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Global Action towards Resource Efficiency and Climate
Mitigation in the Building Sector

Promoting Energy efficiency in Buildings
in East Africa

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Presentation Overview

- The Mandate of UN-Habitat;
- Urbanization and urban energy poverty;
- Global Energy Challenge
- Energy use in buildings in SS Africa;
- African housing stock forecast;
- Introduction to the program on ***Promoting Energy Efficiency in building in East Africa;***
- Strategies and achievements;
- Conclusions.

The United Nations Human Settlements Program - UN-HABITAT

- UN-HABITAT is the United Nations agency for human settlements (the built environment).
- The agency is mandated by the UN General Assembly to promote:
 - ***Sustainable urban development*** and
 - ***Adequate shelter for all.***
- UN-Habitat assists local, regional and national authorities in their effort to ***increase access to decent housing.***
- ***We promote energy access, energy efficiency and the use of renewable energy in urban areas.***



Urbanization and Urban Energy Poverty

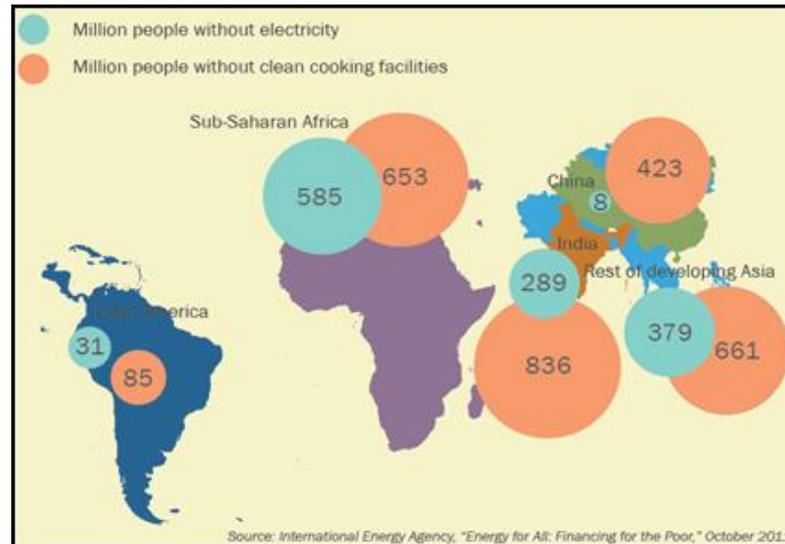
- 10 % of the global population lived in cities in 1900;
- 50% of people lived in cities in 2007;
- 75% of the population will be living in cities in 2050.
- Today, out of the 3.5 billion people living in cities, over **one billion live** in informal settlements and are mainly **urban energy poor**.

Over 60 % of urban population in Africa are **energy poor**. They rely on traditional energy wood/charcoal for cooking and spend more on energy services (kerosene and electricity) compare to other citizens.

Urban energy demand increases annually by 7 %.



Global Energy Challenges



- The UN SG Ban Ki-moon's initiative "**Sustainable Energy for All**" that calls for all actors to join their efforts to:
- Ensuring **universal access to modern energy** services by 2030;
- Doubling the rate of improving in **energy efficiency**;
- Doubling the share of **renewable energy** in the global energy mix.

- 2014-2024 is the UN decade on Energy Access for All

Energy use in buildings in Sub Saharan Africa

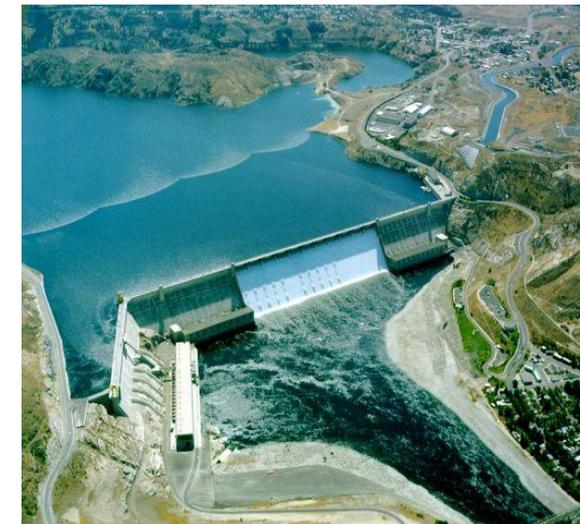
Energy used in buildings in Africa is estimated at 56% of the total national electricity consumption. Big cities consume more than 75 % of all electricity generated.

