MINISTRY OF SCIENCE, ENERGY, TELECOMMUNICATIONS AND TRANSPORT

Energy Efficiency and Conservation Policy and Guidelines for Public Facilities, Specifically for Schools and Hospitals

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Energy Efficiency and Conservation Policy and Guidelines for Public Facilities, Specifically for School, and Hospitals

Developed by the Caribbean Centre for Renewable Energy and Energy Efficiency for the Ministry of Science, Energy, Telecommunications, and Transport with support from the Inter-American Development Bank

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Acronyms/Abbreviations	
AC	Air Conditioning/Conditioners
AEE	Association of Energy Engineers
AER	Annual Efficiency Ratio
ARP	Annual Review Proceeding
BAU	Business-As-Usual
Bbl.	Barrels
Bpd	Barrels per day
BSJ	Bureau of Standards Jamaica
CARCEP	Caribbean Clean Energy Project
CARICOM	Caribbean Community
CC	Climate Change
CDM	Clean Development Mechanism
CEER	Combined Energy Efficiency Ratio
CFC	Chlorofluorocarbons
CFC-11	Trichlorofluoromethane
CFL	Compact Fluorescent Lamps
CPV	Concentrator Photovoltaic
CROSQ	Caribbean Regional Organization of Standards and Quality
CSPF	Cooling Seasonal Performance Factor
DER	Distributed Energy Resource
DG	Distributed Generation
DSM	Demand Side Management.
EA	Electricity Act
ECM	Energy Conservation Measures
EE	Energy Efficiency
EaaS	Energy as a Service

EE&EC	Energy Efficiency and Conservation
EELS	Energy Efficiency Labelling Scheme
EER	Energy Efficiency Ratio
ESCO	Energy Service Company
ESD	Energy Storage Device
GEF	Global Environment Fund
GHG	Green House Gas
GoJ	Government of Jamaica
GWP	Global Warming Potential
HCFC	Hydro chlorofluorocarbons
HFC	Hydro fluorocarbons
HPMP	HCFC Phase-out Management Plan
HPS	High Pressure Sodium
HVAC	Heating Ventilation and Air Conditioning
IADB	Inter-American Development Bank
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producers
IRP	Integrated Resource Plan
IRRP	Integrated Resource & Resilience Plan
IUS	Integrated Utility Services
JCA	Jamaica Customs Agency
JNAA	Jamaica National Agency for Accreditation
JPC	Jamaica Productivity Centre
JPS	Jamaica Public Service Company Limited
K-CEP	Kigali Cooling Efficiency Program
kW	Kilowatt
LAC	Latin America and Caribbean
LCDS	Low Carbon Development Strategy

LED	Light-Emitting Diode
LEDS	Low Emission Development Strategy
LPG	Liquified Petroleum Gas
MEGJC	Ministry of Economic Growth and Job Creation
MEPS	Minimum Energy Performance Standards
MLF	Multilateral Fund
MLFS	Multilateral Fund Secretariat
MoHW	Ministry of Health and Wellness
MOP	Meeting of the Parties
MSETT	Ministry of Science, Energy, Telecommunications and Transport
MW	Megawatt
MWh	Megawatt Hour
NDC	Nationally Determined Contributions
NEP	National Energy Policy
NEPA	National Environment and Planning Agency
NGO	Non-Governmental Organization
NOU	National Ozone Unit.
NR	Natural Refrigerants
ODP	Ozone Depleting Potential
ODS	Ozone Depleting Substances
OUR	Office of Utilities Regulation
PPAS	Power Purchase Agreements
PRAD	Pharmaceutical and Regulatory Affairs Department
PU	Polyurethane
RAC	Refrigeration and Air Conditioning
RACHP	Refrigeration, Air Conditioning and Heat-pump
REEBC	Regional Energy Efficiency Building Code
RMP	Refrigerant Management Plan

SDG	Sustainable Development Goals
SEER	Seasonal Energy Efficiency Ratio
SRD	Standards and Regulation Division (MoHW)
SVP	Secondary Voltage Power
SWAC	Seawater Air conditioning
TOU	Time-Of-Use
UNEP	United Nations Environment Programme
URA	Utilities Regulation Act
VRE	Variable Renewable Energy
W	Watt

Minister's Message

The Hon. Daryl Vaz, MP

Minister of Science, Energy, Telecommunication and Transport

By embracing sustainable practices and adopting energy-efficient solutions within our schools, hospitals and other public facilities can not only reduce their environmental footprint but also enhance operational efficiency, contribute to cost savings, and pave the way for a sustainable future for Jamaica.

Jamaica, known for its natural beauty and commitment to sustainable development, is poised to become a leading example in the Caribbean region for energy conservation and environmental stewardship. Schools and hospitals, as influential pillars of society, have a unique opportunity to lead the way in driving energy efficiency initiatives that align with the nation's vision for a greener future.

This policy shows the Government's continuing commitment to implementing durable energy-efficient measures that can result in substantial cost savings for educational and healthcare facilities once implemented. By upgrading lighting systems, training facility managers, and optimizing ventilation, or using energy-efficient air conditioning (HVAC) systems, schools and hospitals in Jamaica can significantly reduce their energy consumption and subsequently lower the Government's utility bills, freeing up resources for crucial educational and healthcare endeavours.

A cornerstone of the policy is the mandatory use of energy efficiency codes in both new and in the retrofitting of existing buildings. Another pillar, the upskilling of building facilities managers to ensure they understand that implementing energy-efficient measures can lead to substantial cost savings in the long run.

Each public facility, no matter the size, has a part to play in ensuring that our nation achieve the goals set out in this policy and helping to positively impact each of the Government's building's bottom line and leading us onward towards sustainable prosperity.

EXECUTIVE SUMMARY

Jamaica is a net energy importer. In 2019, imported fossil fuels for electricity, transportation, heat, and other applications represented over 75% of the primary energy mix and 88% of the share of the electricity mix [1]. Renewable energy resources in the electricity mix have trended upward from approximately 8% of the electricity mix to 17% in 2021, generating 13% of the electricity consumed [2].

In 2022, electricity (30%) was the second highest fuel consumption category using 5,969,066 bbl. of imported fuel after road and rail transportation (34%), making electricity a targeted opportunity for national energy efficiency interventions.

In 2021 Jamaica had one of the highest energy intensity rates in the Caribbean with a ratio of energy consumption to national gross domestic product of 6,786BTU per Year measured in 2018 U.S. Dollars (based on Purchasing Power Parity)[1] compared to 5,684 for the Caribbean [3]. Against this high level of imported energy, Jamaica has a low ranking for its energy consumption (inefficiency) being 103rd internationally with regards to an Energy Consumption per Capita of 41.75 million BTU per person and also ranked 114th with 40,000 bpd of petroleum and other liquid fuel consumed in 2020.

The Government of Jamaica (GoJ) is the largest single consumer of energy in the economy in the form of electricity, for the water utility, transportation, administrative offices and other critical national services. Jamaican public facilities alone accounted for approximately 107.5 GWh/yr. (2019) of electricity consumption only and energy efficiency (EE) opportunities, had an estimated potential saving of J$2.6 billion per year, while the capital expenditure required to realise these savings was approximately J$9.6 billion with a simple payback of 3.7 years and 24.7% reduction in public sector electrical energy consumption.

The Government of Jamaica over the years, has taken a very proactive approach to the management of its energy portfolio. Since the initial global energy crisis of the 1970's, the GoJ has consistently produced national energy policies which have focused on reliability of energy supplies, security of supplies, energy conservation and lowering the cost of energy to the nation. In 2005, there was a parallel national initiative, Vision 2030 – Jamaica National Development Plan, aimed at preparing Jamaica to become a developed country by 2030 with the stated vision:

"Jamaica, the place of choice to live, work, raise families and do business".

Since 2005, the energy policy was revised with a longer-term perspective and was promulgated in 2009 (National Energy Policy 2009 – 2030).

[1] 6,786 British thermal units (BTU) are required to produce US$ 1.00 of output.

The Vision of the National Energy Policy (NEP) is stated as: -

> ***"A modern, efficient, diversified and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security and supported by informed public behaviour on energy issues and an appropriate policy, regulatory and institutional framework."***

The National Energy Policy 2009 - 2030 was developed around seven (7) goals to achieve the objectives.

These goals are currently stated as follows:

Goal 1

> ***Jamaicans use energy wisely and aggressively pursue opportunities for conservation and efficiency.***

Goal 6

> ***Government ministries and agencies are a model/leader in energy conservation and environmental stewardship in Jamaica.***

In addition to the National Energy Policy, the Draft National Energy Conservation and Efficiency Policy (2009) supporting policy also reiterates these goals as well as sets out the strategies and actions that would result in an increase in the efficient use of energy across all sectors. Goal 3 of this supporting policy states.

> **"*The Government of Jamaica is the leader in energy conservation and efficiency and sets the standard for all other sectors*".**

As the lead-agent, the Government of Jamaica in keeping with Goal 3 of the Energy Conservation and Efficiency supporting policy and this *Energy Efficiency and Conservation Policy and Guidelines for Public Facilities*, will demonstrate models of efficient energy usage and environmental stewardship, resulting in a reduction in the high public sector consumption of energy and will provide a stimulus for private sector and community action.

In fulfilment of these goals for the implementation of the National Energy Policy (NEP), the GoJ has developed Standards and Codes as well as Policy Guidelines to support the NEP. Table ES1. lists the major documentations that have been developed or that is referenced with respect to energy efficiency and energy conservation.

Table ES 1: Frameworks, Guidelines and Codes Applicable for Energy Efficiency and Conservation.

Jurisdiction	Legislation	Objective	Agency
Local	The KSAC Building Act 2016	To legislate development plans	Ministry of Local Government and

Jurisdiction	Legislation	Objective	Agency
		including building codes for KSAC.	Rural Development.
Local	Jamaica National Building Code, Volume 2: *Jamaica Bureau of Standards* Energy Efficiency Building Code, Requirements and Guidelines, 1994	To provide technical codes for all building requirements	Bureau of Standards Jamaica (BSJ)
Regional	CARICOM Regional Energy Efficiency and Energy Conservation Building Code - 2018 (CREEBC)	To provide technical codes for Energy efficiency and conservation for the Region	Developed by CARICOM Regional Organization on Standards and Quality (CROSQ)
International (Local Application)	JS 309:2019 - Application Document for the International Energy Conservation Code (Reviewed every three (3) years).	To provide technical codes for energy efficiency and conservation in Jamaica	Bureau of Standards Jamaica (BSJ)
Local	Energy Efficiency and Conservation – *Standard Guide for the Public Sector - 2018*	To provide guidance to the energy sector on efficiency and conservation	Developed by the then Ministry of Science Energy and Technology (MSET) / Petroleum Corporation of Jamaica (PCJ)[2]
Local	Nationally Determined Contribution (NDC) of Jamaica to the United Nations Framework Convention on Climate Change (UNFCCC) June 2020.	Jamaica's contribution to global Climate Change initiative.	Climate Change Division (CCD)

[2] The Petroleum Corporation of Jamaica was subsumed under the then parent Ministry of Science, Energy and Technology (MSET) in 2020. The Ministry of Science, Energy, Telecommunications and Transport (MSETT) replaced the MSET in May 2023.

This "*Energy Efficiency and Conservation Policy and Guidelines for Public Facilities"* will incorporate the knowledge and successes acquired over the years to facilitate adaptation to new technology, to enable the application of contemporary and appropriate local, regional, and international codes, and implementation of the NEP goals and objectives to improve energy efficiency and energy conservation, as a key component to the solution of Jamaica's economic situation.

To this end, professional bodies such as the Jamaica Institution of Engineers, the Jamaica Institute of Architects, along with the Bureau of Standards and the various Municipalities have been developing standards and adopting and adapting building and energy efficiency codes. The Ministry with responsibility for energy through its then agency, the Petroleum Corporation of Jamaica, had also conducted energy audits on Government buildings over the years to 2019 to establish baselines within the public sector. Also, Investment Grade Audits (IGAs) were conducted on several facilities in the health and education sectors. The generally stated objectives of the audits were to facilitate:

- Reduced electricity consumption within government facilities.
- Decreased oil imports through improved Energy Efficiency.
- Reduced GHG emissions which can contribute to Jamaica's commitment.
- An increased capacity to promote and supervise electricity planning in Jamaica.

A Technical Assessment Report was created for each building which was audited which described in detail the existing building envelope, operating systems and equipment, facilities conditions, personnel behaviour, and the recommended Energy Efficiency Measures (EEMs) and associated savings related to energy consumption/savings. The recommendations were varied and specific for each facility, however there were also similarities in findings and recommendations as the overall building age, equipment type, designs and operations were similar particularly for hospitals, and educational facilities. A sampling of available audits contributed to the overall consumption trend as follows:

Table ES 2: Consumption in Selected Public Sector Buildings

Sources of Energy Consumption	Hospitals	Corporate (PCJ)	Education
HVAC/Mini-Splits[3]	48 - 53%	62%	24 - 47%
Lighting	14 - 20%	7%	17 - 30%
Plug Loads	6 - 10%	26%	17 - 24%
Balance of Systems	8 - 18%	5%	6 - 35%

Development of Energy Efficiency and Conservation Policy and Guidelines

[3] Refrigeration and other cooling services were not included due to high variability.

A review of the energy conservation measures showed that these were recommended to achieve the design level and in some instances standards that were being employed. Also, some recommendations were primarily a reference to established international codes. There was an absence of referencing to relevant local codes or guidelines for which correction or an upgrade was to be made as the time frame in which the audits were being done was the same as when the codes were being developed.

Given the need to adopt or adapt local, regional, and international codes in the Jamaican context, it is imperative that the Policy be stated more prescriptively to encourage the development of a culture of adherence to code.

The *Energy Efficiency and Conservation Policy and Guidelines for Public Facilities aims to achieve the following five (5) Goals: -*

Goal 1: The public sector is the lead agent and catalyst for diverse applications in energy conservation and efficiency practices and progressive technologies to reduce overall national energy consumption and increase national energy security.

Goal 2: National and international energy efficiency standards and codes will be the platform from which compliance with energy conservation and efficiency best practices are continuously and sustainably achieved.

Goal 3: The Government will implement enduring policy, legislative and regulatory frameworks for consistently prioritizing the procurement and utilization of modern, appropriate, and quality energy efficient technologies as a model for all sectors.

Goal 4: Energy conservation and efficiency will be a tool for achieving greater financial prudence, sustainability, and stewardship in the public sector.

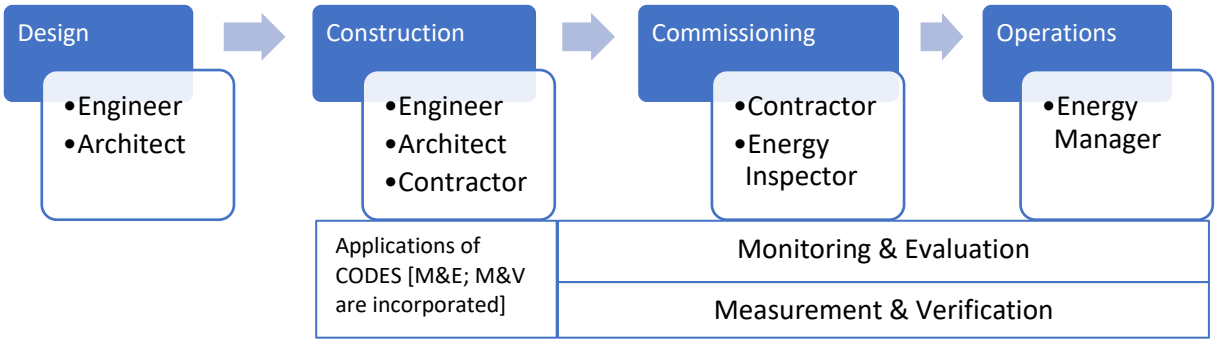
Goal 5: Through the measurable demonstration of energy conservation and efficiency in the public sector, the Government of Jamaica will be a leader in mitigating the adverse environmental impacts from energy consumption and will

model exemplary environmental stewardship towards a greener economy and national energy security.

The foregoing Goals of the Energy *Efficiency and Conservation Policy and Guidelines for Public Facilities* will therefore help to direct a culture of utilizing the appropriate standards and codes as the basis for investment and operational decisions. It will also enable enforcement initiatives to be effectively applied for enforcing the Policy and Guidelines.

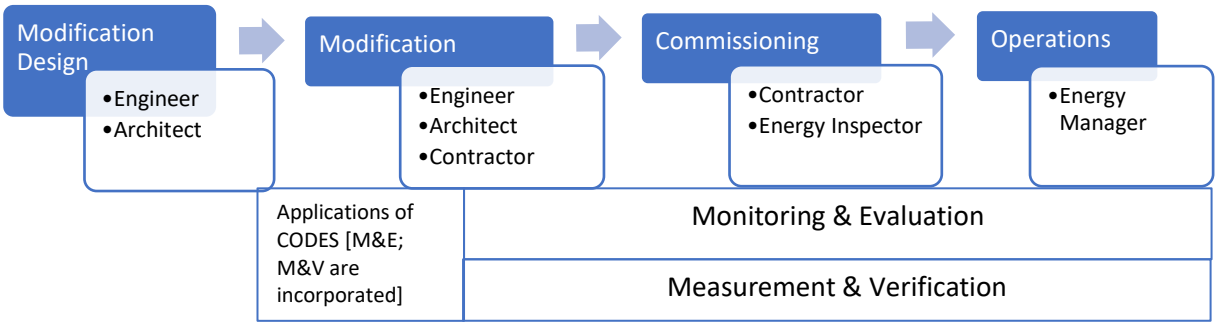
To strategically guide the application of the *Energy Efficiency and Conservation Policy and Guidelines for Public Facilities* ***in new buildings,*** organizational administration of an Energy Efficiency and Conservation Plan will follow the following workflow, plan, and inclusion of appropriate Energy Professionals for efficient equipment and implementation of the Policy and Guidelines in new buildings.

Figure ES 2: Process Flow for inclusion of Energy Professional in EE & EC for New Buildings



To strategically guide the application of the *Energy Efficiency and Conservation Policy and Guidelines for Public Facilities* ***for modification of existing buildings,*** organizational administration of an Energy Efficiency and Conservation Plan will follow the following workflow, plan, and inclusion of appropriate Energy Professionals for efficient equipment and implementation of the Policy and Guidelines in new buildings.

Figure ES 3: Process Flow for inclusion of Energy Professional in EE & EC for Existing Buildings



The targets of the *Energy Efficiency and Conservation Policy and Guidelines for Public Facilities* in new buildings to be attained are the standards as set out in the codes.

Table ES 3: Standards and Codes for Policy and Guideline Implementation.

Category	Standard / Code	Target
GENERAL [Climate zones, design conditions, material systems and equipment]	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
BUILDING ENVELOPE REQUIREMENTS [Walls, floors, roofs, fenestrations, doors & windows]	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
BUILDING MECHANICAL SYSTEMS [Heating, cooling, ventilation]	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
ELECTRICAL POWER AND LIGHTING SYSTEMS [Lighting control, interior, exterior, motor controls]	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
SERVICE WATER HEATING (MANDATORY) [Equipment performance efficiency, heat traps for storage tanks, Insulation piping]	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code

Category	Standard / Code	Target
EXISTING BUILDINGS [Additions, alterations, repairs, change of use /occupancy]	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
SOLAR-READY ZONE—COMMERCIAL	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
MAINTENANCE INFORMATION AND SYSTEM COMMISSIONING	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
REFERENCED STANDARDS	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
TOTAL BUILDING PERFORMANCE	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
ADDITIONAL EFFICIENCY PACKAGES	JS 309:2019 – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code

Policy Statement for Measurement & Verification (M&V)

***All parameters impacting on energy as set out for a public building shall be measured and verified and the results stored in a database and used to contribute to the performance evaluation process*.**

Policy, standards, and codes as well as the human resource professionals to use them and support their use, will form the critical tools for the Policy and Guidance performance monitoring and evaluation as well as measurement and verification.

At a minimum, parameters to be measured and included in the database as well as the frequency of measurement are set out as follows:

- Electricity Usage - Monthly
- Temperature - Daily
- Production - Monthly
- Occupancy - Daily
- Weather - Daily

- Any other parameter as determined by the Energy Professionals for any unique project.

Policy Statements for M&V:

- ***All energy efficiency and energy conservation projects must be resourced with appropriate energy professionals.***
- ***All energy efficiency and energy conservation projects must have monitoring and evaluation as well as a measuring and verification component.***

"Measurement and verification (M&V) is the process of planning, measuring, collecting, and analysing data for the purpose of verifying and reporting energy savings within a facility resulting from the implementation of energy conservation measures (ECMs)". – Efficiency Valuation Organization (EVO) [4]

International Performance Measurement and Verification Protocol (IPMVP®) defines standard terms and suggests best practices for quantifying the results of energy efficiency investments and therefore will form part of the framework for the Policy and Guidelines.

The concept supported by IPMVP® is best expressed as follows:

Savings for Period = Baseline Energy – Reported Period Energy +/- Adjustments

The IPMVP® uses four (4) options by which M&V is done as outlined in Table ES 4 [5].

Table ES 4: Types of ECMs under the IPMVP® Framework

IPMVP® OPTIONS	Types of ECM	Applications
Option A	Retrofit Isolation: with key parameters measurement.	Lighting Retrofit project
Option B	Retrofit isolation: with All parameter's measurement	Installation of new electric motor with variable speed drive.
Option C	Whole Facility Measurement	Replacement of Chiller plant and lighting
Option D	Calibrated Simulation	Comprehensive retrofit in a large building

A wide range of ECMs were recommended for implementation based on the public sector audits as well as the investment grade audits done for the Health and Education sectors. These ECMs would fit into all the four options of the IPMVP®. In this Policy Guideline there is no preferred

option for any of the sectors, instead, each project will be evaluated by energy professionals and an appropriate IPMVP® option assigned.

It is therefore imperative that energy professionals be an integral part of energy projects from the conceptual stage through to operations.

CONCLUSION

The optimal benefits will be obtained when the following is mandated under a policy such as this:

- The use of Energy Efficiency Codes is mandated.
- The use of Energy Professionals is mandated.
- The Policy becomes more than just a statement of intent but an instrument that can be enforced.

INTRODUCTION

Rationale

Jamaica has a high energy intensity index which indicates a low level of energy efficiency. The national consumption of energy for which the greater part is costly imported energy, has adverse impacts on the economy, international business competitiveness, and poses a constraint on the government's ability to execute national development objectives. A significant part of this energy consumption is secondary energy in the form of electricity.

An Energy Efficiency and Conservation Technical Assistance (EECTA) project between the Government of Jamaica (GoJ) and the Inter-American Development Bank (IDB) determined that in 2010 the GoJ annual energy consumption totalled 411.3 GWh, or approximately 12% of total electricity consumption in Jamaica. Jamaican public facilities alone accounted for approximately 107.5 GWh/yr (2019) of electricity consumption only. It also determined that energy efficiency (EE) opportunities, had an estimated potential saving of J$2.6 billion per year, while the capital expenditure required to realise these savings was approximately J$9.6 billion with a simple payback of 3.7 years and 24.7% reduction in public sector electrical energy consumption.

