



UN-Energy
knowledge network



HIGH-LEVEL
POLITICAL FORUM
ON SUSTAINABLE DEVELOPMENT

SUSTAINABLE
DEVELOPMENT
GOALS



“Accelerating Progress toward SDG 7: UN System Contributions”

Thursday, 21 July 2016, 09.00-13.00

Conference Room 5, UNHQ, New York

**“ Mainstreaming Energy and Resources
Efficiency in the Built Environment
UN-Habitat’s experience in Africa.”**

Rapid Urbanization and increasing demand for energy

- Today, over **50%** of the world population lived in cities;
- In 2050, **75%** of them, estimated at 9 billion people, will be living in cities.
- Out of the over 3.5 billion people living today in cities, ***one billion live in informal settlements with no proper shelter, no access to basic services including energy.***
- The **increasing urbanization** is followed by **increasing demand for energy services estimated at 7% annually** in most developing countries).



Energy use in buildings in Sub Saharan Africa

Energy used in buildings in Africa is estimated at 56% of the total national electricity consumption.

Big cities consume more than 75 % of all electricity generated and are responsible for 70% of greenhouse emissions.

Majority of modern buildings in most African countries with tropical climates - **are replica of building designs from western countries** with cold and temperate climates.

Modern cities are **fossil fuel driven cities**.

Very few **urban planners** take into consideration **bioclimatic elements or passive building methods** in their new urban plans.

New buildings are aligned along main roads, rivers and the resulting settlements are **high energy dependent**.



Rapid Urbanization: Housing shortage and inadequate housing

- Housing deficit is estimated globally at one billion. Those without adequate housing live in inadequate housing.
- There is a mismatch between the offer and the demand for housing:
- **Adequate shelter that is unaffordable!**
and
- **Affordable housing that is inadequate.**
- It is estimated that **75% of the housing stock that will exist in 2050 in developing countries is yet to be built.**



Solution: Rapid provision of housing on large scales that are not always environmental friendly.

- New mass housing in Africa with poor environmental considerations.



Housing policies and regulations: building code / standards in Africa

Call upon:

• Governments of the East African Countries to:

1. Fully endorse and implement the concept of Energy Efficiency Building Codes (EEBC), and subsequently to review existing housing policies and building codes, as well as guarantee the involvement and capacity building of relevant stakeholders in energy and resource efficiency in order to meet the requirements set by the new codes,
2. Adopt and integrate measures of energy and resource efficiency as an essential element of the EEBC,
3. Harmonize building codes, regulations and laws at the national level and among the East African Community countries in order to achieve coherence,
4. Create public awareness among all relevant stakeholders regarding the importance of energy efficiency in buildings, the required and available measures, its contribution to mitigate climatic change and the urgent need to make individual contributions,
5. Identify and promote innovative approaches that demonstrate efficient use of energy and resources with particular emphasis on buildings (currently estimated to account for more than 40% of the available energy),
6. Organize national and regional exhibitions and awards for the promotion of Energy and Resource Efficiency in Buildings,
7. Establish a regular forum for networking and exchange of ideas, experiences and best practices which could lead to integrated sustainable buildings,
8. Actively participate in the collection and dissemination of the required data, especially climatic data that may lead to the successful implementation and recording of the effectiveness of the progress resulting from various initiatives under implementation,
9. Create an enabling fiscal environment for adopting energy and resource efficient technologies by the private sector.