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

Between 50-60% of power generation in the region come mainly from **hydro-power plants**.

Energy generation's capacity is being stretched by *rapid population growth*, *increased urbanization*, *growing industries* and *climate change*.

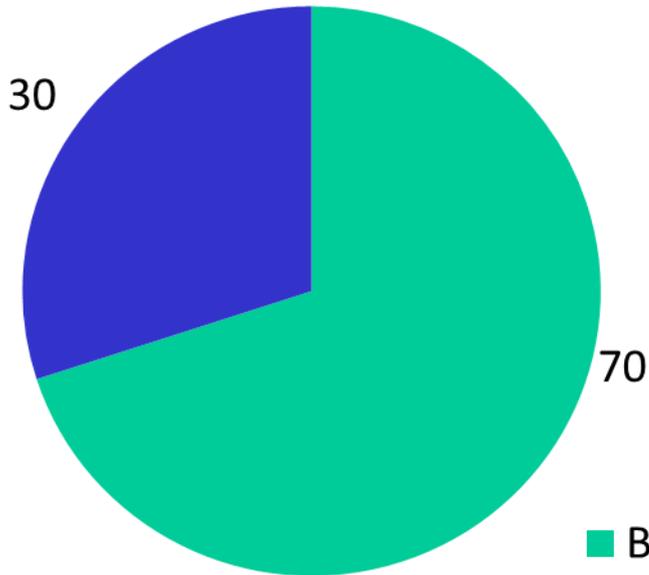
Energy demand increases annually by 8% against an almost stable supply, creating a **huge energy deficit**. There is therefore, the need for energy efficiency and renewable energy.



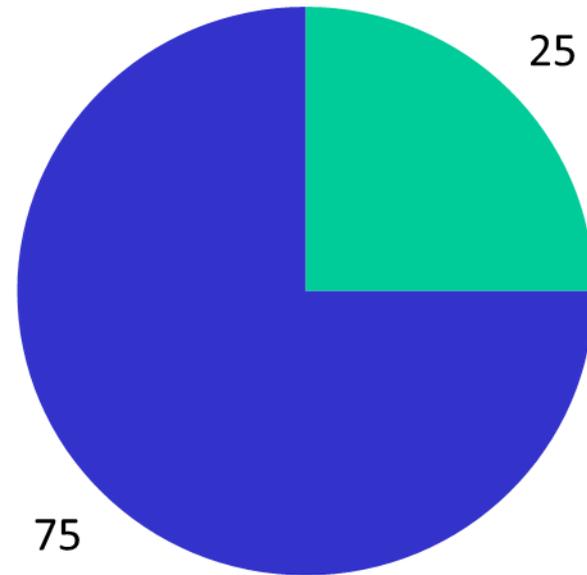
Global Building Stock Forecast

About 80% of the buildings expected to exist in Sub Saharan Africa in 2050 have not been built.

Europe



East Africa



- Built before 2010
- Built between 2010 and 2050

Promoting Energy Efficiency in Buildings in East Africa

- This project is an initiative of UN-Habitat in collaboration with UNEP and the five East African countries: Kenya, Tanzania, Uganda, Rwanda and Burundi.
- The program is designed to address the energy crisis in the region through the promotion of energy conscious building designs and energy demand management.



Objectives of the Programme

- To Mainstream Energy Efficiency Measures into Housing policies, Building Codes, Housing finance and building practices in East Africa;
- To achieve considerable avoidance of GHG emissions as a result of improved energy efficient building practices.

Targets:

- **400,000 units (including government mass housing, real estates, private home etc.),**
- **100 buildings retrofitted (commercial and private sector), built under energy efficiency standards.**
- Estimated Emission Reduction in 20 years:
 - Direct CO2 reduction: 3,629,996 ton;
 - Indirect CO2 saving: 3,937,500 ton.