Against this background, with the Government of Jamacia as the largest single consumer of energy in the economy in the form of electricity, for the water utility, transportation, administrative offices and other critical national services, there is a need for a concerted effort regarding energy efficiency in the public sector. By improving its energy efficiency, it will contribute to reducing Jamaica's total energy consumption as well as demonstrate leadership, stimulating all other sectors to accept and adopt measures to increase the efficient use of energy. As a lead-agent therefore, under Goal 3 of the Energy Conservation and Efficiency supporting policy and this Energy Efficiency and Conservation Policy and Guidelines for Public Facilities, Government ministries, departments and agencies will demonstrate models of efficient energy usage and environmental stewardship, resulting in a reduction in the high public sector consumption of energy and other resources and provide a stimulus for similar private sector and community action.

Energy efficiency across all sectors represents a key aspect of the Government's strategy to reduce energy consumption and the dependence on imported energy (fossil fuels). As the major consumer, implementing energy efficiency initiatives in the public sector will:

- affirm the national energy policy directives;
- reduce public sector spending for energy and the nation by extension;
- demonstrate opportunities for all sectors of the economy to improve energy efficiency to the furtherance of the goals and ambitions of the National Energy Policy 2009, Vision 2030, Development Plan, and the Nationally Determined Contributions;
- and act as a leader-catalyst for all sectors of society to achieve greater energy efficiency and reduced energy imports.

To demonstrate continued leadership in the efficient use of energy, public buildings used for Health, Education and Administration in particular have been targeted for the next stage of the

government's effort to achieve the foregoing. This document sets out a policy and guidelines for energy efficiency in public buildings to reduce energy (electricity) consumption for the national benefit, and for reducing the country's dependence on high-cost, imported fossil fuel.

Nature of the Policy and Guideline Document

The Energy Efficiency and Conservation Policy and Guideline for Public Buildings is subservient and a companion document to other national policies related to energy. It is focused on energy consumption in Government owned and operated public buildings with an emphasis on electrical energy consumption but does not exclude other forms of energy resources consumed for building operation. Conversely, the policy and guidelines does not address energy utilisation for other operational requirements external to the building envelope (e.g., transportation).

The Policy and Guideline document also emphasizes measurable and verifiable parameters for energy to ensure Government has the capability to monitor, measure, evaluate and verify energy consumption or savings quantitatively, however, the document does give ascent to the importance of behavioural and administrative requirements for sustainable energy conservation and efficiency.

The Policy and Guideline document draws upon critical documents inclusive of the National Energy Policy 2009 – 2030 and its draft Energy Conservation and Efficiency supporting policy; Energy Efficiency and Conservation Standards Guide for Public Sector 2018; The KSAC 2016 Building Act; CARICOM Regional Energy Efficiency Building Code 2018; and other local and international standards and codes related to public buildings.

The Policy and Guideline document is intended to inculcate a culture of utilising of building and energy efficiency standards and codes from the conceptual stage, through designs, procurement, construction, operation, maintenance, repair, and replacement.

The policy and guidelines document mandates the utilisation of energy professionals at all stages of the processes. As part of the implementation, all viable options for effecting the policy and guidelines actions from a financial, administrative, and governance perspective are encouraged including, but not exclusive to financing options such as public private partnership (PPP) agreements, Energy as a Service (EaaS) projects and Integrated Utility Service (IUS) Agreements among others.

The policy and guideline document will apply to both new and existing buildings.

SITUATIONAL ANALYSIS

Energy Sector Consumption, Production and Trends

In 2019, imported fossil fuels represented over 75% of the primary energy mix and 88% of the share of the electricity mix [1]. These are improvements over imported fossil fuel imports over the past decades which accounted for over 90% of Jamaica's overall energy mix resulting in a national oil bill in excess of US One Billion Dollars (US$1B) annually. With renewable resources trending upward from approximately 8% of the electricity mix to 17% of the electricity mix, generating 13% of electricity in 2021 [2], the national oil bill has declined by approximately 6% or US One Hundred Million Dollars (US$100M) from 2019 to 2021 amidst rising global fossil fuel prices.

Against this high level of imported energy, Jamaica has a low ranking for its energy consumption being 103rd internationally with regards to an Energy Consumption per Capita of 41.75 million BTU per person and ranking 114th with 40,000 bpd of petroleum and other liquid fuel consumed in 2020. In 2021 Jamaica had one of the highest energy intensity rates in the Caribbean with a ratio of energy consumption to national gross domestic product of 6,786 BTU per Year measured in 2018 U.S. Dollars (based on Purchasing Power Parity)[4] compared to 5,684 for the Caribbean [3].

Overall, the energy (fossil) import trend has been trending downward. In 2021 Jamaica, consumed 19,800,850 barrels of petroleum products, a reduction of approximately 15.9% relative to 2019 and 4.3% relative to 2020 [6] (see Figure 1).

[4] 6,786 British thermal units (BTU) are required to produce US$ 1.00 of output.

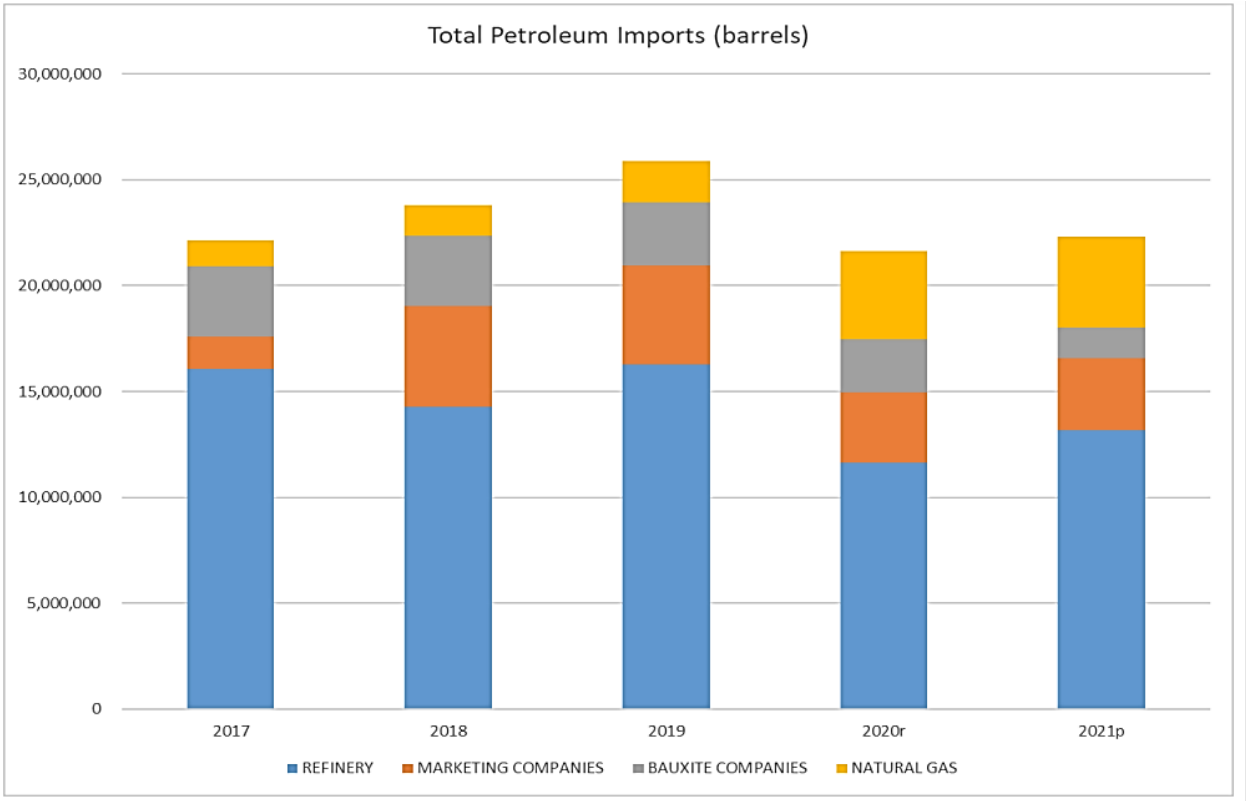


Figure 1: Jamaica Total Petroleum Imports (barrels) [6]

Among the main categories of energy consumption, electricity (30%) was the second highest consumption category using 5,969,066 bbl. of imported fuel (see figure below), after road and rail transportation (34%), making electricity a targeted opportunity for national energy efficiency interventions.

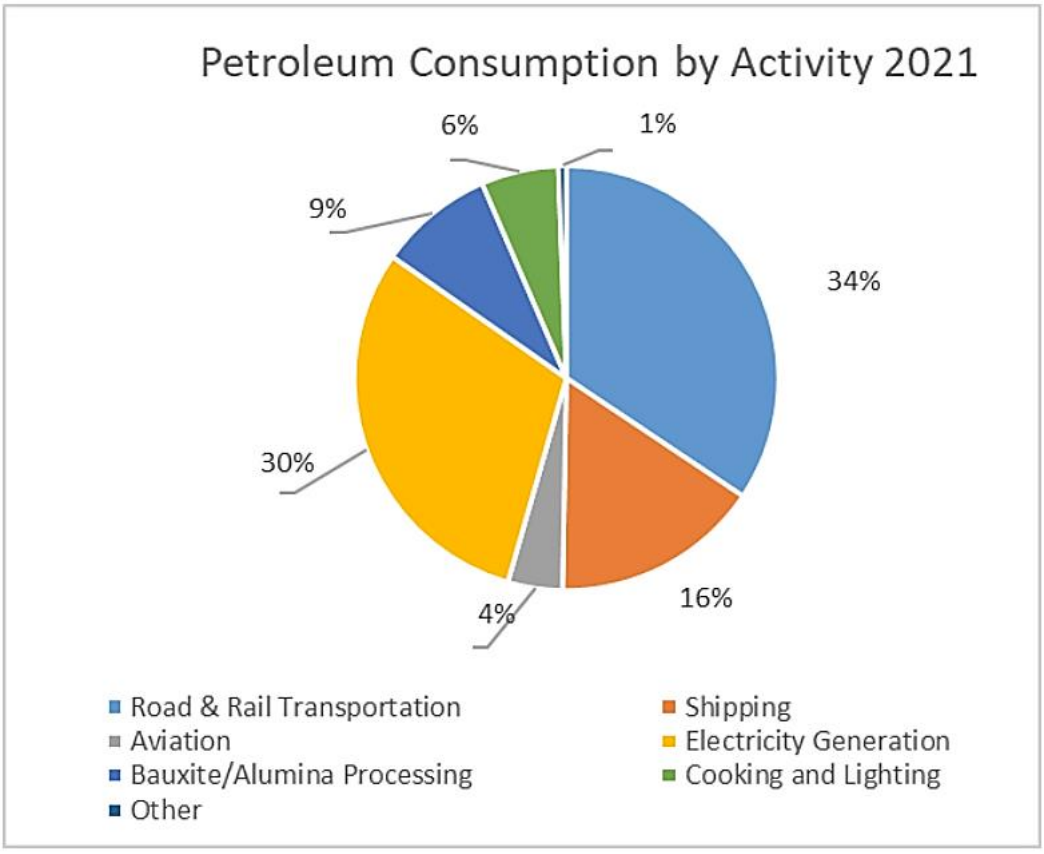


Figure 2: Jamaica Petroleum Consumption by Activity 2021 [6]

Jamaica's current net installed capacity of generation plants is 980 MW from the Jamaica Public Service Company Ltd (JPS) and Independent Power Producers (IPPs), of which almost 33% of the net thermal capacity is comprised of oil-fired plants. Over 200 MW of total installed generation capacity comes from solar, wind and hydropower plants from IPPs, JPS (the electric utility) and smaller net billing customers. In 2020, Jamaica's installed electricity capacity became more diversified with 45% petroleum (oil), 37% natural gas and 18% renewable energy (wind 10%, solar 5% and hydro 3%) [7]. JPS has also implemented its 24.5 MWh capacity flywheel-battery hybrid storage facility to moderate the addition of intermittent renewable energy on the grid.

Based on the Integrated Resource Plan (IRP-1) in a High Growth Scenario, the annual growth rate for electricity generation increases slightly by 1.59% over the period 2017-2038 and energy demand is projected to increase from 4,489.5 GWh in 2018 to 6,012.7 GWh by 2038 in the most likely scenario [8]. Peak load demand is expected to increase from 667 MW to 913 MW by 2038 for the high growth scenario. The increases towards 2023 did not materialize due to the lock down measures instituted by the GoJ to arrest the spread of the COVID-19 pandemic, and resulted in a reduction in electricity demand, peak load and energy demand. The updated IRP (IRP-2) will provide new forecasts for energy demand to 2030 and beyond, but this demand is

likely to increase based on the resumption of pre-pandemic commerce, resumption or increases in industrial energy demand, an increase in residential construction and deployment of more air conditioning services due to higher temperatures attributed to climate change and increased penetration of electric vehicles.

Without greater penetration of indigenous energy resources and energy efficiency conservation interventions, Jamaica's economic context will be impacted by the projected increases in all major fossil fuel prices (see figure below).

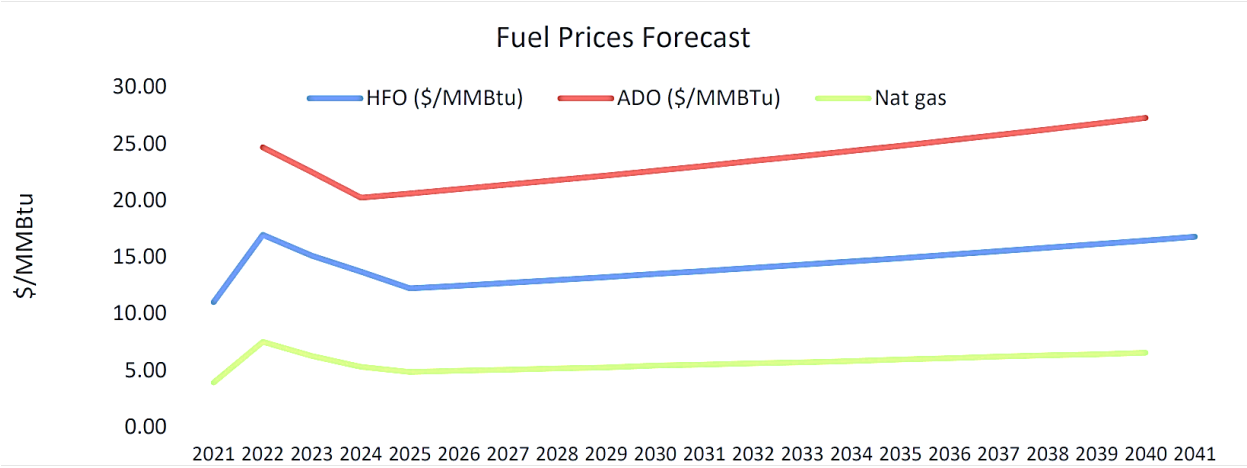


Figure 3: Fuel Prices Forecast 2021 – 2041 [9]

In this context the mandate of the Ministry of Science, Energy, Telecommunications and Transport has shifted the target of thirty percent (30%) renewable energy in the mix for electricity generation, to fifty percent (50%), for which the government is actively pursuing an enabling and adaptive policy and legislative framework, to include the review of existing energy related policies and legislation, or the implementation of new ones, as well as a review of the Electricity License of the Jamaica Public Service Company (JPS) which is up for renewal in 2024 [10]. The development of an Energy Efficiency and Conservation Policy and Guidelines for Public Facilities is part of this action.

Global Energy Efficiency Trends

In 2021 buildings operation accounted for 30% of global final energy consumption and 27% of total energy sector emissions[5] (8% being direct emissions in buildings and 19% indirect emissions from the production of electricity and heat used in buildings). Globally electricity consumption (alone) accounted for 30% in 2010 and about 35% of building energy use in 2021. In particular, space cooling saw the largest increase in demand in 2021 across all buildings end uses, an

[5] Energy sector CO_2 emissions include emissions from energy combustion and industrial processes.

increase of over 6.5% with respect to 2020. Both energy consumption and emissions have increased to above COVID pandemic levels in 2019, affected by COVID 19 restrictions [9].

Energy used in buildings globally for space heating, cooling, ventilating, lighting, cooking, water heating, refrigerating, and operating electric and mechanical devices, is expected to increase as cities in developing countries continue to modernize and per capita income levels continue to increase [11].

With an increased localized attention to energy sustainability for buildings and more rapid changes to satisfy climate change mitigation and Net Zero Emissions global commitments by 2050, minimum performance standards (MPS) and building energy codes are increasing in both scope and stringency, and the use of more efficient and renewable energy technology in buildings is accelerating while the power sector continues to decarbonize. Commitments are advanced with efforts to implement the necessary measures for new buildings and 20% of the existing building stock to be zero-carbon-ready[6] as soon as 2030. Projections by the International Energy Agency indicate that buildings will account for some 41% of global energy savings potential by 2035, compared with the industrial sector (24% savings potential) and the transport sector (21 % savings).

Building energy codes and equipment performance standards are increasingly more critical as tools for improving buildings performance, and the application of enforcement, monitoring, and compliance practices are complementary to enable accounting and reporting of buildings performance indicators for continuous improvement, accountability and data analysis.

Globally there are proven policy and regulatory instruments and tools which increase EE in buildings, accompanied by specific support programs. These are as follows:

a) Energy regulatory policies are usually formulated at the national or regional levels.
b) Mandatory standards and codes are generally developed at the national and regional level and updated periodically.
c) Labels and certificates for recognizing and encouraging EE efforts that go above and beyond the mandatory requirements outlined above and may be voluntary initiatives.
d) Financial facilitation schemes where fiscal and monetary incentives encourage investments in energy efficiency.
e) Requirements for energy management which may include mandatory energy performance benchmarking and disclosure programs that require large public and commercial buildings to monitor and report their EE performance and compare with peers, thus, helping to improve operational and maintenance practices; identify opportunities for cost-effective retrofits; better target support for building retrofits; and bridge existing information gaps related to building energy performance and costs.
f) Public sector financial management and procurement policies which are valuable for supporting municipal efforts to retrofit public buildings and upgrade inefficient energy-consuming equipment.

[6] Zero-carbon-ready buildings are highly energy-efficient and resilient buildings that either use renewable energy directly or rely on a source of energy supply that can be fully decarbonized, such as electricity or district energy. The zero-carbon-ready concept include both operational and embodied emissions.

g) Awareness-raising and capacity-building initiatives which include outreach and public information initiatives to increase the knowledge and know-how of stakeholders and enable the design and implementation of effective EE programs and investment projects. These may involve general awareness campaigns, as well as initiatives to train specialized trades such as architects, building managers, and construction workers.

Energy Policy, Plans and Legal and Regulatory Framework

Energy Policy:

The National Energy Policy (NEP 2009-2030) has a long-term visionary focus and incorporates energy conservation and efficiency; modern infrastructure; renewable energy sources; reduced greenhouse gas (GHG) emissions and environmental stewardship; enabling governance, institutional, legal and regulatory frameworks; and State leadership. It is built on seven interconnected goals, however specifically regarding energy efficiency and conservation for public facilities Goal 1 and Goal 6 addresses energy efficiency and energy conservation directly.

Goal 1

> ***Jamaicans use energy wisely and aggressively pursue opportunities for conservation and efficiency.***

Goal 6

> ***Government ministries and agencies are a model/leader in energy conservation and environmental stewardship in Jamaica.***

In addition, the NEP is supported by five (draft) supporting policies, namely the Energy Conservation and Efficiency Policy, National Renewable Energy Policy, Trading of Carbon Credits Policy, Energy from Waste Policy, and a Biofuels Policy.

Energy Efficiency and Conservation Supporting Policy:

The (draft) National Energy Conservation and Efficiency (2009) supporting policy also reiterates these goals and sets out the strategies and actions that would result in an increase in the efficient use of energy across all sectors. Goal 3 of this supporting policy states;

> "*The Government of Jamaica is the leader in energy conservation and efficiency and sets the standard for all other sectors".*

Consistent with this goal, "*Government will lead the way in energy conservation and efficiency efforts and work in partnership with the private sector and civil society inclusive of setting national and public sector standards and setting the example by achieving compliance".* The Energy Conservation and Efficiency Supporting Policy was also intended to create an enabling

environment for *"All Jamaicans to use energy wisely and continuously pursue opportunities for conservation and efficiency".*

As such, conservation and efficiency indicators and targets have been set and national projects undertaken to create a sustainable change towards greater energy efficiency.

Table 1: National Energy Efficiency Targets to 2030 (Energy Intensity)

Indicator	2009	2012	2015	2030
Energy Intensity Index (EII) BTU/US$1 unit of output (Constant Year 2000 in US$)	21,152	14,000	12,700	6,000

As of 2021, Jamaica had made significant strides towards achievivng the 2030 target with an energy intenshity of 6,786BTU/US$1.

Vision 2030 Development Plan:

Jamaica's national developmental plan to 2030 "Vision 2030" also supports the objectives of the NEP and states that *"Jamaica will create a modern, efficient, diversified and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security that contributes to international competitiveness throughout all the productive sectors of the Jamaican economy".*

National Energy Efficiency Projects and Programmes:

In this regard, the Government has led by example, ensuring that the public sector implements efficiency initiatives. Many critical projects have been implemented over the past three and a half decades which have had a positive effect on public sector conservation.

An Inter-American Development Bank (IDB) sponsored Energy Conservation and Efficiency in the Public Sector (ECEP) project had facilitated energy savings interventions in Jamaican public sector including:

- Installation of AC retrofits at the Kingston Public Hospital, Jamaica Information Service, Tax Administration Jamaica – Donald Sangster Building, Montego Bay Revenue Service Centre, Office of the Prime Minister, MOFPS, Blood Bank and the National Public Health Lab.
- Installation of mini-split AC units at seven facilities – Jamaica College, Edna Manley College, St. Andrew High School, Montego Bay Community College, Moneague Teachers' College, Greater Portmore Police Station and HEART College of Hospitality Services/Runaway Bay Hotel.

- Implementation of the Energy Efficiency Survey for Public Sector workers which concluded a seventy-three (73%) percent awareness level.

Based on this project it is estimated at that 48.1 GWH or approximately 1% of net generation was avoided in 2022 [8]

A second major initiative - the Energy Management and Efficiency Programme, supported by the IDB, the Japan International Cooperation Agency (JICA), the European Union-Caribbean Investment Facility and the Government of Jamaica (GoJ) has also positively impacted energy efficiency in the public sector as follows:

- Retrofitting 80 Government facilities inclusive of Health, Education and Public Agency (HEPA) facilities with renewable energy and energy efficient interventions (solar photovoltaics, LED lighting upgrade and energy efficient air conditioning technology)
- The structural and electrical integrity assessments of twelve (12) hospitals, ten (10) schools and other public office buildings [10].

