Africa-Europe Bioclimatic Collaboration 21

Africa-Europe BioClimatic buildings for XXI century

The United Nations Offices Nairobi:

Energy and Resource Efficient Office Building in Nairobi Headquarters of UN-Habitat and UN - Environment

جامعة الأخوين
AL AKHAWAYN UNIVERSITY

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Ifrane, Morroco

www.abc21.eu

UN-HABITAT

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ABC 21 project has received funding from the EU's Horizon 2020 research and innovation programme under Grant Agreement No. 894712.

OUTLINE

- The first energy and resource efficient and energy plus building in Nairobi, Kenya.
- Headquarters of two United Nations Agencies: The United Nations Human settlements Programme (UN-Habitat) and UN Environment (UNEP).
- The building is designed to show case practical example of a sustainability in the building sector.
- Passive building strategies are integrated in the building design: maximum use of local building materials, proper orientation, natural lighting, natural ventilation, solar protection, use of vegetation in the patio, open spaces for the occupants to enjoy outdoor fresh air.
- The building is self sufficient in energy. 450 Kwp solar roof top provide sufficient energy to operate the building. An extra 35 % of energy is fed into the national grid.
- This building has accelerated the adoption of feed-in tariff by the Kenya Government.
- There are today over 40 other offices buildings, universities and industries that have adopted the industrial solar roof solutions.

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Introduction

- In 2007, the former UN Secretary General **Ban Ki-moon** publicly called on all UN agencies, funds and programmes to become climate neutral and "go green."
- In doing so, he took the first step in leading the UN System towards greater sustainability.
- The new UNON office building were under design at the time and take the advantage to design a building that is a showcase for the sector.
- The goal was to make a building that is energy neutral

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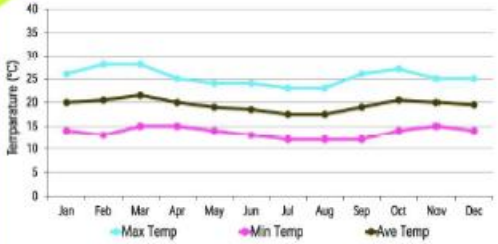
Climate data of Nairobi

Nairobi falls under Highlands Climate

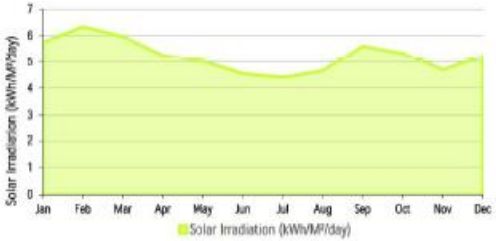
Altitude: 1,800 m Latitude: 1°17'S Longitude: 36°49'E

Climatic charts



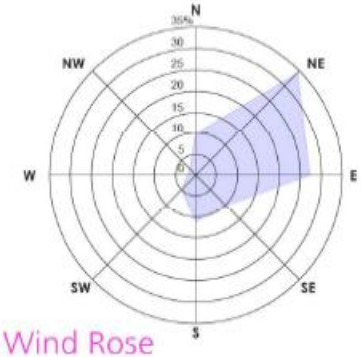
Temperature

Maximum and minimum temperatures are key factors for thermal comfort



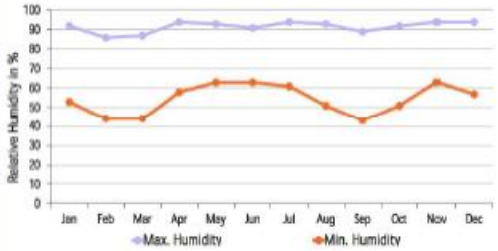
Solar Radiation

The intensity of the solar radiation influences the building heat gains



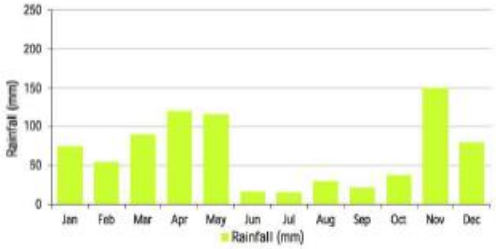
Wind Rose

A wind rose diagram shows the wind directions in a particular location. This is useful to create natural ventilation



Relative Humidity

Maximum and minimum relative humidity determine the dryness of the atmosphere and the feeling of warmth or cold



Rainfall

Monthly rainfall influences the relative humidity and is useful for designing water rain harvesting systems

