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IMPLEMENTATION GUIDE for Caribbean Households to Conduct an Energy Self-Audit

ConserVE-2-SaVE

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An Association Of Electric Energy Solution Providers

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1 Introduction

During your lifetime, you will likely spend thousands of dollars on energy costs in your home. This sum includes the cost of cooling your home, running appliances, using electricity, and so much more.

The amount that households spend, depends on a multitude of factors, like whether things are powered by electricity, oil, propane or even wood; the current cost of certain fuels; and how much energy you are actually using.

To keep your energy costs from being too high, you want to ensure you are being both efficient and conservative in your energy use. One easy way to ensure this is to take the time to have a home energy self-audit done.

While a professional home energy assessment is the best way to determine where your home is losing energy and where you can save, you can start to identify areas of high energy consumption and simple cost saving potentials by conducting your own energy self-audit. This "do-it-yourself" home energy assessment will not be as thorough as a professional home energy assessment, but it can help you to better understand your home's energy consumption pattern and its energy performance to pinpoint some of the easier areas where you can make a change.

In the Caribbean islands, most of the energy consumed inside a household is electrical energy (electricity) to power electric home appliances and lightbulbs. Determining how much electricity your appliances and home electronics use can help you understand how much money you are spending to use those appliances. Use the information presented in this Guide to estimate how much electricity an appliance is using and how much the electricity costs are so you can see how much you are able to save from changes in your consumption behaviour or decide whether to invest in a more energy-efficient appliance.

Why is an Energy Self-Audit important?

An energy self-audit is important because it is designed to help homeowners assess their energy consumption and find ways to create more efficient energy use. Going through an energy self-audit will identify different changes, big and small, that homeowners can make to help significantly reduce utility bills. By doing an energy self-audit and identifying areas for improvement, you will not only lower your utility bills, but you also reduce your carbon emissions.

2 Understanding Energy and Power

Before carrying-out an energy self-audit in your home, it is important to examine and understand the difference of power (P) in watts (W) and energy (E) in watt-hour (Wh),

Based on above, Energy and Power (click on links for more information) are closely related but are not the same physical quantity.

Energy is the ability to cause change; power is the rate at which energy is moved or used.
Energy is the ability to create a change, for example, creating motion. Tasks (like lifting a box) require an amount of energy to complete.

Power is how fast energy is used or transmitted - power is the amount of energy divided by the time it took to use the energy.
The relationship between energy and power is expressed by these formulas:

E(Wh) = P(W) × t(h) or **P(W) = E(Wh) / t(h)**

Example: What is the energy consumption (E) when an electric device demands 5 Watts of average power (P) for a duration (time = t) of 3 hours?

Result: E = 5 W x 3 h = 15 Wh

In general, the base unit of energy is Joule (J). However, when it comes to electricity, energy is usually expressed in watt-seconds (Ws), watt-hours (Wh), kilowatt-hours (kWh) or Megawatt- hours (MWh).

- The numerical relationship between Joule and Ws is: 1 Joule (J) = 1 Ws
- 3,600 Ws or Joules = 1,000 Wh = 1 kWh

3 Electricity bills, tariff structures and consumption monitoring

Guidance on how to read and understand the electricity bill is usually given by the utility company that supplies your home with electricity, through publications on its website, by leaflets distributed to clients or within the electricity bill itself.

In the countries participating in the CAREEP Project, specific instructions to read and understand a customer bill can be found here:

- **Anguilla:** https://www.anglec.com/index.php
- **BVI:** https://bvielectricity.com/customer-service/billing/
- **Cayman Islands:** https://onlineservices.cuc-cayman.com/hc/en-us/articles/4402059904146-Understanding-your-Bill
- **Montserrat:** https://mul.ms/understanding-your-electricity-bill/
- **Sint Maarten:** https://www.nvgebe.com/understand-my-bills
- **Turks and Caicos:** https://www.fortistci.com/understanding-your-bill

The utility's website also typically includes information on applicable customer categories, tariff composition and the current energy rates. The following table summarizes the tariffs/rate structures and categories in the CAREEP Project countries and provides sources for further information.

OCT	Grid parameters (Voltage, Frequency)[1]	Tariff categories/ customer class/ rate class	Tariff components (for residential customers)	Further information on rates/tariffs[2]
Anguilla	1-phase: 120/240 V, 60 Hz 3-phase: 120/208 V, 60 Hz	• 0-40 kWh: flat rate • 41-25,000 kWh • 25,001 – 100,000 kWh • Exceeds 100,000 kWh	*Variable Charges per kWh* • Energy Unit Charge /Base Rate • GST 13% on Electricity Sales* • Fuel surcharge ***Fixed Charges*** • Meter rental	https://www.anglec.com/rates.php
British Virgin Islands	1-phase: 110 V, 60 Hz 3-phase: 190 V, 60 Hz	• 0 – 60 kWh • 61 – 25,000 kWh • 25,001 – 100,000 kWh • Over 100,000 kWh (All categories metered)	***Variable Charges per kWh*** • Energy Unit Charge /Base Rate • Fuel surcharge ***Fixed Charges*** • Fix charge (per billing period)	https://bvielectricity.com/about-us/rates-regulations/ or https://bvielectricity.com/customer-service/billing/
Cayman Islands	1-phase: 120 V, 60 Hz 3-phase: 240 V, 60 Hz	• residential (Rate Class R) • general commercial (Rate Class C) • large commercial (Rate Class L)	***Variable Charges per kWh*** • Energy charge • Fuel cost/Fuel Surcharge • Lic. & Reg. Fees (>1,000kWh) • Govt. Fuel Duty • Renewable Energy Levy ***Fixed Charges*** • Facility charge (monthly flat fee) • Demand charge (only commercial and DER**customers)	https://onlineservices.cuc-cayman.com/hc/en-us/articles/7227102242450-Standard-Billing-Rates-Effective-January-1-2021- and https://onlineservices.cuc-cayman.com/hc/en-us/categories/360003107759-Billing-and-Rates or https://www.cuc-cayman.com/customer-service/understanding-your-bill/
Montserrat	1-phase: 220 V, 60 Hz 3-phase: 400 V, 60 Hz	***For residential customers:*** • Block 1: 0 – 75 kWh • Block 2: 76 - all remaining kWh	***Variable Charges per kWh*** • Electricity charges according block 1 and 2 • Fuel surcharge	https://mul.ms/understanding-your-electricity-bill/
Sint Maarten	1-phase: 110 V, 60 Hz 3-phase: 220 V, 60 Hz	See website	***Variable Charges per kWh*** • Energy charge/Base rate • Fuel Clause *Fixed Charges* • Stamp Duty	https://www.nvgebe.com/understand-my-bills
Turks and Caicos	1-phase: 120 V, 60 Hz 3-phase: 240 V, 60 Hz	• 0 – 300 kWh • 301 kWh – above (Electricity tariffs are different for each island)	***Variable Charges per kWh*** • Electricity charges • Fuel Factor	https://www.fortistci.com/electricity-rates or https://www.fortistci.com/understanding-your-bill

[1]Source: https://www.generatorsource.com/Voltages_and_Hz_by_Country.aspx
[2]Source: Respective utility webpage

Abbreviations and definitions:

***GST**	Goods and Service Tax (in Anguilla: 0-130 kWh exemption on domestic accounts only)
****DER**	Distributed Energy Resources (customer-owned, distributed renewable generation)
Base rate:	(or Energy or Electricity Unit Charge) is usually the applicable energy component of the electricity tariff in your customer category that is multiplied by your electricity consumption. The base rate typically provides for the cost for the utility`s power generation, transmission and distribution infrastructure and operation, by rate class. The infrastructure related costs are however not included in the base rate, in case a fixed charge (demand, metering, service or grid charge) exist, that provides for fixed infrastructure-related costs.
Fuel surcharge:	(or Fuel Clause/Fuel Cost/Fuel Factor) is a fuel adjustment mechanism to mitigate against the fuel price fluctuations and to curb the trend of significant losses, typically as a pass-through charge with no added mark-up by the utility.
Pass-Through Charges:	Charges that are directly passed through to the customer with no added mark up by the utility, e.g., related to fuel or RE cost, government levies or fees, etc.
Variable Charges:	Charges per kWh, that are multiplied with your consumed electricity in kWh to calculate the total amount for this part of your electricity bill. Here you can reduce your monthly cost accordingly through the implementation of energy efficiency measures or change in user behaviour – or cost may increase with increasing power consumption.
Fixed Charges:	Demand, Service, Metering, Facility, or grid charges to be paid per customer account or metering point on a monthly basis independently from your monthly consumption. These charges help to provide for fixed infrastructure- or service-related costs or for the provision of a capacity higher than usual (for commercial and industrial customers).

