1. Introduction

In 2009 Ministry of Renewable Energy & Public Utilities defined a Long-Term Energy Strategy 2009-2025 and Action Plan for The Republic of Mauritius. It puts great emphasis on developing the energy sector up to 2025 including development of renewable energy, reduction of the independence on imported fossil fuel and the promotion of energy efficiency.

This Energy Efficiency Building Code has been developed as one initiative to meet the goal regarding energy efficiency in the building sector under the project: 00058178/Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings – PS/MAR 2010/002, funded by GEF/UNDP and AFD.

A review of International Best Practice for Energy Efficiency Codes and Standards for buildings has formed the basis for the code development and transformation to Mauritian context.

Separate Guidelines has been developed to provide detailed suggestions for good practices and examples of application. Users are strongly recommended to read this Code in conjunction with the Guidelines.

The Guidelines:

(a) Passive Solar Design Guidelines
(b) Duct and Piping Guideline

The Code has been prepared by the Energy Efficiency Building Code Project Team:

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2. Scope

This Code provides the requirements for compliance with the Energy Efficiency Building Regulation (EEBR) under the Building Control Act.

The code is applicable to the following building types:

(a) New Residential Buildings with a gross floor area $\geq$ 500 m^2

(b) New Non-Residential Buildings with a gross floor area $\geq$ 500 m^2

(c) Major conversions in existing buildings (e.g. conversions and other alterations that are significant in terms of energy, are building works on building envelope which affect more than 50% of the building envelope or any changes in buildings, that increases the existing energy load with more than 75%.)

For buildings with a gross floor area below 500 m^2 and individual residential buildings, compliance can be ensured by following the Standard Designs.

2.1 Climatic Zones

Mauritius is defined as two Climatic Zones.

Zone 1: Coastal Area, Altitude < 160 m

Zone 2: High Lands, Altitude $\geq$ 160 m

Rodrigues & other outer islands fall within Zone 1.

A climate map showing the demarcation of the two zones can be found in Annex A.

3. Objective

The aim of this Code is to:

- Assist architects and professional engineers to comply with the energy performance objectives prescribed in the Energy Efficiency Building Regulations (EEBR),
- Encourage the design, construction and operation and maintenance of new and existing buildings in a manner that reduces energy by the means of passive design technologies for solar design and cooling strategies,
- Provide guidance for energy efficiency buildings design and encourage the application of renewable energy in new buildings,
- Set standards for energy efficient requirements for mechanical and electrical building services and construction solutions.

4. Interpretation

For the purpose of the Code, the following definitions shall apply:

“ACMV” means Air-Conditioning and Mechanical Ventilation

”Building envelope” means the exterior portions of a building through which thermal energy is transferred.

“Certified Energy Auditor” means Energy Auditor as defined as per the “Energy Efficiency Act” and included in the database for Energy Auditors managed by the Energy Efficiency Management Office.

“Competent person” means a professional engineer, registered architect, building professionals or technicians/electricians.

“Delivered energy” means the net energy delivered to the building

”Fenestration” means a glazed opening in building wall.

“Gross floor area” means the area measured from the outside surface of the outer building wall to the outside surface of the adjacent outer building wall

“NPLV” means the Non-standard Part Load Value for the water entering a condenser.

“Opaque” wall or roof means the solid part of the wall or roof which is not part of the fenestration.

“OTTV” means the average rate of heat transfer from the outdoor environment into the building, through the building envelope (walls and roof).

“Primary energy means the energy value of the fuel at source.

“Roof lights” means a glazed opening, horizontal or inclined, which is set into roof of a building to provide day lighting.

“Solar Factor” means the proportion of solar energy which is transmitted through the structure

“S-factor$_{roof}$” means the proportion of solar energy which is transmitted through the roofs areas

“S-factor$_{wall}$” means the proportion of solar energy which is transmitted through the external wall combined

“S-factor$_{fen}$” means the proportion of solar energy which is transmitted through openings in the facade (windows and doors)

5. Normative and Legislative References

The EEBC makes reference to standards and legislative documents for further guidance, where appropriate. It refers to the latest version of the standard or legislative document at the time of development of the EEBC. The referenced standards and legislative documents are listed below.

The documents which should be consulted are referred to by the EEBC are:

- Planning Policy Guidance (2004) and Outline Schemes for different districts and towns (Ministry of Housing and Lands)
- Building and Land Use Permit Guide
- Ministry of Health and Quality of Life Guidelines
- Guidelines from Fire Services Department
- Passive Solar Design Guidelines
- Duct and Piping Guideline
- Arrêté du 17 avril 2009 définissant les caractéristiques thermiques minimales des bâtiments d'habitation neufs dans les DOM (Journal officiel de la république française), April 2009
- Guidance to Reunion's RTAA DOM (Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer), (2009)
- CIBSE AM11 - Building energy and environmental modelling, (1998)
- ASHRAE Standard 140-2007 -- Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs (ANSI Approved), (2007)
- ASHRAE Load Calculation Applications Manual
- ASHRAE Handbook for cooling system design loads
- ARI Standard 210/240
- ARI Standard 340/360
- ARI Standard 480-95
- ARI Standard 550/590 -98
- ARI Standard 560-92
- ANSI Standard Z21.40.1-1994
- Malaysian Standard MS 1525:2007
- ASHRAE Standard – Energy Standard for Buildings Except Low-Rise Residential Buildings
- Non-domestic Heating, Cooling and Ventilation Compliance Guide (NBS, 2006)

6. Administrative Provisions

Administrative requirements are specified under the Building Control Act and the Energy Efficiency Building Regulations.

6.1 Compliance Methods

The requirements of EEBR shall be deemed to be satisfied when requirements in this Code are complied with.

Buildings shall comply with one of the following Alternatives:

Alternative 1 - Applicable only to buildings with **residential** purpose (e.g. apartments) with a total gross floor area of more than or equal to 500 m^2 (Gross Floor Area $\geq$ 500 m^2)

(a) Prescriptive requirements for building elements (Solar Factor - Article 8.1.1, and Solar Heat Load - Article 8.1.3) and Building Services (Article 9–18)

or

(b) Overall Thermal Transfer Value (OTTV) (Article 8.1.2) and prescriptive requirements for Building Services (Article 9-18)

Alternative 1 (a) and (b) also include (c) (for information purposes):

(c) Determine the total annual primary energy consumption for the building.

Alternative 2 - Applicable only to **non-residential** buildings with a total gross floor area of more than or equal to 500 m^2 (Gross Floor Area $\geq$ 500 m^2)

(a) Has an Overall Energy Performance determined by a competent person using an approved energy simulation program, less than or equal to that of a reference building designed in accordance with the prescriptive requirements for building elements and services defined in this Code.
Therefore, for this compliance method, the building energy simulation should be performed twice: once for a building as it has been designed (referred to as the *design building)*, and the second simulation for the *reference building.* The reference building shall meet all the minimum prescriptive requirements specified in the EEBC.
A list of approved energy simulation software which can be used for showing compliance can be found in Annex A.

