Removing Barriers for Energy Efficiency in Cabo Verde Building Sector

ECOWAS Sustainable Energy Forum 2019 (ESEF 2019)
22 – 24 October
Accra, Ghana
Cabo Verde in numbers (1)

Quick Information

- 400 km off the coast of West Africa.
- It has a total area of 4,033 square kilometres.
- Population of 542,000 inhabitants

Map source (accessed as of 10 June 2019):
https://antoniocv.wordpress.com/tag/localizacao-geografica-cabo-verde/
Cabo Verde in numbers (2)
There are total 6 objectives of the project

- Develop a new building code
- Pilot demonstration projects
- Develop protocol to measure savings
- Develop an inventory and information systems
- Awareness and Capacity building
- To strengthen the legal, regulatory & institutional framework

• **Start** – December 2016
• **End** – November 2020
**Project Components (1)**

**Component 1**
- **Energy Efficiency Building Code**
  - Legal Document of the code
  - New building code including stringency analysis, compliance mechanisms
  - Implementation framework

**Component 2**
- **EMS**
  - Protocol to measure energy savings, water usage, and emission reduction.
  - Inventory and information system for national energy balance

**Component 3**
- **Pilot Project**
  - Pilot demonstration of EEBC implementation in 4 public buildings
  - Development of best practices guide for energy efficient building design

**Component 4**
- **Awareness Program**
  - Brochures
  - Newsletters
  - Workshops
  - Dissemination through demonstration projects
  - Engagement of Government for adaptation of EEBC

**Component 5**
- **Capacity development**
  - Training for Architects
  - Training for Engineers
  - Training for Govt. Officials
  - Training for students
  - Capacity building of LEC for testing of building materials

**Train the Trainers**
- Capacity development of trainers and skilled human force
Project Components (2)

Component 4

Labelling programme for appliances
- Design of informative labels for appliances
- Selection of appropriate testing procedure
- Setting labelling threshold and range

Import regulations
- Developing an implementation plan for mandatory S&L program.
- Incorporating labelling requirements in import and sales regulations
- Requirement for MRV of sales and actual performance

Testing mechanism
- Engagement of national and regional facilities for appliance and feasibility of setting National test lab in CV
- Periodic testing and reporting of labelled appliances

National certification procedures
- Design of a national certification program for selected appliances

Public awareness programme
- Design of comprehensive awareness programs for key stakeholders – importers, retailers, consumers, enforcement agencies etc.

Demand side management program
- Developing an incentive mechanism for phasing out existing inefficient appliances through DSM program
Energy Efficiency Building Code

Purpose of the Code

• The purpose of the Energy Efficiency Building Code (EEBC) is to provide minimum requirements for the energy efficient design and construction of buildings.
• It provides guidelines for existing buildings to achieve minimum requirements for energy efficiency.
Applicable for all the Commercial Buildings (New and Existing – major renovation) with BTE and MT connections.

Exemption: Residential buildings and other buildings having BTN connection are not covered in this code.

Precedence:
1. Any code(s) or bye-laws
2. Any rules on safety, security, health or environmental by government
Rationale for the code

Existing Bye laws
- The existing building bye laws for Cabo Verde does not have specific chapters for energy efficiency

Standards & Specifications
- There are no standards available for energy efficiency in buildings

EEBC
- Provides standards and specification for energy efficiency in buildings
- Mandatory chapter in the bye laws
Energy Efficiency Building Code (EEBC) for Cabo Verde

Our Approach towards development of EEBC

- Review of energy efficiency building directives & codes
- Identification of different components of Energy Efficiency Building Code
- Situation analysis by conducting Desk Research, Stakeholder Consultation & Energy Audits
- Drafting of Energy Code for Cabo Verde, based on
Applicability of the code on Building Components

BUILDING

- BIO-CLIMATIC DESIGN
- BUILDING ENVELOPE
- HVAC/AIR-CONDITIONING SYSTEMS
- LIGHTING & CONTROLS
### Optimal bio-climatic design (1)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Current Scenario</th>
<th>Energy Consumption</th>
<th>Proposed in EEBC</th>
<th>Energy Savings</th>
<th>Actions to be taken</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Orientation</strong></td>
<td>No standard</td>
<td>NA</td>
<td>Longer side facing North-South direction</td>
<td>Reduction in solar heat gain</td>
<td>Train the Architects</td>
</tr>
<tr>
<td><strong>Daylighting</strong></td>
<td>No Standard</td>
<td>NA</td>
<td>Illuminance level in the indoor work areas as per BS EN 12464-1:2002, Part 1.</td>
<td></td>
<td>Train the Architects</td>
</tr>
<tr>
<td><strong>Shading</strong></td>
<td>No standard</td>
<td>196.6 kWh/m2/year</td>
<td>Overhang of 600 mm</td>
<td>8%</td>
<td>Train the Architects Update building code</td>
</tr>
</tbody>
</table>
Optimal bio-climatic design (2)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Current Scenario</th>
<th>Energy Consumption</th>
<th>Proposed in EEBC</th>
<th>Energy Savings</th>
<th>Actions to be taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Window to wall ratio</td>
<td>40 %</td>
<td>196.6 kWh/m2/year</td>
<td>30%</td>
<td>7%</td>
<td>Train the Architects</td>
</tr>
<tr>
<td>Ventilation</td>
<td>No specific guideline or standard</td>
<td>NA</td>
<td>Minimum ventilation rates as per EN standards</td>
<td>NA</td>
<td>Train Architects, Municipalities</td>
</tr>
</tbody>
</table>
## Components of Building Envelope

