SUSTAINABLE URBANISATION
A CALL TO ACTION ACROSS THE COMMONWEALTH
ONLINE PROGRAMME 24 JUNE 2020 - 02 SEPTEMBER 2020

SESSION #9: UPSCALING DELIVERY OF CLIMATE RESPONSIVE DESIGN
19 AUGUST 2020, 1PM RWANDA, 12PM UK, 11AM UTC
Peter Clegg
Feilden Clegg Bradley Studios
Upscaling Delivery of Climate Responsive Design
CO₂ mitigation curves: 1.5°C

Constant emissions for nine years will use up the remaining carbon budget. Since 18%/yr mitigation is impossible, the only way to achieve this budget is with very large "negative" emissions: pulling CO₂ out of the atmosphere.

Starting mitigation in 2019 will require a mitigation rate of about 18%/yr.

For a >66% chance of staying below 1.5°C, Remaining budget: 420 GtCO₂. Mitigation curves after Raupach et al. 2014.

Starting mitigation in 2000 would have required a mitigation rate of about 4%/yr.

@robbie_andrew • Data: GCP • Emissions budget from IPCC SR1.5
Construction Carbon Emissions

Building related emissions: 39% of all Global emissions
Embodied emissions: 11% of all Global emissions

Bringing Embodied Carbon Upfront - WGBC Sept 2019

Figure 4 Projected yearly share of operational (in grey) vs. embodied carbon emissions (in blue) of a building stock (theoretical). Over time, the share of operational emissions is expected to decrease with requirements imposed by building current standards (i.e. focused on operational). In this case, Danish building code requirements for maximum operational emissions of buildings are used to estimate their share of total building emissions.
Comparative carbon emissions in tonnes of CO2 per capita for different countries around the world.
Figure 1: Projected number of climate migrants in Sub-Saharan Africa, South Asia, and Latin America under three scenarios, by 2050

PLAUSIBLE SCENARIOS

- Pessimistic (Reference)
- More Inclusive Development
- More Climate-Friendly

TOTAL FOR THE THREE REGIONS

SUB-SAHARAN AFRICA

SOUTH ASIA

LATIN AMERICA

Note: The whiskers on the bars in the charts represent the 95th percentile confidence intervals.
Survey of the Built Environment Professions in the Commonwealth, Key Findings
Inhee Chung
Global Green Growth Institute
Rwanda’s Sustainable Urbanization Vision & Green Building Minimum Compliance System
Rwanda – Urbanization Context

- Increasing urbanization
  - 35% by 2024 from 18.4% in 2017
- Capital city Kigali and 6 Secondary Cities as poles of economic growth & prosperity
- Increasing requirement for buildings
  - Housing, Offices, Hospitals, Schools, Hotels etc.
- Increasing energy & resource consumption
- Policy Context
  - SDGs / Paris Agreement & NDCs
  - Vision 2050 & National Strategy for Transformation
  - Green Growth and Climate Resilient Strategy
  - National Urbanization Policy and Housing Policy
  - National Roadmap for Green Secondary City Development
Increasing GHG Emissions from Buildings & Mitigation Potential

Source: Rwanda TNC under UNFCCC Draft Report, September 2018
Approved by Rwanda Cabinet in April 2019

Annex 3 of the Rwanda Building Code 2019

- A mandatory system with in-built flexibility
- Applicable for Category 4 & 5 new buildings
- Shall be administered by District One Stop Centers (Building Permitting Centers) and Rwanda Housing Authority (Central Agency)
- Point-based system
- Basis for mainstreaming green buildings in Rwanda
Green Building Minimum Compliance definition in Rwanda Context

• Can be defined as the one that:

  ✓ Promotes energy & water efficiency
  ✓ Takes advantage of the ambient (upland) climate
  ✓ Reduces the need for air-conditioning usage
  ✓ Maximizes natural ventilation
  ✓ Maximizes use of sustainable & locally manufactured buildings materials
  ✓ Provides superior Indoor Environmental Quality (IEQ) to building occupants
  ✓ Protects environment and promotes biodiversity
Mandatory Indicators