Your household's maximum monthly electricity consumption usually determines the tariff category the utility assigns to you. The tariff category in which you are classified is mentioned on the electricity bill. However, this varies in the different countries and if you have doubts, you may find further information on your utility`s website (see links above) or you can contact the service department of your utility for respective information. The current electricity tariffs (often called 'rates') are usually published on the utility's webpage or in your country's press.

4 Types of Energy audits and Consumption Monitoring

There are mainly two types of energy audits for assessing the monthly electricity consumption of a residence:

i. **Consumption-based** – globally, based on the monitored consumption indicated on the electricity bill for the entire home or detailed, measured with instruments for individual devices that are installed in the home

ii. **Need-based (simplified)** – based on a calculation that includes an inventory of electric devices, their nameplates and energy labels as well as their estimated usage time.

Both approaches can be applied to allow for:

i) a sufficient level of detail and accuracy and

ii) to keep efforts and investments for consumption monitoring at a reasonable level.

The following sub-sections provide more details on both approaches.

4.1 Consumption-based energy audit (Consumption Monitoring)

The electricity consumption as billed by the utility is consumption-based. The utility monitors the client's electricity consumption (metering) during the billing period, computes the consumed electricity (in kWh or units) and bills you according to your tariff class.

Characteristics of the consumption-based audit:

1. A consumption-based self-audit requires the measurement of your electricity consumption and, if done for individual devices separately, it can be complex, time-consuming, and relative costly.

There are two ways of monitoring your electricity consumption:

a. Globally - measuring the power consumption of your entire home[3] using the utility meter
b. Detailed - measuring the consumption of an individual electrical device (usually installed in the same power outlet as the device to be measured).

2. The consumption-based audit can only be carried out after the consumption of your entire system or after the respective device has been measured.[4]

3. Both types of monitoring require instruments to measure the electricity consumption in real time mode.
a. The global measuring option monitors the entire electricity consumption of the residence, but is rather costly and usually needs the support of an electrician.
b. In the detailed measuring option, the consumption on an individual device is being measured by using a monitoring instrument (also called electricity usage monitor, electricity meter, watt meter, electric meter, electrical meter, or kilowatt-hour meter). Such plug-in instruments cost between 20 and 500 USD (see e.g. Amazon.com) and are easy-to-install. The instruments can be ordered for 120 V or 240 V, according to the power supply requirement of the electrical device you want to monitor.

4. To find out how much power in Watts a device requires operating in the selected operation mode, just plug the instrument into the same electrical outlet the device uses, and then plug the device into the instrument. It will display how many Watts of power the device needs at this moment of operation. If you want to know how many kilowatt-hours (kWh) of electricity the device is using in a defined period of time, just leave everything set up and read the display at the end of the time period that you want to monitor. The electricity usage monitor usually also displays the electricity cost for the period measured, if your electricity price per kWh is entered into the system configuration (see manual). A typical Watt meter or electricity usage monitor or households looks as follows:

[3]For details see: https://www.anglec.com/e-monitoring.php
[4]The consumption of your entire system or your device can only be calculated based on measurements.

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Figure 1: Plug-in Monitoring device/Watt meter with US/UK and European power inlet (Sources: Amazon.com, Amazon.uk, Amazon.de)

5. However, not all electric appliances in a household can be easily monitored with plug-in monitoring devices. Ceiling or wall fixed lamps and lightbulbs, electric stoves, or A/Cs with 400 V connections are not connected to your standard power outlet and are thus more difficult to monitor. The investment into specific electric meters for such devices can be quite complex and cost intensive. Here, the need-based energy audit can help to estimate and analyse your respective consumption. Generally, all electric devices that are plugged into a power outlet using the standard grid voltage (120 or 240 V) can be monitored using a measuring instrument as described above.

4.2 Simplified Need-Based Energy Audit (Consumption estimation through nameplate or energy label)

For professional energy audits, the need-based audit is typically the more complex approach as it covers a full analysis of the building. This includes thermal performance of your building components (roof, walls, windows, doors, foundations) for heating or cooling demands, location and climate conditions, lighting needs for the foreseen usage (office, storage, etc.), type and sources for energy generation for cooking, heating and/or cooling, as well as pre-established usage patterns per number of usage and purpose. To implement these types of audits, the auditor must review a large amount of data and design factors of the assessed homes and conduct a thorough energy performance simulation by typically using professional and complex software applications.

For the self-audit at your residence, the need-based energy audit will be somewhat simplified to allow for a reliable and cost-efficient option in case a Watt meter or electricity usage monitor is not available to conduct the detailed consumption-based monitoring explained above. This simplified need-based energy self-audit can be sufficiently accurate if some basic rules are observed.

The two assessment options to calculate the total energy consumption of your electric appliances/devices under the simplified need-based energy audit are:

a. **Option 1:** the estimated time of usage as well as the estimated power demand i) as stated on the nameplate of the electric device, ii) as printed directly on the light bulbs or lighting fixtures, iii) as measured with the monitoring instrument during the ypical usage mode or iv) as estimated based on research, own consumption monitoring and insertion.
b. **Option 2:** based on the average annual consumption (e.g., refrigerator, freezer) or the average consumption per hour(s) of operation (TV set) as per energy label.

For devices such as A/C units, refrigerators, freezers, or washing machines, which have many different operation modes and/or have their maximum power consumption only during specific peak times of operation, the average power consumption may vary strongly from the maximum power consumption shown on the nameplate. However, such devices often possess an energy label which indicates the average annual energy consumption in kWh/year of operation. If available, this information, if accordingly certified (please find more information on existent Energy Labels worldwide under section 6), could be used for carrying out Option 2 of the simplified need-based energy audit.

Examples of appliances, their nameplates and how to read those are given in the figure below.

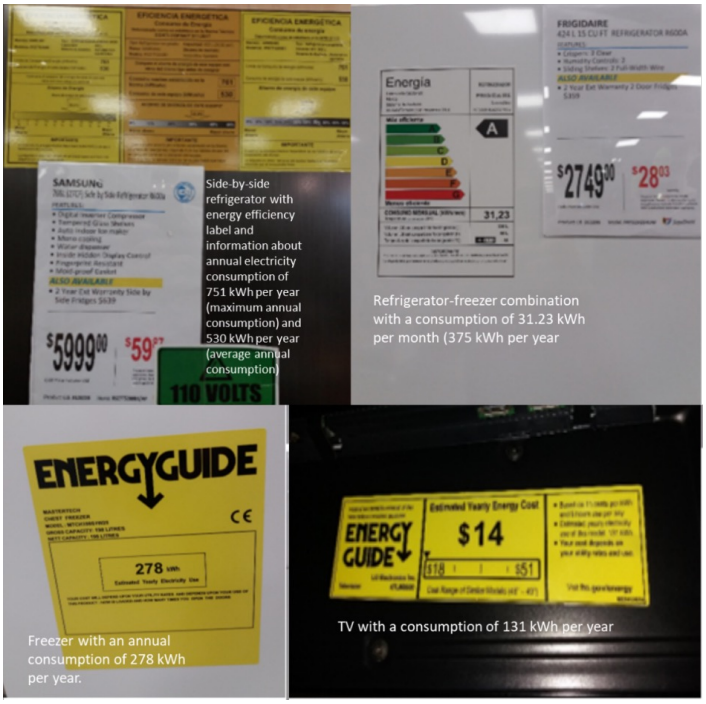


Figure 2: Examples of appliances, their nameplates and how to read those

Although, the consumption estimate based on name-plate information or the labelled energy consumption can be helpful for a first estimation of your electricity consumption for an energy self-audit in your home, it is strongly recommended, when possible, to use a monitoring instrument (as described above). This measures and confirms the electricity consumption, especially for high consumption devices like refrigerators, A/C units, electrical water heater, washing machines etc. whose electricity consumption cannot easily be estimated using the maximum power demand as stated on the nameplate.

