GREEN BUILDING PROCUREMENT MANUAL FOR PUBLIC MANAGERS (VERSION 1.0)

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Abstract

This Green Building Procurement Manual suggests green procurement practices within the context of existing public procurement policies and procedures in select Member States of the Caribbean Community (CARICOM). A definition of green building procurement is offered that emphasises energy in buildings and the overlap with modern day concepts of environmental sustainability.

The Manual suggests how procurement officials may organise their green procurement programmes. Product safety and engineering standards for the procurement of renewable energy and energy efficiency systems are identified. A detailed mapping is made of the requirements of the 2018 CARICOM Regional Energy Efficiency Building Code to the energy efficiency product specifications under the ENERGY STAR label. A special connection to water use efficiency is also made. Performance criteria are introduced in the form of simple payback analysis and life cycle analysis. A survey of other international environmental sustainability labels is also given.

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1 Introduction

This Green Building Procurement Manual (Version 1.0) represents the first effort by the Caribbean Community Climate Change Centre (CCCCC) in Belize to prepare a public sector green procurement programme of any sort. The effort was financed by the Global Environment Facility through United Nations Environmental Programme (UNEP) under the ***"Energy for Sustainable Development in Caribbean Buildings (ESD) Project"*** which was financed by a US$4, 859,000 GEF grant. The manual is guided by UNEP's work on Sustainable Public Procurement[1]. The manual targets five Caribbean Community Member States, namely Antigua and Barbuda, Belize, Grenada, Saint Lucia, Saint Vincent and the Grenadines.

The rationale behind this work is that CARICOM Member States would like to reduce energy use of all sub-markets in an environmentally sustainable manner, while reducing the foreign exchange impact of their energy sector. The effort recognises that public sector procurement represents one of the largest untapped potential sources of energy savings. To date, efforts to conserve energy and to be more energy efficient have been focused on site specific building energy audits and voluntary action by consumers. Energy audits tend to focus on the largest end use at the facility level such as air conditioning and lighting. However, this focus tends to relegate the parallel buying decisions made on a daily basis by purchasing officials and office managers (e.g. Permanent Secretaries and Directors). Typically, such buying decisions are usually made at the product level and are based on defensible first costs considerations. Unfortunately, decisions made on first costs considerations are done at the expense of any life cycle cost considerations of the product. Other jurisdictions such as the United States of America (USA) have evolved in this regard, and this Manual benefits from their experience as reviewed by the Lawrence Berkeley National Laboratory, Berkeley, California, USA[2].

This Manual attempts to capture the energy aspects of the initial product and building level decisions made by purchasing officials and office managers, by introducing product specifications that meet or exceed the international standards marks of renewable energy systems and products, as well as the 2018 CARICOM Regional Energy Efficiency Building Code. For energy efficiency products, this is achieved by codifying an internationally recognised energy efficiency label such as ENERGY STAR. It is hoped that as time progresses, later evolutions of this Manual will be extended beyond energy and product safety to include the full scope of Green Public Procurement (GPP).

This Green Building Procurement Manual is intended to leverage the influence of Government action in the transformation of the marketplace for renewable energy and energy efficiency, while giving Government the opportunity to lead by example in achieving national Sustainable Development Goals (SDG's), in particular SDG 7. Our approach is also intended to meet national policies on public procurement, energy and the environment with guiding sensitivity to the regional initiatives of the Caribbean Community (CARICOM) Secretariat and the CARICOM Regional Organisation for Standards for Quality (CROSQ).

[1] https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/sustainable-publicprocurement
[2] Guide to Promoting an Energy Efficient Public Sector (PePS) - https://etapublications.lbl.gov/sites/default/files/lbnl1004318.pdf

2 The Essentials of Green Public Procurement (GPP)

This Manual is further guided by the related "operational" definitions of the Caribbean Community Secretariat and the European Union (EU) of Green Public Procurement (GPP) among others. The Manual then goes on to further operationalize the definition of GPP to focus on "green buildings".

2.1 Definition of Green Public Procurement (GPP)

At present, the Caribbean Community Secretariat is developing the CARICOM Protocol on Public Procurement. While each Member State within the Caribbean Community (CARICOM) will seek to develop its own green public procurement policy, it is expected that their national efforts will be guided by the ongoing work at the CARICOM Secretariat. Under Article 1 – Use of Terms of the CARICOM Protocol on Public Procurement[3], it states that:

> *"green procurement" means the acquisition of goods, services or works in a manner that causes minimal adverse environmental impact and includes – (a) improved recyclability;*
> *(b) high recycled content;*
> *(c) greater energy efficiency;*
> *(d) utilizing clean technology or clean fuels;*
> *(e) reduced water consumption;*
> *(f) reduced emissions of irritating or toxic substances during installation or use;*
> *(g) reduced production of toxic substances during use or disposal;"*

The EU gives a broader operational definition of Green Public Procurement (GPP) but with a specific mention of life cycle impact[4]. Their operational definition is given as:

> *"a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured."*

2.2 Operationalising the Definition of Green Building Procurement

The successful implementation of the CARICOM definition of "green procurement" at the level of Member States requires the identification, evaluation, and application of embedded environmental criteria at both the strategic and operational levels. At the strategic level, implementation requires consideration of national sustainable development goals in addition to national energy and environmental policy. At the operational level, this requires consideration and alteration of specific buying patterns, to include a systematic inclusion of environmental attributes. In turn, this will permit government to influence the demand of environmentally preferable goods, services and works both within its own buildings as well as those in the wider

[3] CARICOM Protocol on Public Procurement - http://www.oas.org/juridico/PDFs/mesicic5_blz_resp_annex23.pdf
[4] EU Definition of Green Public Procurement (GPP) - https://ec.europa.eu/environment/gpp/what_en.htm

economies. This will also allow Government to influence the ability of vendors, professionals and industry at large to be responsive to Governments' use of green building energy and other environmental standards, and environmental performance considerations.

The use of standards and environmental performance considerations is also to be set within the context of achieving "value for money". Value for money includes consideration of multiple criteria such as cost, performance, availability, quality and environmental performance. This implies that ideally, a life cycle assessment of the goods and services should be applied. As a first step towards the ideal, the approach of using a payback criteria would suffice.

The concept of Best Value is given in page 21 by the European Commission in their manual "Buying Green! A handbook on green public procurement 3rd Edition[5]":

> *"Best value not only measures the cost of goods and services, but also takes into account factors such as quality, efficiency, effectiveness and fitness for purpose. Protection of the environment can be one of these factors and can therefore act as an equal consideration amongst others for the award of the contract."*

In turn, the EC handbook draws on an earlier explanation of the concept of "value for money" within the wider context of "sustainable procurement" by the United Kingdom (UK) for Environment, Food and Rural Affairs (2006) as:

> *"Sustainable Procurement is a process whereby organisations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organisation, but also to society and the economy, whilst minimising damage to the environment."*

At the regional institutional level of the CARICOM Secretariat, procurement is governed by the Guideline and Procedures Manual[6]. That manual's Principles and Standards governing procurement at the Secretariat are stated as follows:

> *"The procurement process shall be governed by the principles of **best value for money**, transparency, non-discrimination, and equal treatment, not withstanding that regional suppliers/contractors, either alone or in combination with international suppliers/contractors, are preferred."*

Also at the regional institutional level, the Caribbean Development Bank's (CDB's) policy on its core procurement principles[7] states:

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[5] Buying Green! A handbook on green public procurement 3rd Edition - https://ec.europa.eu/environment/gpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf

[6] CARICOM Secretariat's Guideline and Procedures Manual - https://caricom.org/wp-content/uploads/RevisedGPM2015-20-March-2015.pdf

[7] Caribbean Development Bank's (CDB's) policy on its core procurement principles - https://www.caribank.org/work-with-us/procurement/resources

- *"Value for Money (VfM): The principle of VfM means the effective, efficient, and economic use of resources, which requires an evaluation of relevant costs and benefits, along with an assessment of risks, and non-price attributes and/or life cycle costs, as appropriate. Price alone may not necessarily represent VfM.*
- *Economy: The principle of economy takes into consideration price, and non-price factors, including quality, sustainability and life cycle costs, as appropriate, that support VfM. Economy may consider sustainability with specific criteria in support of the Recipient's own sustainable Procurement Policy. The maximising of competition supports the achievement of economy.*
- *Efficiency: The principle of efficiency necessitates that procurement processes be proportional to the value and risks of the underlying project activities. Efficient procurement and subsequent contract management is crucial to the timely completion of projects.*
- *Integrity: The principle of integrity refers to CDB financing being used for its intended purposes, in accordance with Paragraph 1.1, and requires that all parties involved in the procurement process observe the highest standards of integrity and ethics during the procurement and execution of CDB financed contracts, and refrain from Prohibited Practices, in accordance with [Section 5].*
- *Equality and Fairness: The principle of equality and fairness requires that all Bidders be treated in an equal and fair manner and be provided equal opportunities. Therefore, open competitive procurement is CDB's preferred procurement approach, whenever possible. In addition, there should be an equitable distribution of rights and obligations between Recipients and Suppliers, Bidders, Consultants, and Contractors, and credible mechanisms for addressing procurement-related complaints and providing recourse.*
- *Transparency: The principle of transparency requires that relevant procurement information be made publicly available to all interested parties, consistently and in a timely manner, through readily accessible and widely available sources at reasonable or no cost and appropriate reporting of procurement activities, including contract awards."*

2.3 This Manual's Interpretation of the Definition of Green Building Procurement

In this Version 1.0 of the Green Building Procurement Manual, the scope of application of these definitions is narrowed to "green buildings". This is ostensibly interpreted to mean:

> "**The energy, product safety, and recyclability aspects of the public procurement process for sustainable energy systems in buildings which achieve the goal of 'value for money' on a life cycle basis**".

