Electricity Theft – User Guidance Document

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energysavingtrust.org.uk

All views expressed in this report are solely of Energy Saving Trust

About Energy Saving Trust

Energy Saving Trust is the UK's leading impartial organisation helping people save energy, reduce carbon emissions and use water more sustainably. We do this by directly supporting consumers to take action, helping local authorities and communities to save energy, using our expert insight and knowledge, providing quality assurance for goods and services and by working in collaboration with national and international governments and organisations.

This work was carried out by Energy Saving Trust and commissioned by Electralink.

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Version Control

Version	Corresponding tool	Date	Authors	Signed Off by	Notes and changes
1.0	2.0	28 April 2020	William Jamieson	James Wakelin	Updated previous guidance document to correspond to latest tool.
1.1	2.1	27th August 2020	William Jamieson	Andrew Tod	Added details of the reset button functionality.

Contents

1. Introduction

This guidance document gives an overview of how the Electricity Theft Calculator should be completed in order to estimate the electricity consumption in a domestic or commercial property. This document should be used with the corresponding version of the tool which can be found in the Version Control section on page 2. The tool is designed to be as simple as possible while capturing an adequate amount of data to come up with a good estimate of the quantity of electricity which a home or business could be expected to consume.

In addition to the guidance given in this document there are tips provided within the tool itself. In the top right-hand corner of many of the boxes in the spreadsheet tool there is a small red triangle. Hovering the mouse pointer over these triangles will make a window pop up with information about how to complete that section.

This tool can make six different estimates of electricity consumption:

- Domestic Estimation
    - If the property is a domestic residence and meter reading data is not available, then this calculator should be used to estimate the electricity consumption over the theft period.
- Commercial Estimation
    - If the property is a commercial property and meter reading data is not available, then this calculator should be used to estimate the electricity consumption over the theft period.
- Industrial Estimation
    - If the property is an industrial property and meter reading data is not available, then this calculator should be used to estimate the electricity consumption over the theft period.
- Clamp Meter Readings
    - If meter reading data is not available and a clamp meter is available to make measurements of the load in the building, then this calculator should be used to estimate the electricity consumption over the theft period.
- Cannabis Farm Estimation
    - If the property is the location of a cannabis farm and meter reading data is not available, then this calculator should be used to estimate the electricity consumption over the theft period.
- Baseline Estimation
    - If the property does have meter readings, then this calculator should be used to estimate the electricity consumption over the theft period.

Please note that the tool does not calculate the cost of the electricity stolen but simply estimates the number of kilowatt hours (kWh) used.

2. Customer information

This section of the tool allows the assessor to add contextual information about the customer and assessment. It contains information about who the customer is (both private individuals and businesses), the address and dates.

2.1 Calculation type

It is important to select the correct calculation type. There are five options:

- **Domestic** – where you can select the house type, fuel type, age, appliances and insulation levels.
- **Commercial** – where you can select the type of commercial premises, operating hours, appliances and lighting.
- **Industrial** – where you can estimate the electricity use by using floor area and industry type.
- **Clamp Meter Reading** – where you can estimate the electricity used based on current readings
- **Cannabis Farm** – where you can select the lighting type, growing area and cultivation appliances.
- **Baseline** – where you can estimate the total consumption using meter readings.

Selecting the correct calculation type will allow you to navigate to the relevant section of the tool and will display the correct output in the results section.

2.2 Customer address

This field can be used to record the address of the house or business establishment being assessed.

2.3 Customer name

These fields can be used to record the name of the customer as well as the business name if applicable.

2.4 MPAN

This field can be used to record the Meter Point Administration Number of the meter being assessed. If more than one meter has been tampered with then it will be necessary to complete a separate calculation for each meter.

2.5 Dates of theft

These fields can be used to record relevant dates associated with the theft:

- Assessment Date - the date when the tool was completed to obtain an estimate of the quantity of electricity stolen.
- Start Date of Theft – the estimated date when the theft was initiated (please use the notes if it is not possible to give a specific date).
- End Date of Theft – the date when the theft was discovered / rectified.

2.6 Notes

This field can be used to add any notes or relevant information about the customer, or the property being assessed. Tip: if you wish to start a new line within this field please press Alt Return.

3. Domestic calculation

If the property which is being assessed is a home, the Domestic calculation should be selected. The navigation buttons will then take the user to the Domestic calculation section where a selection of attributes describing the property and main energy efficiency measures will be input in order to estimate the electricity consumption.

3.1 Region

The region which you select should be the Government Office Region in which the property is found.