In “Algorithms for Compliance Method – Alternative 1 in Energy Efficiency Code for Mauritius” the calculation procedures are detailed and it includes calculation samples for illustration. The Algorithms includes two parts:

Part 1: Overall Thermal Transfer Value (OTTV) and Solar Factor (S)
Part 2: Total Annual Energy Consumption

6.2 Information to be submitted

The following information shall be provided by a competent person to a Certified Energy Auditor (CEA) for approval and who will issue the Energy Efficiency Certificate:

All Compliance Alternatives:

- Plans, elevations and cross-sections of building;
- Details of roof and wall construction, giving details of the type and thickness of basic construction material, insulation and air space etc.;
- Solar Factor for building envelope elements (Alternative 1(a));

- OTTV calculation (Alternative 1(b));
- Solar Heat Load Limitation;
- R-values building envelope elements (walls, roofs, fenestration);
- Details of shading elements (horizontal and vertical): colour, size and deflection angle where an overhang is sloping;
- Details of insulation specification (if available), conductivity, thermal resistance;
- Calculation of maximum energy demand and annual primary energy consumption (Alternative 1);
- Brief explanation of the passive energy means (shading, overhang, natural ventilation etc);
- Data sheet for all building service components (system and equipment type, sizes, efficiencies, controls, piping and duct insulation, etc);
- Lighting systems (types, wattage, control etc);
- Electrical Power (motor efficiencies, metering system, power factor correction devices etc);
- On-site renewable energy use report;

If complying with Compliance Alternative 2 (supplementary information):

- Name of software used and evidence that it complies with requirements in either CIBSE AM11 or ASHRAE Standard 140 (see Annex B);
- The annual energy use for the design building and the reference building;
- Details of parameters used in the building simulation programs, including R-values or U-values of construction elements, hourly levels and schedules used for occupancy, lighting and equipment gains, type and efficiency of ACMV equipment used in the software;
- Where the software is able to produce a report with input parameters and outputs such as annual energy consumption and solar gains, these should be provided;
- A list of the energy-related building features in the proposed design that is different from the standard design;
- The input and output report(s) from the simulation program including a breakdown of energy usage by at least the following components: lights, internal equipment loads, service water heating equipment, space heating equipment, cooling and heat equipment, fans, and other ACMV equipment (such as pumps);
- An explanation of any error messages noted in the simulation program output.

7. Passive Design Strategies

7.1 Integrated Energy Design

Using the methodology of Integrated Energy Design (IED), it is possible for the developer, architect and engineer to work around the design of the building. In this way decisions about architecture, engineering, interior, etc. can be made in a systematic process.

The basic principle of IED, is to make use of all the passive properties from the architectural choices to create the best possible indoor environment by the building design itself. Use of installations in the building should be minimized and only to supplement the building with light, air and cooling/heating when the passive properties of the building cannot create the effect by itself.

Before the introduction of mechanical systems, comfort can be achieved through passive means and architectural features built into the building design. The design process that at one time integrates all design disciplines evolved into a sequential process carried out in separate disciplines.

Life Cycle Cost Analysis (LCCA) is an essential mean for controlling the initial and the future cost of building ownership. LCCA can be implemented at any level of the design process and can also be an effective tool for evaluation of existing building systems. LCCA can be used to evaluate the cost of energy saving alternatives for the full range of the project and for specific initiatives.

7.2 Building Layout and Design

Reference should be made to the Passive Solar Design Guidelines for information regarding building layout and design in order to maximise the potential of passive design strategies (e.g. night cooling, use of thermal mass, natural ventilation, etc.).

8. Building Envelope

The building envelope design is a very important part of the design process. The building envelope should be considered as the first characteristic of the building which can be modified based on the climate and immediate environment, in order to control the indoor climate.

It is essential to adapt the envelope design to the climate where the building is located, failing which it may not performance as expected. For instance, Mauritius is subject to a predominantly hot and humid climate throughout the year. It is important, therefore, to design the building envelope such that it minimises solar heat gains and risks of overheating. In Mauritius, it is usually effective to use a combination of shading and thermal mass to attenuate heat gains, and to use insulation only where it is found to positively reduce solar gains without causing internal gains to be “trapped” inside the building (for example using insulation in roofs rather than walls).

8.1 Prescriptive requirements for building elements

Buildings related to Compliance Alternative 1(a) shall meet the prescriptive requirements for buildings elements expressed by the Solar Factor limitation.

The Solar-factor does not only take into account the resistance of the element itself but also its protection from direct solar gains and its solar absorbance. For roofs, the limiting S-value limitation is more stringent than the S-factor limitations for walls, since the roof is the element through which most of the solar gains enter a building. The roof should be protected from solar gains either by horizontal ventilated shading or use of insulation.

Buildings related to Compliance Alternative 1(b) shall meet the prescriptive requirements for buildings elements expressed by the OTTV.

The OTTV (Overall Thermal Transfer Value) is a measure of the energy consumption of a building due to its envelope. The OTTV is a measure of average rate of heat transfer from the outdoor environment into a building, through the building envelope (walls and roof). The higher the OTTV value, the greater the heat gains in the building. The principle behind the OTTV is to reduce heat gains and therefore reduce the cooling load of the air-conditioning systems.

As compared with the prescriptive requirements in Alternative 1(a), the OTTV allows more flexibility in that the various envelope components (type of glazing, window size, external shading to windows, wall colour and wall type) can be varied so as to meet the maximum OTTV criteria.

In “Algorithms for Compliance Methods – Alternative 1 in Energy Efficiency Code for Mauritius” the calculation procedures for the Solar – Factor and OTTV is detailed and includes calculation samples for illustration.

8.1.1 Solar-factor requirements for building elements - Compliance Alternative 1(a).

Solar-factor for opaque elements (walls)

The **Solar Factor, S**, of an opaque wall is defined as follows:

$$\boxed{S = \frac{0{,}074 \cdot \mathrm{SSF} \cdot \alpha}{R + 0{,}20}}$$

Where

S is the Solar Factor for the opaque wall
SSF is the coefficient of reduction based on shading of the wall element
α is absorption coefficient, which is based on the colour of the wall element
R is the thermal resistance of the wall element [m^2*C/W]

The prescriptive requirement for external walls is that the average S-factor for all external walls combined, should meet the following limiting S-factor:

$\text{S-factor}_{wall} \leq$ 9 % (0,09)

Solar Factor for opaque element (roofs)

The **Solar Factor, S**, of an opaque roof is defined as follows:

$$\boxed{S = \frac{0{,}074 \cdot \mathrm{SSF} \cdot \alpha}{R + 0{,}21}}$$

Where

S is the Solar Factor for the opaque roof
SSF is the coefficient of reduction based on shading of the roof element
α is absorption coefficient, which is based on the colour of the roof element
R is the thermal resistance of the roof element [m^2*C/W]

The prescriptive requirement for roof is that the average S-factor for all roofs combined, should meet the following limiting S-factor:

$$\text{S-factor}_{roof} \leq 3\ \%\ (0{,}03)$$

Solar Factors for fenestration
The solar factor for fenestration is defined as follows:

$$\boxed{S = So \cdot SSF}$$

Where

S	is the Solar Factor for fenestration
So	is the Solar Factor without horizontal shading
SSF	is the coefficient of reduction based on shading of the fenestration

The prescriptive requirement for fenestration is that the S-factor for each orientation, should meet the following limiting S-factor:

Adjacent to an air-conditioned space: $S \leq 25\%$

Adjacent to an un-conditioned space: $S \leq 65\%$

Restriction of roof lights (depending on exposure to direct sunlight)
In order to minimise solar heat gains through the roof, it is prohibited to have transparent/ translucent skylight in roofs, unless the skylight can be oriented such that it is not exposed to direct solar gains (i.e. oriented South or adequately shaded) and have a purpose towards passive cooling, such as to enhance stack ventilation.