This operational definition builds on the following considerations from the European Union (EU), the Caribbean Community (CARICOM), and the Caribbean Development Bank (CDB) as surveyed above.

3 Barriers to Green Procurement

The likely barriers to green procurement are:

- The tradition least cost or best price approach to procurement decision making has always been based on the best first price, which is a very defensible policy by purchasing officers. That policy now has to be replaced by an approach that takes a more holistic approach to the total cost of ownership (TCO). This total cost approach includes supplier identification, purchasing, handling, shipping, disposal, resilience of materials, environmental impacts, and lifetime energy use savings.
- Green purchasing requires a committee based approach to decision making, as opposed to the traditional individual decisions made by procurement officials and office managers.
- The lack of appropriate and sufficient information on the environmental and energy performance of products, systems, and processes.
- The lack of integration of general green procurement principles into existing procurement policies and management systems such as those for quality, safety, environmental health and safety, national environmental policy, and international environmental policy.
- Products that are labelled as environmentally preferred or energy efficient may potentially be perceived to create barriers to international trade.

4 Design of a Green Building Procurement Programme

The design of programmatic approach to green building procurement involves the consideration of aspects. These range from defining the rationale and purpose of the programme, to implementing organizational change to provide for cross-function committee decision making, to the setting of priorities and targets, to the consideration of the multiple criteria of the environmental attributes of energy savings products, and finally to identifying lifetime criteria for the measurement of performance impacts.

4.1 Rationale – Purpose

The rationale of a public sector green building procurement programme is as follows:

1. To stimulate the demand for environmentally friendly products and services, especially those with energy savings impacts;
2. To encourage and support vendors, contractors and professionals to specify and supply environmentally friendly products and services;
3. To provide a mechanism for procurement officials and office managers to introduce green award criteria into the procurement process;
4. To provide a mechanism for procurement officials and office managers to communicate multicriteria approaches to environmental performance criteria;

5. To provide a mechanism for procurement officials to introduce minimum performance standards for environmentally beneficial products and services, in particular energy conservation, energy efficiency and renewable energy in buildings;
6. To identify a database of online tools to help guide procurement officials, contractors, vendors and professionals alike in evaluating the environmental performance of products and services;
7. To provide a data tracking mechanism to monitor the deployment of environmentally beneficial products and services in public sector buildings;
8. To perform post impact evaluations of the initiatives in order to measure the implementation impacts of green building initiatives;
9. To create an opportunity for an oversight committee to guide the overall green procurement process. (This committee would typically be led by the Ministry with responsibility for Energy, with support from the Standards Bureau, the Ministry with responsibility for the Environment, and the procurement officials in the Ministry of Finance);
10. To provide the basis of developing a legal mandate for a public sector organisation to develop their own internal green procurement guidelines that are consistent with the policies of the procurement officials;
11. To encourage vendors and professionals to "green their supply chains" by requesting that their international suppliers ship products that conform to environmental and other relevant green attributes.

4.2 Suggested Role of the Ministry(ies) with Responsibility for Energy and/or the Environment

The Ministry of Energy and/or the Environment should establish an Inter-Ministry Expert Committee on Green Building Procurement (IMEC GBP) (The Committee).

The suggested committee structure is as follows:

1. Secretary with a technical background from the Ministry of Energy and/or Environment;
2. Director level representative from the Ministry of Finance;
3. Representative from the Bureau of Standards;
4. Representative from the Ministry with responsibility for building management and/or facilities management; and
5. Representative from private sector.

The suggested Terms of Reference of The Committee is as follows:

a. Preparation and the oversight of the adoption by all concerned parties of the green building specifications for public procurement;
b. Oversight and constant update of the list of commonly used products and services by the public sector for the benefit of the procurement officials in the Ministry of Finance as well as office managers;

c. Oversight of the identification of materials employed in sustainable energy products with the view of promoting the use of green or sustainable materials;
d. Examination and/or inspection of select products and services that are procured by the public sector, with a view of developing green specifications as appropriate for adoption across all sectors of government and the public sector as a whole;
e. Review of this Manual on a regular basis with a view to its update in order to enhance green building procurement.

4.3 Setting Priorities and Targets

This Manual suggests the following approach to setting priorities and targets within the context of green building public procurement. The approach is guided in part by the prior work of the European Union in its handbook: Buying Green! A Handbook on Green Public Procurement 3rd Edition[8]. The approach is:

1. Undertake a step-by-step approach that begins with a pilot of a small range of renewable energy and/or energy efficiency products and technologies.
2. Target Ministries or Departments that express a wiliness to help demonstrate the successful implementation of the programme as a means to help gain credibility with the wider group of stakeholders across the public sector.
3. Prioritise those building energy end uses that are perceived to have the highest energy consumption impacts over the life cycle of a building. These might include air conditioning, lighting and office appliances and equipment.
4. Further prioritise by considering the overall environmental impact of the selected products or services. For example:
    a. Those energy end use technologies and products that have the greatest potential to influence the wider market including the private sector. Such end use technologies should be "visible" to the market, by virtue of their visual appeal within the context of a building, or by virtue of the involvement of high profile vendors, contractors and professionals. A special case could be made for the inclusion of the new entrepreneurs and startups entering the sustainable energy sector. Even further, particularly interesting products and technologies would be indoor office lighting, outdoor lighting, security lighting and roof top solar photovoltaics;
    b. Those political priorities that are topical, such as vulnerability to climate change, resilience in respect to fast recovery from hurricanes and other natural disasters and environmental adaptation;
    c. Those products, technologies and services that are already available in the marketplace, or than can readily be made available by vendors, contractors and suppliers. For example, consider taking advantage of any well established programme such as the environmental products that have the ENERGY STAR

[8] Buying Green! A Handbook on Green Public Procurement 3rd Edition - https://ec.europa.eu/environment/gpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf

label. ENERGY STAR[9] is considered to be a "single criteria label" that identifies "energy efficient" products and services relative to a market baseline or the prevailing "current practice". In reality, ENERGY STAR products are more than just energy efficient, they are also about safety and quality. Moreover, there are other programmes that represent "high" energy efficient products such as the programmes of the Consortium for Energy Efficiency[10] (CEE). Products and services in this higher category are relatively expensive and therefore require financial incentives to encourage their adoption in the marketplace. These incentives are typically paid to customers, trade allies within the context of specialised electric utility demand side management (DSM) programmes or government fiscal incentive and market based programmes. There is strong collaboration between ENERGY STAR and the CEE.

d. The cost and quantities of the environmentally products that could be purchased given existing annual budgets. Cost considerations should include life cycle costs such as purchase price, energy usage costs, annual and lifetime maintenance, and end-of-life disposal costs. An immediate and easily implantable surrogate for life cycle cost is simple payback;
e. Use green purchasing criteria that have been developed elsewhere that could be inserted directly into a tender document. For example, Section 5.2 below of this Manual gives specifications for several energy efficiency products that immediately impact on the minimal codes requirements given in the 2018 CARICOM Regional Energy Efficiency Building Code (CREEBC). (A notable exception is lighting, as the CREEBC specifies power density for particular space types, rather than specific products with higher energy efficiency);
f. Give practical and timely consideration to terminating any existing long term procurement contracts that are up for renewal. A poignant example of this are the electricity power purchase agreements (with embedded take-or-pay clauses) for the generation and supply of electricity to government owned and operated electric utilities. Consider what is the remaining duration of the term of the contract and the financial resources available for switching to renewable energy supply with storage. Consider whether there are any existing product or service providers that already have relevant expertise in sustainable energy and environmental management.

4.4 Environmental Attributes of Products

While this Manual considers the measurable energy consumption criteria as being the single most significant in respect to the 2018 CARICOM Regional Energy Efficiency Building Code, there are several other (multiple) criteria that should be considered at least anecdotally. These include:

[9] ENERGY STAR - https://www.energystar.gov
[10] Consortium for Energy Efficiency - https://www.cee1.org

- Toxic Material and Hazardous Content;
- Biodegradability;
- Recyclability;
- Content of Recycled/Renewable Materials;
- Emissions to Air, Land and Water;
- Waste associated with Product or Service; • Resource and/or Land use;
- Embodied Energy.

In order to operationalise the use of the multiple environmental criteria of products for procurement purposes, the Manual is guided by best practices from across the globe. Examples of best practices can be found in the following jurisdictions:

4.4.1 European Union

Guidance from the European Union's (EU) handbook, Buying Green! A Handbook on Green Public Procurement outlines the three kinds of labels that have been of use in the industry. These are:

- Single Issue Labels: These are based on one or more pass/fail criteria linked to a specific issue, e.g. energy efficiency. A good example is ENERGY STAR from the United States of America. This Manual employs ENERGY STAR for energy efficiency measures.
- Graded Product Labels: These are based on the grading products or services in respect to their environmental performance on a particular attribute, e.g. energy efficiency. A good example of this is the EU Energy Label. Caribbean procurement officers would also wish to consider this label.
- Multi-Criteria Labels: The EU Handbook Buying Green! states that "*Multicriteria labels are based on scientific information about the environmental impact of a product or service throughout its life cycle, from extraction of the raw materials, through production and distribution, the use phase, and final disposal. They apply a number of criteria that set the standard for the label in question. Different sets of criteria are established for each product or service group covered. Examples of this type of label include the EU Ecolabel[11] (flower), the Nordic Swan[12] and the Blue Angel[13]*"

Other examples of European Labels are:

- Sweden's Eco-Label Listings[14].
- Switzerland's Eco-label Listings[15].

[11] EU Ecolabel for Businesses - https://ec.europa.eu/environment/ecolabel/eu-ecolabel-for-businesses.html
[12] Nordic Swan - https://www.nordic-ecolabel.org/the-nordic-swan-ecolabel
[13] Blue Angel, The German Ecolabel - https://www.blauer-engel.de/en
[14] Sweden's Eco-Label Listings - https://www.svanen.se/
[15] All Ecolabels in Switzerland - http://www.ecolabelindex.com/ecolabels/?st=country,ch

4.4.2 Japan

- Energy Labels in Japan - Mark Index[16].

