



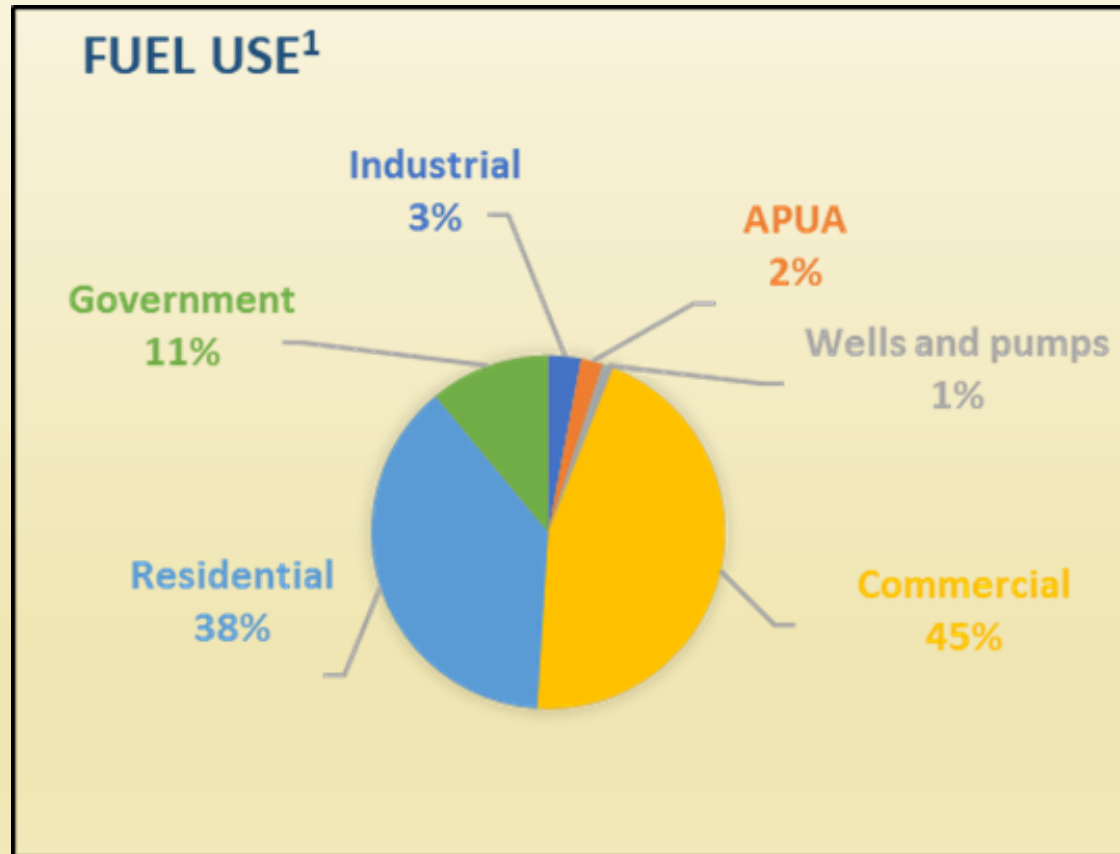
CARICOM REGIONAL ENERGY EFFICIENCY BUILDING CODE

WHY THE CREEBC IS IMPORTANT FOR THE BUILDING SECTOR?

CHURCHILL NORBERT - CEM

FOSSIL FUEL USE BY SECTOR

SOURCE: 2017 ENERGY REPORT CARD – ANTIGUA AND BARBUDA



2016 - 2018 FOSSIL FUEL PURCHASED BY SECTOR IN ANTIGUA AND BARBUDA

SOURCE: WEST INDIES OIL COMPANY

SECTORS	VOLUME 2016 (barrels)	VOLUME 2017 (barrels)	VOLUME 2018 (barrels)	AVERAGE (%)
Electricity	517,253.00	508,655.00	514,479.91	49
Government	25,949.00	28,660.00	31,462.92	3
Gas Stations-WIOC	179,147.00	188,802.00	207,316.25	18
Gas Stations-RUBIS	196,490.00	195,780.00	191,693.59	18
Hotels & Restaurants	33,527.00	30,292.00	26,177.49	3
Marinas	58,320.00	64,246.00	79,027.49	6
Other Consumers/ Commercial	30,682.44	33,894.29	31,096.27	3
Total	1,041,368.44	1,050,329.29	1,081,254.32	

