"ELITH"
Energy for Low-income Tropical Housing – a 3-year 5-country research programme
Introduction to Kampala Workshop, April 2016

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UK: Universities of Warwick and Cambridge

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University of Nottingham, Ningbo, China

King Mongkut's University Thonburi Thailand

East Africa:

Uganda Martyrs University in Nkozi

National Housing and Building Research Agency (in Dar es Salaam, Tanzania)

Energy for Low-income Tropical Housing

The University of Cambridge

The University of Warwick

National Housing and Building Research Agency (NHBRA)

The University of Nottingham Ningbo China

Uganda Martyrs University

King Mongkut's University of Technology Thonburi

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ENERGY, GHG EMISSIONS AND HOUSING COST

The Global Housing Deficit requires reductions in housing cost

Countering the Global Warming Crisis requires reductions in emissions

From the recent COP Conference in Paris (December 2015) it is clear that current national commitments to reduce GHG emissions will be very unlikely to keep global temperature rise below 2^{o}C.

Energy for Low-income Tropical Housing

New Houses Construction & repair

‘Embodied’ Energy / Carbon

+ All Houses’ Occupation

Operational Energy per year

= Housing Sector Annual Energy Consumption

Carbonaceous fuels

Renewable electricity

Greenhouse Gas Emissions (in kg CO_2 eq)

burning a fuel to get 1 kWh of energy releases about 0.3 kg of CO_2 ;

manufacturing 1 kg cement emits 1kg CO_2

Embodied carbon

is taken as the carbon in the gases emitted in the process of creating a given housing unit: these emissions are associated with creating materials such as **cement, bricks, steel, plastics** and **glass** but also with **transport of materials** to site.

Most building materials require high temperature heat for their production and therefore the combustion of fuels rather than the use of electricity. In addition, cement production actually produces CO_2

All are mature industries with limited scope for improving their energy efficiency.

Routes to reducing embodied carbon

Make houses smaller (under 8 sq m per person?)

Substitute less carbon-intensive materials for existing materials or reduce the energy-intensity of existing materials production processes

Reduce, by architectural and technical means, the **volume** of materials used for a dwelling of given size.

Extend the life of housing and thereby reduce the embodied energy 'per year of usage'

Energy for Low-income Tropical Housing

Operational Energy

comprises all energy 'consumed' in a dwelling during its lifetime – for convenience calculated for in 1 year of that lifetime.

Cooking & water-heating was historically dominant

Cooling is now the major domestic energy use in SE Asia as home-cooling progresses from 'passive' ventilation via mechanical ventilation to 'heat-pump' air conditioning. In Africa (poorer and generally cooler) this usage is yet to become significant.

Lighting Is getting markedly more energy-efficient (up to 100 lumens per watt) and is therefore of declining importance in energy demand

The load from **Electrical appliances & electronic equipment** is growing strongly and much effort is going into improving the energy efficiency of such devices

Reducing the capacity, cost & power of 'heat-pump' cooling

Minimise solar gain (shading, insulation, white roofs, green roofs)

Use fans and enhanced natural ventilation to defer when air-conditioning is turned on

Accept that design to meet the worst possible condition (heat wave) is both extravagant and like to exacerbate network failures at such times

Access new sources of 'cold' such as deep sea water

Means of driving change (towards more energy-efficient housing)

European experience – although focused on more efficient heating and on reducing the winter heating load – went via demonstrations and prototypes, awards and voluntary codes to mandatory building codes, standards and energy labelling

Asia is following, Africa not yet.

Energy and City Form

Energy and therefore GHG emissions are involved not just in the construction and use of individual buildings but are affected by city planning.

The ‘heat island’ effect whereby cities are several degrees hotter than the surrounding countryside has been well studied – means of reducing it less so. Not only should we be trying to reduce the embodied energy in urban and housing infrastructure but we should be exploring city-wide cooling.

Some Asian cities, which are currently hotter and larger than African ones, are pioneering city-wide initiatives for both transport and for housing – such as city-scale cooling and electrical vehicles.

I hope you find today's presentations useful.

They relate to the reduction of GHG emissions from housing and its construction – an important sector in our century-long battle against global warming.