4.4.3 Canada

- The EnerGuide label[17].

4.4.4 Mexico

- Mexico Energy Label[18].
- All ecolabels in Mexico[19].

4.4.5 Brazil

- Energy Efficiency Labeling in Brazil[20].

4.4.6 World

- International Energy Agency (IEA) - Energy Standards and Labelling Programs throughout the World in 2013[21].

4.5 Life Cycle Criteria to Measure Performance Impacts

There are several approaches to explicitly addressing the life cycle impacts and their associated criteria within the context of the green building procurement process. The implementation of these approaches varies in the level of ambition and difficulty.

The award criteria available to suppliers are, in increasing level of ambition and technical complexity, as follows:

4.5.1 Simple Payback for Energy Efficient and Energy Saving Product and Services.

[16] Energy Labels in Japan - Mark Index - https://www.env.go.jp/policy/hozen/green/ecolabel/f01.html
[17] The EnerGuide label - https://www.nrcan.gc.ca/energy-efficiency/energuide-canada/energuide-label/13609
[18] Mexico Energy Label - https://www.cerpass.com.tw/en-US/ima_mexico_02
[19] All ecolabels in Mexico - http://www.ecolabelindex.com/ecolabels/?st=country,mx
[20] Energy Efficiency Labeling in Brazil - https://thebrazilbusiness.com/article/energy-efficiency-labeling-in-brazil
[21] IEA) - Energy Standards and Labelling Programs throughout the World in 2013 - https://www.iea4e.org/document/343/energy-standards-labelling-programs-throughout-the-world-in-2013

The energy industry uses the concept “simple” payback method to calculate the payback of an energy efficiency or renewable energy measure. The formula is given as:

Simple Payback (in Years) = Incremental installed cost / first year energy savings.

Where:
Incremental installed cost – cost difference between doing the base line measure versus doing the energy efficient measure or renewable energy measure.

While the Simple Payback Method is quite intuitive and easy to compute, due care must be taken in its application. There are several technical issues that should be considered and addressed. The most important are:

(a) The Simple Payback Method does not take into account the lifetime energy saving impacts of the measure, or the discounting of those future financial savings.
(b) Simple payback periods should not exceed the lifetime of the equipment;
(c) Simple payback periods should be relatively short. However an “acceptable” payback policy would depend on the type of energy saving measure under consideration. For example, a low cost measure should have a payback of less than one year. That way, the beneficiary building would free-up some of their annual budget for energy expenses within that first year. The surplus could then be reinvested to additional energy saving measures all before the end of the current the budget year. On the other hand, some energy saving measures will have simple payback periods of more than one year. A simple payback of say five (5) years is “roughly” a twenty (20) percent return on investment. That is well above the typical discount rates used by governments.
(d) Simple payback periods must also be considered within the context to the prevailing market conditions. For example, supply chains would necessarily be specific to whether the market is large versus small, urban versus rural, continental versus small island, competitive vs oligopoly or monopoly, and local fiscal policy and the existence of market based incentives, etc. Each of the five CARICOM jurisdictions targeted by this Manual would treat to their own unique market realities. Only local market research aimed could treat to these market conditions, and this further defines the role of The Committee.
(e) In some specialised instances, decisions based on simple payback are not relevant to all energy technology interventions, e.g. an energy efficient air conditioner or chiller installed for use in a hospital operating theatre is not really an "energy" decision, but rather a "health" or "medical" decision. Within this context, air-conditioners are required by

code to designed to be of the "once through" type, where 100 percent of the conditioned air is ejected to the outdoor. That means that there is no recycling of conditioned air as an energy saving measure as is typical with office buildings. At most the ejected cooled air could be used to pre-cool fresh intake air using fully isolated heat exchangers. This would minimise chiller energy. These hospital theatre systems would therefore have long payback periods from an energy perspective, perhaps upwards of fifteen (15) years. However, the energy based simple payback analysis is somewhat irrelevant given the special context even though it could still be used as a guide to help choose one chiller over another; and

4.5.2 Life Cycle Assessment (LCA): This would require bidders to evaluate the life cycle impacts of their products and services.

The Stanford University approach to life cycle cost assessment prescribes that the best option is simply that with the lowest life cycle cost (LCC) or the highest net present value as computed by the formula[22]:

$$LCC = C + PV_{RECURRING} - PV_{RESIDUAL\text{-}VALUE}$$

Where:

LCC is the life cycle cost
C is the Year 0 construction cost (hard and soft costs)
$PV_{RECURRING}$ is the present value of all recurring costs (utilities, maintenance, replacements, service, etc.)

$PV_{RESIDUAL\text{-}VALUE}$ is the present value of the residual value at the end of the study life (note: these guidelines recommend this to be $0)

4.6 Grievance Mechanisms

This Green Building Procurement Manual recommends that grievance mechanisms should first be grounded within the context and framework of national legislation, policies, and administrative procedures for addressing grievances in public procurement. Given this Manual contemplates the special nature of the procurement of good and services that have

[22] The Stanford University approach to life cycle cost assessment, - https://sustainable.stanford.edu/sites/default/files/Guidelines_for_Life_Cycle_Cost_Analysis.pdf)

environmental attributes, it is further recommended that green building procurement grievance mechanisms should be guided by two principal documents:

1. The United Nations Environmental Programme (UNEP) Environmental and Social Sustainability Framework[23] (ESSF). A relatively high level reference is made on stakeholder engagement processes in respect to "grievance redress" for persons who may be adversely by a UNEP project (see page 20).
2. The United Nation Development Programme (UNDP) Guidance Note - UNDP Social and Environmental Standards (SES) - Stakeholder Engagement - Supplemental Guidance: Grievance Redress Mechanism[24]. The UNDP document move further along the way to operationalising grievance redress mechanisms (GRM). The UNDP guidance is reduced to a detailed checklist of questions in a GRM Evaluation Tool (at Attachment 1 on pages 11 -12 of their document). The checklist is presented in a logical fashion that makes it straight forward for public procurement officials to contemplate as they develop their own targeted grievance processes for environmental goods and services (should none be available). The illustrative GRM Evaluation Tool is reproduced here as follows:

[23] UNEP Environmental and Social Sustainability Framework (ESSF) - https://wedocs.unep.org/bitstream/handle/20.500.11822/32022/ESSFEN.pdf?sequence=1&isAllowed=y

[24] UNDP Guidance Note - UNDP Social and Environmental Standards (SES) - https://info.undp.org/sites/bpps/SES_Toolkit/SES%20Document%20Library/Uploaded%20October%202016/Supplemental%20Guidance_Grievance%20Redress%20Mechanisms.pdf

GRM Evaluation Tool (Source: UNDP Social and Environmental Standards (SES) - Stakeholder Engagement - Supplemental Guidance: Grievance Redress Mechanism)

Questions to Consider		
Design Stage		
What environmental and/or social impacts, risks or concerns led you to include a Grievance Redress Mechanism (GRM) in your project? Where/how did you locate the GRM? How did you determine it would be effective? Was the GRM designed with participation from the communities it is intended to serve?		
Implementation Stage		
1. Organizational Commitment	Do the project's management and staff recognize and value the GRM process as a means of improving public administration and enhancing accountability and transparency? Is grievance redress integrated into the project's core activities? Is grievance redress integrated into staff job descriptions and responsibilities? Is it appropriately resourced and monitored?	
2. Principles:		
2.1 Legitimacy	Does the GRM operate independently of interested parties? Is the GRM widely-perceived as independent?	
2.2 Accessibility	Is the GRM accessible to all stakeholders, irrespective of their remoteness, language, education or income level? Are procedures to file grievances and seek action easily understood by project beneficiaries? Can grievances be filed anonymously? Are there a range of contact options? Is the GRM appropriately advertised and communicated to project-affected people?	
2.3 Predictability	Is the GRM responsive to the needs of all complainants? Does the GRM offer a clear procedure with time frames for each stage and clarity on the types of results it can (and cannot) deliver?	
2.4 Fairness	Are grievances treated confidentially, assessed impartially, and handled transparently?	
2.5 Rights Compatibility	Are the GRM's outcomes consistent with applicable national and international standards? Does it restrict access to other redress mechanisms?	
2.6 Transparency	Are the GRM's procedures and outcomes transparent enough to meet the public interest concerns at stake?	

2.7 Capability	Do GRM officials have the necessary technical, human and financial resources, means and powers to investigate grievances?	
3. Staff	Are there dedicated and trained staff available to handle the GRM? Are they given learning opportunities and do they receive any systematic reviews of their performance?	
4. Processes:		
4.1 Uptake	Do multiple uptake channels exist?	
4.2 Sorting and processing	Is there a system to categorize, assign priority, and route grievances to the appropriate entity?	
4.3 Acknowledgement and follow-up	Are complaints acknowledged in writing? Does the acknowledgement outline the GRM process, provide contact details and indicate how long it is likely to take to resolve the grievance? Are there clear timetables that are publicly available?	
4.4 Verification, investigation and action	Is the merit of each grievance judged objectively against clearly defined standards? Are investigators neutral or do they have a stake in the outcome? Is action taken on every grievance?	
4.4 Monitoring and Evaluation	Is there a process to track grievances and assess progress being made to resolve grievances? Are there indicators to measure grievance monitoring and resolution? If there is data being collected, is this data used to make policy and/or process changes to minimize similar grievances in the future?	
4.6 Feedback	Does a user survey exist to get feedback on the credibility of the process? Is such feedback publicly available? Is there right to appeal? If yes, are GRM users informed about this right?	
4.6. Analysis	Is there a process to analyze the effectiveness of the GRM? Is there a timeframe?	

5 Product Specifications for Green Buildings in the Caribbean

The purpose of this section is to present specification information that procurement officials can use in their tender documents.

