

Development of the Fixed Infrastructure Sharing Cost (IS) Model

Fixed Infrastructure Sharing Cost Model - User manual

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1. Introduction

This report describes how to use the Fixed Infrastructure Sharing Model ('the model') commissioned by the Office of Utilities Regulation of Jamaica (hereinafter, the OUR).

The present document contains the following sections:

- ▶ **General Overview of the Model**, describing the structure of the infrastructure sharing 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.

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: Usage factors mappings
- ▶ Step 4: Calculation of resources' unit costs
- ▶ Step 5: Calculation of services costs
- ▶ Step 6: Results summary

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

The exhibit below shows the model calculation flow:

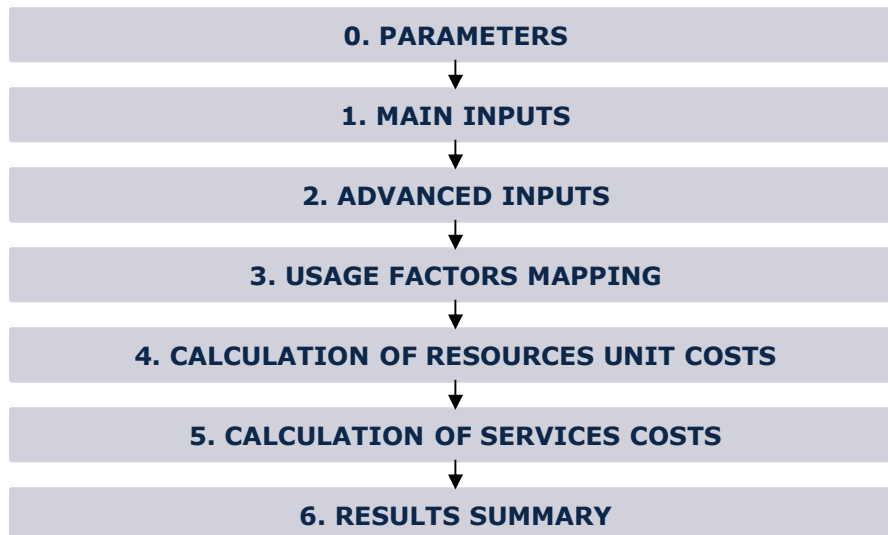


Exhibit 2.1: Calculation Flow of the Model [Source: Axon Consulting]

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

The worksheets contained in the calculation steps have been labelled according to the following structure (except “Support and Control Worksheets” step):

1. 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 ...)
2. 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: Calculations
 - ❖ OUT: Results worksheet
 - ❖ GRAPH: Graphical results of the services
3. Name of the worksheet

As an example, the worksheet '1A INP UNITARY COSTS' is the first (A) worksheet of the Step 1. It represents an input (INP) related with the unit costs.

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-sections 2.1.1 and 2.1.2 do not strictly describe a block of the calculation flow, but the supporting and control worksheets and the definition of parameters (or dimensions) used within the model.

2.1.1. Support and Control Worksheets

In the model there are seven (7) worksheets providing general information, supporting the calculation process and checking that execution has been performed correctly.

Sheet name	Features
CONTENTS	<ul style="list-style-type: none"> ▶ Shows overall information about the model file (i.e. version, status and contacts) ▶ Provides a list and a brief description of the model worksheets
CONTROL	<ul style="list-style-type: none"> ▶ Modelling and network options to enable it to perform different analysis selecting the desired inputs
DISPLAY OPTIONS	<ul style="list-style-type: none"> ▶ This worksheet presents only those worksheets related to the inputs/outputs of the model, hiding the calculation sheets
MAP	<ul style="list-style-type: none"> ▶ Provides a map of the model showing dependencies between worksheets and the calculation flow
QUICK LINKS	<ul style="list-style-type: none"> ▶ Shows a list of the most important inputs and outputs to facilitate navigation through the model
COLOUR CODE	<ul style="list-style-type: none"> ▶ Lists the set of colours that are used, detailing their meaning
CHECKS	<ul style="list-style-type: none"> ▶ Ensures the correct calculation process

Exhibit 2.2: Support and Control Worksheets. [Source: Axon Consulting]

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	Features
OA PAR SERVICES	<ul style="list-style-type: none"> ▶ Lists the services considered in the model ▶ Offers additional details about services, such as the units in which services are measured and to which increment each service is associated

Sheet name	Features
OB PAR RESOURCES	▶ Defines network resources and cost items
OC PAR TIME	▶ The years considered in the model can be configured in this worksheet
OD PAR CURRENCIES	▶ Defines the currencies in which the unitary costs can be introduced and in which the results are going to be obtained
OE PAR OTHER SERVICES	▶ Defines the list of ancillary services considered in the model

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 five (5) worksheets have been defined in this calculation block and are defined in the table below.