5 Guidelines for Energy Self–Audit

The recommended methodology for the energy self-audit combines both previously mentioned audit approaches into a "Combined Energy Self-Audit" in order to allow for:

i) a sufficient level of detail and accuracy and
ii) to maintain efforts and investments for consumption monitoring at a reasonable level.

The global consumption-based monitoring provided by your utility through monthly electricity bills for your entire home and all devices connected behind your electricity meter allows for:

i) confirming the results from your self-auditing (device-specific consumption-based and need-based energy self-audit)

ii) monitoring monthly trends based on applied energy efficiency measures and change of your consumption behaviour

iii) benchmarking with similar household electricity customers, either provided via your electricity bill or through online-research. The detailed consumption-based monitoring through an electricity usage monitor will help you to get;

i) detailed information on the average power demand (wattage) per operation mode and

ii) the exact electricity consumption within a defined period.
This approach is suggested for devices plugged into a standard power outlet and which have different types of average consumption per operation mode and time of usage (e.g., entertainment and communication devices, washing machines, refrigerators, and freezers).

For devices not plugged into a standard power outlet (ceiling lamps, electric stoves, larger air-conditioners) and all other devices, in case an electricity usage monitor is unavailable, the simplified need-based energy audit based should be conducted. The audit can be done using the power demand shown on the nameplate of the device/lightbulb and the estimated time of usage or based on the energy label.

The main implementation steps of the Energy Self- Audit are as follows.

Step 1: Review, familiarisation, and interpretation of your monthly electricity bill

Step 2: Creation of an inventory using the excel template "Energy Self-Audit Consumption Inventory" available under https://careep.carilec.org/guidance-and-learning-materials/.

Step 3: Estimating Appliance and Home Electronic Energy Use

Step 4: Analysis and interpretation of inventory results

Step 5: Optional – Preparation of an audit report to summarize the audit results, e.g.,by using the word template "Energy Self-Audit Report" in the Annex to these Guidelines.

Step 6: Identification of energy saving opportunities (energy efficiency measures) that can reduce your monthly electricity consumption and save money. The CAREEP Project website under https://careep.carilec.org/ under "Publications" and" E-Learning" will provide further guidance on the implementation of suitable and cost-efficient energy efficiency measures for Caribbean households.

Step 7: Monitor your monthly energy consumption and repeat Steps 1 - 5 after 3-6 months to monitor your progress.
In the following subchapters 5.1 – 5.7, the seven main implementation steps are explained in detail.

5.1 Review, familiarisation, and interpretation of your monthly electricity bill

It is guaranteed that an electricity consumer/client who wants to reduce her/his monthly electricity consumption[5] wants to understand and interpret the electricity bill issued monthly.[6] The first step of the Energy Self-Audits is therefore to conduct a global consumption-based energy audit by reading and evaluating your monthly electricity bill(s).

For additional guidance on how to read your electricity bill, please refer to chapter 3.3.

To properly analyse and interpret your electricity bill, answer the following questions to yourself or optionally, insert the answers in the audit report:

1. How much electricity in kWh did the household consume in the billed period?
2. How much is the share of variable charge, that I can influence through energy conservation, in the total amount and what are fixed price components that I may have to continue to pay?
3. Have the fuel cost component (fuel surcharge, fuel clause or fuel factor) or other tariff components significantly changed compared to the previous month?
4. Which tariff category/customer class/rate class do I belong to? Can I benefit from reduced rates if I reduce my monthly electricity consumption and if yes, by how much would I have to reduce it to enter the more beneficial category?
5. How did my consumption change compare to previous billing periods? Did seasonal changes (ambient temperature, humidity) or changed consumption patterns (occupancy, user behaviour) lead to any significant changes?
6. How does my consumption compare to the consumption of other households with similar consumption patterns in my neighbourhood/the Caribbean/world-wide?

Some electric utilities provide a 12-month-history of the customer´s monthly consumption on electricity bills to ease the analysis. Alternatively, you may have stored previous bills or can start to note down and monitor your total monthly consumption and related cost in your own energy consumption diary.

An excel sheet is provided as a template to enter your meter readings (see sheet "Total Consumption Monitoring" within excel template "Energy Self-Audit Consumption Inventory"). Regularly entering meter reading data will help you to analyse and better understand your daily consumption. To answer question 6, you have several options. Some utilities provide a benchmark of your consumption with other customers of your customer category in your area, either on their electricity bill or on their website. Alternatively, you can research current numbers online or ask your neighbours, friends, and family members.

If you can answer the first five of the six questions above, you are ready for the next steps of the energy self-audit.

5.2 Creation of Energy Consumption Inventory

Make a list or create an inventory of all electricity consuming devices in each room of your home. Any outside consumption devices, like security lights, alarm systems, pool pumps, irrigation pumps etc. should also be included.

As you prepare this checklist, make a mental (or actual) note on the devices that may be left on standby mode frequently, and also identify age and condition of devices.

[5]Reducing the overall electricity consumption would result in the reduction of your electricity bill provided the same tariff applies and no additionally installed electric equipment compensate the consumption savings (rebound effect).
[6]Some utilities are using billing cycles like monthly or bi-monthly or any other billing cycles.

The excel template "Energy Self-Audit Consumption Inventory" will serve as your template form to further fill out and calculate results for your energy self-audit. Note that all yellow-marked cells with a red font colour represent a possible field for your insertion, while non-marked cells with a black font colour represent either a pre-defined formula or a specific definition that should remain in the template. Only if you insert the results from a conducted consumption-based monitoring, the formulae under Columns F and I can be replaced through the insertion of those results (see comments under Columns F and I). Use the sheet "Template" to insert your data and the sheet "Example" for reference.

As a first step to use the template "Energy Self-Audit Consumption Inventory", insert the names or types of all identified devices and lightbulbs under Column B and the number of units for each device of the same type, nameplate capacity and operation mode under Column H. Add a new row for devices of the same type but with different usage patterns, e.g., in case of the same type of lightbulb, but installed in different rooms which different usage times. You may want to use the existing examples already inserted in the template or use your own definitions accordingly for each device/lightbulb.

5.3 Estimating Appliance and Home Electronic Energy Use

Once the devices are inserted into your "Energy Self-Audit Consumption Inventory" you may want to proceed with the assessment and insertion of consumption relevant data following one or both of the two types of audit approaches explained under section 4. In case an electricity monitoring device is available, you should start with assessing the results for the Detailed Consumption-Based Energy Audit (Consumption Monitoring) for all devices that are connected to standard power outlets.

5.3.1 Detailed Consumption-Based Energy Audit (Consumption Monitoring)

For the implementation of the Detailed Consumption-Based Energy Audit you typically have three options to monitor your device's consumption:

Option 1: Monitor and assess the average wattage in W or kW of each mode of operation (e.g., TV set on and on stand-by) and estimate the average time of usage in hours per day and days per month for this operation mode.

Option 2: Monitor and assess the daily consumption for your device in kWh.