5.1 Renewable Energy Technology

Many of the specification information for renewable energy is captured in the certifications marks and product safety/electrical standards that are required in the industry. Procurement officials should always be sure to only purchase technologies that are appropriately certified and marked.

5.1.1 Renewable Energy Systems

All distribution generation (DG) facilities that interconnect to the national electric grid shall conform with the requirements of all the relevant government authorities, including but not limited to authorities on engineering, planning, regulatory, energy policy, and environmental policy. Further, all DG's shall conform to the requirements of the USA National Fire Protection Association (NFA) 70, and the USA National Electric Code (NEC).

All DG should be compatible with the national electric utility's standard operating, protection, control and metering systems, and communications practices. These shall include the requirement either of:

- The Institute of Electrical and Electronic Engineers (IEEE) Standard 1547 – Interconnecting Distributed Resources with Electric Power Systems;
- CAN/CSA C22.3 No. 9-08 Standard – Interconnection of Distributed Resources and Electricity Supply Systems;
- British Standard EN 50160;
- The German Guidelines from BDEW for medium Voltage (2008) and from VDE for Low Voltage (VDE AR-N 4105:2011-08);
- NFA NEC 2011 Code

5.1.2 Photovoltaic Modules and Panels

The Photovoltaic industry has several product certification requirements for panels and modules that speak to issues of product safety and consumer protection at a basic level. Procurement officials should only buy products that are appropriately marked.

Certification requirements for PV panels are:

- Non-concentrating crystalline silicon (c-Si) modules, Non-concentrating ThinFilm modules shall be certified to UL 1703, the Standard for Safety for FlatPlate Photovoltaic Modules and Panels by a Nationally Recognised Test Lab

(NRTL) for safety and reliability. Modules shall also be tested using the relevant subsections of:

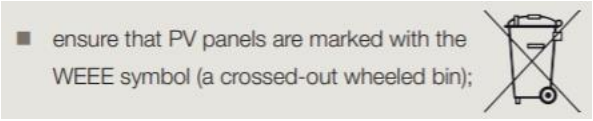
- ○ International Electrotechnical Commission IEC Standard 61215 or 61646 as appropriate; or ○ International Electrotechnical Commission IEC Standard 61730; or ○ IEC/UL 61730.

Certification Marks from nationally accredited testing and certification organisations include, but are not limited to:

- CE - Conformite Europeenne[25] (Certifies that a product has met EU health, safety, and environmental requirements, which ensure consumer safety);
- CSA – Canadian Standards Association[26] (CAS); and CSA International
- TUV - Technischer Überwachungsverein[27] (Germany and Austria)
- UL – Underwriters Laboratory[28]
- MCS – Microgeneration Certification Scheme[29] (UK). (NB: *MCS is a standard organisation[30]. [They] create and maintain standards that allows for the certification of products, installers and their installations*).

Procurement officials may consider the mandate of international membership nonprofit organisations such as PV Cycle[31]. This organisation is originally founded in the United Kingdom circa 2007 by the private sector and is concerned with the sustainable end-of-life disposal of solar PV modules and panels, and other e-Waste.

Later in 2012, the European Union revised its existing legislation for the Waste Electrical and Electronic Equipment Directive (WEEE) to explicitly include photovoltaics and other products. This revision is known officially as WEEE Directive 2012/19/EU and published in issue L197 of the Official Journal on 24 July 2012. The provision on the disposal of photovoltaic (PV) modules is given in Article 2,(1), a[32]. Among other things, the PV panels should be marked as follows:



[25] CE - https://ec.europa.eu/growth/single-market/ce-marking_en
[26] CSA - https://www.csagroup.org
[27] TUV - https://www.tuv.com/world/en
[28] UL - https://www.ul.com
[29] MCS - https://www.ofgem.gov.uk/key-term-explained/microgeneration-certification-scheme-mcs
[30] MCS is a Standards Organisation - https://mcscertified.com/about-us
[31] PV CYCLE - http://www.pvcycle.org/homepage
[32] WEEE Directive 2012/19/EU, see Article 2,(1), a. - https://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:197:0038:0071:EN:PDF

5.2 Energy Conservation and Energy Efficiency Products

The following specification tables map baseline energy requirements taken from the 2018 CARICOM Regional Energy Efficiency Building Code to energy efficiency products listed by ENERGY STAR. The purpose is three fold: (a) to provide procurement officials with a reference to quickly find product specifications for ENERGY STAR equipment that could be included in tender documents; (b) to map the ENERGY STAR products to the Building Code; (c) to provide the basis for the determination of energy savings potential and the performance of these purchase decisions. This potential should be combined with run hours to get a total picture about the difference in energy consumption in the base case versus energy consumption in the energy efficient case. Energy saving performance would simply be a matter of subtracting these two numbers. Simple payback would then be computed by determining the incremental cost of the energy efficiency case over the base case. Incremental cost is simply the difference in cost between what would have been purchase normally in the base case, versus the expected higher costs of the energy efficient product. These two sets of cost numbers would come from existing records and the bids of the prospective suppliers and vendors.

The first column (to the left) in the specification tables below are the baseline data as prescribed by the 2018 CARICOM Regional Energy Efficiency Building Code. The Building Code prescribes minimum performance standards only. The remaining columns to the right, give links to the energy efficient products to be found on the ENERGY STAR website. This website is where to find the technical specifications that procurement official would need to include in their tender documents.

Specification Tables

Table 1

2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)	Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search Section 402 Building Envelope Requirements – ENERGY STAR Recommendation	
Table C402.1.3 Building Envelope Requirements for Tropical Climate Zones (pg. C21) Units of Measure: U in W/m^2K or Btu/h•ft^2•^{o}F; R-Value in m^2•K/W or h•ft•f/Btu NB: U = 1/R, i.e. U is the reciprocal of R) Table C402.1.4.1 Effective R-Values for Steel Stud Wall Assemblies (pg. C-22) Units of Measure: U in W/m^2K or Btu/h•ft^2•^{o}F; R-Value in m^2•K/W or h•ft•f/Btu NB: U = 1/R, i.e. U is the reciprocal of R) Table C402.1.4 Opaque Thermal Envelope Assembly Maximum Requirements, UFactor Method (pg. C-23) Units of Measure: U in W/m^2K or Btu/h•ft^2•^{o}F; R-Value in m^2•K/W or h•ft•f/Btu NB: U = 1/R, i.e. U is the reciprocal of R)	No ENERGY STAR specs found for commercial buildings.	(ENERGY STAR Recommended Home Insulation R–Values – Attics & Floors) (R-Value for Residential Buildings. Given for guidance only. Residences in Zone 1 [i.e. Florida, Hawaii, Puerto Rico, Guam, US Virgin Islands]: Attic – Uninsulated = R30 to R49 Attic with 3 to 4 ins of existing insulation = R25 to R30 Floor = R13) **Recommendation**: CARICOM Procurement Officials should seek to purchase thermal insulation with higher R-Values subject to budget considerations and space limitations.

Table C402.3 Minimum Roof Reflectance and Emittance Options (pg. C-25) Units of Measure: R_{aged} = Solar Reflectance Index (aged) (dimensionless); $R_{initial}$ = Solar Reflectance Index (initial)(dimensionless))	Roof Products	ENERGY STAR Roof Products Key Product Criteria and ENERGY STAR® Program Requirements Product Specification for Roof Products Eligibility Criteria Version 3.0 Reflectance: Low Slope roofs must have an initial solar reflectance of >= 0.65. After 3 years, the solar reflectance must be >= 0.50. Steep Slope roofs must have an initial solar reflectance of >= 0.25. After 3 years, the solar reflectance must be >= 0.15. **Recommendation**: CARICOM Procurement Officials should seek to purchase roof materials and finishes that have higher Solar Reflectance Index subject to budget considerations
Table C402.4 Building Envelope fenestration Maximum UFactor and SHGC Requirements (pg. C-26) Units of Measure: U in W/m^2K or $Btu/h•ft^2•^oF$; SHGC = Solar Heat Gain Coefficient (dimensionless))	No ENERGY STAR specs found for commercial buildings.	(ENERGY STAR Residential Windows, Doors and Skylights) (U & SHGC for residences only. Given for guidance only. Residences in Southern Zone 1 [i.e. Florida and similar] Windows: U-Factor ≤ 0.40 SHGC ≤ 0.25 Skylights: U-Factor ≤ 0.60 Btu/h•ft2•oF SHGC ≤ 0.28 NB: At Air leakage ≤ 0.3 cfm/ft^2

<table>
<tr>
<td></td>
<td></td>
<td>Doors:
<table>
<tr><th colspan="4">DOORS</th></tr>
<tr><td>GLAZING LEVEL</td><td>U-FACTOR[1]</td><td colspan="2">SHGC[2]</td></tr>
<tr><td>Opaque</td><td>≤ 0.17</td><td colspan="2">No Rating</td></tr>
<tr><td>≤ ½-Lite</td><td>≤ 0.25</td><td colspan="2">≤ 0.25</td></tr>
<tr><td rowspan="2">> ½-Lite</td><td rowspan="2">≤ 0.30</td><td>Northern North-Central</td><td>≤ 0.40</td></tr>
<tr><td>Southern South-Central</td><td>≤ 0.25</td></tr>
</table>
Air Leakage for Sliding Doors ≤ 0.3 cfm/ft^2
Air Leakage for Swinging Doors ≤ 0.5 cfm/ft^2
Southern Climate [includes Florida])

<u>Recommendation</u>: CARICOM Procurement Officials should seek to purchase windows, doors and skylights with <u>lower</u> U-Factors, SHGC’s and Air Leakage subject to budget considerations.</td>
</tr>
<tr>
<td>Table C402.5.2 Maximum Air Leakage Rate for Fenestration Assemblies (pg. C-29)

