR COSTING	TO APPLY FACTOR OF TRAFFIC CONSUMPTION?
Broadband	xDSL	Retail	xDSL retail	Lines	Conveyance	Unit	Yes	Month	Yes
Broadband	xDSL	Wholesale	xDSL resale	Lines	Conveyance	Unit	Yes	Month	Yes
Broadband	xDSL	Wholesale	xDSL bitstream	Lines	Conveyance	Unit	Yes	Month	Yes
Broadband	xDSL	Wholesale	VULA (Virtual Unbundled Local Access)	Lines	Conveyance	Unit	Yes	Month	Yes
Broadband	FTTH/B	Retail	FTTH/B retail	Lines	Conveyance	Unit	Yes	Month	Yes
Broadband	FTTH/B	Wholesale	FTTH/B resale	Lines	Conveyance	Unit	Yes	Month	Yes
Broadband	FTTH/B	Wholesale	FTTH/B bitstream	Lines	Conveyance	Unit	Yes	Month	Yes
Broadband	FTTH/B	Wholesale	VULA (Virtual Unbundled Local Access)	Lines	Conveyance	Unit	Yes	Month	Yes
Voice	Voice	Retail/Wholesale	Fixed voice	Minutes	Conveyance	Unit	No		Yes
IPTV	IPTV	Retail	VoD	Lines	Conveyance	Unit	Yes	Month	Yes

Exhibit 5.1: Example services in worksheet '0A PAR SERVICES'. [Source: Axon Consulting]

In this worksheet the following parameters must be filled:

- Category: This displays the main category of the service, for instance Broadband or Voice. In the case that the service cannot be defined within one of the categories used, the user can create a new one for the service.
- Subcategory: This allows for a more specific differentiation of the services within the same category.
- Segment: 'Retail' or 'Wholesale'
- Description: Name of the service
- Unit: Units used to measure the service, for instance lines or Mbps.
- Increment: Increment used to calculate the incremental cost of the service.

- Monetary unit display: Subunits (EURCents) may be used as alternative to main units (EUR)
- To display the cost: 'Yes' or 'No' may be selected to display or not the cost of the service in the results block (final block of the model).
- Time period for costing: Used typically for subscription services that are billed monthly
- To Apply factor of the consumption per user?:`Yes´ or `No´ must be selected if the service refers to a traffic consumption service.

Step 2: Service demand

The next step is the definition of the service demand, which must be included by the user in sheet `1A INP DEMAND´ for the time period modelled.

Step 3: Service mappings

This step includes updating two separate worksheets:

- '3A MAP SERV TO DRIV
- '3C MAP ROUTING FACTORS

Worksheet '3A MAP SERV TO DRIV' maps each service to the drivers in the model. The user should add a row for each driver in case that the new service applies and fill in the corresponding usage factor and the unit conversion factor. The user should also make sure that the variables included in columns E:J are properly filled using the existing formulas.

On the other hand, worksheet '3C MAP ROUTING FACTORS' outlines the different Routing Factors used for the allocation of resources' costs to each service. The user should add one row for each of the group of resources, in case the new service makes use of such group, and adding the corresponding routing factor, in a similar way as it is done for the already implemented services.

5.2. Definition of new resources

In order to define new resources that may be needed to accommodate the definition of new services, there are several steps that need to be followed.

Step 1: Definition of the resource

Similarly, to the definition of new services, the first step is to define the new resource in worksheet '0B PAR RESOURCES', table 'RESOURCES PARAMETRISATION'

Category	Name	Short Name	Cost Component	Unit	Equivalent Equipment
Fibre cables	Fibre Cable - 1 strand - Regional	Regional - 1 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 2 strands - Regional	Regional - 2 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 6 strands - Regional	Regional - 6 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 12 strands - Regional	Regional - 12 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 20 strands - Regional	Regional - 20 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 24 strands - Regional	Regional - 24 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 48 strands - Regional	Regional - 48 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 72 strands - Regional	Regional - 72 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 96 strands - Regional	Regional - 96 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 144 strands - Regional	Regional - 144 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 288 strands - Regional	Regional - 288 strand	length	km	Fibre cables - Regional
Fibre cables	Fibre Cable - 1 strand - National	National - 1 strand	length	km	Fibre cables - National