Sheet name	Features
1A INP UNITARY COSTS	<ul style="list-style-type: none"> ▶ Introduces the unitary costs (both OPEX and CAPEX) of the resources (network elements, direct costs, etc.) ▶ The currency can be selected for each element
1B INP COST TRENDS	<ul style="list-style-type: none"> ▶ Defines the cost trends of the resources whose cost has been defined in the previous worksheet ▶ This trend is used for forecasting the unitary prices of the resources (differentiating OPEX and CAPEX)

Sheet name	Features
1C INP EXCHANGE RATES	<ul style="list-style-type: none"> ▶ Introduces the exchange rates between the currencies considered ▶ Introduces the forecasted inflation for the different currencies
1D INP COST GA	<ul style="list-style-type: none"> ▶ Contains the G&A considered in the model
1E INP OTHER SERV	<ul style="list-style-type: none"> ▶ Introduces different concepts and values of the implementation and testing services.

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 the infrastructure sharing parameters mainly. Two (2) worksheets have been defined in this step, and they are detailed in the table below.

Sheet name	Features
2A INP NW	<ul style="list-style-type: none"> ▶ Introduces the infrastructure sharing parameters needed for the calculation of the infrastructure services.
2B INP RESOURCES LIFE	<ul style="list-style-type: none"> ▶ Defines the useful lives for the annualisation of resources' cost

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

2.1.5. Step 3: Usage factors mappings

The two (2) worksheets contained in this step are used to map the services with the resources included in the infrastructure sharing cost model. These worksheets are defined in the table below.

Sheet name	Features
3A MAP USAGE FACTORS	<ul style="list-style-type: none"> ▶ Defines the relationship between services and resources ▶ Usage factors will be used to allocate resources' cost to services
3B MAT UF - SERV	<ul style="list-style-type: none"> ▶ Contains a matrix with the usage factors relating resources and services

Exhibit 2.6: Usage Factors Mappings worksheets. [Source: Axon Consulting]

2.1.6. Step 4: Calculation of resources' unit costs

The two (2) worksheets introduced in this section consolidates the unit costs of the network elements included in the model. These worksheets are defined in the table below.

Sheet name	Features
4A CALC CAPEX OPEX CONSOL	<ul style="list-style-type: none"> ▶ Consolidates OPEX and CAPEX unitary costs in a table with a predetermined format to be used throughout the model ▶ Considers cost trends to obtain future costs
4B CALC RES COST	<ul style="list-style-type: none"> ▶ Calculates the cost of the resources (OpEx, depreciation, cost of capital and overhead costs [G&A])

Exhibit 2.7: Calculation of resources unit costs worksheets. [Source: Axon Consulting]

2.1.7. Step 5: Calculation of services costs

The three (3) worksheets defined in this step perform calculation of the services costs.

Sheet name	Features
5A CALC SERV COST	▶ Calculation of the services total costs disaggregated between the different type of costs (OpEx, depreciation, cost of capital and G&A).
5B CALC SERV UNIT COST	▶ Calculation of the services' unit final costs.
5C CALC OTH SERV COST	▶ Calculation of the ancillary services' unit final costs.

Exhibit 2.8: Services costs worksheets. [Source: Axon Consulting]

2.1.8. Step 6: Results summary

The worksheets provided in this step aim at displaying a summary of the results. These worksheets serve the purpose of analysing the final costs per service for the different scenarios. The details of these worksheets are provided in the table below.

Sheet name	Features
6A OUT SUMMARY RESULTS	▶ This worksheet summarises the results for a selection of services.
6B GRAPH DUCTS AND SUBDUCTS	▶ Chart presenting the ducts and subducts sharing costs for the period modelled.
6C GRAPH POLES	▶ Chart presenting the poles sharing costs for the period modelled.
6D GRAPH DARK FIBRE	▶ Chart presenting the dark fibre costs for the period modelled.
6E GRAPH COLLOCATION	▶ Chart presenting the collocation in Submarine Cable Landing Stations (SCLS) costs for the period modelled.
6F GRAPH ANCILLARY SERVICES	▶ Chart presenting the implementation and testing services' costs for the period modelled.

Exhibit 2.9: Results summary worksheets. [Source: Axon Consulting]

3. Getting Started

Computer Requirements

The infrastructure sharing model is an Excel file. To run the model, we recommend a computer with at least 1 GB of RAM memory and with Microsoft Excel version 2010 (or a newer version). For enhanced performance, it is recommended to run the model on computers with 2 GB or more of RAM Memory.