Option 3: Monitor and assess the monthly consumption for your device in kWh.

Obviously, while the level of audit accuracy increases from Option 1 to Option 3, the required time, and effort for the monitoring increase simultaneously. By monitoring your consumption, the consumption of all applicable operation modes of the device will be included in the final result and thus do not have to be assessed separately. The user manual for your monitoring device should provide instructions on how to configure the device to display the different monitoring results for power/wattage, energy/electricity, number of days etc. Typically, the device includes a functions button that you can click to select the desired display mode.

The following steps should be implemented for each option.

5.3.1.1 **Option 1** - Monitor the average wattage in W or kW of each mode of operation and estimate the average time of usage in hours per day (24 h) and days per month for this operation mode.

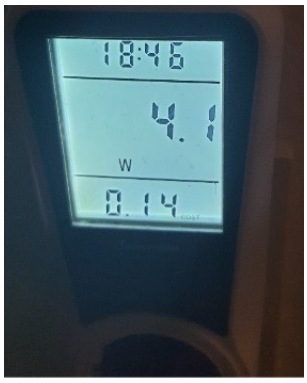


Figure 2: Display of watt meter showing current Wattage in the center of the display

Step 1: Assess and insert the monitored wattage in W for the specific operation mode under Column C for this device.
Step 2: Insert the average time of usage in hours per day under Column E and the estimated days per month for this operation mode under Column G.
Step 3: Repeat Step 1 and 2 in case you want to insert another operation mode under another row.

Example calculation for TV Set as per template:

B	C - Power Demand/ Wattage	D -Power Demand/ kW	E - Estimated average daily usage	F -Average Daily electricity consumption	G - Days of usage per month	H - Number of units	I - Monthly electricity consumption
Formula		C/1000		D*E			F*G*H
Unit	[W]	[kW]	[h]	[kWh]	[days/month]		[kWh]
Name/type of electronic device							
TV set "on"	80	0.08	6	0.48	30	1	14.40
TV Set "Standy-by"	5	0.005	18	0.09	30	1	2.70

5.3.1.2 Option 2 - Monitor the daily consumption for your device in kWh

Figure 3: Display of consumed kWh and number of monitored days

Step 1: Assess the daily consumption in kWh on your monitoring device by reading the displayed results after exactly 24 hours for which the monitoring device has been connected to the monitored electronic device and the power outlet. Alternatively, you can monitor the consumption for several days and divide the respective result in kWh by the number of monitored days, typically displayed below the total result in kWh. To obtain a reliable result, make sure that for each monitored day, the 24h cycle has been completed as far as possible.

Step 2: Insert the daily consumption in kWh under Column F for this device and leave columns C – E blank.

Step 3: Insert the estimated days per month for this device under Column G.

Example calculation for TV Set as per template:[7]

B	C - Power Demand/ Wattage	D -Power Demand/ kW	E - Estimated average daily usage	F -Average Daily electricity consumption	G - Days of usage per month	H - Number of units	I - Monthly electricity consumption
Formula		C/1000		D*E			F*G*H
Unit	[W]	[kW]	[h]	[kWh]	[days/month]		[kWh]
Name/type of electronic device							
TV Set average		0		0.60	30	1	18.00

5.3.1.3 Option 3 - Monitor and assess the monthly consumption for your device in kWh

Step 1: Insert the monthly consumption in kWh after 30 days of monitoring under Column I for this device and leave columns C – G blank.

[7]If a label provides for annual or monthly electricity consumption of the TV or device the assumptions made are usually displayed. If these assumptions match with your consumption pattern (x usage hours per day or cycles per week/month), you can use the given consumption figure (kWh/year or kWh/month) and calculate them to monthly consumption.

Example calculation for TV Set as per template:

B	C - Power Demand/ Wattage	D -Power Demand/ kW	E - Estimated average daily usage	F -Average Daily electricity consumption	G - Days of usage per month	H - Number of units	I - Monthly electricity consumption
Formula		C/1000		D*E			F*G*H
Unit	[W]	[kW]	[h]	[kWh]	[days/month]		[kWh]
Name/type of electronic device							
TV Set average		0		0.00	0	1	18.00

5.3.2 Simplified Need-based Energy Audit (Consumption estimation through nameplate or energy label)

For the devices that you cannot assess with your monitoring device or in case a monitoring device is not available, a simplified need-based approach can help to provide a first indication on their electricity consumption.

As described under section 4, there are two options to implement a simplified need-based energy self-audit:

a. **Option 1:** Calculate the power consumption of your device based on the estimated power demand i) as stated on the nameplate of the electric device, ii) as printed directly on the light bulbs or lighting fixtures or iii) as measured with the monitoring devices during the typical operation mode as well as based on the estimated time of usage/operation.

b. **Option 2:** Calculate the power consumption of your device based on the average annual consumption (e.g., refrigerator) or the average consumption per hour(s) of operation (TV set) as per energy label.

The following steps should be implemented for each option.

5.3.2.1 Option 1 - Calculate the power consumption of your device based on the estimated power demand

Formula to be used:
Monthly power consumption in kWh = Power demand (nameplate, printed on device or measured) in kW x usage in hours per month. (Remember: 1 W = 0.001 kW)

Step 1: Assess and insert the estimated power demand in W for the specific operation mode under Column C for this device.
Step 2: Insert the average time of usage in hours per day under Column E and the estimated days per month for this operation mode under Column G.
Step 3: Repeat Step 1 and 2 in case you want to insert another operation mode under another row.

Example calculation for Lightbulb (incandescent) as per template:

Option 1 can be applied for the following devices:
- Luminaires (tubes, bulbs, incandescent, compact fluorescence, LED type), in-door and out-door
- Drink water pump and pool pump
- Electric stove (oven, stove top)
- Microwave
- Toaster/Sandwich-maker
- Electric water kettle
- Iron

- Electric shower head
- Hairdryer
- Hair Curler
- TV set (stand-by consumption to be considered separately)
- Radio/stereo set
- Fan
- Laptop, computer
- Printer, scanner, copy machine, other office machines (stand-by consumption to be considered separately)
- Charger (s) for mobile device (s) (mobile phones, tablets, electric bike or car etc.)
- Step-up/step-down transformer[8]

In case, neither a name plate, an energy label (to conduct Option 2) or any other indication on the average wattage or power consumption of the device is not available, you may find some guidance and indication about average power demand and wattages of selected household appliances under the following websites:

List of the Power Consumption of Typical Household Appliances
https://www.daftlogic.com/information-appliance-power-consumption.htm

Wattage & Power Consumption Of Typical Household Appliances
https://letsavelectricity.com/wattage-power-consumption-of-household-appliances/

Power Consumption of Typical Household Appliances
https://simpleghar.com/household-appliances-power-consumption/

However, be aware that due to differences in consumption patterns, environmental and climate conditions, age, quality, dimensions and sizes of devices, the actual power demand of your device may vary from those shown in online overviews. Hence, results must be carefully verified and the assumptions may have to be re-adjusted several times upon comparison of the calculated overall consumption with the measured monthly energy consumption from your electricity bill.

5.3.2.2 Option 2 - Calculate the power consumption of your device based on the average power consumption as per energy label.

Step 1: Divide the indicated annual consumption in kWh/year by 12 to calculate the average monthly consumption.
Step 2: Insert the calculated average monthly consumption in kWh/month under Column I for this device and leave columns C – H blank.

Some labels indicate the average consumption in kWh/h of operation or per 10/100/1000 hours of operation. In this case, the calculation for your monthly consumption for this specific device should be made as follows:

Step 1: Divide the indicated average consumption in kWh/year by the indicated numbers of operation hours to calculate the average power demand in W, e.g., 204 kWh/1,000 h of operation = 0.204 kW = 204 W.
Step 2: Insert the calculated power demand in W under Column C for this device.

Step 3: Insert the average time of usage in hours per day under Column E and the estimated days per month for this operation mode under Column G.