Other targets:

- Energy saving in new building by 30% ;
- Energy savings in existing buildings by 20 %;
- Improved energy efficiency in at least 30% of new buildings;
- Energy efficient building code adopted by at least 3 African countries;
- Green mortgage systems established and adopted.



Main Components

1. Baseline Data, Energy Audits and Benchmarking on Energy Efficiency (EE)in the Building Sector.
2. Adoption of Energy/Resource Efficient Building Codes in the region.
3. Awareness Raising; Capacity Building, Guidelines and training tools.
4. Appropriate Financial Framework and Mechanism for the Promotion of energy efficient Measures in Buildings.
5. Integration of EE measures in **all new government housing projects**, donor funded housing projects and encourage such practices in the **private sector**.

1. Baseline data and Benchmarking on energy use in buildings

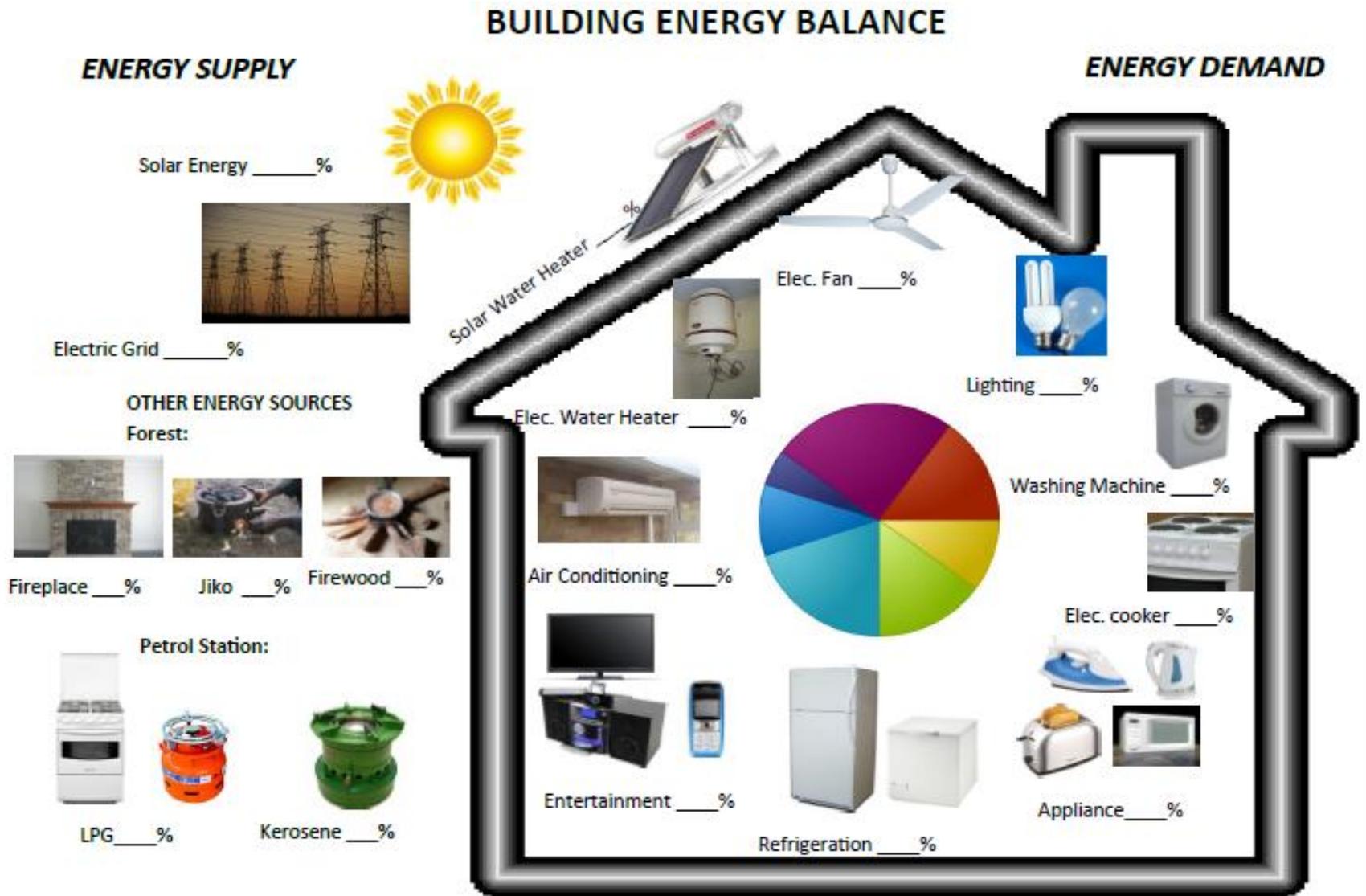
- Assess energy consumption trends in buildings.
- Conduct energy audits in residential, public and commercial buildings.
- Establish energy consumption benchmarks per categories and typologies of buildings and climatic zones.
- Identify energy saving potentials.