8.1.2 Overall Thermal Transfer Value (OTTV) – Compliance Alternative 1(b)

OTTV for external walls
The OTTV for walls is defined as follows:

$$\boxed{OTTV_w = \frac{Q_r + Q_{gc} + Q_{sol}}{A_i}}$$

Where

OTTV is overall thermal transfer values for walls [W/m^2]
Q_{wc} is heat conduction through opaque wall [W]
Q_{gc} is heat conduction through window glass [W]

Q_{sol} is solar radiation through window glass [W]
A_i is gross area of the walls (opaque area and window area) [m^2]

The external walls of a building should be designed and constructed to meet the following OTTV limitation:

Climate Zone 1: $OTTV_{wall} \leq 45 \ W/m^2$

Climate Zone 2: $OTTV_{wall} \leq 40 \ W/m^2$

The maximum OTTV should apply to the overall building facade, i.e. all the external walls, as the case may be, in average and do not apply to the individual wall.

OTTV for roofs
The OTTV for roofs is defined as follows:

$$\boxed{OTTV_r = \frac{Q_r + Q_{gc} + Q_{sol}}{A_r}}$$

Where

OTTV is overall thermal transfer values for roof [W/m^2]
Q_r is heat conduction through opaque roof [W]
Q_{gc} is heat conduction through roof lights [W]
Q_{sol} is solar radiation through roof lights [W]
A_r is gross area of the roof (opaque area and roof lights) [m^2]

The roofs of a building should be designed and constructed to meet the following OTTV limitation:

Climate Zone 1: $OTTV_{roof} \leq 45 \ W/m^2$

Climate Zone 2: $OTTV_{roof} \leq 40 \ W/m^2$

The maximum OTTV should apply to the overall building roof, i.e. all the roof area, as the case may be, in average and do not apply to the individual roof.

8.1.3 Solar Heat Load for buildings

All buildings should be designed and constructed such that:

(a) occupied spaces that are naturally ventilated do not overheat, and
(b) spaces that are subject to mechanical ventilation or cooling do not require excessive cooling plant capacity to maintain the desired temperature within the space.

For buildings following Compliance Alternative 1(a) - (Solar - Factor), compliance with the prescriptive requirements for the Solar Factor of opaque and transparent elements would suffice to show that solar heat gains entering the building are limited.

For buildings following Compliance Alternative 1(b) - (OTTV), the requirement for limiting solar heat gains would be met by meeting the OTTV limit prescribed.

For buildings following Compliance Alternative 2 (Overall energy performance calculation through simulation), it is required to show that the solar heat load per unit floor area, averaged over the operational hours of the building (e.g. 7:30am to 5:30pm for office buildings), does not exceed the limiting solar heat gains value prescribed under the OTTV (section 8.1.2), as follows:

Buildings located in Climate Zone 1: Solar heat load should be less than 45 W/m^2

Buildings located in Climate Zone 2: Solar heat load should be less than 40 W/m^2

8.1.4 Other recommendations related to building envelope

Reflective external roof surface or reflective insulation
It is recommended to use of light-coloured and reflective finishes to building surfaces as this can help reduce the solar heat load. If insulation is used, it is recommended to use insulation which contains reflective foil on one side, and that it is placed so that the reflective side of the insulation is on the external side of the roof or wall.

Moisture shield
Moisture ingress through the building envelope can cause the following problems:

- Mold & mildew
- Corrosion
- Rot
- Insects
- Staining
- Adhesion loss
- Loss of thermal resistance

Moisture can also affect the building's comfort to its occupants, therefore, it recommended that vapour retarders or moisture shields are used on the exterior surface of the building envelope where moisture ingress is likely to be a problem (roof, basement walls, etc.).

Air leakage
In air-conditioned buildings, the building envelope should act as a barrier to prevent uncontrolled entry of outside air into an air-conditioned space.

It is recommended that the following areas of the building envelope be sealed, caulked, gasket, or weather-stripped to minimize air leakage:

a) joints around fenestration and door frames;
b) junctions between walls and foundations, between walls at building corners, between walls and structural floors or roofs, and between walls and roof or wall panels;
c) openings at penetrations of utility services through roofs, walls and floors;

d) site-built fenestration and doors;
e) building assemblies used as ducts or plenums;
f) joints, seams, and penetrations of vapour retarders; and
g) all other openings in the building envelope surrounding conditioned space.

However, these provisions should not affect the minimum air exchange rates specified in the EEBC.

9 Air Conditioning and Mechanical Ventilation (ACMV)

9.1 Load calculation procedures

Cooling system design loads for the purpose of sizing systems and equipment should be determined in accordance with the procedures described in the latest edition of the ASHRAE Handbook, or other equivalent publications.

9.1.1 Design conditions

Recommended indoor and outdoor design conditions for air-conditioned spaces for comfort cooling:

- Recommended indoor temperature shall be 23-27 ^{o}C
- Recommended minimum indoor temperature shall be 22^{o}C
- Recommended CO_2-level shall be 1000 ppm
- Recommended relative humidity shall be 55-80 %
- Recommended air movement in occupancy zone shall be 0,15 – 0,5 m/s
- Recommended maximum air movement 0.7 m/s
- Recommended outdoor dry bulb temperature
  - Climatic Zone 1 30 ^{o}C
  - Climatic Zone 2 27.7 ^{o}C
- Recommended outdoor wet bulb temperature
  - Climatic Zone 1 25 ^{o}C
  - Climatic Zone 2 23 ^{o}C

9.2 Equipment and system sizing

Cooling equipment and systems capacity shall not exceed the loads calculated in accordance with 9.1.

Where chillers are used and when the design load is greater than 1000kW (or 3412000 Btu), a minimum of two chillers or a single multi compressor chillers should be provided to meet the required load.

9.3 Equipment performance requirements

9.3.1 Coefficient of performance (COP)

System equipment/component shall meet the minimum coefficient of performance (COP) as described in tables 1 - 6. Coefficient of performance (COP) being the ratio of the rate of net heat removal to the rate of total energy input expressed in consistent units and under designed rating conditions.

9.3.2 System equipment/component - Electrically operated – Cooling mode

Table 1: Standard rating temperatures Cooling – Equipment (electrically driven)

Item	**Air-cooled**		**Water-cooled (watersource)**	
	Dry-bulb	**Wet-bulb**	**Inlet**	**Outlet**
Room air entering equipment (°C)	27.0	19.0	-	-
Condenser ambient (air-cooled) (°C)	35.0	24.0	-	-
Refrigerant-water heat exchanger (°C)	-	-	29.4	35.0

NOTES:
1. Data in this table apply to the following types of equipment:
a. Central Air Conditioners Air Evaporatively and Water Cooled, ARI Std 210/240
b. Commercial/ Industrial Unitary Air-conditioning Equipment, ARI Std 340/360

2. Standard Ratings are also based on other standard rating conditions such as but not limited to electrical conditions; cooling coil air quality; requirements for separated (split) assemblies; and minimum external static conditioned-air flow resistance, as provided in the applicable standards

Table 2: Minimum COP - cooling for unitary (central cooling) air conditioners (electrically driven)

Equipment	Size	Sub-category	Minimum COP
Air-conditioners: Air cooled with condenser	<19 kWr (or 64828 Btu/h)	Split system Single package	2.7 2.7
	≥ 19kWr (or 64828 Btu/h) and < 35 kWr (or 119420 Btu/h)	Split system and single package	2.6
	≥ 35 kWr (119420 Btu/h)	Split system and single package	2.5
Air conditioners: Water and evaporatively cooled	< 19 kWr (or 64828 Btu/h)	Split system and single package	3.1
	≥ 19kWr (or 64828 Btu/h) and < 35 kWr (119420 Btu/h)	Split system and single package	3.5
	≥ 35 kWr (119420 Btu/h)	Split system and single package	3.6