<table>
<thead>
<tr>
<th>Building Envelope Components</th>
<th>What Cabo Verde has</th>
<th>Proposal for the code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U-Value (W/m²K)</td>
<td>U-Value (W/m²K)</td>
</tr>
<tr>
<td>Wall</td>
<td>NA</td>
<td>3.13</td>
</tr>
<tr>
<td>Roof</td>
<td>NA</td>
<td>0.28</td>
</tr>
<tr>
<td>Glass</td>
<td>NA</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>0.6 SHGC</td>
</tr>
</tbody>
</table>
Lighting system
Optimal lighting system

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>Proposed in EEBC</th>
<th>Energy Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting</td>
<td>CFL lamps – Lighting power density of 1 W/ft2</td>
<td>196.6 kWh/m²/year</td>
<td>Lighting power density of 0.2 W/ft² using LED lamps</td>
<td>20%</td>
</tr>
</tbody>
</table>

- Lighting power densities is proposed to comply the minimum LPD requirements laid in the code (Adapted from EU GPP Criteria for Indoor Lighting).

- And Lighting levels as per EN CIBSE Lighting levels.
Air conditioning system
Optimal air-conditioning system

<table>
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<th>Proposed in EEBC</th>
<th>Energy Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioning</td>
<td>Split ACs with no energy efficiency labelling</td>
<td>196.6 kWh/m2/year</td>
<td>Inverter AC (based on market scenario)</td>
<td>22%</td>
</tr>
</tbody>
</table>

- Use of **centralized air-conditioning system** alone shows reduction of more than **40%** in the Energy Performance Index (EPI).
- However, based on the market scenario in Cabo Verde, use of **Inverter Split ACs** will reduce the energy consumption by **22%**.
Impact of individual component on Energy Savings of Building

Individual Impact on Energy Savings

- HVAC: 22%
- Lighting: 21%
- Fenestration: 11%
- Roof: 1%
- Wall: 1%
- Design: 10%
## Standard & Labelling Program for appliances

<table>
<thead>
<tr>
<th>Category</th>
<th>Minimum requirement MEPS</th>
<th>Minimum requirement to get Seal Guarantee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air conditioning</td>
<td>4,10 ≤ SEER Classe C N/A</td>
<td>5,10 ≤ SEER Classe A N/A</td>
</tr>
<tr>
<td>TVs</td>
<td>EEI &lt; 0,80 Classe D</td>
<td>EEI &lt; 0,30 Classe A</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>EEI &lt; 75 Classe B</td>
<td>EEI &lt; 55 Classe A</td>
</tr>
<tr>
<td>Lamps</td>
<td>EEI ≤ 1,20 Classe C Directional</td>
<td>EEI ≤ 0,40 Classe A Non-directional</td>
</tr>
<tr>
<td>Water electrical heaters</td>
<td>* $\eta_{wh}$ ≥ 33 Classe D</td>
<td>* $\eta_{wh}$ ≥ 65 Classe A</td>
</tr>
<tr>
<td>Washing machine</td>
<td>EEI &lt; 68 Classe A</td>
<td>EEI &lt; 68 Classe A</td>
</tr>
</tbody>
</table>

* depends on use (M)
**Cabo Verde Energy label layout**

**Seal Guarantee**

**comparative labels**

<table>
<thead>
<tr>
<th>Category</th>
<th>Label Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iluminação</td>
<td>XYZ kWh/1000h</td>
</tr>
<tr>
<td>Frigoríficos</td>
<td>XYZ kWh/ano</td>
</tr>
<tr>
<td>Televisões</td>
<td>XYZ kWh/ano</td>
</tr>
<tr>
<td>Ar Condicionado</td>
<td>XYZ kWh/ano</td>
</tr>
<tr>
<td>Aquecedor de Água</td>
<td>XYZ kWh/ano</td>
</tr>
<tr>
<td>Máquina de lavar Roupa</td>
<td>XYZ kWh/ano</td>
</tr>
</tbody>
</table>
Obrigado!!

Thank you!

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