



SEAI LIGHTING AUDIT WORKBOOK USER GUIDE

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SEAI wishes to acknowledge the permission given to it by Zero Waste Scotland (<http://www.zerowastescotland.org.uk/>)to develop their Light Touch Calculator for use by Irish businesses.

DISCLAIMER: This workbook is intended to provide indicative results, SEAI cannot be held liable for any losses incurred though its use.

Executive Summary

The Light Replacement Calculator is designed to enable building users to analyse data from lighting surveys in more detail and calculate the annual savings which could be achieved by upgrading or retrofitting existing lighting.

The calculator is capable of collecting lighting survey information from up to 100 zones. Where a zone has more than one light type present this will reduce the number of zones that can be entered correspondingly. Information can be entered via the single Zone Input tab or can be entered in bulk via the Input Sheet. The user can enter varying complexities of lighting survey data depending on the type of surveys that are undertaken and can tailor the lighting information for individual zones.

The user is provided with recommended lighting replacement options that are relevant to the existing fitting type, wattage and any controls that are already installed.

Once data input is completed, the user can refine the data and add additional costs. The Light Replacement Calculator then undertakes an array of calculations to calculate the capital costs, annual savings (kWh, €, CO₂) and payback periods for the replacement fittings and generates a series of reports which summarise the capital costs, savings and paybacks. It also includes whole life costing to take account of periodic lamp replacement costs. The lifetime saving is based on the difference between net present value (NPV) after 20 years for the existing and replacement luminaires.

Introduction

The Light Replacement Calculator is designed to enable energy managers to easily collect and analyse lighting data and to calculate the annual savings which could be achieved by upgrading or retrofitting the existing lighting. The Light Replacement Calculator assist users by providing a series of tailored lighting replacement options and enables the user to review the relative annual savings that could be achieved for individual replacement options. It has example costs for different fitting types embedded within the tool.

The calculator is capable of collecting lighting survey information from up to 100 zones. Where a zone has more than one light type present this will reduce the number of zones that can be entered correspondingly. The user can enter lighting survey information including existing fitting types, wattage, quantities, daylight controls and motion controls. It provides the user with a selection of recommended replacement fittings from which the user has the option to select the most appropriate replacement option for each existing lighting type. The user also has the option to reduce the quantity of fittings and add daylight controls or motion controls. This functionality grants the user the flexibility to trial different replacement options and review the comparative differences in annual savings.

The tool undertakes an array of calculations to calculate the capital costs, annual savings (kWh, €, CO₂) and payback periods for each of the selected replacement fittings. It also includes whole life costing to take account of periodic lamp replacement costs. The lifetime saving is based on the difference between net present value (NPV) after 20 years for the existing and replacement luminaires. A series of reports can be printed which summarise the capital costs, savings, payback and 20 year NPV of savings both for the entire building i.e. combined replacement options and also in detailed view i.e. per replacement option. This allows the user to determine the relative benefits for an entire building lighting replacement programme but also on a more localised basis for individual zones.

The Lighting Audit Workbook has been developed in Microsoft Excel and is compatible with devices that have Excel compatibility. It has been tested with Excel 2016, 2013, 2010 and 2007. It has not been tested on Excel for Macs or Excel 2003. The Lighting Audit Workbook has been designed and formatted to be easily useable on compatible computers, laptops and tablets. This functionality means that users have the option to input lighting survey data directly into the Tool during a survey if they have a compatible tablet. Alternatively, users can collect lighting data using traditional data collection methods and input data to the Tool using a computer or laptop. The Zone Input tab is more suited to entry of data during the survey but the Input Sheet allows direct entry of bulk data.

1 Setting up the audit

The Lighting Audit Workbook has tabs along the bottom of the Excel document that allow the user to navigate through the workbook. Users should refer to this 'Light Audit Workbook User Guide' or the 'User Guide' summary contained within the workbook.

When setting up the Lighting Survey the user should start by selecting the 'Set Up' tab. If the user is entering the Tool for the first time then the data entry fields will be blank yellow cells (with the exception of the cost multiplier, real discount rate and Emissions Factors which use standard figures but can be modified).

If the user has previously used the tool, there may be data already entered into the data entry cells. If this is the case, then the user should click the 'New Project' box in the top right of the page. A Warning! message will display asking the user to confirm whether they would like to erase all data. The user should select 'Yes' to erase all data or 'No' to retain the data. It is recommended that a Master copy of the Lighting Audit Workbook is saved.

The user should enter the required data into the cells shaded yellow. Some of these cells will require the user to select an option from a drop down list. In cells that have a drop down list the user will only be able to select one of the designated options.