Eastgate: Sustainable building in Harare.



Energy audit of buildings: You Can't Manage What You Don't Measure!



Energy audit of buildings: You Can't Manage What You Don't Measure!

BUILDING ENVELOPE

BUILDING TYPOLOGY	 Informal Settlement	 Single dwelling (Bungalow)	 Single dwelling (Maisonette)	 Multiple Dwelling	 Commercial building	 Institution Building (School)	 Institution Building (Hospital)			
BUILDING MATERIALS	Roof	 Makuti roof		 Iron sheets		 Stone coated tiles		 Clay roofing tiles		
	Wall	 Earth/ Mud walls	 Masonry stone	 Iron sheets	 Wooden walls	 Stabilised earth blocks	 Clay Bricks	 Concrete walls	 Glass and steel	
BUILDING OCCUPANCY	< 5 occupants			5-10 occupants			>10 occupants			
BUILDING AREA (m²)										
CLIMATE PROFILE	Hot and Humid		Hot and Semi-Arid/ Savannah and low Savannah			Hot arid		Upland/ High upland		Great lakes

ENERGY BILLS

COST OF ENERGY

ELECTRICITY BILL



Kshs _____

LPG Bill



Kshs _____

Charcoal/ Firewood/ Biomass Bill



Kshs _____

Kerosene Bill



Kshs _____

ENERGY DEMAND

ENERGY SOURCE	MONTHLY CONSUMPTION
Electricity	kWh
LPG	Kg
Charcoal	Kg
Kerosene	Litres

Energy

Washing machine

Manufacturer Model

More efficient

A

B

C

D

E

F

G

Less efficient

Energy consumption kWh/cycle (based on standard test results for 60°C cotton cycle)

Actual energy consumption will depend on how the appliance is used

Washing performance A B C D E F G

Spin drying performance A B C D E F G

Capacity (cotton) kg 5.0

Water consumption / 55

Noise (dB(A) re 1 pW) Washing 5.2 Spinning 7.0

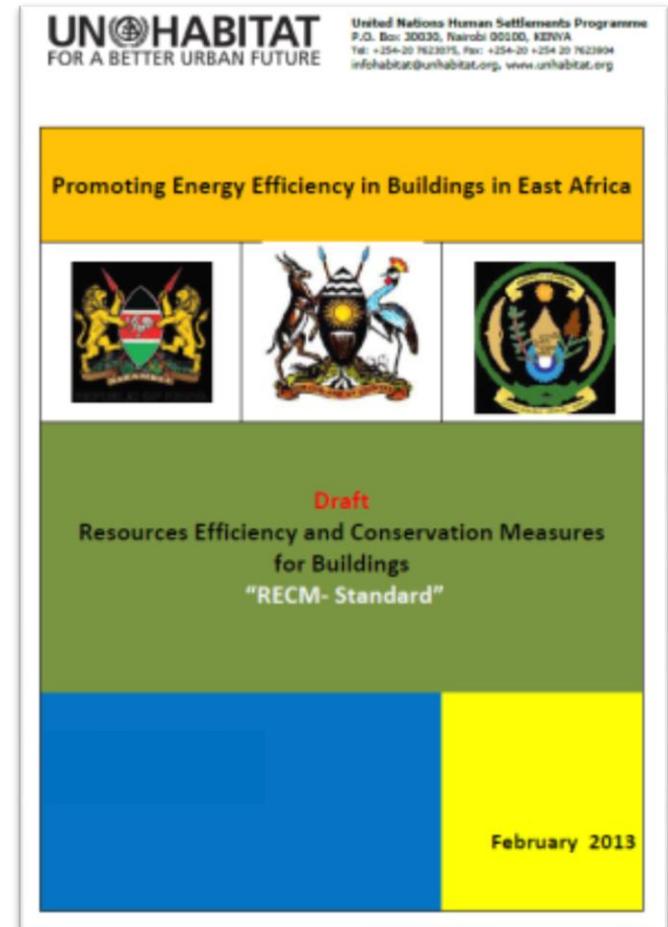
Further information is continued in product brochures