Development Partners in collaboration with the Governments to:

1. Share experiences and resources to create both a knowledge pool and meaningful sustainable responses,
2. Facilitate and support the development of local expertise and research capacity through knowledge sharing, exchange visits, and thematic workshops and training courses,

Training institutions to:

- 1) Review and re-orient educational curricula to incorporate energy and resource efficiency as a theme to the benefit of various relevant stakeholders,
- 2) Undertake action research on affordable and appropriate building materials, cost-benefit and life-cycle analyses of energy and resource efficient buildings,

The private sector to:

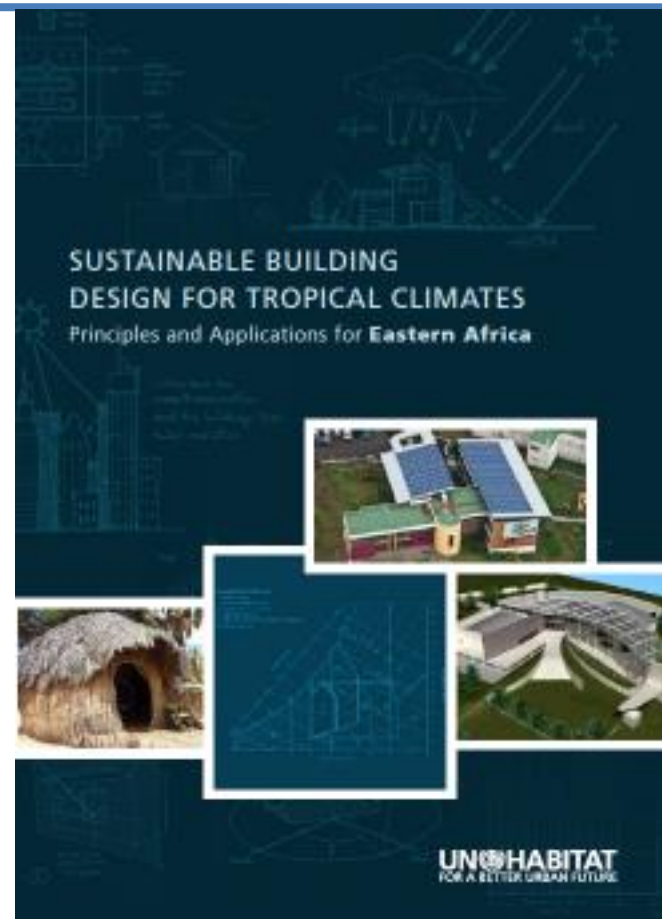
- 1) Support and promote energy and resource efficient operations and lifestyle,
- 2) Establish voluntary market-based performance-oriented Green Building Rating Systems and to support mandatory Energy Performance Certificates and Energy Savings Performance Contracts,
- 3) Establish affordable and sustainable 'Green Mortgage' scheme to support the implementation and scaling-up of energy and resource efficient building projects, and
- 4) Develop and distribute resource efficient building and construction materials and equipment.

Energy/Resource efficient Building Code has the highest potential of saving energy in buildings over a long run.

Kigali Declaration on mainstreaming energy efficiency measures into building code, building policies and building regulations in east Africa. April 2013.

Promoting Energy Efficiency in Buildings in East Africa

- In response to the rapid urbanization taken place mainly in Africa and Asia, and to the poor access to energy, together with the aim of addressing SDG7 and climate change, UN-Habitat has developed several programs to address the urban energy challenges.
- Promoting energy efficiency in buildings in East Africa which objective is to mainstream Energy Efficiency Measures into Housing policies, Building Codes, Housing finance and building practices in East Africa.
- Review of the building codes in Nigeria, Cameroon and Senegal to integrate energy and resources efficiency measures.
- Training the youth on renewable energy technologies and energy efficiency measures.



Promoting Energy Efficiency in Buildings in East Africa

The program has conducted **energy audits** in 1200 buildings to assess energy consumption trend and also establish an energy benchmark for buildings. This work is particularly relevant as it is the basis for energy rating system.

The Government of **Rwanda has just adopted a new building code** with a chapter on energy. Kenya has enacted a regulation that makes solar hot water system mandatory for all new buildings. Uganda has included energy issues in their housing policies. All these have happened through UN-Habitat advocacy and technical assistance to those countries on Energy Efficiency (EE).