9.3.3 Water chillers – electrically driven

Table 3: Standard rating conditions Cooling – Water chillers (electrically driven)

Conditions	Water Chilling Package	Condenserless[d] Water Chilling Package
Leaving chilled water temperature °C	6.7	6.7
Entering chilled water temperature °C	12.2	12.2
Leaving condenser water temperature °C	35.0	-
Entering condenser water temperature °C	29.0	-
Fouling factor, water[c]		
Condenser, m^2 K/W	0.000044	0.000044
Evaporator, m^2 K/W	0.000180	0.000180
Fouling factor, Refrigerant, m^2 K/W	0.000000	0.000000
Condenser, ambient Temperature		
Air-cooled, °C	35.0 DB	-
Evaporatively-cooled, °C	23.9 WB	-

NOTES:
1. Data in this table apply to the following types of ACMV system components:
Centrifugal or Rotary or Reciprocating water-chilling packages ARI Std 550/590 - 98

2. Standard Ratings are also based on other Standard Rating Conditions, such as but not limited to, electrical conditions, indoor or condenser air quantities: minimum external flow resistance etc. as provided in the applicable standards.
3. For information on fouling factors, see the following standard.
4. Refrigerant condensers, remote type:
a. ARI Standard 480-95 for refrigerant-cooled liquid coolers, remote type
b. ARI Standard 550/590 - 98 also contain procedures for adjusting rating for other than the standard rating fouling factor.
5. The condenser is not within the package unit.

Table 4: Minimum COP/Chiller energy performance rating – water chilling package (electrically driven)

Equipment	Size in metric units	Size in Btu/h	*COP @ 100% Load Conditions		*COP @ NPLV Conditons	
			Minimum COP	Maximum Kwe/RT	Minimum COP	Maximum kWe/RT
Air cooled, with condenser	<105 kWr (30RT)	<358,260 Btu/h	2.6	1.36	2.8	1.26
	>105 kWr and < 530 kWr (150RT)	>358,260 Btu/h and <1,808,360 Btu/h	2.7	1.3	2.8	1.26
	>530kWr and < 1060 kWr (300RT)	>1,808,360 Btu/h and <3,616,720 Btu/h	2.8	1.26	2.9	1.21
	>1060 kWR (300RT)	>3,616,720 Btu/h	2.9	1.21	3	1.18
Water cooled, positive displacement (Reciprocating and Scroll	All capacities		3.9	0.9	4	0.88
Water cooled, positive displacement (Rotary Screw)	>530kWr (150RT)	>1,808,360 Btu/h	4	0.88	4.2	0.84
	>530kWr and < 1060 kWr (300RT)	>1,808,360 Btu/h and <3,616,720 Btu/h	4.4	0.8	4.7	0.75
	>1060 kWR	>3,616,720 Btu/h				

	(300RT)		5.4	0.65	5.8	0.61
Water cooled, positive centrifugal	>1060 kWR (300RT)	>3,616,720 Btu/h	5.2	0.68	4.7	0.75
	>1060 kWR (300RT)	>3,616,720 Btu/h	5.7	0.62	5.2	0.68

NOTES:

Chiller efficiency rating compliance shall be m either Minimum COP @ 100% Load Condition or Minimum COP

@ NPLV Condition and not at both conditions, note that COP is applicable to a single chiller.

NPLV denotes Non-Standard part Load Value where for part-load entering condenser water temperatures (ECWT), the temperature should vary linearly from the selected ECWT at 100% load to 26.7° (80°F) at 0% load, and is defined by the following formula:

NPLV = 1 / [(0.01 / A) + (0.42 / B) + (0.45 / C) + (0.12 / D)]

Where,
A = kWe/RT at 100%
B = kWe/RT at 75%
C = kWe/RT at 50%
D = kWe/RT at 25%

9.3.4 System equipment/component – heat operated (absorption), cooling mode

Table 5: Standard rating conditions – System cooling equipment/component (heat operated)

Standard rating conditions	**Heat source**		
	Units	**Direct fired (Gas, oil)**	**Indirect fired (Steam, hot water)**
		Temperatures	**Temperatures**
Air-conditioners[a]			
Entering conditioned air	°C	26.7 DB, 19.4 WB	-
Entering condenser air	°C	35.0 DB, 23.9 WB	-
Water chillers[b]			

Leaving chilled water	°C	7.2	6.7
Fouling factor	m^2 K/W	-	0.00009
Entering chilled water	°C	Per mfg. spec.	12.2
Entering condenser air	°C	23.9	29.4
Fouling factor	m^2 K/W	-	0.00018
Leaving condenser water	°C	35.0	-
Condenser water flow rate	l/min		Per mfg. spec.

NOTES:

1. Per ANSI Standard Z21.40.1-1994 and Addenda for Gas-fired absorption summer air-conditioning appliances.
2. Per ARI Standard 560-92 for Absorption water-chilling packages.

Table 6: Minimum COP (cooling) – System cooling equipment/components (heat operated)

Heat Source			
Direct fired (Gas, Oil)		**Indirect fired (Steam, hot water)**	
Type X[a]	Type Y[a]	Type X[a]	Type Y[a]
0.6	1.0	0.6	1.0

NOTES

1. [a] Type X = Single effect absorption chillers

[a] Type Y = Double effect absorption chillers

2. [b] As listed in Tbale 22 at sea level

3. c Minimum COP = Net cooling output/(Total heat input(electrical auxiliary inputs included))

9.4 Ventilation

9.4.1 Mechanically ventilated buildings

For mechanical ventilated buildings minimum ventilation rate should be determined in accordance with the procedures described in the latest edition of the ASHRAE Handbook, or other equivalent publications.

For **residential** buildings, all living spaces should make provision for the later connection of a ceiling fan or have a ceiling fan installed as from the construction of the building for every 15m^2.

9.4.2 Fan power

For **non-residential buildings**, the performance of air handling plant would need to consist of:

a. suitably efficient air handling plant; and

b. effective control systems.

Table 7 specifies the following limits to Specific Fan Power (SFP) of mechanical ventilation systems in new non-residential buildings.

Table 7: SPF of mechanical ventilation systems in new buildings

System type	**Specific Fan Power, W/(litre/s)**
Central mechanical ventilation including heating, cooling and heat recovery	2.5
Central mechanical ventilation with heating and cooling	2.0
All other central systems	1.8
Local ventilation only units within the local area, such as window/wall/roof units, serving one room or area	0.5
Local ventilation only units remote from the area such as ceiling void or roof mounted units, serving one room or area[1]	1.2
Other local units, e.g. fan coil units (rating weighted average)[2]	0.8

NOTES:

1. This also includes fan assisted terminal VAV units where the primary air and cooling is provided by central plant.

2. The rating weighted average is calculated by the following formula

$$\frac{P1.SFP1 + P2.SFP2 + P3.SFP3 + \ldots}{P1 + P2 + P3 + \ldots}$$

For **residential buildings**, where the work involves the provision of a mechanical ventilation system or part thereof, reasonable provision would be to install systems which also have specific fan powers and heat recovery efficiency not worse than those in the table below:

Table 8: Limits on design flexibility for mechanical ventilation systems in domestic buildings

System type	**Specific Fan Power, W/(litre/s)**
Specific Fan Power (SFP) for continuous supply only and continuous extract only	0.8
SFP for balanced systems	2.0
Heat recovery efficiency	66%

Fan motor power of at least 5 kW should incorporate control devices.