Exhibit 5.2: Example resources in worksheet '0B PAR RESOURCES'. [Source: Axon Consulting]

The categories that need to be defined for each resource are as follows:

- Category: Main classification of the resource, typically one of the already defined categories should be used for any new resource.
- Name: Complete name of the resource.
- Short Name: Shorter version of the name for abbreviation purposes throughout the model.
- Cost Component: Separates costs for different types of resources.
- Unit: Unit in which the resource is measured
- Equivalent Equipment: Used to group resources whose costs are allocated to services using the same Routing Factors.

Step 2: Definition of unitary costs

The next step is the definition of the unitary cost of the resource in worksheet '1B INP UNITARY COSTS'. It is important to note that in this worksheet the CAPEX as well as the OPEX for the historical period need to be introduced.

Resource	Cost Type	Currency	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Fibre cables.Regional - 1 strand.length	CAPEX	EUR	2.192	2.245	2.299	-	-	-	-	-	-	-
Fibre cables.Regional - 2 strand.length	CAPEX	EUR	2.239	2.293	2.349	-	-	-	-	-	-	-
Fibre cables.Regional - 6 strand.length	CAPEX	EUR	2.286	2.341	2.398	-	-	-	-	-	-	-
Fibre cables.Regional - 12 strand.length	CAPEX	EUR	2.364	2.421	2.480	-	-	-	-	-	-	-
Fibre cables.Regional - 20 strand.length	CAPEX	EUR	2.484	2.541	2.600	-	-	-	-	-	-	-
Fibre cables.Regional - 24 strand.length	CAPEX	EUR	2.571	2.629	2.688	-	-	-	-	-	-	-
Fibre cables.Regional - 48 strand.length	CAPEX	EUR	2.659	2.716	2.775	-	-	-	-	-	-	-
Fibre cables.Regional - 72 strand.length	CAPEX	EUR	3.073	3.131	3.190	-	-	-	-	-	-	-
Fibre cables.Regional - 96 strand.length	CAPEX	EUR	3.163	3.221	3.280	-	-	-	-	-	-	-
Fibre cables.Regional - 144 strand.length	CAPEX	EUR	3.252	3.312	3.373	-	-	-	-	-	-	-
Fibre cables.Regional - 288 strand.length	CAPEX	EUR	3.344	3.405	3.468	-	-	-	-	-	-	-
Fibre cables.National - 1 strand.length	CAPEX	EUR	2.192	2.245	2.299	-	-	-	-	-	-	-

Exhibit 5.3: Example resources in worksheet '1B INP UNITARY COST'. [Source: Axon Consulting]

In order to include the unitary cost, the user must ensure that the name introduced in the 'Resource' column is the variable associated with the new resource created, which may be found in column H of worksheet 'OB PAR RESOURCES'.

Step 3: Definition of new cost trends

As in step 2, the user must define the expected cost trends for both, CAPEX and OPEX in worksheet '1C INP COST TRENDS'.

Resource	Cost Type	Unit	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Fibre cables.Regional - 1 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	2,42%	2,42%	2,42%	2,42%	2,42%	2,42%	2,42%
Fibre cables.Regional - 2 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	2,42%	2,42%	2,42%	2,42%	2,42%	2,42%	2,42%
Fibre cables.Regional - 6 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	2,42%	2,42%	2,42%	2,42%	2,42%	2,42%	2,42%
Fibre cables.Regional - 12 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	2,42%	2,42%	2,42%	2,42%	2,42%	2,42%	2,42%
Fibre cables.Regional - 20 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	2,31%	2,31%	2,31%	2,31%	2,31%	2,31%	2,31%
Fibre cables.Regional - 24 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	2,23%	2,23%	2,23%	2,23%	2,23%	2,23%	2,23%
Fibre cables.Regional - 48 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	2,16%	2,16%	2,16%	2,16%	2,16%	2,16%	2,16%
Fibre cables.Regional - 72 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	1,88%	1,88%	1,88%	1,88%	1,88%	1,88%	1,88%
Fibre cables.Regional - 96 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	1,83%	1,83%	1,83%	1,83%	1,83%	1,83%	1,83%
Fibre cables.Regional - 144 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	1,83%	1,83%	1,83%	1,83%	1,83%	1,83%	1,83%
Fibre cables.Regional - 288 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	1,83%	1,83%	1,83%	1,83%	1,83%	1,83%	1,83%
Fibre cables.National - 1 strand.length	CAPEX	Annual Growth (YoY %)	-	-	-	2,42%	2,42%	2,42%	2,42%	2,42%	2,42%	2,42%