Awareness programs and training workshop on sustainable building design are conducted to build the capacity of building practitioners. Several guidelines and training tools have been developed.

An **appropriate financial mechanism** for the promotion of energy efficient measures in buildings is under development.

The program provides **technical advices** to ongoing new housing and building projects to make them green.

Promoting Energy Efficiency in Buildings in East Africa

PROMOTING ENERGY EFFICIENCY IN BUILDINGS IN EAST AFRICA

Urban Energy Technical Note



Guidelines for Green Building Design

Over 70% of the world energy generation is consumed in human settlements, resulting in an emission of more than two thirds of CO₂ that contributes to climate change. Widespread energy poverty and the increasing cost of fossil fuels are impacting negatively on the economic development and the living conditions of people.

The way buildings are planned and designed today has a direct implication on their energy bills.

To address the global challenges of climate change and the high cost of energy it is essential to adopt urban planning and building design methodologies that are energy conscious and environmentally friendly. This document acts as a guideline

to provide some of the mandatory criteria that should be taken into consideration. These criteria include:

- Optimization of the structure's energy efficiency;
- Minimization of the energy demand of buildings;
- Maximization of the efficiency of energy supply;
- Maximization of the share of renewable energy sources.

To design an energy efficient built environment involves minimizing the wastage of resources while maximizing the use of renewable energy sources and passive building design options.

This technical note introduces a simplified path to sustainable design, accessible through 7 Steps.

Step 1: Site Analysis

Site analysis helps to identify opportunities or constraints which will influence the outcome of the urban design.

Sun Path:

Understanding the movement of the sun during the day and throughout the year allows for a qualitative analysis of the sunlight or shading of a site or part of a building. It is very useful for estimating the effects of the neighbouring buildings' shading or sunscreen needs. In the tropics, the orientation of the main road path should be developed along the East-West axis.

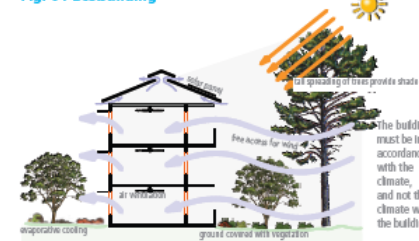
Prevailing Winds:

Knowledge of the speed and directions of the prevailing winds will facilitate natural ventilation. The main road orientation should follow the prevailing wind direction to assure natural ventilation and dust removal to all buildings along the road. A compromise should be taken in case the prevailing winds direction are in conflict with the sun path.

Site Topography:

The existence of rivers, streams, valleys, hills, mountains; may assist or obstruct natural cooling, wind and sun shading. Proper site analysis is required to maximize the use of the existing micro climate.

Fig. 01 Ecobuilding



Multi dwelling housing

CLIMATIC ZONE 1: Sub Tropical Highland climate



DESIGN RESPONSES

Orientation: The building's major axis is optimally oriented along the east-west axis.

Ventilation: All the rooms are actively passively naturally ventilated through the windows and the permanent ventilation provided at the roof level through linear eaves. The maximum natural cooling is made of hollow concrete vent blocks which guarantee optimum ventilation and reduce lighting.

Roof: vents enable air movement and heat release by stack ventilation.

Natural daylighting: All the rooms are naturally lit during the day by the provision of windows. The reduced energy consumption required for artificial lighting. During the cold months, the openings on the east and west facing walls contribute to warm the building through heat gain from the morning and afternoon sun respectively.

Room shading: North- and south-facing windows are protected from the high mid-day sun by the provision of balconies, horizontal window overhangs and roof overhangs on the top level.

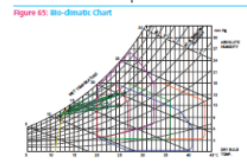
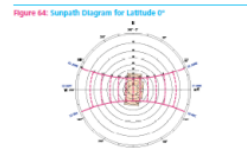
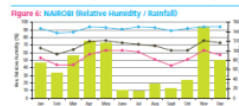
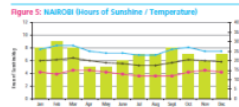
Windbreak: on the east and west-facing windows are installed and appropriate oblique vertical sun shading elements are provided where major windows exist (balconies) to avoid unwanted solar gains by the low morning and afternoon sun during the hot months.

