



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



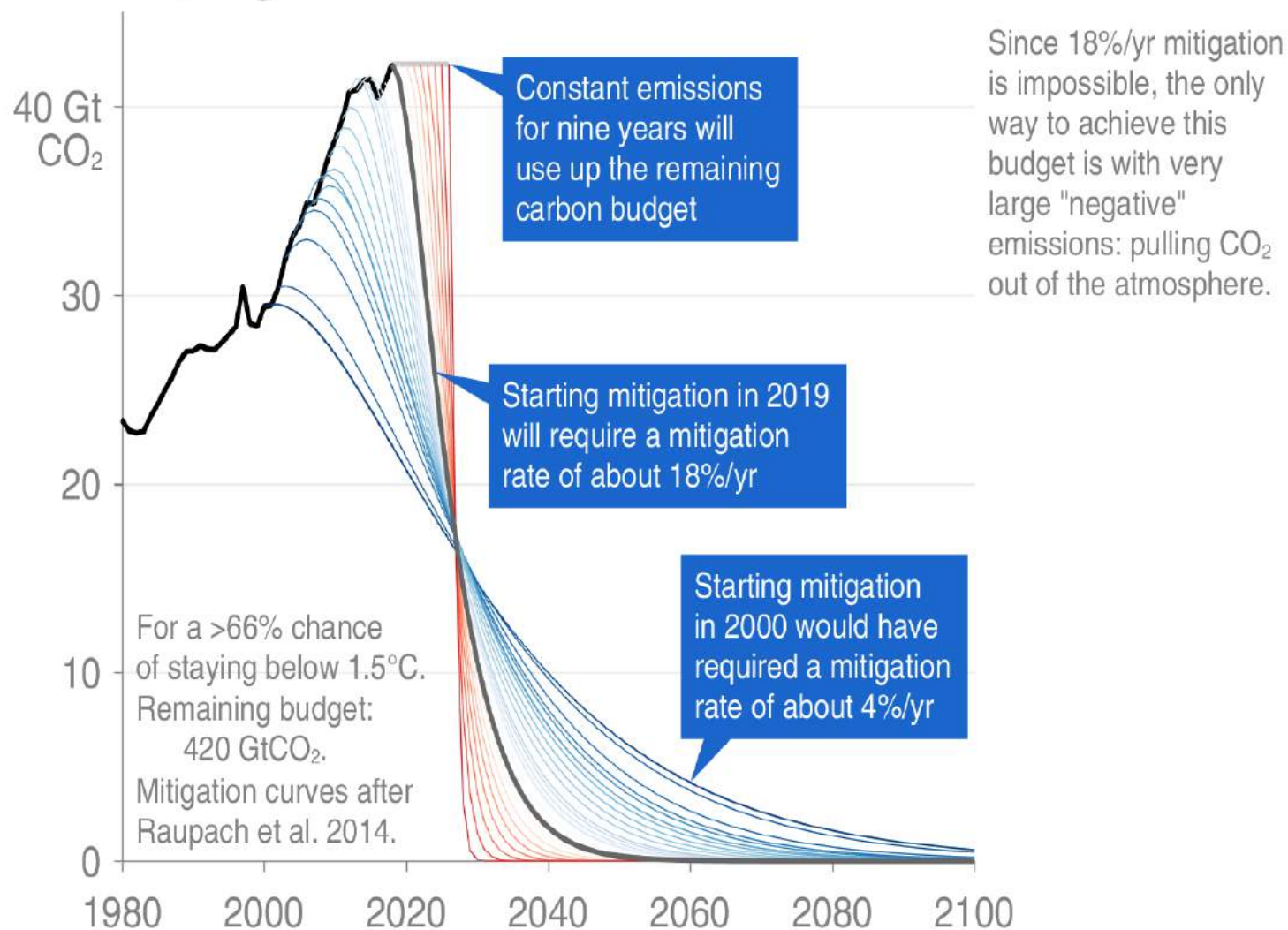
Peter Clegg
Feilden Clegg Bradley Studios

Upscaling Delivery of Climate Responsive Design

Peter Clegg

FeildenCleggBradley**Studios**

CO₂ mitigation curves: 1.5°C



@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

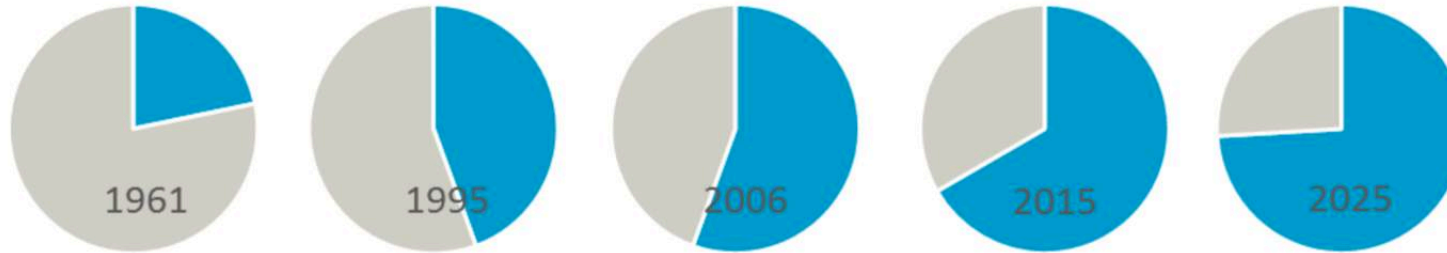


Figure 4 Projected yearly share of operational (in grey) vs. embodied carbon emissions (in blue) of a building stock (theoretical). Over time, the share of operational emissions is expected to decrease with requirements imposed by building current standards (i.e. focused on operational). In this case, 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.

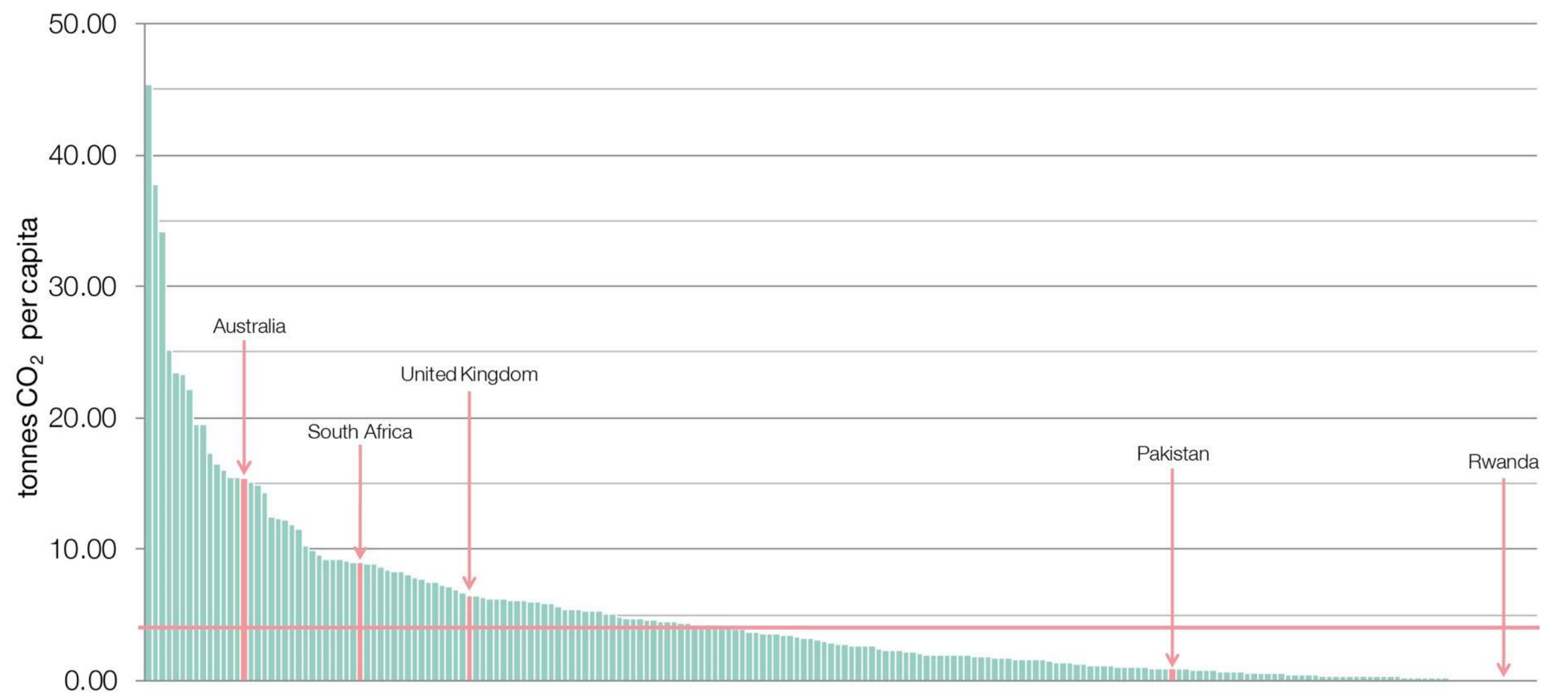


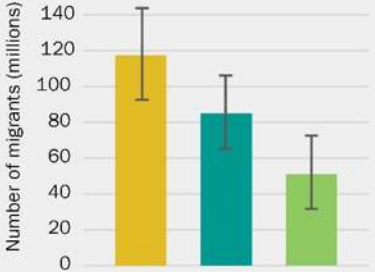
Figure 1: Projected number of climate migrants in Sub-Saharan Africa, South Asia, and Latin America under three scenarios, by 2050

PLAUSIBLE SCENARIOS

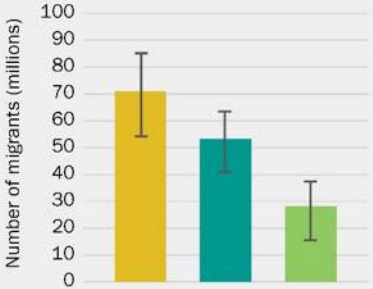
 Pessimistic (Reference)  More Inclusive Development  More Climate-Friendly