Sun Path

The sun path of a particular location is crucial for designing proper sun shading devices

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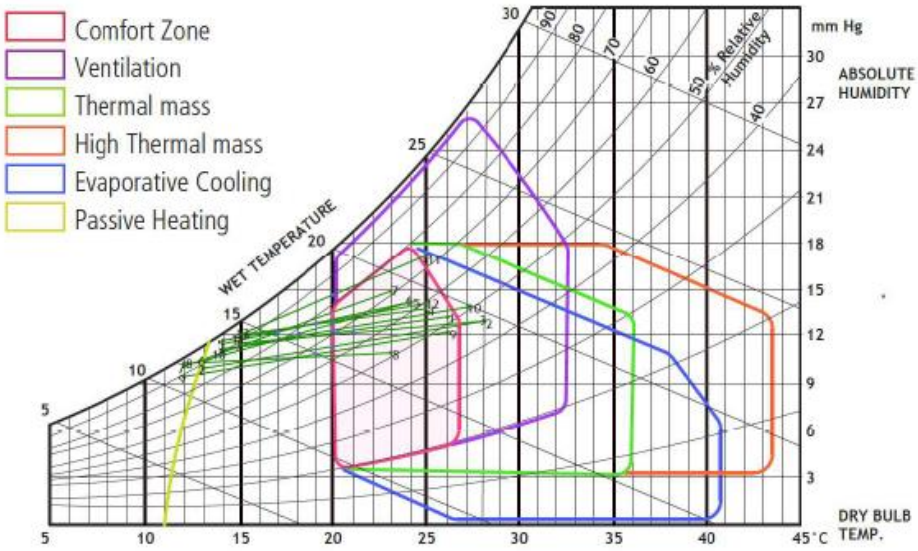
Bioclimatic chart for Nairobi

Bioclimatic chart



The bioclimatic chart shows temperature vs humidity and can be used to determine human thermal comfort and design strategies required for a particular climatic zone.

Guidelines for Green Building Design

According to the climatic data for Nairobi, a green building should observe:

- Building orientation with main facades facing North-South
- Natural ventilation should be provided making use of the prevailing winds from NE-E direction
- Natural lighting in all the rooms but preventing solar radiation will reduce energy consumption
- Protection of windows from direct solar light but allowing some solar radiation to enter the building in the colder season from May to September will enhance passive heating
- High thermal capacity walls (made of stones or bricks) are very appropriate to assist passive heating for the colder season

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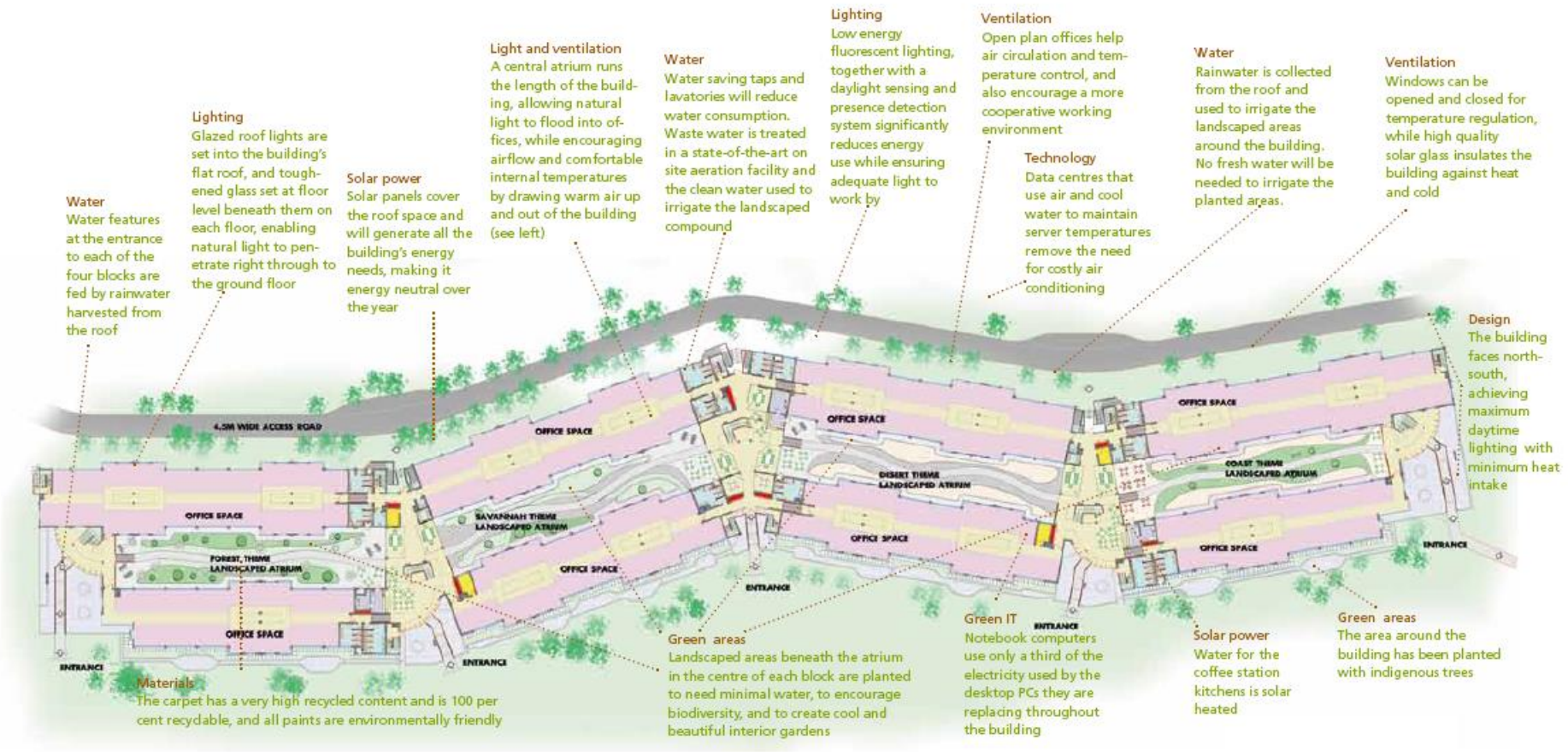
Passive building strategies



