World Bank Group - LED Streetlight Financing Tool: User's Manual

The World Bank Group developed the CityLED Streetlight Financing Tool to allow cities to evaluate the financial implications, as well as the energy and emission reduction benefits, of switching from conventional street lighting technologies to LED lamps. While city staff (mayor's office/executive team, finance department, public works department, etc.) are the primary target users, the tool could also help potential financiers (e.g. local financial institutions; national, multilateral, bilateral development agencies) and others to identify opportunities.

The tool performs the following functions:

- Allows the user to define project assumptions including implementation rates, timing, costs, interest rate, or other financial terms;
- Provides user with estimates of the financial performance of a proposed project including metrics such as the net present value (NPV), internal rate of return (IRR), payback period, debt-service coverage ratio (DSCR), etc.;
- Allows comparisons of financial performance of alternative projects (scenarios); and,
- Allows users to conduct sensitivity analysis on key variables to identify a potential range of financial outcomes.

The tool contains five different modules, and each module has sub-pages that contain user interfaces that either require inputs from the user or display outputs. This manual explains how to use the tool, including descriptions of each module and sub-page, the required actions, and the displayed outputs. The manual also provides definitions of the terms used within the tool.

While the tool exists within a Microsoft Excel workbook, the tool's user interfaces have been designed to resemble a webpage to facilitate the user's experience. The cells that require the user to enter data entry are identified with a light blue fill color (when no data has been entered). Cells with light blue text and white fill contain adjustable default values or user-entered data. Cells with black text and white fill are locked and contain either calculated values or non-adjustable defaults.

The tool currently is available in English and Portuguese. Note that the user can also change the selected language at the top of any user interface in the tool. Other languages are envisioned to be added over time.

1. Introduction Module

The 'Introduction' module provides an overview of the tool's functions and allows the user to customize the user interface configurations. Page '1.2 Steps & Workflow' provides an overview of how the user can develop a streetlight project and evaluate the performance of a potential project, and compare the feasibility of alternative scenarios. Page '1.3 Toolkit Configurations' allows the users to change the user interface settings. The user can choose 'Option 1' to select a streamlined webpage-like user interface format or select 'Option 2' to be able to view the tool's calculation worksheets and databases, which are hidden in Option 1. Option 3 is the administrative, password-protected mode. The page also provides a "Clear All" function. By pressing the grey 'Clear' button, the user can delete all data inputs and reset the tool assumptions to the default settings.

Page '1.4 Definitions' provides definitions of all the key variables listed in the tool – these are also provided in this User Guide.

2. Set up

In the 'Set Up' module, the user must enter the basic data required to run the tool's calculators. These include information regarding location (city and country), the community's streetlight inventory, and the technical and financial parameters and assumptions specific to each city.

2.1 Basic Information

In page '2.1 Basic Information', you need to enter the name of your city and select the name of your country in the appropriate cells. This will populate the appropriate currency for the analysis. You will need to enter the current exchange rate. If you do not know the current exchange rate, you can click on the blue 'Lookup' button to obtain the most recent data from a website and then manually enter the value.

Figure 1 – Basic Information Input Table

BASIC CITY INFORMATION	
Name of City	Curitiba
Country	Brazil
Currency	R$
Currency Exchange Rate (R$ per 1 $US)	3.58 R$ Lookup

2.2 Street Light Inventory

Next on page '2.2 Street Inventory' you need to define your city's existing streetlight inventory. Select one of the two options below:

Option 1: If you have a detailed inventory of your city's streetlight lamps (i.e., number, type, and wattage), you can choose Option 1 and enter the relevant information.

Option 2: If you do not have detailed data of your city's streetlight lamps, select Option 2. Enter the approximate number of streetlights in the city, and estimate the distribution by technology and wattage. If you are uncertain about the distribution in your city, you can press the blue 'Use Default % Share' button to use a default distribution.

Figure 2 – Street Light Inventory Input Table - Option 1

Figure 3 – Street Light Inventory Input Table - Option 2

If you want to clear all previously entered inventory data, you may press the blue 'Clear Inventory' button at the top of the data entry table.