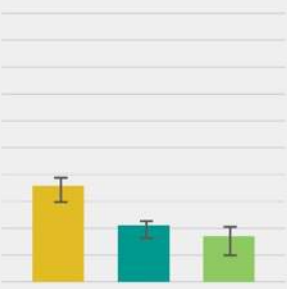
TOTAL FOR THE THREE REGIONS



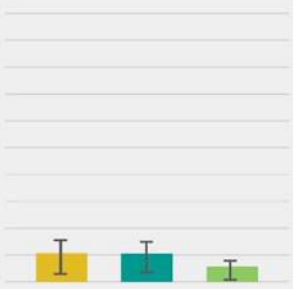
SUB-SAHARAN AFRICA



SOUTH ASIA

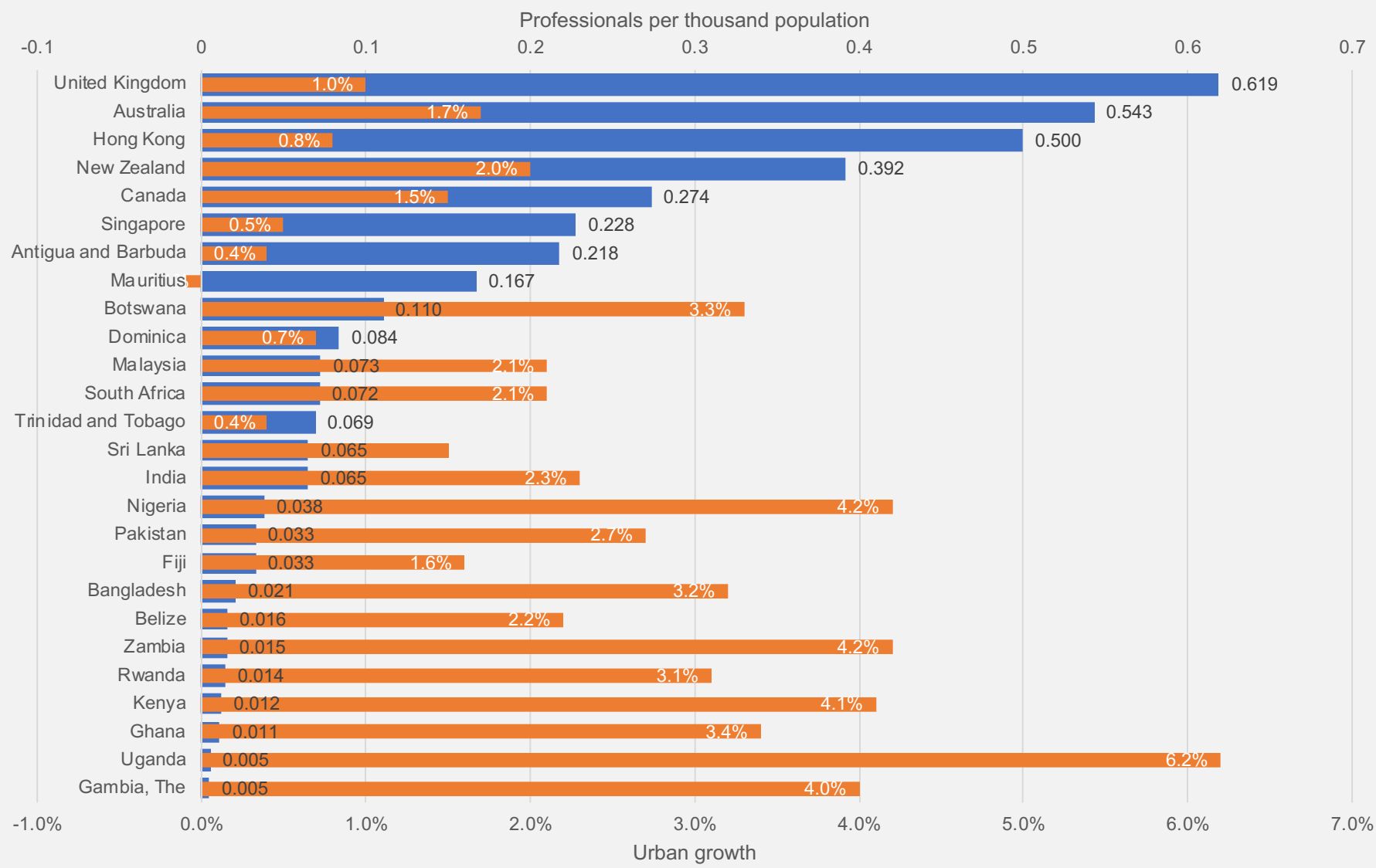


LATIN AMERICA



Note: The whiskers on the bars in the charts represent the 95th percentile confidence intervals.

Ratio of Architects v Rates of Urbanisation, 2019



Inhee Chung
Global Green Growth Institute



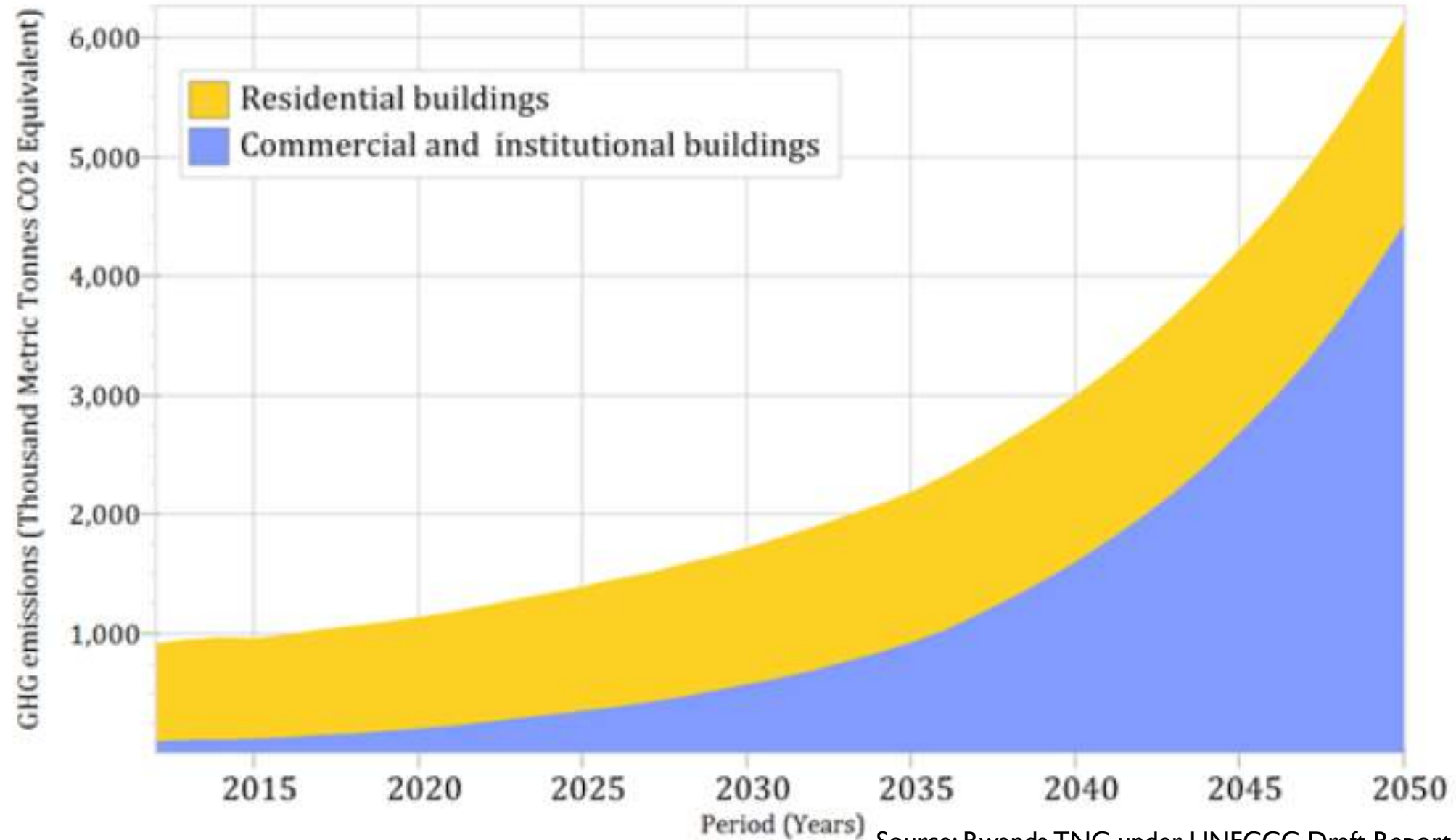
Rwanda's Sustainable Urbanization Vision & Green Building Minimum Compliance System

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

Official Gazette no.Special of 16/04/2019



REPUBLIC OF RWANDA

ANNEX 3
**RWANDA GREEN BUILDING MINIMUM
COMPLIANCE SYSTEM**

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

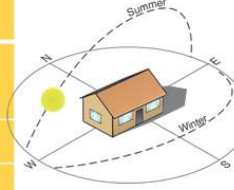
Mandatory Indicators

- 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

#	Indicator	Optional/ Mandatory	Points Allocation
1.1	Building Envelope - Façade Design Parameters	Optional	25
1.2	Ventilation	Optional	25
1.3	Daylighting	Optional	17.5
1.4	Artificial Lighting Efficiency	Mandatory	5
1.5	Enhanced Artificial Lighting Efficiency	Optional	9
1.6	Lifts and Escalators	Optional	3
1.7	Renewable Energy	Optional	5
1.8	Solar Hot Water Systems	Mandatory	5
1.9	Energy Metering	Optional	2
1.10	Air Conditioning System	Optional	7.5
1.11	Building Envelope – Air-conditioned Space	Optional	8



Module 2: Water Efficiency

#	Indicator	Optional/ Mandatory	Points Allocation
2.1	Rainwater Harvesting	Mandatory	4
2.2	Efficiency Plumbing Fixtures	Mandatory	3
2.3	Enhanced Efficient Plumbing Fixtures	Optional	6
2.4	Wastewater Treatment and Reuse	Mandatory Optional	16
2.5	Water Metering	Optional	2



