UNEP / DFS / UNMIS
Technical Report

Assessment of Energy and Water Reduction Options for the Proposed UN House

Juba, South Sudan

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Issued by the United Nations Environment Programme

Date: January 2011

Executive Summary

Rationale

The Environmental Policy for the Department of Peacekeeping Operations (DPKO) and Department for Field Support (DFS) came into effect on 1 June 2009. This policy, developed in cooperation with UNEP, provides a minimum set of environmental standards for UN Field Missions. These standards have been developed to minimize the environmental footprint of peacekeeping operations while maximizing the efficient use of natural resources. Application of these standards should reduce the overall consumption of natural resources and production of wastes, thereby reducing potential conflicts with local communities and enhancing the reputation of the UN as a leading organization in environmental sustainability. The application of sustainable technologies and practices also improves the self-sufficiency of bases, for example through energy production and water treatment, thereby reducing dependency on external supplies.

Given its environmental mandate, UNEP was requested by DPKO and DFS to provide technical assistance in the implementation of this policy.

Previously UNEP in co-operation with UNSOA, undertook an assessment of the resource-demand and operating practices of two proposed African Union Mission to Somalia (AMISOM) camps, in Mogadishu, Somalia and Mombasa, Kenya in June 2009. Building on this work, UNEP and UNMIS have collaborated to recommend sustainable technologies and operating practices to be included in the design and construction of the proposed UN House built in Juba, South Sudan, under UNMIS' supervision.

Using the same methodology as for the work done with UNSOA, each option has been ranked using a traffic light system of green (immediate adoption), yellow (further study) and red (not feasible) according to practicality, technical robustness and financial implications.

This report details the outcomes of this assessment and provides a set of immediate-, medium- and long-term recommendations for reducing energy and water footprints. Furthermore calculations have been completed assessing the contribution of the UN House to Greenhouse Gases.

Findings

Energy: A total of thirty-three energy efficiency measures were identified for the residential units with seventeen ranked as green, twelve as yellow and four as red. For the offices forty-nine energy efficiency measures were identified for the offices units with thirty-four ranked as green, thirteen as yellow and two as red. These are a range of measures to reduce cooling demand, lighting energy consumption, reduce hot water demand and energy, generate energy from low carbon technologies, improve controls, and provide metering to reduce the energy consumption of the building. Based on the calculated reduction in energy consumption from a baseline thermal model, the carbon footprint of the 358 residential units could be reduced by 775 tonnes of CO_2 (27 percent) while the six new offices could be reduced by 243 tonnes of CO_2 (36 percent).

Water: A total of fifteen technology options and best practices were considered in order to reduce water consumption. Ten were ranked as green and five as yellow. Of the green options, the analysis found that water consumption could be reduced by 37 percent in the residential units and 46 percent in the office units, through the adoption of recommended technologies. The most significant savings come from the adoption of technologies for urinals, toilets, showers, and hand washing. Importantly for the offices, significant savings come from the incorporation

of measures that are aligned with the occupancy profile of the offices.

Greenhouse gas emissions: The total estimated emissions for UN House in Juba once operating at full capacity is 19521 tonnes of carbon dioxide equivalent (CO2 e) per annum of which 16553 tonnes per annum is derived from electricity generation and the bulk of the remainder from vehicle usage

Priority recommendations

This assessment provides a series of immediate-, medium- and long-term recommendations, which reflect the commitment to ongoing reductions in resource-consumption and carbon emissions. There is a single immediate recommendation:

Conduct a review of the herewith proposed resource-reduction measures by UNMIS/DFS experts to enable the adoption of specific measures for inclusion into the design. This could be as, for example, performance specifications. This should be undertaken in line with the programme for contractor assessment and appointment. The effectiveness of this recommendation is controlled by the programme for contractor appointment; for full potential to be realised detailed communication between UNMIS and contractor's is required prior to final appointment.

Particular focus is required on the following recommended measures, with "green ranked" solutions presented in Appendices 2, 3, and 4. These recommendations reflect the current fluidity that exists in the design and construction of the remaining units--both office and residencies--and the need to alter design or seek additional emphasis on aspects that may not be reflecting its true potential efficiencies. All energy demand measures will later need to be underpinned by information and education to all staff on the site to ensure that energy good practice is built into daily life staff behaviours.