[8]About 5% (transformer losses) of their nominal capacity must be added to the power demand of the devices that are connected to the transformer. Example: the operation of a 50" TV with 250 W power demand (e.g., stated on nameplate) connected to a 500 W transformer requires a maximum of 275 W (250 W + 25 W). Note, that a plugged-in transformer still consumes its 5% electricity losses, even if the TV is switched off.

Option 2 could be applied for the following devices, if an energy label on the average consumption is available:

- Refrigerator
- Freezer
- Refrigerator/freezer combinations
- A/C unit (consider adjustment to personal time of use)
- Washing machine (consider adjustment to personal time of use)
- Laundry dryer (consider adjustment to personal time of use)
- TV Set including stand-by consumption (consider adjustment to personal time of use)

In case an energy label stating the annual or monthly electricity consumption is not available, you may find some guidance on an indication of typical consumption data of selected household appliances under the following websites:

Default Energy Consumption of end-use of appliances
http://hes-documentation.lbl.gov/calculation-methodology/calculation-of-energy-consumption/major-appliances/miscellaneous-equipment-energy-consumption/default-energy-consumption-of-mels

How Much Energy Do Household Items Use?
https://www.ecowatch.com/electricity/how-many-kwh-does-a-house-use

Overview of annual and daily electricity consumption per electric household device (site in German, use translator in your browser):
TV Sets: https://www.stromverbrauchinfo.de/stromverbrauch-tv-geraete.php
Refrigerators: https://www.stromverbrauchinfo.de/stromverbrauch-kuehlschraenke.php
Freezer: https://www.stromverbrauchinfo.de/stromverbrauch-gefrierschraenke.php
Washing machines: https://www.stromverbrauchinfo.de/stromverbrauch-waschmaschinen.php

How much energy do my household appliances use?
https://www.energuide.be/en/questions-answers/how-much-energy-do-my-household-appliances-use/71/

However, be aware that due to differences in consumption patterns, environmental and climate conditions, age, quality dimensions and sizes of devices, the actual consumption of your device may vary from those indicated in online overviews. Hence, results must be verified carefully. The assumptions may have to be re-adjusted several times upon comparison of the calculated overall consumption with the measured monthly energy consumption from your electricity bill.

5.4 Interpretation of energy self-audit

Once you have created your inventory and calculated your estimated total monthly electricity consumption of your residency (kWh per month), sum up the total kWh consumption of all appliances and compare the total with the consumption in the electricity bills.

It is unlikely that the numbers will be exactly the same. A 10-20% difference can be expected and would be regarded as normal.

The more detailed the checklist, the more closely it may reflect the actual bills. In case the indicated electricity consumption from your bill differs significantly (more than 20%) from the electricity consumption as estimated in your self-audit, critically review the assumption you made in the self-audit and adjust them in the excel table, if required. Ask yourself the following questions:

- Did I correctly assume the monthly usage time of the device?
- Did I consider standby-losses and different operation mode of devices?
- Did I use the power consumption as stated on the device's nameplate?
- Did I use the maximum or the average power consumption?
- Did I correctly calculate the power consumption according to the selected assessment approach described under 3.5.2.2?
- Do I unplug transformers and charging devices if not needed?

Keep in mind, that the electricity consumption as stated in your electricity bill is based on actual measurements, while the self-audit if not conducted with actual monitoring devices, is based on assumptions and estimations.

As reference, sample consumption values of selected electric equipment are given in Annex 7.3.

5.5 Optional: Summarize results of the energy self-audit

Summarise your findings (lists, tables, calculations, energy saving opportunities) in a brief audit report (see example and instructions in the Annex to this Self-Audit Guide).

5.6 Identification of energy saving measures

Your energy consumption inventory shows which of your electric devices consume the largest bulk of electricity.

Create a ranking list of devices per monthly consumption. The ranking will help you to identify how well any electricity saving measure works. Once this is done, create a simple list of potential energy reduction strategies, keeping in mind that slight reductions on big ticket items like air conditioning will provide the largest impact on reduction of electricity consumption. Insert the identified Energy Saving Measures for each device into Column K of your "Energy Self-Audit Consumption Inventory".

To ease the implementation process of energy saving measures, consider strategies in order of potential cost impact – ranging from no cost, low-cost and high-cost investments. This will give you an idea of "quick fixes" that can be implemented on the spot whilst creating large impacts, and ones that might take a bit more planning.

Some common no cost efforts that can be considered include:

- Utilize natural resources like natural light, natural ventilation and air circulation, and natural shading for lighting, cooling, or drying laundry, wherever possible.
- Use the A/C only when necessary – use natural ventilation instead by opening windows and doors on cooler days.
- Set the thermostat of your A/C unit(s) at 24 to 25 °C (75-77 °F) and ensure that all A/C Units are turned off when you are not using the room.
- Reduce water consumption, as water use (e.g., heating, pumping,) is closely related to electricity consumption
- Reduce the water temperature of your electric water heater down to 55 °C (131 °F).
- Unplug unused gadgets and appliances when not in use
- Turn off all lights that are not in use.
- Keep refrigerators doors closed and don't open unnecessarily.
- Maximize the use of your electric stove by cooking or baking several dishes at the same time.
- Wash clothes in cold water or use the 30°C washing cycle.
- Make sure the washing machine is fully loaded and for smaller loads, use less water
- If you cook and bake with electricity, but without induction-fields, turn off the burners of your stove cooking fields or your oven a few minutes before the allotted cooking time. The burners will retain heat long enough to finish the cooking or baking.
- Turn off and unplug the TV when nobody is watching. Use the timer function of modern TVs and other entertainment devices to turn them off automatically after use.

Common low-cost improvement that one could take to reduce consumption include:

- Replacing incandescent lights or CFLs with LEDs
- Investing in devices for consumption control, e. g. timers for electric water heaters and AC units, motion sensors for lights, smart power strips as central 'turn-off' points etc.
- Introducing more trees and shrubs surrounding the perimeter of your home to reduce heat gain and prevent long A/C run times.
- Repainting dark surfaces like external and internal walls with lighter colours to prevent heat absorption and increase reflectivity of these surfaces.

If possible, consider investment measures such as:

- Replacing an inefficient A/C unit with an efficient inverter type split unit with a programmable thermostat.
- If your refrigerator or freezer is due for replacement (e.g., older than 10 years), purchase new & energy efficient systems with an energy label (see further guidance under section 6)

- If your TV set is due for replacement, purchase new & energy efficient systems with an energy label and a standby-consumption below 1 W (see further guidance section 6). Currently, the most energy efficient TVs are LED or OLED types.
- Installing/using a Solar Water Heater (SWH) to generate hot water.
- Reducing your electricity expenses through self-generation of electricity by investing e.g., in a Photovoltaic (PV)/solar system.

See also TopTwenty EE Tips for Caribbean households and further information here.

5.7 Monitor your monthly energy consumption and repeat Step 1 - 5 after 3-6 months to monitor your progress.

Track improvements in energy bills every month from the time energy saving measures were deployed. Monitor and document your total monthly consumption by using the sheet "Total Consumption Monitoring" within excel template "Energy Self-Audit Consumption Inventory".

Analyse the reductions to help you keep track of the impact that has resulted from every effort.

Revisit your "Energy Self-Audit Consumption Inventory" and repeat the self-audit from time to time based on changes to your lifestyle and additions to your home appliance list.

Repeat steps 1 - 5 after 3-6 months and check whether energy savings have been achieved and adjust or add new energy saving measures to your to-do-list as necessary.

The most rewarding part of putting efforts into energy savings at home is to reap the benefits from a reduced electricity bill the following months and knowing that you have done your part to reduce the environmental impact from daily routines is an added benefit that you could sit back and feel good about!