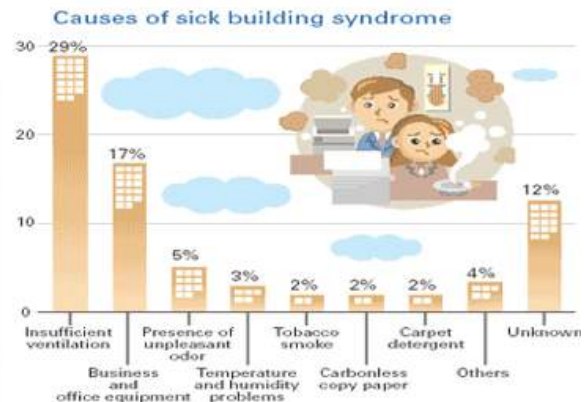
Module 3: Environment Protection

#	Indicator	Optional/ Mandatory	Points Allocation
3.1	Sustainable Concrete Usage	Optional	5
3.2	Greenery Protection	Optional	10
3.3	Environmentally Friendly Practices	Optional	2
3.4	Low-impact Refrigerants: Zero Ozone Depletion Potential	Mandatory	2
3.5	Low-impact Refrigerants: Low Global Warming Potential	Optional	4
3.6	Segregation of Waste, Post-occupancy	Optional	2
3.7	Heat Island Mitigation	Optional	3



Module 4: Indoor Environmental Quality

#	Indicator	Optional/ Mandatory	Points Allocation
4.1	Minimum Outdoor Fresh Air Supply - Mechanically ventilated spaces	Mandatory	4
4.2	Thermal Comfort - Mechanically ventilated spaces	Mandatory	2
4.3	Noise Level	Mandatory	2
4.4	Low Volatile Organic Compound Paints & Adhesives	Optional	2



Module 5: Innovation and Other Green Features

#	Indicator	Optional/ Mandatory	Points Allocation
5.1	Innovation	Optional	10
5.2	Universally Accessible Building	Mandatory	9



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





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Yasmeen Lari

Architect and founder of the
Heritage Foundation of Pakistan

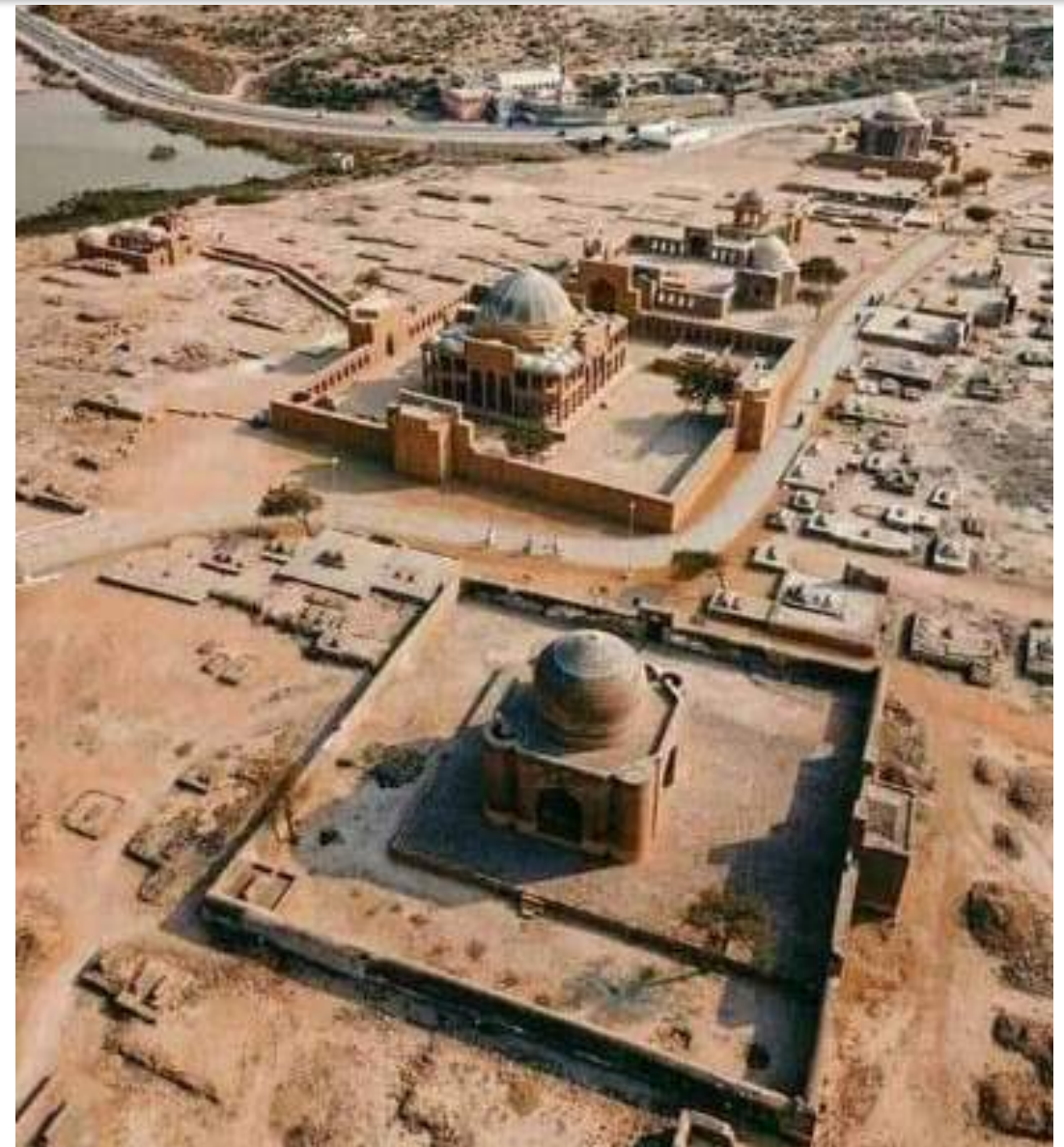
HERITAGE FOUNDATION OF PAKISTAN



Living conditions of BOP.



Waiting for social & ecological justice.



Makli World Heritage, largest Muslim necropolis.

BAREFOOT SOCIAL ARCHITECTURE (BASA)

BASA Impact 2011-2018

Humanitarian Assistance to 0.84 million

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



BASA TENET 2: HUMANISTIC ARCHITECTURE



DRR earth & bamboo house showing pride.



Earthen self built Pakistan Chulah stove for wellbeing.



Zero carbon eco construction for dignified living.

BASA TENET 3: BISGES FOR FULFILLING PRIMARY NEEDS

Socially Just DRR Green Construction
Cost: US\$ 250/Family



One room house.



Shared Eco-toilet.



Shared water pump.



Pakistan Chulah stove.

BASA TENET 3: BISGES FOR FULFILLING UNMET NEEDS

8 Specialist Villages for Affordable Green Products

Construction Village

Chulah Village

Mother Earth Items

Bamboo Village

Kashi/Terracotta.

Barefoot Tourism

Climate Smart Farm.

Food Sec. Dairy

Construction Techniques	Chulah Making	Mother Earth Products	Bamboo Products	Kashi / Terracotta Products	Hospitality	Food Security	Dairy Products
  	  	   	   	  	   	   	  
<i>Earth/ lime/brick Thatch</i>	<i>Chulah making/ Décorattion</i>	<i>Organic soap, compost Fuel briquettes</i>	<i>Bamboo stools, doors Windows</i>	<i>Ornaments, washbasins tiles, frames</i>	<i>Hospitality for Tourism</i>	<i>Kitchen Garden, Forests</i>	<i>Dairy Products</i>

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.

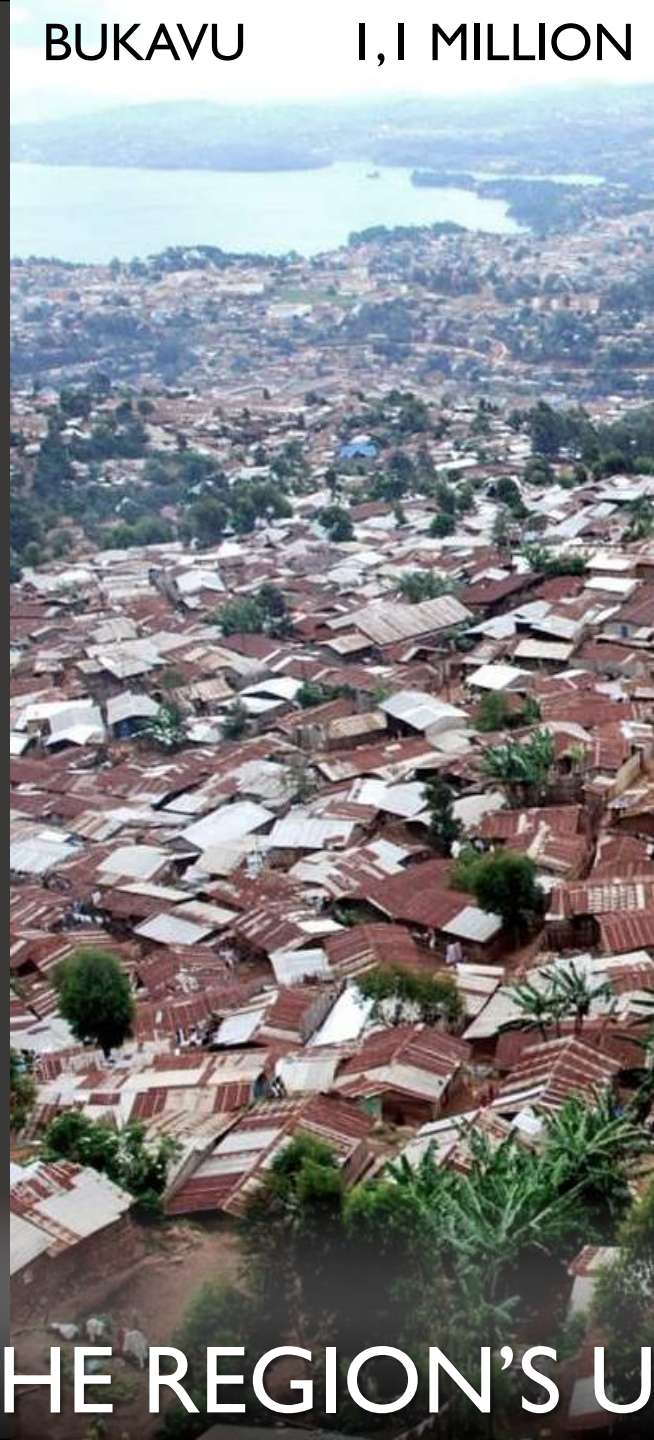
WAY FORWARD

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.**
3. **Livelihood promotion through step-by-step video tutorials for safe self-built green construction and affordable craft items.**
4. **Support to micro enterprises for unmet needs led by barefoot entrepreneurs.**
5. **Access to healthcare and education.**