In England these are:

- North East
- North West
- Yorkshire and The Humber
- East Midlands
- West Midlands
- East of England
- London
- South East
- South West

In addition to these English regions we have included options for Scotland and Wales. If the property is in England and you are unsure of the correct region then please go to the region/nation profile search section of the Nomis website: https://www.nomisweb.co.uk/reports/lmp/gor/contents.aspx. Input the property's postcode in the postcode search box, click search and the correct region will be displayed.

3.2 Property type

There are six options for dwelling type within the tool. These are defined as follows:

- Flat / maisonette
  - A flat is a self-contained unit which occupies part of a building and is accessed via a shared front door. Flats may be found in purpose-built blocks or in subdivided houses and tend to be laid out over a single floor. A maisonette tends to be laid out over multiple floors and has its own entrance but shares a building with another maisonette (or is sometimes found over retail premises).
- Bungalow
  - A house with one floor only (although chalet bungalows which have an additional room in the loft space fall into the bungalow category).
- Mid terrace
  - A house with more than one floor that is found in the middle of a row of terraced houses (i.e. it shares one internal wall with the house on each side).

- End terrace
    - A house with more than one floor that is found on the end of a row of terraced houses (i.e. an end terrace house shares one internal wall with the neighbouring mid terrace house).
- Semi-detached
    - A house with more than one floor that shares one inside wall with another house or building.
- Detached
    - A house with more than one floor that does not share an inside wall with another house or building.

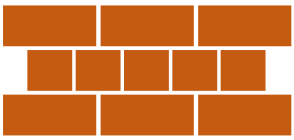
3.3 Heating fuel

- **Electric heating** – This would include households whose property's main heating systems are electric storage heaters, electric panel heaters and electric boilers etc.
- **Other heating** – This would be for anything else that doesn't come under electric heating.
- **Unknown heating** – If the main heating system is unknown select this option and the tool will assume that electric heating is not used for a conservative estimate of the electricity theft.

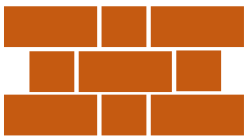
3.4 Property age

Pre-1930s

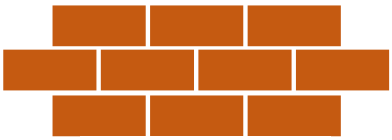
The easiest way to spot a pre-1930s home is to check the wall construction. Most homes built before 1930 were of solid wall construction while most homes built after this date were of cavity wall construction. It is possible to identify the likely wall construction by observing the arrangement (or 'bond') of the brickwork. There are two bonds which were used in solid wall construction: English and Flemish. These have an alternating pattern of 'stretcher' (the side of the brick) and 'header' (the end of the brick). Cavity wall properties (which were mostly built from 1930 onwards) tend to have their bricks arranged in a Stretcher bond where only the stretchers can be seen:



English Bond



Flemish Bond



Stretcher Bond

- There were three main architectural styles during this period: Georgian (around 1720 to 1830), Victorian (around 1830 to 1900) and Edwardian (from around 1900 to 1920).
- Bay windows (window spaces projecting out from the front wall of a house) and sash windows (which had panels which slide vertically rather than opening outwards) were common to all three periods.
- Georgian homes were generally larger with high ceilings and flat or shallow pitched roofs, often hidden behind a parapet.
- Victorian homes tended to have steeply pitched roofs (which meant that many have had loft conversions in order to increase the internal space) with slate roof tiles. As a typical Victorian home had a fireplace in nearly every room the roof of a Victorian home usually has many chimney pots.
- Edwardian homes tended to be wider than Victorian homes, allowing space for a full-size hallway.
- Georgian homes were mostly built as detached and semi-detached properties, Victorian homes were mostly built as terraces and Edwardian homes were also mostly built as terraces and are typically found in the suburbs of cities and towns (generally

speaking housing within a town or city tends to be more modern the further out from the centre you go as urban areas have expanded over the centuries).

- In the 1920s and 1930s semi-detached homes predominated. These often had pebble dash renders or were half timbered (i.e. had visible timber frames infilled with a render) and featured leaded glass windows. Decorated wooden gable ends (the triangular end section of a pitched roof) were popular along with wooden balconies and verandas and porches.