2.3 Parameters and Assumptions

On page '2.3 Parameters and Assumptions' you are required to enter the base case technical and financial parameters and assumptions that will be used to analysis calculations. Please complete the 'Technical Parameters and assumptions' and 'Financial Parameters and Assumptions' tables. If you do not have city-specific information, you can use default values by clicking the 'Use Default' button for an individual parameter, or set all parameters on the page to the default values by clicking on the 'Set All to Default'. If you are not sure about the meaning of a specific input, please refer to the list of definitions below:

Definitions of Technical Parameters:

- **Average operating hours per day:** Average numbers of hours the streetlights are used per day in the city
- **Average life existing technology:** Average number of hours that the current street light lamps is expected to last. This is calculated automatically based on the inventory entered by the user, but the user can override the value if desired.
- **Average life LED:** Average number of hours that a LED street light lamp is expected to last.
- **Grid emission factor (tCO2e):** Reflects the CO2e emissions of the grid of the country selected by the end user. Automatically populated figures come from IGES database. User can override as needed.

Definitions of Financial Parameters:

- **Retail cost of electricity for street lighting:** Cost per kWh for street lighting electricity paid by the city. This is used to calculate the costs and benefits in the financial analysis.
- **Unsubsidized cost of electricity for street lighting:** Real cost per kWh of street lighting, before any subsidies are applied. This is used to calculate the costs and benefits in the economic analysis. If this value is not know, the user could enter an estimate or the retail cost of electricity.
- **Real annual increase on electricity tariff (net of inflation):** Percent expected annual increase/decrease in electricity tariffs, excluding inflation.
- **Average price per luminaire- existing technology**: Average price of an existing street light lamp, excluding installation labor and infrastructure costs. This is calculated based on the inventory entered by the user. User can override.
- **Average price per luminaire- LED- existing case:** Average price of a LED street light lamp, excluding installation labor and infrastructure costs. This is calculated automatically and assumes a weighted average cost of US$400 per LED in 2012 terms, discounted by 10% per year. User can override.
- **Annual decrease in LED prices:** Percent decrease per year in the average price of a LED street light lamp. Model assumes 10% decrease. User can override.

- **Additional infrastructure (civil works) cost per point:** Cost of other necessary infrastructure (e.g., new poles, burying distribution lines, etc.) per luminaire.
- **Installation cost per LED:** Labor costs of installing new LEDs, per point of light. Assumes economies of scale from planned, efficient implementation of LED project.
- **Labor cost per lamp replacement:** Labor costs for routine replacement for all technologies as part of regular maintenance (does not assume economies of scale since replacement is ad-hoc).
- **Years of depreciation:** The period of time that it takes to exhaust the useful life of an LED lamp, measured in years. Model assumes 13 years, an approximate lifetime of a 50,000 hour LED bulb used for 11.5 hours per day.
- **Tax on domestic equipment:** Level of taxation paid for the materials from domestic sources. Taxes are taken into account for the financial analysis but are excluded in the economic analysis.
- **Tax on imported equipment:** Level of taxation paid for the materials from foreign sources. Taxes are taken into account for the financial analysis but are excluded in the economic analysis.
- **% equipment expected to be imported**: The proportion of equipment that is expected to be imported.
- **Corporate tax rate**: Level of taxation on business profits.
- **Current annual budget**: Yearly funds available to the city fund the public street lighting program.
- **Estimated annual increase (decrease) in budget for PSL:** Percentage expected annual increase or decrease in funding for the public street lighting program.
- **Social Cost of Carbon dioxide:** Estimated social cost of emission of one ton of CO2d. Used in calculating the costs and benefits in the economic analysis (not included in the financial analysis, as monetization of these costs/benefits are not taken into account in this version of the tool).

Please note that the boxes with an asterisk (*) are parameters that have a considerable impact on the financial performance of the project. Please, take extra effort to customize these parameters to your project context.