In the cold season, these windows are instrumental in letting in some heat to warm up the houses.

Building orientation: Passive heating is obtained in this type of climate. High thermal mass materials are recommended.

CLIMATIC ZONE 1: Sub Tropical Highland climate

Climatic Zone 1: Sub Tropical Highland climate	
Location	Nairobi, Kenya
Latitude	1°17'N
Longitude	36°49'E
Altitude	1800m above sea level
Temperature	Min average temp 17.7°C Max average temp 26°C
Humidity	Average 79%max 85%min
Windiness	Average relative humidity 73.2%
Prevalent Wind Direction	North East and East prevailing winds



INTERPRETATION

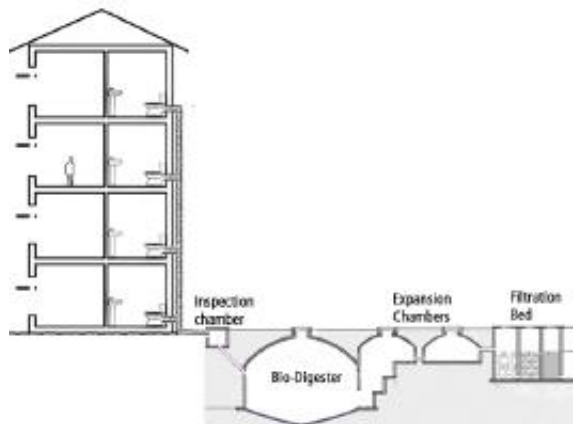
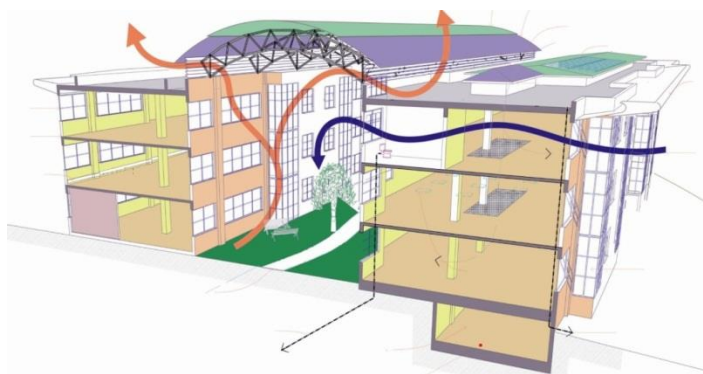
At year round:

- The mean temperature falls in the passive heating zone (PH). The use of passive solar heating is recommended for this region. This can be achieved by having openings face the sun in transitable orientations.
- The maximum temperature throughout the year are lower than 12°C at night. In these cases the use of artificial heating (AH) is

suitable to enable indoor thermal comfort.

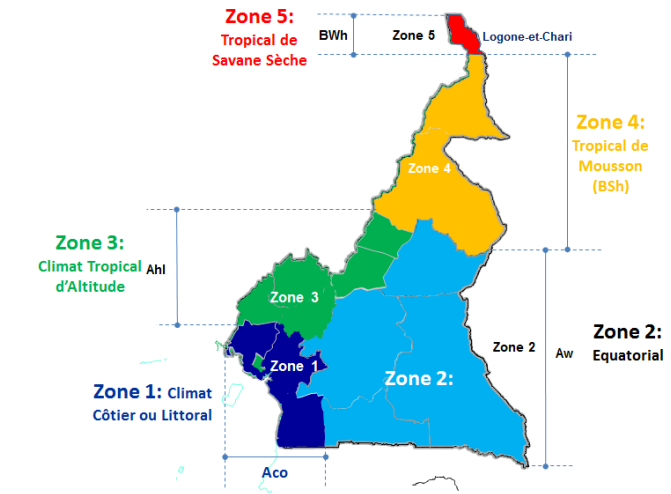
Promoting Energy Efficiency in Buildings in East Africa