A third major intervention supported by the United Nations Development Programme (UNDP) for the Deployment of Renewable Energy (RE) and Energy Efficiency (EE) in the Public Sector project facilitated:

- Grid-tied solar PV systems and LED lighting solutions at May Pen Hospital; National Chest Hospital; and Sir John Golding Rehabilitation Centre;
- LED lightbulbs installation at Savanna La Mar Hospital, Black River Hospital and Bellevue Hospital (total of 5,672 LED lighting solutions across all six public health facilities).

The Government of Jamaica also developed an Energy Efficiency and Conservation (EE/EC) Standard Guide 2018 (Manual) based on the Jamaica Application Document for the International Energy Conservation Code (JS 309:2009) published by the Bureau of Standards Jamaica (BSJ). The Manual is designed to be an information resource tool for Office Managers and Facilities Managers in the procurement and management of energy efficient goods and services in the public sector and will increase the knowledge and awareness of public sector employees on energy efficiency and conservation standards. The main areas where recommendations were mase for various efficiency interventions are as follows:

- Air conditioning and ventilation.
- Building envelope infrastructure.
- Computing and electronics.
- Electrical power management.
- Water heating.
- Energy efficient lighting.
- Motors.
- Water use.

Nationally Determined Contributions (NDCs):

A framework and commitment to energy efficiency in the public sector is also embedded in Jamaica's updated NDC 2020 [12] which commits Jamaica to focus on the energy sector. Climate change mitigation commitments are to reduce greenhouse gas (GHG) emissions from the sector by 7.8% by 2030 (13.4 MtCO2e) unconditionally relative to the business-as-usual (BAU) emission baseline (14.5 MtCO2e), with the potential for a greater 10% reduction in emissions by 2030 (13.0 MtCO2e) with international support (unconditional scenario).

The NDC is specifically designed to be consistent with the NEP based on;

- *"The current level of implementation of the National Energy Policy and the existing pipeline of renewable energy projects"; and*
- *"Expansion of energy efficiency initiatives in the electricity and transportation sectors in line with sector action plans and policies currently under development*"

From among thirteen energy commitments to the NDC, there are 3 unconditional[7] energy efficiency commitments applicable to the public sector.

- Switch all inefficient T12 fluorescent lighting to T8 fluorescent lighting in hospitals and schools between 2020 – 2030.
- Smart LED Street Lighting. Upgrade all grid-connected streetlights to LED equipped with pedestrian and light sensors (2017 – 2020).
- Conditional[8] support for Energy Management and Efficiency Programme (EMEP) for implementation of an Urban Traffic Management System (UTMS) throughout the Kingston and Metropolitan Area (KMA) (2017 – 2023).
- Conditional EMEP programme of energy efficiency to reduce electricity consumption by 30% in public sector health and educational facilities (2017 – 2023).
- Conditional Energy Efficiency and Conservation Programme (EECP) to improve energy efficiency and conservation in the public sector (2013 -2018) involving heat reduction window films (37 public buildings); cool roof solutions (11); and energy efficiency air-conditioning solutions (25).

The NDC projects that by 2030 the commitments which can lead to reduced electricity demand are also expected to reduce electricity generation output by 25% (unconditional) and 26% (conditional) compared to the baseline scenario. For various energy efficiency interventions in commerce and services alone (other interventions would be for changes in industrial electricity demands) a 3-6% reduction in electricity consumption or 0.1-0.2 TWh is expected relative to the baseline by 2030. Interventions would include:

- Switching from high pressure sodium and mercury vapour lights for street lighting systems to energy efficiency LED lighting.

[7] Energy and climate change commitments of the Government, not dependent on external commitments for support.

[8] Conditional greenhouse gas mitigation initiatives require international commitments.

- Efficient water pumping and distribution.
- Switch to more energy efficient lighting in hospitals and schools.
- Water sector energy efficiency based on the Nationally Approved Mitigation Actions (NAMA).
- EECP and EMEP projects/programmes to reduce electricity consumption in the public sector.

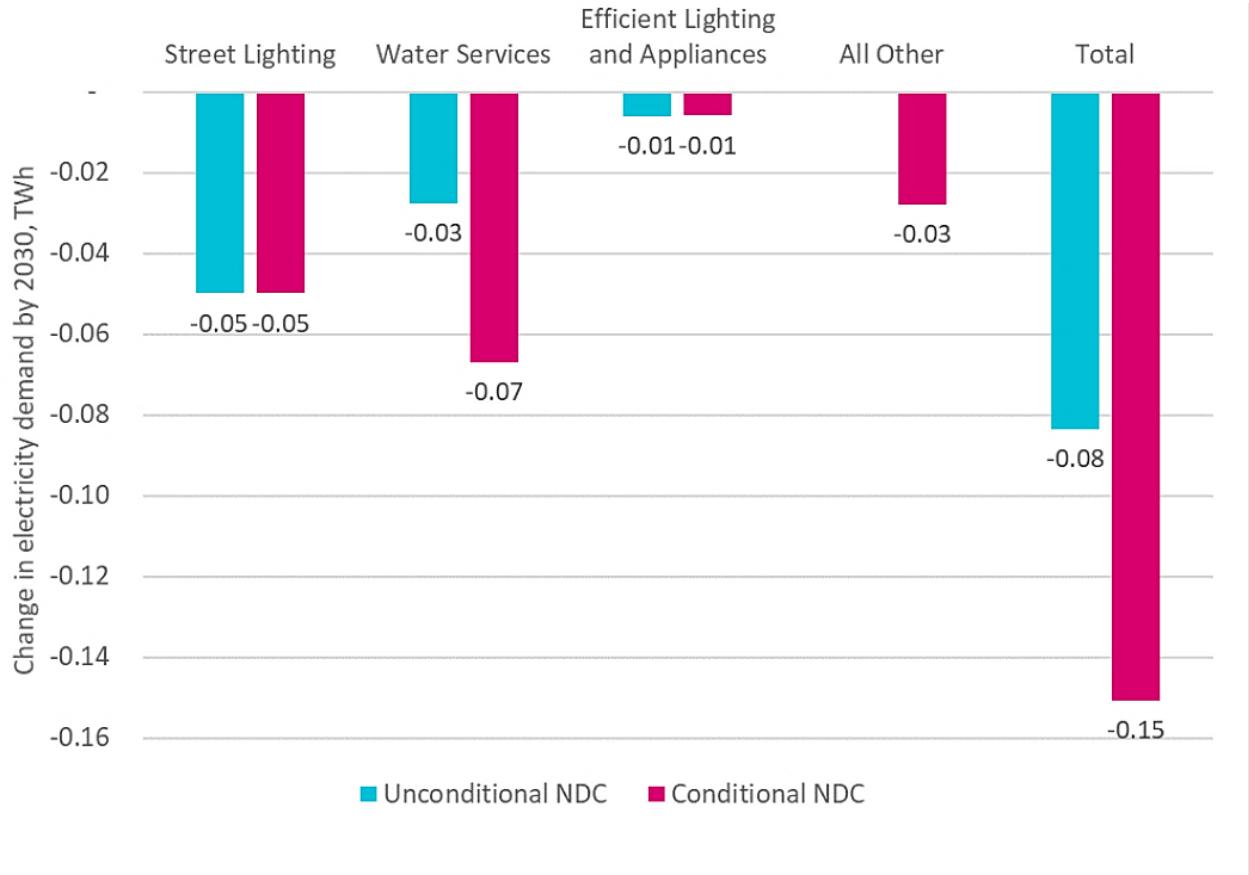


Figure 4: Projected Reduction in Electricity Demand for Commerce and Services in Jamaica with the Implementation of Energy Efficiency Commitments 2030 [12]

POLICY FRAMEWORK

Problem Statement

Sustainable national economic, social, and environmental development are significantly dependent on limiting energy importation, increasing energy independence and the efficient consumption of energy. Satisfying critical global and international commitments are likewise dependent on the effective management of national energy consumption.

The public sector in Jamaica is the largest consumer of all energy resources (indigenous and imported) and is the owner of the most diverse range of energy consuming facilities, therefore with comparison to other sectors, a substantial contributor to greenhouse gas emissions, foreign exchange export, adverse environmental impacts, and the national energy demand.

An "*Energy Efficiency and Conservation Policy and Guidelines for Public Facilities"* is therefore critical to frame the necessary course of action to be taken by the Government to resolve this problem, while signalling to all other sectors of society, the initiatives required to achieve the goals of the National Energy Policy and Vision 2030.

Vision Statement:

The Government of Jamaica is a change leader in responsible and efficient energy utilization, by implementing best applicable technologies and certifiable standards and codes to mitigate environmental impacts, decarbonize the energy sector, improve financial performance and demonstrate stewardship.

Goals and Objectives:

The goals of the Energy Efficiency and Conservation Policy and Guidelines for Public Facilities are consistent with achieving the Vision for Jamaica's Energy Sector development [13], being *"A modern, efficient, diversified and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security and supported by informed public behaviour on energy issues and an appropriate policy, regulatory and institutional framework"* and the associated goals of the National Energy Policy (2009-2030) Goal 1, Goal 6 and Goal 7 namely:

> ***Goal 1:*** *Jamaicans use energy wisely and aggressively pursue opportunities for conservation and efficiency.*
>
> ***Goal 6****: Government ministries and agencies are a model/leader in energy conservation and environmental stewardship in Jamaica.*

***Goal 7**: Jamaica's industry structures embrace eco- efficiency for advancing international competitiveness and moves towards building a green economy.*

The Energy Efficiency and Conservation Policy and Guidelines for Public Facilities goals are therefore:

Goal 1: The public sector is the lead agent and catalyst for diverse applications in energy conservation and efficiency practices and progressive technologies to reduce overall national energy consumption and increase national energy security.

Public sector is the single largest energy consumer for the national economy which is adversely impacted by high imported energy costs and low levels of energy security. Both impacts have adverse financial outcomes at the local level and for the economy. Energy conservation and efficiency in this sector has the direct effect of measurably lowering the national energy demand, retention of foreign exchange earnings and improving financial sustainability. Private sector, civil society and the citizenry will be motivated to improve energy conservation and efficiency practices and applications if this is demonstrated as prudent and effective by the administrators of the energy policy. By sheer volume and diversity of interventions, the demonstrated performance of such interventions, and lowering the perceived risk for such interventions, other sectors will gain confidence to follow the public sector's example.

Key Issues Addressed:

- Hesitance for all of society to apply energy conservation and efficiency due to data and information deficits.
- Latency by consumers to invest and proactively improve energy performance and tendency to be reactive, lagging behind energy efficiency leaders.

Key Players:

- Ministry of Science, Energy, Telecommunications and Transport.
- Ministry of Health and Wellness.
- Ministry of Education and Youth.
- Ministry of Finance and the Public Service.
- Ministry of Local Government.
- Bureau of Standards Jamaica.
- Jamaica Customs Agency.
- Jamaica Information Service.
- Media (print/radio/tv/internet-broadband/mobile).
- Technology Service Providers.
- National Commission on Science and Technology
- Scientific Research Council.
- Academia (universities/colleges/other).

- Private sector associations (Private Sector Organization of Jamaica, Jamaica Chamber of Commerce, Jamaica Manufacturers and Exporters Association, other)

Objectives:

a) Establish appropriate standards and codes applicable for public procurement of energy efficiency equipment.
b) Establish and apply public procurement guidelines which prioritize modern energy efficient equipment.
c) Establish administrative guidelines/rules to promote behavioural change, procedures and protocols supporting energy conservation and efficiency.
d) Enable appropriate communication channels, platforms, and public forums to promote and create visibility on energy performance and initiatives in public facilities.

Goal 2: National and international energy efficiency standards will be the platform from which compliance with energy conservation and efficiency best practices are continuously and sustainably achieved.

Energy conservation and efficiency gains must be achieved continuously and must be predictable, measurable, and verifiable as provided by standards. With the diversity of public sector buildings, range in ages of such buildings, administrative nuances, procurement, and reporting requirements the unifying factor will be adherence to certifiable energy efficiency standards. The goal will therefore seek to achieve consensus and endorsement of the applicable standards.

Key Issues Addressed:

- Inconsistency in energy efficiency and conservation initiatives and equipment.
- Unpredictability in equipment quality, energy performance and budgeting.
- Inconsistency in energy reporting and documentation throughout public sector.

Key Players:

- Ministry of Science, Energy, Telecommunications and Transport.
- Ministry of Health and Wellness.
- Ministry of Education and Youth.
- Ministry of Finance and the Public Service.
- Ministry of Local Government.
- Bureau of Standards Jamaica.
- Jamaica Customs Agency.
- Technology Service Providers.
- National Commission on Science and Technology

- Scientific Research Council.
- Academia (universities/colleges/other).

Objectives:

a) Establish (adopt/adapt/originate) appropriate standards, codes, legislation and regulations applicable for public procurement of energy efficiency equipment. National codes (e.g., Building Code and Regional Codes such as the CARICOM Energy Efficiency & Conservation Building Codes) should be adopted/adapted/gazette to direct all sectors towards energy conservation and efficiency.
b) Establish (adopt/adapt/originate) protocols for data collection, reporting, measurement and verification and documentation on energy performances.[9]
c) Establish procurement guidelines/rules specific to prioritized purchases of modern energy efficient equipment.
d) Establish protocols which act as a precursor for procurement, inclusive of energy audits.
e) Create a platform for innovation to support energy efficient equipment compliant with approved standards.
f) Capacity building and training for GoJ personnel particularly those within the Key Players supporting Goal 1.

Goal 3: The Government will implement enduring policy, legislative and regulatory frameworks for consistently prioritizing the procurement and utilization of modern, appropriate and quality energy efficient technologies as a model for all sectors.

Policy and laws will provide appropriate levels of guidance, incentive and constraint favouring application of energy conservation and efficiency options across all sectors. They will also provide direction regarding the quality and performance requirements pertaining to efficient energy utilization in all buildings by all stakeholders (administrators, professionals, service providers and consumers), and transparency for inspection, monitoring and verification, reward, and penalties across all sectors. Such policy and legislative direction will also enable predictability for public sector and national budgeting and be an enabler for related existing and future laws.

Key Issues Addressed:

- Inconsistency regarding applicable standards, codes, and rules for achieving energy efficiency in public buildings.

[9] Adopt the International Performance Measurement and Verification Protocol (IPMVP®)

- Uncertainty regarding mandatory energy efficiency building requirements and building codes leading to variable energy efficiency standards.
- Inability to determine compliance with energy and environmental policies and application of controls.

Key Players:

- Ministry of Science, Energy, Telecommunications and Transport.
- Ministry of Health and Wellness.
- Ministry of Education and Youth.
- Ministry of Finance and the Public Service.
- Ministry of Local Government.
- Attorney General's Chamber.
- Jamaica Customs Agency.
- Technology Service Providers.

Objectives:

a) Establish/amend relevant policy and legislation consistent with other policies, codes, and legislation, for supporting energy conservation and efficiency.
b) Empower Ministries Departments and Agencies (MDA) to monitor compliance and enforce legislation and codes.

Goal 4: Energy conservation and efficiency will be a tool for achieving greater financial prudence, sustainability, and stewardship in the public sector.

The application of energy conservation and efficiency codes and standards, supports reliability and predictability (of savings) for financial planning. Codes and standards also allow for greater border controls for the importation of quality and efficient equipment and a framework for determining incentives and their financial impact in the market. Energy conservation and efficiency also demonstrate greater stewardship of energy resources and prudence for budget allocations on public sector energy requirements.

Issues Addressed:

- High budget expenditure for energy services.
- Insufficient monitoring and measurement of the cost for energy services in public sector.
- Public confidence in government expenditure.

Key Players:

- Ministry of Science, Energy, Telecommunications and Transport.
- Ministry of Health and Wellness.
- Ministry of Education and Youth.
- Ministry of Finance and the Public Service.
- Tax Administration Jamaica.
- Ministry of Local Government.
- Jamaica Customs Agency.
- Technology Service Providers.

Objectives:

a) Incorporate energy planning, measurement and reporting into public sector budgeting processes.
b) Re-allocate energy savings into other national energy programme budget line items including loan servicing for sustainable energy programmes like the Energy Management and Efficiency Programme (EMEP).

Goal 5: Through the measurable demonstration of energy conservation and efficiency in the public sector, the Government of Jamaica will be a leader in mitigating the adverse environmental impacts from energy consumption, and model exemplary environmental stewardship towards a greener economy and national energy security.

Jamaica is committed to local stakeholders and the international community to accelerate decarbonization of its energy sector, contribute to climate change mitigation consistent with its NDC, and practice sustainable consumption and production principles to protect the environment and livelihoods. Energy conservation and efficiency reduce the use of carbon-dense fuels, the emissions of GHGs, and improves energy security and the resilience of the energy system. The size of the public sector and its collective energy consumption means that energy conservation and efficiency in the public sector, will cause a measurable change in energy and environmental impact at the national level and advance environmental ambitions and adaptation to changes in the climate.

Issues Addressed:

- Delays in achieving national and international commitments to climate change mitigation.
- Hesitance for all of society to apply energy conservation and efficiency in the absence of demonstrable efforts from government.

Key Players:

- Ministry of Science, Energy, Telecommunications and Transport.
- Ministry of Housing Urban Renewal Environment and Climate Change.
- Climate Change Division.
- National Environment and Planning Agency.
- Ministry of Health and Wellness.
- Ministry of Education and Youth.
- Ministry of Finance and the Public Service.
- Technology Service Providers.
- Academia (universities/colleges/other).

Objectives:

a) Incorporate energy metrics and energy reporting into environmental sustainability criteria, including climate change mitigation, ambient air quality emissions, avoided carbon (fossil fuels), reduced fossil fuel imports, and other.
b) Establish (adopt/adapt/originate) protocols for data collection, reporting, measurement and verification and documentation on energy and environmental performances.
c) Enable appropriate communication channels, platforms and public forums to promote and create visibility on energy performance and initiatives in public facilities.

SWOT Analysis:

The analysis of strength, weaknesses, opportunities and threats related to the implementation of the *Energy Efficiency and Conservation Policy and Guidelines for Public Facilities in Jamaica* considering the national, regional and international context will allow for planning to operationalize the policy and optimize successful implementation.

Strengths (National)	**Weaknesses (National)**
1) GoJ has significant experience and successes in implementing EE & EC programmes and projects in the public sector. 2) The country is replete with technology services providers providing full services in energy conservation and efficiency locally and Regionally. 3) International, Regional and national energy efficiency codes, and guidelines are available and promulgated.	1) Financial savings in public sector institutions are not retained/credited to beneficial institutions, posing a financial disincentive for EE&EC efforts. 2) Regional and National Building codes are not mandatory, and unenforceable under law. 3) Poor quality performance of some EE devices due to the absence of mandatory standards, reduces confidence in EE&EC measures and is a disincentive.

4) Fiscal incentives exist for importation, retail and wholesale of energy efficient equipment/devices. 5) Development Plans, NDC, Energy Policy are consistent in supporting EE&EC. 6) High cost for electricity and short payback period incentivizes EE&EC measures.	4) Limited elasticity in foreign exchange spending on energy. 5) Nascent culture of abiding by standards and codes for compliance.
Opportunities (Global)	**Threats (Global)**
1) Supportive international development partners with more favourable models for financing. 2) Positive credit rating and reputation for meeting financial obligations. 3) Increasing financing opportunities in both grants and loans. 4) Decreasing prices for EE equipment/ devices. 5) Improved performance quality in EE equipment/ devices. 6) Large market of manufacturers/suppliers for EE equipment/ devices. 7) Increasing fossil fuel prices.	1) Unproven suppliers of lower cost and inferior EE products reduces confidence in the market. 2) Fluctuating foreign exchange reduces predictability for project costing.

IMPLEMENTATION

Policy Actors:

Implementation of the *Energy Efficiency and Conservation Policy and Guidelines for Public Facilities* will require the collaboration of many critical stakeholders within government, private sector and civil society. The accompanying table highlights some of the central stakeholders and their expected responsibilities for successfully implementing the Policy and Guidelines.

Table 2: Key Public and Private Sector Stakeholders for Implementation of the Policy and Guidelines

INSTITUTION/ STAKEHOLDER	IMPLEMENTATION ROLE
Ministry of Science, Energy, Telecommunications and Transport (MSETT)	Lead agency for implementing NEP and other energy policies, guidelines, and actions.
Ministry of Housing, Urban Renewal, Environment and Climate Change (MHURECC)	Lead State Ministry for environment and climate change mitigation initiatives benefiting from implementation of the EE Policy & Guideline.
Climate Change Division (CCD)	Has the broad mandate on behalf of the GoJ to manage the national response to climate change to achieve a low-carbon and climate resilient society. Specific and relevant strategies include mainstreaming climate change mitigation in strategies and policy formulation, development planning and decision-making and promoting actions to reduce greenhouse gas (GHG) emissions through fossil fuel reduction, EE&EC, and switching to clean and/or renewable energy sources.
Environment & Risk Management Branch (ERMB)	Supporting agency to NEPA for preparatory actions and ratification of the Kigali Amendment, supporting a Jamaica National Cooling Strategy (JNCS) inclusive of MEPs and energy efficiency cooling.
Bureau of Standards Jamaica (BSJ)	Lead agency for developing standards, labelling and conducting energy efficiency tests on cooling equipment (i.e., room air conditioners and refrigerators/freezers).
National Compliance and Regulatory Authority (NCRA)	Lead agency for enforcement of standards for energy efficient equipment/devices and will collaborate with BSJ to ensure compliance in energy efficiency standards.
Statistical Institute of Jamaica (STATIN)	Lead agency for data collection, analysis and publication of information on imported energy consuming devices in collaboration with JCA.
Jamaica Customs Agency (JCA)	Lead agency for management and control of importation of energy equipment; application of duties, charges or waivers on energy equipment. An agency of the Ministry of Finance and the Public Service.
Jamaica Air conditioning, Refrigeration and Ventilation Association (JARVA)	National association which will assist with compliance among its members, support to NCRA and BSJ regarding developing appliable standards on efficient cooling, and will assist with training and competence development in collaboration with the academic and vocational institutions.