The 'Set Up' sheet is split into Building Details, Operating Hours, Survey Parameters, Costs and Emissions Factors.

Building Details

The user should enter the building name, organisation name and auditor name. The user should select the building type from the drop down list. The surveyed area can also be entered.

Operating Hours

The user should enter the building defaults for operating hours per day, days per week and weeks per year. The user will have the opportunity to tailor these operating hours for each zone later in the tool (on the 'Zone Input' tab).

Survey Parameters

When conducting a lighting survey, the auditor will need to record the type and quantity of luminaires. The auditor can additionally survey the lux levels and room dimensions; which are useful if the user is conducting detailed designs. If the auditor is planning to record lux levels and record room dimensions, 'Yes' should be selected from the drop down lists, and the user will be given cells to input this data in the 'Zone Input' tab. If the user selects 'No' then the recommended lux levels will be applied automatically and room dimensions will not be factored into calculations.

Costs

The user should enter the cost of their electricity tariff in pence per kWh. The electricity cost escalation is the % rate at which the electricity cost is expected to increase annually. The user should enter a typical electrical contractor cost per hour; this will later be included in the capital cost of replacement fittings. The cost multiplier option allows the user to inflate the cost of all fittings to take account of the user's procurement arrangements. For example, entering 1.1 would cause the cost of all fittings to be increased by 10%. The real discount rate is used in the whole life costing calculation and is given as 3.5% which is typical for many organizations.

Emissions Factors

The emissions factor is automatically set at the 2017 SEAI factor of 0.000475 tonnes CO₂ per kWh. The user can overwrite this if required and a link has been provided to lookup the latest value on the SEAI website.

Once the user has entered all required information into the 'Set up' tab the Lighting Survey audit should be undertaken.

2 Carrying out the audit

When carrying out the lighting audit users have the option to enter data directly into the Lighting Audit Workbook ; provided they have access to a compatible Microsoft tablet. The workbook has been designed and formatted to be easily useable on a tablet so that the user has the option to input the lighting directly into the 'Zone Input' tab whilst undertaking the lighting audit. Alternatively, users can collect lighting data using traditional survey methods and input the data after the audit. This data may then be entered in bulk in the 'Input Sheet'.

General Zone Information

The 'Zone Input' sheet requires the user to enter the zone name, which will most likely be the room number or room name, and the activity that occurs in this room e.g. office, kitchen, toilet etc. The user should select the activity that occurs in this zone from the drop down list of options.

The selection of the zone activity will automatically set the recommended lux level; for example, offices have a recommended lux level of 300 compared to toilets which are 100 lux. If the user has chosen to survey lux levels (as selected in the 'Set Up' tab) then a box will be visible for the user to manually input the lux levels recorded during the lighting survey. This can be used to inform the choice and number of fittings when considering a replacement scheme.

If the user has chosen to survey room dimensions (as selected in the 'Set Up' tab) then boxes will be visible for the user to input the room dimensions (width and length in metres). If room dimensions are entered these will be used to calculate watts per m² which is a useful spatial metric for determining appropriate lighting levels.

The user has the opportunity to override the building averages for operating hours per day, days per week and weeks per year. The user may want to do this if the zone being entered has hours, days or weeks that differ from the average building figures e.g. kitchens, meeting rooms or toilets.

Current Luminaires

The next section requires the user to input the current luminaires. The user should select the relevant fitting type (e.g. T8 fluorescent tube) from the drop down list. This then allows the selection of the specific fitting for that type in the box below (the list is limited to standard fittings which are likely to be surveyed).

Selection of the fitting will automatically generate a figure for the circuit watts. For fitting types that are not included in the drop down list, the user has the option to input an over-ride circuit watts value (if no over-ride changes are required then this should be left blank).

The user should enter the quantity of each type of fitting present for each zone. If daylight or presence (motion) controls are currently located in the zone, then the reduction in output should be input into the daylight and motion rows. The user should be aware that the product of the reductions from daylight and presence controls are used to determine the total reduced hours (revision to hours).

Recommended Luminaires

After the user has entered the current fittings, quantities and control reductions (which will give the power output of the fittings), the user is required to input the recommended replacement fitting type/lamp. The drop down list for the recommended fitting type/lamp will provide the user with the different recommended options for replacement. If a different fitting type/lamp altogether is desired, the user can choose the type 'Other', which will provide a much longer drop down box of all fitting types/lamps available in the workbook.

The circuit watts will be calculated automatically for each recommended fitting type/lamp that the user has input, but this can be overridden if necessary. The user should again enter the quantity of recommended fittings types/lamps. If the lighting survey has identified opportunities to reduce lighting (e.g. if lux levels are above the recommended levels) then the user should account for this by reducing the quantity of replacement fitting types/lamps.