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Passive buildings

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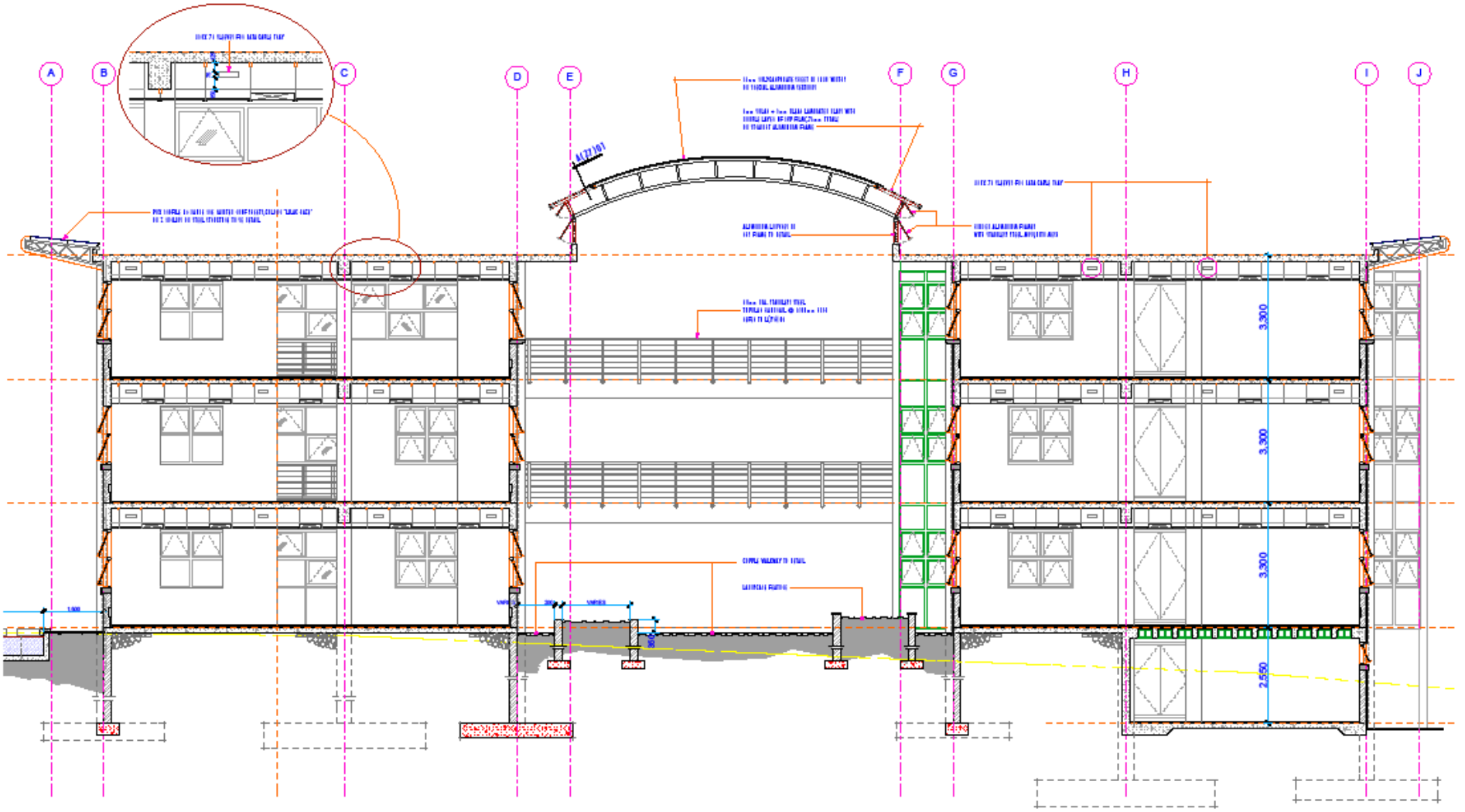
Energy efficiency