- UN-Habitat has developed a **user friendly charter for sustainable building design** in tropical countries.
- The charter has 20 tips on green buildings and 10 tips on sustainable neighborhood design.
- The charter address issues related to:
- Proper orientation, natural ventilation, solar protection, daylighting, waste management, renewable energy etc.



Housing policies and regulations: building code / standards in NIGERIA, CAMEROON AND SENEGAL

- Nigeria has a housing deficit of 17 million. The existing building codes, building regulations and standards have limited references on sustainable construction and passive building design principles.
- UN-Habitat has just finalized the review of the 3 countries building codes and regulations. Measures on energy efficiency and clean energy systems are being developed to be included in the codes.
- These measures take into consideration: local climate, traditional architecture, colonial and post colonial architectures, locally available building materials, local context/ costumes and the geographical context.
- The solutions are also based on the results from energy audits conducted.



Recommendations for building code amendment

1. Environmental friendly design incorporating green building concepts and regulations (**passive building design as per climatic zone**);
2. Use of climate adapted and **sustainable building materials**;
3. Use of **energy efficiency appliances** such as mandatory use of Solar Hot Water (SWH), lighting, air conditioning and ventilation, HVAC
4. Water efficiency: **mandatory rainwater harvesting**, water reuse and recycling;
5. **Renewable energies** (mandatory use of solar PV in nonresidential building > 300m² for lighting and other electrical appliances);
6. Sustainable site planning: **sewage separation and treatment**; waste management; land/vegetation and landscaping; drainage, urban layout and street orientation; erosion prevention etc.
7. Energy management and conservation for buildings through **Energy Certification of Buildings**
8. Procedures for **building inspection** and **penalties** for non-compliances

Hand-on Training on Energy Efficiency and Renewable Energy for Youth Empowerment

- The youth constitute the majority of the African population and empowering them to participate in activities focusing on renewable energy uptake is key to the achievement of SDG7
- UN-Habitat has developed a program to empower the youth through the provision of training courses on energy efficiency and renewable energy technologies.
- During the training young people learn how to; build solar lanterns; install small biogas systems; set up briquette production; build improved cook stoves; and assemble and install solar bulb lights.
- 5 training courses have been undertaken in different in Kenya, Tanzania, Cameroon, Burundi and Nigeria.
- An online training course program is under development.



Conclusion

Adoption of Energy efficient building code will allow countries to:

- Reduce their energy demand for buildings;
 - Reduce their carbon footprint as buildings contribute significantly to the greenhouse gases emission;
 - Make significant economic saving in term of fuel import and for the building owners.
-
- **Building permit requirements should** include **environmental design strategies** and passive building measures.;
 - The **integration of the renewable energy technologies** in building will generate additional energy which excess could be sell to the national grid.
-
- **Reviewing the building code is not enough there is a need to:**
 - **Develop awareness and implementation tools;**
 - **Build the capacity of architects, engineers and other building practitioners** on sustainable building design.
 - **Integrate passive building design into Universities curriculum.**
 - **Involve the youth into renewable energy technologies .**
 - **Special financial mechanism need also to be put in place: dedicated line for credit; incentives, green mortgage etc.**

HABITAT III is the turning point for the transition towards sustainable energy use in cities.

THANK YOU FOR YOUR ATTENTION



Our homes & offices create as much energy as they use



Cars are efficient and powered by clean energy



Electricity is generated by sun, wind, and waves



Our communities center around people, not cars



We choose eco-friendly products



UN  **HABITAT**
FOR A BETTER URBAN FUTURE

