



---

# **XL-MITIGATION TOOLKITS (MAURITIUS)**

---

## **User Manual**



**AUGUST 1, 2017**

Ministry of Social Security, National Solidarity, and Environment and Sustainable Development  
(Environment and Sustainable Development Division)  
Republic of Mauritius

# XL-Mitigation Toolkits (Mauritius)

## User Manual

Climate change, affecting every corner of the world, manifests itself in many ways (global temperature rise, prolonged droughts, increased flash flood events, more intense cyclones, accelerated sea level rise and salinization) and impacts fiercely Small Islands Developing States like the Republic of Mauritius, thus, threatening development initiatives. This manual, XL-Mitigation User Reference, forms part of a family of toolkits to compute and plot a number of other variables including GHG emissions for different sectors of the economy. The User Reference has been written from an application developer's perspective. A fundamental conceptual and operational knowledge of Excel is assumed.

### Disclaimer

Data used has been obtained from reliable sources. The Ministry of Social Security, National Solidarity, and Environment and Sustainable Development (Environment and Sustainable Development Division) assumes no responsibility for errors and omissions in the data provided. Users are, however, kindly asked to report any errors or deficiencies in this product to the Ministry. The choices of calculation made in this tool are derived from TNC Report (2016).

### Copyright

#### ©2017 Government of Mauritius and United Nations Environment Programme

All rights reserved. No part of this Guideline and/or Toolkit may be produced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without prior permission from the Ministry of Social Security, National Solidarity, and Environment and Sustainable Development (Environment and Sustainable Development Division) and the United Nations Environment Programme. Results based on the use of the Toolkit must be duly acknowledged and referenced; the copyright holder's endorsement of Users' views, products or services shall not be implied in any way.

<p><b>Ministry of Social Security, National Solidarity, and Environment and Sustainable Development (Environment and Sustainable Development Division)</b></p> <p>Ken Lee Tower, Corner St Georges and Barrack Streets Port Louis, Mauritius Phone: +(230) 203 6200 Fax: +(230) 212 9407 Email: <a href="mailto:menv@govmu.org">menv@govmu.org</a> Website: <a href="http://environment.govmu.org">http://environment.govmu.org</a></p>	 <p><b>United Nations Environment Programme</b></p> <p>Division of Technology, Industry and Economics, DTIE P.O. Box 30552 Tel :+( 254-20) 762 5264 Fax :+(33-1) 4437-1474 Website: <a href="http://www.unep.org/">http://www.unep.org/</a></p>	 <p><b>Global Environment Facility</b></p> <p>1818 H Street, NW Washington, USA Tel :+( 202) 473 3202 Fax :+(202) 522 3240 Email: <a href="mailto:gefceo@thegef.org">gefceo@thegef.org</a> Website: <a href="http://www.thegef.org">www.thegef.org</a></p>
---	--	---

## **Acknowledgements**

The Government of Mauritius is very appreciative of the financial and technical support that the Global Environment Facility and the United Nations Environment Programme have extended under the Third National Communication project.

The User Manuals and the XL Mitigation Toolkits are the result of a collaborative work of key institutions and facilitated by the University of Mauritius, as the Consultant Team. The inputs from the institutions mentioned below are duly acknowledged for their valuable contribution.

- Ministry of Energy and Public Utilities;
- Central Electricity Board;
- National Transport Authority;
- Wastewater Management Authority;
- Solid Waste Management Division;
- Forestry Service;
- Food and Agricultural Research and Extension Institute;
- Mauritius Cane Industry Authority;
- Statistic Mauritius; and
- All other institutions from which data and information were gathered for the mitigation analysis during the TNC.

# Table of Contents

Chapter 1: Introduction to XL-Mitigation Toolkits (Mauritius) .....	4
Chapter 2: GHG Emission Trends for the Republic of Mauritius in a Nutshell .....	6
Chapter 3: The XL Mitigation Toolkits- General Features.....	8
3.1 Introduction .....	8
3.2 Structure of the XLM Toolkits .....	8
3.3 Methodology.....	8
3.4 Inputs, Outputs and Calculations.....	10
3.5 Using the Toolkits.....	10
3.6 Protection Features.....	20
3.7 Installation and running the tool .....	20
Chapter 4: Good Practices and Protocols .....	21
Chapter 5: Conclusions .....	22
References .....	22

## Chapter 1: Introduction to XL-Mitigation Toolkits (Mauritius)

This User Manual concerns *Excel*-based mitigation toolkits (XLM-Toolkits) developed for the Republic of Mauritius.

The climate change mitigation for the Republic of Mauritius was assessed in the Third National Communications Report (TNC, 2016) for a Business-as-Usual (BAU) and other scenarios, after a screening exercise to select the most feasible options. The need for a mitigation tool to help stakeholders was then raised to enable the latter to perform important investigations in their quest to keep abreast with the implementation, monitoring and development of mitigation scenarios proposed in the (TNC, 2016) studies. As such, there was a call to propose a user-friendly version for that purpose. The complexity of each sector, however, meant that it was more convenient to devise separate toolkits for individual sectors. As such, the sectorial toolkit allows faster calculations and renders the toolkit size smaller (typically less than 5 MB). The seven (7) sectors and the toolkit details are shown in Table 1.1.

**Table 1.1: Sectorial XLM Toolkit details**

Sectors		Toolkit names
ENERGY	Energy Industries	XLM-Energy Industries
	Transport	XLM-Transport
NON-ENERGY	Agricultural Crop	XLM-Agricultural Crop
	Livestock	XLM-Livestock
	FOLU	XLM-FOLU
	Liquid Waste	XLM-Liquid Waste
	Solid Waste	XLM-Solid Waste

An operational protocol is also proposed for data sharing, updating, publishing, and for harmonizing use of crucial parameters common to different sectors.

The XLM Toolkits performs basic calculations based on the parameters and assumptions derived from the TNC Report (2016). Users of the XLM Toolkits can adjust the scenarios by choosing appropriate parameters/assumptions to suit their needs for the mitigation analysis. These TNC-budded XLM-Toolkits (Mauritius) work with MS Excel 2013 and above. No doubt, newer versions of XLM-Toolkits (Mauritius) will call for not only the latest editions of Excel but also be updated with the findings of the periodic NCs.

The major capabilities of the XLM-Toolkits are:

- a common structure for all sectors. This structure allows Users to quickly adapt to other sectors;
- use of Graphical User Interface (GUI) as a major assistance;
- graphics to display of all variables relevant to the sector;
- graphics generation and user has the capabilities to generate other relevant type of charts according to taste;
- navigation between worksheets;
- file manipulation such as open, close and print features, export or import worksheets;
- innovative dashboards (to keep track of proposed mitigation scenarios);
- simple data manipulations (copy/paste/export);
- use of Excel cell format features (such as cell formatting, inserted comments, etc.); and
- automatic report generation;

The toolkits can be used not only to make projections of GHG emissions of different scenarios, but also to investigate policy implications, to track performance (using dashboards), to proposed mitigation targets. Depending on the sector, toolkits can display important sector variables, permitting in-depth analysis useful for research purposes (Table 1.2).

**Table 1.2: Input and Output Details of XLM-Toolkits**

<b>Sector</b>	<b>Number of Scenarios (incl BAU)</b>	<b>Type of Inputs (TNC)</b>	<b>Number of Variable Plots</b>
Energy Industries	6	Modelled Data	53
Transport	6	Modelled Data	158
Solid Waste	5	Modelled Data	133
Liquid Waste	2	Modelled Data	49
Agricultural Crop	5	Expert Estimates	64
Livestock	5	Expert Estimates	111
FOLU	3	Expert Estimates	144

Seven User Manuals were developed to be used in conjunction with this document. Each of these discusses briefly individual sectors, the mitigation scenarios proposed under TNC, the targets under different scenarios, and the details of key worksheets (Data, Parameters, and Assumptions) with snapshots of the worksheet where appropriate.