TYPICAL ATRIUM & LIGHT WELL SECTION
SCALE 1:100

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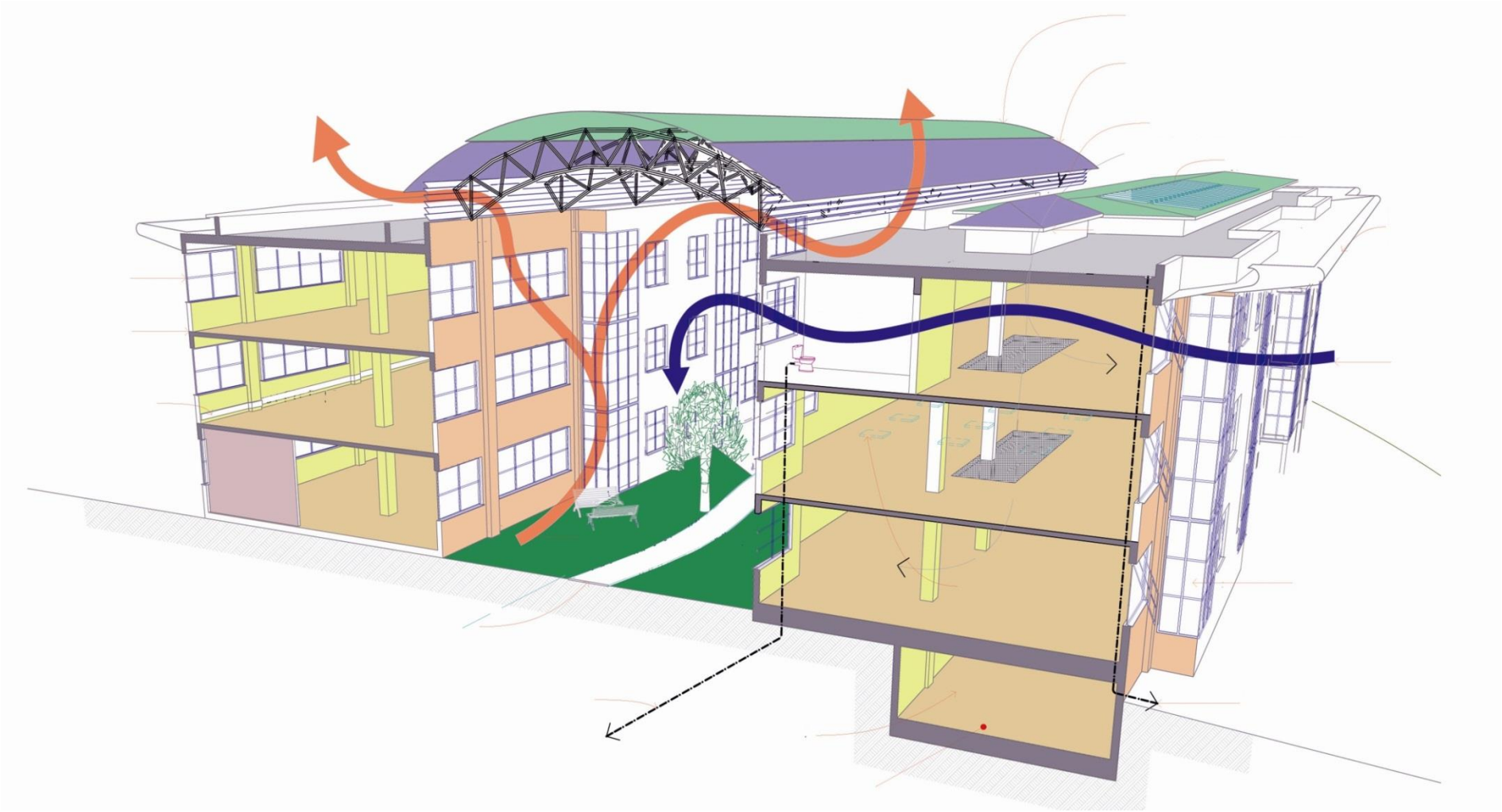
Energy efficiency