INSTITUTION/ STAKEHOLDER	IMPLEMENTATION ROLE
Jamaica Public Service Company Ltd (JPS Co)	Electric utility which will play a key role in facilitating financing strategies such as the Integrated Utility Service Model (IUS) which may facilitate leveraging economies of scale to procure energy efficiency and energy conservation measures, or Energy as a Service (EaaS) to financially de-risk EE projects.
Jamaica Society of Energy Engineers (JSEE)	National association of Certified Energy Managers which will assist with compliance among its members and will assist in certifying trained professionals to implement EE and EC measures under the IUS Model
Jamaica Renewable Energy Association (JREA)	National association of renewable energy consultants and companies which will assist with compliance among its members to support distributed generation technologies under the IUS Model
Inter-American Development Bank (IDB)	Financier of the EMEP, EECP and other key national energy intervention projects.
Caribbean Development Bank (CDB)	Regional financier of the Integrated Utility Services model with financing from the Global Environment Fund.
United for Efficiency (U4E)	A United Nations agency and project developer for the Jamaica National Cooling Strategy for energy efficient cooling.
United Nations Development Programme (UNDP) Country Office	Key development agency for supporting the Kigali Amendment, HCFC Phase-out Management Plan (HPMP) and public sensitization of the JNCS, regarding energy efficient cooling.
Academic and Vocational Institutions.	Existing institutions will continue to develop and deliver a holistic and diverse syllabus to comply with national, Regional and international quality and performance standards and certification and training towards the promulgation of the CARICOM Regional Energy Efficiency Building Code and energy efficiency applications in collaboration with private sector, BSJ and other stakeholders.
Government Electrical Regulator (GER)	As an external Division of the Energy Ministry (MSETT), is responsible for the inspection, certification and regulation functions regarding all electrical installations throughout the island in accordance with the electricity laws and to ensure that they meet the required standards of safe electrical installations.
Ministry of Education and Youth (MOEY)	Is responsible for education at the pre-primary to tertiary levels and has responsibility for the requisite

INSTITUTION/ STAKEHOLDER	IMPLEMENTATION ROLE
	building management and coordinating or financing relevant energy management initiatives. The Project Management and Technical Services Division is specifically tasked with project management and technical services required for the efficient and effective implementation of Capital Investment Projects, including coordination of grants and loans provided by bilateral and international agencies, as well as local companies. The division supervises the construction, extension and furnishing of public education institutions. Educational institutions benefitted significantly from EE&EC and renewable energy interventions to date.
Ministry of Health and Wellness (MOHW)	The central Ministry for health and with a portfolio of several public buildings for the purpose. Public health services buildings have been significant beneficiaries of EE&EC and renewable energy interventions to date.
Ministry of Local Government and Rural Development (MLGRD)	This Ministry acts as the agent of local development and has related responsibilities for maintenance, repair and upkeep of numerous public sector infrastructure.
Public Procurement Commission (PPC)	Examines and gives oversight to Jamaica's public procurement processes including certifying service providers for services and infrastructural works to the public sector; examining applications for the award of government contracts; and reviewing, approving and/or overseeing the award of government contracts within the specified limits.
Attorney-General's Chambers (AGC)	The Attorney-General's Chambers provides legal advice and representation on behalf of all Ministries and Departments of Government.
Technology Service Providers/ Energy Service Companies (ESCOs)	Private sector associations and companies which are distributors, dealers, and suppliers of a wide range of EE&EC services including consulting, project management, financing, contracting and procuring of services. ESCOs, in particular, support the entire chain of project implementation from project organization and financing to engineering, contracting, procurement, build and M&V for promoting sustainable energy in buildings.

Framework of Codes and Audit Baseline:

In fulfilment of these goals for the implementation of the National Energy Policy, GoJ has developed Standards and Codes as well as Policy Guidelines to support the policy. Table 3 lists the major documentations that have been developed or referenced with respect to energy efficiency and energy conservation.

Table 3: Frameworks, Guidelines and Codes Applicable for Energy Efficiency and Conservation.

Jurisdiction	Legislation	Objective	Agency
Local	The KSAC Building Act 2016	To legislate development plans including building codes for KSAC.	Ministry of Local Government and Rural Development
Local	Jamaica National Building Code, Volume 2: *Jamaica Bureau of Standards* Energy Efficiency Building Code, Requirements and Guidelines, 1994	To provide technical codes for all building requirements	Bureau of Standards Jamaica (BSJ)
Regional	CARICOM Regional Energy Efficiency and Energy Conservation Building Code -2018	To provide technical codes for Energy efficiency and conservation for the Region	Developed by CARICOM regional Organization on Standards and Quality (CROSQ)
International (Local Application)	JS 309:2019 - Application Document for the International Energy Conservation Code (Reviewed every three (3) years).	To provide technical codes for energy efficiency and conservation in Jamaica	Bureau of Standards Jamaica (BSJ)
Local	Energy Efficiency and Conservation – *Standard Guide for the Public Sector - 2018*	To provide guidance to the energy sector on efficiency and conservation	Developed by the then Ministry of Science Energy and Technology (MSET) / Petroleum

Jurisdiction	Legislation	Objective	Agency
			Corporation of Jamaica (PCJ)[10]
Local	Nationally Determined Contribution (NDC) of Jamaica to the United Nations Framework Convention on Climate Change (UNFCCC) June 2020.	Jamaica's contribution to global Climate Change initiative.	Climate Change Division (CCD)

In addition to the legislation and codes developed over the years, the Energy Conservation and Efficiency supporting policy has advocated for the following key strategies and actions:

- Ensure that Ministries and Agencies develop and implement environmental stewardship action plans, with special emphasis on energy and fleet management.
- Develop and implement a specific programme of energy management for the National Water Commission focused on loss reduction at all levels.
- Fast track the implementation of energy efficiency programmes based on the findings of public sector studies and energy audits.
- Establish energy conservation and efficiency (ECE) protocols for the operation of public sector facilities and entities including the appointment of a trained energy professional as an energy coordinator for each facility.
- Align energy conservation and efficiency initiatives with the procurement guidelines and practices of government.
- Promote and accelerate the use of energy efficient equipment in government operations, and investigate the adoption of mandatory energy efficiency requirements, considering life cycle costing.
- Increase the energy efficiency of street lighting.
- Provide information to street lighting service providers and local government authorities' information on energy efficient street lighting.

As part of the continued development towards energy efficiency and conservation, professional bodies such as the Jamaica Institution of Engineers, the Jamaica Institute of Architects, along with the Bureau of Standards and the various Municipalities have been developing standards and adopting codes.

The Ministry with responsibility for energy (through its agency, the Petroleum Corporation of Jamaica at the time) had also conducted energy audits on Government buildings over the years

[10] The Petroleum Corporation of Jamaica was subsumed under the then parent Ministry of Science, Energy and Technology (MSET) in 2020. The Ministry of Science, Energy, Telecommunications and Transport (MSETT) replaced the MSET in May 2023..

to 2019 to establish baselines within the public sector and the conducted Investment Grade Audits (IGA). The generally stated objectives of the audits were to facilitate:

- Reduced electricity consumption within government facilities.
- Decreased oil imports through improved EE.
- Reduced GHG emissions which can contribute to Jamaica's commitment.
- An increased capacity to promote and supervise electricity planning in Jamaica.

A Technical Assessment Report was created for each building in the audits which described in detail the existing building envelope, operating systems and equipment, facilities conditions, personnel behaviours, and the recommended Energy Efficiency Measures (EEMs) and associated savings related to energy consumption/savings.

Whereas the consumption patterns vary based on the building envelope, operations and location of the entity, the similarities were that space cooling was the highest energy consumer followed by lighting and plug loads for which effective modern codes and technologies are available. In line with the findings the general and comprehensive recommendations for energy savings from these audits included: -

- Building Envelopes to include roofing, walls, windows, doors, and fenestrations.
- Lightings systems
- Air Conditioning Systems
- Ventilation
- Mechanical systems
- Mini-Split Air Conditioning Systems
- Air Handling Unit Fans
- Chilled Water Pumps
- Steam Plant
- Steam Distribution System
- Compressed Air Systems
- Kitchen Operations
- Refrigeration Systems
- Energy Management

Audits are available for the facilities below:

HEALTH

- Annatto Bay Hospital
- Port Antonio Hospital
- Bustamante Childrens Hospital
- Port Maria Hospital
- St. Anns Bay Hospital
- St. Thomas Hospital

- Mandeville Public Hospital
- Victoria Jubilee Hospital
- Cornwall Regional Hospital
- Falmouth Public Hospital

In addition, Investment Grade Audits (IGA) were also done through PCJ for other institutions as follows:

- Petroleum Corporation of Jamaica
- Marcus Garvey Technical High School
- Ebony HEART Trust Academy

The recommendations of these audits were varied and specific for each facility, however there were also similarities in findings and recommendations as the overall building age, equipment type, designs and operations were similar particularly for hospitals, and educational facilities. A sampling of available audits begins to develop a consumption trend as follows:

Table 4: Electricity Consumption in Selected Public Sector Buildings

Sources of Energy Consumption	Hospitals	Corporate (PCJ)	Education
HVAC/Mini-Splits[11]	48 - 53%	62%	24 - 47%
Lighting	14-20%	7%	17-30%
Plug Loads	6 - 10%	26%	17 - 24%
Balance of Systems	8 - 18%	5%	6 - 35%

Other public sector audits were conducted in schools and other agencies through private interest groups, government agencies and development partners. The result is that these audits have contributed to defining a baseline consumption in some public sector agencies and the consequent energy efficiency and conservation measures (EE&ECM) that were required to shape the nation's behaviour into a culture of energy efficiency and conservation. From among the public sector audits available, several EE&ECM were identified for each facility with each having its unique set of measures.

The audits and investment grade audits and specifically the recommendations provided appropriate guidance towards achieving optimal energy efficiency for existing and future public sector buildings. A significant observation however is that energy conservation measures were referenced at the design level and in some instances standards that were being employed at the time. Also, for some recommendations there was primarily a reference to established international codes. There was an absence of referencing to relevant local codes or guidelines to which correction or an upgrade was being made. This is understandable as the time frame in

[11] Refrigeration and other cooling services not included due to high variability in findings which are location specific.

which the audits were being done were the same timeframe in which the codes were being developed.

As we go forward however, given the adoption of international codes and the adaptation of these codes to Jamaican condition it is imperative that the Policy be stated more definitively to influence the culture to use and rely on energy efficiency and conservation codes.

Based on the foregoing analysis of how the energy efficiency and energy conservation portfolio has developed over the years, it is imperative that the Policy and guidelines be stated within the framework of standards, codes and legislations that are relevant to the EE&EC interventions

The foregoing changes are intended to make the Policy more than just a statement of intention but to influence a greater use of and reliance on codes. Hence enforcement initiatives would be aimed at re-enforcing the Policy.

ENERGY EFFICIENCY AND MANAGEMENT STANDARDS, CODES AND TARGETS.

Table 5: Standards, Codes and Targets for Implementation of the Policy and Guidelines

Category	Standard / Code	Target
GENERAL [Climate zones, Design conditions, Material systems and equipment]	**JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
BUILDING ENVELOPE REQUIREMENTS [Walls, Floors, Roofs, Fenestrations (Doors & Windows]	**JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
BUILDING MECHANICAL SYSTEMS [Heating, Cooling, Ventilation]	**JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
ELECTRICAL POWER AND LIGHTING SYSTEMS [Lighting Control, Interior, Exterior, Motor controls]	**JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
SERVICE WATER HEATING (MANDATORY) [Equipment Performance Efficiency, Heat traps for	**JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code

Category	Standard / Code	Target
storage tanks, Insulation piping]		
EXISTING BUILDINGS [Additions, alterations, repairs, change of use /occupancy]	**JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
SOLAR-READY ZONE— COMMERCIAL	**JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
MAINTENANCE INFORMATION AND SYSTEM COMMISSIONING	**JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
REFERENCED STANDARDS	**JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
TOTAL BUILDING PERFORMANCE	**JS 309:2019** – Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code
ADDITIONAL EFFICIENCY PACKAGES	**JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC)	As set out in the referenced Code

Mandatory Energy Efficiency and Conservation Plan for Existing and New GoJ Buildings

This Policy and Guideline document is intended to highlight Policy implementation through legislation, regulations, standards to the development and mandatory use of technical Codes. Whereas it will propose processes to close the gap between high level policy and implementable codes, it is not intended to be a replacement for the numerous chapters of Codes that have been developed nor is it intended to highlight and explain methodologies. It will however draw reference to the relevant Policy goals as well as codes developed to date for existing and new buildings for use in particular the Health, Education and Administration sectors in Jamaica.

Optimal energy performance which results in the most efficient use of energy is best obtained if from the concept and design stages of a project, the energy efficiency and energy conservation

plan, the monitoring and evaluation as well as the measurement and verification protocols are built into the project. This approach holds true whether it be new or existing building or equipment installation.

Given the development in Policy, legislation up to the launch of codes, it is proposed for this policy and guideline document on public buildings that the plans be centred around the use of energy efficiency codes at every stage of the development and operations of public buildings.

Mandatory Energy Efficiency Codes

Figure 5 illustrates the proposed plan of having Energy Efficiency Codes as the centre of the development and operations of public buildings in Jamaica. These codes are developed locally or in the absence of local codes, are adopted from international codes. They are adapted to the Jamaican environmental conditions to make them relevant and locally usable. An important part of this plan is that the codes are updated every three years or as soon as there are technological changes. In that way the codes remain relevant.

The codes are relevant and should be used at every step of the establishment, operation and replacement of public buildings. Codes should be referenced at the conceptual stage, during designs, at procurement, for construction, as part of operations, during maintenance for repairs and replacement.

Energy Professionals

The human resource component of the plan is critical to its successful implementation. Figures 6 and 7 illustrate the professionals that are necessary at every step of the process to get public buildings utilizing the optimal application of energy efficiency and energy conservation at every stage of its development from concept to operations and even to repair and replacement. Codes are complex technical documents; they are also very detailed and reflects all the conditions and possible solutions for optimal energy efficiency. The engagement of trained and experienced energy professional such as energy efficiency engineers at each stage of the building development will ensure that energy efficiency objectives are met.

Measurement and verification is also critical to ensure that expected targets are met and gaps are appropriately defined. It is therefore critical that energy professionals are specifically trained in measurement and verification.

Innovative Financing

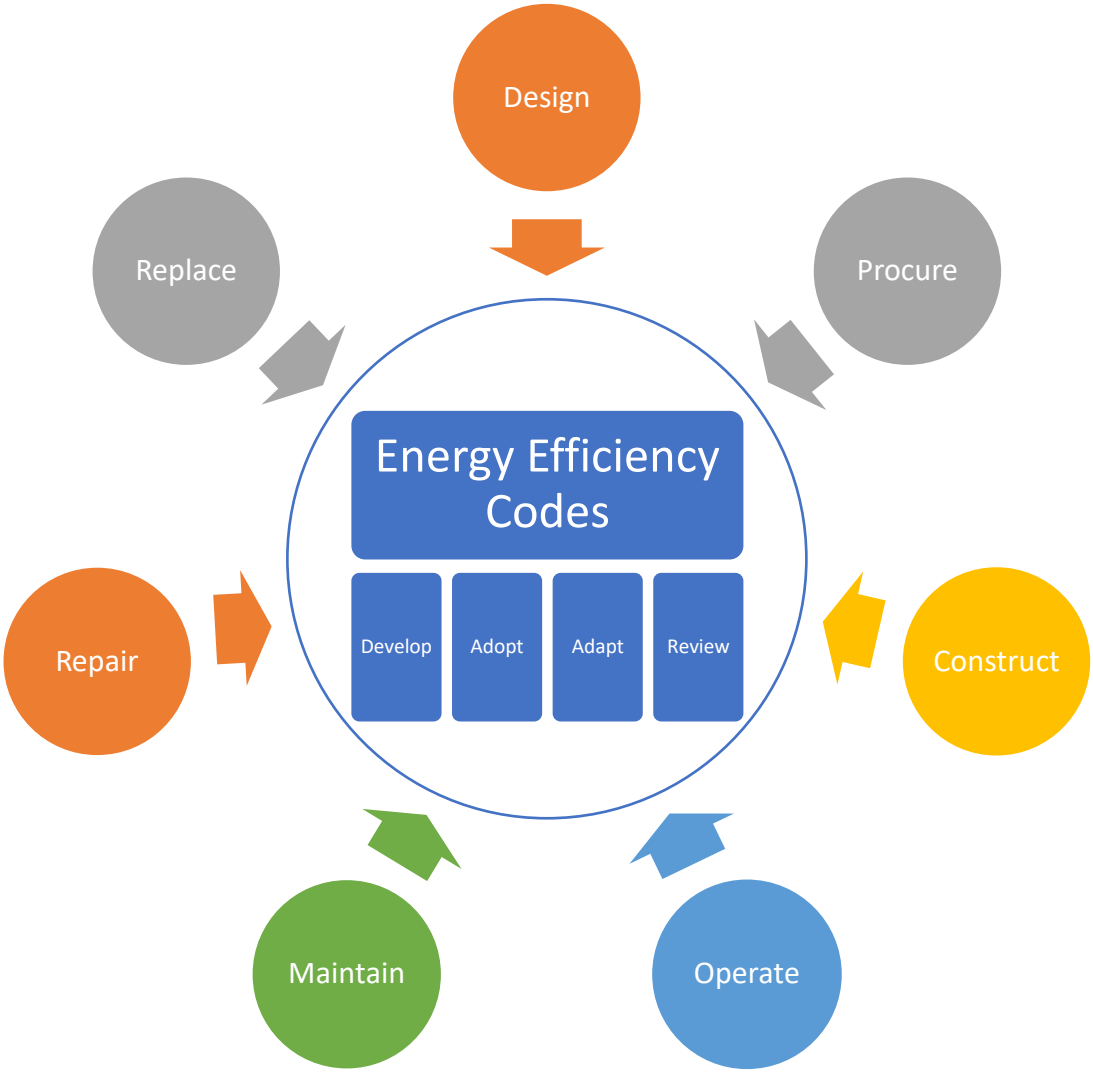
The government has a limited budget inclusive of internal and external financial debt obligations and is often constrained to finance non-core projects. New innovative financing for energy conservation and efficiency interventions have emerged through international development partners, green financiers, and other sources, and includes a mixture of debt and grant funding.

Implementation of the Policy and Guideline will consider new financing models such as the Integrated Utility Services (IUS) where the utility undertakes the financing risk and delivers integrated energy packages (e.g., distributed energy resources of EE&EC products) to customers using on-bill repayment and delivering savings from day one. The business model can be applied as a regulated model (under specific tariffs and legislation with a regulatory oversight) or un-regulated model (utility acting independently in a market context through direct contracting). The models would diversify the utility's revenue stream while delivering energy and financial savings to customers at low risk. An ESCO would be a critical intermediary between the utility and (potential) clients. Such a model was piloted in a few CARICOM Member States under the Technical Assistance for Sustainable Energy in the Caribbean (TAPSEC) implemented by GIZ in partnership with the CARICOM Secretariat Energy Unit and the Caribbean Centre for Renewable Energy and Energy Efficiency (CCREEE). This is now being expanded by the Caribbean Development Bank in partnership with the CCREEE, the Green Climate fund and other partners for which Jamaica is a potential candidate.

Another financial model for energy services is Energy-as-a-Service (EaaS), which is an innovative business model for financing and providing bundled energy services, combining hardware, software and services. Solutions include demand management and energy efficiency services, facilitate the adoption of decentralized energy generation and EE&EC. The chief benefit to the client is the simplification of an increasingly multifaceted service offering with a fixed (reduced) scheduled repayment over the life of the contract. EaaS makes use of traditional arrangements such as energy performance contracts (EPCs), energy supply contracts (ESCs) and power purchase agreements (PPAs), and employs alternative new models that lower or eliminate upfront costs around funding, owning and operating capital-intensive energy generation and storage systems.

Both models above reduce the financial risk to government, while delivering the energy efficiency services at lower monthly cost in a structured and scheduled manner. IUS and EaaS are not exclusively recommended as other financing models and opportunities exist and should be applied to project implementation and delivery.

Figure 5: Energy Efficiency Codes at the Centre of ALL Building activities



The sustainability of the policy on public buildings relies on all stages impacted by public buildings to focus on the codes being at the centre at each stage of the development and that the codes are constantly revised; and that the safety of the building occupants and the surroundings remain paramount.

<u>Policy Guidance Statement: - Retrofit of Existing Building</u>

Retrofits for existing buildings as well as upgrades or replacement of equipment shall be done to achieve the maximum energy performance as if it were designed as new.

The EE&EC intervention when completed shall meet the requirement of the relevant Jamaica Application Document and other stated policies and frameworks.

It is recognized that each building or equipment will have different characteristics and operate in different environment. Hence the applicable section of the Code shall apply.

Guidelines:

- Each building must be evaluated on its own parameters.
- Energy Professionals such as Energy Engineers, Architects and Certified Energy Managers must be engaged in the core concept, design, analysis and implementation for the upgrade of the project. These professionals must contribute to the decision making on the measures to be implemented for the upgrade.
- An investment Grade Audit must be done to inform the technical measures to be considered as well as the economic viability of the measures to be implemented in the case of retrofits and upgrades.
- Baseline period energy use must be established and agreed between facility owner and Energy Professionals.
- The design and implementation must be done to meet the requirements of the Jamaica Application Document for the Energy Efficiency & Energy Conservation Code -.

Key Performance Indicators as detailed in the Code must be adhered to for ALL aspects as outlined but as a minimum must address the following:

- Building Envelopes
    - Walls, roofs, doors, windows, openings (fenestration)
- Lighting
- Computer Devices and Electronics
- Mechanical Systems
- HVAC system

Building inspection during and after modification is done, is mandatory.

- Building inspection must be conducted by professional energy personnel representing the municipality.
- Building inspection shall be done to ensure conformance with the requirement of the Code.
- Measurement and verification must be done as part of the process to commission and return the building or equipment to operation
- Certification and approval that the changes of the building have met the requirement of the Code must be done by the Municipality.

The workflow for the Plan for inclusion of Energy professional for existing Buildings and Equipment is set out in Figure 6.

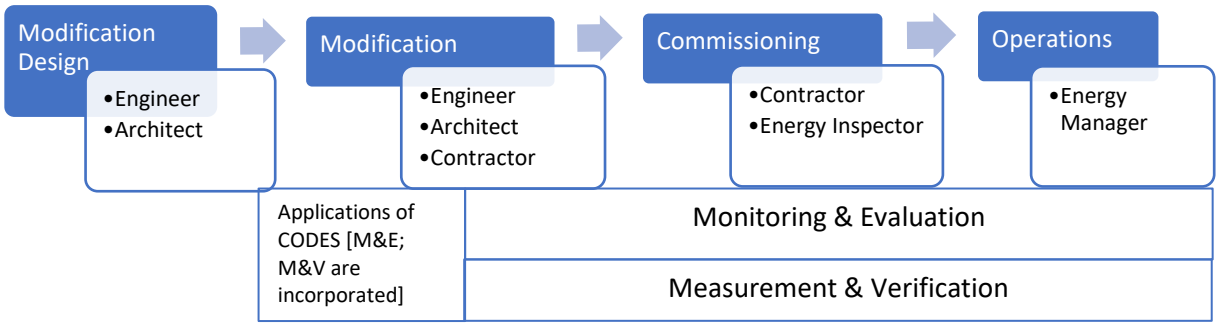


Figure 6: Process Flow for inclusion of Energy Professional in EE & EC for Existing Buildings

Policy Guidance Statement: New Buildings:

All new buildings shall have its energy systems designed and constructed to a standard to satisfy the JS 309:2019 - Jamaican Application Document - Energy Efficiency and Energy Conservation Code or other applicable standards, codes, policies or legislation.

Guideline

The following guideline should be set as a minimum mandate to ensure conformance.