2. Housing policies and regulations: building code / standards

- Review country specific housing policy to include EE measures.
- Prepare EEB policies, session papers and by-laws for enactment, adoption and enforcement.

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



Energy Efficiency in Building Codes Workshop (EEBC) Kigali – April 2013.



3. Education: Awareness creation and capacity building in EEB

The Journal of SUSTAINABLE BUILDING DESIGNS

Multi dwelling housing

CLIMATIC ZONE 1: Sub Tropical Highland climate

Climatic Zone 1: Sub Tropical Highland climate	
Location	Nairobi, Kenya
Latitude	1°17'P
Longitude	36°50'E
Altitude	1665 m above sea level
Temperature	Min average temp 17.7°C; Max average temp 26°C
Humidity	Average relative humidity 72.8%
Prevalent Wind Direction	North-East and East prevailing winds

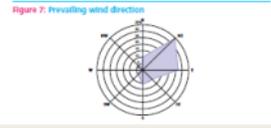
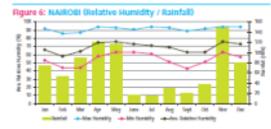
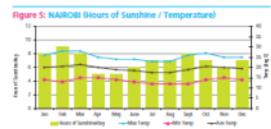


Figure 64: Sunpath Diagram for Latitude 1°

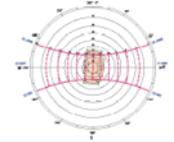
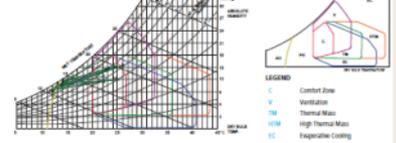


Figure 65: Bio-climatic Chart



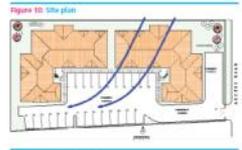
INTERPRETATION

All year round:

- The mean temperature falls in the passive heating zone (PH). This use of passive solar heating is recommended for this region. This can be achieved by having openings face the sun in favourable orientations.
- The minimum 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.

CLIMATIC ZONE 1: Sub Tropical Highland climate

Multi dwelling housing



DESIGN RESPONSES

- Orientation:** The building's major axis is optimally oriented along the east-west axis.
- Ventilation:** All the rooms are airily passively ventilated through the windows and the permanent ventilation provided at the roof level through linear louvers.
- Roof overhangs:** North and south-facing windows are protected from the high midday sun by the provision of horizontal overhangs, horizontal exterior awnings, and roof overhangs (at the top level).
- Roof shading:** North and south-facing windows are protected from the high midday sun by the provision of horizontal overhangs, horizontal exterior awnings, and roof overhangs (at the top level).
- Window shading:** North and south-facing windows are protected from the high midday sun by the provision of horizontal overhangs, horizontal exterior awnings, and roof overhangs (at the top level).
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Development of tools and awareness materials on sustainable building design and technical notes to promote passive building measures/strategies.

Urban Energy Technical Note

PROMOTING ENERGY EFFICIENCY IN BUILDINGS IN EAST AFRICA

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;
- Maximization of the energy demand of buildings;
- Maximization of the efficiency of renewable 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

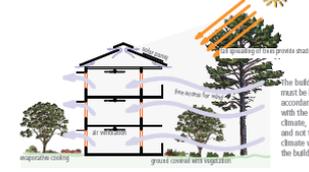
Site analysis helps to identify opportunities or constraints which will influence the outcome of the urban design.