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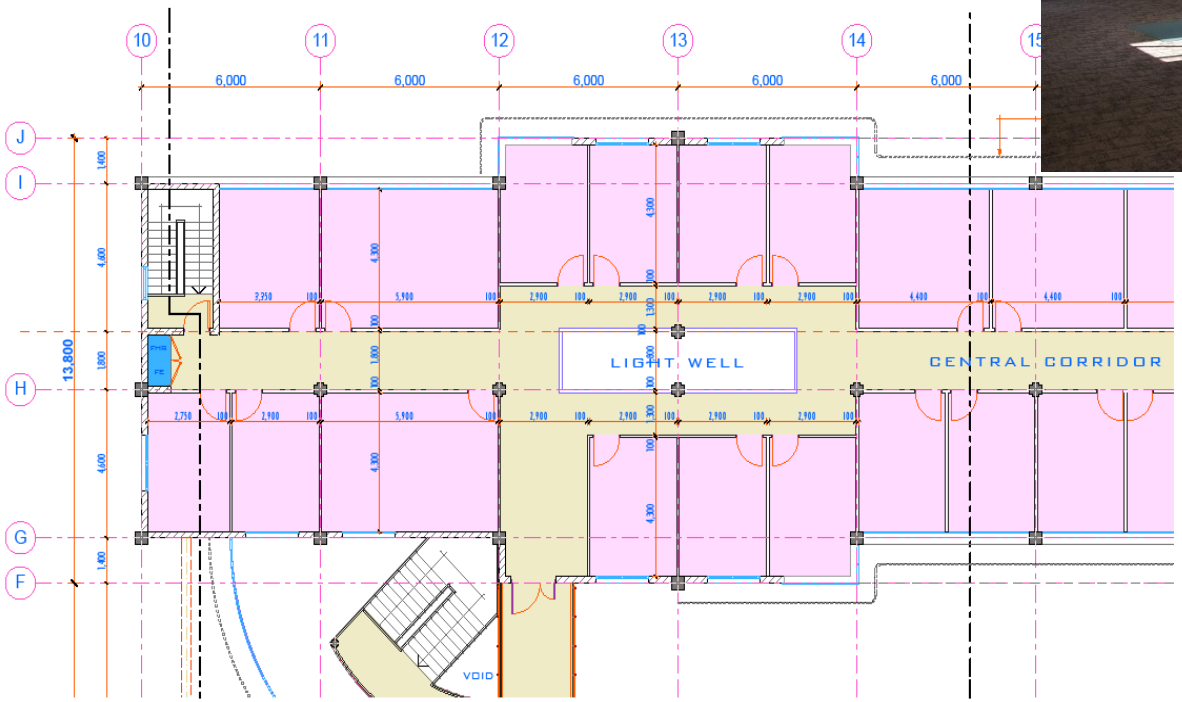
Natural lighting: LIGHTWELLS



TYPICAL OFFICE PARTITION LAYOUTS
SCALE 1:100

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Natural and efficient lighting and monitor sensors