Units of Measure:
Leakage in L/s or CFM/FT$^{2)}$)

NB: Unit Conversion: For SI units – 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093 m^3</td>
<td>No ENERGY STAR specs found for commercial buildings.</td>
<td>(ENERGY STAR Residential Windows, Doors and Skylights)

Windows:
No spec given at this URL

Skylights:
Air leakage ≤ 0.3 cfm/ft^2

<u>Recommendation</u>: CARICOM Procurement Officials should seek to purchase windows, doors and skylights with <u>lower</u> Air Leakage subject to budget considerations.</td>
</tr>
</table>

Table 2

2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)	Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search Section C403 Building Mechanical Systems – ENERGY STAR Recommendations	
Table C403.3.2 (1). Minimum Efficiency Requirements: Electrically Operated Unitary Air Conditioner and Condensing Units (pg. C-32 & C33) Units of Measure: kW = kilowatts; $SCOP_c$ = Sensible Coefficient of Performance (cooling); COP_c = Coefficient of Performance (cooling); $ICOP_c$ = Integrated Coefficient of Performance (cooling) NB: Single phase, air-cooled air conditioners less than 19 kW (65,000 Btu/h) are regulated by NAECA. SEER values are those set by NAECA. NAECA = National Compliance Energy Conservation Act (USA) SEER = Seasonal Energy Efficiency Ratio (USA) NB: Unit Conversion: For 1 KW = 3,412 Btu/h	Air Conditioners, Central	ENERGY STAR Air-Source Heat Pumps and Central Air Conditioners Key Product Criteria Central Air Conditioners: ≥15 SEER/ ≥12.5 EER for split systems Where: EER = Energy Efficiency Ratio SEER = Seasonal Energy Efficiency Ratio Unit Conversion: EER = 3.41214 × COP, or COP = EER / 3.41214 **Recommendation**: CARICOM Procurement Officials should seek to purchase Central Air Conditioners with higher EER's or COP's specifications subject to budget considerations
Table C404.3.2 (2) Minimum Efficiency Requirements: Electrically Operated Unitary and Applied Heat Pumps (pg. C34 & C-35) Units of Measure: kW = kilowatts; $SCOP_C$ = Sensible Coefficient of Performance (cooling); COP_C = Coefficient of Performance (cooling); $ICOP_C$ = Integrated Coefficient of Performance (cooling))	(Heat Pumps)	(ENERGY STAR Air-Source Heat Pumps and Central Air Conditioners Key Product Criteria) Air-Source Heat Pumps: ≥ 8.2 HSPF ≥15 SEER/ ≥12 EER for single package equipment including gas/electric package units

$SCOP_H$ = Sensible Coefficient of Performance (heating); COP_H = Coefficient of Performance (heating); NB: Unit Conversion: For 1 KW = 3,412 Btu/h)		SEER = Seasonal Energy Efficiency Ratio EER = Energy Efficiency Ratio NB: Unitary = Single Package Unit Conversion: EER = 3.41214 × COP, or COP = EER / 3.41214 **Recommendation #1**: CARICOM Procurement Officials should seek to purchase Heat Pumps with higher EER's or COP's specifications subject to budget considerations. **Recommendation #2**: CARICOM Procurement Officials should seek to purchase HVAC equipment with copper coils and fins. While these are more expensive, copper withstand the climatic and saline atmospheric conditions of the Caribbean must better than other materials. Further, they are easier to clean and maintain.
Table C403.3.2 (3) Minimum Efficiency Requirements: Electrically Operated Packaged Terminal Air Conditioners, Package Terminal Heat, Single-Package Vertical Air Conditioners, Single Vertical Heat Pumps, Room Air Conditioners and Room Air Conditioner Heat Pumps (pg. C36 and C-37) Units of Measure: kW = kilowatts; $SCOP_C$ = Sensible Coefficient of Performance (cooling); COP_C = Coefficient of Performance (cooling);	Air Conditioner, Room	ENERGY STAR Room Air Conditioners Key Product Criteria See Tables at URL for room air conditioners over a range of sizes Unit Conversion: EER = 3.41214 × COP, or COP = EER / 3.41214 CEER - Combined Energy Efficiency Ratio:

$ICOP_C$ = Integrated Coefficient of Performance (cooling)) $SCOP_H$ = Sensible Coefficient of Performance (heating); COP_H = Coefficient of Performance (heating); NB: Unit Conversion: For 1 KW = 3,412 Btu/h		The ratio of measured cooling output (in BTU per hour) to measured average electrical energy input (in Watts) and measured standby/off-mode power consumption (in Watts.) **Recommendation #1**: CARICOM Procurement Officials should seek to purchase Room Air Conditioners with higher EER's or COP's specifications subject to budget considerations **Recommendation #2**: CARICOM Procurement Officials should seek to purchase HVAC equipment with copper coils and fins. While these are more expensive, copper withstand the climatic and saline atmospheric conditions of the Caribbean must better than other materials. Further, they are easier to clean and maintain.

Table 3

2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)	Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search Section C403 Building Mechanical Systems – ENERGY STAR Recommendations	
Table C403.3.2 (5) Minimum Efficiency Requirements: Gas- and Oil-Fired Boilers (pg. C-38) Units of Measure: kW = kilowatts; AFUE = Annual Fuel Utilization Efficiency expressed as a percentage (dimensionless) E_t = Thermal Efficiency expressed as a percentage (dimensionless) E_c = Combustion Efficiency expressed as a percentage (dimensionless) NB: Unit Conversion: For 1 KW = 3,412 Btu/h)	Boilers	ENERGY STAR Boiler Specs and/or ENERGY STAR® Program Requirements Product Specification for Boilers Eligibility Criteria Version 3.0 ENERGY STAR certified gas boilers have annual fuel utilization efficiency (AFUE) ratings of 90% ENERGY STAR certified oil boilers have annual fuel utilization efficiency (AFUE) ratings of 87% **Recommendation**: CARICOM Procurement Officials should seek to purchase Boilers (Residential) with higher annual fuel utilization efficiency (AFUE) specifications subject to budget considerations
Table C403.3.2 (5) Minimum Efficiency Requirements: Gas- and Oil-Fired Boilers (pg. C-38) Units of Measure: kW = kilowatts; AFUE = Annual Fuel Utilization Efficiency expressed as a percentage (dimensionless) E_t = Thermal Efficiency expressed as a percentage (dimensionless) E_c = Combustion Efficiency expressed as a percentage (dimensionless)	Commercial Boilers	Commercial Boilers Spec and/or Eligibility Criteria ENERGY STAR certified commercial boilers have a thermal efficiency of ≥ 94.0% and a turndown ratio of ≥ 5:1. They use 14 percent less energy than a standard model **Recommendation**: CARICOM Procurement Officials should seek to purchase Commercial Boilers with higher annual fuel utilization efficiency (AFUE) and higher Turndown Ratios

NB: Unit Conversion: For 1 KW = 3,412 Btu/h)		specifications subject to budget considerations
Table C404.2 Minimum Performance of Water Heating Equipment (pg. C-62 & C-63) Units of Measure: kW = kilowatts; L = Letres V = Volume in Letres V_m = Measure Volume in Letres EF = Energy Factor E_t = Thermal Efficiency expressed as a percentage (dimensionless) SL = Standby Loss COP = Coefficient of Performance SEF = Solar Energy Factor (dimensionless) NB: Unit Conversion: 1 KW = 3,412 Btu/h) ^oF = [^oC • 1.81] + 32 1 L = 0.2642 gal 1 W/L = 5,076 Btu/gal	Commercial Water Heaters	Commercial Water Heater Key Product Criteria and/or ENERGY STAR Program Requirements Product Specification for Commercial Water Heaters Eligibility Criteria See Tables at URL for: (a) Commercial Water Heater Key Product Criteria; (b) ENERGY STAR Product Performance Criteria for Certified Commercial Gas-fired Water Heaters, i.e. Thermal Efficiency TE ≥ 0.94, and Maximum Standby Loss [Btu/hr] ≤ 0.84 * [(Input Rate / 800) +110 $(Volume_r)_{1/2}$] ; and (c) Criteria for Certified Commercial Electric Heat Pump Water Heaters **Recommendation**: CARICOM Procurement Officials should seek to purchase Water Heaters with higher Thermal Efficiency (TE or E_t) specifications, and lower Standby Loss (SL) specifications subject to budget considerations
No CREE BC Code	Connected Thermostat	Connected Thermostat Device Criteria and/or ENERGY STAR Program Requirements Product Specification for Connected Thermostat Products Eligibility Criteria Version 1.0 Rev. Jan 2017

		See Table 1 at URL for Connected Thermostat Device Criteria **<u>Recommendation</u>**: CARICOM Procurement Officials should seek to purchase Thermostats that follows the ENERGY STAR recommendations.