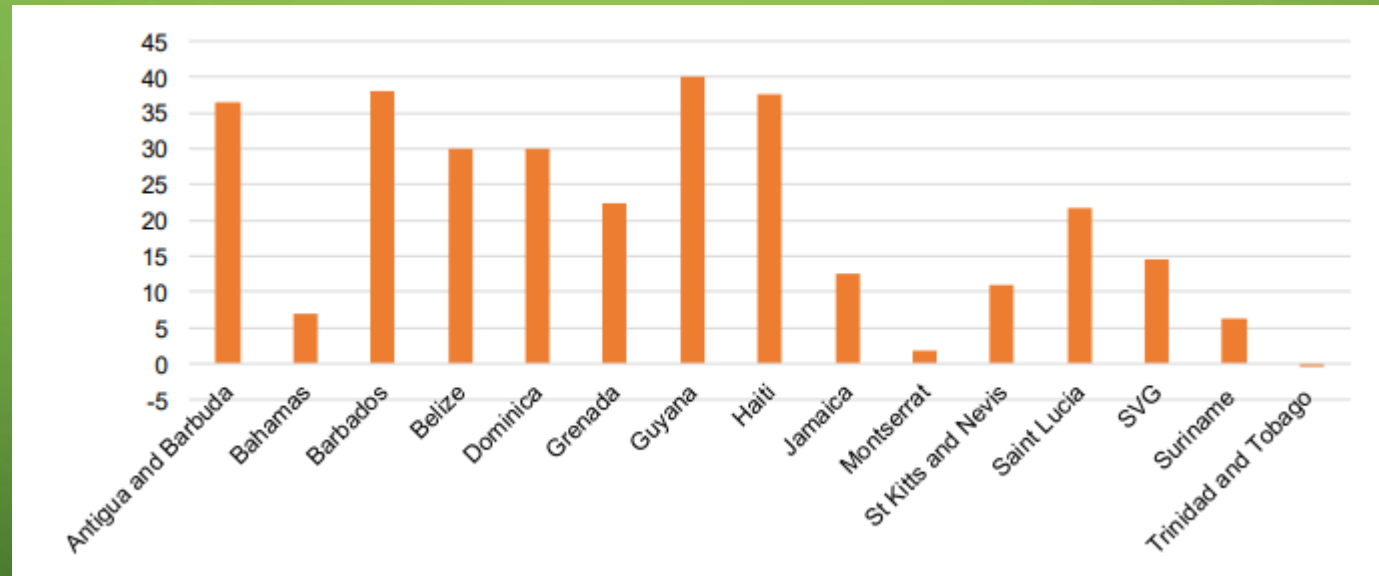
ANTIGUA AND BARBUDA EE TARGETS AND POTENTIAL SAVINGS BY 2030

SOURCE: ECONOLER 2019 REPORT

Sectors	Energy Demand BAU (TJ)	Energy Demand Reduced by EE (TJ)	EE Savings (%)
Residential	1,749.0	532.7	30
Industrial	206.1	93.6	45
Government	503.4	265.3	53
Commercial & Tourism	3,291.9	1,517.8	46
Transportation	4,837.3	1,934.9	40

EXPECTED FUEL SUPPLY DEMAND INCREASE IN CARICOM MEMBER STATES FROM 2019-2035 (%)

SOURCE: ECONOLER 2019 REPORT



REGIONAL BENEFITS OF ADOPTING OPTIMAL SCENARIOS

SOURCE: ECONOLER 2019 REPORT

Scenarios	For 2035		For 2020-2035			
	Total Primary Oil Demand (TJ)	Oil Savings (%)	Cumulative Oil Savings (M USD)	Avoided Costs (M USD)	Incremental Investment Costs (M USD)	BCR
BAU-1: Fossil-based Supply	1,089,735					
CARICOM Optimal Scenarios	786,535	28%	45,647	2,537	20,286	2.6

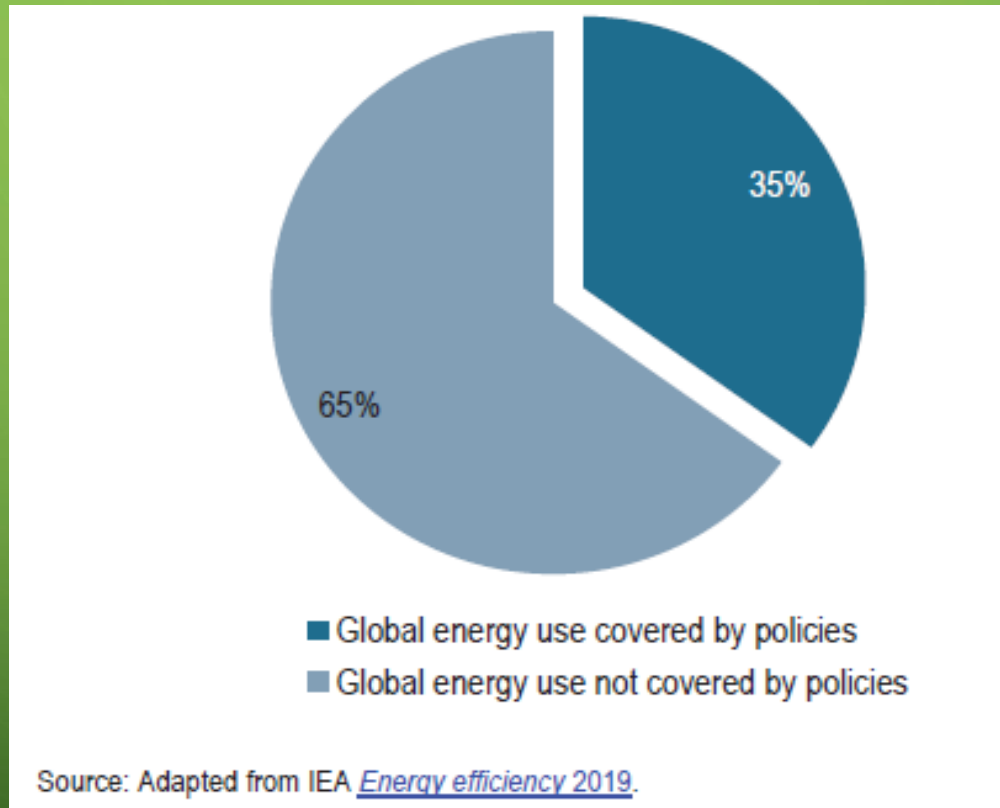
PRIORITY SECTORS AND EE TARGETS

SOURCE: ECONOLER 2019 REPORT

CARICOM Member States	EE Target per Sector (%)					
	Transport	Residential	Industry	Public	Commercial and Tourism	Extraction, Agriculture, Mining and Construction
Antigua & Barbuda	40	30	45	53	46	
Bahamas ⁸	23	46	45	50	48	45
Barbados	20	30	42	50	59	
Belize	16	28	45	40	52	
Dominica	-	56	51	59	50	
Grenada	21	11	46	32	38	
Guyana ⁹	13	9	50		53	
Haiti	-	10	34	50	15	
Jamaica	11	38	14	34	48	4
Montserrat	-	45	43	67	49	
Saint Kitts and Nevis	44	35	18	39	52	
Saint Lucia	-	46	49	37	58	
SVG	25	29	47	50	57	
Suriname	20	23	23	50	23	44
Trinidad and Tobago	20	29	35	50	-	5