6 Energy labels for electric household appliances

6.1 Background Energy Labels

Most large and internationally recognised manufacturers of electrical and electronic household devices/appliances test and certify the energy consumption of their products based on average customer usage as part of their quality management processes.
Many countries worldwide allow for specific type of electric devices and only equipment with an energy label to be imported and sold on the market. Mandatory energy labels and standards are one way in which governments can lessen energy consumption, improve energy efficiency, and cut greenhouse gas emissions.

Labelling the energy consumption of household devices/appliances have proved extremely effective to increasing energy efficiency and to reduce final energy consumption of a country. The demand for energy labels on electric equipment is steadily spreading and manufacturers are forced by national law to increase the energy performance of their products.

Frameworks for energy labelling of imported electric devices/appliances are still under development in Caribbean countries. The CARICOM Regional Organisation for Standards & Quality (CROSQ) is currently developing Energy Efficiency Labelling Standards and Minimum Energy Performance Standards for electrical appliances and light industrial appliances as part of the CARICOM Energy Label (find more information here).
Globally, there exists a wide range of energy labels. In the Caribbean, the most common energy labels are Canadian, European, Latin-American as well as US energy labels. The following sub-sections provide some insights on history, performance requirements and labelling approach of these labels.

6.2 Energy labels in the EU

According to EU legislation for energy labels and eco-design, energy labels are increasingly mandatory for electric equipment/appliances in all member states of the European Union. The energy labels provide a clear and simple indication of the energy efficiency and other key features of products at the point of purchase. Eco-design sets common, EU-wide, minimum standards to eliminate the least performing products from the market.

The UE energy label was first introduced for several household appliances in 1994 and subsequently expanded in 2004. It has a comparative scale from A (most efficient) to G (least efficient). The EU energy label has been a key driver for helping consumers choose products which are more energy efficient. In addition to information about the product's energy consumption, the labels can also provide specific data about other relevant features of usage, such as the product's noise emissions or water consumption.

Manufacturers are eager to see their energy-labelled products in the highest available category when compared to competitors. Therefore, it is likely that manufacturers who sell appliances in the less efficient classes aim to improve their rating to position their products within the highest category. For example, roughly two-thirds of refrigerators and washing machines sold in 2006 were labelled as class A, whereas over 90% of those sold in 2017 were labelled A+, A++ or A+++.

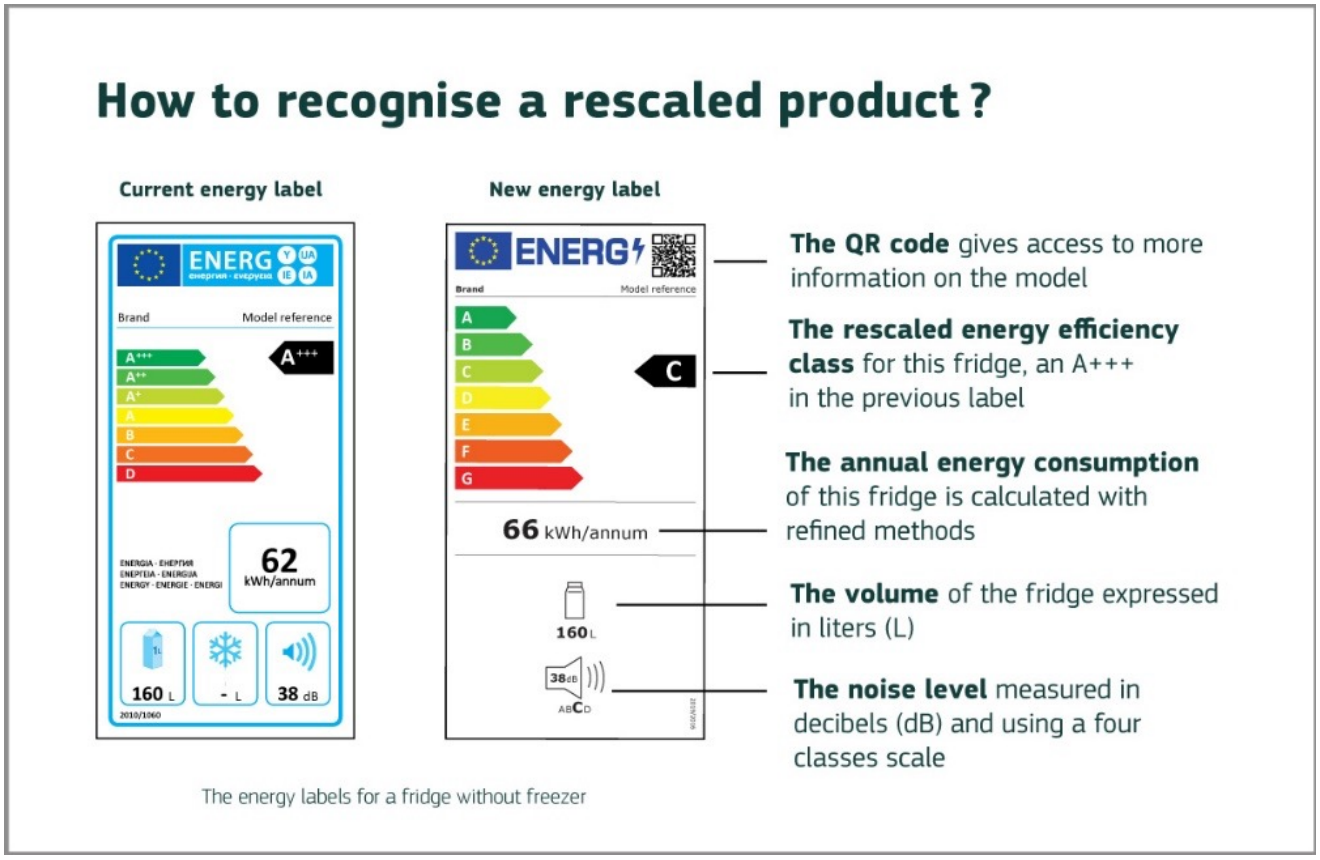
As more and more energy efficient products are developed and because the difference between A++ and A+++ is less obvious to the consumer, the EU energy label categories were gradually adjusted to reintroduce the simpler A to G scale.

The following 5 product groups were 'rescaled' in 2021 (click on links for further information):

- Fridges and freezers
- Dishwashers
- Washing machines and washer-dryers
- Electronic displays including televisions
- Lighting

Other product groups carrying EU energy labels will follow in the coming years.

The final format and visual identity of the new labels for the above product groups and for 'refrigerating appliances with a direct sales function' were adopted by the Commission on 11 March, 2019.



For details about European Energy Efficiency labels, see also:

https://ec.europa.eu/info/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign/about_en

https://ec.europa.eu/info/news/clearer-and-simple-energy-labels-will-help-consumers-save-money-and-contribute-energy-unions-objectives-2019-mar-11_en