Figure 4 – Base Case Technical and Financial Parameters and Assumption Input Tables

TECHNICAL PARAMETERS AND ASSUMPTIONS			
Average operating hours per day	11.53	hours	Use Default
Averge life existing technology	29,628.00	hours	Use Default
Averge life LED	50,000.00	hours	Use Default
Averge life LED with dimming	55,000.00	hours	Use Default
Grid emission factor (tonnes CO2e/MWh)	0.2997	tonnes	Use Default

FINANCIAL PARAMETERS AND ASSUMPTIONS			
Retail cost of electricity for street lighting	419.79	R$/kWh	
Unsubsidized cost of electricity for street lighting	560.40	R$/kWh	
Real annual increase on electricity tariff (net of inflation)	2%		Use Default
Average price per luminaire - existing technology	415.41	R$	Use Default
Average price per luminaire - LED - existing case (pre-tax)	1,020.60	R$	Use Default
Annual decrease in LED prices	10.0%	%	Use Default
Additional cost of smart system (% increase to assumed LED price)	20.0%	%	Use Default
Additional infrastructure (civil works) cost per point	0.00	R$	Use Default
Installation cost per LED	87.50	R$	Use Default
Labor cost per lamp replacement - all technologies	175.00	R$	Use Default
Years of depreciation (default is straight-line)	13	years	Use Default
Tax on domestic equipment	46.0%	%	Use Default
Tax on imported equipment	75.0%	%	Use Default
% equipment expected to be imported	70.0%	%	Use Default
Corporate Tax Rate	30.0%	%	Use Default
Current annual budget / COSIP rev. to fund PSL (elec. + O&M)	300,000,000	R$	
Estimated annual increase (decrease) in budget for PSL	2.0%	%	
Social cost of carbon dioxide (CO2e)	30.00	R$	Use Default

3. Project Design

The 'Project Design' module allows the user to define and test project-specific implementation assumptions. Once the assumptions are entered, the module will automatically generate tables and charts that demonstrate the technical and financial performance of the project. Additionally, the section allows the user to save the current 'live project' as a scenario alternative. The user can save up to ten alternative project scenarios and also modify the assumptions of a previously-saved scenario.

3.1 Project Design

Page '3.1 Parameters and Assumptions' consists of two user interface components: the 'Project Design Parameters and Assumptions', and the 'Project Performance Dashboard'.

Project Design Parameters and Assumptions

In the Project Design Parameters and Assumptions box, you are required to enter the project implementation and financial variables. As in the previous section, **the boxes with an asterisk (*) are parameters that have a considerable impact on the financial performance of the project.** Please, take extra effort to customize these parameters to your project context. Below you will find the definitions of the required information. Definitions of the inputs are described below.

Definitions of Implementation and Technical Variables:

- **Total luminaries in the city:** Input from the inventory section. No input needed here.
- **% luminaires replaced:** Percentage of existing luminaries to be replaced by the project.
- **Total luminaires replaced:** Calculates the total luminaries to be replaced, using a pro-rata approach across all existing technologies and wattages.
- **Detailed Streetlight Replacement Settings:** allows users to enter a detailed replacement plan, specifying the exact technology and wattages that will be replaced by LEDs, rather than taking a pro-rata approach used with the "% luminaires replaced" approach.
- **Years to implement project:** Number of years to implement retrofit project.
- **Starting year of the project:** Year when the project starts LED installation.
- **Period of analysis:** Number of years of project costs and revenues used in the financial or economic analysis.
- **Include smart system? :** Asks user if the project includes a "smart system" to save energy and increase operational life of luminaries. The tool assumes a smart system includes centrally controlled lighting for dimming and trouble shooting. More or less sophisticated smart systems should be reflected by an increase or decrease in the % cost of the smart system, respectively.
- **Dimming hours per day:** If a smart system is included, how many hours per day is the dimming function applied.
- **Include manufacture warranty:** Does the city want to include a manufacture warranty for the LED luminaires?

- **Manufacture warranty duration:** If the city includes a manufacture warranty, how many years of warranty are provided?
- **% failure not warrantied:** Percentage of luminaires expected to fail during period of analysis that will not be covered under the manufacturer warranty.