Every attempt has been made to conform to stakeholders' expectations and more.

## Chapter 2: GHG Emission Trends for the Republic of Mauritius in a Nutshell

### FACTS 2016: (ESI, 2017)

- Total GHG emission: ~ 5.1 million tonnes carbon dioxide equivalents (CO<sub>2</sub>e)
- GHG removal: ~ 367,000 tonnes CO<sub>2</sub>e
- GHG Gas Share: Carbon dioxide: 75.9%; Methane (20.7%); Nitrous oxide (3.3%); HFCs (0.1%);
- Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>), though having high global warming potentials, occurred in very small amounts.

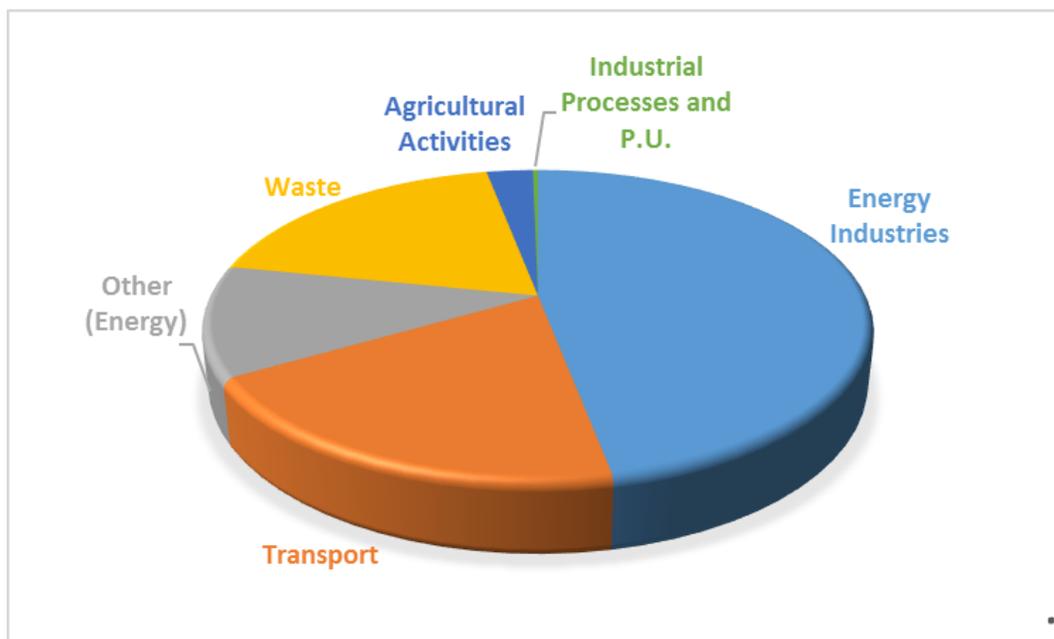


Figure 2.1: Share of 2016 Emissions by sector (see Table 2.1 for details)

**Table 2.1: Summary of GHG Emission Trends by Sector for 2016 (ESI, 2017)**

<b>2016</b>	<b>GHG Emissions (GgCO<sub>2</sub>e)</b>	<b>%</b>	<b>REMARKS (estimates using IPCC methodologies – IPCC, 2006)</b>
<b>Energy Sector</b>			Main source of GHG emissions;
<b>Energy Industries</b>	2440.99	45.45	Biggest emitter (primarily electricity production)
<b>Transport</b>	1065.95	19.85	Second biggest emitter in energy sector
<b>Manufacturing &amp; Construction</b>	347.33	6.47	
<b>Others</b>	250.71	4.67	
<b>TOTAL</b>	<b>4104.98</b>	<b>76.43</b>	
<b>Non-Energy Sector</b>			
<b>Wastes</b>			Main GHG: methane; Second biggest emitter overall
<b>Solid Waste</b>	1038.2	19.33	
<b>Liquid Waste</b>	58.6	1.09	
<b>TOTAL</b>	<b>1096.8</b>	<b>20.42</b>	
<b>AFOLU</b>			
<b>Manure</b>	10.9	0.20	Main GHG: methane
<b>Enteric</b>	15.3	0.29	Main GHG: methane; (almost half from Rodrigues with an important livestock population).
<b>Soil</b>	99.4	1.85	Primarily due to use of fertilizers (esp. in the sugarcane fields); Emissions primarily as N <sub>2</sub> O.
<b>Field burning</b>	2.1	0.04	
<b>FOLU</b>	-363.3	-6.76	Sink of carbon; (Rodrigues: around -32 GgCO <sub>2</sub> e)
<b>TOTAL (excl. FOLU)</b>	<b>127.8</b>	<b>2.38</b>	
<b>TOTAL (incl. FOLU)</b>	<b>-235.5</b>		
<b>Industrial Processes and Products Use (IPPU)</b>			Least significant sector in terms of the magnitude of emissions.
<b>Metal Industry</b>	33.75	0.63	The metal industry (construction of iron bars from scrap metals) shared the highest level of emissions for this sector (~82%).
<b>Mineral Industry (Lime Production)</b>	0	0.00	No lime production as from 2015.
<b>Hydro-fluorocarbons</b>	7.53	0.14	HFCs show rising emissions likely due to increased use of the gases in air conditioning and refrigeration.
<b>TOTAL</b>	<b>41.28</b>	<b>0.77</b>	
<b>Total (excl. FOLU)</b>	<b>5370.86</b>		
<b>Total (incl. FOLU)</b>	<b>5007.56</b>		

## Chapter 3: The XL Mitigation Toolkits- General Features

In this chapter the general features of the XLM-Toolkits are described. Seven (7) sector-wise guides describe the specific features for individual sectors.

### 3.1 Introduction

Whilst the underlying principle is a user-friendly version of the toolkit that responds to the complexity of individual sectors, the authors have found it important to make several efforts in the quest to make the final user-friendly product a robust one. In this pursuit, the design has been made:

- versatile (adaptable from sector to sector),
- modular (so that future versions can easily incorporate new or modified scenarios),
- flexible (to accommodate the results of different models, where relevant),
- simple and elegant (with only 7 important tabs with easy navigation, useful links),
- efficient and reliable in terms of performance (calculations and results display),
- to allow for analysis and post analysis (using the Excel analytical functions),
- equipped with radar dashboard (for monitoring purposes),
- secure (for traceability purposes and to prevent any abuse).

Excluding the introductory worksheet ‘*Start*’, the visible worksheets in the XLM-Toolkits have been tabbed with a rainbow configuration for ease-of-use.

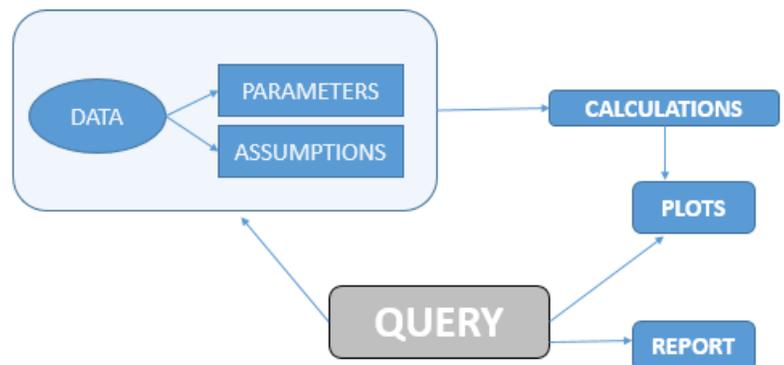
### 3.2 Structure of the XLM Toolkits

After careful considerations of the approach used in the TNC (2016) studies, an underlying framework common for all the sectors has been adopted. The heart of the Toolkit is the ‘*Query*’ worksheet where all the assumptions made can be analyzed in details. Users may also alter parameters if required for their investigations. The XLM-Toolkits have been mapped as shown in Table 3.1.