Fatou Dieye
SKAT Consultancy



KIGALI 1,5 MILLION



BUKAVU 1,1 MILLION



GOMA 1,2 MILLION



BUJUMBURA 1 MILLION

URBAN DWELLERS BY 2050 : +20 MILLION

URBAN DWELLINGS 2019: +110.000

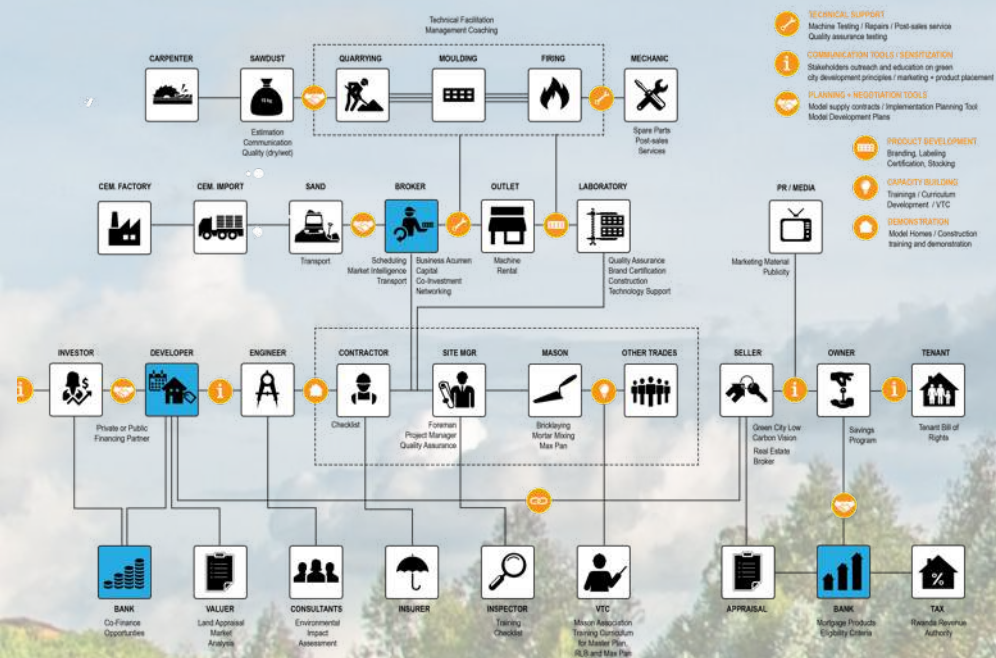
GDP : \$ 20 BILLION

THE REGION'S URBAN EXPANSION PATTERN

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

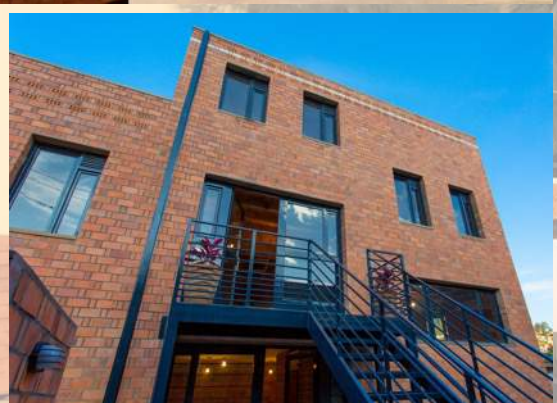
skat Swiss Resource Centre and
Consultancies for Development

THE FORMAL HOUSING SUPPLY CHAIN



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





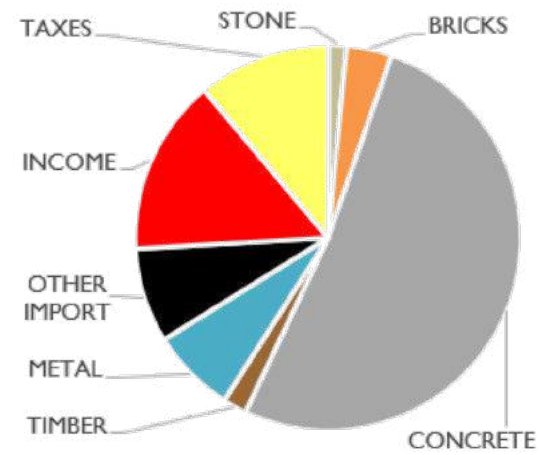
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

skat Swiss Resource Centre and
Consultancies for Development

A MODULAR & CUSTOMISABLE BUILDING SYSTEM

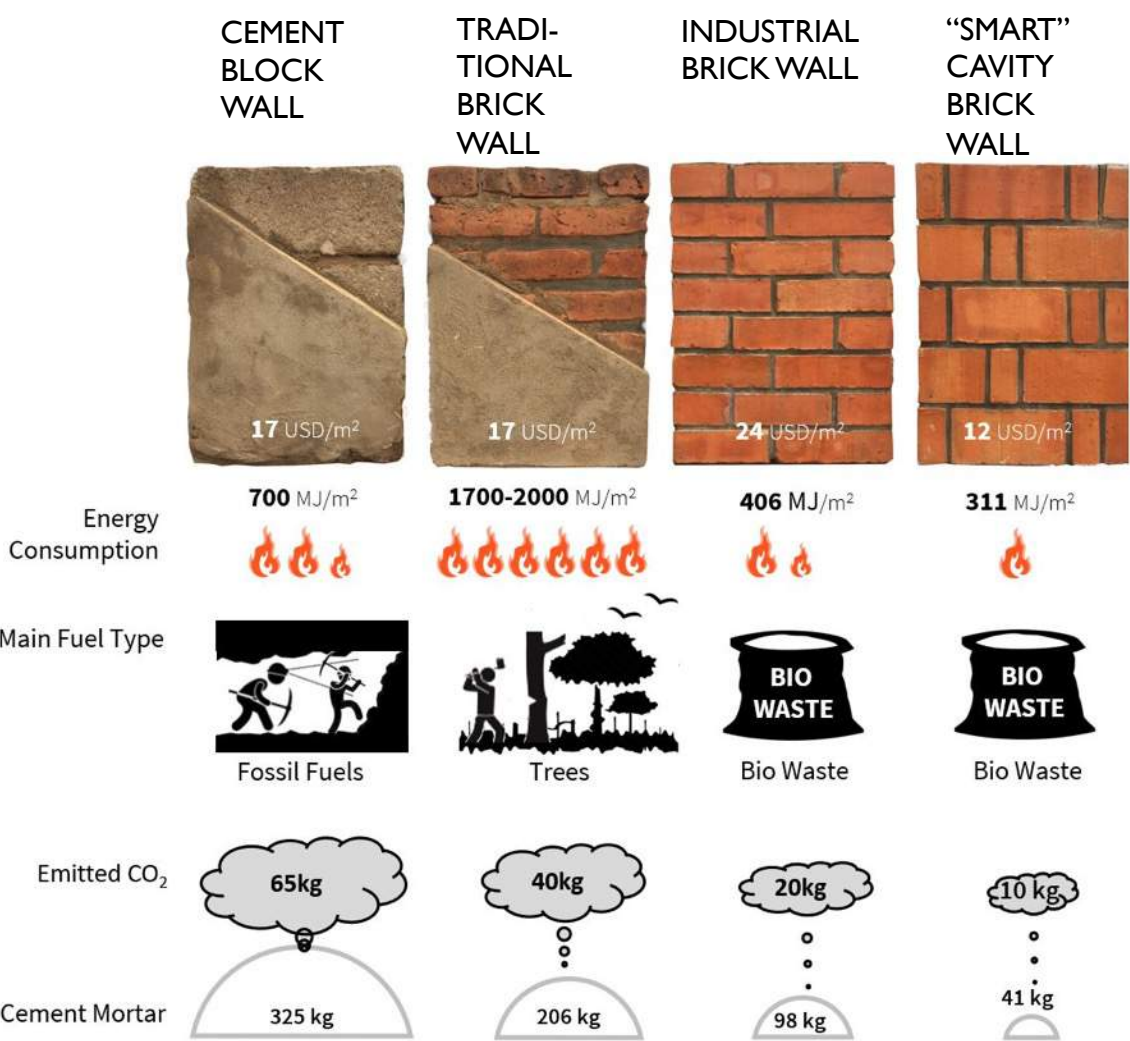
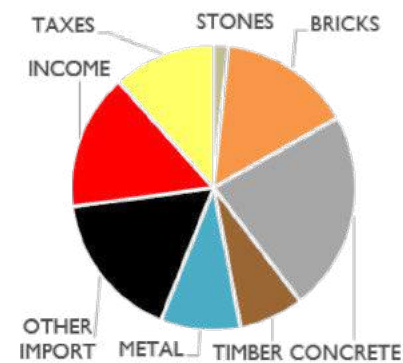
LOCAL “AFFORDABLE” URBAN HOUSING DESIGN