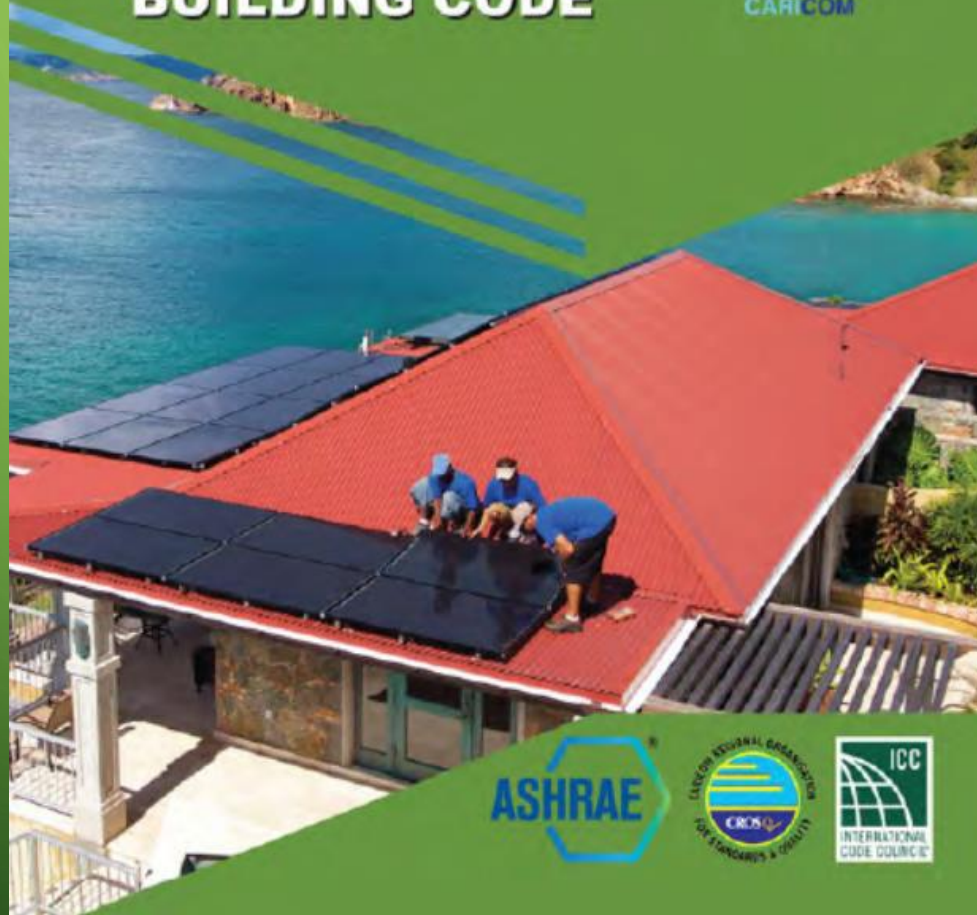
Priority Sectors
 Not applicable or no data available

FROM A GLOBAL CONTEXT





CARICOM REGIONAL ENERGY EFFICIENCY BUILDING CODE



MEMBERS OF THE CREEBC PROJECT TEAM

- Mr. Zepherinus Churchill Norbert (Chairman)
- Mr. Mali Barnes – Antigua and Barbuda
- Mr. Craig Delancy – Bahamas
- Mr. Fabian Scott – Barbados
- Mr. Jonathan Platt – Barbados
- Mr. Ryan Cobb – Belize
- Mr. Fred Esprit – Dominica
- Mr. Whyne Cox – Grenada
- Mr. Dwayne Cenac – Grenada
- Mr. Brian A. Constantine – Guyana
- Mr. Hemraj Sanichara – Guyana
- Mr. Nicolas Darius Allien – Haiti
- Andia Persad-Maharaj – Trinidad and Tobago
- Mr. Joseph A. Junior Jean-Gilles - Haiti
- Mr. Stanley G. Smellie - Jamaica
- Mr. Shane Slater (Technical Secretary) – Jamaica
- Mr. Alvin Ryan - Montserrat
- Mr. Bertille Brown – St. Kitts and Nevis
- Mr. Rhon Boddie – St. Kitts and Nevis
- Mr. Verne Emmanuel (Vice Chairman) – Saint Lucia
- Mr. David Hird – Saint Lucia
- Mr. Ellsworth Dacon – St. Vincent and the Grenadines
- Mr. Ricardo Adams – St. Vincent and the Grenadines
- Mr. Devanand Ragbir – Trinidad and Tobago
- Ms. Nadita Ramachala – Trinidad and Tobago

TABLE OF CONTENTS

CREEBC COMMERCIAL PROVISIONS C-1		CREEBC RESIDENTIAL PROVISIONS R-1	
Chapter 1 Scope and Administration	C-3	Chapter 1 Scope and Administration	R-3
Chapter 2 Definitions	C-7	Chapter 2 Définitions	R-7
Chapter 3 General Requirements	C-13	Chapter 3 General Requirements	R-11
Chapter 4 Commercial Energy Efficiency	C-19	Chapter 4 Residential Energy Efficiency	R-17
Chapter 5 Existing Buildings	C-91	Chapter 5 Existing Buildings	R-35
Chapter 6 Referenced Standards	C-95	Chapter 6 Referenced Standards	R-39
Appendix CA Solar Ready Provisions	C-103	Appendix RA Solar Ready Provisions	R-43
Index	C-105	Index	R-45

TABLE OF CONTENTS

ASHRAE 90.1-2016

Chapter 1 Purpose	Chapter 7 Service Water Heating
Chapter 2 Scope	Chapter 8 Power
Chapter 3 Definitions, Abbreviations and Acronyms	Chapter 9 Lighting
Chapter 4 Administration and Enforcement	Chapter 10 Other Equipment
Chapter 5 Building Envelope	Chapter 11 Energy Cost Budget Method
Chapter 6 Heating, Ventilating and Air Conditioning	Chapter 12 Normative Appendices

THE SCOPE

This CREEBC applies to *residential and commercial buildings* and their *building sites* and associated systems and equipment.