9.5 Piping and ducts

9.5.1 Insulation

Please refer to the *Duct and Piping Guideline* for insulation.

9.5.2 Hydraulic design

Hydraulic design needs to take account of the effect of water velocity on noise and erosion, and of the pressure and flow characteristics of the circulation pump.

Please refer to the *Duct and Piping Guideline*.

9.6 Systems controls

Individual thermostatic controls are required for heating and cooling in a building. The zone thermostatic controls should provide a dead band of at least 2.8^{o}C within which the supply of heating or cooling energy to the zone is capable of being shut off or reduced to a minimum.

Provisions for an accessible manual switch or an automatic shut off system when the room is unoccupied, for rooms < 30m2. For hotels, all hotel rooms to provide for an accessible manual switch or an automatic shut off system when the room is unoccupied.

Thermostatic setback controls should have the capability to set back or temporarily operate the system to maintain zone temperatures of 23-27^{o}C

9.7 Energy recovery ventilation systems

Individual fan systems that have both a design supply air capacity of 2.36 m^3/s or greater and a minimum outside air supply of 70 percent or greater of the design supply air quantity shall have an energy recovery system that provides a change in the enthalpy of the outdoor air supply of 50 percent or more of the difference between the outdoor air and the return air at design conditions.

Provision shall be made to bypass or control the energy recovery system to permit cooling with outdoor air where cooling with outdoor air is required.

10 Domestic Hot Water

10.1 Solar water heating

Mandatory Solar Water Heating System in the following building classes:

- Public buildings
- Integrated Resort Schemes
- Residential Estate Schemes
- Integrated Hotel Schemes

Residential facilities, hotels and hospitals etc. with a centralized system shall have solar water heating for 70% of the design capacity.

All new residential buildings must be fitted with a solar water heating system, which amount to at least 70% of the hot water demand.

In buildings with installed water heating capacity more than 10W/m2 (or 3.17Btu/ft^2.h) floor area, a minimum of 70% consumption shall be covered by solar water heating system or process waste heat recovery.

Buildings that uses heat recovery for at least 70% of the design capacity is exempted.

10.2 Requirements

Performance and prescriptive requirements for domestic hot water systems:

- Systems designed to maintain usage temperatures in hot-water pipes, such as recirculating hot-water systems or heat trace, shall be equipped with automatic time switches or other controls that can be set to switch off the usage temperature maintenance system during extended periods when hot water is not required.

- Service water heating equipment shall be provided with controls to allow a set point of 43^{o}C for equipment serving dwelling units and 32^{o}C for equipment serving other occupancies to allow for storage temperature adjustment from 48^{o}C or lower to a maximum temperature compatible with the intended use.

- The outlet temperature of lavatories in public facility rest rooms shall be limited to 43^{o}C.

- For automatic-circulating hot water systems, piping shall be insulated with 0.025 m of insulation having a conductivity not exceeding 0.039 W/m*K (or 0.023Btu/ft.h.^{o}F). The first 3m of piping in non circulating systems served by equipment without integral heat traps shall be insulated with 0.0125 m of material having a conductivity not exceeding 0.039 W/m.K (or 0.023Btu/ft.h.^{o}F).

- For pipe insulation thickness refer to *Duct and Piping Guideline* document.

- Condenser heat recovery systems shall be installed for heating or preheating of service hot water where there is a chiller air conditioning systems. Maximum heat must be recovered.

Exceptions:
  - Facilities that employ condenser heat recovery for space heating with a heat recovery design exceeding 30% of the peak water-cooled condenser load at design conditions.
  - Facilities that provide 60% of their service water heating from site-solar or site-recovered energy pr from other sources.

- Pump for water distribution should have a minimum efficiency of 70%. Provisions should be made for hot water system pumps to be turned off automatically or manually when the hot water system is not in operation.

11. Light conditions

11.1 Natural daylighting

To obtain a good daylighting system, the following means must be considered in the early design stage:

- Orientation and space organization,
- Shape and size of glazing,
- Internal surface properties,
- Protection from solar gain or glare, external and internal shading devices,
- Solar and thermal properties of windows

Windows must be made, located and, where appropriate, screened such that sunlight through them does not cause overheating in the rooms, and such that nuisance from direct solar heat gain is avoided.

For natural daylighting recommendations refer to Passive Solar Design Guidelines.

11.2 Artificial Lighting

The lighting requirements shall apply to:

1. Interior spaces of buildings
2. Exterior building features, including facades, illuminated roofs, architectural features, entrances, exits, loading docks and illuminated canopies
3. Exterior building grounds lighting that is provided through the building’s electrical service

Exemptions are:

1. Emergency lighting
2. Outdoor recreational facilities
3. Exterior lighting for public monument
4. Special lighting for research laboratories
5. Lighting used solely for commercial greenhouse
6. High risk security areas
7. Lighting power for theatrical productions, television broadcasting, audiovisual presentations and portion of entertainment facilities where lighting is essential technical element for the function performed

11.2.1 Recommended average illuminance levels

Recommended average illuminance levels shall be as specified in the table below.

Table 10: Average illuminance levels

Task	Illuminance	Applications
Lighting area for infrequently used area	20	Minimum service illuminance
	100	Interior walkway and car-park
	100	Hotel bedroom
	100	Lift interior
	100	Corridor, passageways, stairs
	150	Escalators, travellator
	100	Entrance and exit
	100	Staff changing room, locker and cleaner room, cloak room, lavatories, stores
	100	Entrance hall, lobbies, waiting room
	300	Inquiry desk
	200	Gate house
Lighting for working interiors	200	Infrequent reading and writing
	300 - 400	General offices, shops and stores, reading and writing
	300 - 400	Drawing office
	150	Restroom
	200	Restaurant, canteen, cafetaria
	150 - 300	Kitchen
	150	Lounge
	150	Bathroom
	100	Toilet
	100	Bedroom
	300 - 500	Class room, library
	200 - 750	Shop/ supermarket/ department store
	300	Museum and gallery
Localised lighting for exacting task	500	Proof reading
	1000	Exacting drawing
	2000	Detailer and precise work

11.2.2 Lighting power allowances

Interior lighting

The installed interior power shall include all power used by the luminaries, including lamps, ballasts, current regulators, and control devices.

Maximum interior lighting power shall not exceed the allowance provided in Table 11.

Table 11: Lighting power allowance

Type of usage	Max. Lighting power, W/m^2
Residential	6
Restaurants	10
Offices	10
Classrooms/ Lecture theatres	15
Auditoriums/ Concert halls	15
Hotel/ Motel guest rooms	10
Lobbies/ Atriums/ Concourse	18
Supermarkets/ Department stores/ Shops	20
Stores/ Warehouses/ Stairs/ Corridors/ Lavatories	
Hospitals/Clinics	20
Car parks	3

Power limits for exterior building lighting is given in the Table 12 below.

Table 12: power limits for exterior building lighting

Exterior lighting applications	Power limits
Building entrance (with canopy)	13 W/m2 of canopied area
Building entrance (without canopy)	60 W/lin m of door width
Building exits	40 W/lin m of door width
Building facades	2 W/m2 of vertical facade area

11.2.3 Lighting control and requirements

All lighting systems except those required for emergency or exit lighting should be provided with manual, automatic or programmable controls. For lighting loads exceeding 100 kW, automatic controls should be provided.

Interior lighting systems must be fitted with an automatic control device. In these buildings automatic occupancy sensors must be fitted for offices < 30m2, meeting rooms, classrooms, hotel rooms and storage spaces.