USD 350/M2



OPTIMISED DESIGN WITH LOCAL MATERIAL

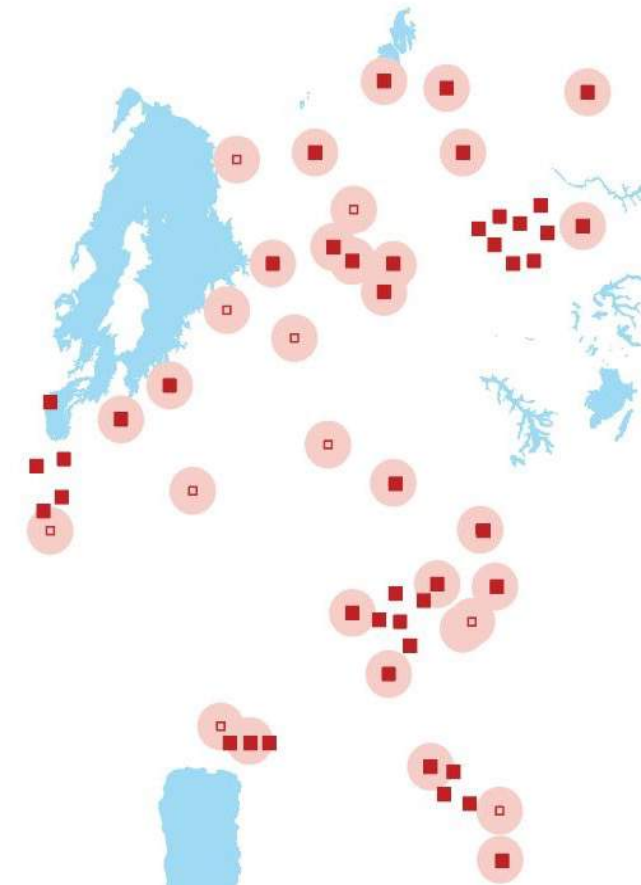
USD 200/M2



COSTS & CLIMATE PERFORMANCE CALCULATOR

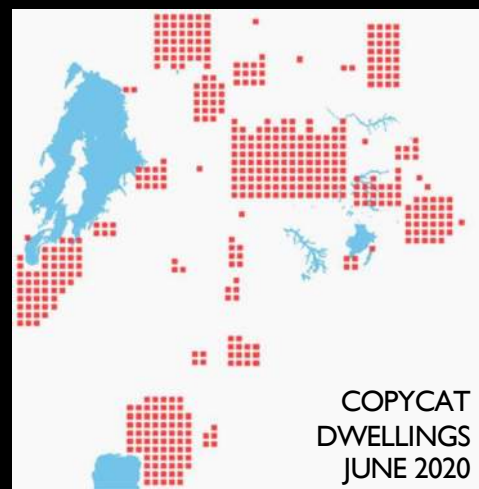


EQUIPED TILE- & BRICKYARDS AND TRAINED RURAL LABOUR,
FOR CO₂-NEUTRAL BUILDING MATERIAL PRODUCTION

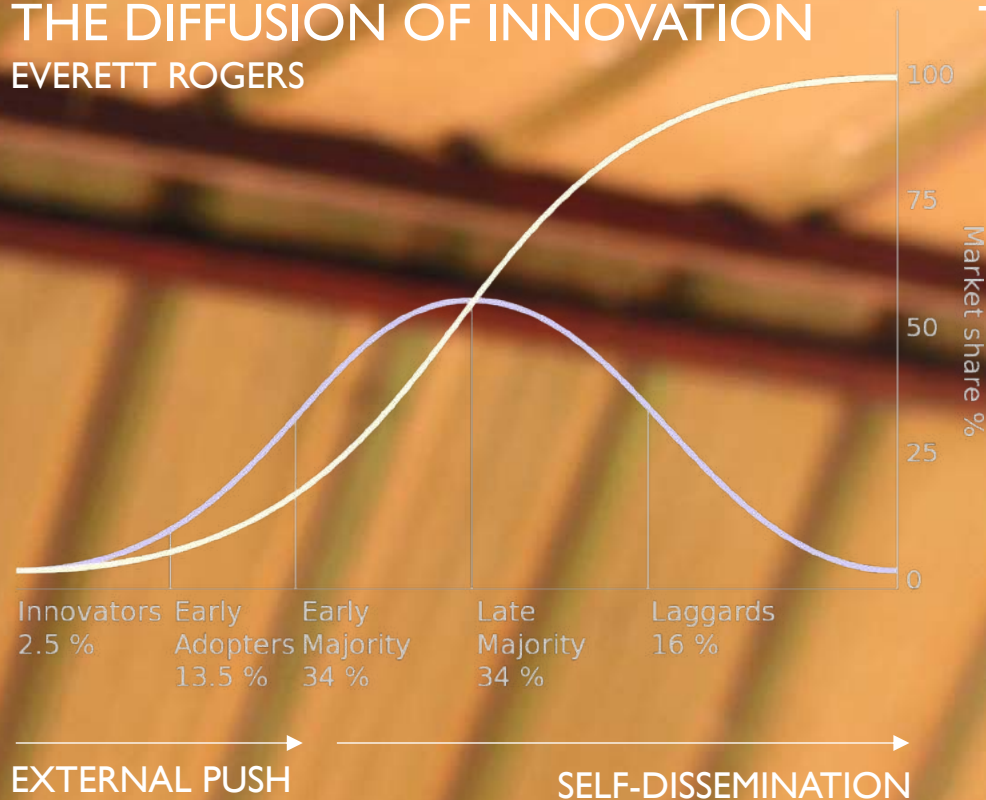


■ Modern (CO₂-neutral) tile and brickyard
● Rural tile and brickmakers trained in
CO₂ neutral production