- Energy Professionals such as Energy Engineers, Architects and Certified Energy Managers must be engaged in the core concept, design, analysis and implementation of the project and must contribute to the decision making on the measures to be implemented for each situation.

- Energy Professionals engaged in the project must have specific training and experience in Monitoring and Evaluation to include Measurement and Verifications.

- The design must be done to meet the requirements of the JS 309:2019 - Jamaica Application Document - Energy Efficiency and Energy Conservation Code -.

Key Performance Indicators as detailed in the Code must be adhered to for ALL aspects as outlined but as a minimum must address the following: -

- Building Envelopes
    - Walls, roofs, doors, windows, openings (fenestration)
- Lighting
- Computer Devices and Electronics
- Mechanical Systems
- HVAC Systems
- Mandatory approval of the designs by the municipality.

- Building inspection to be conducted by professional energy personnel representing the municipality during and after the installation.
- Building inspection to be done to ensure conformance with the requirement of the Code.
- Measurement and Verification as part of the process to commission and operate the building or equipment.
- Mandatory certification that the building has met the requirement of the Code by the municipality.

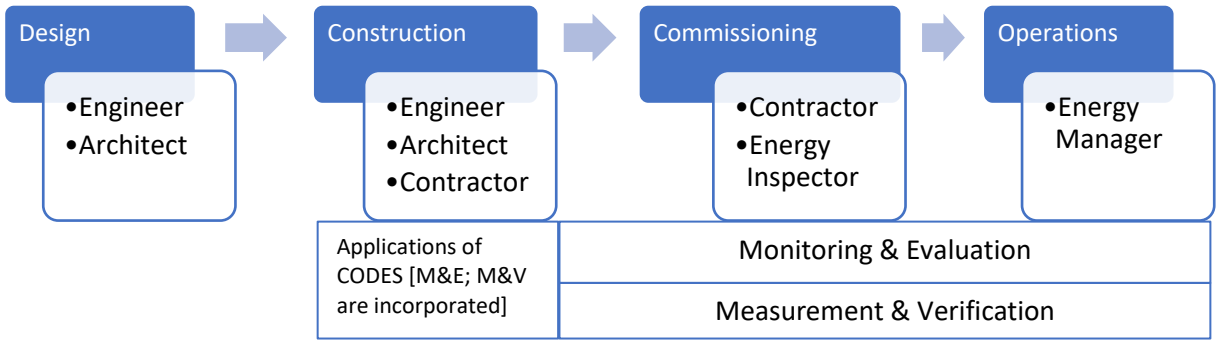


Figure 7: Process Flow for inclusion of Energy Professional in EE & EC for New Building

GUIDELINES FOR HEALTH FACILITIES

Health facilities are an integral part of the infrastructure of any economy. As a result of the critical services they provide for the population and the nature of their operations, areas of the health facilities are mostly operated on a 24-hour basis with the use of the facilities scheduled for use appropriately. Indeed, every aspect of the health facility depends on the use of energy of some kind. There is therefore every opportunity to build into the health sector a culture of the efficient use of energy in all its facilities. Where possible and appropriate, adequate sunlight/natural light and passive cooling should be utilised to increase energy savings and enhance comfort levels of building occupants.

The main functional areas of a health facility can be generally summarized as consisting of: -

- Administration, which includes offices, staff area, data storage, equipment storage etc. The greatest energy usages in these areas are lighting, air conditioning and plug loads.
- Outpatients' area to include Outpatient clinics, Pharmacy and Emergency reception. Lighting and air conditioning are the main users of energy in these areas.

- Diagnostic services which include Laboratories and Radiology (diagnostic). Here the use of energy is more specialized as there is the need for lighting and air conditioning as well as refrigeration, heating, and the need for specialized redundant supplies of electricity.
- Therapeutic services: Physical Therapy and Radiology (therapeutic). The use of energy in this area is lightning and air conditioning as well as refrigeration, heating, and redundant sources of reliable energy.
- Internal medical treatment includes Operation Theatres, Intensive Care unit. Here there is the need for lighting, air conditioning, specialized sources of reliable energy.
- Maternity section and Central Sterilization Department. In addition to the lighting and air conditioning as the main users of energy, there may be the need for steam and heating, which could include the use of other fuels.
- Inpatient division includes Patient wards, Nurses stations and Inpatient services. This for the most part will require lighting and air conditioning.
- General Service division includes Kitchen, Laundry, Storages, Workshops, Mechanical services, Mortuary, Security, Parking and Landscaping. This will require all aspects of energy which will incorporate the use of fuels other than electricity.

This demonstrates a wide variety of energy applications to service health facilities. In addition to the varied building types and specialized areas in the health service is the application of specialized equipment which for the most part depends on the use of energy in its varied forms.

Ventilation

For hospitals, it is not always the heat surplus that decides the ventilation rates, but the hygiene considerations. As indoor air is contaminated by occupants and activities in the hospital, it must be renewed in order to eliminate odours and pollutants. Room ventilation levels typically range from 35-140 m3 per person/hr depending on the function of the room. Operating theatres are usually among the rooms having the highest demands, with ventilation rates around 30-55 m3 per square metre/hour.

Natural ventilation may compromise the building envelope integrity by allowing in non-filtered air with outdoor air contaminants such as fungal spores. Natural ventilation is best supplemented with mechanical ventilation (known as mixed-mode ventilation) when natural ventilation rates are too low or when outdoor temperatures are not amenable for natural ventilation.

A building's orientation and shape can significantly affect how energy-efficient it is and may restrict the introduction of extra passive design elements. Natural ventilation may be less effective due to a building's depth. There are several highly technological areas in healthcare buildings that need stringent temperature control or high ventilation rates to prevent infection. This frequently results in architectural solutions that block off façades and use centralized mechanical ventilation to supply and remove air.

Humidity Control in Hospitals
Humidity control in buildings has been primarily focused on reducing humidity to eliminate condensation and mold growth. The climate zone and moisture category where the building is located should determine the best methods for controlling humidity. The design goal should be to remove humidity from supply air if the location is in a humid area and high indoor humidity levels are recorded. Utilizing energy recovery ventilators to restore and maintain humidity levels can result in greater energy efficiency.

Lighting for Health Facilities
Daylighting design should incorporate window treatment, such as low-E film, to control glare and excessive solar heat gain. Some of the recommendations include:

- Glare-free lighting to improve visual acuity, reduce eye strain, and enhance the ambience
- Proper illumination levels and uniformity to maximize speed and accuracy of task performance
- Proper illumination to enhance safety and limit slips and falls
- Wayfinding to assist patients and visitors
- The use of LED technology

Design of areas used by patients should always provide for large windows. Their size, orientation and position in rooms must provide sufficient lighting levels. The balance between daylighting, solar gain and artificial light should be considered during the design process.

Air Leakage
Internal air leaks from buildings increase cooling loads if the building is not sufficiently airtight. With hospitals, low levels of air leakage can reduce the heat lost to the external environment and so lower the carbon emissions associated with ventilation and cooling.

The guidelines for the efficient use of Energy in new health facilities are:

- Energy Professionals such as Energy Engineers, LEED[12] certified Architects and Certified Energy Managers must be engaged in the core concept, design, analysis, and implementation of the project to establish the facility and must contribute to the decision making on the measures to be implemented for each situation.

- Energy Professionals engaged in the project must have specific training and experience in Monitoring and Evaluation to include Measurement and Verifications.

[12] LEED – Leadership in Energy and Environmental Design

- The design must be done to meet the requirements of the JS 309:2019 - Jamaica Application Document - Energy Efficiency and Energy Conservation Code currently being aligned to the CARICOM Regional Energy Efficiency and Conservation Code (CREEBC)-.

Key Performance Indicators as detailed in the Code must be adhered to for ALL aspects as outlined but as a minimum must address the following: -

FACILITY	APPLICABLE CODE
• **General Requirements (Climatic conditions, special designs)**	JS 309:2019 / CREEBC SECTION C 300
• Building Envelopes ○ Walls, roofs, doors, windows, openings (fenestration)	JS 309:2019 / CREEBC SECTION C 402
• Mechanical Systems (including HVAC systems)	JS 309:2019 / CREEBC SECTION C 403
• Service Water Heating	JS 309:2019 / CREEBC SECTION C 404
• Electrical Power and Lighting Systems	JS 309:2019 / CREEBC SECTION C 405
• Specialised equipment /Additional Efficiency	JS 309:2019 / CREEBC SECTION C 406

In addition, there shall be the following: -

- Mandatory approval of the designs by the Municipality.
- Building inspection to be conducted by professional energy personnel representing the municipality during and after the installation.
- Building inspection to be done to ensure conformance with the requirement of the Code.
- Measurement and Verification as part of the process to commission and operate the building section or equipment.
- Mandatory certification that the building or equipment has met the requirement of the Code by the municipality.
- Specialized equipment must be evaluated and chosen against the latest technology and in conformance with the Energy Star or equivalent Standard for its use of Energy where applicable.

The guidelines for the efficient use of Energy in upgraded or refurbished Health facilities are:

- Each building component must be evaluated on its own parameters.

- Energy Professionals such as Energy Engineers, LEED certified Architects and Certified Energy Managers must be engaged in the core concept, design, analysis, and implementation for the upgrade of the project. These professionals must contribute to the decision making on the measures to be implemented for the upgrade.
- An investment Grade Audit must be done to inform the technical measures to be considered as well as the economic viability of the measures to be implemented in the case of retrofits and upgrades.
- Baseline period energy use must be established and agreed between facility owner and Energy Professionals. This shall be utilized in the measurement and verification process.
- The design must be done to meet the requirements of the JS 309:2019 - Jamaica Application Document - Energy Efficiency and Energy Conservation Code currently being aligned to the CARICOM Regional Energy Efficiency and Conservation Code-.

Key Performance Indicators for each parameter as detailed in the Code must be adhered to for ALL aspects as outlined but as a minimum must address the following:

FACILITY	APPLICABLE CODE
• **General Requirements**	JS 309:2019 / CREEBC SECTION C 501
• Additions	JS 309:2019 / CREEBC SECTION C 502
• Alterations	JS 309:2019 / CREEBC SECTION C 503
• Repairs	JS 309:2019 / CREEBC SECTION C 504
• Change of use / occupancy	JS 309:2019 / CREEBC SECTION C 505

Building inspection during and after modification is mandatory.

- Building inspection must be conducted by professional energy personnel representing the Municipality.
- Building inspection shall be done to ensure conformance with the requirement of the Code.
- Measurement and verification must be done as part of the process to commission and return the building or equipment to operation.
- Certification and approval that the changes of the building have met the requirement of the Code must be done by the Municipality.

Energy Efficiency Measures for Hospitals for energy savings:

- Enhanced building opaque envelope insulation

- Enhanced window glazing with overhangs
- Reduced lighting power density (LPD) and occupancy control
- Daylighting in staff areas (exam rooms, nurse stations, offices, corridors) and public spaces (waiting, reception)
- Higher efficiency HVAC equipment (condenser water heat recovery, displacement ventilation, demand-controlled ventilation, thermal storage, desiccant-based dehumidification, evaporative condensing)
- Good practices for lighting (exterior lighting, LEDs)
- Process loads (medical equipment, high-performance kitchen and laundry equipment)
- Renewable energy (photovoltaic and solar systems, wind turbines)
- Electrical distribution systems (transformer efficiencies, metering)
- Energy Management Plan, to include the following recommended improvements for operating the hospital efficiently:
    - Digital Energy monitoring and verification system
    - Smart metering, energy monitoring devices and energy management software (Building Energy Management Software, BEMS)
    - Building digitisation, automation and controls (control of the heating, cooling, ventilation and lighting systems)
    - Building Control Operation Plan

GUIDELINES FOR EDUCATIONAL FACILITIES

The efficient use of energy in educational facilities is just as critical to the national economy. Educational facilities vary in sizes and scope as well as in their operational regime. This varies from the primary level where the facilities may just be a standalone school building to University campuses covering a wide area of buildings with multipurpose use.

Schools shall consider the economic, academic, and environmental impacts of building design and seek to include environmentally sound design elements:

- Orient the school building effectively, to maximize solar access and boost the effectiveness of daylighting strategies to reduce the need for electrical lighting and cooling
- Use renewable energy systems and energy-efficient technologies (consider building-integrated photovoltaic (PV) systems for electricity production)
- Consider the shading potential of landscaping and other site features. Shading is important throughout the year in tropical climates. Shading east and west facing walls is important for decreasing thermal load.
- Consider the geometry and reflectance of finishes in each space to maximize the illumination.
- Incorporate resource-efficient building products and systems (lighting control systems)

- Promote water-conserving strategies
- Use less polluting transportation alternatives
- Establish recycling systems
- Incorporate environmentally sound site design
- Use an effective construction and demolition waste management plan.

The main functional areas of educational facilities can be generally summarized as consisting of: -

- Administration, which includes offices, staff area, data storage, equipment storage etc., and the greatest energy usages in these areas are lighting, air conditioning and plug loads from computers, printers, and equipment.
- Classrooms or lecture theatres. Again, lighting and air conditioning and plug loads are the main users of energy in these areas.
- Library. Here the use of energy is used by lighting and air conditioning and plug loads.
- Laboratories: The use of energy in this area is lightning and air conditioning as well as refrigeration, heating, and redundant sources of reliable energy.
- Assembly area / chapel which uses energy mostly for lighting and air conditioning.
- General Service division includes Kitchen, Storages, Workshops, Mechanical services, Security, Parking and Landscaping. This will require all aspects of energy which could incorporate the use of fuels other than electricity.

The principles governing the use of energy varies for each configuration but leads back to the same objective of efficient use.

From a Policy and Guideline perspective therefore

The guidelines for the efficient use of Energy in new educational facilities are:

- Energy Professionals such as Energy Engineers, LEED certified Architects and Certified Energy Managers must be engaged in the core concept, design, analysis, and implementation of the project and must contribute to the decision making on the measures to be implemented for each situation.

- Energy Professionals engaged in the project must have specific training and experience in Monitoring and Evaluation to include measurement and verifications.

- The design must be done to meet the requirements of the JS 309:2019 - Jamaica Application Document - Energy Efficiency and Energy Conservation Code currently being aligned to the CARICOM Regional Energy Efficiency and Conservation Code (CREEBC)-.

Key Performance Indicators as detailed in the Code must be adhered to for ALL aspects as outlined but as a minimum must address the following: -

FACILITY	APPLICABLE CODE
• **General Requirements (Climatic conditions, special designs)**	JS 309:2019 / CREEBC SECTION C 300
• Building Envelopes ○ Walls, roofs, doors, windows, openings (fenestration)	JS 309:2019 / CREEBC SECTION C 402
• Mechanical Systems (including HVAC systems)	JS 309:2019 / CREEBC SECTION C 403
• Service Water Heating	JS 309:2019 / CREEBC SECTION C 404
• Electrical Power and Lighting Systems	JS 309:2019 / CREEBC SECTION C 405

In addition, there shall be the following: -

- Mandatory approval of the designs by the Municipality.
- Building inspection to be conducted by professional energy personnel representing the municipality during and after the installation.
- Building inspection to be done to ensure conformance with the requirement of the Code.
- Measurement and Verification as part of the process to commission and operate the building or equipment.
- Mandatory certification that the building has met the requirement of the Code by the municipality.

The guidelines for the efficient use of Energy in upgraded or refurbished educational facilities are:

- Each building component must be evaluated on its own parameters.
- Energy Professionals such as Energy Engineers, LEED certified Architects and Certified Energy Managers must be engaged in the core concept, design, analysis, and implementation for the upgrade of the project. These professionals must contribute to the decision making on the measures to be implemented for the upgrade.
- An investment Grade Audit must be done to inform the technical measures to be considered as well as the economic viability of the measures to be implemented in the case of retrofits and upgrades.
- Baseline period energy use must be established and agreed between facility owner and Energy Professionals. This shall be utilized in the measurement and verification process.
- The design must be done to meet the requirements of the JS 309:2019 - Jamaica Application Document - Energy Efficiency and Energy Conservation Code currently being aligned to the CARICOM Regional Energy Efficiency and Conservation Code-.

Key Performance Indicators for each parameter as detailed in the Code must be adhered to for ALL aspects as outlined but as a minimum must address the following:

FACILITY	APPLICABLE CODE
• **General Requirements**	JS 309:2019 / CREEBC SECTION C 501
• Additions	JS 309:2019 / CREEBC SECTION C 502
• Alterations	JS 309:2019 / CREEBC SECTION C 503
• Repairs	JS 309:2019 / CREEBC SECTION C 504
• Change of use / occupancy	JS 309:2019 / CREEBC SECTION C 505

Building inspection during and after modification is done, is mandatory.

- Building inspection must be conducted by professional energy personnel representing the Municipality.
- Building inspection shall be done to ensure conformance with the requirement of the Code.
- Measurement and verification must be done as part of the process to commission and return the building or equipment to operation.
- Certification and approval that the changes of the building have met the requirement of the Code must be done by the Municipality.

Low-Cost Energy Efficient Measures for Schools:

- Measure and track energy performance.
- Turn off lights when not in use or when natural daylight can be used.
- Set back the thermostat in the evening and other times when a building is unoccupied.
- Perform monthly maintenance of heating and cooling equipment to guarantee efficient operation throughout the year.
- Educate students and staff about how their behaviours affect energy use. Some schools have created student energy patrols to monitor and inform others when energy is wasted.

Cost-Effective Energy Efficient Investments for Schools:

- Install energy-efficient lighting systems and controls that improve light quality and reduce heat gain.
- Upgrade and maintain cooling equipment.
- Use a performance contract to guarantee energy savings from upgrades. > Work with an energy services provider to help manage and improve energy performance.
- Install window films and add insulation or reflective roof coating to reduce energy consumption.

Monitoring and Reporting for Schools:

Educational institutions are encouraged to establish benchmark year data and savings goal, and monitor and report energy consumption. Reporting is vital to the success and sustainability of the plan. The following reports should be performed at a minimum:

1. Weekly monitoring and continuous management of areas of turning off lights, faucets, and devices.
2. Periodic and seasonal setback or shutdown reminders to staff before school breaks or holidays.
3. Bi-yearly reports to the Energy Manager and board of education on cost-avoidance usage and savings.

MONITORING AND EVALUATION

"Monitoring and Evaluation (M&E) is a continuous management function to assess if progress is made in achieving expected results, to spot bottlenecks in implementation and to highlight whether there are any unintended effects (positive or negative) from an investment plan, programme or project ("project/plan") and its activities". The various processes of planning, monitoring and evaluation correspond to make up the Result-Based Management (RBM) approach, which is intended to aid decision-making towards explicit goals[13].

Policy, standards, and codes as well as the human resource professionals to use them and support their use will form the critical tools for Policy performance monitoring and evaluation as well as the complementary processes of measurement and verification (following section).

Critical parameters relating to the use of energy must be measured and recorded on a periodic basis as required by the project but at a minimum as set out in this policy guideline.

A database with the relevant parameters must be developed and its content contribute to the evaluation of the performance of the policy.

Codes are reviewed on a three-year cycle and all resources should be put in place to maintain this cycle. As technology continues to develop and changes take place this is captured in the next update of the code. Notwithstanding this periodic review of the code, monitoring and evaluation should be done on a continuous basis driven by the parameter being monitored.

At a minimum, parameters to be measured and included in the database as well as the frequency of measurement are set out as follows: -

- Electricity Usage - monthly
- Temperature - daily trends

[13] FAO Investment Learning Platform 2023 (https://www.fao.org/investment-learning-platform/themes-and-tasks/monitoring-and-evaluation/en/)

- Production - monthly
- Occupancy - Daily
- Weather - Daily
- Any other parameter determined by the Energy Professionals for a unique project,

Policy Guidance Statement: Critical Parameters for Measurement

> ***All parameters impacting on energy as set out for a public building shall be measured and verified and results stored in a database and used to contribute to the performance evaluation process.***

MEASUREMENT AND VERIFICATION

"Measurement and verification (M&V) are the processes of planning, measuring, collecting, and analysing data for the purpose of verifying and reporting energy savings within a facility resulting from the implementation of ECM". M&V demonstrates how much energy the ECM has avoided using, rather than the total cost saved. [4]

Measurement and verification are therefore critical to the previous monitoring and evaluation process however for participation in any service agreements with energy service providers or utility it needs to be performance based. For this Policy Guideline the International Performance Measurement and Verification Protocol (IPMVP®) is adopted.

Measurement and Verification will therefore be a critical component of achieving the Implementation Framework/Action Plan for Energy Conservation and Efficiency as updated from time to time. The Energy Ministry will be responsible for leading and facilitating the implementation of the National Energy Conservation and Efficiency Policy, in collaboration with other Government Departments and Agencies, the private sector, academia and NGOs. The government will therefore facilitate the implementation of various energy conservation and efficiency projects to achieve the objectives of the Energy Efficiency and Conservation Policy for Public Facilities. The government will therefore also be responsible for building the requisite human resource capacities across the various implementing partners to strengthen information access, skills, and capacity. The successful implementation of this policy will require that eventually links are made between the energy sector as well as other aspects of the economy and society.

Policy Guidance Statement: M&E and M&V are Mandated.

> ***All energy efficiency and energy conservation projects must have monitoring and evaluation as well as a measuring and verification component.***

As a specific tool M&V is a critical function for Energy Efficiency and Energy Conservation and hence the International Performance Measurement and Verification Protocol (IPMVP®) which was developed initially by the US Department of Energy (US-DOE in 1994) and in later years further expanded by the Efficiency Valuation Organisation (EVO) an Energy NGO, will be a central enabler to achieving M&V objectives as stated above.

Whereas ECMs are about creating savings. These savings cannot be measured as they represent energy not used. Savings are analysed and evaluated by measuring energy consumption and adjusting these measurements against an established baseline to determine savings. To determine efficiency and savings, the parameters to be measured, monitored and verified include:

- Electricity Usage - monthly
- Temperature - monthly trends
- Production - monthly
- Occupancy - daily
- Weather - daily
- Any other parameter as specified for the project

Baseline year energy usage shall be measured and verified for each project using the IPMVP® process.

The concept supported by IPMVP® is best expressed as follows [5]:

Savings for Period = Baseline Energy - Reported Period Energy +/- Adjustments

A critical pillar of the IPMVP® is to establish a **baseline energy** use for a period, for example over a one-year period to capture seasonal variations. The protocol avoids using estimation from nameplate for calculating energy. The reporting period energy is also measured but adjustments are made for conditions that impact the baseline such as temperature, occupancy, variations in output etc.

Especially for larger projects, regression analysis is used to develop correlation between energy use and the independent variables that impact this use for the project. With this adjustment to the reported period, energy savings for the period are refined and there is greater confidence in the savings that are being derived from the ECMs.

The IPMVP® uses four (4) options by which M&V is done (Table 6).