THE CREEBC INTENT

- Conserve energy over **useful life** of each building.
- Provide **flexibility** for innovation
- Not to **abridge** safety or health requirements from other laws and regulations

ABOVE CODE PROGRAMS

Allows National or Local Energy Efficiency Programs as Alternatives

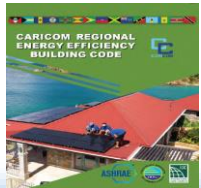
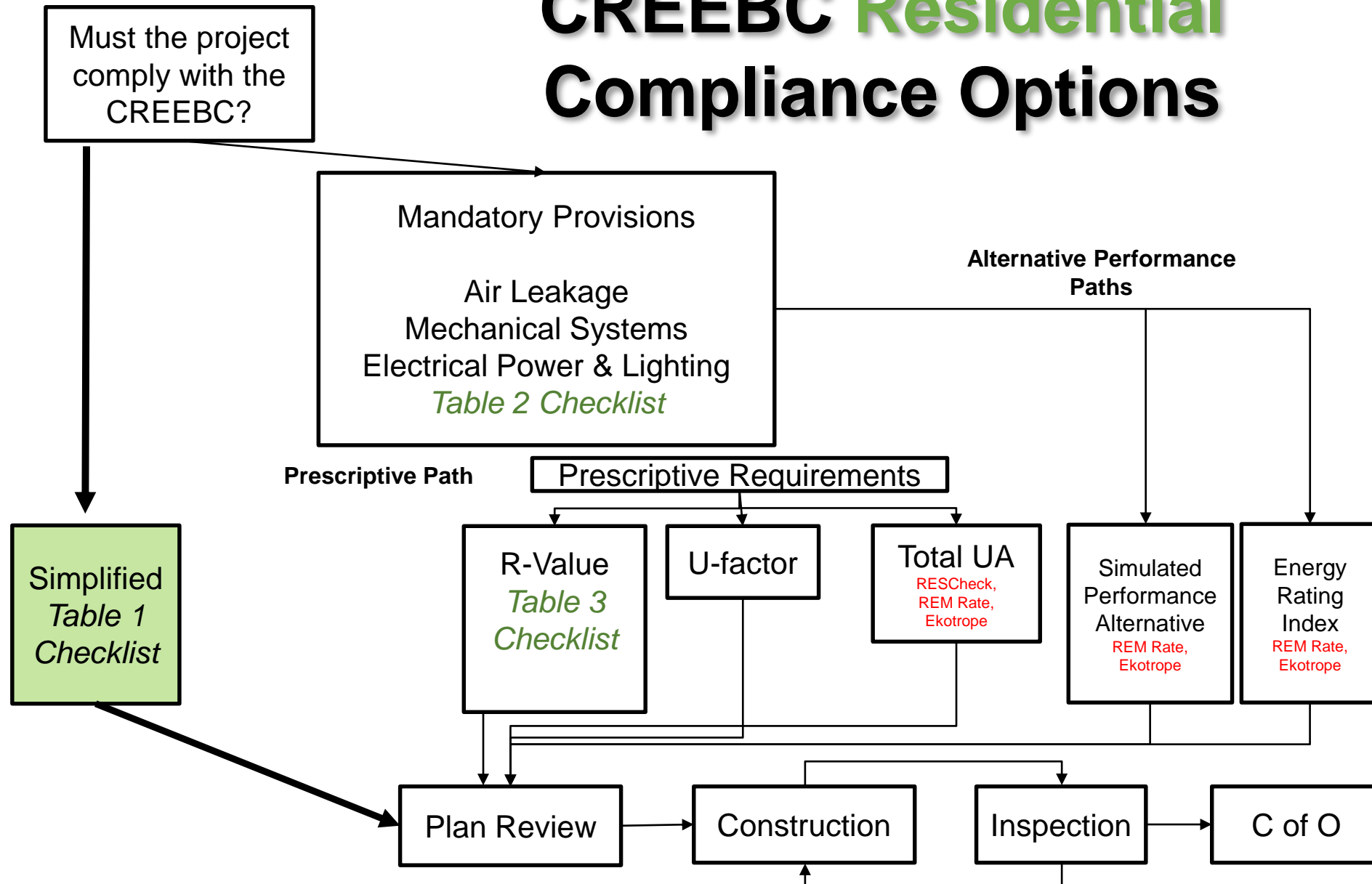
- Must be approved by the code official or the authority having jurisdiction
- Mandatory requirements of the CREEBC must still be met



INFORMATION ON CONSTRUCTION DOCUMENTS

1. Insulation materials and their R -values.
2. Fenestration U -factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted U -factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.

CREEBC Residential Compliance Options



Comparison of CREEBC Compliance Options

Requirements	Simplified	Prescriptive	Simulated Performance	Energy Rating Index
Limited to 50% cooling	Yes			
Heating not allowed	Yes			
Envelope insulation meets code tables (or UA Tradeoff)		Yes		2009 IECC min
Items marked Prescriptive met		Yes		
Items marked Mandatory met		Yes	Yes	Yes
Permanently Installed Lighting is 90% Efficacy, and ceiling fans roughed in bedroom and largest other room	Yes	Yes	Yes	Yes
Air leakage, Duct testing, Ventilation testing required		Yes	Yes	Yes
Duct Insulation outside envelope		Yes		
Accounts for mechanical system efficiency				Yes
Accounts for appliances				Yes
Accounts for on-site power production	(water heating)			Yes
Checklist Provided	Yes	Yes		
Requires Software			Yes	Yes

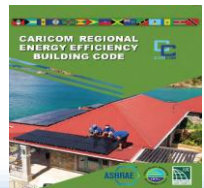
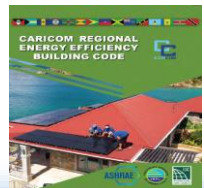