1930-1972

- Predominantly semi-detached homes were built during this period but the late 1940s saw the start of the large post-war council housing construction programme with large numbers of socially rented flats built
- Modern architectural styles also arose during this period with Art Deco designs such as curved metal window frames. Art Deco properties often had features reminiscent of old cruise liners and usually had flat roofs.
- Bungalows became popular during the inter-war period. Bungalows constructed during the 1930s to the 1950s tended to have square floor plans while bungalows built during the 1960s tended to have rectangular floor plans. Chalet bungalows (which included rooms built into the pitched roof) also started to appear.
- During the 1930s towns and cities expanded as people moved out to the suburbs which were becoming better connected with public transport links
- The typical house of the 1930s was smaller than houses that came before but often featured a garage as cars were becoming more popular.
- Design features of houses prior to the 1950s included herringbone decorative brickwork (with bricks laid at 90-degree angles to each other in a herringbone pattern) and red clay roof tiles rather than slate roof tiles.
- So called New Towns were constructed after the Second World War around existing cores to house people displaced from damaged homes. These were mostly located around London with a few sites in the north of England. By the end of the 1940s Basildon, Bracknell, Corby, Crawley, Harlow, Hatfield, Hemel Hempstead, Newton Aycliffe, Peterlee, Stevenage and Welwyn Garden City had all seen rapid development.
- The modern house form which is familiar to us today emerged during the two decades after the Second World War.
- Bay windows had disappeared, as had sash windows and there was little in the way of the embellishments seen in previous housing styles
- Semi-detached homes continued to be very popular during this period, but purpose-built flats comprised 20% of homes constructed during this period as post-war social housing construction gathered pace.
- Concrete became popular after the Second World War, especially in social housing developments and high-rise blocks.
- A second wave of New Towns were constructed in the early 60s including Redditch, Runcorn, Skelmersdale, Telford and Washington.
- A third wave of New Towns was constructed in the late 1960s including Milton Keynes, Northampton, Peterborough, Telford and Warrington.

1972-1999

- Tower block construction at the start of this period tended to be more medium rise than high-rise.
- 1970s homes were generously sized compared with homes built in the 1980s and later with houses typically having a generous front and rear garden. They also tended to have larger windows than houses which came before or after.
- 1980s homes often had large driveways or garages to accommodate two cars

2000 onwards

- Modern homes are smaller than equivalent homes constructed in previous decades
- Recently constructed homes will tend to look fresher as they have not had a chance to weather as much as older properties
- There is a tendency towards more minimalist and contemporary design features during this period.
- Eco-friendly materials and use of tubular steel, laminated plywood and fibreglass gained more prominence.

3.5 Number of bedrooms

The number of bedrooms is used in the tool as a proxy to estimate the size of a property. If you can gain access to the property, please count the number of bedrooms and please include rooms which would have originally been bedrooms but may have been converted to other uses (e.g. into a study).

If you are unable to gain access to the property, please estimate how many bedrooms there are likely to be given the size of property and the layout of similar properties. This can be done based on a visual inspection or by identifying the house on Google Street View.

3.6 Wall insulation

Identifying whether a house has cavity wall insulation can be challenging as the signs of the installation can be covered up by skilful mortar work, painting or rendering.

Cavity walls came into general usage in housing construction during the early 1930s so the first step to identifying whether a house has cavity wall insulation is to establish whether it has cavity walls. Please see the section on identifying Pre-1930s homes for information about different wall construction. If the property is a pre-1930s home, then it will be of solid wall construction and it will be very unlikely to be insulated as solid wall insulation is currently quite rare.

Homes built since about 1990 were constructed with cavity wall insulation fitted. Homes built before this date were built with unfilled cavity walls however there has been a lot of activity retrofitting of cavity wall insulation in older properties, especially since the 1990s. Now, over two thirds of cavity wall homes have cavity wall insulation.

Homes which have had cavity wall insulation fitted post-construction will have had 20mm to 30mm holes drilled at regular intervals so that the insulation pump could be inserted into the wall. These holes are usually found just below the ground floor windowsill up to near the top of the wall and will usually be spaced a meter or two apart. These holes will have been filled in with mortar which may be a slightly different colour to the mortar in the rest of the wall.

Note that homes which are exposed to strong wind and rain are generally not suitable for cavity wall insulation and should not have had it installed.

3.7 Roof insulation

Conventional loft insulation in an unconverted loft with a pitched roof is quite easy to identify if you have access to the loft space. In most cases you will be able to see the loft insulation fitted between the roof joists (the horizontal beams which run across the roof space). In some cases, the insulation will be laid across the joists as well (this is an example of a fully insulated loft space). More often the insulation is laid up to the top of the joists only. Loft insulation can come in the form of rolls of fibrous materials (mineral wool or sheep's wool) or rigid insulation boards.

In some cases, the joists will have been boarded over in order to use the loft space as storage. If this is the case, it may be difficult to establish whether the loft is insulated or not. However, it should be possible to see the insulation under the boards at the edges of the loft or near the loft hatch.