### 3.3 Methodology

The heart of the Toolkit is the ‘*Query*’ worksheet.

‘*Query*’ worksheet has links for parameters and assumptions changes to be made within the jurisdictions of the TNC studies. The results of the calculations that are then performed can be scrutinized in the form of graphics for the period ending 2050 and a radar dashboard can be used to examine the extent of departure from TNC-estimated targets. Up to three sets of computations are performed simultaneously: default TNC, user-defined UD1



and user-defined UD2; the latter two defining cases the User wishes to make. The findings of the results can be copied/saved or published in pdf format.

**Table 3.1: Structure of XLM-Toolkits (Mauritius)**

Worksheet(s)	REMARKS
<b>0. Start</b>	This is essentially the starting point of the Toolkit welcoming its User members. Users can only access the Toolkit through a login provided by the chair of the sector concerned.
<b>1. Sector</b>	This worksheet provides important details of the Users, as listed therein, likely to utilize this product.
<b>2. Description</b>	This worksheet highlights the Mitigation Scenarios for the sector identified within the context of 2016 TNC Studies and also provides important details regarding the sector.
<b>3. Query</b>	Users will spend most of their time here analyzing the results after inputting their parameters and/or assumptions; the data ( <i>next item</i> ) is assumed to be entered by the sectoral chair. Results can be compared graphically or through tabular representations. Radar dashboards and a pdf reporting system are also provided.
<b>4. Data</b>	Official data along with modelled and/or expert estimates appear in this area in a specified format that suits the Toolkit calculations therein. These are strictly maintained by the sectoral chair who is responsible for any modification and/or for updating.
<b>5. (TNC/UD1/UD2) Parameters</b>	<p>The XLM-Toolkit identifies three such worksheets that are essentially configured to reproduce the original TNC results.</p> <p>Whilst Users would normally not change the values of parameters, they can do so, if required, in the user-defined worksheets (UD1 and UD2).</p> <p>For permanent alterations, where justified, Users must approach the sectoral chair for changes; in which case the default values are modified.</p> <p>In addition to ‘<i>TNC Parameters</i>’, the two User-defined case studies employ worksheets labelled ‘<i>UD1 Parameters</i>’ and ‘<i>UD2 Parameters</i>’.</p> <p>The results of the TNC, UD1 and UD2 can be compared in the ‘<i>Query</i>’ worksheet.</p>
<b>6. (TNC/UD1/UD2) Assumptions</b>	<p>The XLM Toolkit identifies three such worksheets that are essentially configured to reproduce the original TNC results.</p> <p>In addition to ‘<i>TNC Assumptions</i>’, the two User-defined case studies employ worksheets labelled ‘<i>UD1 Assumptions</i>’ and ‘<i>UD2 Assumptions</i>’.</p> <p>The results of the TNC, UD1 and UD2 can be compared in the ‘<i>Query</i>’ worksheet.</p>
<b>7. Calculations</b>	This is a free worksheet for Users to copy data and carry out simple calculations, estimations or make their own projections, etc.

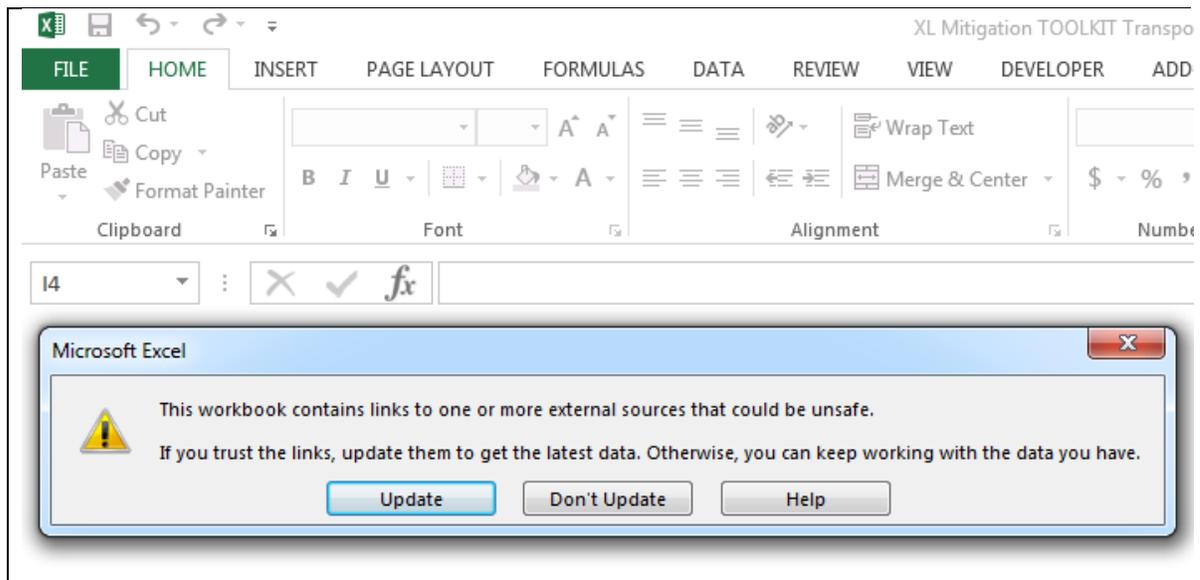
### 3.4 Inputs, Outputs and Calculations

The projected inputs of the XLM-Toolkits differ from sector to sector (Table 1.1). Some sectors use modelled data which have been calibrated using past data whilst others use estimates based on expert evaluation or mixtures of the two. The details of each sector appear in the TNC Report (2016). All calculations followed in the Toolkits have been derived, without modification, from the TNC (2016) work.

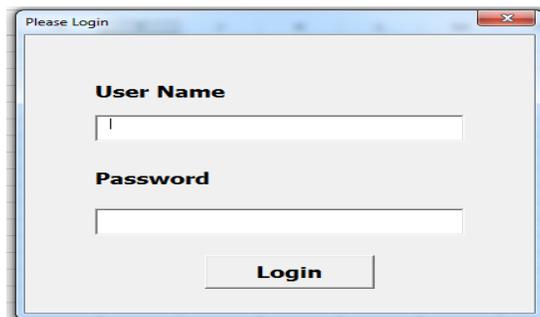
The projected outputs in the TNC studies have been primarily GHG emissions (Total CO<sub>2</sub>e). However, in the Toolkits, in addition to the latter, several other variables relevant to individual sectors can be examined. The number of variables differ from sector to sector. For instance, for the Transport sector, some 158 variables are provided to the Users for their investigations (see Table 1.2).

### 3.5 Using the Toolkits

**1:** Double-click at the Microsoft Macro Enabled Worksheet Toolkit and then click *Update*.



**2: Login** as follows: Enter the User Name and Password provided to you to login.



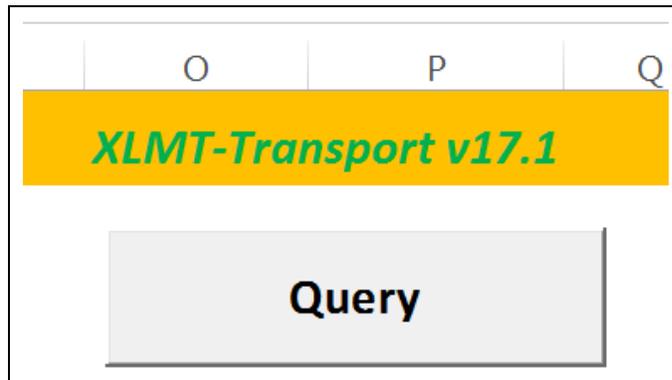
**3: Start** – Toolkit welcome page to the Users.