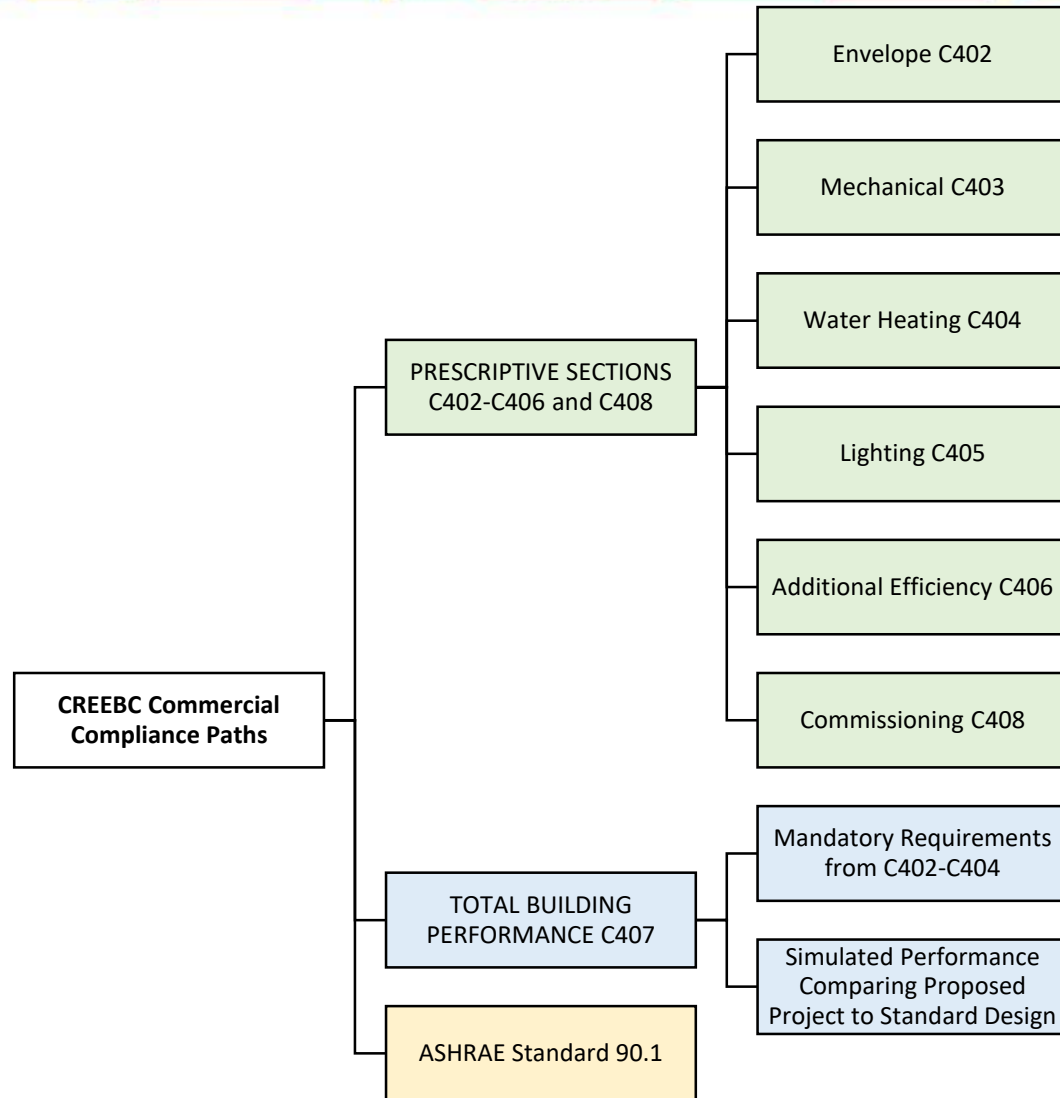
Table 1. Simplified Semi-Conditioned Compliance Path Requirements— Per Section R401.2.1