Table 6: Types of ECMs under the IPMVP® Framework

IPMVP® OPTIONS	Types of ECM	Best Use
Option A	Retrofit Isolation: with key parameters measurement.	Lighting Retrofit project
Option B	Retrofit isolation: with All parameter's measurement	Installation of new electric motor with variable speed drive.
Option C	Whole Facility Measurement	Replacement of Chiller plant and lighting
Option D	Calibrated Simulation	Comprehensive retrofit in a large building

The IPMVP® has also adopted ISO:50001 and is the recognized standard used for M&V.

A review of the audits as well as the investment grade audits done for the Health and Education sectors revealed a wide range of ECMs are recommended for implementation. In fact, these ECMs would fit into all the four options of the IPMVP®. In that regard in this Policy Guideline there is not a preferred option for any of the sector. Instead, each project will be evaluated by energy professionals and an appropriate IPMVP® option assigned.

Policy Guidance Statements: Engagement of Energy Professionals

- ***All energy efficiency and energy conservation projects must be resourced with appropriate energy professionals.***
- ***Energy Professionals must have specific training in Measurement and Verification (M &V)***

The complexities of executing M&E and M&V activities requires institutions to have competent energy efficiency practitioners who are trained and engaged in facility and building management, maintenance, and operation throughout all stages. Responsible for managing and continually improving energy performance in commercial buildings must be a focused and dedicated responsibility to maintaining a successful and effective energy management programme.

It is therefore imperative that energy professionals be an integral part of energy projects from the conceptual stage through to operations.

PROPOSED IMPLEMENTATION SCHEDULE

The Policy and Guidelines on EE and Conservation for Public Buildings implementation schedule synchronises with existing national milestones such as the NEP and Vision 2030, being 2030 to allow for a comprehensive audit of the policy outcomes and decision-making which can be synchronised with other complementary national energy frameworks. This is important to ensure relevance and impact, however the Policy and Guideline will also have mid-term evaluation to determine if the Goals and objectives are being achieved before the detailed audit in 2030. A mid- term review (year 3) of the Policy and Guidelines allows for improvements in operationalizing the Policy and Guideline to maximise efficiency of roll-out; financial prudence and achievement of the desired outcomes.

The Goals and Objectives as in Table 7 will provide the roadmap for the mid-term evaluation/review and final audit, while the many policy actors will be the drivers for successful implementation. Each policy actor has a specific role and linkage with specific Goals (see Table 7) to ensure responsibilities and accountability can be clearly determined. This list of policy actors is not exhaustive or exclusive. In this regard the knowledge, experiences and recommendations of such key stakeholders have played a critical part of developing the Policy Guidance document and their future collaboration will be fundamental in successful implementation. The Ministry of Science Energy Technology and Transportation (or successor) will be the responsible Government implementation agency with overarching coordinating, monitoring, analysis and reporting responsibility for Policy and Guideline implementation. The MSETT will therefore be responsible to ensure the necessary agreements and understandings between MDAs is achieved for operationalising the Policy and Guideline.

Table 7. Proposed Implementation Schedule

POLICY GOALS	ACTIONS	TIMELINES								POLICY ACTORS
		2023	2024	2025	2026	2027	2028	2029	2030	
GOAL 1 **Lead Agent & Catalyst**	a)Establish standards/codes b)Establish PP guidelines c)Establish Admin rules d)Communications									**MSETT, MOEY, MOHW, MLGRD, MOFPS, BSJ, JCA, JIS, TSP, NCST, SRC, ACADEMIA, PSO, OPPP.**
GOAL 2 **Standards & Codes**	a) Establish standards/codes/ legislation etc. b)Data, M&E, M&V protocols c) Establish PP guidelines d)Innovation Platform									**MSETT, MOHW, MOEY, MLGRD, JCA, NCST, BSJ, TSP, SRC, ACADEMIA**
GOAL 3 **Policy, Legislation/ Regulations**	a) Estab. policy & legislation documentation. b) Empower MDAs - monitoring, compliance, and enforcement									**MSETT, MOEY, MOHW, MOFPS, MLGRD, AG, TSP, JCA, PPC, OPPP.**
GOAL 4 **Financial Stewardship**	a) Energy-Financial Budgeting b) Rules for Financial Savings									**MSETT, MOHW, MOEY, MOFPS, TAX, MLGRD, JCA, TSP, JIS.**
GOAL 5 **Environ. Stewardship**	a) Establish energy-environ metrics. b) Establish protocols for data, M&E, M&V. c) Communications and public reporting.									**MSETT, MHURECC, MOHW, MOEY, CCD, MOFPS, TSP, ACADEMIA**
		Initiation				**Mid-Term Review**			**Audit & Review**	

CONCLUSION

This Policy and Guideline document for public buildings in Jamaica will form a critical framework tool for enabling the Government of Jamaica to be a leader and catalyst for achieving the critical national goals of sustainable environmental and financial stewardship through the efficient use of energy, and by creating and utilising legislation, frameworks and mandatory codes to achieve this end. Through its vision and five (5) stated goals, a platform is created to achieve success and continuous improvement in energy management in Government, private sector and the citizenry.

Policy success will be achieved through collaboration between the Government's various MDAs, and private sector as policy actors who will activate the Policy and Guidelines.

The Policy and Guideline's vision and goals can only be achieved by establishing a clear roadmap for establishing energy efficiency and conservation baselines for new and existing buildings alike, and by using a professional Result-Based Management (RBM) approach mandating codified M&E and M&V practices as fundamental to measure, verify and analyse the intended outcomes of the policy intervention. By doing so, the Government of Jamaica will be able to deliver effective decision-making towards achieving its energy and environmental goals. Achieving the vision and goals will also require various national laws and regulations and best in class standards and codes used internationally. These have been detailed in the Policy and Guidance document.

Already progressive development of legislative and regulatory initiatives had resulted in standards and codes being available for the energy sector and in particular new and existing public sector buildings and facilities.

The optimal benefits will be obtained when the policy mandates:

- The use of Energy Efficiency Codes.
- The use of Energy Professionals.
- The Policy is enforced.

The Government is now able to access new innovative project finance and de-risking options such as IUS and EaaS among others which engrain energy efficiency as core outcomes.

Finally, implementation of the Policy and Guidelines on EE and Conservation for Public Buildings synchronises with existing national milestones being 2030, however there will need to be a mid-term evaluation to determine if the objectives are being achieved, followed by a detailed audit at 2030. Policy and Guidelines improvements can therefore be made after the first 3 years of implementation (similar to other GoJ policy mechanisms) before the audit is done and a decision for future EE initiatives are made. The Goals and Objectives will provide the roadmap for evaluation/review and policy actors will be the drivers for success. In this regard the knowledge, experiences and recommendations of such key stakeholders have played a critical part of developing the Policy Guidance document and their collaboration will be fundamental in successful implementation.

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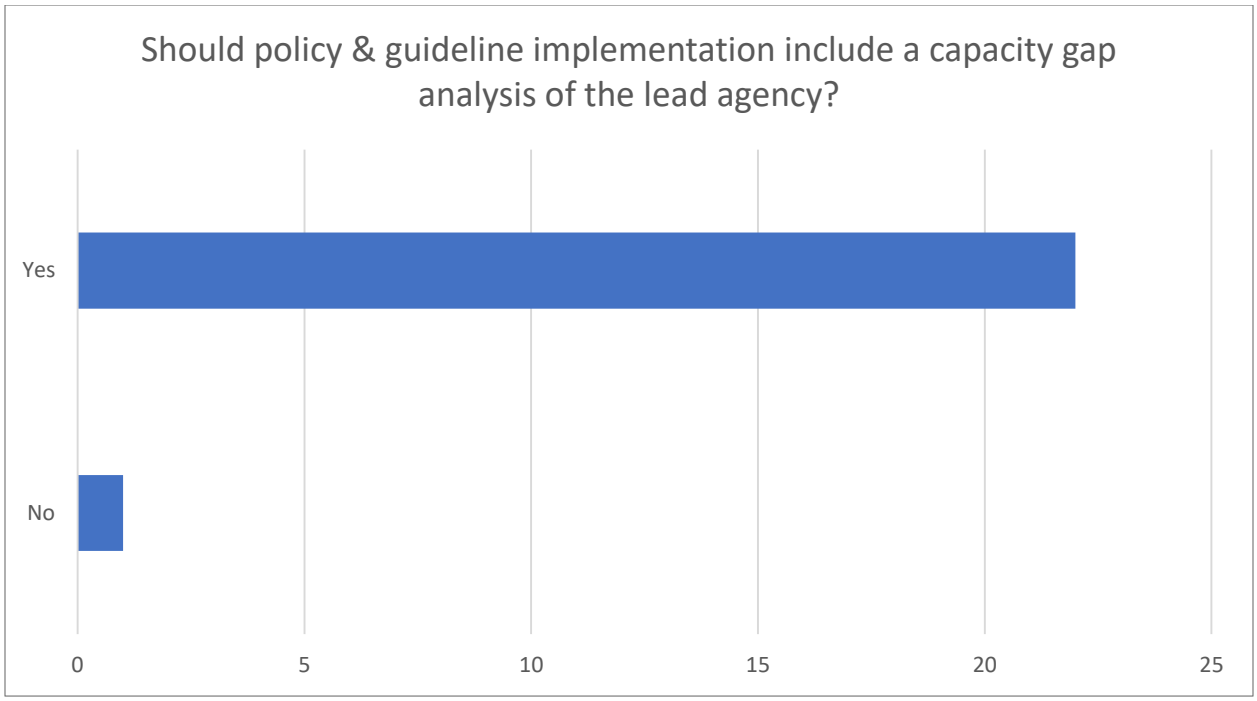
APPENDICES

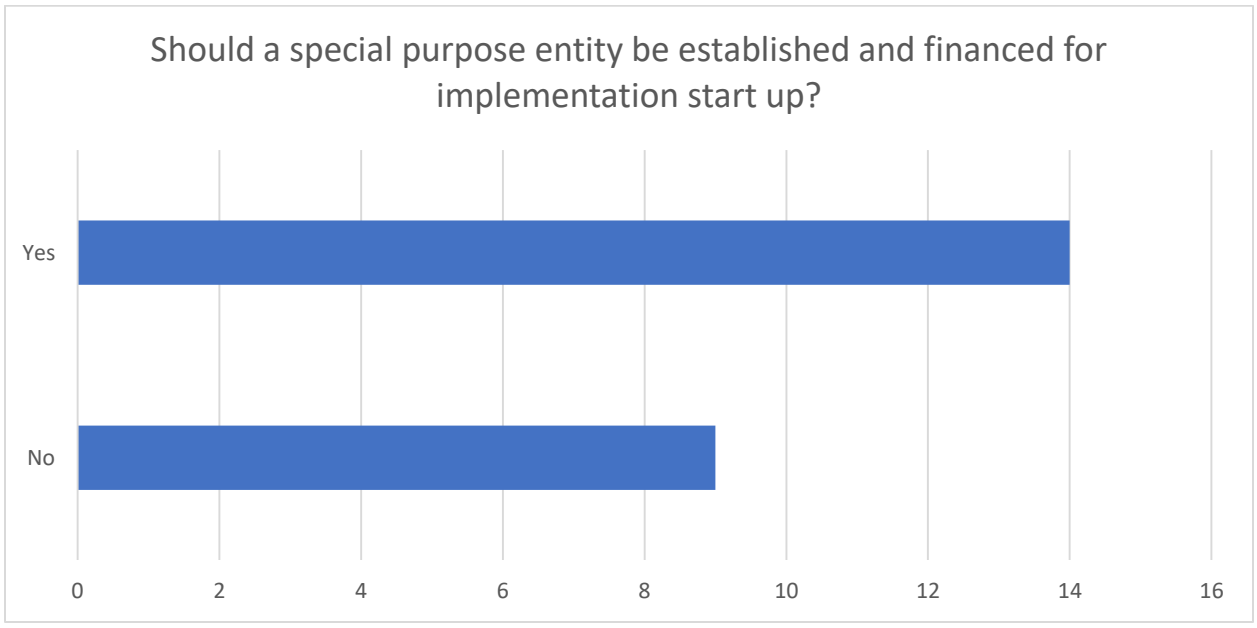
Stakeholder Consultations

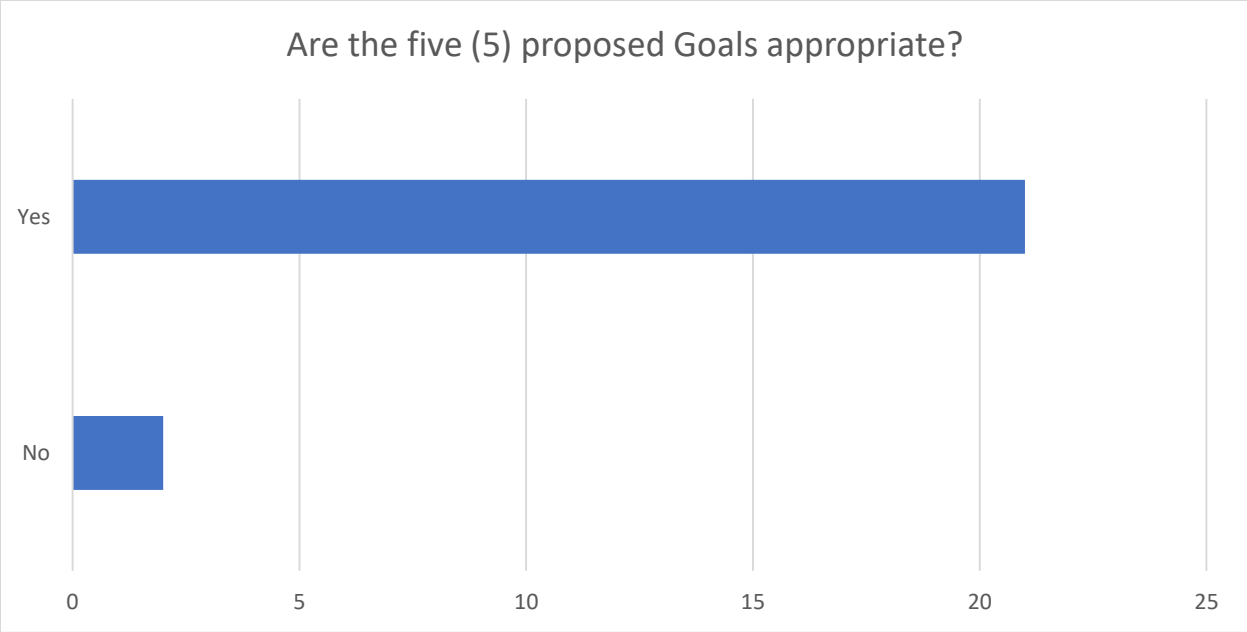
A virtual stakeholder meeting was held on Tuesday, May 16th to present the draft policy and guidelines and to solicit initial feedback from key public and stakeholders. Approximately 50 personnel attended the consultation from the following ministries, agencies, and organizations:

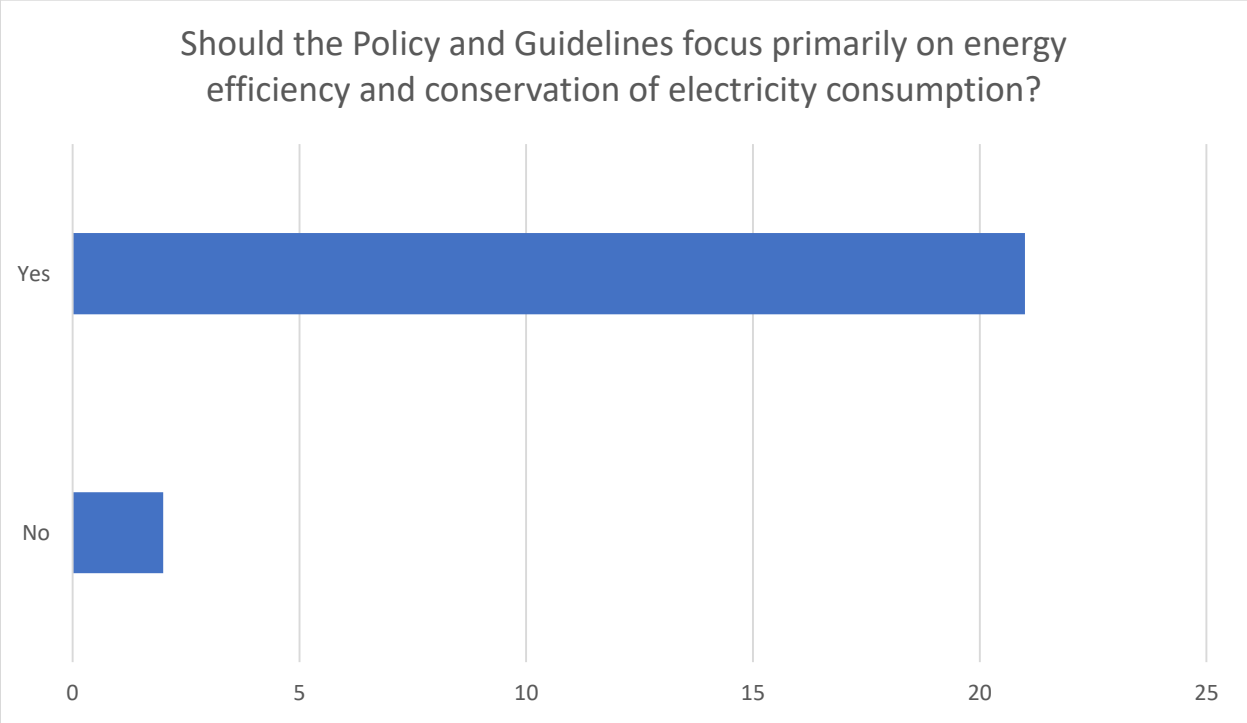
- National Water Commission
- Development Bank of Jamaica
- Ministry of Economic Growth and Job Creation
- National Environment and Planning Agency
- Scientific Research Council
- Bureau of Standards Jamaica
- Planning Institute of Jamaica
- University of Technology Jamaica
- National Works Agency
- Jamaica Institution of Engineers
- Jamaica Society of Energy Engineers
- Ministry of Foreign Affairs and Foreign Trade
- Jamaican Institute of Architects
- National Irrigation Commission

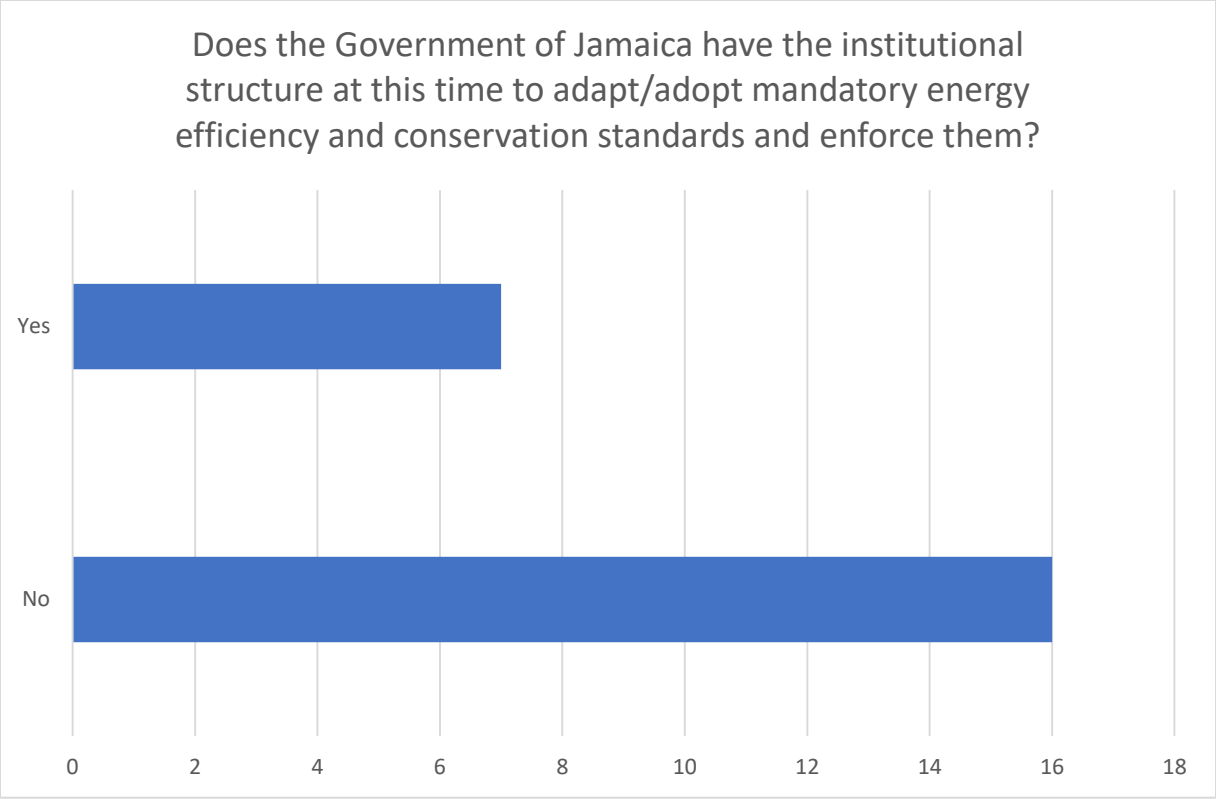
The following series of figures reflect feedback via polls which were conducted during the virtual stakeholder engagement.