Table 4

2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)	Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search	
Table C403.3.2 (5) Minimum Efficiency Requirements: Gas- and Oil-Fired Boilers (pg. C-38) Units of Measure: kW = kilowatts; AFUE = Annual Fuel Utilization Efficiency expressed as a percentage (dimensionless) E_t = Thermal Efficiency expressed as a percentage (dimensionless) E_c = Combustion Efficiency expressed as a percentage (dimensionless) NB: Unit Conversion: For 1 KW = 3,412 Btu/h)	Boilers (Residential and other)	Boiler Specs and/or ENERGY STAR® Program Requirements Product Specification for Boilers Eligibility Criteria Version 3.0 ENERGY STAR certified gas boilers have annual fuel utilization efficiency (AFUE) ratings of 90% ENERGY STAR certified (residential and other) oil boilers have annual fuel utilization efficiency (AFUE) ratings of 87% **Recommendation**: CARICOM Procurement Officials should seek to purchase Boilers (Residential) with higher annual fuel utilization efficiency (AFUE) specifications subject to budget considerations
Table C403.3.2 (5) Minimum Efficiency Requirements: Gas- and Oil-Fired Boilers (pg. C-38) Units of Measure: kW = kilowatts; AFUE = Annual Fuel Utilization Efficiency expressed as a percentage (dimensionless) E_t = Thermal Efficiency expressed as a percentage (dimensionless)	Commercial Boilers	Commercial Boilers Spec and/or Eligibility Criteria ENERGY STAR certified commercial boilers have a thermal efficiency of ≥ 94.0% and a turndown ratio of ≥ 5:1 **Recommendation**: CARICOM Procurement Officials should seek to

E_c = Combustion Efficiency expressed as a percentage (dimensionless) NB: Unit Conversion: For 1 KW = 3,412 Btu/h)		purchase Commercial Boilers with higher annual fuel utilization efficiency (AFUE) and higher turn down ratio specifications, subject to budget considerations

Table 5

2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)	Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search ENERGY STAR Recommendations for Section C403 Building Mechanical Systems of CREE BC	
No CREE BC Code	Dehumidifiers	Dehumidifiers Key Efficiency Criteria – Energy Star and/or ENERGYSTAR® Program Requirements Product Specification for Dehumidifiers Eligibility Criteria Version 5.0 See Tables at URL for: Dehumidifiers Key Efficiency Criteria ENERGY STAR Efficiency Criteria for Certified Portable Dehumidifiers ENERGY STAR Efficiency Criteria for Certified Whole-Home Dehumidifiers Integrated Energy Factor (IEF): A measure of energy efficiency of a dehumidifier that expresses the amount of water the dehumidifier can remove with a given energy input under test conditions, reported in liters per kilowatt hour (L/kWh). **Recommendation**: CARICOM Procurement Officials should seek to purchase dehumidifiers with a high Integrated Energy Factor (IEF)
Table C403.3.2 (1). Minimum Efficiency Requirements: Electrically Operated Unitary Air Conditioner and Condensing Unit (pg. C-32 & C33) Units of Measure: kW = kilowatts; $SCOP_c$ = Sensible Coefficient of Performance (cooling);	Light Commercial Heating and Cooling	Light Commercial HVAC Key Product Criteria and/or ENERGY STAR® Program Requirements, Product Specification for Light Commercial HVAC, Eligibility Criteria Version 3.1 Rev. March 2017 See Tables at URL for: ENERGY STAR Light Commercial HVAC – Eligible Product Type

COP_c = Coefficient of Performance (cooling); $ICOP_c$ = Integrated Coefficient of Performance (cooling) NB: Single phase, air-cooled air conditioners less than 19 kW (65,000 Btu/h) are regulated by NAECA. SEER values are those set by NAECA. NAECA = National Compliance Energy Conservation Act (USA) SEER = Seasonal Energy Efficiency Ratio (USA) NB: Unit Conversion: For 1 KW = 3,412 Btu/h Table C403.3.2 (2) Minimum Efficiency Requirements: Electrically Operated Unitary and Applied Heat Pumps (pg. C-34 & C-35) Units of Measure: kW = kilowatts; $SCOP_C$ = Sensible Coefficient of Performance (cooling); COP_C = Coefficient of Performance (cooling); $ICOP_C$ = Integrated Coefficient of Performance (cooling)) $SCOP_H$ = Sensible Coefficient of Performance (heating); COP_H = Coefficient of Performance (heating); NB: Unit Conversion: For 1 KW = 3,412 Btu/h) Table C403.3.2 (3) Minimum Efficiency Requirements: Electrically Operated Packaged Terminal Air		ENERGY STAR Efficiency Criteria: (a) Criteria for Certified Light Commercial Air Conditioners (b) Criteria for Certified Light Commercial Heat Pumps (c) Criteria for Certified Light Commercial VRF Multi-Split Systems EER = Energy Efficiency Ratio: The ratio of the produced cooling effect of an air conditioner or heat pump to its net work input, expressed in Btu/watt-hour. Unit Conversion: EER = 3.41214 × COP, or COP = EER / 3.41214 **Recommendation #1**: CARICOM Procurement Officials should seek to purchase Light Commercial Air Conditioners and other Heating, Ventilation and Air Conditioning (HVAC) equipment with higher EER's or COP's specifications subject to budget considerations. **Recommendation #2**: CARICOM Procurement Officials should seek to purchase HVAC equipment with copper coils and fins. While these are more expensive, copper withstand the climatic and saline atmospheric conditions of the Caribbean must better than other materials. Further, they are easier to clean and maintain.

Conditioners, Package Terminal Heat, Single-Package Vertical Air Conditioners, Single Vertical Heat Pumps, Room Air Conditioners and Room Air Conditioner Heat Pumps (pg. C-36 & 37) Units of Measure: kW = kilowatts; $SCOP_C$ = Sensible Coefficient of Performance (cooling); COP_C = Coefficient of Performance (cooling); $ICOP_C$ = Integrated Coefficient of Performance (cooling)) $SCOP_H$ = Sensible Coefficient of Performance (heating); COP_H = Coefficient of Performance (heating); NB: Unit Conversion: For 1 KW = 3,412 Btu/h)		

Table 6

<table>
<tr><td rowspan="2">2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)</td><td colspan="2">Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search</td></tr>
<tr><td colspan="2">ENERGY STAR Recommendations for Section C403 Building Mechanical Systems of CREE BC</td></tr>
<tr><td>Table C404.2 Minimum Performance of water Heating Equipment (pg. C62 & C-63)

Units of Measure:

kW = kilowatts;

L = Letres

V = Volume in Letres

V_m = Measure Volume in Letres

EF = Energy Factor

E_t = Thermal Efficiency expressed as a percentage (dimensionless)

SL = Standby Loss COP = Coefficient of Performance

SEF = Solar Energy Factor (dimensionless)

NB: Unit Conversion:
1 KW = 3,412 Btu/h)
°F = [°C • 1.81] + 32
1 L = 0.2642 gal</td><td>Water Heater, Gas Condensing

Water Heater, Heat Pump

Water Heater High Efficiency, Gas Storage</td><td>ENERGY STAR® Program Requirements
Product Specification for Residential Water Heaters
Eligibility Criteria
Version 3.2, Certification Criteria, paragraph (C)

See PDF at URL, Section 3 (C) for Certification Criteria Tables as follows:

Table 1: Criteria for Certified Electric Water Heaters
<table><tr><th colspan="2">Criteria</th><th>ENERGY STAR Requirements</th></tr><tr><td rowspan="2">Energy Factor</td><td>≤ 55 gallons</td><td>EF ≥ 2.00</td></tr><tr><td>> 55 gallons</td><td>EF ≥ 2.20</td></tr><tr><td colspan="2">First-Hour Rating</td><td>FHR ≥ 50 gallons per hour</td></tr><tr><td colspan="2">Warranty</td><td>Warranty ≥ 6 years on sealed system</td></tr><tr><td colspan="2">Safety</td><td>UL 174 and UL1995</td></tr><tr><td colspan="2">Lower Compressor Cut-off Temperature (Reporting Requirement Only)</td><td>Report ambient temperature below which the compressor cuts off and electric resistance only operation begins</td></tr></table>
Table 2: Criteria for Certified Gas Storage Water Heaters
<table><tr><th colspan="2">Criteria</th><th>ENERGY STAR Requirements</th></tr><tr><td rowspan="2">Energy Factor</td><td>≤ 55 gallons</td><td>EF ≥ 0.67</td></tr><tr><td>> 55 gallons</td><td>EF ≥ 0.77</td></tr><tr><td colspan="2">First-Hour Rating</td><td>FHR ≥ 67 gallons per hour</td></tr><tr><td colspan="2">Warranty</td><td>Warranty ≥ 6 years on system (including parts)</td></tr><tr><td colspan="2">Safety</td><td>ANSI Z21.10.1/CSA 4.1</td></tr></table>
Table 3: Criteria for Certified Gas Instantaneous Water Heaters
<table><tr><th>Criteria</th><th>ENERGY STAR Requirements</th></tr><tr><td>Energy Factor</td><td>EF ≥ 0.90</td></tr><tr><td>Gallons Per Minute</td><td>GPM ≥ 2.5 over a 77°F rise</td></tr><tr><td>Warranty</td><td>Warranty ≥ 6 years on heat exchanger and ≥ 5 years on parts</td></tr><tr><td>Safety</td><td>ANSI Z21.10.3/CSA 4.3</td></tr></table>
Table 4: Criteria for Certified Light Duty EPACT covered Gas Water Heaters
<table><tr><th>Criteria</th><th>ENERGY STAR Requirements</th></tr><tr><td>Thermal Efficiency</td><td>TE ≥ 0.90</td></tr><tr><td>Standby Loss</td><td>Standby loss ≤ 1889 Btu/h ×(TE–0.73)</td></tr><tr><td>Warranty</td><td>Warranty ≥ 6 years on system</td></tr><tr><td>Safety</td><td>ANSI Z21.10.3/CSA 4.3</td></tr></table></td></tr>
</table>

<table>
<tr>
<td>1 W/L = 5,076
Btu/gal</td>
<td></td>
<td>
Table 5: Criteria for Certified Solar Water Heaters
<table>
<tr><th>Criteria</th><th>ENERGY STAR Requirements</th></tr>
<tr><td>Solar Energy Factor</td><td>SEF ≥ 1.8 for electric backup
SEF ≥ 1.2 for gas backup</td></tr>
<tr><td>Warranty</td><td>Warranty ≥ 10 years on collector,
≥ 6 years sealed system,
≥ 2 years on controls,
≥ 1 year on parts</td></tr>
</table>

<u>Recommendation #1</u>: CARICOM
Procurement Officials should seek to purchase boilers with higher Energy Factors
(EF) or higher Thermal Efficiency (TE)
</td>
</tr>
<tr>
<td>Table C404.2
Minimum
Performance of water
Heating Equipment (pg.
C62 & C-63)