Table 1. Simplified Semi-Conditioned Compliance Path Requirements per R401.2.1

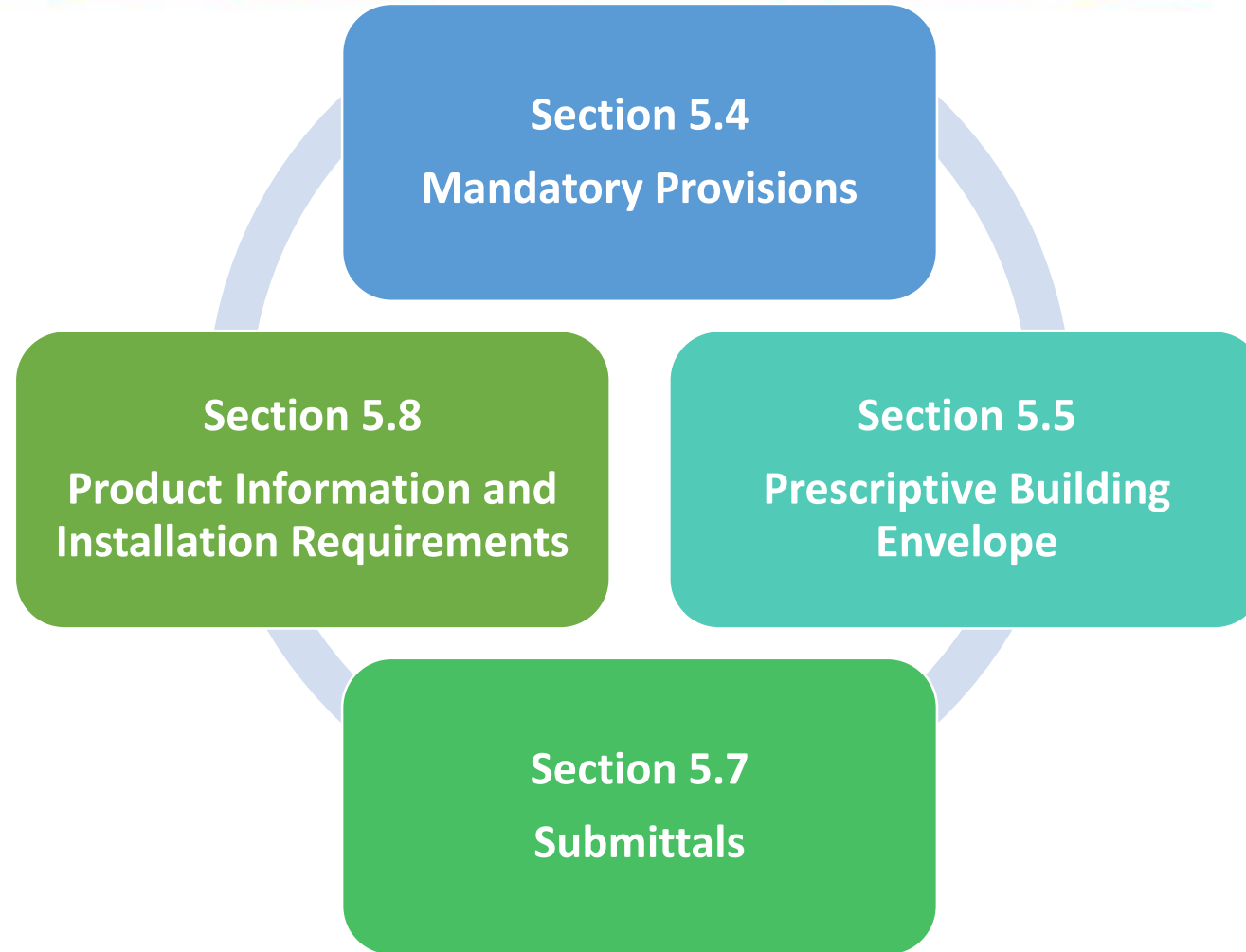
Section #	Simplified Semi-Conditioned Compliance Path Checklist	Required Value		To be Completed by Applicant		Compliance – Official Use Only		
				Value	Page #	Plans Verified	Field Verified	Notes
R401.3	Certificate: Permanent certificate posted on/near electrical panel with energy values	---				---		
R401.2.1	1. Conditioning: No more than one-half of the occupied space is air conditioned	YES						
R401.2.1	2. Conditioning: The occupied space is not heated	YES						
R401.2.1	3. Water Heating Power: Solar, wind or other renewable energy source supplies not less than 90 percent of the energy	90%						
	4. Glazed Fenestration							
R401.2.1	Fenestration U-Factor: Fixed fenestration	2.84						
Table R401.2.1	Fenestration U-Factor: Operable fenestration	3.69						
Table R401.2.1	Vertical Fenestration U-Factor: Entrance doors	6.25						
Table R401.2.1	SHGC based on projection factor and orientation:	SEW	N	---	---	---	---	
Table R401.2.1	PF < 0.2	0.25	0.33					
Table R401.2.1	0.2 ≤ PF ≤ 0.5	0.30	0.37					
Table R401.2.1	0.5 ≤ PF	0.40	0.40					
Table R401.2.1	Skylight SHGC	0.35						
R404.1	5. Lighting Equipment Minimum percentage of lamps in permanent light fixtures must be high efficacy.	90% minimum						
R401.2.1	6. Roof/ceiling: 1. SRI of 55+ thermal emittance of 0.75 + insulation R-2.3 – OR- Insulation R-3.3	SRI 55+ TE 0.75 + R-2.3 R-3.3						



Commercial Compliance Paths

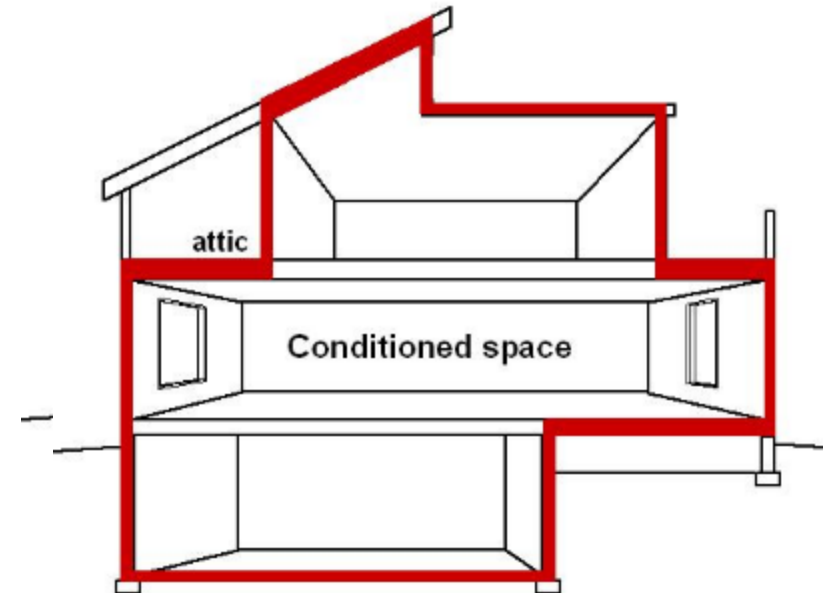


ASHRAE 90.1 2016 Compliance



Building Thermal Envelope

- Must be shown in drawings
- Exterior walls, basement walls, floor, roof, any other building element that enclose *conditioned space*
- Includes the boundary between *conditioned space* and any exempt or unconditioned space



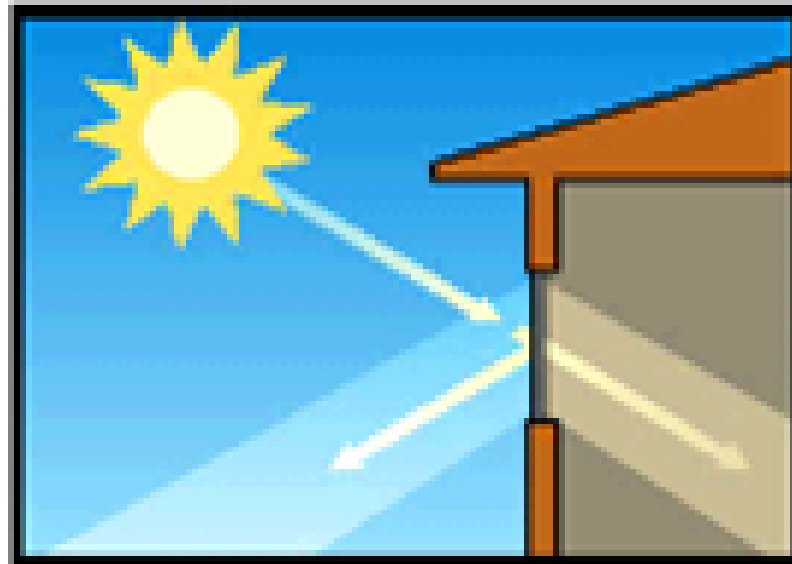
Show on Plans, Seal it, Test it

Glazing - What is SHGC?