THE DIFFUSION OF INNOVATION
EVERETT ROGERS



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 : **+ 6000**

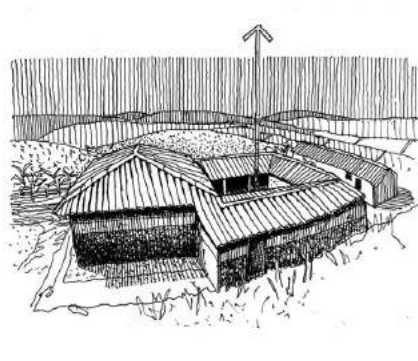
THANK YOU FOR YOUR ATTENTION

Peter Rich
Architect, Light Earth Designs

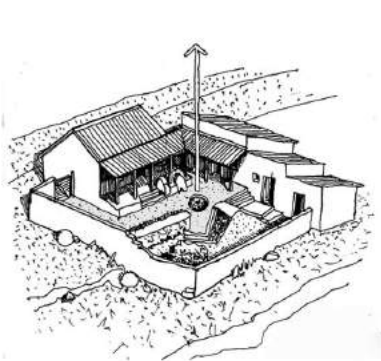
4.1. SPACEMAKING

INTERPRETING RWANDAN CULTURAL
PATTERN

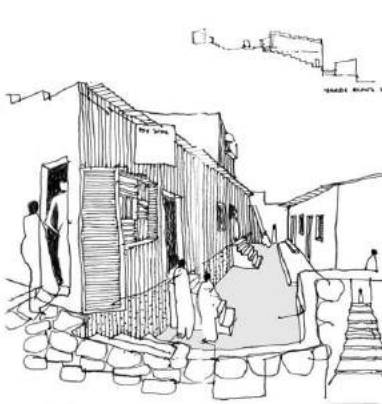
COURTYARD - DEFENSIBLE SPACE
PUBLIC / PRIVATE
RURAL / URBAN



IGIKARI



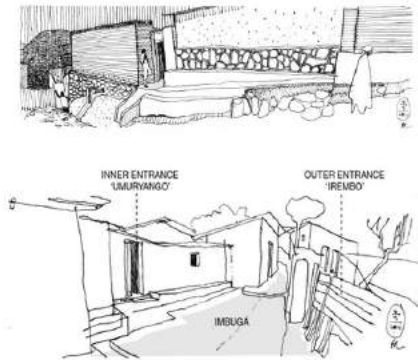
IMBUGA- RURAL



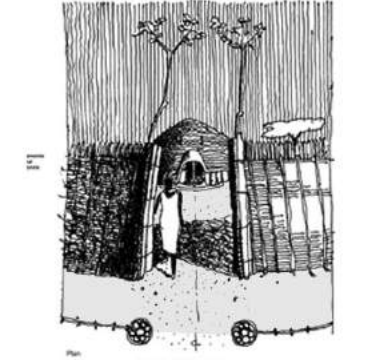
IMBUGA- URBAN



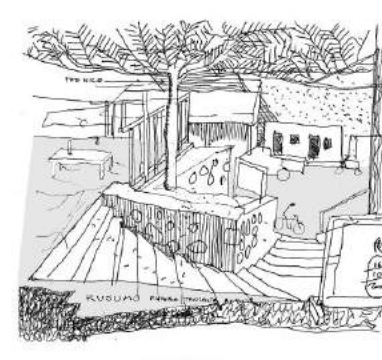
URUBUGA



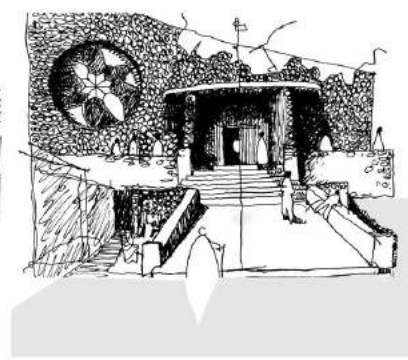
IREMBO



IREMBO



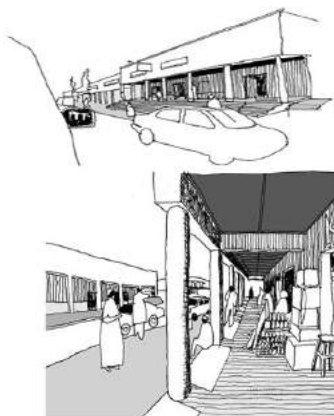
INGAZI



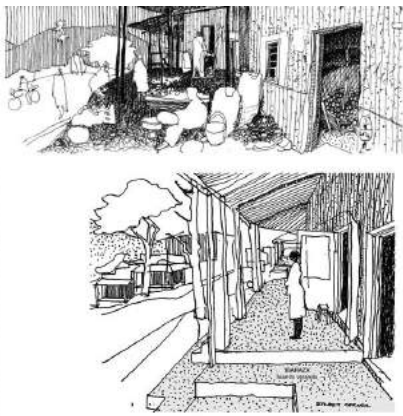
UMURYANGO

ENTRANCE THRESHOLDS
FROM PUBLIC TO PRIVATE

STREET EDGE + PATHWAYS
COLONNADE, TIGHT WALKWAYS



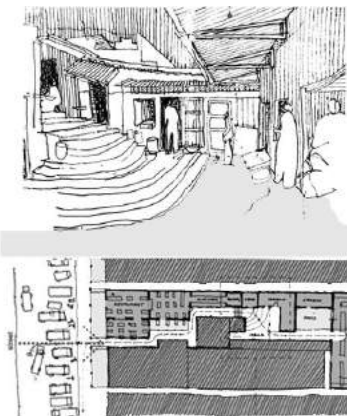
KONOSHI



IBARAZA

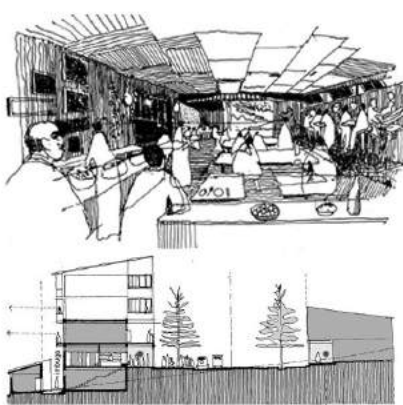


AKAYIRA

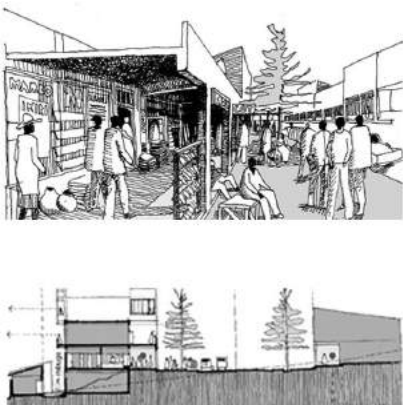


IKIRONGOZI

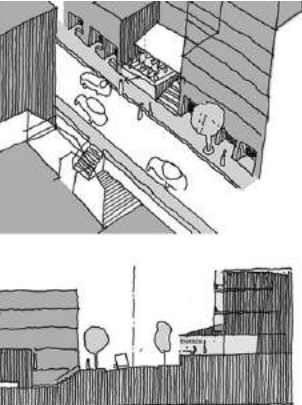
PUBLIC ACCESS TO BUILDINGS
ACTIVATING STREET EDGE



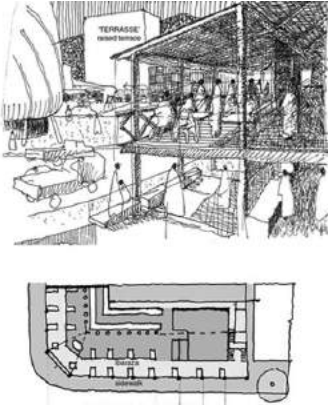
RESTAURANT



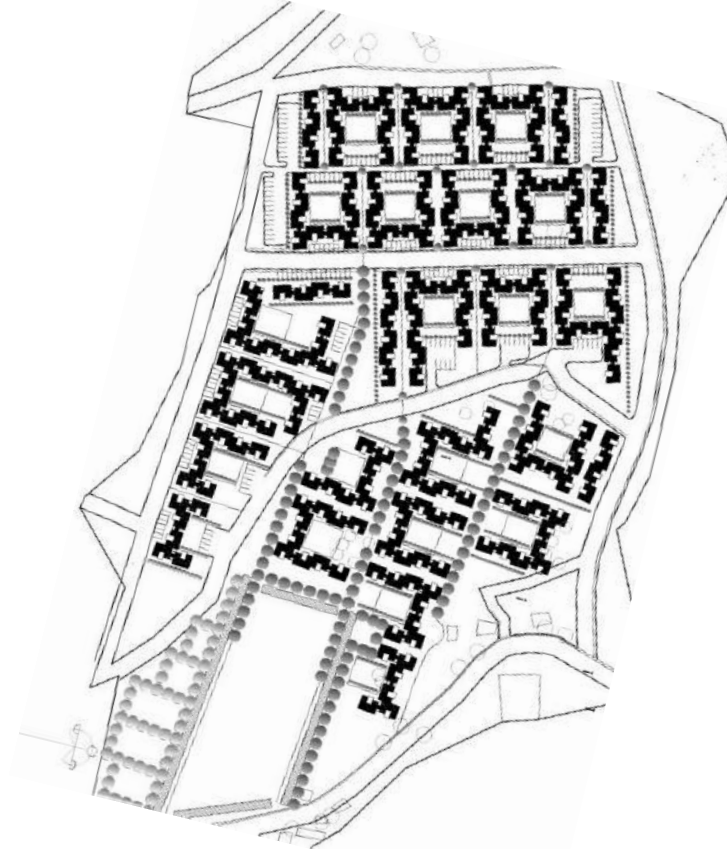
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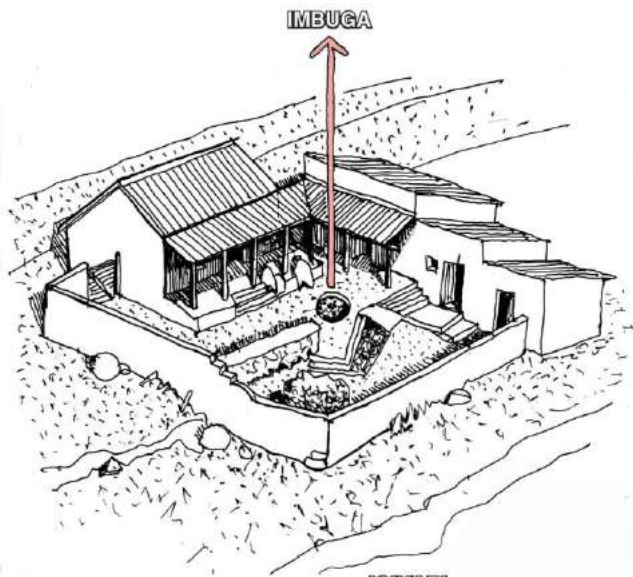


IGICUCU

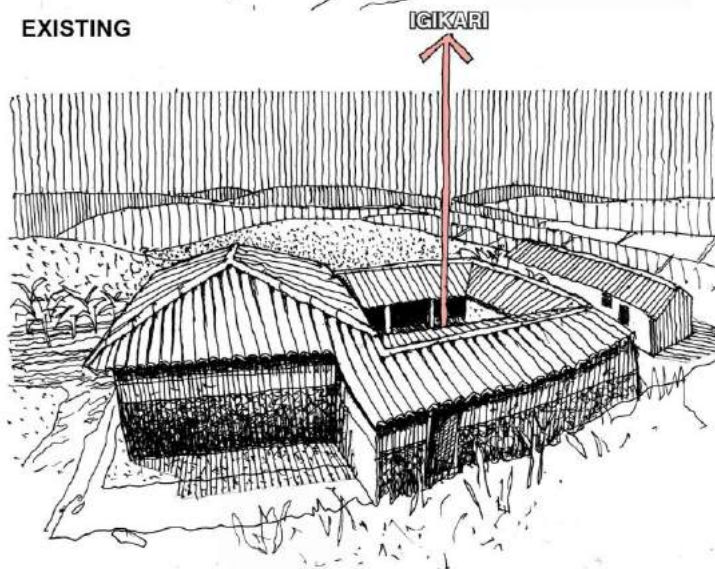


TERRASSE

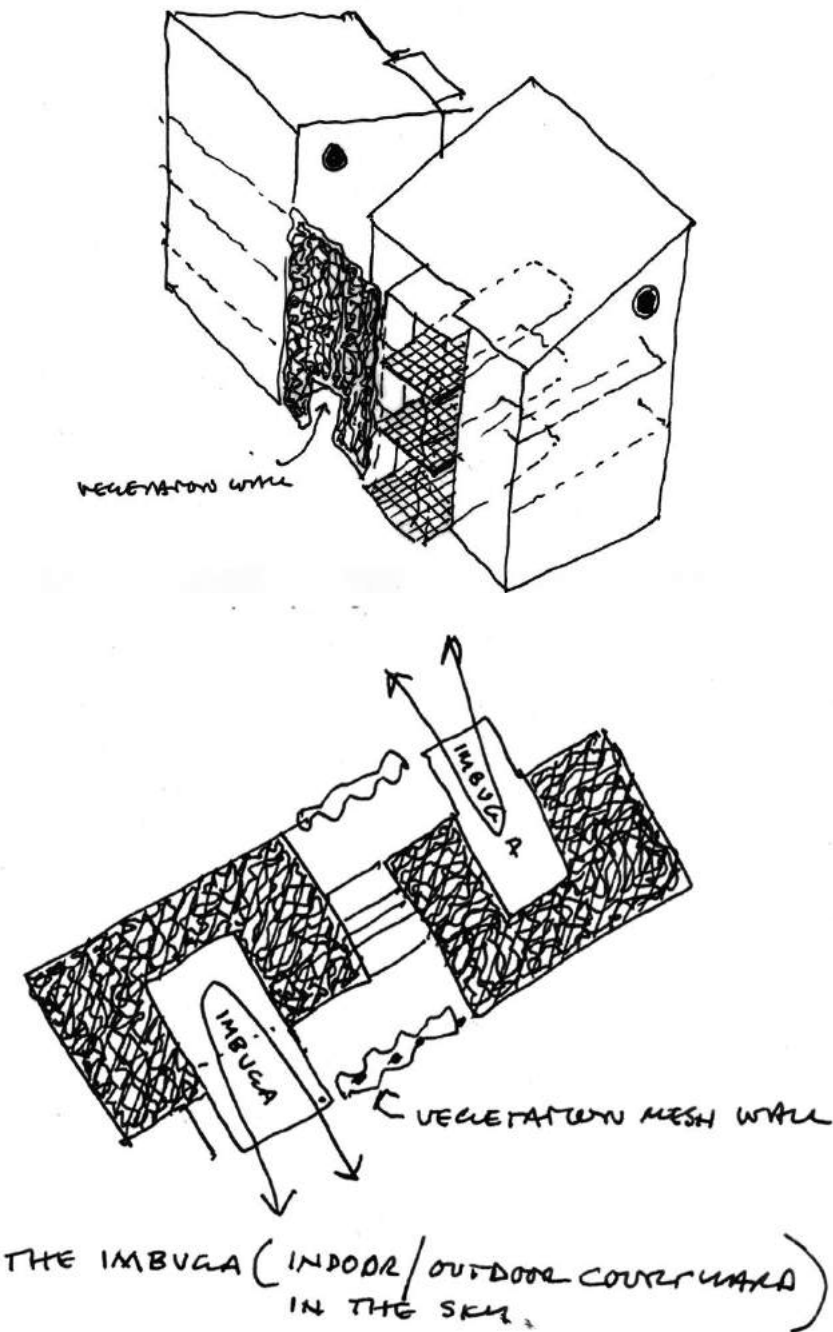
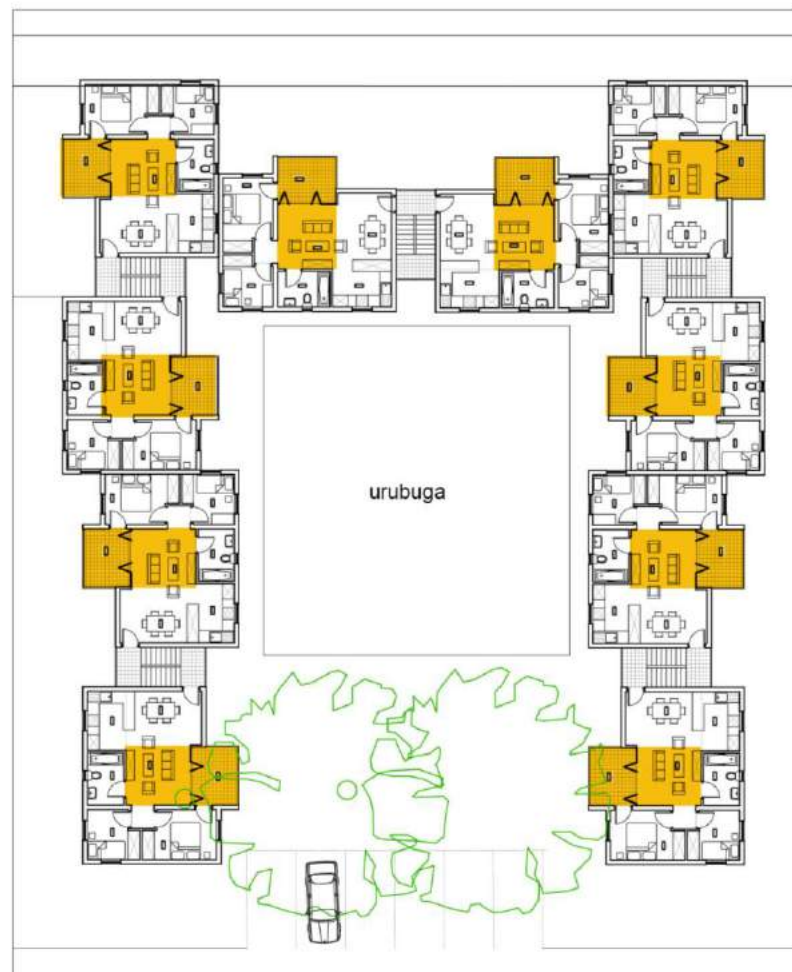