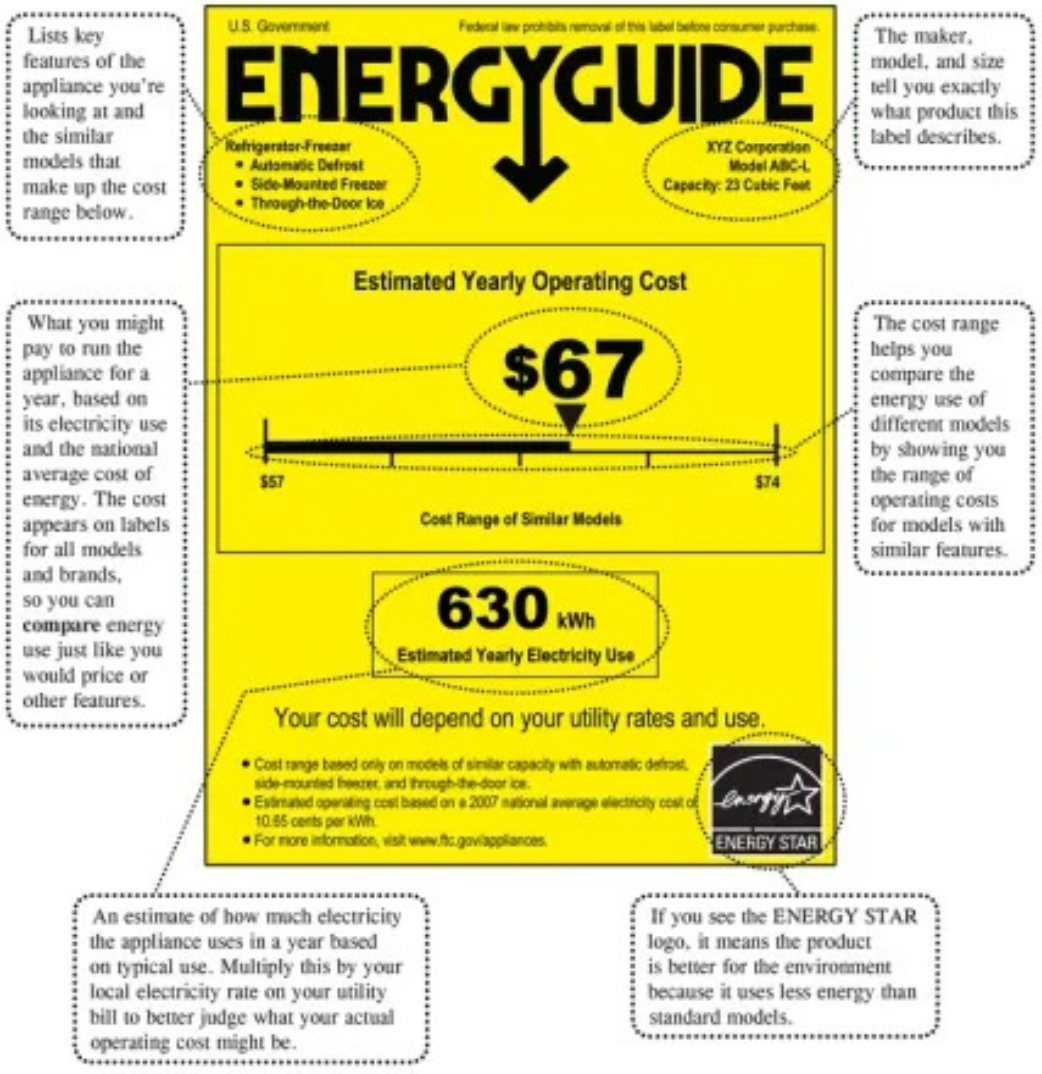
https://ec.europa.eu/info/sites/default/files/energy_climate_change_environment/standards_tools_and_labels/documents/rescaled_eu_energy_labels_and_transition_period.pdf

6.3 Energy labels in the USA

For the US market, there are two energy labels available to certify the energy consumption and efficiency of electric equipment: the Energy Guide and the Energy Star, which are both described in the following subsections.

For general information about US energy labels, standards, and energy efficiency programmes, check also:
https://www.usaid.gov/energy/efficiency/technical-guide/standards-rating-labeling

6.3.1 Energy Guide



For more details on the Energy Guide label, please check:
https://www.ftc.gov/news-events/topics/tools-consumers/energyguide-labels
https://consumer.ftc.gov/articles/how-use-energyguide-label-shop-home-appliances

6.3.2 Energy Star

ENERGY STAR is a nationally run programme offered by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy. It provides carefully developed energy efficiency standards and encourages energy efficient products and practices.

The following devices/appliances that are relevant for residences are included in the programme (click on the link to find out more about the label requirements and standards per device):

- Residential Windows, Doors, and Skylights
- Seal and Insulate
- Storm Windows
- Refrigerators
- Freezers
- Ventilation Fans
- Ceiling Fans
- Decorative Light Strings
- Light Bulbs
- Light Fixtures
- Clothes Washers
- Clothes Dryers
- Dishwashers
- Room Air Conditioner
- Ductless Cooling
- Smart Thermostats
- Solar Water Heaters
- High Efficiency Gas Storage Water Heaters
- Tankless Gas Water Heaters
- Heat Pump Water Heaters
- Computers
- Slates and Tablets
- Monitors
- Televisions
- Set-top Boxes
- Audio/Video
- Digital Media Player
- Telephones

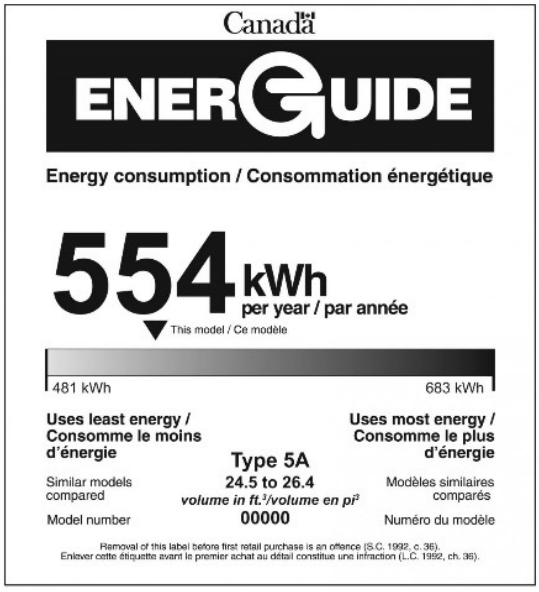
For more details on the Energy Star label, please check:

https://www.energystar.gov/?s=megahttps://www.energystar.gov/products/how-product-earns-energy-star-label

6.4 Energy labels in Canada

Canada and the United States usually use similar test methods to determine the energy rating. However, the range on the scale may differ because of differences in the number and types of models available in each country.

Both, the black-and-white Canadian EnerGuide label and the black-and-yellow American EnergyGuide label are displayed on major appliances.


Canada

ENERGUIDE

Energy consumption / Consommation énergétique

554 kWh per year / par année

This model / Ce modèle

481 kWh — 683 kWh

Uses least energy / Consomme le moins d'énergie

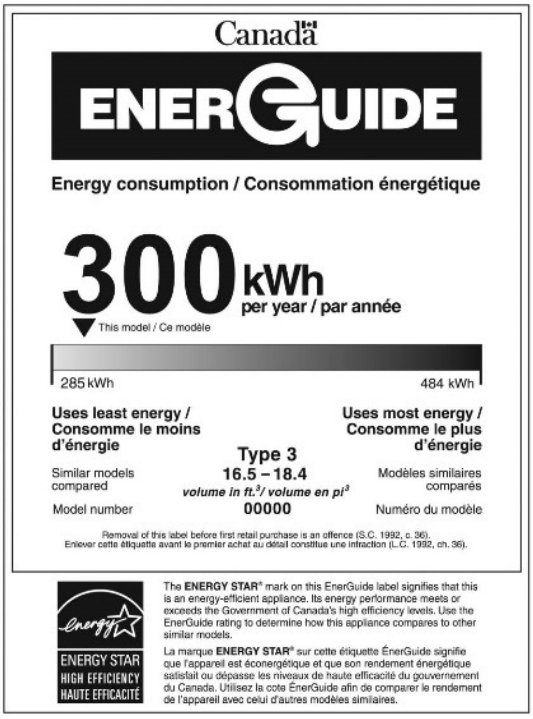
Uses most energy / Consomme le plus d'énergie

Type 5A

Similar models compared: 24.5 to 26.4 *volume in ft.³/volume en pi³* — Modèles similaires comparés

Model number: 00000 — Numéro du modèle

Removal of this label before first retail purchase is an offence (S.C. 1992, c. 36).
Enlever cette étiquette avant le premier achat au détail constitue une infraction (L.C. 1992, ch. 36).