Units of Measure: kW =
kilowatts SEF = Solar
Energy
Factor
(dimensionless)

NB: Unit Conversion:

1 KW = 3,412 Btu/h)
°F = [°C • 1.81] +
32

1 L = 0.2642 gal

1 W/L = 5,076
Btu/gal</td>
<td>Water Heater,
Solar
(Residential)</td>
<td>ENERGY STAR® Program Requirements
Product Specification for Residential Water Heaters
Eligibility Criteria
Version 3.2, Certification Criteria, paragraph (D)

Table 5: Criteria for Certified Solar Water Heaters
<table>
<tr><th>Criteria</th><th>ENERGY STAR Requirements</th></tr>
<tr><td>Solar Energy Factor</td><td>SEF ≥ 1.8 for electric backup
SEF ≥ 1.2 for gas backup</td></tr>
<tr><td>Warranty</td><td>Warranty ≥ 10 years on collector,
≥ 6 years sealed system,
≥ 2 years on controls,
≥ 1 year on parts</td></tr>
</table>

Recommendation: CARICOM procurement officials should seek to purchase solar water heaters with higher Solar Energy Factor (SEF) than those required by the CREEBC</td>
</tr>
</table>

Table C404.2 Minimum Performance of water Heating Equipment (pg. C62 & C-63) Units of Measure: kW = kilowatts; L = Letres V = Volume in Letres V_m = Measure Volume in Letres EF = Energy Factor E_t = Thermal Efficiency expressed as a percentage SL = Standby Loss COP = Coefficient of Performance SEF = Solar Energy Factor NB: Unit Conversion: 1 KW = 3,412 Btu/h) $^oF = [^oC \bullet 1.81] + 32$ 1 L = 0.2642 gal 1 W/L = 5,076 Btu/gal	Water Heater, Whole Home, Gas Tankless (i.e. Instantaneous)	ENERGY STAR® Program Requirements Product Specification for Residential Water Heaters Eligibility Criteria Version 3.2, paragraph (C.b) NB: No specs for commercial systems at URL. Residential systems reported for guidance only. Instantaneous (or "tankless") type units which initiate heating based on sensing water flow and deliver water at a controlled temperature of less than 180 °F, heat water, but contain no more than one gallon of water per 4,000 Btu per hour of input with an input capacity greater than 50,000 Btu per hour but less than 200,000 Btu per hour

Table 7

<table>
<tr><td>2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)</td><td colspan="2">Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search</td></tr>
<tr><td>Table C403.8.1 (1)
Fan Power
Limitation (pg. C-52)

Units of Measure: kW = The maximum combined motor nameplate [power] in kilowatts;

kW_i = The maximum combined fan nameplate [power] in kilowatts;

L/S_S = The maximum design airflow rate to conditioned spaces served by the system in cubic
feet per minute;

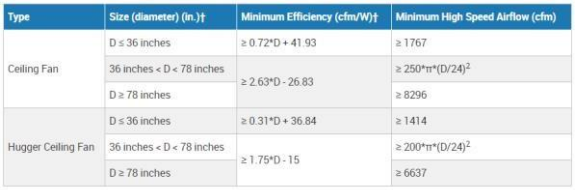
L/S_D = The design airflow rate through applicable device from Table
C403.8.1(2) in litres per second;

A = sum of [PD x L
L/S_S / 65,000]

PD = Each applicable airdrop adjustment form Table C403.8.1920 in units of Pa (Pascals)

hp = The maximum combined nameplate horsepower</td><td>Fans, Ceiling</td><td>Ceiling Fans product Criteria and/or ENERGY STAR® Program Requirements
Product Specification for Residential Ceiling Fans
and Ceiling Fan Light Kits
Eligibility Criteria
Version 4.0, Ceiling Fan Requirements

See graphs and tables at URL for:
(a) Ceiling Fan Efficiency Requirements.

Units = Minimum Efficiency (cfm/W); and
Units = Minimum High Speed Airflow (cfm)
 

†D represents the fan size in inches

(a) Ceiling Fan Light Kit Efficacy Requirements.
Units = lumens / watt
Ceiling Fan Light Kit Efficacy Requirements
 

<u>Recommendation</u>: CARICOM Procurement Officials should seek to purchase Ceiling Fans with specification higher than the requirements of the CREEBC</td></tr>
</table>

NB: Unit Conversion: 1kW = 1.34 bhp 1 kW = 1.36 hp 1 L/s = 2.12 cfm		
Table C403.8.1 (1) Fan Power Limitation (pg. C-52) Units of Measure: kW = The maximum combined motor nameplate [power] in kilowatts; kW_i = The maximum combined fan nameplate [power] in kilowatts; L/S_S = The maximum design airflow rate to conditioned spaces served by the system in cubic feet per minute; L/S_D = The design airflow rate through applicable device from Table C403.8.1(2) in litres per second; A = sum of [PD x L L/S_S / 65,000] PD = Each applicable airdrop adjustment form Table C403.8.1920 in units of Pa (Pascals)	Fans, Ventilating (Residential) NB: No commercial systems given at URL. Residential systems reported for guidance only	Ventilating Fans key Product Criteria and ENERGY STAR® Program Requirements Product Specification for Residential Ventilating Fans, Eligibility Criteria, Version 4.1, Certification Criteria See Tables at URL for: (a) Criteria for ENERGY STAR Certified Residential Ventilating Fans — Minimum Efficacy Levels (b) Criteria for ENERGY STAR Certified Residential Ventilating Fans — Maximum Allowable Sound Levels **Recommendation**: CARICOM Procurement Officials should seek to purchase Ventilating Fans following the recommendations of ENERGY STAR.

hp = The maximum combined nameplate horsepower NB: Unit Conversion: 1kW = 1.34 bhp 1 kW = 1.36 hp 1 L/s = 2.12 cfm		

Table 8

2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)	Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search	
Table C403.10.1 (1) Minimum Efficiency Requirements: Commercial Refrigeration (pg. C-55) Table C403.10.1 (2) Minimum Efficiency Requirements: Commercial Refrigerators and Freezers (pg. C-56 & C-57) Table C403.10.2.1 (1) Walk-In Cooler and Freezer Display Door Efficiency Requirements (pg. C-57) Table C403.10.2.1 (2) Walk-In Cooler and Freezer Non-Display Door Efficiency Requirements (pg. C-57) Table C403.10.2.1 (3) Walk-In Cooler and Freezer Refrigeration System Efficiency Requirements (pg. C-57)	Commercial Refrigerators & Freezers (food service)	Commercial Refrigerators & Freezers Key Product Criteria: ENERGY STAR and ENERGY STAR Program Requirements Product Specification for Commercial Refrigerators and Freezers Eligibility Criteria Version 4.0 See Table at URL for: (a) Commercial Refrigerators & Freezers Key Product Criteria. Unit of Measure = Maximum daily energy consumption (MDEC) requirements. NB: These MDEC criteria should be interpreted with care as they may be unique to the USA MDEC = Maximum Daily Energy Consumption (MDEC) Requirements (kWh/day) **Recommendation**: CARICOM procurement officials should seek to purchase Commercial Refrigerators and Freezers with higher instantaneous energy efficiencies of equipment as measured by EER (Energy Efficiency Ratio) or COP (Coefficient of Performance)

Table 9

2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)	Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search	
Table C403.10.1 (1) Minimum Efficiency Requirements: Commercial Refrigeration (pg. C-55) Units of Measure: V = Volume of the chiller r frozen compartment as defined in AHAM-HRF-1 AHAM-HRF-1 = Association of Home Appliance Manufacturers - Energy and Internal Volume of Refrigerating Appliances Table C403.10.1 (2) Minimum Efficiency Requirements: Commercial Refrigerators and Freezers (pg. C-56 & C-57) Table C403.10.2.1 (1) Walk-In Cooler and Freezer Display Door Efficiency Requirements (pg. C-57) Table C403.10.2.1 (2) Walk-In Cooler and Freezer Non-Display Door Efficiency Requirements (pg. C-57) Table C403.10.2.1 (3) Walk-In Cooler and Freezer Refrigeration System Efficiency Requirements (pg. C-57)	Commercial Ice Makers	Commercial Ice Maker Key Product Criteria: ENERGY STAR and ENERGY STAR® Program Requirements Product Specification for Automatic Commercial Ice Makers Eligibility Criteria Version 3.0 See Tables URL for: (a) ENERGY STAR Requirements for AirCooled Batch-Type Ice Makers (b) ENERGY STAR Requirements for AirCooled Continuous-Type Ice Makers Units of Measure: (a) Applicable Ice Harvest Rate Range (H) (lbs of ice/24 hrs) (b) Energy Consumption Rate (kWh/100 lbs ice) (c) Potable Water Use (gal/100 lbs ice) **Recommendation**: CARICOM Procurement Officials should purchase Commercial Ice Makers with specifications that are higher than ENERGY STAR

Table 10

<table>
<tr><td>2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)</td><td colspan="2">Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search</td></tr>
<tr><td>Table C403.10.1 (1) Minimum Efficiency Requirements: Commercial Refrigeration (pg. C-55)

Units:
V = Volume of the chiller r frozen compartment as defined in AHAM-HRF-1

AHAM-HRF-1 = Association of Home Appliance Manufacturers - Energy and Internal Volume of Refrigerating Appliances

Table C403.10.1 (2) Minimum Efficiency Requirements: Commercial Refrigerators and Freezers (pg. C-56 & C-57