If additional controls (e.g. daylight reduction / motion reduction) are planned to be installed, then the user should also enter the revised reduction percentages for each of these. Finally, the user should enter the time that it will take to fit the luminaires, drivers or sensors (in minutes per fitting) and the total costs of any sensors (€).

Adding the Zone

Once all information has been input then the user should click 'Add Zone'. The data from the Zone Input will then be added to the relevant tabs within the workbook. The user can then go to the 'Input Sheet' tab where there is the opportunity to refine the results. At this stage the user can either refine the results in the 'Input Sheet' tab or return to the 'Zone Input' tab and enter data for a new zone.

Once a zone has been 'added' then the data on the 'Zone Input' tab will be erased to allow a new zone to be entered. If entering more than one zone, then the user should repeat the process until all zones have been successfully input and 'added' to later tabs.

Bulk Data Entry Method

As an alternative to entering data via the 'Zone Input' tab, the same data can be entered directly in the 'Input Sheet' tab. This tab has a dedicated row for each existing luminaire and its replacement. Zone information should be added for each row even if there is more than one type of fitting in a given zone. Data should only be entered in the cells shaded in yellow. The cells in white will then update based on the data entered and the parameters entered in the 'Set up' tab as in section 1 above. Note that you should only select a replacement fitting from the 'Suggested Replacement List' OR the 'All Replacements List', not both. If you do enter both they will turn red to warn you.

3 Refining the results

Once all 'Zone Input' data has been input the user has the opportunity to refine the results. The 'Input Sheet' tab is the repository for all the data that has been input via the 'Zone Input' tab. The 'Input Sheet' tab has a dedicated row for each existing luminaire / replacement luminaire that was input for all zones that have been added. The user can therefore review and refine the data for individual luminaires. Only the cells shaded yellow can be changed.

The user has the opportunity to refine various options such as the Replacement Fitting, Quantity of Fittings and Fitting/Sensor costs. These refinements allow the user to amend/update any data entries, explore multiple replacement fittings with ease and determine the relative impacts on Annual Savings, Total Cost, Pay Back and 20 year NPV of savings.

4 Generating reports

The Lighting Audit Workbook develops a Main Report, Summary Schedule and a Fittings Report which are all automatically updated once the user has submitted data via the 'Set Up' and 'Zone Input' or 'Input Sheet' tabs.

Main Report

The Main Report is a summary of all information that has been input into the workbook and provides the overall figures for all replacement options for all zones. The Main Report does not have a detailed breakdown for each replacement option; for detailed breakdowns the user should refer to the Summary Schedule or Fittings Report.

The first section of the Main Report provides an overview of annual cost savings identified, 20 year savings. The annual kWh and cost savings are shown graphically by comparing consumption and cost of existing lighting (before) and replacement lighting (after). Additional graphs are presented to show:

- Top ten zones ranked by annual savings
- Top ten zones ranked by payback
- Top ten zones ranked by 20 year savings
- Savings by zone activity

At the bottom there is summary table of survey information. This summary provides a comparative analysis of the changes to the total number of fittings, different types of fittings, total wattage, watts/m² and zones with controls between the existing fittings (before) and the replacement fittings (after).

Another table provides a comparative analysis of the total energy consumption 'before' and 'after' in both annual kWh and annual cost (€). a final table contains the savings identified; this is a summary of the total annual savings (kWh, CO₂, energy cost saving). This section also contains economic figures including the total capital cost and total payback period and 20 year NPV of savings for all replacement fittings.

Summary Lighting Replacement Schedule

The Summary Schedule provides a detailed breakdown of each existing lighting type that was input and each chosen replacement lighting type that was selected. This Summary Schedule provides a detailed breakdown of the capital cost, savings (kWh, Cost, CO₂), payback and 20 year NPV of savings for each replacement option. The Summary Schedule can be used to examine each existing lighting / replacement option on an individual basis and have a detailed breakdown of the relative capital costs, savings, paybacks and whole life savings.

Fittings Report

The Fittings Report provides a quantified list of all existing fittings and replacement fittings that were input / selected in the workbook. The Fittings Report allows the user to review the changes in lighting types from the existing lighting to the replacement lighting.

5 Conclusion

The Lighting Audit Workbook allows users to easily analyse data from lighting surveys, suggests relevant replacement lighting options and calculates the annual savings for individual replacement options.

It enables building users to quantify the capital costs, annual savings (kWh, €, CO₂), payback periods and 20 year NPV of savings for replacement lighting options. This should assist users to determine the relative costs-benefits for replacing lighting.

The workbook generates a series of useable reports which can be used both for technical and non-technical audiences.