Solar Heat Gain Coefficient:

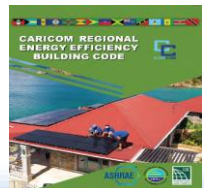
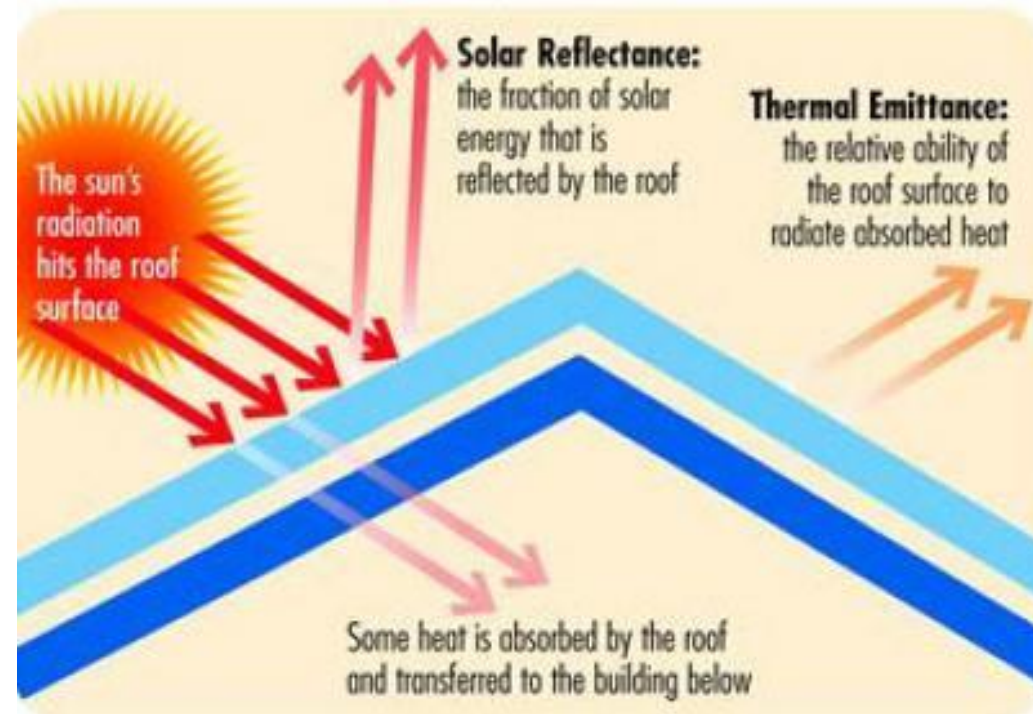
- Most important performance characteristic of fenestration in hot climates.



Cool Roof Concept

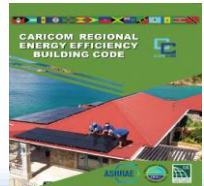
Roofs with either:

- High Albedo Roof Plus R-2.3 insulation
- OR -
- R-3.3 insulation

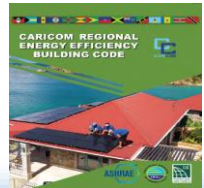
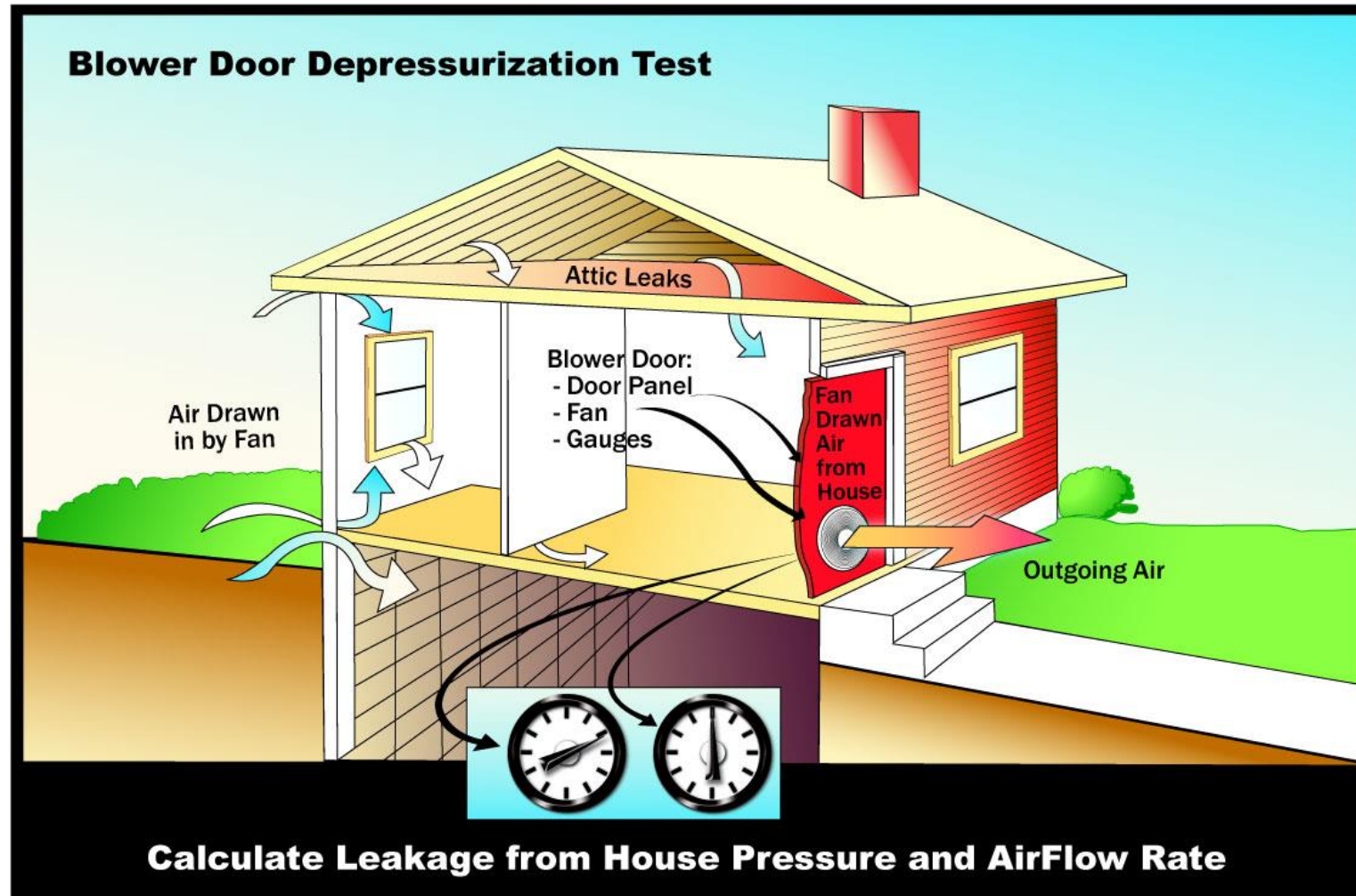