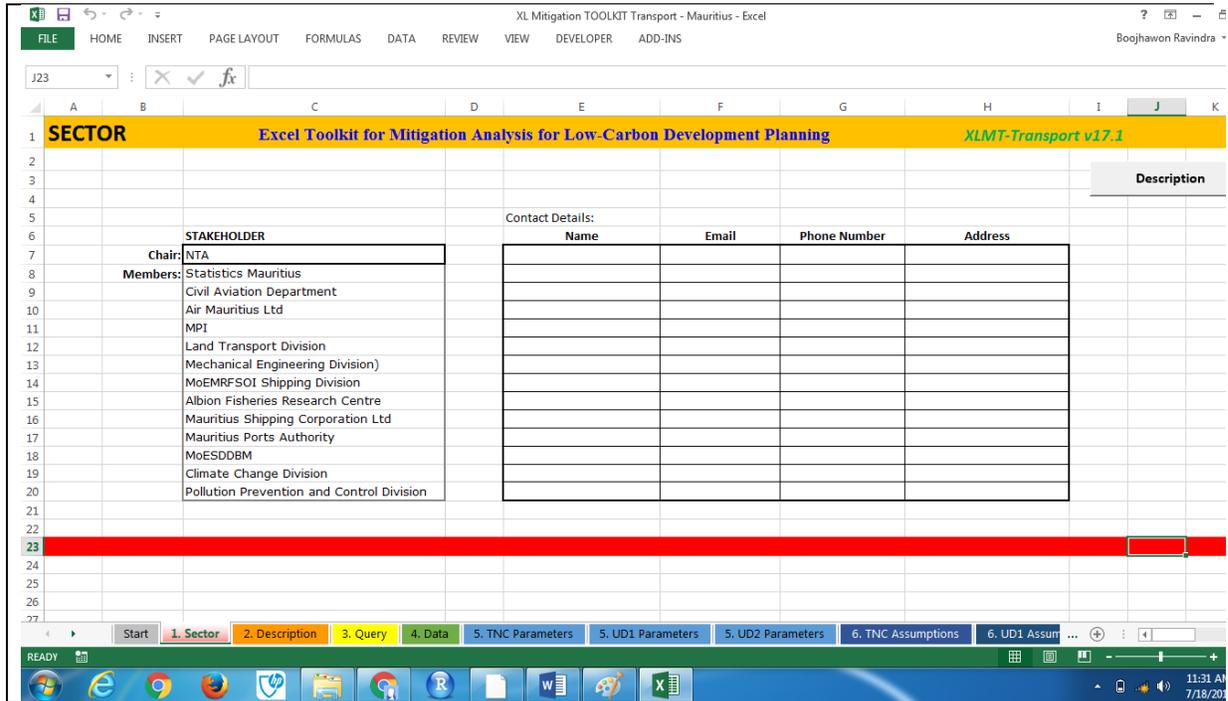
Users can navigate from worksheet to worksheet using the rainbow-coloured tabs at the bottom.



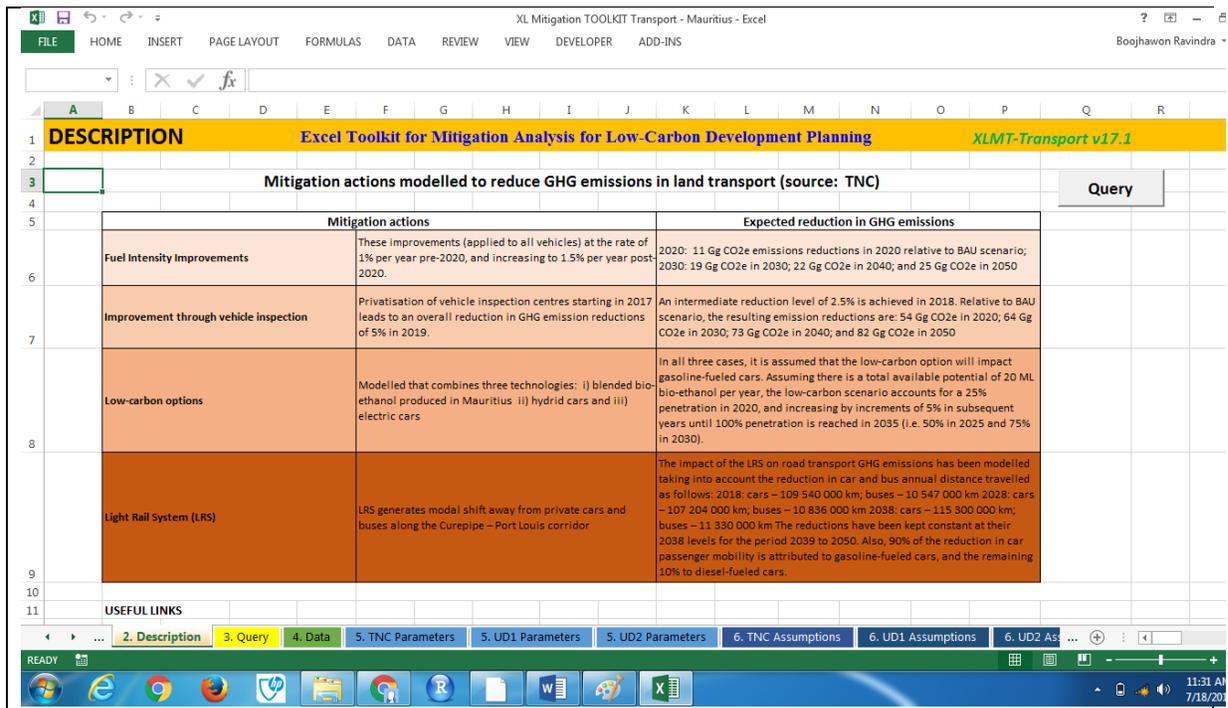
Users can also navigate using the grey buttons within the worksheet:



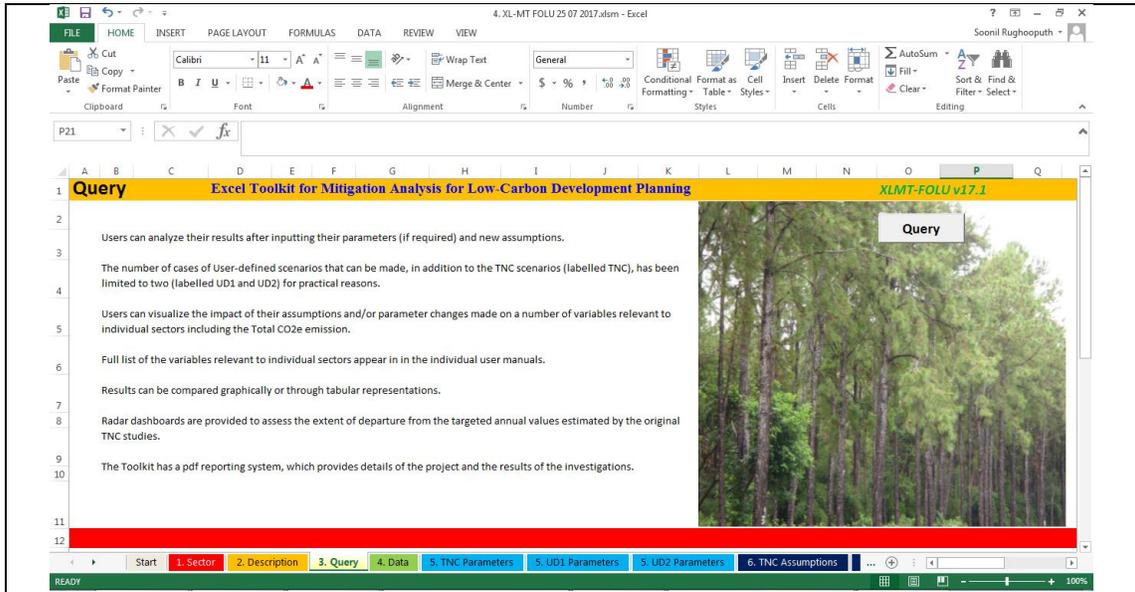
**4: Sector** - The *Sector* worksheet caters for the record of the Registered Users; this sheet is maintained by the sectoral chair.