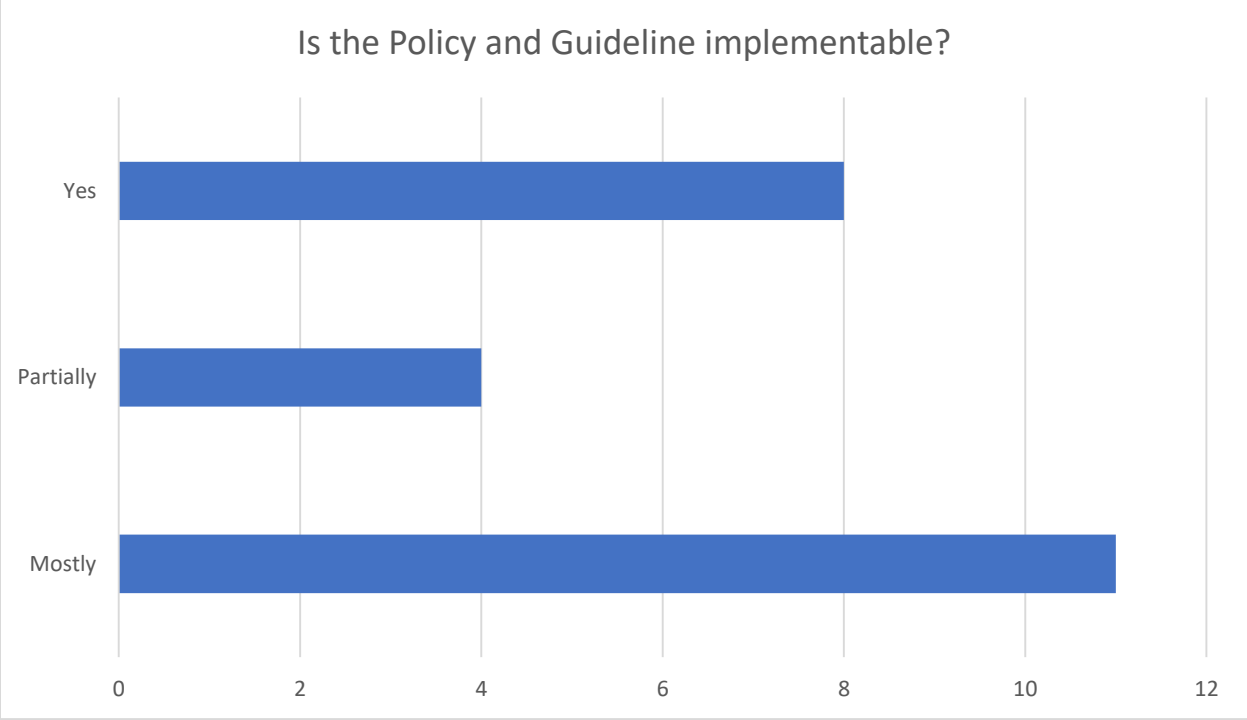

Should policy & guideline implementation include a capacity gap analysis of the lead agency?
Yes
No
0
5
10
15
20
25

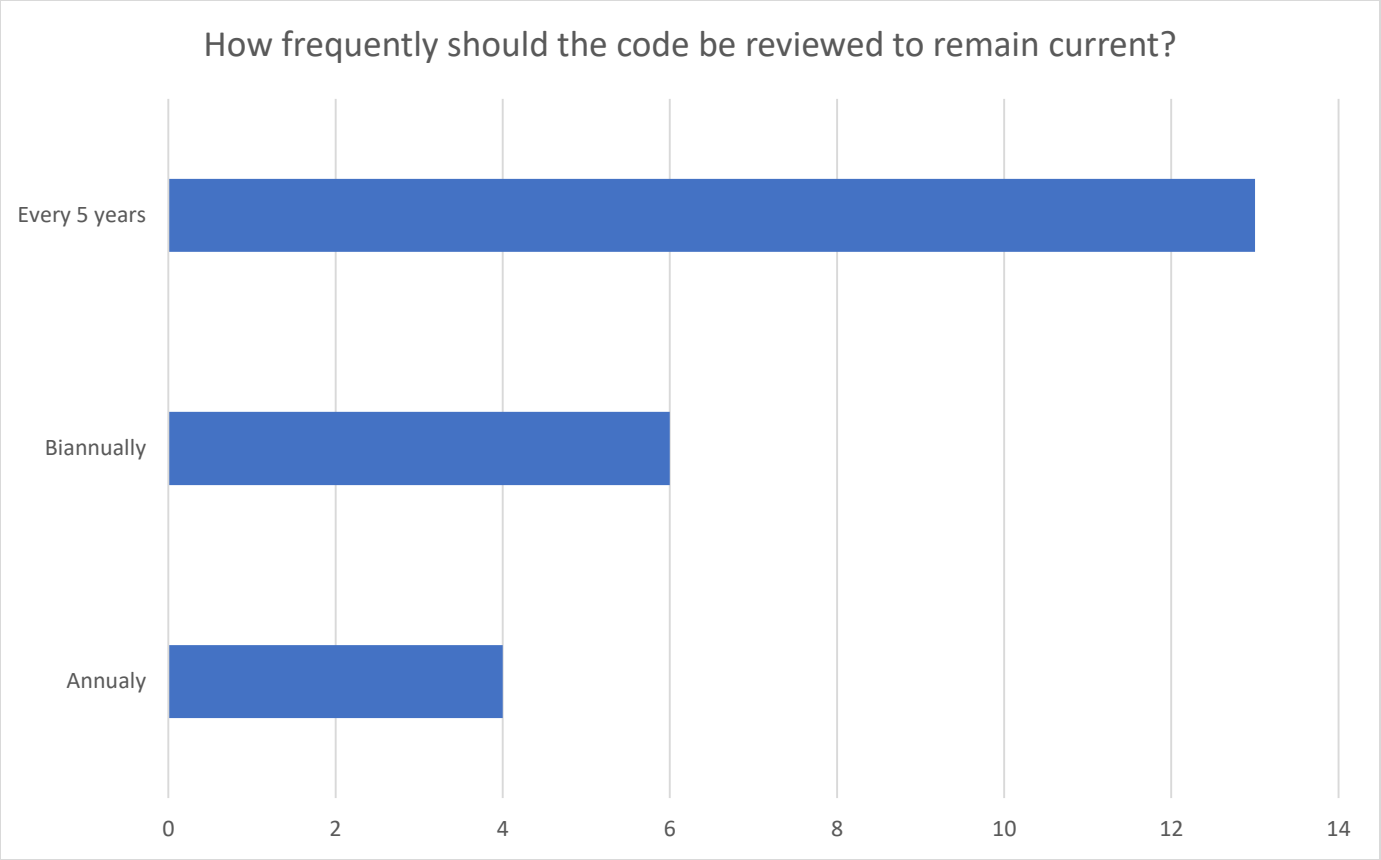

Should a special purpose entity be established and financed for implementation start up?
Yes
No
0
2
4
6
8
10
12
14
16

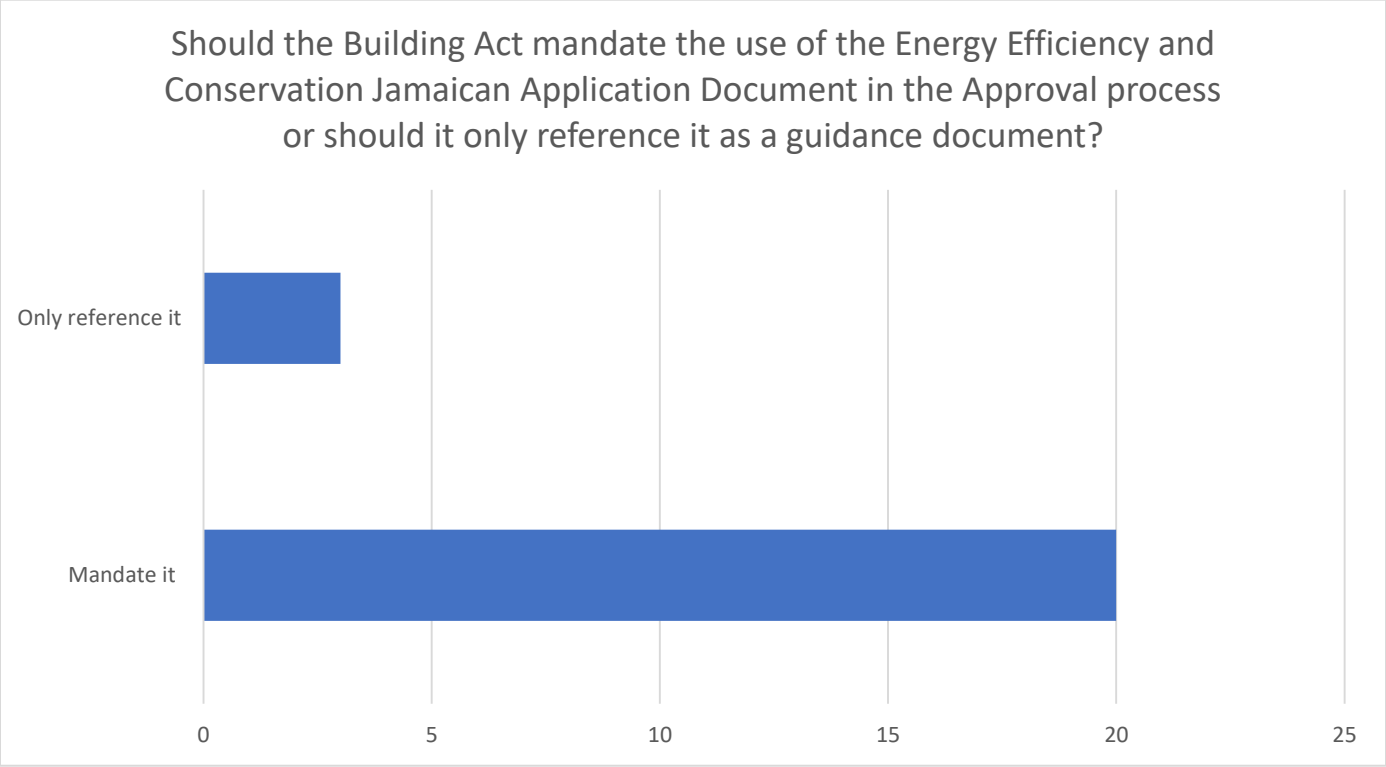

Are the five (5) proposed Goals appropriate?
Yes
No
0
5
10
15
20
25

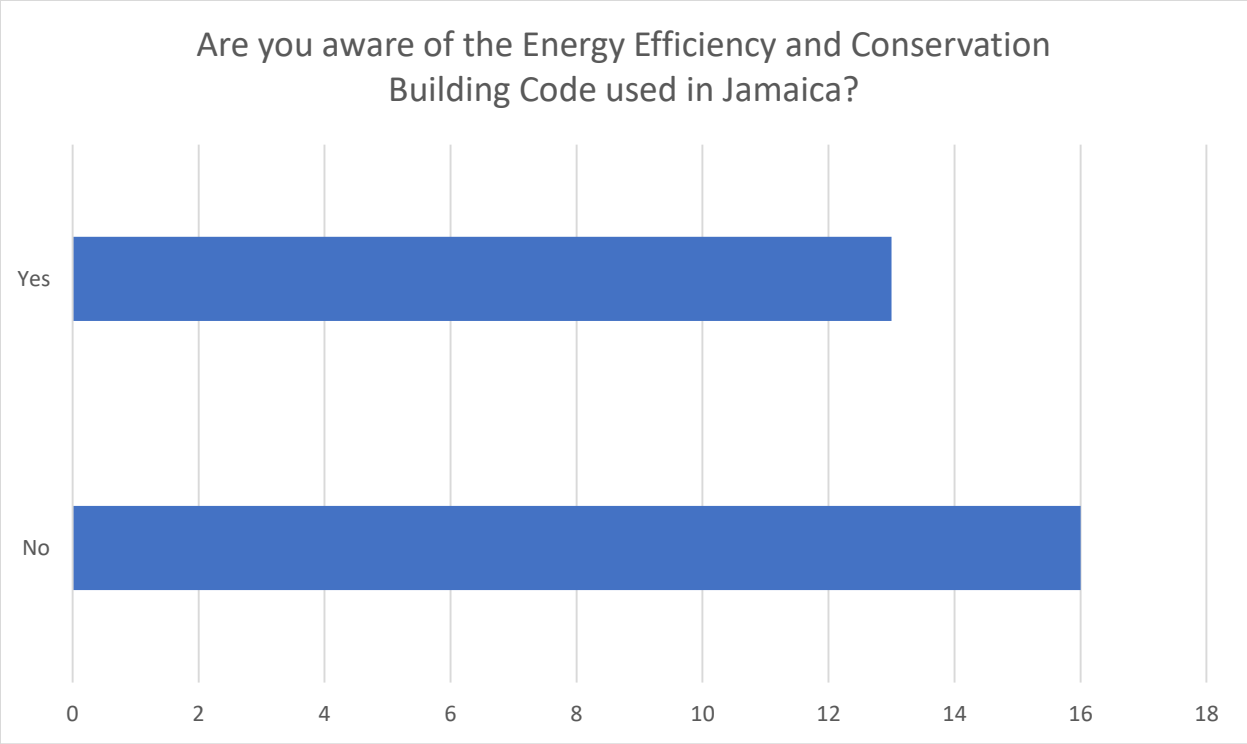

Should the Policy and Guidelines focus primarily on energy efficiency and conservation of electricity consumption?
Yes
No
0
5
10
15
20
25

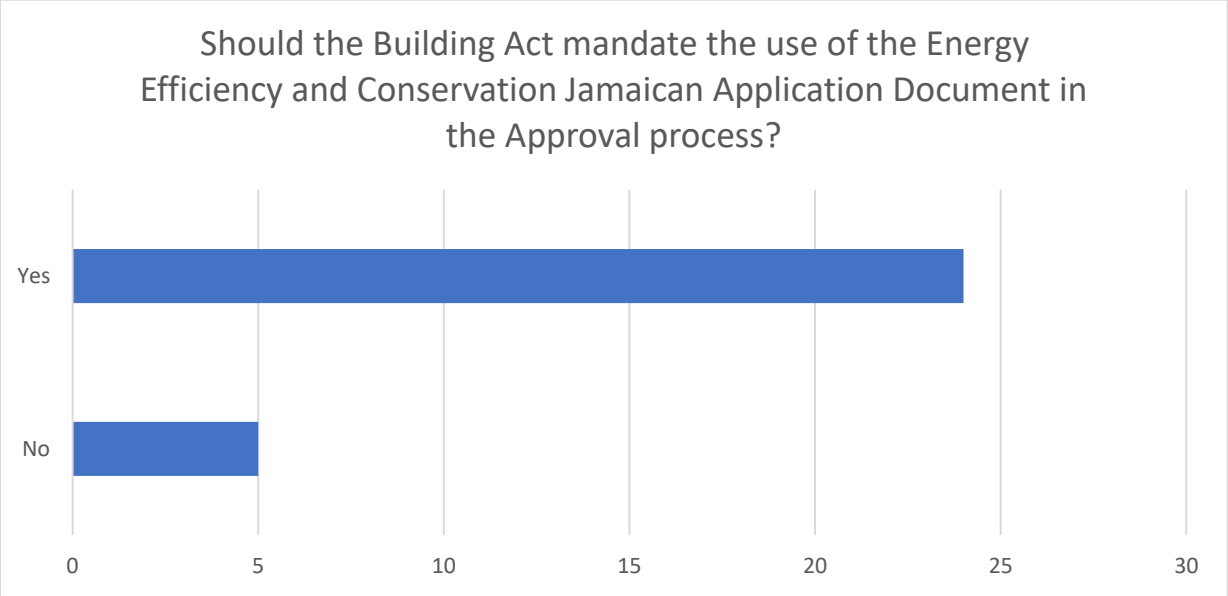

Does the Government of Jamaica have the institutional structure at this time to adapt/adopt mandatory energy efficiency and conservation standards and enforce them?
Yes
No
0
2
4
6
8
10
12
14
16
18

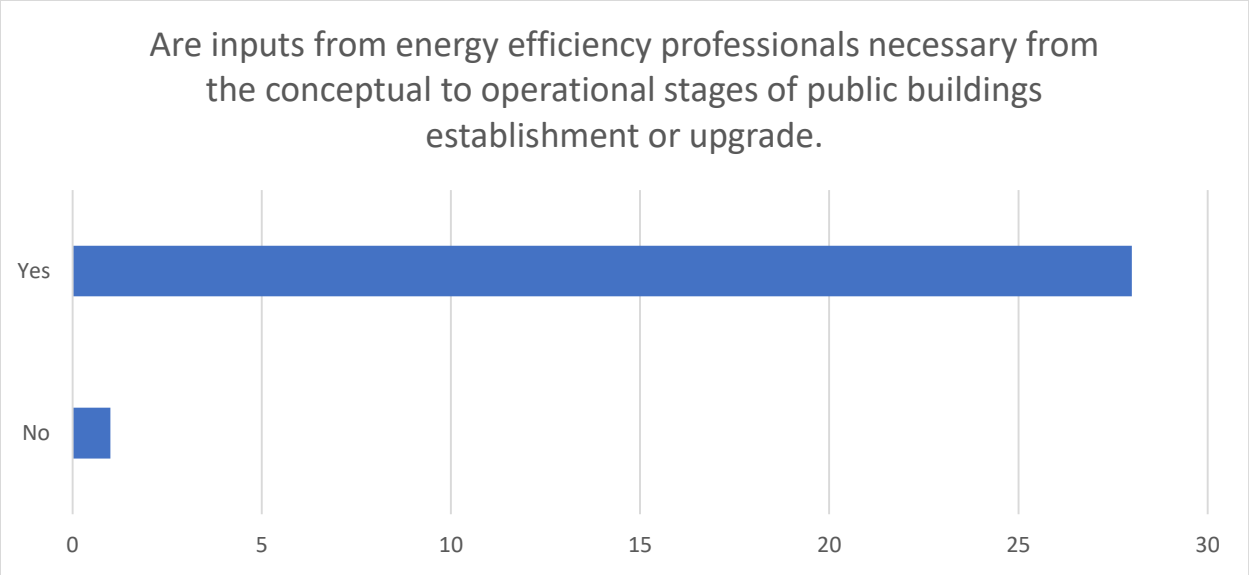

Is the Policy and Guideline implementable?
Yes
Partially
Mostly
0
2
4
6
8
10
12

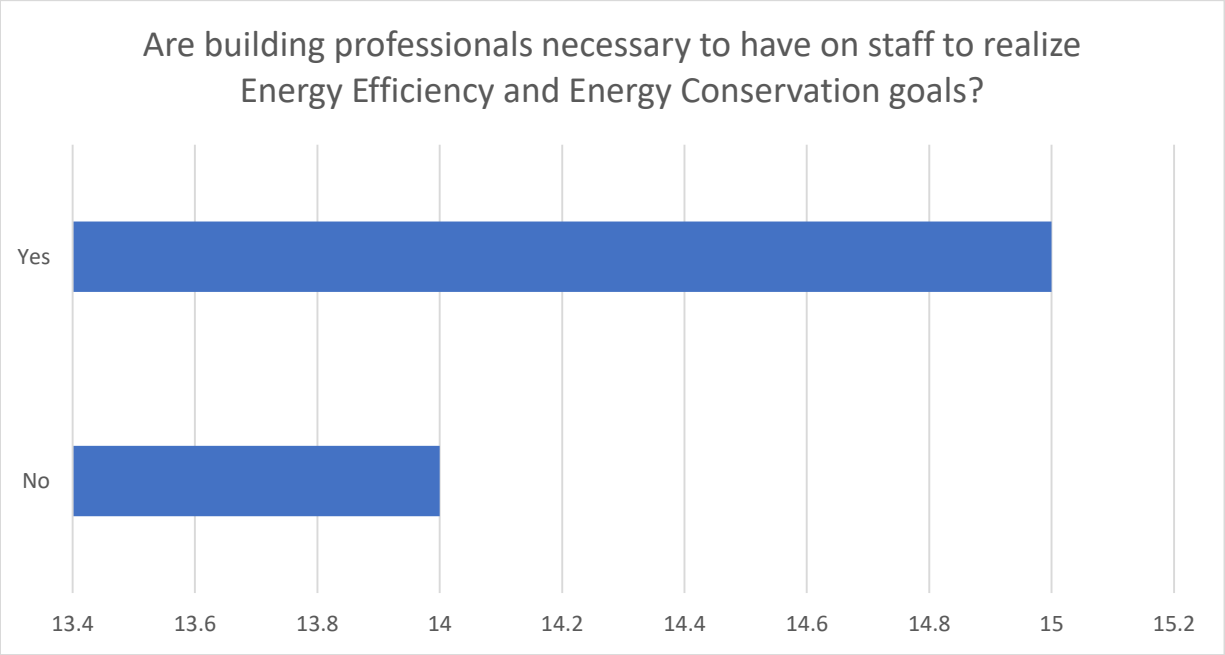

How frequently should the code be reviewed to remain current?
Every 5 years
Biannually
Annualy
0
2
4
6
8
10
12
14

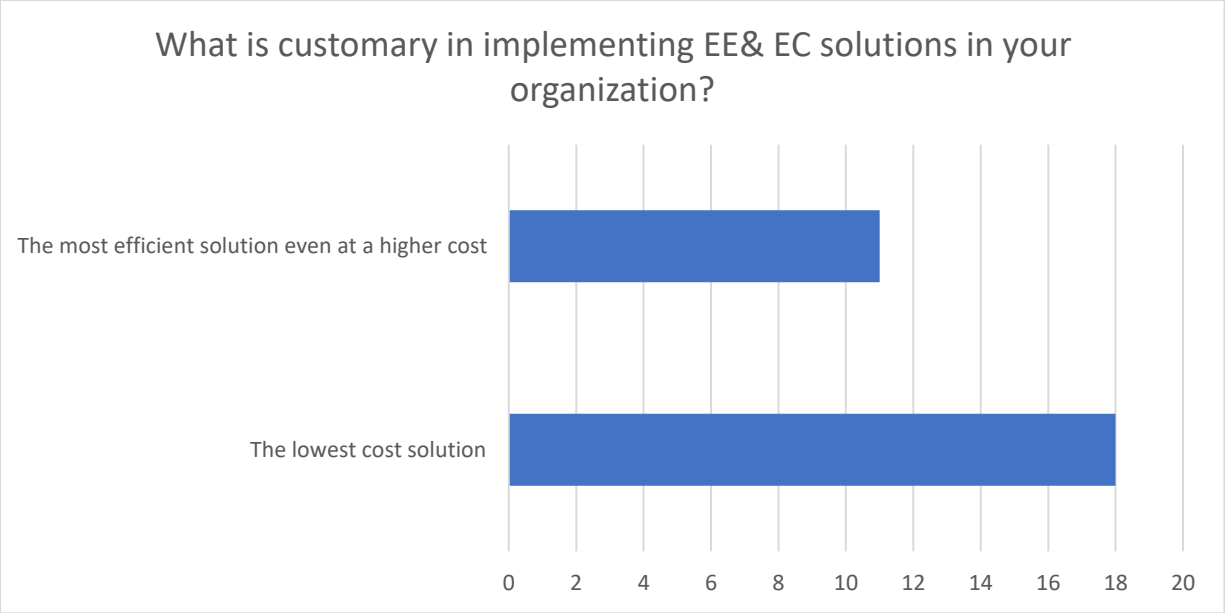

Should the Building Act mandate the use of the Energy Efficiency and Conservation Jamaican Application Document in the Approval process or should it only reference it as a guidance document?
Only reference it
Mandate it
0
5
10
15
20
25


Are you aware of the Energy Efficiency and Conservation Building Code used in Jamaica?
Yes
No
0
2
4
6
8
10
12
14
16
18


Should the Building Act mandate the use of the Energy Efficiency and Conservation Jamaican Application Document in the Approval process?
Yes
No
0
5
10
15
20
25
30


Are inputs from energy efficiency professionals necessary from the conceptual to operational stages of public buildings establishment or upgrade.
Yes
No
0
5
10
15
20
25
30


Are building professionals necessary to have on staff to realize Energy Efficiency and Energy Conservation goals?
Yes
No
13.4
13.6
13.8
14
14.2
14.4
14.6
14.8
15
15.2


What is customary in implementing EE& EC solutions in your organization?
The most efficient solution even at a higher cost
The lowest cost solution
0
2
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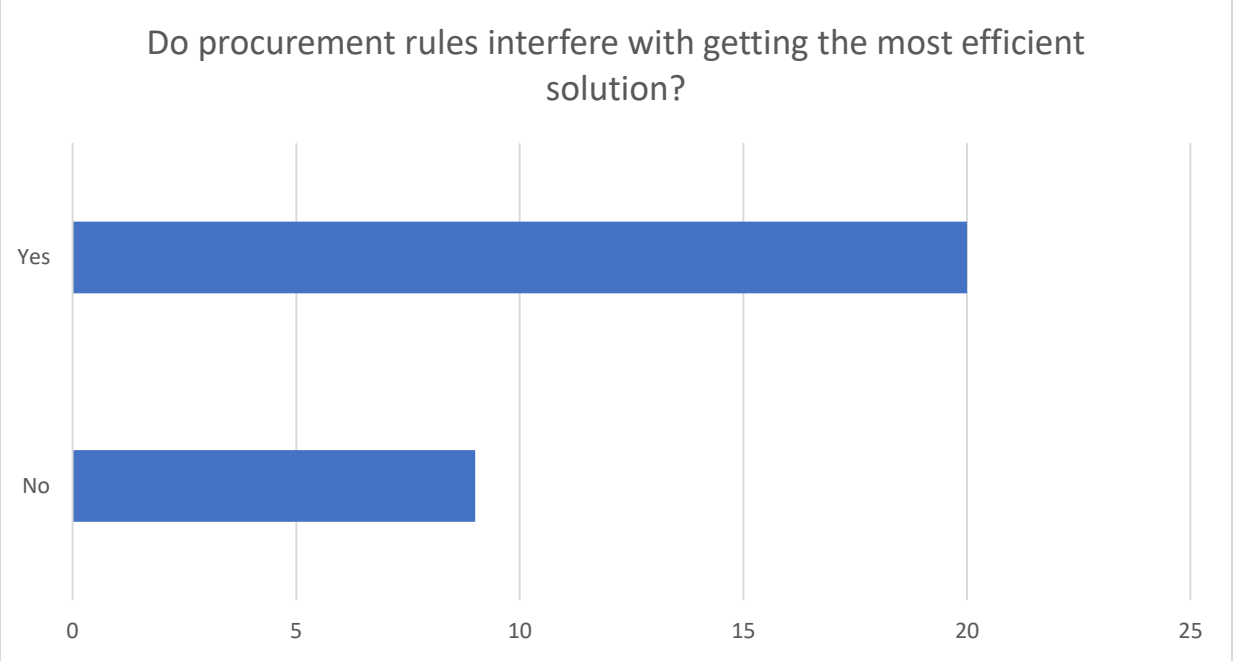
6
8
10
12
14
16
18
20


Do procurement rules interfere with getting the most efficient solution?
Yes
No
0
5
10
15
20
25

Health Facilities Guidelines

It is important to note that medical practitioners, administrators and operators of the facilities all have a role to play in the Energy Efficiency and energy conservation of the facilities they work. As such, an orientation of the policy and guidelines should be provided to all by an energy professional, and in some instances incorporated in their work activities.