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



3. Education: Awareness creation and capacity building in EEB

EFICIENCIA Y AHORRO ENERGÉTICO

Edificios

El aislamiento, la mejor solución

Guía práctica de la energía para la rehabilitación de edificios

25 °C

40 °C

25 °C

32 °C

25 °C

28 °C

GOBIERNO DE ESPAÑA

MINISTERIO DE INDUSTRIA, TURISMO Y COMERCIO

IDA Instituto para la Diversificación y Ahorro de la Energía

2014

www.unhabita.org/urbanenergy

Build Green.

Save money, save the environment.

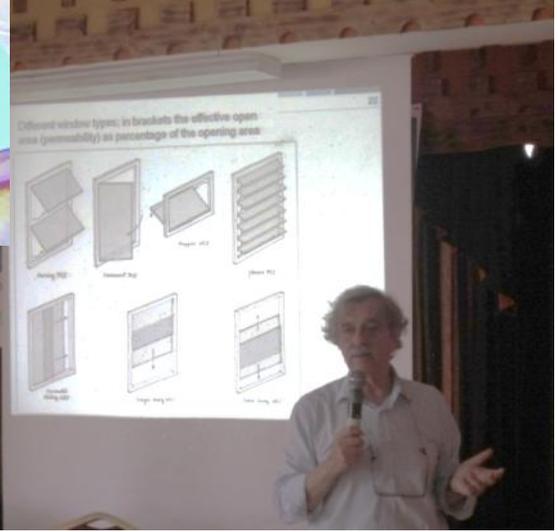
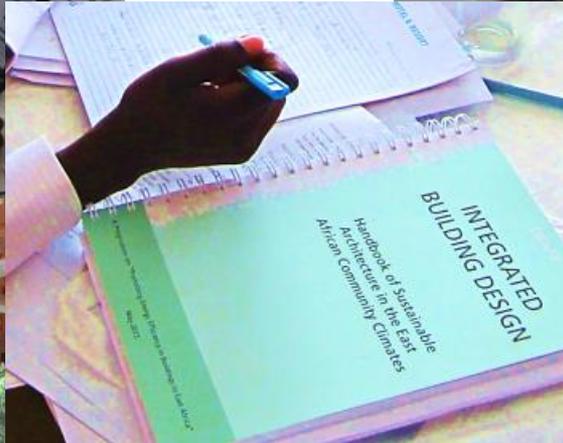
The project "Promoting Energy Efficiency In Buildings in East Africa" is an initiative of UN-Habitat in collaboration with the United Nations Environment Programme (UNEP), the Global Environment Facility (GEF) and the governments of Kenya, Uganda, Tanzania, Rwanda and Burundi.



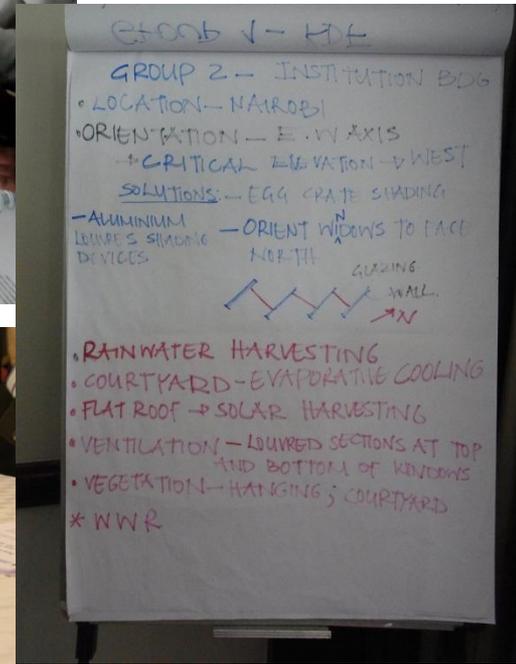
Training Workshop on Energy Efficiency in Buildings Kampala – June 2012.



Sustainable Integrated Building Design for Tropical Countries Dar es Salaam – May 2013.



KAM Green Buildings Training Nairobi- August 2013.



4. Financing instruments of EEB

- Sensitize financial institutions, investment banks, private developers and power utilities on the economic benefits of EE measures.
- Facilitate the adoption and establishment of green mortgage systems.
- Encourage governments to create **fiscal** and **administrative incentives**; subsidies program and to allocate **national budget** for promoting EEB.