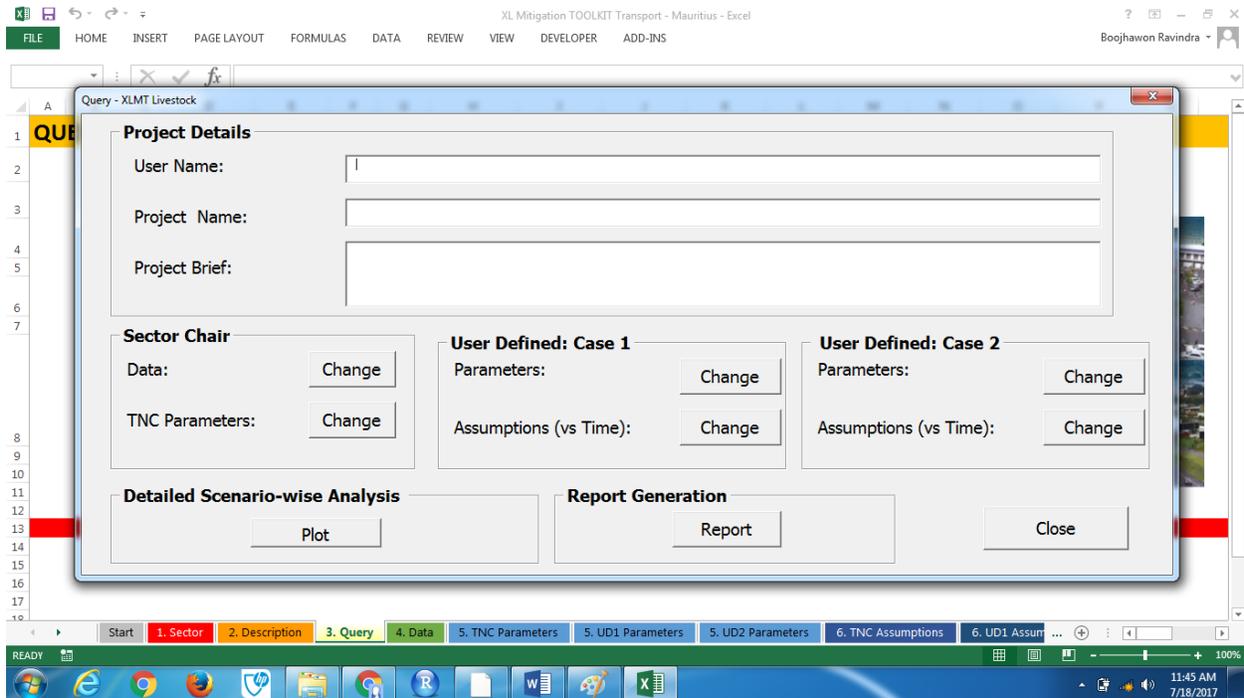
**5: Description** - The *Description* worksheet contains relevant information with respect to the mitigation scenarios and relevant details – such as links to useful sites and glossary.



**6: Query** - The *'Query'* worksheet is the heart of the Toolkit. Users will spend most of their time here analyzing the results after inputting their parameters (if required) and new assumptions; the data (next item) is assumed to be entered by the sectoral chair.



The *'Query'* worksheet has some information and a *'Query'* button. Clicking the latter brings us the following:



**This Graphics User Interface (GUI) has several areas mapped as follows:**

**Project Details area:** Users need to input their User name, project name and a brief of the project.

**Sector Chair area:** The Chair for each sector has access through the ‘Change’ buttons to update or modify data and/or TNC parameters using a password. Links are provided to navigate.

**User-Defined areas:** Using ‘Change’ links, Users can navigate to change parameters and assumptions to enable them to do their simulations using a maximum of two scenarios (User-defined Case 1 and User-defined Case 2) and compare their results with respect to the TNC results. The number of cases of User-defined scenarios that can be made, in addition to the TNC scenarios (labelled TNC), has been limited to two (labelled UD1 and UD2) for practical reasons.

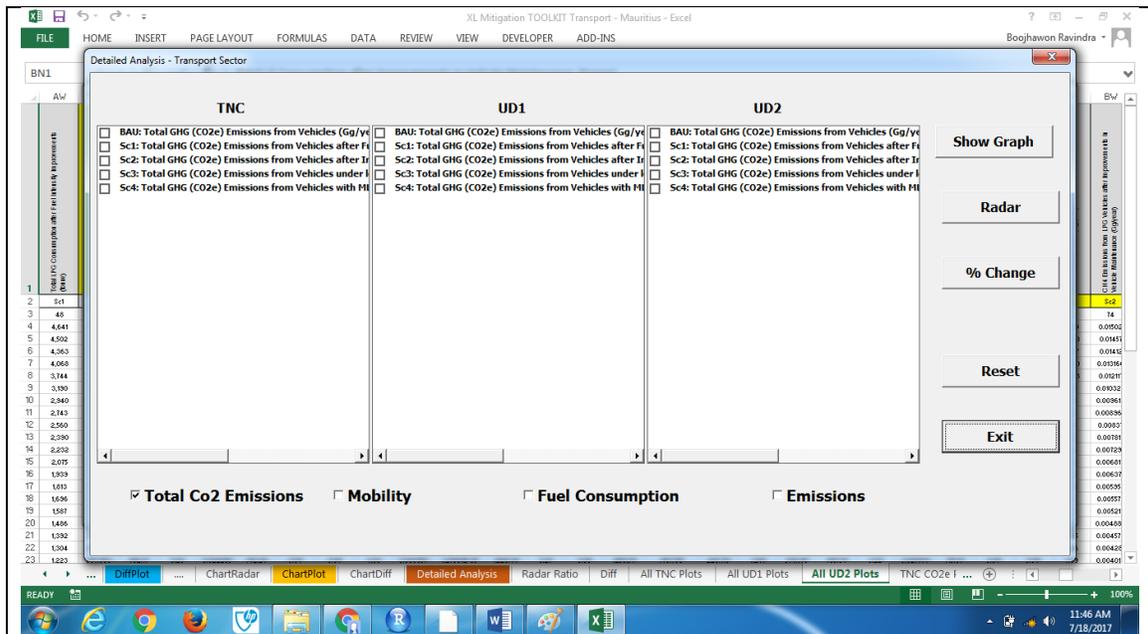
**Detailed Scenario-wise Analysis area:** Upon clicking ‘Plot’ button, Users can visualize the impact of their assumptions and/or parameter changes made on a GUI. A number of variables relevant to individual sectors including the *Total CO<sub>2</sub>e emission* can be plotted; the full list of these variables appear in the individual user manuals. The various aspects of the Plot GUI are discussed below.

**Report Generation area:** The Toolkit has a pdf reporting system, which provides details of the project and the results of the investigations.