• 1.4 Artificial Lighting Efficiency
• 1.8 Solar Hot Water Systems
• 2.1 Rainwater Harvesting
• 2.2 Efficient Plumbing Fixtures
• 2.4 Wastewater Treatment
• 3.4 Low-impact Refrigerants: Zero Ozone Depletion Potential
• 4.1 Minimum Outdoor Fresh Air Supply – Mechanically Ventilated Spaces
• 4.2 Thermal Comfort – Mechanically Ventilated Spaces
• 4.3 Noise Level
• 5.2 Universally Accessible Building

Points awarded for fulfilling mandatory indicator requirements
## Module 1: Energy Efficiency

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## Module 2: Water Efficiency

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## Module 3: Environment Protection

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### Module 4: Indoor Environmental Quality

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### Module 5: Innovation and Other Green Features

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Summary & Outlook

• Green and sustainable urbanization key growth driver of Rwanda
• Greening the built environment important
• GBMCS foundational to green urbanization process
• Roll out of GBMCS at sub-national level and increasing capacity for implementation are key next steps
• Need to also focus on greening existing building stock and the building and construction sector value chain
Yasmeen Lari
Architect and founder of the Heritage Foundation of Pakistan
Heritage Foundation of Pakistan

Living conditions of BOP.

Waiting for social & ecological justice.

Makli World Heritage, largest Muslim necropolis.
BASA Impact 2011-2018
Humanitarian Assistance to 0.84 million

Fulfilling Primary Needs
Humanitarian Assistance
Beneficiaries in Pakistan

Targeting 12 out of 17 SDGs.

BASA Tenet 1
Maximizing Barefoot Ecosystem

MAXIMIZING BAREFOOT ECOSYSTEM
for SELF RELIANT MARGINALIZED COMMUNITIES

- Humanitarian Marketplaces
- Millions of items for un-met needs
- Products by poor for other poor

- Transactions of goods for un-met needs
- Human-centred development
- Low cost eco-products

- Social/Eco businesses
- Target Un-met needs, dignity/wellbeing
- Foster social & ecological justice

- Poor, non-literate trained for social good
- Products for marginalized communities

- Expertise for low cost eco-products
- Use of sustainable materials
- Maximising recycling, re-use

- Low cost eco-products for un-met needs
- Safe structures
- Use of sustainable materials
- Minimize waste
- Labour-intensive

- Bottoms-up approach
- Efficient use of funds and resources
- Rights-based development
- Knowledge sharing and training
- Cost-effective output

Basa Impact 2011
420
301
70
Targeting 12 out of 17 SDGs.

Heritage Foundation of Pakistan Projects 2011-2018

Cost: €4/

Barefoot Social Architecture (BASA)
BASA Tenet 2: Humanistic Architecture

DRR earth & bamboo house showing pride.

Zero carbon eco construction for dignified living.

Earthen self built Pakistan Chulah stove for wellbeing.
Socially Just DRR Green Construction
Cost: US$ 250/Family

One room house.

Shared Eco-toilet.

Shared water pump.

Pakistan Chulah stove.
8 Specialist Villages for Affordable Green Products
BASA Tenet 4: Shrinking the Carbon Footprint

Bamboo prefab panels - LOG to INTBAU Centre.

LOG Cottages, Zero Carbon Campus near Makli.

INTBAU Centre, Zero Carbon Campus near Makli.
BASA Tenet 4: Promoting Non Engineered Structures

80’x57’ Marquee, Zero Carbon Cultural Centre (ZC3), ZC3.

Craft Pavilions in ZC3.

INTABU Pakistan International Conference, ZC3.

ZC3 as training venue.
WAY FORWARD

1. Digital community centres and affordable smart phones for tutorials and guidance for imparting barefoot methodologies.

2. Widely spread BISGES for trainings, mentoring and monitoring by design professionals and arrangement for angel funding.


4. Support to micro enterprises for unmet needs led by barefoot entrepreneurs.

5. Access to healthcare and education.
THE FORMAL HOUSING SUPPLY CHAIN

- Building Material Production
- Trade and quality certification
- Concept design and engineering
- Housing finance
- Construction
- End-user finance

STRONG URBAN BUILDING SUPPLY CHAINS
A MODULAR & CUSTOMISABLE BUILDING SYSTEM
LOCAL “AFFORDABLE” URBAN HOUSING DESIGN

USD 350/M2

OPTIMISED DESIGN WITH LOCAL MATERIAL

USD 200/M2

COSTS & CLIMATE PERFORMANCE CALCULATOR
LOW CARBON BRICK MAKING FACILITIES

EQUIPED TILE- & BRICKYARDS AND TRAINED RURAL LABOUR, FOR CO₂-NEUTRAL BUILDING MATERIAL PRODUCTION

Modern (CO₂-neutral) tile and brickyard
Rural tile and brickmakers trained in CO₂ neutral production
~2,000 COPYCAT DWELLINGS SINCE EARLY 2018
THE DIFFUSION OF INNOVATION