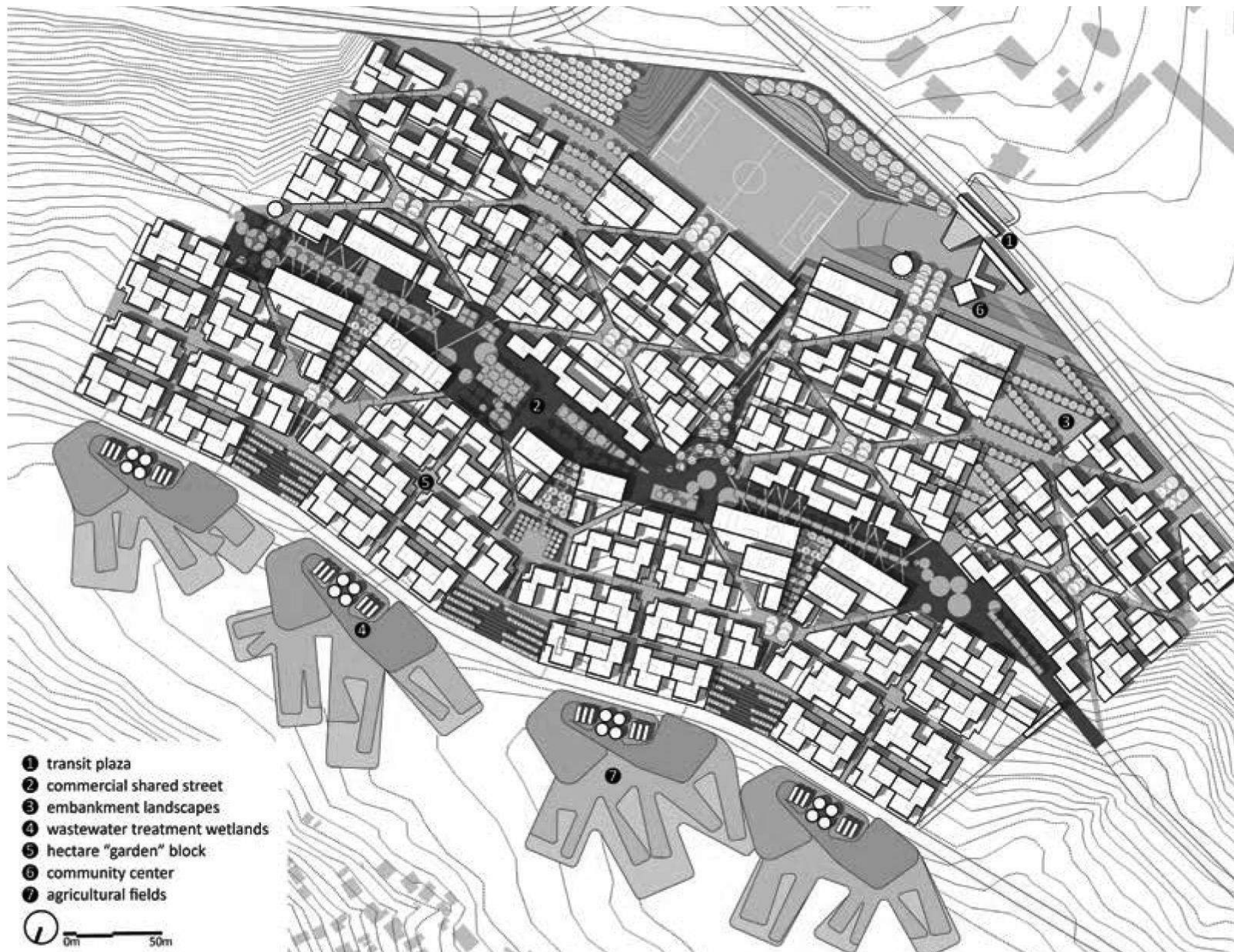
EXISTING

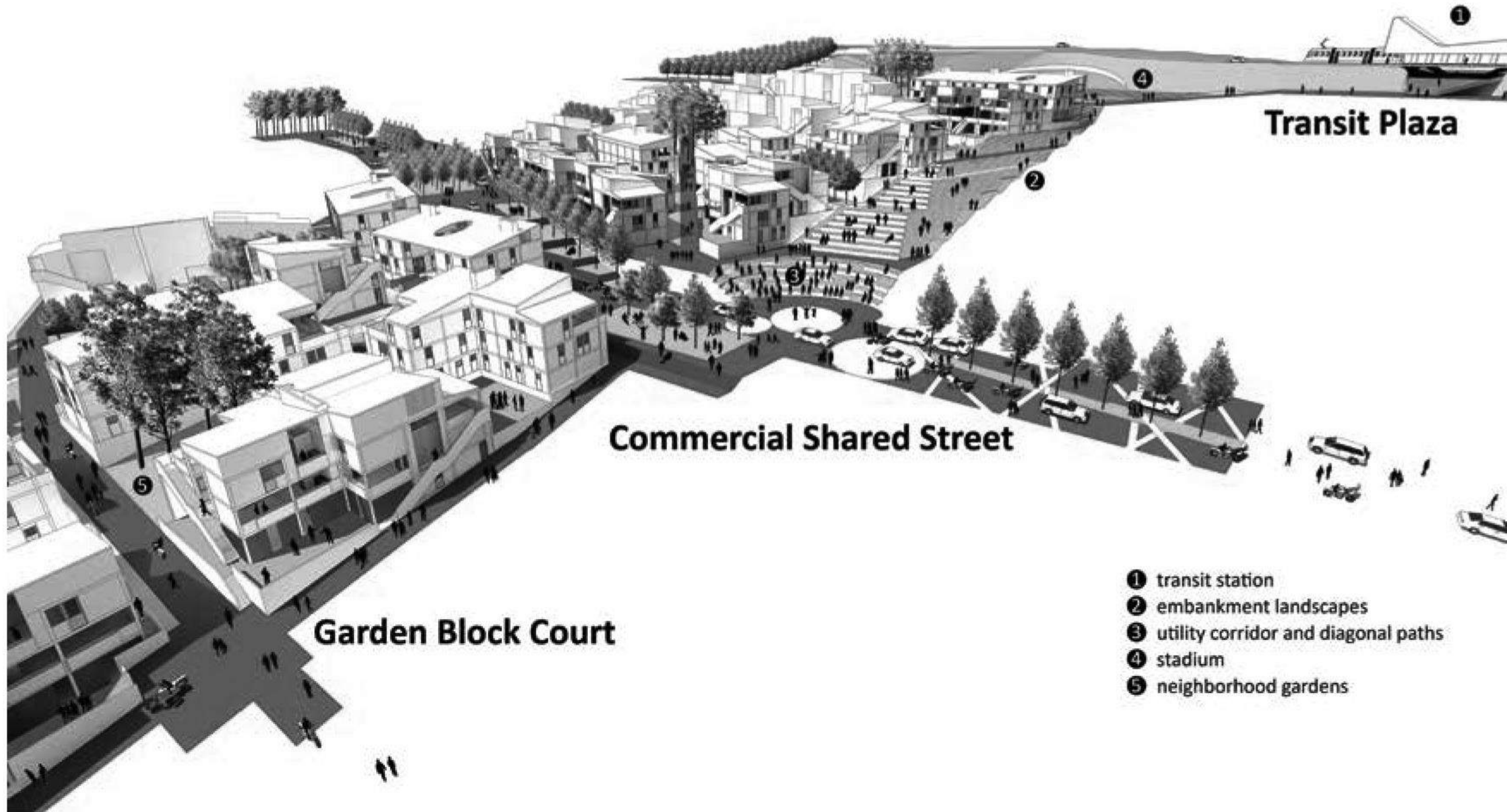


RURAL PRIVATE COURTYARDS









Transit Plaza

Commercial Shared Street

Garden Block Court

- ① transit station
- ② embankment landscapes
- ③ utility corridor and diagonal paths
- ④ stadium
- ⑤ neighborhood gardens