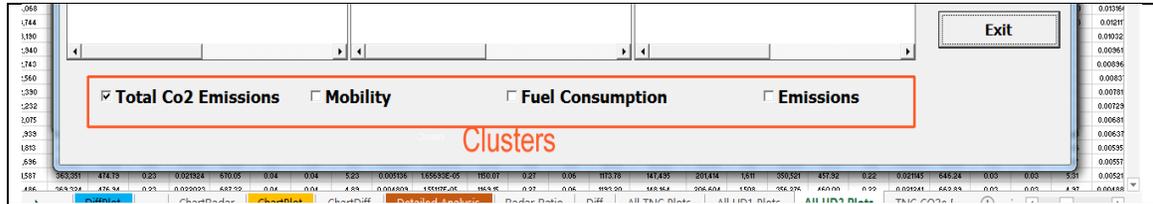
**Close:** Users can exit the GUI to go back to the worksheets.

**Detailed Scenario-wise analysis**

As mentioned above, detailed scenario plots for analysis can be done by a simple click of the ‘Plot’ button. This action takes you to the following GUI:



This GUI has three columns: one for the TNC and the other two for the user-defined cases (UD1 and UD2); each column has a list of plots that are available as defined by the cluster button at the bottom of the GUI display (see below); the clusters group plots of similar nature (which renders selection less cumbersome and quicker). When opening the GUI for the first time, the ‘*Total CO2 Emissions*’ cluster button is ticked. The User will be required to select individual plots in the columns for display purposes.



The right-hand side of the GUI has the following link buttons:

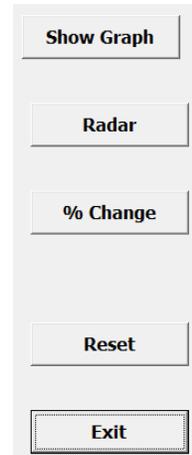
**Show Graph:** for displaying all selected plots (see below).

**Radar:** for displaying a radar plot that is useful for tracking the performance of the chosen scenario against another scenario of similar nature. Only two plots can be selected for this purpose.

**% Change:** for displaying a difference plot (displayed as a ratio of two plots).

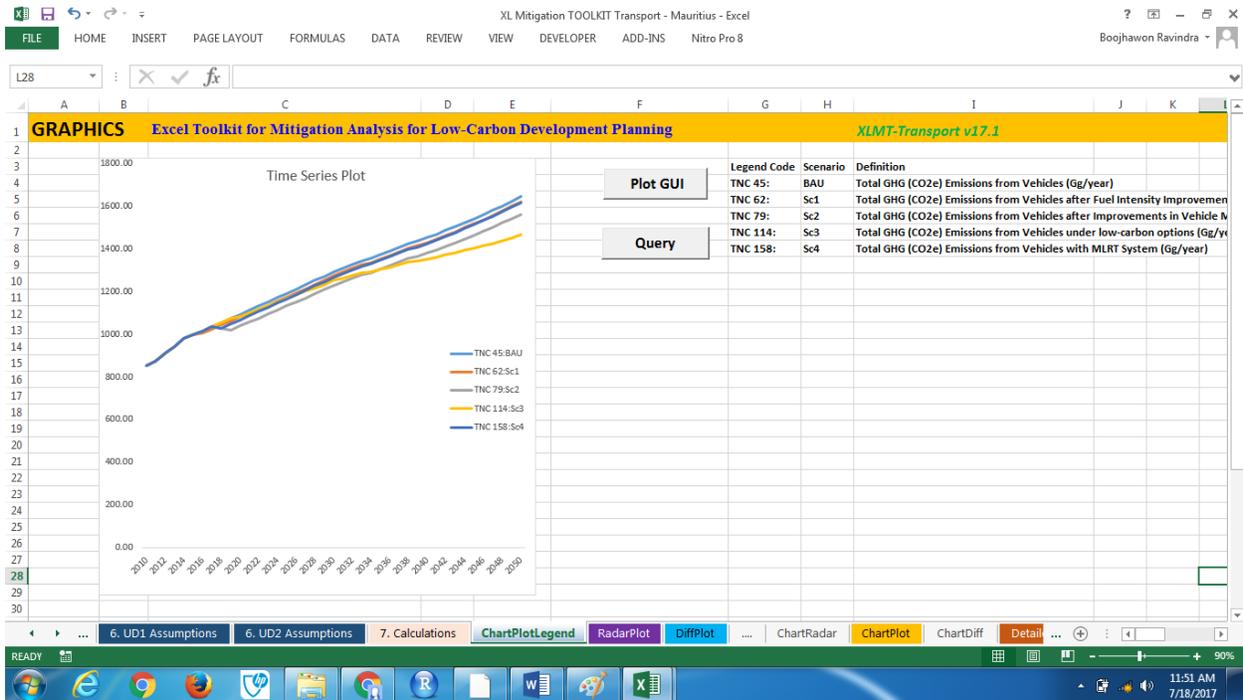
**Reset:** allows the User to start afresh. But in this case, all plots that are available will be displayed in the three columns.

**Exit:** Users can exit the GUI to go back to the worksheets.



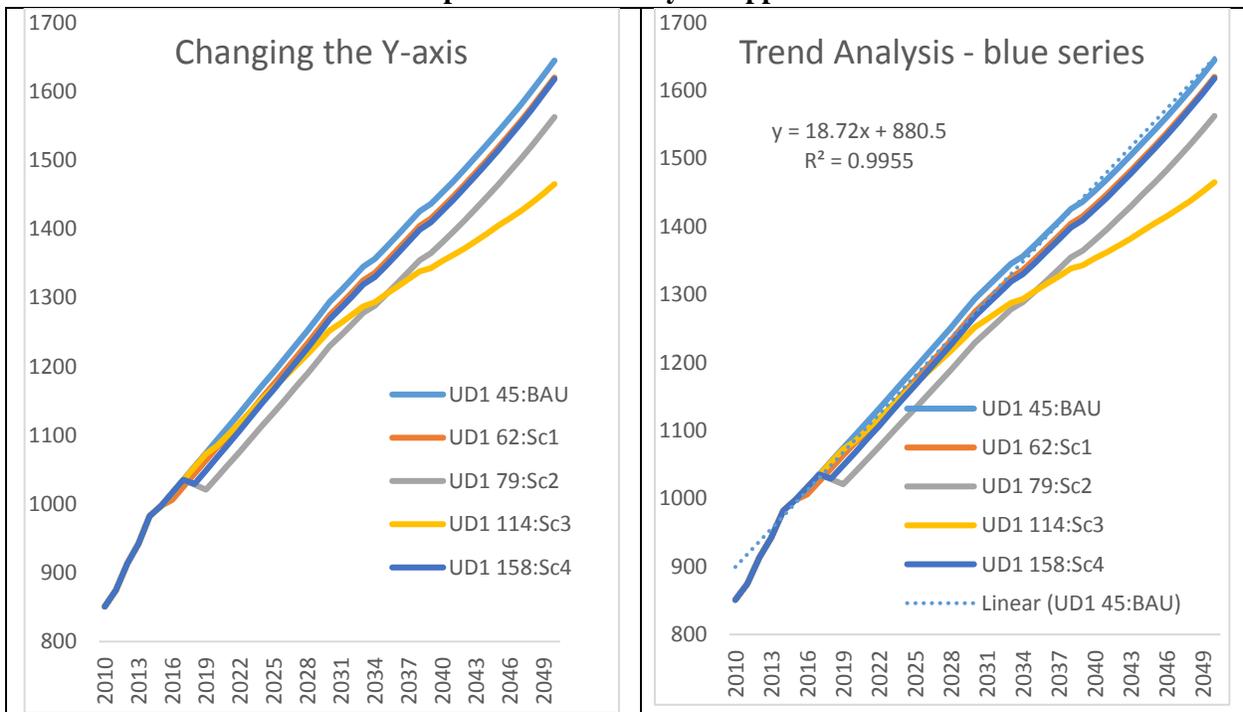
### Show Graphs

The results obtained can be further adapted to the User’s taste by using the Excel chart features. These are shown as graphs (on the left side) with shortened legends and as full legends on the right side.