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Greening and garden inside

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Greening and garden inside

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Energy efficiency

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Materials selection

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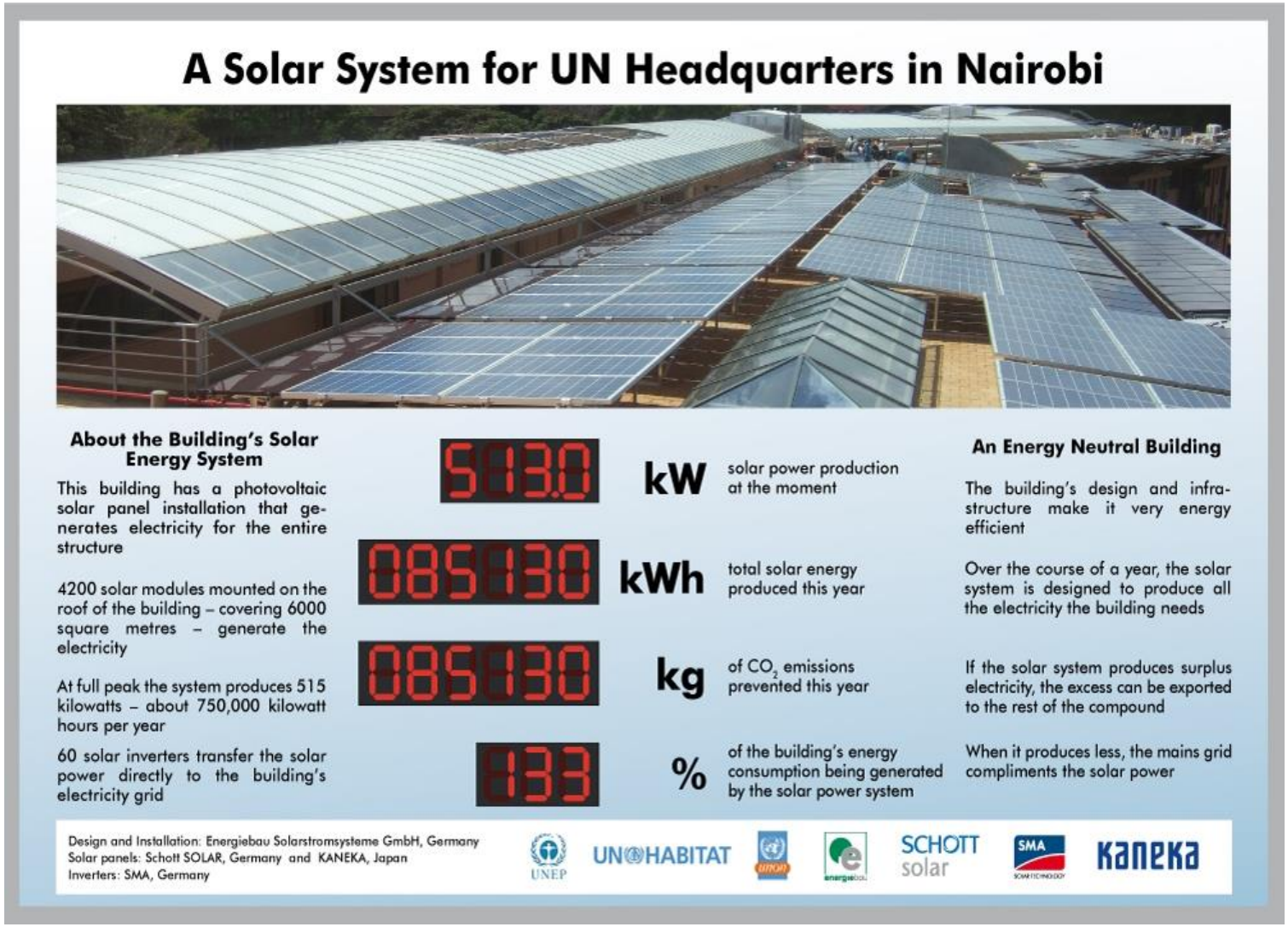
Solar energy



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Solar energy

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Resource efficiency: rain water management

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Resource efficiency: rain water management

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Resource efficiency: rain water management

ROOF 10,000 SQM HARVESTING
RAINWATER 7.5 MILLION LITERS/YR

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Lessons learned

- Goals were set to show-case a sustainable building in the tropical country.
- For energy, the target was to make the building energy neutral. This was achieve and surpassed by having an energy positive building.
- Sustainable water management - full recycling of all water and sewage.
- This building has created a good example for the region.
- Seeing is believing.
- The biggest lesson is the political will. Technology and finances alone cannot solve the problem, we need to have an holistic and all inclusive approach.
- The building is being monitored for improvement.

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Thank You!
Q & A

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