For other spaces, this automatic control device shall function on either:

(a) A scheduled basis at specific programmed times. An independent program schedule shall be provided for areas of no more than 2,500 m^2 and not more than one floor; or,

(b) Occupancy sensors that shall turn the lighting off within 30 minutes of an occupant leaving the space. Light fixtures controlled by occupancy sensors shall have a wall-mounted, manual switch capable of turning off lights when the space is occupied.

Lighting control requirements are specified to ensure that lights can be switched off when not needed, and to allow daylight energy saving strategies to be implemented.

Each space enclosed by ceiling-height partitions shall have at least one control device to independently control the general lighting within the space. Each control device shall be activated either manually by an occupant or automatically by sensing an occupant. Each control device shall cover a maximum of 250m^2.

Internally illuminated exit signs shall not exceed 5W per face.

For office, industrial and storage areas in all building types, the average initial efficacy should be no less than 45 lumens/circuit-Watt.

For any other non-residential buildings, an average initial lamp plus ballast efficacy of not less than 50 lumens/circuit-Watt is required.

For residential buildings, the requirement is to provide lighting fittings that only take lamps having a luminous efficacy greater than 40 lumens/circuit-Watt.

All exterior building grounds luminaries that operate at greater than 100 W shall contain lamps having a minimum efficacy of 60 lumens/circuit-Watt.

12 Vertical transportation

Where any vertical transportation system is required, an analysis of the demand and usage pattern, as well as the energy consumption for the system arrangements needs to be estimated.

Motors driving vertical transport (lifts, escalators and conveyors) shall be efficient. Lifts to have the following features:

- Operating in a stand-by mode during off-peak periods for lifts or when there is no passenger demand for escalators (fitted with a sensor). The power side of a lift controller and other operating equipment could switch off automatically when the lift has been idle for a prescribed length of time.

- Motors to be of AC variable voltage and variable frequency (VVVF) drive.

- Lifts having a regenerative drive unit so that any energy generated by the lifts (due to running up loaded to less than the counterbalancing ratio or down loaded to more than the counter balancing ratio) is used elsewhere in the building.
- In buildings where 3 or more lifts are installed, a destination control system shall be provided.

13. Heated pools

Pool heaters should be equipped with a readily accessible on-off switch or time switches to allow shutting off the heater without adjusting the thermostat setting, except where public health standards require 24-hour pump operation.

Where a heat pump is used for pool heating, the COP of heat pump shall not be less than 5. Thermal solar heating shall be considered wherever possible.
Pool heaters fired by natural gas or LPG shall not have a continuously burning pilot light

Pools heated to more than 32^{o}C should have a vapour retardant pool cover with a minimum insulation value of R-12. Pools using solar energy or 60% of energy from site recovered energy or solar energy are exempted.

14 Power Factor Correction

The total power factor for all circuits shall not be less than 0,95 at duty point. Exempted are buildings with electricity supplies less than 100 A.

15 Transformers

15.1 Minimum Transformer Efficiency

The privately owned distribution transformers shall be selected to optimise the combination of no-load, part-load and full-load losses without compromising operational and reliability requirements of the electrical system. The transformer shall be tested in accordance with relevant IEC standards and shall have a minimum efficiency shown in Table 15.1 at the test conditions of full load, free of harmonics and at unity power factor

Table 15.1: Minimum Transformer Efficiency

Transformer Capacity	Minimum Efficiency
< 1000 kVA	98 %
≥ 1000 kVA	99 %

15.2 Assessment of transformer efficiency in terms of load and no load losses

The following formula should be used:

$$\text{Transformer loss percentage} = \frac{(LL + NLL) * 100}{P.F * kVAtr}$$

Where,
LL is the load losses in kW (winding losses)
NLL is the no load losses in kW (iron losses)
P.F is the power factor of load
kVAtr is the rated transformer capacity in kVA

Other methods for selection of transformer that can be adopted include assessment of "Total Present Worth" of Capital cost plus the capitalisation of the energy losses over lifetime".

15.3 High Voltage Distribution

The locations of distribution transformers and main LV switchboards should preferably be sited at their load centres or they should comply with table 15.3 below.

Table 15.3: Location of Distribution Transformers

Load fed by transformer	Distance of transformer from load centres
>600 A	Not more than 20 M
300 A to 600 A	Not more than 100 M

15.4 Power Factor

The average power factor of the loads being served by the transformer should not be less than 0.85. In cases where load power factors fall below 0.85, capacitor or power factor improving devices should be provided for automatic or manual correction.

15.5 Transformer configuration

Transformer configuration should endeavour to maintain a firm capacity that meets the full load requirements and should not normally exceed 150% of the load demand.

15.6 Harmonics

Where harmonics content is significant, a transformer with higher harmonics withstand capability should be selected. This normally includes transformers with:

a) Enlarged primary windings to withstand third harmonic circulating current;
b) Larger secondary neutral conductor to carry third harmonic current;
c) Magnetic core designed with lower normal flux density using higher grade iron; and
d) Smaller, insulated secondary conductors configured in parallel and transposed to reduce heating due to skin effect and associated AC resistance.

The use of "harmonics mitigating transformer" which utilises multiple – secondary windings which are phase-shifted for cancelling zero-sequence third harmonics current may also be considered.

15.7 Measurement and Reporting of Transformer Losses

All measurement of losses shall be carried out by using calibrated digital meters of class 0.5 or better accuracy and certified by the manufacturer. All transformers of capacity of 500 kVA and above would be equipped with additional metering class current transformers (CTs) and potential transformers (PTs) additional to requirements of Utilities so that periodic loss monitoring study may be carried out.

16 Appliances for Offices

It is recommended that office appliances shall have an energy rating. Energy consumption for office appliances shall not be included in the overall energy performance calculation for the building.

17 Renewable Energy

Evidence of assessment of potential on-site renewable energy such as solar water heating systems, photovoltaics, wind turbines must be provided for following buildings and projects:

- Public buildings
- Integrated Resort Schemes
- Residential Estate Schemes
- Integrated Hotel Schemes
- Hotels
- Buildings larger than 4000m^2

A report template is provided in Annexure E.

All buildings to provide a minimum of 50m^2 of unobstructed roof area facing within 30° of North for future solar collector or photovoltaic panels. Reservations in the roof must be provided within 500mm of the boundary of the unobstructed roof area for future conduits and piping.

18 Building Energy Management System

To improve the efficiency of building operation requirements and recommendation for Energy Management, buildings with a gross floor area $\geq$ 4000 m^2 a Building Energy Management System (BEMS) shall be installed having at least the following functions:

- Control of electrical and mechanical equipment
- Monitoring of energy consumption
- Integration of equipment sub-system (fire, alarms etc)

18.1 Application of EMS for Energy Audit

Buildings providing Energy Management Systems should be equipped with data logging facilities for the collection of data for energy auditing

18.2 Sub-metering

Electrical sub-meters for the monitoring of energy consumption should be provided to all incoming power supply in any building and the outgoing sub-circuits serving, but not limited to the following:

a) central air-conditioning system;
b) lift and escalator system;
c) major water pumping system;
d) general power supply; and
e) lighting supply.

In residential buildings with individual dwelling units each unit shall be equipped with an electrical sub-meter.