If the model is going to run for the first time on the computer, it is recommended to press the following keys *Ctrl-Alt-Shift-F9* for a full calculation with dependency tree rebuild.

Opening the Model

The execution of the model can be performed through pressing the key F9¹. However, a VBA macro has been developed to improve the performance of the calculations and to increase the robustness of the file². To use this option (see section 4. Understanding the Control Panel) it is required to enable Macros. If Macros are not enabled when opening the model, the following warning will appear:

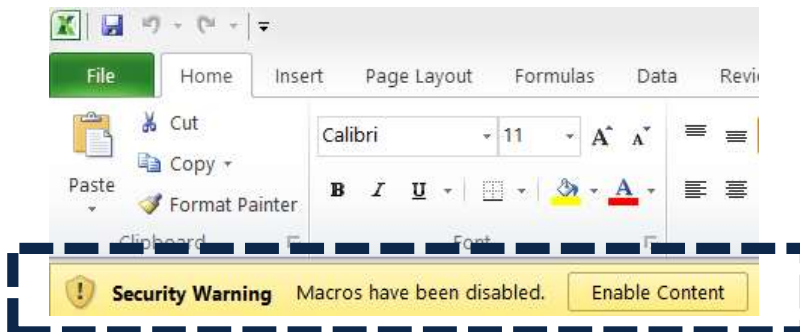


Exhibit 3.1: Warning appearing in Microsoft Excel 2010 when model is open and Macros are not enabled. [Source: Axon Consulting]

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

Additionally, it has been identified in certain distributions of MS Excel that the model file may crash while running. To solve this issue, a hard reset of Excel’s calculation tree is required through the following steps:

¹ F9 is the default key in MS Excel for calculating the formulas.

² MS Excel may crash sometimes when handling big Excel files (like this one).

1. Open the model
2. Press Ctrl+Alt+Shift+F9
3. Wait until Excel stops calculating (it may take some minutes)
4. Save the model (if the model is not saved this process may be required the next time it is open on that computer).

4. Understanding the Control Panel

The control panel represents the main user interface for the model. It is used to select the model’s main available options, configure the execution mode and run the model. Exhibit 4.1 shows a snapshot of the control panel.