If the loft has been converted into an additional living area in the last two decades then insulation should have been fitted between the rafters (the sloping beams which create the pitch of the roof), however, in older loft conversions, it may not have been done. Insulating the rafters will normally involve fitting a stud wall which will make the depth of the roof considerably greater than the normal depth of just the uninsulated rafter and plasterboard.

3.8 Domestic appliances

This section allows you to specify the appliances within the household. The tool already includes an average consumption for appliances, but this can be tailored if needed.

3.9 Enable appliance adjustment

If you select '*Yes*', this will enable an adjustment to the electricity consumption according to the number and type of appliances you enter into the following boxes. If the number of appliances is unknown, please select '*No*'.

3.10 Kitchen appliances, lighting, electronics & computing

These boxes include a selection of household appliances. Enter the number of appliances for each appliance type; this will adjust the electricity consumption to reflect this. The more appliances found in a household the higher the consumption potentially will be.

3.11 Hot tub

This allows for the user to add electricity consumption from a hot tub. Enter the location and size of the hot tub to adjust the overall consumption figure.

4. Commercial calculation

The commercial tool allows the user to estimate the electricity consumption of commercial buildings such as takeaway, restaurants, pubs, mini markets, corner shops, offices and beauty salons. Unlike the domestic calculator which is based adjusted usage data from meter readings of dwellings across the UK, the non-domestic calculation models the energy usage from first principles, based on the heat requirements of the establishment, plus the energy used and excess heat generated by appliances.

4.1 Commercial heating

4.1.1 Region

Selecting a region helps to estimate how much heating the business requires. If there is any uncertainty in which region the business is located in – then a postcode lookup is available on the website: https://www.nomisweb.co.uk/reports/lmp/gor/contents.aspx.

4.1.2 Energy efficiency band

Selecting an energy efficiency band will allow the calculation to work out what the typical energy consumption per square metre should be. If this is unknown the average energy consumption per square metre will be used.

4.1.3 Business Type

Select the type of business from takeaway, restaurants, pubs, mini markets, corner shops, offices and beauty salons that you are assessing.

4.1.4 Operating hours and floor area

Enter the opening hours of the business and the number of customers per hour, this will establish the period of time electricity is likely to be used and indicate at what rate. If these are unknown these fields can be left blank. Entering the floor area will also establish the scale of the business. A larger area will see an increase the electricity consumption.

4.1.5 Primary heat energy source

Select the main heating type, either electricity or other. Other includes all other heating systems that are not electric heating.

4.1.6 Electric heating system type

If the main heating type is electricity, please select the type of heating system set up. If electricity is not the main heating type, please ignore this selection.

4.2 Commercial appliances and light

4.2.1 Use of gas appliances

Check this box if gas appliances are being used on the premises, for instance gas cookers.

4.2.2 Appliance energy class

Select how energy efficient the appliances are; generally modern appliances tend to be more energy efficient.

4.2.3 Appliance Usage

Select to what extent the appliances are used, if the appliances are used heavily then select high.

4.3 Lighting calculation selection

There are two ways lighting electricity consumption can be calculated:

- **Based on user input** – Lighting energy consumption will be based on the number of light bulbs entered in each box.
- **Based on floor area** – If the bulb number and type is not known then the lighting energy consumption can be based on the floor area of the premises.

4.3.1 Lighting user input

Use this box to indicate the number and type of bulbs present with their associated power rating in watts.

4.3.2 Kitchen appliances selection

If the details of the kitchen appliances are known for takeaways, pubs and restaurants then check this box. This will take you to the next page which will give the opportunity to give more information on the appliances.

4.4 Commercial kitchen appliances

Enter the number of each appliance which are present in the premises.

5. Industry Calculations

5.1 Industrial demand

Enter the relevant power supply system for the industrial category of interest (e.g. wood production, quarries, recycling etc.). The following options are available:

- Single phase
- Three phase (line to line voltage)
- Three phase (line to neutral voltage)

Enter the load current (in amps) and power factor of the premises. The voltage is automatically populated from the power system type selection. The resulting installed power in MW is shown in the last column.

For warehouses, enter the floor area in m^2 for the warehouse to account for their electricity consumption.

NOTE: only fill in one line (industry category) of the table as the tool selects the first non-zero value within the sheet as the output.

6. Clamp Meter Readings

6.1 Power Supply Type

You can select the power supply type from the menu. Either specify single phase (measure current on the single conductor) or three phase (measure the current on each conductor).

6.2 Custom properties

Additional details can be added if known. They are:

- Custom voltage. The default voltage for both single and three phase is 230 V. If more accurate information is known, enter this value into the box. Leave blank for the default.
- Power factor. The power factor can be entered if known. This will scale the power produced accordingly.