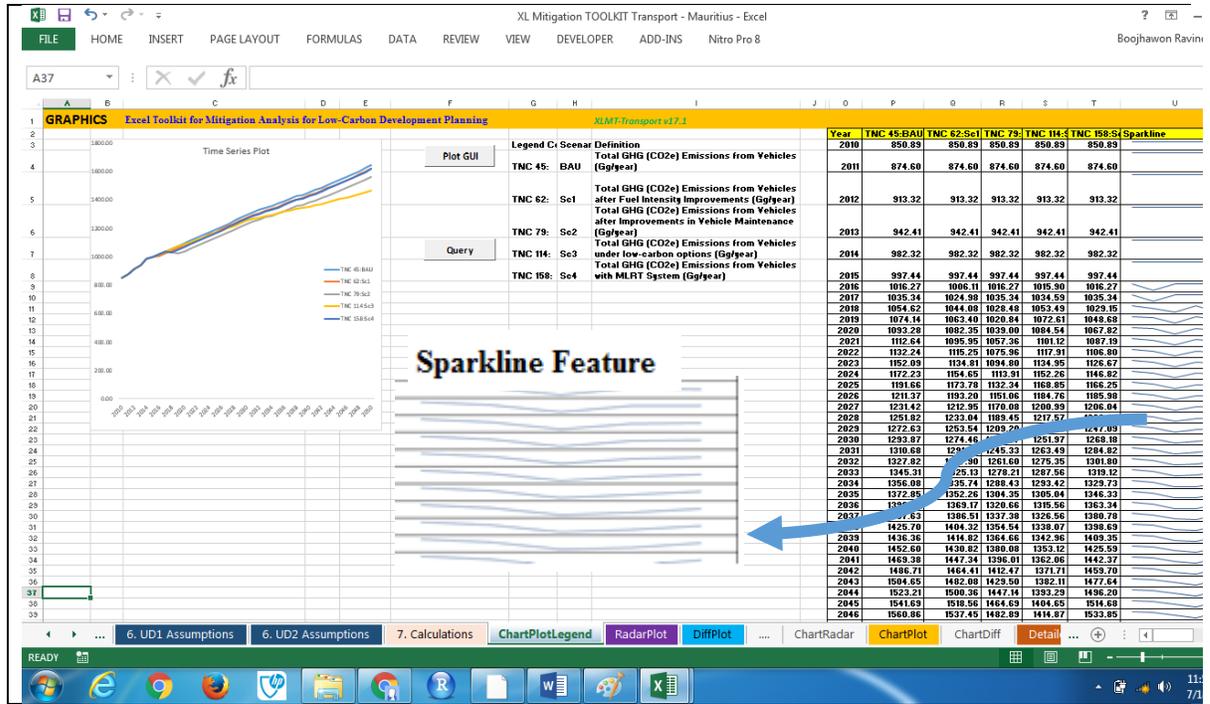


**It is very important to select plots which make sense.**

### Examples of Excel Analytics applications



Whilst the above demonstrate results that can be compared graphically, the tabular representations can be found in the same excel sheet (on the right-hand side). **Sparkline** feature has been added which provides the User to quickly check the data 'trend' for all variables for individual year and/or to use it for comparative purposes between years (see inset below).

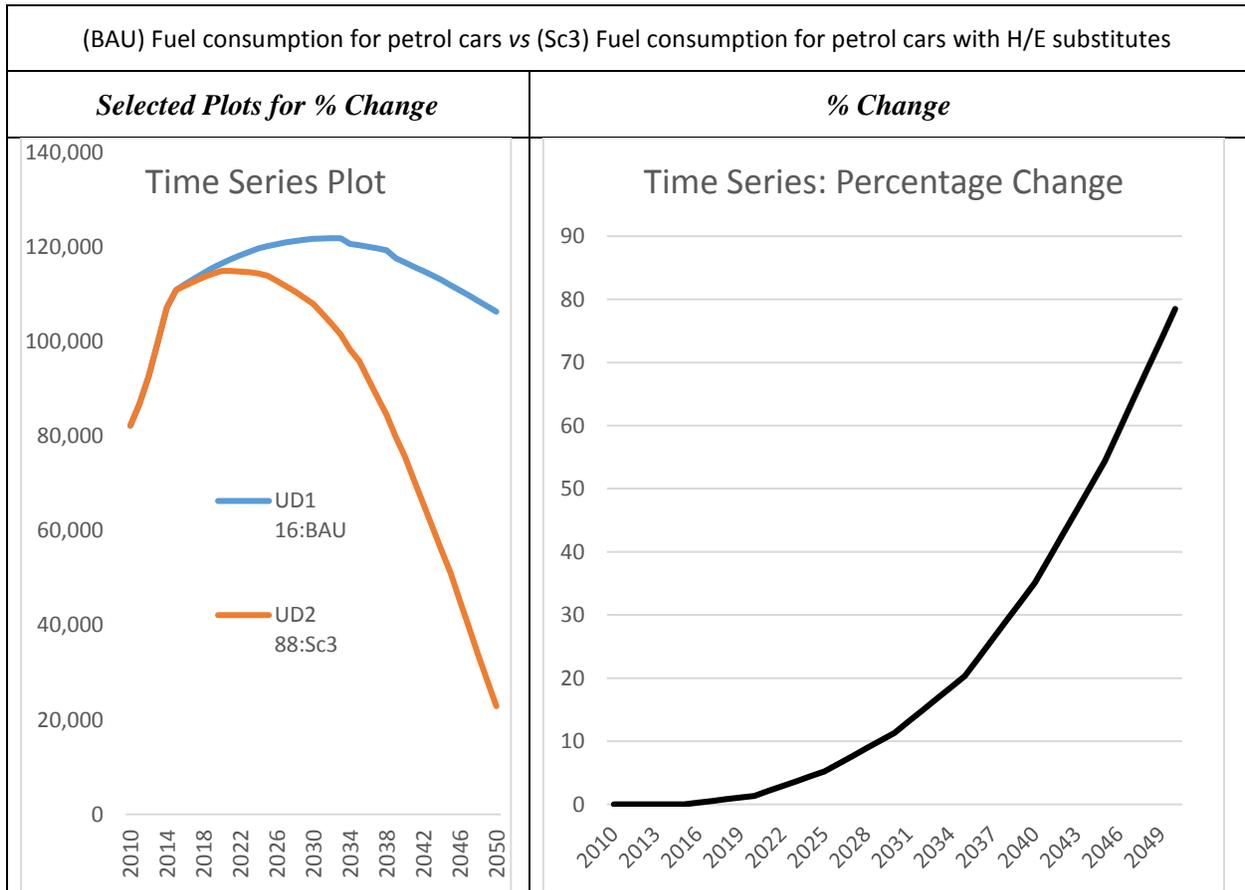


## Special Functions

The Toolkit has the potential to be extended to the following pairwise comparison: for percentage change plot and for radar dashboard plot showing to what extent a target will be met as a function of time. These plots (including difference plots and radar dashboard) to be generated can be selected from a stand-alone graphical user interface (GUI) and a window pops up to generate the plots.