Definitions of Financial Variables:

- **Revenue source:** Will project costs be paid using project-derived savings (i.e., project finance approach) or municipal budgetary/ear-marked resources (i.e., municipal finance approach)?
- **% financed by debt:** Percentage of the project financed by loan.
- **% financed by equity:** Percentage of the project financed by equity.
- **Cost of Debt:** real interest rate to be paid on loan (excluding inflation).
- **Cost of Equity:** real returns expected by equity holders (excluding inflation).
- **Loan tenor:** Years of loan amortization (repayment).
- **Estimated loan size:** Amount of loan principal.
- **Grace Period (Principal):** Number of years for which payments on loan principal are delayed.
- **Grace Period (interest):** Number of years for which payments on loan interest are delayed.
- **Total loan fees:** Loan service fees compared to total loan principal, expressed as a percentage.
- **Engineering + Design costs:** Cost of project engineering and design. If the user knows the project-specific cost for these services, click on the bottom box "Engineering + Design Cost (user input)" to enter the information. If not, then use the default cost provided and leave the 'user input' box unchecked.
- **Additional cost of smart system (% increase to assumed LED price):** Additional cost of a smart system per luminaire expressed as a percentage of the average price of an LED street light. As described above, the tool assumes a cost of 20% of the LED price for a smart system including centrally controlled lighting for dimming and trouble shooting. More or less sophisticated smart systems should be reflected by an increase or decrease in the % cost of the smart system, respectively.

Project Performance Dashboard

Once you have completed the input of the required variables, the tool automatically performs a variety of financial calculations and displays the estimated level of project performance in the tables and charts contained within the Project Performance Dashboard. At the top of the Dashboard, users need to select between Financial and Economic Analysis. Below, a variety of financial, energy, and emissions metrics are provided.

Definitions of these metrics are shown below.

- **Total investment over the period:** Total capital cost and loan servicing fees paid over the project's analysis period**.**
- **Total revenues over the period:** Total project-related revenues over the analysis period resulting from either project savings (i.e., savings on electricity and operation and maintenance) or from or from city's budget allocation/ ear-marked street lighting funds.
- **Total electricity savings over the period:** Gigawatt hours of electricity saved over the project analysis period.
- **Total GHG reductions over the period:** Tonnes of greenhouse gas emissions (expressed as carbon dioxide equivalent) reduced over the project analysis period.
- **Project Net Present Value over the period:** Sum of all expenses and revenues expressed in terms of present value (discounted by the weighted average cost of capital, WACC) over the project analysis period.
- **Equity Net Present Value over the period:** Free Cash Flows to Equity (project cash flows net of financing costs) expressed in terms of present value (discounted by the cost of equity) over the project analysis period.
- **Project Internal Rate of Return:** The internal rate of return (IRR) is the rate of return (discount rate) where the net present value of the project expenses and revenues occurring over the period of analysis is equal to zero. 'Project IRR' is calculated only including direct project cash flows (excluding the financing cash flows).
- **Equity Internal Rate of Return:** 'Equity IRR' is calculated as above but includes all cash flows including the financing expenses and revenues.
- **Payback period (non-discounted):** Number of years required to recover the cost of the project's initial investment. It is calculated by dividing the total cost by the annual revenue, both of which are taken in nominal (non-discounted) terms.
- **Return on Investment:** The net revenue from a project divided by the project's cost (expressed as a percentage). ROI can be used to compare the investment efficiency of the project to other investments opportunities.
- **Weighted Average Cost of Capital:** Overall cost of capital where each capital component (i.e., cost of equity and cost of debt) is proportionally weighted.
- **Debt Service Coverage Ratio (DSCR):** Ratio of Cash Flow Available for Debt Service (CFADS) to debt obligations due over the same period.
- **Minimum DSCR:** The lowest DSCR over the analysis period.

Below the performance metrics, the dashboard contains a series of charts that demonstrate the financial performance of the project over the analysis period. The first chart shows annual capital expenses, annual operating cash flow, and cumulative free cash flow. The second chart includes annual net revenue from operations, net revenue from investment, equity proceeds, debt proceeds, debt service, and cash flow. The third chart compares the public street lighting budget to expenditures from current and proposed electricity and replacement expenditures. The user can select the different charts by clicking on the buttons numbered '1' to '3', or display all charts by clicking the "Show All" button.