Financing Green Building in Africa

STRATHMORE UNIVERSITY, NAIROBI
17-19 SEPTEMBER 2013

new opportunities for
an emerging market



5. Demonstration projects

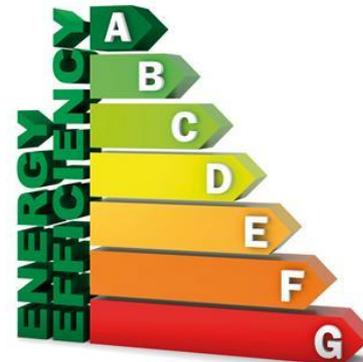
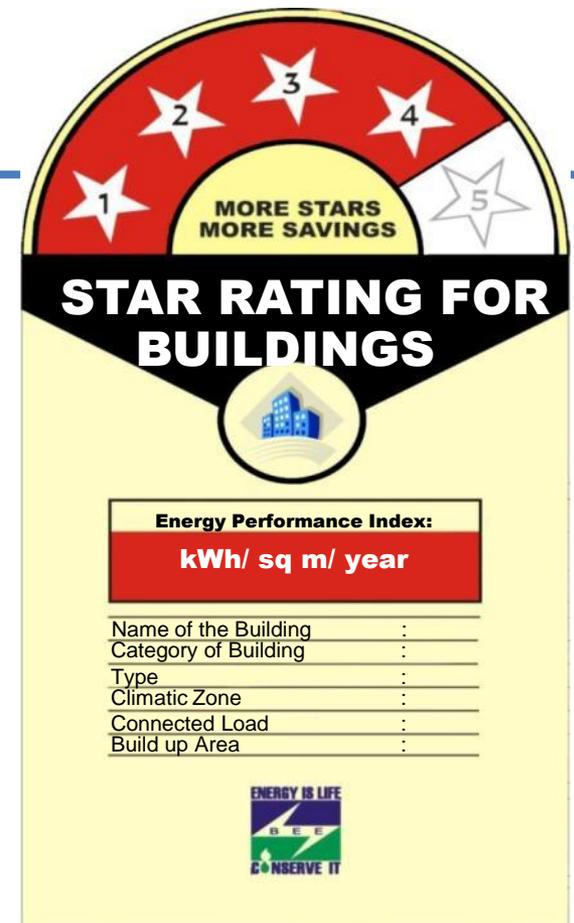
- Facilitate the construction of more EEB in the region through advocacy and capacity building;
- Ensure that majority of new buildings comply with EE principles;
- Work with governments, donors and developers to make sure that new housing projects are EE;
- Conduct practical training with real estate developers and other housing stakeholders to sensitize and provide them with technical assistance on EEB.
- Incorporated EE in all ongoing new housing schemes.



Pilot projects in Dar es Salaam Tanzania that integrate passive building design strategies

East Africa Energy Efficient Building Award (EAEEBA)

- Create a **Regional Energy Efficiency Award Systems** to acknowledge best practices and reward excellent achievement;
- Using internationally agreed green building rating systems as criteria for the award;
- Develop Green building certification system for the region.
- Facilitate the creation of other awards and competition systems on sustainable architecture.



Class	Primary energy use (kWh/m ² /year)
A	0-80
B	81-110
C	111-150
D	151-200
E	201-250
F	251-300
G	301-350
H	351-400
I	401 and above



Conclusion

- A roadmap towards low carbon buildings in Africa must include the following action points:
- The establishment of a baseline on energy performance in building. This can be done through energy audit to identify saving potentials;
- Governments should set green requirements for resource efficient buildings. **Building permit** requirements should include environmental design strategies and passive building measures. **Energy efficient building code** should be adopted;
- Awareness to stimulate consumer demand for sustainable products and to promote behavior change;
- Capacity building and tools development for architects, engineers and other building practitioners on sustainable building design are needed to bridge the gap. **Universities to initiate training courses on sustainable built environment.**
- **Engage investors to finance resources efficient buildings** and appliances through green mortgage. This will help remove financial barriers;
- Engage other stakeholders such as **power utilities** to promote energy efficiency and responsive consumption.



THANK YOU FOR YOUR ATTENTION

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FOR A BETTER URBAN FUTURE