19 Commissioning

An appropriate project team member(s) must be appointed to monitor and programme pre-commissioning, commissioning and, where necessary, re-commissioning on behalf of the developer. The commissioning manager must have been appointed during the design stage. The individual serving as the commissioning manager shall be independent of the project's design and construction management and shall report results, findings and recommendations directly to the developer.
The scope of their responsibility includes:

- Design input: commissionability design reviews
- Commissioning management input to construction programming
- Commissioning management input during installation stages
- Management of commissioning, performance testing and handover/post handover stages
- Verify that the requirements for training operating personnel and building occupants are completed

Commissioning shall be on complex systems (where they exist) such as:

- Air conditioning
- Mechanical ventilation, displacement ventilation, complex passive ventilation
- Building Energy Management Systems (BEMS)
- Renewable energy sources
- Microbiological safety cabinets and fume cupboards
- Cold storage enclosures and refrigeration plant

Commissioning should cover the following key services as a minimum:

- Heating systems
- Water Distribution systems
- Lighting systems and daylighting controls
- Ventilation systems
- Domestic hot water systems

- Refrigeration systems
- Automatic controls
- Cold storage

Where a Building Energy Management System (BEMS) is specified, the following commissioning procedures must be carried out:

- Commissioning of air and water systems is carried out when all control devices are installed, wired and functional
- In addition to air and water flow results, commissioning results include physical measurements of room temperatures, off coil temperatures and other key parameters as appropriate
- The BEMS/controls installation should be running in auto with satisfactory internal conditions prior to handover
- All BEMS schematics and graphics (if BEMS is present) are fully installed and functional to user interface before handover
- The occupier will be fully trained in the operation of the system

20 Operation and Maintenance

Adequate maintenance practice should be enforced, without which the energy efficiency measures implemented during the design/construction stages could be lost.

Operating and maintenance documents should be handed over to the building owner/ occupier/ manager. An operating “log-book” should also be handed over, which provides information about the installed building services and controls, and maintenance methods.

Annexes

Annexes to be included, such as:

A. Climate Map for Mauritius
B. List of Approved Energy Simulation Programs
C. Design Temperatures for Mauritius
D. Energy Efficiency Certificate
E. Report template for evidence of renewable energy assessment
F. Matrix showing requirements at different stages, from design to post-construction.

Annex A. Climate Map for Mauritius

To be inserted

Annex B. List of Approved Energy Simulation Programs

The simulation program for Compliance Method 2 should be a computer-based program which can carry out energy consumption analysis in buildings. It should be noted that one specific tool, adapted for Mauritius, may be prescribed at a later stage, for compliance with the Code. At this stage, the software listed and meeting the prerequisites in their calculation methodologies below, can be used for compliance.

The simulation program used should incorporate within its calculation methodologies at least the following:

a) a minimum of 8,760 hours time step per year, i.e., the software should be able to perform calculations on an hourly basis, based on hourly climatic data;
b) hourly sun positions are taken into account;
c) at least eight orientations are considered in calculations (N, NE, E, SE, S, SW, W, NW);
c) hourly values for occupancy, lighting power, equipment power, thermostat set-points, and HVAC systems operation, which can be defined separately for each day of the week and holidays;
d) thermal mass effects is taken in account;
e) the effect of shading can be modelled;
f) software allows for sufficient thermal zones in the building model.

The simulation program compliant with ASHRAE Standard 140 or CIBSE: AM11 would generally meet the above requirements.

A list of approved simulation software is found below:

- SBEM
- EDSL TAS
- IES
- EnergyPlus
- ESP-r
- Trnsys
- DOE-2

The simulation program uses the weather data (consisting of hourly values of parameters such as temperature, humidity and solar radiation) which are specified for the climatic zone in which the *design building* is to be located.

Annex C. Design Temperatures for Mauritius

The climatic data which is used for the purpose of showing compliance with the requirements of the EEBC, should be the climatic data specified for the climatic zones, as defined in the EEBC.

Design temperature for Mauritius:

	Wet Bulb (1%) °C	**Dry Bulb (1%) °C**	**Reference**
Climatic Zone 1 (Plaisance)	25,0	30,0	ASHRAE
Climatic Zone 2 (Vacoas)	23,0	27,7	MMT

Annex D. Energy Efficiency Certificate

Energy Efficiency Certificate

Page 1

A. Applicant Information

Name of organisation:		
Adress:		
Telephone no:		
Fax no:		
E-mail:		
Registered professional architecht/engineer responsible for the compliance:	Name: Reg.no: Discipline:	Telephone no: Fax no: E-mail:
	Date:	Signature:

B. Building Information Data

Project/Building Name:	
Project/Building Location:	
Building Type/Activity:	
Year of Completion:	
Gross Floor Area (m^2):	
Building Area (m^2):	
Climate Zone (1: Coastal Area or 2: High Lands)	

C. Energy Compliance Method

Compliance alternative in Energy Efficiency Building Code for Mauritius (Alternative 1 or 2):	

D. Approval

It is hereby certified that the building described in this Energy Effciency Certificate has been verified to comply with the requirements defined in the Energy Efficiency Building Code for Mauritius.		
Certified Energy Auditor	Name: Reg.no: Discipline:	Telephone no: Fax no: E-mail:
	Date:	Signature:

E. Building Energy Data

Compliance Alternative 1(a) - Residential Buildings		
Solar Factor (%):	External walls:	
	Roofs:	
	Fenestration:	
Solar Heat Load (W/m^2):		
Max. total primary annual energy consumption:	kWh/year:	
	kWh/m^2/year:	

Compliance Alternative 1(b) - Residential Buildings		
OTTV (W/m^2):	External walls:	
	Roofs:	
Solar Heat Load (W/m^2):		
Max. total primary annual energy consumption:	kWh/year:	
	kWh/m^2/year:	

Compliance Alternative 2 - Non-residential Buildings		
Max. total primary annual energy consumption (*Design Building*):	kWh/year:	
	kWh/m^2/year:	
Max. total primary annual energy consumption (*Reference Building*):	kWh/year:	
	kWh/m^2/year:	

General electricity information - All Buildings	
Electridicy supply account number:	
Overall Power Factor:	

Renewable Energy Sources (e.g. Solar Water Heating, Photo Voltaic)		
1.	Energy Source:	
	Annual Supply (kWh/year):	
2.	Energy Source:	
	Annual Supply (kWh/year):	
3.	Energy Source:	
	Annual Supply (kWh/year):	

F. Support Documentation Page 3

All Compliance Alternatives
Description of document/information
Compliance Alternative 1(a) - Residential Buildings
Description of document/information

Compliance Alternative 1(b) - Residential Buildings	Page 4
Description of document/information	

Compliance Alternative 2 - Non-Residential Buildings
Description of document/information

Annex E. Report template for evidence of Renewable Energy assessment

Renewable Energy Report Template

> *At least one renewable energy system type must be investigated to cover the following options:*
> *Option 1: 5% of estimated annual energy consumption*
> *Option 2: 10% of estimated annual energy consumption*
> *Option 3: 50% of estimated annual energy consumption*

Estimated Annual Energy Consumption:

Electricity: ____
Gas: ____
Diesel: ____
Other: ____

System Type Investigated (e.g. Photovoltaics):-
____

Sizes of System Investigated (in kW):
Option 1.PHOTOVOLTAICS
Option 2.____
Option 3.____

Suppliers Contacted (at least two suppliers must be approached for a quote):
Company Name____
Contact Name____
Phone____

Company Name____
Contact Name____
Phone____

Company Name____
Contact Name____
Phone____

Company Name____
Contact Name____
Phone____

Company Name____
Contact Name____
Phone____

Company Name____
Contact Name____
Phone____

Payback of system (capital cost vs saving in electricity costs and material costs, in years)
Option 1.____
Option 2.____
Option 3.____

Evidence of this calculation must be provided with this report.