It is important to note that, the dashboard can show the financial performance results from either a 'financial' or an 'economic' perspective. The 'financial' analysis reflects the direct private benefits and costs (i.e., the cash flow) of the project, whereas the 'economic' analysis also takes into consideration the social costs and benefits (e.g., cost of carbon emissions) and opportunity costs. You can toggle between the two types of analysis using the dropdown menu at the top right corner of the dashboard.

Figure 5 – Project Design Parameters and Assumptions Input Table

PROJECT DESIGN PARAMETERS AND ASSUMPTIONS		
IMPLEMENTATION & TECHNICAL VARIABLES		
Total luminaires in city	424,977	n
% luminaires replaced	80%	%
Total luminaires replaced	339,982	n
Years to implement project	* 5	n
Starting year of project	2016	YYYY
Period of analysis	13	years
Include smart system?	Y	Y/N
Dimming hours per day	5	hours
Include manufacture warranty	Y	Y/N
Manufacture warranty duration	10	years
% failure not warrantied	10%	%
FINANCIAL VARIABLES		
Revenue source	* Project Savings	
% finance by debt	80%	%
% finance by equity	20%	%
Cost of Debt (net of inflation)	4%	%
Cost of Equity (net of inflation)	11%	%
Loan Tenure	* 10	years
Estimated loan size	421,500,000	R$
Grace Period (Principal)	0	years
Grace Period (Interest)	0	years
Total loan fees	1.0%	%
Engineering + design cost (default)	3,849,839	R$
☐ Engineering + design cost (user input)		R$
Additional Expenditures	0	R$
Annual Change in Additional Expenditures	0.0%	%

* The asterisk mark indicates parameters that have a considerable impact on the financial performance of the project.

Figure 6 – Project Performance Dashboard
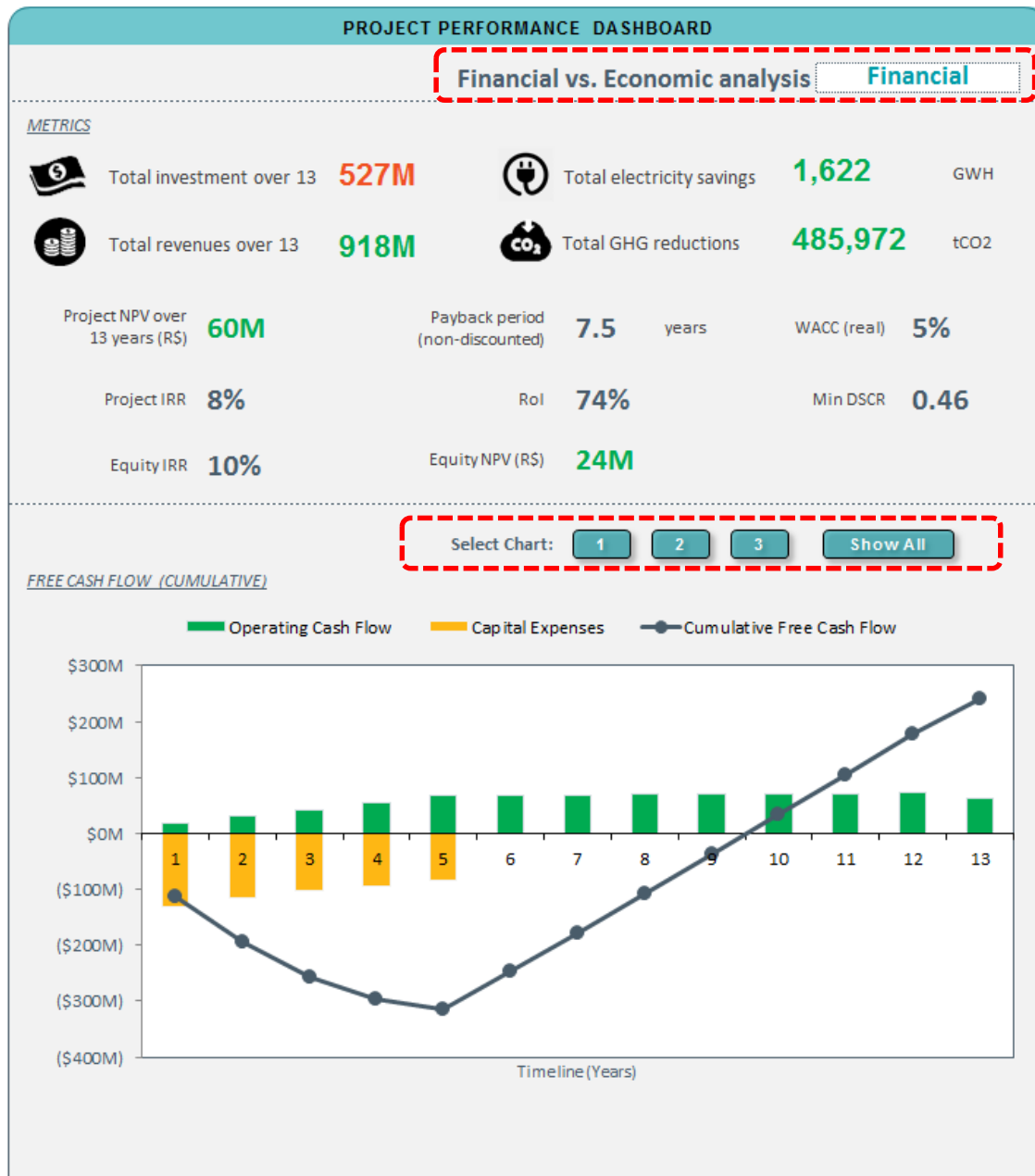
3.2 Save and Modify Scenario