Everett Rogers

EXTERNAL PUSH

SELF-DISSEMINATION

TARGETED MARKET SHARE OF LOW CARBON BRICKS WALLING: 70%

Urban dwellings built by 2050: 3,000,000

Less trees cut by 2050: 50,000,000

tCO₂ reduced by 2050: 30,000,000

Labourers: +150,000

Builders: +100,000

Ceramists: +6,000

Thank you for your attention.
Peter Rich
Architect, Light Earth Designs
STREET EDGE + PATHWAYS
COLONNADE, TIGHT WALKWAYS

PUBLIC ACCESS TO BUILDINGS
ACTIVATING STREET EDGE
RURAL PRIVATE COURTYARDS

THE IMBUGA (INDOOR/OUTDOOR COURTYARD) IN THE SKY
Lauren Shevills
Architects Climate Action Network
and Architects Declare
Sustainable Urbanisation: A call to action across the commonwealth

Upscaling Delivery of Climate Responsive Design

Lauren Shevills
10% of all designed new buildings are zero carbon

20% by 2021

40% by 2022

80% by 2024

60% by 2023

100% of all designed new buildings are zero carbon

2030

100% of all built new buildings are zero carbon
Medium and large scale housing

Operational energy

Implement the following indicative design measures:

- Robust U-values (W/m².K):
  - Walls: 0.13 - 0.15
  - Floor: 0.08 - 0.10
  - Roof: 0.10 - 0.12
  - Exposed ceilings/mezzanine: 0.13 - 0.18
  - Windows: 1.0 (Triple glazing)
  - Doors: 1.0

- Window area guide (% of wall area):
  - North: 10 - 15%
  - East: 10 - 15%
  - West: 10 - 15%
  - South: 30 - 50%

- Efficiency measures:
  - Air tightness: <1 (m³/h.m².Pa)
  - Thermal bridging: 0.04 (w/m².K)
  - G-value of glass: 6 - 0.5
  - MVHR: 90% (efficiency)

- Balance daylight and overheating:
  - Include external shading
  - Include operable windows and cross ventilation

- Reduce space heating demand:
  - 15%

- Reduce energy consumption to:
  - 35% compared to baseline

Heating and hot water

Implement the following measures:

- Fuel: Ensure heating and hot water generation is fossil fuel free

- Heat:
  - The average carbon content of heat supplied (e.g. CO₂ in kWh) should be reported in use

- Heating:
  - Minimum 10 W/m² peak heat loss (including ventilation)

- Hot water:
  - Maximum dead leg of 1 litre for hot water pipework

- Water
  - ‘Green’ Water Label should be used for hot water outlets (e.g. certified L/min shower heads - not using low restriction).

Demand response

Implement the following measures to smooth energy demand and consumption:

- Peak reduction
  - Reduce heating and hot water peak energy demand

- Active demand response measures
  - Install heating set point control and thermal storage

- Electricity generation and storage
  - Consider battery storage

- Electric vehicle (EV) charging
  - Electric vehicle turn-down

- Behaviour change
  - Incentives to reduce power consumption and peak grid constraints.

Embodied carbon

Focus on reducing embodied carbon for the largest scale:

- Products/materials (A1-A5)
- Transport (A4)
- Construction (A9)
- Maintenance and replacements (B1-B5)
- End of life disposal (C1-C4)

Average split of embodied carbon per building element:

- Superstructure: 46%
- Substructure: 21%
- Substructure: 12%
- Internal finishes: 16%
- Façade: 13%
- MEP: 4%

Data disclosure

Meters and disclose energy consumption as follows:

1. Collect annual building energy consumption and generation
2. Aggregate average operational reporting, e.g. by post code or anonymous meter from part or whole of apartment block
3. Collect water consumption meter readings
4. Upload five years of data to GLA and/or CarbonBuzz online platform
5. Consider uploading to Low Energy Building Database.
Harriet Wennberg
INTBAU