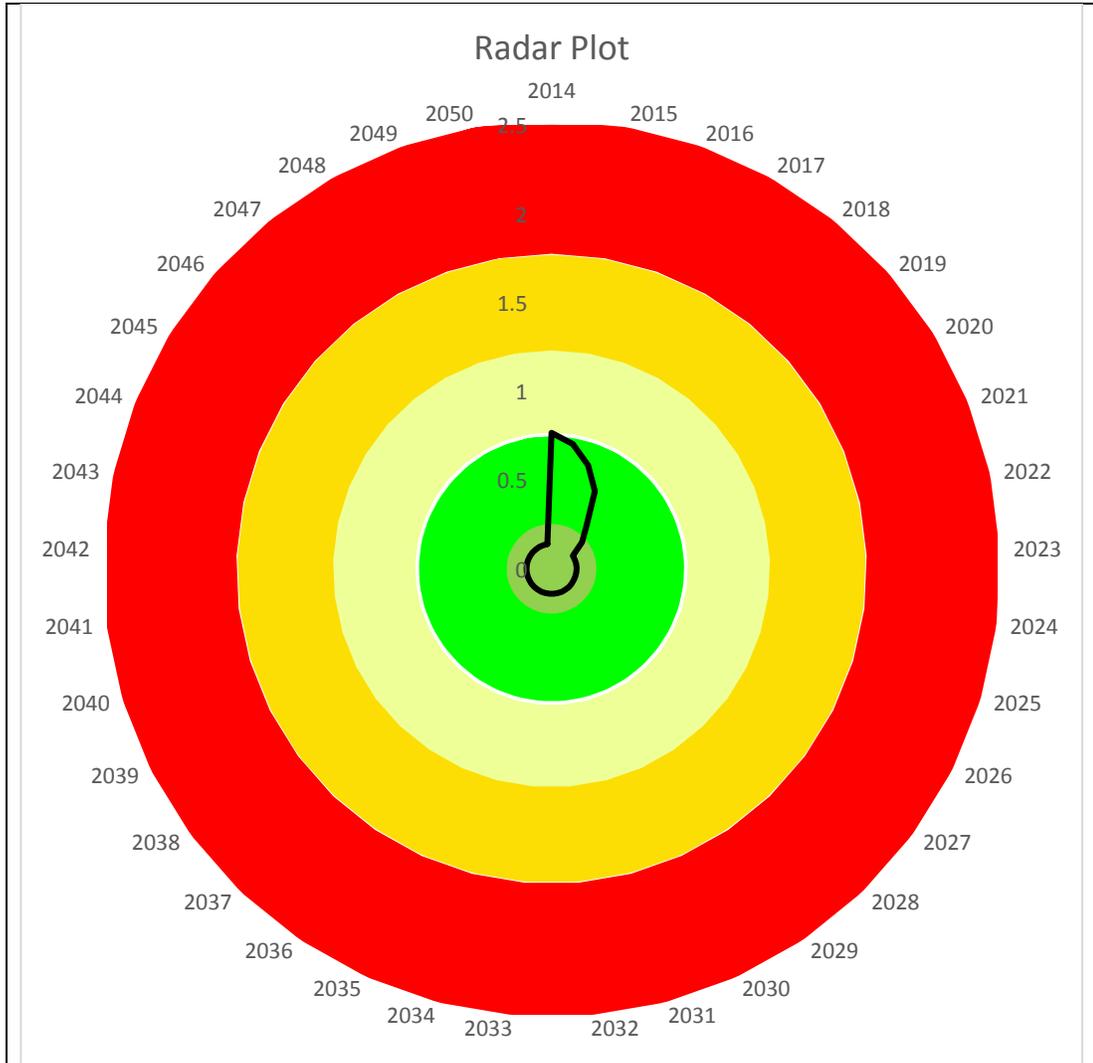
### Percentage Change

Users will be often required to reveal changes. These can be displayed in the form of ratio. An example is given below.



### ***Radar Plots***

Radar dashboards are provided to assess the extent of departure from the targeted annual values estimated by the original TNC studies. An example of a radar is shown below. Customized dashboards for TNC/UD1/UD2 have been developed to permit the Users to view the relative change between the two targets. Other radar plots can be easily developed using the Excel chart type functionalities.



## ***Report***

At the end, a report can be generated that captures the User details, assumptions, parameters, and plots. For traceability purposes, the reporting system adopted in the Toolkit derives all the information from the selections made by the user, as shown below:

- PDF Official Toolkit Reporting System**

  - Date
  - Username
  - Project Name
  - Project Brief
  - Results (*Tables, Graphs including Radar Dashboard and Difference Plots*)
  - Documentary notes

### **3.6 Protection Features**

Whilst the above worksheets are visible to the Users, the EM Toolkit houses several other worksheets in a restricted zone, which are only accessible to the chair of the sector. This has been done purposely to prevent any accidental errors, and hence misinterpretation of ensuing results. Many cells in the visible area have been protected and navigational links have been inserted for the same reasons. Reset buttons are also provided whenever the programme encounters any accidental problems. Thus, Users are restricted only to manipulate at 2 - 4 of the visible worksheets, rendering the toolkit even more robust.

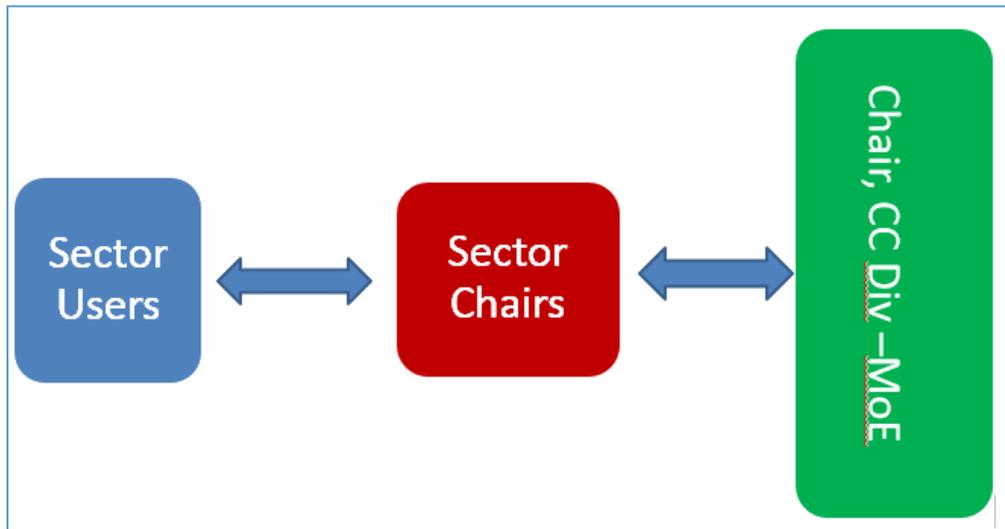
### **3.7 Installation and running the tool**

The Toolkit for each sector is easily operated by just opening the file in Excel and login in to start its use. Excel Version 2013 and above are desired for the macro commands to be compatible and to run bug-free. The 'Start' sheet can be used to navigate to all relevant worksheets by using press button commands or clicks.

## Chapter 4: Good Practices and Protocols

To harmonize the flow of data and information, three major sets of stakeholders are set to be involved, as shown in the diagram below.

Any changes done to the ‘*TNC Parameters*’ worksheet has to be reported to the Chair, Climate Change Division- Ministry of Social Security, National Solidarity, and Environment and Sustainable Development. Subject to green-light from the latter, the sector chair distributes the new updated version to all Users.



## **Chapter 5: Conclusions**

The Toolkits are designed in a user friendly fashion and enable use by all types of Users, from beginners to advanced experts. The version presented is an original and start-up version which is bound to be improved over time to accommodate new features to address mitigation assessment challenges that may crop up after updated information are made available, for instance, after new policies or legislations.

We hope that the Toolkits will prove to be very useful for reporting and policy decisions, as well as for other activities related to climate change.

## **References**

ESI, 2017: Environment Statistics 2016, Statistic Mauritius, 28 July 2017

IPCC, 2006: Intergovernmental Panel on Climate Change (IPCC), 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Washington D.C., USA, 2009

TNC, 2016: Third National Communication: Report to the United Nations Framework Convention on Climate Change. Republic of Mauritius, Port Louis, 2016