Fenestration (Sealing the Building Envelope)

 National Fenestration Rating Council® CERTIFIED	World's Best Window Co. Series "2000" Casement Vinyl Clad Wood Frame Double Glazing • Argon Fill • Low E ABC-X-1-00001-00001
ENERGY PERFORMANCE RATINGS	
U-Factor (U.S. / I-P) 0.35	Solar Heat Gain Coefficient 0.32
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance 0.51	Air Leakage (U.S. / I-P) ≤ 0.3
<small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information. www.nfrc.org</small>	



Air Exchange Rate



RESULTS FROM A RECENT STUDY IN ANTIGUA AND BARBUDA

SUMMARY OF EE AND RE PROJECTS AT A PUBLIC FACILITY

EE and RE Projects	Annual kgCO ₂ e Savings	Initial Cost USD	Annual Savings USD	Simple Payback (Yrs.)	Equity Simple Payback (Yrs.)
Low-No Cost EE Measures	65,206.20	NA	25,104.70	NA	NA
EE Capital Project	77,401.53	50,500	29,800	1.7	0.57
Subtotal	142,607.73	50,500	54,904.70	1.7	0.57
48kW Rooftop PV System	89,283.23	316,800	15,301	13.4	11.6
Total	231,890.96	367,300	70,205.70	NA	NA

ENERGY AUDITS - ENERGY EFFICIENCY (EE) & RENEWABLE ENERGY (RE) MEASURES - JULY 2020

	Capital Cost (US\$)	% of Total	Energy Reduction (kWh/ Year)	% of Total	Energy Savings (US\$/ Year)	% of Total	GHG Emission Reduction (Tonnes/YR)	% of Total
1. MSJMC HOSTIPAL								
Energy Efficiency Measures (EEM)	\$ 570,596.00	23.60	1,353,245.00	52.13	\$ 500,700.00	52.13	1,082.70	52.13
Solar PV for Onsite Power Generation	\$ 1,847,130.00	76.40	1,242,813.00	47.87	\$ 459,841.00	47.87	994.30	47.87
TOTAL	\$ 2,417,726.00	100.00	2,596,058.00	100.00	\$ 960,541.00	100.00	2,077.00	100
2. GOVERNMENT COMPLEX								
Energy Efficiency Measures (EEM)	\$ 1,660,550.00	28.24	784,004.00	33.43	\$ 290,082.00	34.27	627.1	33.43
Solar PV for Onsite Power Generation	\$ 4,219,450.00	71.76	1,561,065.00	67	\$ 556,497.00	65.73	1,248.90	66.57
TOTAL	\$ 5,880,000.00	100.00	2,345,069.00	100.00	\$ 846,579.00	100.00	1,876.00	100.00
3. NEW AIRPORT TERMINAL								
Energy Efficiency Measures (EEM)	353,792.00	43.85	1,443,932.00	75.90	\$660,738.00	79.67	1,155.20	75.90
Solar PV for Onsite Power Generation	\$453,000	\$56	458,456	24	\$168,648	20.33	366.8	24.10
TOTAL	\$806,792.00	\$100.00	1,902,388.00	100.00	\$829,386.00	100.00	1,522.00	100.00

OVERALL FINDINGS: EE Vs RE

	EE % of Totals	RE % of Totals	Ratio EE Vs RE
Average Capital Cost (US\$)	31.90	68.10	32 Vs 68
Average Energy Reduction (kWh/Year)	53.82	46.18	54 Vs 46
Average Energy Savings (kWh/Year)	55.35	44.65	55 Vs 45
Average GHG Emission Reduction (Tonnes/YR)	53.82	46.18	54 Vs 46
Average Savings & GHG Emission Reductions for EE Vs RE	54.33	45.67	54 Vs 46

NOTES

1. On average EE Capital Cost (US\$) is 32 % of total costs for all three audits compared to 68% for RE Capital Cost (US\$)
 2. Average savings and GHG emission reductions is 54% for EE measures compared to 46% for RE measures for all three audits
 3. EE and RE interventions listed in the audit reports should be implemental by local experts in A&B with grant funding from CDB. Savings (avioded fuel costs) should be placed in a revolving fund for the implementation of additional Energy Audits, EE and RE interventions in buildings here in A&B.
- Hence EE interventions should always be done first followed by RE interventions in buildings. Interventions such as the 2018 CARICOM Regional Energy Efficiency Building Code should be adopted alone with EE standards developed by the ABBS. Policies in support of EE and RE interventions and fiscal incentive programs for EE and RE should be included in recovery strategic plans for A&B.



Prepared by: *Zepherinus C. Norbert*

THANK YOU!