6.3 Current measurements

Up to 5 separate load profiles can be measured and added to the tool. Up to 5 readings can be input per phase and an average of those will be used. Leave any unused reading values blank.

6.4 Time profiles

The time for each profile can be defined either in hours per day or as a percentage allowing variation in use between morning/afternoon/night or weekday/weekend. The total time must add up to 24 hours or 100% respectively. A macro enabled button labelled ‘Scale Profile Time’ allows the time to be automatically scaled to sum to the correct amount although users should then double check the times are appropriate to what they desire.

7. Cannabis Farm Calculations

7.1 Calculation Type

There are two methods for calculating the electricity consumption of cannabis farms:

- By farm equipment properties – based on power of lighting/additional equipment
- By clamp meter readings – based on current measurements for the farm

7.2 Farm Equipment Properties

7.2.1 Lighting calculation selection

When using the farm equipment properties method, you can calculate the electricity consumption for cannabis farms in two ways:

- Based on actual lighting – you can enter the number and power of each light bulb types.
- Based on floor area – an average value will be used based on the floor area.

7.2.2 Actual lighting

Use this box to enter the number of bulbs present by type and the average power in watts.

7.2.3 Growing area inputs

This box allows you to input the dimensions in metres in terms of length and width. Alternatively, the growth area can be entered in square metres if known.

7.2.4 Cannabis cultivation equipment

The number of additional electrical devices and the power rating in watts used in cannabis cultivation can be input. Typical figures for each device type are preset in the power rating column if the actual value is not known.

7.3 Clamp Meter Readings

7.3.1 Power supply type

You can select the power supply type from the menu. Either specify single phase (measure current on the single conductor) or three phase (measure the current on each conductor).

7.3.2 Custom properties

Additional details can be added if known. They are:

- Custom voltage. The default voltage for both single and three phase is 230 V. If more accurate information is known, enter this value into the box. Leave blank for the default.
- Power factor. The power factor can be entered if known. This will scale the power produced accordingly.

7.3.3 Current measurements

Current measurements should be input for the lighting and non-lighting phases. Up to 5 readings can be input per phase and an average of those will be used. Leave any unused reading values blank.

7.4 Growth Periods

The user can define the length of the grow periods in weeks and the hours for the lighting in the two phases of growth. If left blank, the tool will use the default values.

8. Baseline Calculations

If meter readings are available for the premises that cover a reasonable period of time, during a period when theft did not take place, then the baseline calculation should be used as this is the most accurate means of estimating consumption. Ideally, this should be at a similar time of year to the theft period to account for seasonal variability.

8.1 Baseline meter readings

Details of a period of known consumption when theft has not taken place can be entered in two ways:

- Using two meter readings with their corresponding dates.
- Entering an energy value in “Total baseline consumption” and providing the dates over which this took place.

8.2 Theft period meter readings

Similarly, details of the theft period consumption can be entered in two ways:

- Using two meter readings with their corresponding dates.
- Entering an energy value in “Total theft period consumption” and providing the dates over which this took place.

Once the information has been added for both, a daily consumption for before and during the theft period is calculated and scaled to the duration of the theft period defined on the Customer Information tab to give the estimated results.

9. Results

The Results section pulls in some of the information from the Customer Information section and displays the estimated electricity consumption during the theft period. Electricity consumption results are rounded to the nearest 100kWh.

10. Reset Buttons

10.1 Macro enabled reset buttons (recommended)

The tool incorporates two reset buttons on each sheet. Macros should be enabled for this functionality to work. The ‘Reset Page’ simply resets the page you are currently on back to defaults, while the ‘Reset Tool’ button will reset all pages to their defaults. This clears all data already input throughout the tool so should not be used unless the user is sure they want to do this. A warning will appear which the user will have to confirm prior to reset.

10.2 Reset without macros

Individual page resets of the tool are not possible without macros. To reset the whole tool without using macros, the original file should be saved in a template location as a Read-only file. EST will provide a version of the tool in this state. To reset the tool with the default values, the user should simply re-load this version and use ‘Save As’ for each scenario.

11. Tool Expiry

The tool has functionality built in which will prevent it from delivering results after a certain date. This has been done to ensure that the latest version is always used by assessors. In the run up to the tool expiring, the tool will give the user a warning message that they should download an updated version. Once the final expiry date has been reached a further warning will be given. The warnings appear in red text in the Customer Information section and the Results section.

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Underpinned by our independent status and impartial perspective, we offer a depth of energy expertise, but we're not content to stand still. Our goal is to find new and better ways to drive change and reduce UK energy consumption.

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