Once you have defined the project parameters and financial analysis type (e.g., economic or financial) you can navigate to the '3.2 Save and Modify Scenario' page and save the current 'live' project as an alternative scenario. Saving the live project as a scenario allows you to compare it to other saved scenarios or to conduct a sensitivity analysis on key variables or assumptions (these features are described in more detail in the next section). To save a project, you will need to enter a unique scenario name in the 'Save a Scenario' box. You may also wish to provide a brief description that describes the key features/characteristics of the scenario. Once the name is defined, you need to press the grey 'Save' button to record the project details in the tool's database.

Figure 7 – 'Save Scenario' User Interface

On the same page, the user can also select and restore a previously saved scenario and make it the live project. To do this the user selects one of the saved scenarios in the dropdown located in the 'Modify a Scenario' box and then pressing the grey 'Open' button. Revisions to the scenario description can be written in the "Description" area.

Figure 8 – 'Modify Scenario' User Interface

4. Scenarios

In the 'Scenarios' module the user is able to compare multiple alternative scenarios and conduct sensitivity analyses on individual scenarios. The module also allows the user to generate exportable report outputs.

4.1 Scenario Selection

To use the scenario comparison feature of the tool, you will need to select (list) the scenarios you want to compare on the '4.1 Scenario Selection' page. Using the dropdown menus in the 'Scenario Name'

column you can select up to 10 scenarios. The order of scenarios within the list will determine their position in the comparison tables. Once you have selected the desired scenarios, press the blue 'Compare Scenarios' button to navigate to the '4.2 Scenario Comparison' page to view the results of your selection.

To use the sensitivity analysis feature, you will need to select the desired scenario by checking to relevant box in the 'Preferred Scenario' column. Note that the sensitivity analysis can only be run on one scenario at a time. Once you have selected the desired scenario, press the blue 'Sensitivity Analysis' button to navigate to the '4.3 Sensitivity Analysis' page and begin you evaluation.

Figure 9 – Scenario Selection Table

4.2 Scenario Comparison

The '4.2 Scenario Comparison' page displays a summary of the performance metric for each selected scenario. A cash flow diagram is also provided for each analysis as graphic representation of different levels of performance. The layout out of the performance information allows you to compare the various alternative scenarios and determine a preferred scenario. If you want to change the order of the scenarios, return to page '4.1 Scenario Selection' and adjust the list order.