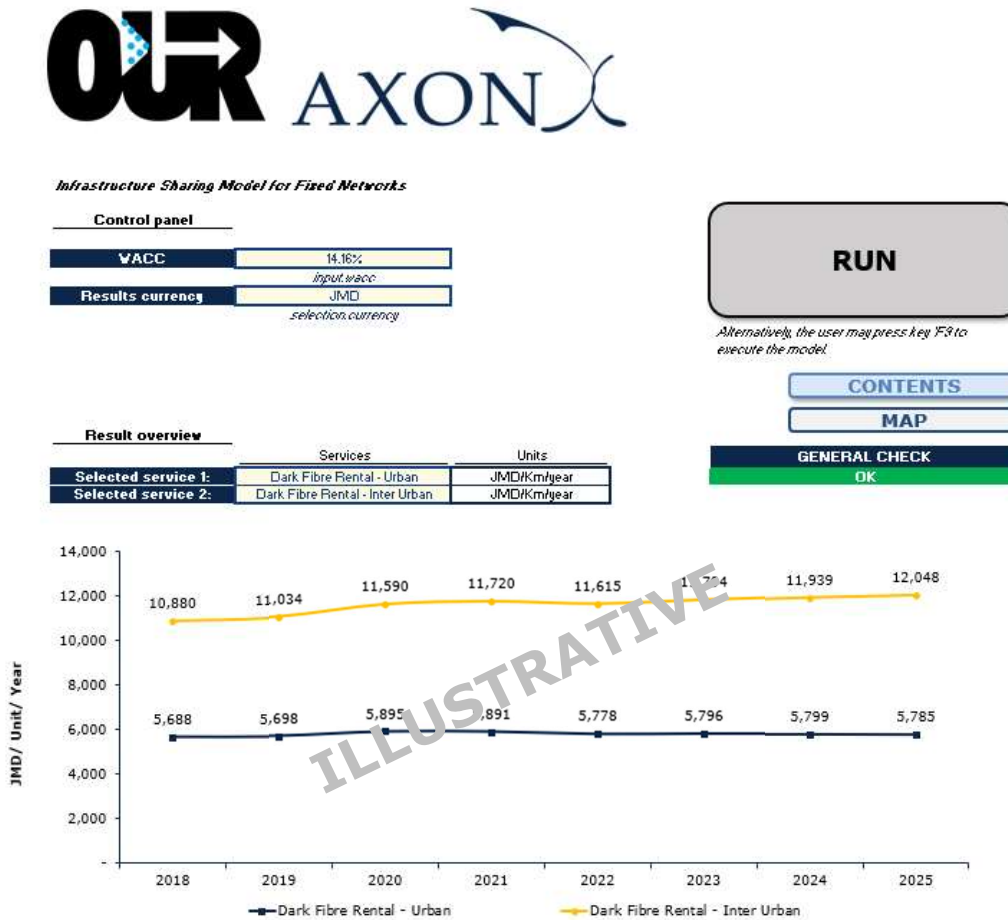


Exhibit 4.1: Snapshot of the control panel [Source: Axon Consulting]

The control panel is divided into the following blocks:

- ▶ Run button
- ▶ Control panel
- ▶ Results overview

All these blocks are covered in the paragraphs following.

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

4.1. Run button

This button is used to run the model. The text in the button will change during execution. Once pressed, the model will automatically run and this button will show the execution process percentage³, as it can be observed in the following Exhibit 4.2.

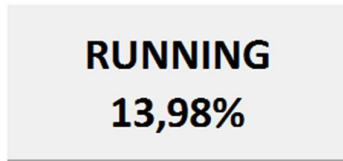


Exhibit 4.2: Illustrative example of execution percentage shown in the “Run” button [Source: Axon Consulting]

When the text in the button changes to “RUN” the model execution will be completed.

4.2. Control panel

The Finance panel includes two options affecting the way in which costs are calculated and presented:

- ▶ **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.
- ▶ **Results currency:** It allows the user to select the currency in which the results will be presented.

4.3. Results overview

This panel allows the user to display the results of two different services, based on the selection of the services.

³ Some distributions of MS Excel may not represent the percentage.

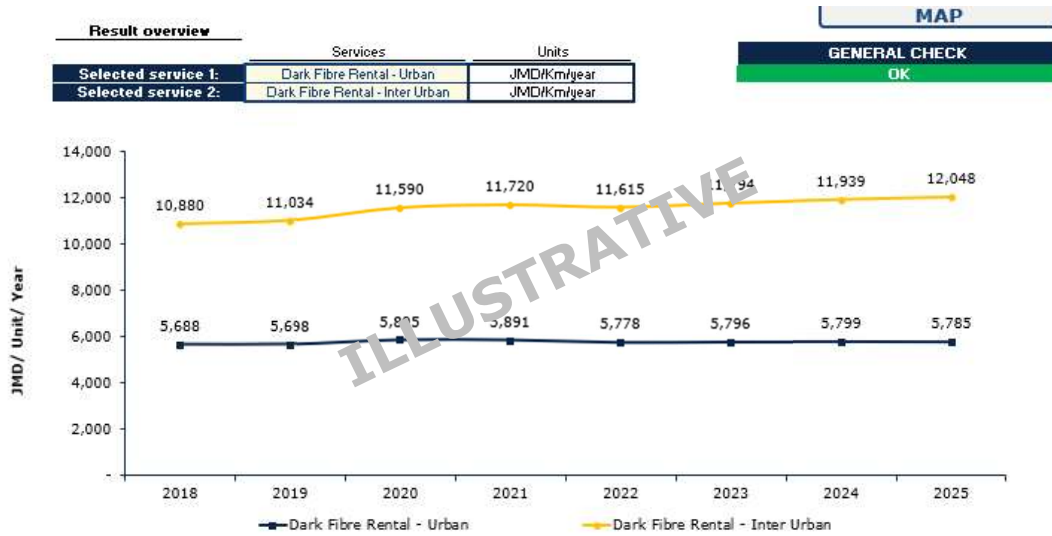


Exhibit 4.3: Result overview [Source: Axon Consulting]

5. Modifying inputs

The model inputs are identified by the following formats:

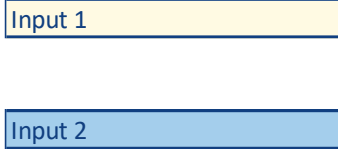


Exhibit 5.1: Format that identifies model’s inputs [Source: Axon Consulting]

As shown above, two different types of inputs are considered in the model:

- ▶ Input 1: These inputs include the basic information of the model that we recommend updating (or at least reviewing) with each update of the model.
- ▶ Input 2: These inputs represent advance information that, if changed, could significantly modify the model calculations.

Therefore, we recommend that Input 2 not be modified except for people with advanced knowledge of the model’s technical mechanisms and algorithms.

Please note that the model should be executed in order for changes in the inputs to be propagated to the results.