Notes on system feasibility (feasible or non-feasible):
____
____
____
____
____
____
____

Signature and Date

____

Annex F. Matrix showing requirements at different stages, from design to post-construction.

BUILDING PROJECT STAGE	PRE-DESIGN PROJECT INITIATION	PRE-DESIGN SITE ANALYSIS	OUTLINE PROPOSALS	SCHEMATIC DESIGN	DETAILED DESIGN	CONTRACT DOCUMENTS/ BID/ NEGOTIATIONS	CONSTRUCTION	COMMISSIONING	OPERATION (IN-USE)
MAIN POINTS to be considered	- Identify client's vision - Identify key energy and environmental objectives, criteria and targets	- Identify site suitability, restrictions and alternatives. -Consider building shape and arrangement on site. - Identify options to maximise the building's EE and reduce EC (orientation, natural means of shading, identify natural ventilation flowpaths...)	- Fine-tune client/user requirements. - Outline servicing and energy strategy (ventilation, air conditioning, daylighting, etc.). - Plan building layout so as to facilitate zone control for services systems, and to minimise EC (e.g. Use some low occupancy zones as buffer zones). - Select main fuel to be used, and allow provisions for change in fuel (i.e. from grid electricity to possiblity of on-site generation in the future).	- Design windows and shading to take into account the consequences on the energy usage, including lighting energy usage. - Select basic building envelope's thermal characteristics, considering levels of insulation, thermal mass, etc. - Design artificial lighting controls, considering availability of daylight and occupancy/usage patterns	- Detailed design of services should consider low-energy systems and equipment, with a preference for high-performance certified products	- Ensure that contractual documents include all requirements, to ensure that building construction meets the standards specified at design stages.	- The integrity of the building envelope should be as specified at design stage, i.e. In buildings where the design specifies air tightness and thermal conductivity as very important issues for the optimal performance of the building, it should be ensured that ventilation is controlled and thermal breaks are provided where necessary.	- Ensure that energy performance targets are being met. - Mechanical/electrical systems should be commissioned to ensure that they are properly integrated to reduce total energy consumption. - Where air tightness is an issue, the building envelope should be commissioned/tested for air leakage. - Energy-efficient lighting	- Ensure that future use, maintenance and servicing of the building does not compromise its performance as-designed (possibly with the requirement of an Operations and Maintenance Manual).
Key people involvement	Developer, Certified Energy Auditor, Building Consultants, Architects, Funding Agencies	Developer, Land Surveyor, Architects, Quantity Surveyor, Certified Energy Auditor, Building Consultants	Developer, Certified Energy Auditor, Building Consultants, Architects, Quantity Surveyor, Civil/Strutural Engineer, Mechanical Engineer, Electrical Engineer			Developer, Certified Energy Auditor, Building Consultants, Architects, QS, Civil/Strutural Engineer, Mechanical Engineer, Electrical Engineer, Site contractor		Developer/Owner, Building Occupants, Building Manager, Certified Energy Auditor	
Relevant *Existing Regulatory* Dcouments	- The Code Civil Mauricien (Amendment) Act 2007 - Criminal Code (Amendment) Act 2003 - Town and Country Planning Act 1990 (Act 2/90) - Local Govternment Act 2003 and subsequent Amendment 2005 - Building Act 1981 and attached Building Regulations 1919 - Environmental Protection Act 2002 and subsequent Amendment Act 2008 - Utility Regulatory Authority Act 2004 - Electricity Act 2005 - Insurance Act - Energy Efficiency Act							- Utility Regulatory Authority Act - Electricity Act - Occupational Health and Safety Act - The Code Civil Mauricien (Amendment) Act 2007 - Criminal Code (Amendment) Act 2003 - Insurance Act - Energy Efficiency Act	
***Future Regulatory* Documents**	- Building Control Bill, Energy Efficiency Building Regulation and Energy Efficiency Building Code - Land Use Planning and Development Bill (to replace the Town and Country Planning Act and the Planning and Development Act) * * The new Land Use Planning and Development Bill foresees the possibility for the Authority to demand "the payment of security for works to be undertaken under a Permit" as a condition to grant permit. Should mandatory insruance be required in the new Bill, reference should be made to the Insurance Act for different types of insurance policies.							- Building Control Bill - Energy Efficiency Building Regulation - Energy Efficiency Building Code	
Relevant Existing *Reference* Documents (Guidelines)	- Building and Land Use Permit Guide - Planning Policy Guidance (PPG) and Outline Schemes for different districst and towns (Ministry of Housing and Lands) - Ministry of Health and Quality of Life Guidelines - Guidelines from Fire Services - Guidelines from Ministry of Environment - Passive Solar Design Guidelines - Duct and Piping Guidelines							- Occupational Health and Safety Guidelines - Ministry of Health and Quality of Life Guidelines - Guidelines from Fire Services - Guidelines from Ministry of Environment	
Documentation to be submitted by developer/ design team to local authorities	**Building and Land Use Permit** needs to be obtained by application to the appropriate Local Authority (Planning Department of the Municipal or District Council). Documents required to be submitted include: - Title deed and memorandum of survey - Location and site plans - Layout, elevation and cross-sectional plans - Structural details - Engineer's certificate (where applicable) - Clearance from Central Electricity Board (CEB), Central Water Authority (CWA), and Waste Management Authority (WMA) - Certificate from Ministry of Health stating the proposed construction, alterations, additions or repairs are in accordance with sanitary requirements (where applicable). - Clearance from the Ministry of Agriculture, if the development or part of, is situated within the river reserve. - Preliminary Environmental Report (PER) or Environmental Impact Assessment (EIA) (where applicable)* - Energy Efficiency Certificate, issued by the Certified Energy Auditor (CEA) * where an PER/EIA is required, the development should show compliance with Environmental Standards for air, noise, water, and waste as per Environmental Protection (Amendment) Act 2008.						- Local Authority is to be informed of date of start of construction works as per Section 18 of the Building Act, through signed letter	- Local Authority is to be informed of date of completion of construction works as per Section 19 of the Building Act through signed letter, so that Officers of the Municipal/District Council can carry out inspection of building prior to occupation/operation, and can issue Certificate of Occupancy. - Fire Certificate (where applicable) should be obtained, as per Occupational Health and Safety Act. - The developer / builder must also secure the relevant property damage insurance policy as per section 16 of the Building Control Bill.	
Authorities to provide clearance and approve documentation	- Certified Energy Auditor to provide Energy Efficiency Certificate - Central Electricity Board (CEB) to provide clearance letter to developer/design team. - Central Water Authority (CWA) to provide clearance letter to developer/design team. - Ministry of Environment to approve PER or issue the EIA license, where required. - Local Authority (Planning Department of Municipal/District Council) to verify submitted application documents in compliance with the PPG and the following acts: (a) Local Government Act 2003 and subsequent Amendment 2005 (including Fire Services Requirements) - enacted by Ministry of Local Government (b) the Building Control Bill, Energy Efficiency Building Regulation and Energy Efficiency Building Code - Ministry of Public Infrastructure (c) the Town and Country Planning Act 1990 (Act 2/90) - Ministry of Housing and Lands (d) the Planning and Development Act 2004 - Ministry of Housing and Lands						- Site inspection by Engineer/ Architect - Local Authority may carry out inspection to ensure regulations /acts are being adhered to.	- Certified Energy Audotor to issue Energy Efficiency Clearance Certificate, certifying that the building has been constructed as per the Energy Efficiency Certificate issued at design stage. - Local Authority to provide Certificate of Occupancy after inspection on completion of construction works - Fire Services Authority to provide Fire Certificate (where applicable)	