Canada

ENERGUIDE

Energy consumption / Consommation énergétique

300 kWh per year / par année

This model / Ce modèle

285 kWh — 484 kWh

Uses least energy / Consomme le moins d'énergie

Uses most energy / Consomme le plus d'énergie

Type 3

Similar models compared: 16.5 – 18.4 *volume in ft.³/ volume en pi³* — Modèles similaires comparés

Model number: 00000 — Numéro du modèle

Removal of this label before first retail purchase is an offence (S.C. 1992, c. 36).
Enlever cette étiquette avant le premier achat au détail constitue une infraction (L.C. 1992, ch. 36).

ENERGY STAR HIGH EFFICIENCY HAUTE EFFICACITÉ

The **ENERGY STAR**® mark on this EnerGuide label signifies that this is an energy-efficient appliance. Its energy performance meets or exceeds the Government of Canada's high efficiency levels. Use the EnerGuide rating to determine how this appliance compares to other similar models.

La marque **ENERGY STAR**® sur cette étiquette ÉnerGuide signifie que l'appareil est écoénergétique et que son rendement énergétique satisfait ou dépasse les niveaux de haute efficacité du gouvernement du Canada. Utilisez la cote ÉnerGuide afin de comparer le rendement de l'appareil avec celui d'autres modèles similaires.

The Canadian EnerGuide label displays:

- Annual energy consumption in kilowatt hours (kWh)
- Energy consumption indicator, which positions the model compared with the most efficient and least efficient models in the same class
- Type and capacity of models that make up this class
- The model number

The Canadian EnerGuide label is mandatory for (click on the link to find out more about the label requirements and standards per device):

- refrigerators and refrigerator-freezers
- freezers
- miscellaneous refrigeration products
- Washing machines (including integrated washer-dryers)
- clothes dryers
- dishwashers
- electric ranges, cooktops and ovens
- room air conditioners

Often products, that are regulated and carry the EnerGuide label are also ENERGY STAR certified models. In these cases, the ENERGY STAR symbol will appear at the bottom of the EnerGuide label.
The ENERGY STAR label is similar to the one used in the USA.

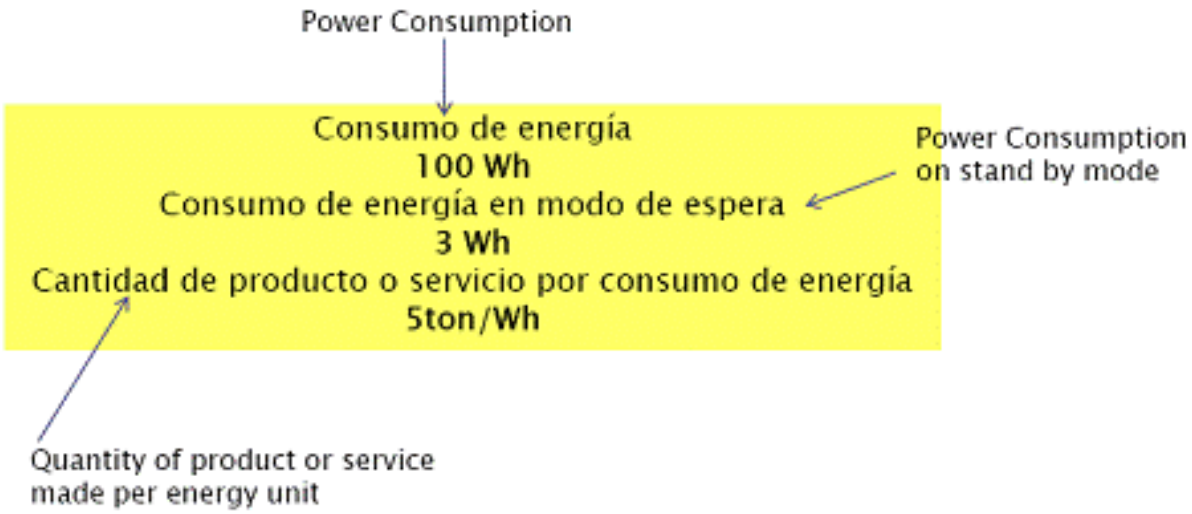
For more details on the EnerGuide label, please check:

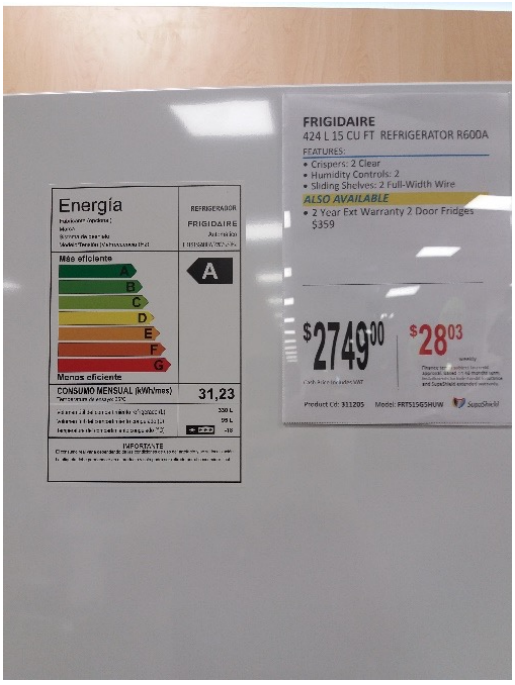
https://www.nrcan.gc.ca/energy-efficiency/energuide-canada/energuide-label/13609

6.5 Energy labels in Latin America (e.g. Mexico)

Electric equipment/appliances that are imported by Caribbean trading companies from Latin-American countries (e.g., Mexico) usually come with an energy label in Spanish (see example below).

In Mexico for example, the Mexico Energy Saving Approval is mandatory starting September 2011. In the Caribbean, electric devices/ appliances are





Latin-American energy labels are similar to the EU label as shown in the example picture for the Mexico Energy Saving Approval at the right.

For more details on the Mexico Energy Saving Approval label, please check the link here.

7 Annex

Energy Self-Audit Report (Template)

Basic data

Address/location: .....

Utility user ID (if any): .....

No. of Persons in household: .....

Utility contact: (e.g., website, physical address of headquarter, phone number/email address of customer service and for failure reporting)

.....

.....

Billing cycle: (e.g., monthly, bi-monthly) .....

Average monthly consumption: ..... kWh (based on last three bills)

Rate/tariff: ..... EC$/kWh or USD/kWh (base rate plus fuel surcharge, if any)

1. Technical data of electrical network

Mono phase or three phase system (if known): ……..

Voltage level: …… V (110/120 V or 220/240 V)

Frequency: …….. Hz (50 or 60 Hz)

2. Energy Consumption Inventory

Insert the table of your "Energy Self-Audit Consumption Inventory" here.

3. Comparison of estimated and billed electricity consumption

Comparison between billed electricity and electricity as estimated in the self-audit

Monthly electricity	Measured as shown in the utility's monthly electricity bill	Estimated as per energy self-audit	Difference in percentage +/- %
[kWh] or [unit]			

4. Selection of EE measures

Insert the identified Energy Saving Measures as stated under column K of your "Energy Self-Audit Consumption Inventory" here.

1 .....

2 .....

CAREEP

CARILEC Resiliency and Energy Efficiency Project

ConserVE-2-SaVE

Contact Us

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Tel: 758 731 7111
Website: https://careep.carilec.org/

@careepproject

CARILEC
An Association Of Electric Energy Solution Providers

In Partnership With

Anguilla Electricity Company Limited (ANGLEC)
Anguilla — Strength and Endurance
British Virgin Islands Electricity Corporation (BVIEC)
Government of the Virgin Islands — Ministry of Communications and Works
CUC — You've got the power
Ministry of Sustainability & Climate Resiliency — Cayman Islands Government
Montserrat Utilities Limited
FORTIS TCI
resembid
Funded by the European Union
Expertise France — Groupe AFD
GFDRR — The World Bank