The Health Facilities energy efficiency and conservation principles are guided by **JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC). The following are guidelines to consider:

Improving building design, operations and restructuring maintenance procedures to increase energy savings. In this regard, perform detail survey of existing buildings or simulate new buildings, including documenting the configuration and sequencing of operations to increase energy savings

Where applicable (NRCAN 2017):

- Schedule air handling system
- Employ temperature setback during unoccupied hours
- Employ optimum start control
- Confirm lighting control schedule
- Employ static pressure reset
- Correct damper operation
- Lower variable air volume box minimum flow set points
- Calibrate building automation system sensors
- Calibrate operating room ventilation for occupied and unoccupied modes
- Verify steam traps
- Ensure that kitchen equipment is off outside of operating hours
- Repair missing or damaged pipe insulation
- Sequence boilers through controls
- Reset boiler supply temperature
- Sequence chillers through controls
- Employ chilled water reset
- Employ condenser water reset
- Take full advantage of available cooling towers
- Optimize boiler blowdown and combustion air control

The following four measures apply to equipment serving administrative, out-patient and other day-use areas of the hospital. These **do not** apply to patient care areas.

Schedule air handling system: Equipment that runs longer than necessary wastes energy. Equipment schedules are often temporarily extended, then forgotten. Although much of the hospital has

24/7 occupancy for patient care, some areas are occupied only during daytime hours, and the ventilation system can be scheduled off during unoccupied periods. Check equipment scheduling in the building controls (or operational procedures) to ensure that it matches occupancy as closely as possible.

Employ temperature setback during unoccupied hours: One of the most cost effective means of reducing energy consumption is by modifying the temperature set point of the building when portions are empty, i.e. letting the thermostat go above the occupied period set point during the cooling season. Setback temperatures typically range from 2 to 5 °C; however, the actual appropriate setback levels depend on the recovery time of your facility's HVAC equipment, i.e. the time it takes to bring the space temperature back to a comfortable level before occupants arrive. Review the set points for cooling during unoccupied hours to ensure that setback temperatures are in place.

Employ optimum start control: Many buildings direct digital control (DDC) systems have an optimum start control feature that, when enabled, reduces energy use by starting the building HVAC system so that the occupied set point is reached just as occupants arrive. If a DDC is not in place, operational procedures of the facility should include in the building operations as part of the facilities management.

Confirm lighting control schedule: Confirm that the lighting control schedule matches the actual occupancy. Controls (where they exist) should typically be configured to turn interior lights off at a set time, but not on; staff are expected to turn lights on when they arrive in the morning.

The remaining measures apply to equipment serving the majority of hospital areas.

Employ static pressure reset: Supply fans on variable air volume (VAV) systems (where applicable) are often controlled to maintain static pressure within ductwork at a single set point. A more efficient strategy, and one that is required by ASHRAE Standard 90.1-2013, is to use DDC to reset the pressure set point based on the zone requiring the most pressure. The static pressure set point can be automatically reset through a zone-level control feedback loop, which allows the supply fan to maintain the minimum air flow needed to keep individual zone conditions comfortable. Static pressure reset is an extremely effective method of reducing fan energy in VAV systems.

Correct damper operation: For systems with zone dampers (VAV), periodically inspect the dampers, linkages and actuators for proper operation. In older buildings, where maintenance has not been rigorous, some zone dampers may be stuck in a fixed position, rendering them ineffective at regulating comfort. Evaluating and repairing them can be time consuming and costly (especially in large buildings that may have many of zones), but by inspecting a portion of zone dampers as part of your ongoing commissioning program, all dampers will be inspected within a given cycle (e.g. every five years)

Lower variable air volume box minimum flow set points: VAV box manufacturers typically list a minimum recommended air flow set point for each box size and for each standard control option. However, when DDC is employed, the actual controllable minimum set point will depend on the specific requirements of the space involved and is usually much lower than the manufacturer's scheduled minimum. Reducing the minimum set point will result in lower fan power requirements

Calibrate building automation system (BAS) sensors: Building automation systems (where applicable) rely on the information provided to them by various sensors throughout the building. Sensors for temperature, carbon dioxide and enthalpy (total energy content of air) are just a few examples. If the

critical sensors in a building are inaccurate (i.e. out of calibration), the building systems will not operate efficiently, costs will increase and comfort issues can result.

Calibrate operating room ventilation for occupied and unoccupied modes: A typical operating room ventilation system delivers 20 to 25 air changes per hour (ACH) in occupied mode with 4 ACH of outside air; many older designs have air changes in excess of 30 ACH. Reducing the volume of air treated will not only reduce the cooling energy, but the humidification-related energy as well. For example, a typical operating room HVAC system manages humidity in the cooling season by supplying air as low as 11 °C, then reheating it to room temperature – an energy intensive practice.

ASHRAE Standard 170[14] requires operating rooms to have a minimum of 20 ACH. ASHRAE Standard 170 also allows the number of air changes to be reduced by up to 90% "when the space is unoccupied, providing that the required pressure relationship to adjoining spaces is maintained while the space is unoccupied and that the minimum number of air changes indicated is reestablished any time the space becomes occupied.

Verify steam traps: Many hospitals generate and use steam for heating and sterilization. Steam traps are essentially automatic valves that discharge condensate from the steam flow and maintain the proper operation of the steam distribution system. Because steam traps are exposed to harsh conditions, they will eventually leak or fail. When they fail in the open position or leak, energy is wasted from the loss of steam heat. One malfunctioning trap can cost thousands of dollars in wasted steam annually. Traps that fail in the closed position do not cause energy or water losses, but can cause significant capacity reduction and damage to the system.

Approximately 20% of steam delivered by a central boiler is typically lost due to failed and leaking traps in existing buildings[15]. Depending on the size of your boiler plant, this can waste tens or even hundreds of thousands of energy dollars annually. Facility Management should conduct a steam trap audit, using the services of a technician specifically trained in steam systems.

Ensure that kitchen equipment is off outside of operating hours: Commercial kitchens are intense consumers of energy and water. Equipment such as ovens and hood exhaust fans are often left on for convenience during the course of the day and subsequently can be left on after the kitchen is closed.

Repair missing or damaged pipe insulation: Routine inspections of heating and cooling pipe insulation can identify spots that require repair. Without insulation, energy is wasted in the form of standby losses and cycling losses (e.g. heat loss for hot water supply or sterilization as hot water cycles through pipes).

Sequence boilers through controls: With multiple boilers, it is important to stage them in a manner whereby each boiler operates as efficiently as possible for the given load. Solar hot water heaters where appropriate should be used to complement boiler usage.

Reset boiler supply temperature: During hotter ambient conditions, facility heating loads can often be met with lower heating water temperatures. Resetting the supply water temperature based on outdoor air temperature helps match boiler output to the actual load and results in energy savings.

[14] ASHRAE Standard 170, article 7.1-subsection 1c

[15] U.S. Department of Energy by the Pacific Northwest National Laboratory. July 1999. *Steam Trap Performance Assessment*. DOE/EE-0193.

Sequence chillers through controls: With multiple chillers, it is important to stage them in a manner whereby each chiller operates as efficiently as possible for the given load.

Employ chilled water reset: As outdoor temperatures and humidity rise, the temperature of the chilled water needs to be colder to overcome the internal loads. Conversely, as outdoor temperatures and humidity decrease, the chilled water temperatures should increase to prevent overcooling and support occupant comfort. This strategy helps match chiller output to the actual load. Energy and demand savings can be realized by allowing chilled water temperatures to increase when conditions permit.

Employ condenser water reset: Allowing condenser water temperatures to rise decreases the cooling tower fan power and increases the chiller power. As shown in Figure 8, the optimum operating temperature occurs at the point where these two opposing trends combine to produce the lowest total power use. However, the point of lowest power usage changes depending on outdoor conditions (e.g. temperature, humidity). By implementing a reset schedule, condenser water temperatures can vary according to the outdoor conditions to maintain operations at or near the point of lowest system power requirements

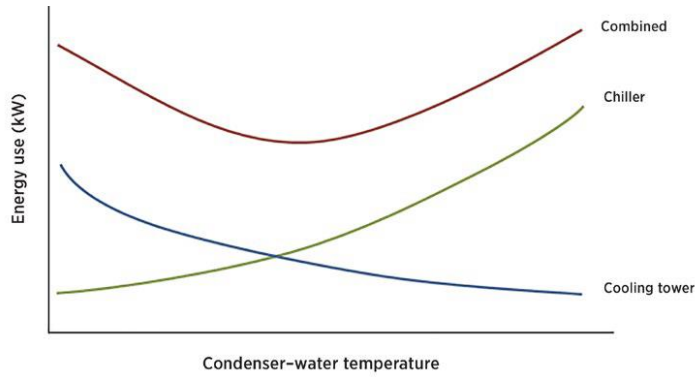


Figure 8: Energy Impact of condenser water temperature

Take full advantage of available cooling towers: Most chilled water plants have excess capacity, with one or more cooling towers not operating during low-load periods. To make the most of existing cooling towers, simply run condenser water over as many towers as possible, as often as possible, and at the lowest possible fan speed. This strategy is only available for chilled water systems that have the ability to vary the speed of the cooling tower fans and that include multiple chillers and cooling towers plumbed in parallel.

Optimize boiler blowdown and combustion air control: Blowdown controls the buildup of solids in the boiler water; it protects the boiler's surfaces, enhances heat transfer (thus saving energy) and ensures a safe chemical concentration. Combustion efficiency is affected by accumulation of soot and other fouling in the combustion area and by excess combustion air. Proper tuning can extend boiler life and save significant energy. For example, for every 15% reduction in excess combustion air, boiler efficiency is improved by 1%.

Educational Facilities Guidelines

It is important to note that students, teachers, lecturers, administrators and operators of the facilities all have a role to play in the Energy Efficiency and energy conservation of the

facilities they work or attend. As such, an orientation of the policy and guidelines should be provided to all by an energy professional, and in some instances incorporated in the teaching curriculum of the students.

The Educational Facilities energy efficiency and conservation principles are guided by **JS 309:2019 –** Application Document for the International Energy Conservation Code being revised with the CARICOM Regional Energy Efficiency Code (CREEBC). The following are guidelines to consider:

Improving building design, operations and restructuring maintenance procedures to increase energy savings. In this regard, perform detailed survey of existing buildings or simulate new buildings, including documenting the configuration and sequencing of operations to increase energy savings.

Where applicable (NRCAN 2017) [14]:

- Confirm lighting control schedule
- Schedule air handling system
- Employ temperature setback during unoccupied hours
- Reset supply air temperature
- Test and adjust ventilation flow rates
- Employ static pressure reset
- Correct damper operation
- Lower variable air volume box minimum flow set points
- Calibrate building automation system sensors
- Repair missing or damaged pipe insulation

Confirm lighting control schedule: Confirm that the lighting control schedule matches the actual occupancy, and explore opportunities to reduce hours of operation by reducing or eliminating after-hours activities (e.g. cleaning) by moving them to existing occupied hours. Controls should typically be configured/schedule (or operations personnel) to turn interior lights off at a set time, but not on; staff are expected to turn lights on when they arrive in the morning.

Schedule air handling system: Equipment that runs longer than necessary wastes energy. Equipment schedules are often temporarily extended, then forgotten. Check that equipment scheduling in the building controls, mechanical timeclocks or thermostat settings matches occupancy as closely as possible.

Employ temperature setback during unoccupied hours: One of the most cost-effective means of reducing energy consumption is by modifying the temperature set point of the building when it is empty, i.e. letting the thermostat setting go below the occupied period set point during the heating season, and above it during the cooling season. Setback temperatures typically range from 2 to 5 °C; however, the actual appropriate setback levels depend on the recovery time of your facility's HVAC equipment, i.e. the time it takes to bring the space temperature back to a comfortable level before staff and students arrive for the day. Review the set points for cooling during unoccupied hours to ensure that setback temperatures are in place.

Reset supply air temperature: Moderate weather, typically in the cooler months, permits a warmer supply air set point for cooling.

Test and adjust ventilation flow rates: School ventilation rates should meet the requirements of ASHRAE Standard 62.1. These requirements are set to maintain healthy indoor air quality (IAQ), something that is particularly important for schools. Poor IAQ impacts student performance and tends to affect younger children more than adults. Energy can be saved by ensuring that ventilation rates do not exceed ASHRAE requirements.

Employ static pressure reset: Supply fans on variable air volume (VAV) systems are often controlled to maintain static pressure within ductwork at a single set point. A more efficient strategy, and one that is required by ASHRAE 90.1-2010, is to use direct digital controls (DDC) (or manually) to reset the pressure set point based on the zone requiring the most pressure. The static pressure set point can be automatically reset through a zone-level control feedback loop, which allows the supply fan to maintain the minimum air flow needed to keep individual zone conditions comfortable. Static pressure reset is an extremely effective method of reducing fan energy in VAV systems.

Correct damper operation: For systems with zone dampers (VAV), periodically inspect the dampers, linkages and actuators for proper operation. In older buildings, where maintenance has not been rigorous, some zone dampers may be stuck in a fixed position, rendering them ineffective at regulating comfort. Evaluating and repairing them can be time consuming and costly (especially in larger institutions like the Universities), but by inspecting a portion of zone dampers as part of your ongoing commissioning program, all dampers will be inspected within a given cycle (e.g. every two years).

Lower variable air volume box minimum flow set points: VAV box manufacturers typically list a minimum recommended air flow set point for each box size and for each standard control option. However, when DDC is employed (or manually through Standard operating procedures), the actual controllable minimum set point will depend on the specific requirements of the space involved and is usually much lower than the manufacturer's scheduled minimum. Reducing the minimum set point will result in lower fan power requirements.

Calibrate building automation system sensors: Building automation systems rely on the information provided to them by various sensors throughout the building. Sensors for temperature, CO_2 and enthalpy (total energy content of air) are just a few examples. If the critical sensors in a building are inaccurate (i.e. out of calibration), the building systems will not operate efficiently, costs will increase and comfort issues can result.

Repair missing or damaged pipe insulation: Routine inspections of heating and cooling pipe insulation can identify spots that require repair. Without insulation, energy is wasted in the form of standby losses and cycling losses (e.g. heat loss in unoccupied spaces as chill water cycles through pipes).

Summary of Recommended Audit Energy Conservation Measures (ECMs)

Table 8: Audit Intervention Summary:

Audit Location	Building Design	RECOMMENDED ECMs									
		Maintenance	Lighting Retrofits	Lighting controls	Ventilation (Fans/ Other)	Building Automation Systems	Solar PV	Water Management/ RWH	HVAC/AC	Plug Loads/ Miscellaneous Equipment	Building Envelope
St Ann Bay Hospital	Metal roofing. Block and steel. Bricks.	Preventative maintenance and repairs for equipment.	Convert to LED	lighting controls	Replace inefficient equipment. Fans – IPMP and ASHRE Guideline 14 for developing M&V Plan; ENERGY STAR®. National Building Code; ASHRE HVAC Design for Hospitals and Clinics;	Install Building Energy Management System (BEMS) ANSI/ASHRE 135 Standard.	630 kW Modules - IEC 61215; 61853; 61730; UL 1703; EN 61730-2:2007; IEC 60364-4-41; 61701; 62804; 61345; CE conformity. Inverters - EN 50524; 50530; UL 1741; IEC 61683; IEC 62109-1 and 2; IEC 61000-6-2;	Water fixture replacement and RWH (3.3 million L/annum)	Upgrade AC units to higher EER (EER 11 – 13)/or SEER. ENERGY STAR®. National Building Code; ASHRE HVAC Design for Hospitals and Clinics; ASHRE 90.1; 170; 55; 62.1	Energy efficient ratings e.g., ENERGY STAR® ratings and use of power settings.	Air tightness and roof insulation.

Audit Location	Building Design	RECOMMENDED ECMs									
		Maintenance	Lighting Retrofits	Lighting controls	Ventilation (Fans/ Other)	Building Automation Systems	Solar PV	Water Management/ RWH	HVAC/AC	Plug Loads/ Miscellaneous Equipment	Building Envelope
					ASHRE 90.1; 170; 55; 62.1		IEC 61000-6-4; IEC 62116.2014; IEC 61727:2004.				
Bustamante Children's Hospital		Preventative maintenance and repairs for equipment (compressors; AC; refrigerant other)	Convert to LED. Illumination Engineering Society of North America (IES) LM-80 & IES TM-21; Luminous efficacy IES LM-79	lighting controls (vacancy sensors).	Replace inefficient equipment. Fans – IPMP and ASHRE Guideline 14 for developing M&V Plan; ENERGY STAR®. National Building Code; ASHRE HVAC Design for Hospitals	Instal Building Energy Management System (BEMS) ANSI/ASHRE 135 Standard.	2,450 kW Modules - IEC 61215; 61853; 61730; UL 1703; EN 61730-2:2007; IEC 60364-4-41; 61701; 62804; 61345; CE conformity. Inverters - EN 50524; 50530; UL 1741; IEC 61683; IEC 62109-1	Water fixture replacement and RWH (4.38 million L/annum). All shower heads and faucets at 1.5 GPM; toilets at 0.8 GPF.	Upgrade AC units to higher EER (EER 11 – 13)/or SEER. ENERGY STAR®. National Building Code; ASHRE HVAC Design for Hospitals and Clinics; ASHRE 90.1; 170; 55; 62.1; 55 BTU/sq. ft PCJ recommendation).	Energy efficient ratings e.g., ENERGY STAR® ratings and use of power settings.	Air tightness and roof insulation (R-13); ASHRE 90.1; National Building Code. Fenestration to reduce radiation. Passive cooling options (wall colour; ventilation;

Audit Location	Building Design	RECOMMENDED ECMs									
		Maintenance	Lighting Retrofits	Lighting controls	Ventilation (Fans/ Other)	Building Automation Systems	Solar PV	Water Management/ RWH	HVAC/AC	Plug Loads/ Miscellaneous Equipment	Building Envelope
					and Clinics; ASHRE 90.1; 170; 55; 62.1		and 2; IEC 61000-6-2; IEC 61000-6-4; IEC 62116.2014; IEC 61727:2004. Use OEM MC4 connectors. DC cables rated at $\geq 90^0$C Use Photovoltaic Installation Guide 2012 (Jamaica)				landscaping; shading etc).
Ebony HEART Trust Academy	Concrete block and steel walls;		Convert to LED tubes. Solar tubes and	Occupancy / Motion sensors.		Programmable Building Energy Management	106 – 775 kW.		High efficiency inverter technology AC; improve air flow	Vacancy sensors; programmable advanced	Air seals for all openings; automatic

Audit Location	Building Design	RECOMMENDED ECMs									
		Maintenance	Lighting Retrofits	Lighting controls	Ventilation (Fans/ Other)	Building Automation Systems	Solar PV	Water Management/ RWH	HVAC/AC	Plug Loads/ Miscellaneous Equipment	Building Envelope
	slab or metal roofs with or without ceiling.		transparent roofing.			System (BEMS). Programmable thermostats and lighting controls. Submetering for M&V.			behind condensers.	power strips. ENERGY STAR® appliances.	door closers; double-glazed windows.
PCJ Building	Concrete block and steel. Slab roof (2015). Glass windows. Atrium.		Use of natural illumination.			Install full BEMS.	Repair storage system. Replace battery with 1.8 kW battery. Repair solar street lights.	Add Jockey pump to Fire suppression pump motor pressurized system.	Use condenser supply water temperature based on ambient wet bulb settings for chillers. Repair AC ductworks.		
Marcus Garvey Technical High School	Block and steel walls; slab and metal roofing.		Convert to LED; solar tubes	Occupancy Light sensors; exterior light		Programmable Building Energy Management System (BEMS).	36-520 kW	RWH 2.54 million gallons/annum; SWH system.	High efficiency inverter technology split units; improve air flow behind condensing units;	Vacancy sensors; programmable advanced power strips. ENERGY	Air seals for all openings; automatic door closers;

Audit Location	Building Design	RECOMMENDED ECMs									
		Maintenance	Lighting Retrofits	Lighting controls	Ventilation (Fans/ Other)	Building Automation Systems	Solar PV	Water Management/ RWH	HVAC/AC	Plug Loads/ Miscellaneous Equipment	Building Envelope
				timing controls.		Programmable thermostats and lighting controls. Submetering for M&V.			programmable timers.	STAR® appliances.	double-glazed windows.