Lauren Shevills

Architects Climate Action Network
and Architects Declare

Sustainable Urbanisation : A call to action across the commonwealth

Upscaling Delivery of Climate Responsive Design

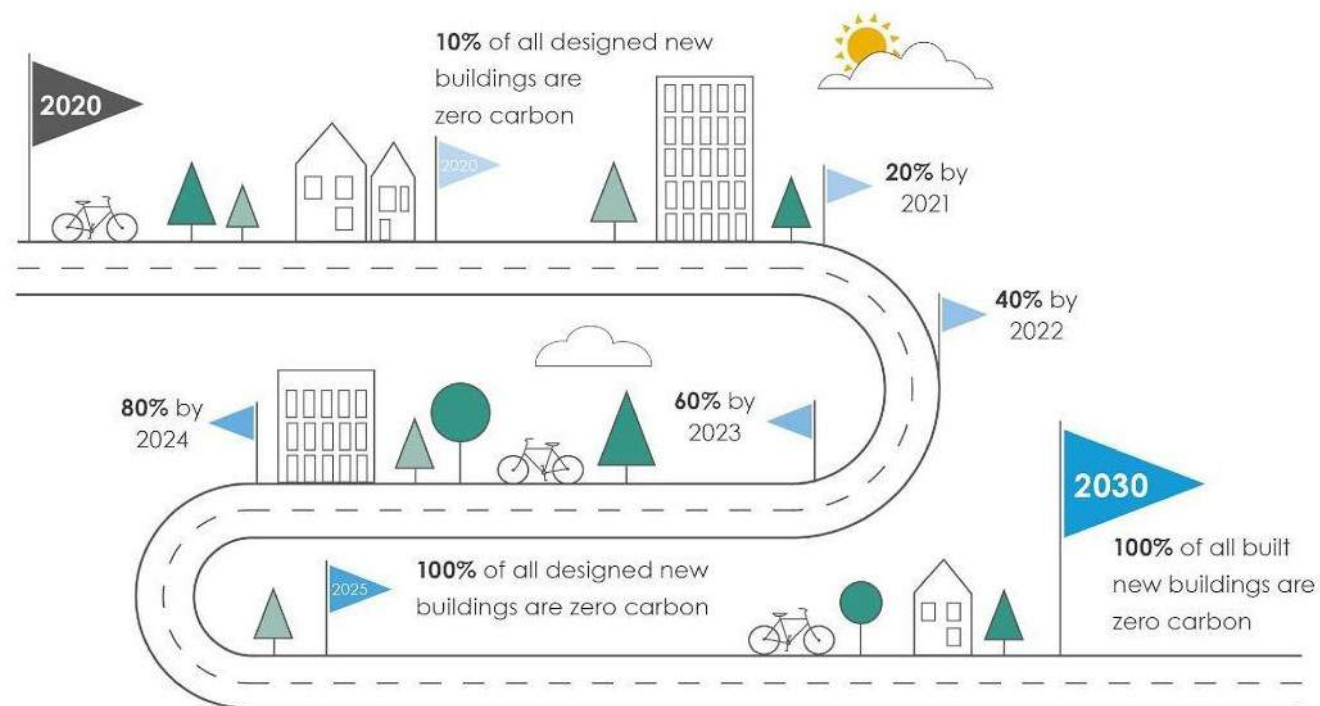


Lauren Shevills





Architects Declare
Climate and
Biodiversity
Emergency



Medium and large scale housing

Operational energy

Implement the following indicative design measures:

Fabric U-values (W/m².K)

Walls	0.13 - 0.15
Floor	0.08 - 0.10
Roof	0.10 - 0.12
Exposed ceilings/floors	0.13 - 0.18
Windows	1.0 (triple glazing)
Doors	1.00

Efficiency measures

Air tightness	<1 (m³/h.m²@50Pa)
Thermal bridging	0.04 (y-value)
G-value of glass	0.6 - 0.5
MVHR	90% (efficiency) ≤2m (duct length from unit to external wall)

Maximise renewables so that 70% of the roof is covered

Form factor of <0.8 - 1.5

Window areas guide (% of wall area)

North	10-20%
East	10-15%
South	20-25%
West	10-15%



Balance daylight and overheating



Include external shading

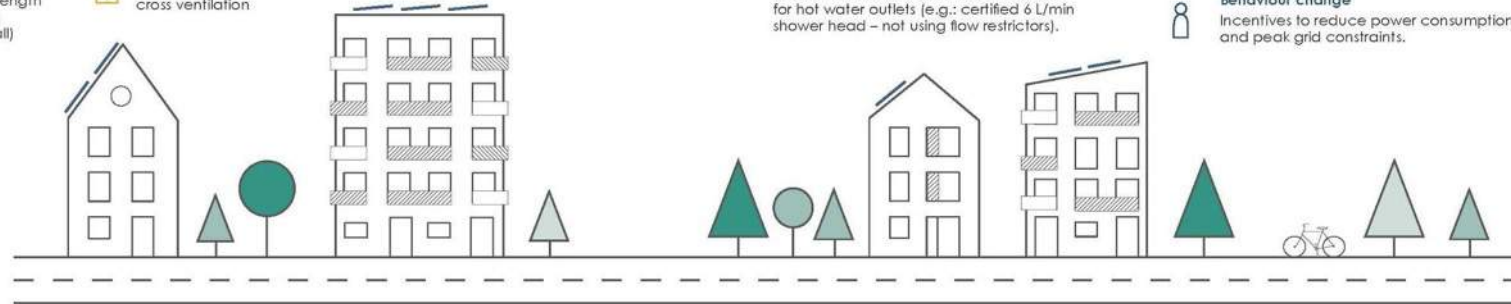


Include openable windows and cross ventilation

Reduce energy consumption to:



Reduce space heating demand to:



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 (gCO₂/kWh.yr) should be reported in-use



Heating

Maximum 10 W/m² peak heat loss (including ventilation)



Hot water

Maximum dead leg of 1 litre for hot water pipework

'Green' Euro Water Label should be used for hot water outlets (e.g.: certified 6 L/min shower head – not using flow restrictors).

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 uses:

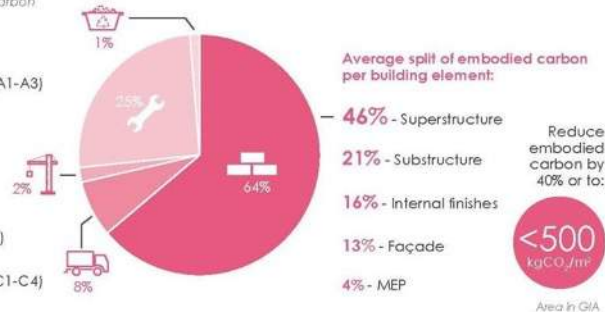
Products/materials (A1-A3)

Transport (A4)

Construction (A5)

Maintenance and replacements (B1-B5)

End of life disposal (C1-C4)



Data disclosure

Meter and disclose energy consumption as follows:



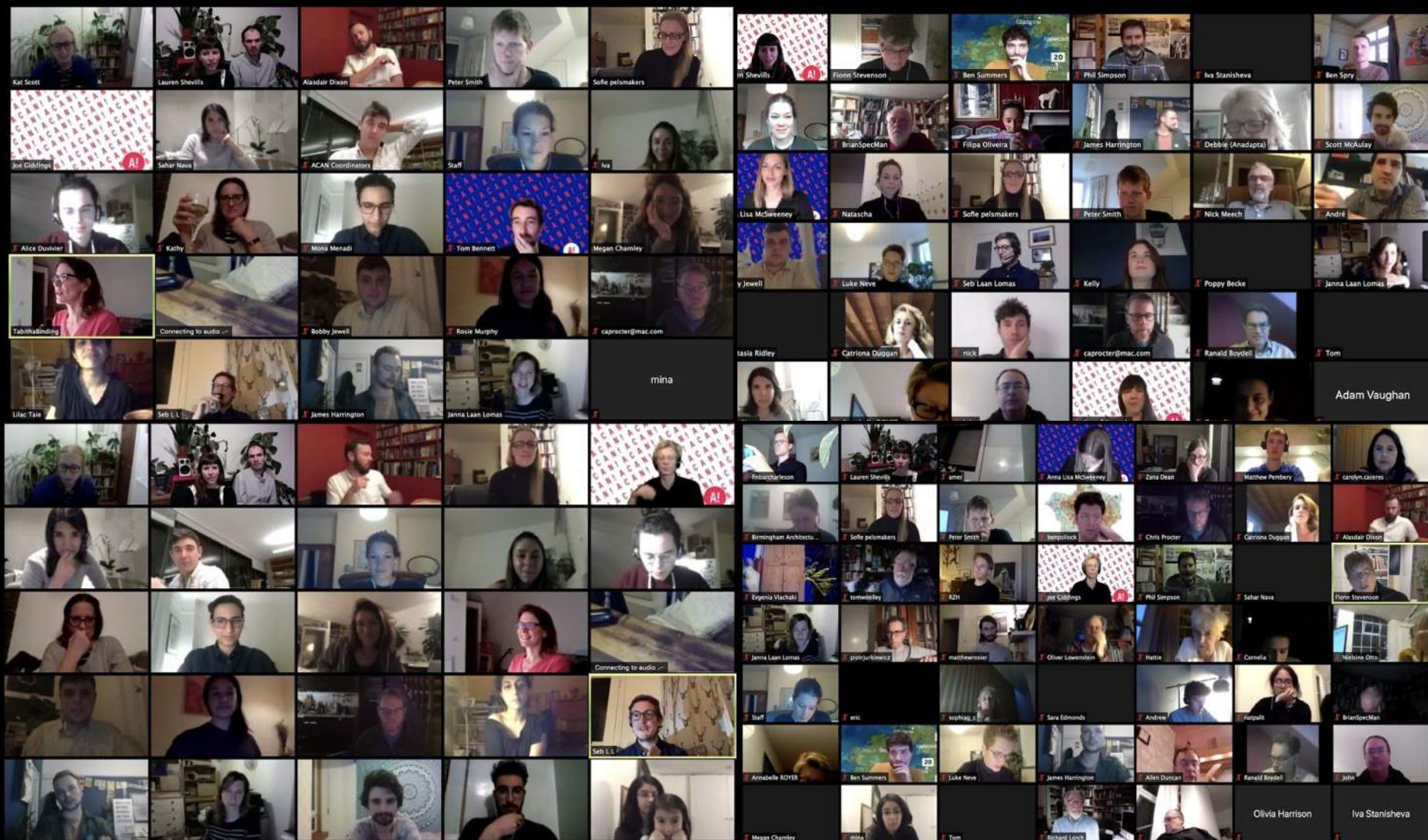
Metering

1. Submeter renewables for energy generation
2. Submeter electric vehicle charging
3. Submeter heating fuel (e.g. heat pump consumption)
4. Continuously monitor with a smart meter
5. Consider monitoring internal temperatures
6. For multiple properties include a data logger alongside the smart meter to make data sharing possible.

123

Disclosure

1. Collect annual building energy consumption and generation
2. Aggregate average operational reporting e.g. by post code for anonymity or upstream meters 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



intbau.org
@intbau