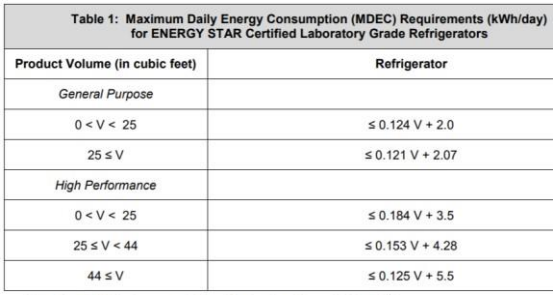
Units: Same as above

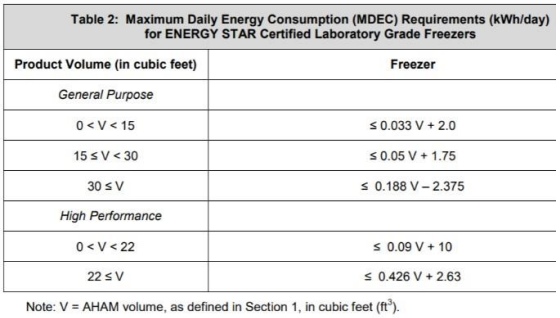
Table C403.10.2.1 (1) Walk-In Cooler and Freezer Display Door Efficiency Requirements (pg. C-57)</td><td>Laboratory Grade Refrigerators and Freezers</td><td>ENERGY STAR® Program Requirements
Product Specification for Laboratory Grade Refrigerators and Freezers
Eligibility Criteria
Version 1.1

Section 3: Certification Criteria – Sub-Section 3.2 - Energy Efficiency Requirements:

Table 1 - Maximum Daily Energy Consumption (MDEC) Requirements (kWh/day) for ENERGY STAR Certified Laboratory Grade Refrigerators; &

Table 2 - Maximum Daily Energy Consumption (MDEC) Requirements (kWh/day) for ENERGY STAR Certified Laboratory Grade Freezers

 
<table>
<tr><th colspan="2">Table 1: Maximum Daily Energy Consumption (MDEC) Requirements (kWh/day) for ENERGY STAR Certified Laboratory Grade Refrigerators</th></tr>
<tr><th>Product Volume (in cubic feet)</th><th>Refrigerator</th></tr>
<tr><td>General Purpose</td><td></td></tr>
<tr><td>0 < V < 25</td><td>≤ 0.124 V + 2.0</td></tr>
<tr><td>25 ≤ V</td><td>≤ 0.121 V + 2.07</td></tr>
<tr><td>High Performance</td><td></td></tr>
<tr><td>0 < V < 25</td><td>≤ 0.184 V + 3.5</td></tr>
<tr><td>25 ≤ V < 44</td><td>≤ 0.153 V + 4.28</td></tr>
<tr><td>44 ≤ V</td><td>≤ 0.125 V + 5.5</td></tr>
</table>
Note: V = AHAM volume, as defined in Section 1, in cubic feet (ft³).

 
<table>
<tr><th colspan="2">Table 2: Maximum Daily Energy Consumption (MDEC) Requirements (kWh/day) for ENERGY STAR Certified Laboratory Grade Freezers</th></tr>
<tr><th>Product Volume (in cubic feet)</th><th>Freezer</th></tr>
<tr><td>General Purpose</td><td></td></tr>
<tr><td>0 < V < 15</td><td>≤ 0.033 V + 2.0</td></tr>
<tr><td>15 ≤ V < 30</td><td>≤ 0.05 V + 1.75</td></tr>
<tr><td>30 ≤ V</td><td>≤ 0.188 V – 2.375</td></tr>
<tr><td>High Performance</td><td></td></tr>
<tr><td>0 < V < 22</td><td>≤ 0.09 V + 10</td></tr>
<tr><td>22 ≤ V</td><td>≤ 0.426 V + 2.63</td></tr>
</table>
Note: V = AHAM volume, as defined in Section 1, in cubic feet (ft³).

NB: These MDEC criteria should be interpreted with care as they may be unique to the USA</td></tr>
</table>

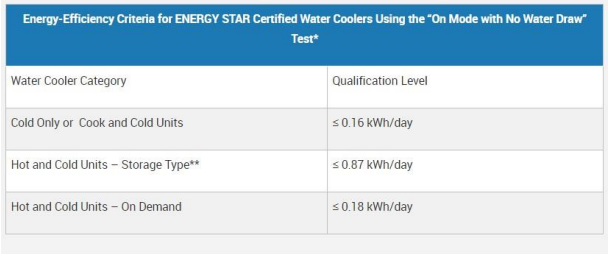
Units: Same as above Table C403.10.2.1 (2) Walk-In Cooler and Freezer NonDisplay Door Efficiency Requirements (pg. C-57) Units: Same as above Table C403.10.2.1 (3) Walk-In Cooler and Freezer Refrigeration System Efficiency Requirements (pg. C-57) Units: Same as above		MDEC = Maximum Daily Energy Consumption (MDEC) Requirements (kWh/day) **Recommendation**: CARICOM procurement officials should focus on comparing instantaneous energy efficiencies of equipment as measured by EER (Energy Efficiency Ratio) or COP (Coefficient of Performance)

Table 11

<table>
<tr><td>2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)</td><td colspan="2">Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search</td></tr>
<tr><td>Table C403.10.1 (1) Minimum Efficiency Requirements: Commercial Refrigeration (pg. C-55)

Units:
V = Volume of the chiller r frozen compartment as defined in AHAM-HRF-1

AHAM-HRF-1 = Association of Home Appliance Manufacturers - Energy and Internal Volume of Refrigerating Appliances</td><td>Water Coolers</td><td>Water Cooler Key Product Criteria: ENERGY STAR and ENERGY STAR® Program Requirements
Product Specification for Water Coolers Eligibility Criteria Version 2.0

NB: These Maximum Daily Energy Consumption (MDEC) criteria using the “On Mode with no Water Draw” Test are may be unique to the USA.

MDEC = Maximum Daily Energy Consumption (MDEC) Requirements (kWh/day)

<u>Recommendation</u>: CARICOM procurement officials should focus comparing instantaneous energy efficiencies of equipment as measured by EER (Energy Efficiency Ratio) or COP (Coefficient of Performance)</td></tr>
</table>

Table 12

2018 CARICOM Regional Energy Efficiency Building Code (CREE BC)	Energy Star (USA) - Products. Also see Product Specifications & Partner Commitments Search	
No CREE BC Code	Lamps	Light Bulb Key Product Criteria and ENERGY STAR® Program Requirements Product Specification for Lamps (Light Bulbs) Eligibility Criteria, Version 2.1, Recommendation: CARICOM Procurement Officials should use the lighting efficacy (lumens per watt) requirements and other key product specifications as given at the URL.
No CREE BC Code	Light Fixtures (Luminaires)	Purchasing Guide - LED Bulbs Made Easy Just Look for the ENERGY STAR® and Color and Mood and ENERGY STAR® Program Requirements Product Specification for Luminaires (Light Fixtures) Eligibility Criteria Version 2.2 **Recommendation**: CARICOM Procurement Officials should use the guidance and product specifications given at all three URL's

5.3 Special Case – Water Efficiency Product Labelling

The use of water in public buildings in CARICOM Member States presents a special case for energy conservation and energy efficiency. In some jurisdictions, the cost of water includes embedded energy cost as high as fifty percent (50%). Therefore, any water use savings that could be effected in public buildings will result in significant concomitant energy savings. As is the case in this Green Building Procurement Manual for the use of product labelling for energy efficiency (employing the recommended ENERGY STAR label), there are also several examples of the use of water efficiency product labelling across the globe. These have been surveyed by the International Water Association in and presented in their report entitled "Review of International Water Efficiency Product Labelling[33]". A summary table (given as Table 1) is introduced and presented at page 3 of the IWA report as follows:

> *There are a wide range of water efficiency labelling schemes that have been developed internationally. These all differ based on the local context and drivers. A summary is provided in Table 1 and this includes whether the standard is voluntary or mandatory and who leads on the scheme. A detailed comparison is provided in Appendix A – Matrix of International Water Efficiency Labelling.*

Table 1 International Water Efficiency Labels

Country/ area	Scheme	Mandatory/ Voluntary	Government/ industry/ NGO led
Australia	Water Efficiency Labelling Scheme (indoor)	Mandatory	Government
Australia	Smart Approved Watermark	Voluntary	NGO
Canada	Watersense	Voluntary	Government
China	Water Conservation Certificate	Voluntary	Industry with independent certification
Europe (including UK)	European Water Label	Voluntary	Industry
Hong Kong	WSD Water Efficiency Labelling Scheme	Voluntary	Government
India	Water Efficient Products India (WEP-I)	Voluntary	NGO - Indian Plumbing Association (IPA)
Malaysia	Water Efficiency Product Labelling Scheme	Voluntary	Government
New Zealand	Water Efficiency Labelling Scheme	Mandatory	Government
Portugal	ANQUIP	Voluntary	NGO
Singapore	Water Efficiency Labelling Scheme	Mandatory	Government
UAE	United Arab Emirates ESMA Water Efficiency Label	Mandatory	Government
UK	Water Technology List	Voluntary	Government
UK	Waterwise Checkmark	Voluntary	NGO
USA	Watersense	Voluntary	Government

[33] IWA Review of international water efficiency product labelling - https://iwa-network.org/wpcontent/uploads/2019/02/IWA-EUWM-Labelling-Report_Final-002.pdf

6 Summary

This Green Buildings Procurement Manual is the first attempt by the Caribbean Community Climate Change Center in Belize to prescribe green buildings public procurement policies and procedures in the Caribbean Community (CARICOM). An extensive literature review of the concepts of green public procurement, and environmentally sensitive procurement shows that Green Buildings Procurement can be codified in the form of requiring quality and standards marks for renewable energy products, and labelling for energy efficiency products e.g. ENERGY STAR. This codification is a minimum first step which is consistent with nascent trends in other jurisdictions across the globe. While the issue of recycling of renewable energy products is now at the early stages, the CARICOM Member States should consider stepping ahead of the curve and include recycling in their public procurement decisions. Should public agencies adopt the recommendations of this Green Building Procurement Manual, it will show public sector leadership in transforming both the public and private markets for sustainable energy products and services across CARICOM.