Figure 10 – Scenario Comparisons Table and Charts

Scenario	Scenario 1a	Scenario 1b	Scenario 1c	
Descriptions	100% implementation	80% implementation	40% implementation	
Cash Flow Diagram				
PRIMARY METRICS				
Total Investment	318 M	318 M	318 M	
Total Revenue	799 M	799 M	799 M	
Total Electricity Savings	1,026 GWH	1,026 GWH	1,026 GWH	
Total GHG Reduction	307,440 tCO2e/yr	307,440 tCO2e/yr	307,440 tCO2e/yr	
SECONDARY METRICS				
Total NPV	152 M	152 M	152 M	
IRR	17.5%	17.5%	17.5%	
Payback period (non-discounted)	5 yrs	5 yrs	5 yrs	

Scenario	Scenario 1a	Scenario 1b	Scenario 1c
Descriptions	100% implementation	80% implementation	40% implementation
Min DSCR	1.53	1.53	1.53
KEY ASSUMPTIONS			
Total luminaires in city	300,000	300,000	300,000
% luminaires replaced	100%	100%	100%
Total luminaires replaced	300,000	300,000	300,000
Years to implement project	5	5	5
Starting year of project	2016	2016	2016
Period of analysis	13 yrs	13 yrs	13 yrs
Include smart system?	Y	Y	Y
Dimming hours per day	5	5	5
Include manufacture warranty	Y	Y	Y
Manufacture warranty duration	10 yrs	10 yrs	10 yrs
% failure not warrantied	10%	10%	10%
Revenue source	Economias do Projeto	Economias do Projeto	Economias do Projeto
% finance by debt	80%	80%	80%
% finance by equity	20%	20%	20%
Cost of Debt (net of inflation)	4%	4%	4%
Cost of Equity (net of inflation)	11%	11%	11%
Loan Tenure	10 yrs	10 yrs	10 yrs
Estimated loan size	254 M	254 M	254 M
Grace Period (Principal)	3 yrs	3 yrs	3 yrs
Grace Period (Interest)	3 yrs	3 yrs	3 yrs
Total loan fees	1%	1%	1%
Engineering + design cost (user input)	0	0	0

4.3 Sensitivity Analysis

The '4.3 Sensitivity Analysis' page allows you to conduct a sensitivity analysis and evaluate the viability of a project under various "what if" scenarios (e.g., what if the annual decrease in LED prices changes or what if the cost of electricity goes down?). The analysis allows the city to assess the likely range of performance it can expect from a street lighting retrofit investment and better understand the potential risks or benefits involved.

The left-hand side of the page contains the key variables that can be modified within the sensitivity analysis. These variables include:

- **LED price in Year 1 (%):** Percent decrease or increase in the anticipated cost per LED luminaire in the first year of the project compared to the reference case assumption.
- **Annual Decrease in LED prices:** Annual rate of change in LED luminaire costs compared to the assumed 10% annual decrease (expressed as percentage).
- **Additional cost of smart system:** Percentage decrease or increase in the cost of the streetlight dimming system compared to reference case assumption.
- **Cost of electricity in Year 1 (%):** Percent decrease or increase in the anticipated cost per kWh for street lighting electricity paid by the city in the first year of the project compared to reference case assumption.
- **Annual increase in electricity tariff (%):** Annual rate of change in the electricity tariff compared to the assumed Year 1 base cost (expressed as percentage).
- **Change in average LED life (%):** Percent change in the average number of hours that a LED street light lamp is expected to last compared to reference case assumption.

Using default assumptions, the tool automatically generates a reference, best, and worst case. The default reference case values are based on the user-selected assumptions entered in the Set Up module. By using the up or down arrows located next to each variable or by entering values directly into the blue cells, you can adjust a single variable or a combination of variables. You can adjust variables for the best case, worst case, or reference case as desired. You can press the grey 'Set All Variables to Default' button to restore the default variable assumptions. You can press the grey 'Set All Variables to Reference' button to make the best and worst case variables equal to the reference case variable assumptions. In this latter instance, the best and worst case lines will be hidden by the reference case line until you adjust the assumptions. Please note that while you are allowed to change the reference case variable assumptions, doing so essentially changes the project that you created in the Project Design module. The changes made to the reference case in the Sensitivity Analysis will not be saved as a scenario. Also note that the values in the variable cells will display a red color if an entered parameter is incongruent (e.g., if the parameter for the best case is worse than the reference case or if the worst case is better than the reference case).