For the offices:

Air tightness: significant savings in overall energy use can be gained by improving the air tightness of the buildings. However, this will require additional local or centralised mechanical ventilation to deliver sufficient fresh air for the office areas.

Central Cooling: Centralised cooling can improve efficiency and improve service control. Importantly centralised cooling allows for the connection with low carbon technologies at construction or in the future.

Combined Heat and Power with Absorption Cooling: Diesel generators produce electricity and heat. With the existing design only the electricity is captured and the heat is wasted. The process to produce electricity is only 35-40 percent efficient. Significant energy savings at the site will be realised if the diesel generators can be made to be more efficient. Combined heat and power units (CHP) are like generators but enable the heat to be utilised as well as the electricity, increasing the overall efficiency of the unit. The waste heat can be used to generate cooling within an absorption (or adsorption) chillers. This can either be from a centralised chiller (from one or two CHP units) or packaged absorption chillers available for each building.

Low energy lighting: Install LED or low wattage lights where feasible with occupancy sensors for relevant areas

Building Management Systems: These provide additional control with provision of half hourly metering for cooling, lighting and small power (discussed separately in Appendix 5)

Renewable technologies: Photovoltaic's and solar thermal should be maximised where economic and feasible.

Urinal controls and dual flush toilets: The installation of an appropriate urinal flushing system (operator activated or dry flush) – continuous flush urinals operate even at times when the offices are unoccupied significantly wasting water.

For the residences:

Efficiency of air-conditioning unit: Specification should require seasonal efficiencies of at least 3.5 COP as this has a significant impact on energy consumption.

Insulation: Add insulation to improve the thermal performance of the wall to reduce the cooling load.

Renewable technology: Solar thermal should be specified for each unit and photovoltaics if cost effective.

Controls: Adding a last man out switch for all electrical demand in the unit (or include a key card occupancy control) will reduce energy demand.

Low energy lighting: Low energy LED lighting should be specified for internal lights and occupancy and daylight timers for external lights.

De-centralised power: It would not be possible to distribute chilled water from the existing location of the energy centre. However it is recommended that the feasibility should be considered of a localised energy centre with diesel generators and one or two CHP units, the residential units could benefit from the waste heat from electrical generation used within an absorption chiller.

Aerated Showerheads and taps: The provision of aerated units will substantially reduce the water consumption.

Future test units

Orange and red ranked initiatives and technologies while not considered relevant within the context of the immediate- to short-term build profile of the Juba camp could become more relevant over time. The development of test units within the camp would offer the facility for innovation to be tried on a practical level. It is recommended that a residential unit be constructed with metering installed that could allow for measurement of water and energy reduction initiatives – metering would be installed on the main power and water incomers with submeters installed where detailed assessment is required for any equipment specific measures.

Acronyms List

AC:	Air Conditioning
AMISOM:	African Union Mission in Somalia
BMS:	Building Management System
CEB:	UN Chief Executive Board
CHP:	Combined Heat and Power
DFS:	Department of Field Support
DPKO:	Department of Peacekeeping Operations
EIA:	Environmental Impact Assessment
EMP:	Environmental Management Plan
FOI:	Swedish Defence Research Institute
GHG:	Greenhouse Gas
GRI:	Global Reporting Initiative
REAP:	Re-engineering Assessment Practices
REEIO:	Regional Economy Environment Input Output model
LED:	Light-Emitting Diode
LEED:	Leadership in Energy and Environment Design
BREEAM:	Building Research Establishment Environment Assessment Method
CASBEE:	Comprehensive Assessment System for Building Environmental Efficiency
HLCM PN:	High-Level Committee on Management Procurement Network
HQ:	Headquarters
IT:	Information Technology
LED:	Light Emitting Diode
MSW:	Municipal Solid Waste
Pa:	Per annum
PIR:	Passive Infra-red
PV:	Photo-voltaics
UNEP:	United Nations Environment Programme
UNHCR:	United Nations High Commissioner for Refugees
UNMIS:	United Nations Mission in Sudan
UNSOA:	United Nations Support Office for AMISOM
VSD:	Variable Speed Device

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