Exhibit 5.4: Example resources in worksheet '1C INP COST TRENDS'. [Source: Axon Consulting]

Step 4: Definition of the useful life

In order to allow the Model to distribute the acquisition costs over the years by means of the Economic Depreciation, the user must include the corresponding useful life of the new resource, in sheet '2C INP RESOURCES LIVES'.

Step 5: Routing Factor Mapping

This step involves the mapping of services to the newly defined resource. The user should add a row in worksheet '3C MAP ROUTING FACTORS' for each service that makes use of the resource, including the corresponding Routing Factor in column G.

EQUIVALENT EQUIPMENT (Group of resources)	Service CATEGORY	Service SUBCATEGORY	Service SEGMENT	Service DESCRIPTION	Routing Factor
Fibre cables - Regional	Broadband	xDSL	Retail	xDSL retail	1,00
Fibre cables - Regional	Broadband	xDSL	Wholesale	xDSL resale	1,00
Fibre cables - Regional	Broadband	xDSL	Wholesale	xDSL bitstream	1,00
Fibre cables - Regional	Broadband	FTTH/B	Retail	FTTH/B retail	1,00
Fibre cables - Regional	Broadband	FTTH/B	Wholesale	FTTH/B resale	1,00
Fibre cables - Regional	Broadband	FTTH/B	Wholesale	FTTH/B bitstream	1,00
Fibre cables - Regional	Broadband	FTTH/B	Wholesale	VULA (Virtual Unbundled Local Access)	-
Fibre cables - Regional	Voice	Voice	Retail/Wholesa	Fixed voice	1,00
Fibre cables - Regional	IPTV	IPTV	Retail	VoD	1,00

Exhibit 5.5: Example mappings in worksheet '3C MAP ROUTING FACTORS'. [Source: Axon Consulting]

In order to map the resources and the services, the user needs to set the equivalent equipment selected for the resource as well as the Category, Subcategory, Segment and description of the mapped services.

Step 6: Definition of the dimensioning algorithm for the resource

The last step is the definition of the dimensioning algorithm for calculating the number of units of the new resource, based on drivers. In this step, the user should add the algorithm in the following worksheet:

- 6A CALC DIM NETWORK

In this worksheet, there are tables reserved for calculations where the user can add the needed calculations to determine the number of elements of the new resource.

Additionally, the user should add the new resource to the 'Resources' table manually and add the reference to the rows where the final dimensioning value is calculated.

6. Description of checks

This section describes the list of checks incorporated in the worksheet `CHECKS´ to guarantee the correct functioning of the Model:

- **GENERAL CHECK**: This check indicates if the model is working properly or if it is necessary to review any of its worksheets and calculations.
- **Duplicity of resources unitary cost input**: This check indicates that any of the resources is duplicated in the sheet "1B INP UNITARY COSTS". This duplication should be removed.
- **Resources unitary cost input**: This check indicates that any of the resources is missing in the sheet "1B INP UNITARY COSTS". It should be introduced.
- **Invalid name of resource**: This check indicates that the name of any resource in the sheet "1B INP UNITARY COSTS" is not correct and therefore, it should be reviewed.
- **Allocation of Incremental Costs**: This check indicates that some resources' costs are not being allocated to services. In this case, Routing Factors in sheet "3C MAP ROUTING FACTORS" should be reviewed.
- **Allocation of Common Costs**: Similar to the above, this check indicates that some resources' common costs are not being allocated to services. In this case, Routing Factors in sheet "3C MAP ROUTING FACTORS" should be reviewed.