As you adjust the best, worst, or reference case parameters, the chart on the right had side of the page will automatically update and show the impact on cumulative free cash flow. If the variables are logically applied, the best case (thin dark blue line) will be above the reference case (bold blue line), and the

reference case in turn will be above the worst case (thin red line). Other key financial performance metrics including NPV, IRR, Payback Period, WACC, and DSCR are shown in the table below the reference, best, and worst cases.

4.4 Reports

The '4.4 Reports' page allows the user to export PDF reports of an individual project scenario, the scenario comparison, or the sensitivity analysis. You can use the dropdown menu to select the desired report type, review the contents, and then press the grey 'Export Report' button to save the file as a PDF file. A message box will pop up asking you to name the file. The file will be saved into the same folder that your tool workbook file is located in.

5. Database

The 'Database' module allows the user to modify the default assumptions used in the project performance and sensitivity analyses. If desired, the user can replace the default values contained in the tables within this module. Care should be taken to ensure that the modified values use the same format and unit as the original value. Please note that all costs contained in this module are in US dollars. Elsewhere in the tool the US dollar values are converted to the selected currency and therefore the user must enter US dollar values here or the financial calculations will be incorrect.

Figure 11 – Sensitivity Analysis Variable Setting User Interface

Figure 12 – Sensitivity Analysis Dashboard

SENSITIVITY ANALYSIS DASHBOARD

KEY METRICS

	Reference Case	Best Case	Worst Case
Total Investment	318M	273M	364M
Total Revenue	707M	681M	659M

CUMULATIVE CASH FLOW

SECONDARY METRICS

	Reference Case	Best Case	Worst Case
Total NPV	110M	129M	61M
IRR	14%	17%	10%
Payback period (non-discounted)	5.8 years	5.2 years	7.2 years
RoI	122%	150%	81%
WACC (net)	5%	5%	5%
Min DSCR	1.39	1.51	0.96

Figure 13 –Default Assumptions Database (1)

DEFAULT COST ASSUMPTIONS (IN U.S. DOLLARS)		
Annual decrease in LED prices	%	10.0%
Additional infrastructure (civil works) cost per point	US$ / point	0
Engineering + project design cost	US$	1,099,954
Installation cost/luminaire	US$ / point	25.00
Current lamp replacement (equipment & labor) cost per point per year	US$ / point / year	60.00
Maintenance cost per lamp replacement - all technologies	US$ / point	50.00
Overhead cost of software for smart system (CAPEX)	US$	100,000
Additional cost of smart system (% increase to assumed LED price)	%	20.0%
Cost of existing tech. replacement parts upon failure	% luminaire cost	20.0%
Cost of LED replacement parts upon failure	% luminaire cost	40.0%
Social cost of carbon (CO2e)	US$ / tonne	30.00

OTHER LUMINAIRE PRICING ASSUMPTIONS		
Change in LED price in low price scenario (Year 1)	%	-15.0%
Change in LED price in high price scenario (Year 1)	%	15.0%
Year of LED price plateau	n	10
Annual change in current technology prices	% / year	-2.0%
Year of current technology price plateau	n	5

TAX ASSUMPTIONS	
Tax on domestic equipment	46.0%
Tax on imported equipment	75.0%
% equipment expected to be imported	70.0%
Corporate Tax Rate	30.0%

ELECTRICITY TARIFF ASSUMPTIONS		
Change in electricity tariff in year 1 - low case	%	-15.0%
Change in electricity tariff in year 1 - high case	%	15.0%
Real annual increase on electricity tariff - existing case	%	2.0%
Change in real annual increase on electricity tariff - low case	%	-15.0%
Change in real annual increase on electricity tariff - high case	%	15.0%

DEFAULT FINANCIAL ASSUMPTIONS		
Mortgage style amortization	% Principal	100.0%
Social cost of carbon (CO2e) in 2015	US$ / tonne	30.00
Maximum social cost of carbon (CO2e) in 2050	US$ / tonne	80.00