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GREEN URBAN GROWTH

DANIEL WYSS – ARCHITECT
SKAT CONSULTING LTD SWITZERLAND / RWANDA
OCT 2020 COPENHAGEN / GENEVA

ADDRESSING CHALLENGES OF

MASS SUPPLY OF AFFORDABLE HOUSES IN AFRICA

SKAT CONSULTING LTD. SWITZERLAND, FOUNDED IN 1978

THE SWISS RESOURCE CENTRE FOR APPROPRIATE TECHNOLOGIES ADVISES INDUSTRY, DEVELOPMENT AGENCIES AND GOVERNMENTS OF THE GLOBAL SOUTH IN ADRESSNG URBANISATION AND POST-DISASTER CHALLENGES

DANIEL WYSS

ARCHITECT	UNIVERSITY OF GENEVA, SWITZERLAND
DEVELOPMENT STUDIES	UNIVERSITY OF GENEVA, SWITZERLAND
ATELIER 5 - SWITZERLAND	URBAN DESIGN EMPLOYEE
BALKANS ROMA-SLUM UPGRADING PROJECT	INTERN, ARCHITECT, ADVISOR
SKAT - ASIA – AFRICA - LATIN AMERICA	ARCHITECT, INDUSTRY ADVISOR
SKAT - AFRICA	RESIDENT MANAGING DIRECTOR, ARCHITECT, SUPPLY CHAIN ADVISOR

SWISS AGENCY FOR COOPERATION AND DEVELOPMENT

THE SWISS GOVERNMENT INTENSIVELY FUNDED CONSTRUCTION INDUSTRY DEVELOPMENT IN ASIA, LATIN AMERICA & AFRICA, INCLUDING THE ONE IN AFRICA'S GREAT LAKES REGION PRESENTED IN THE FOLLOWING SLIDES

OUR MANDATE IN AFRICA

ENABLING THE LOCAL CONSTRUCTION INDUSTRY TO SUPPLY GREEN AND AFFORDABLE BUILDINGS, THAT CREATE DECENT EMPLOYMENTS

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SPEAKER'S INFORMATION

THE TODAY'S PROGRAMME

1. URBANISATION IN AFRICA
2. SKAT'S MANDATE IN THE GREAT LAKES REGION
3. GROUP WORK 1

LUNCH

1. MAKING URBAN HOUSING AFFORDABLE
2. UPGRADING INFORMAL SETTLEMENTS

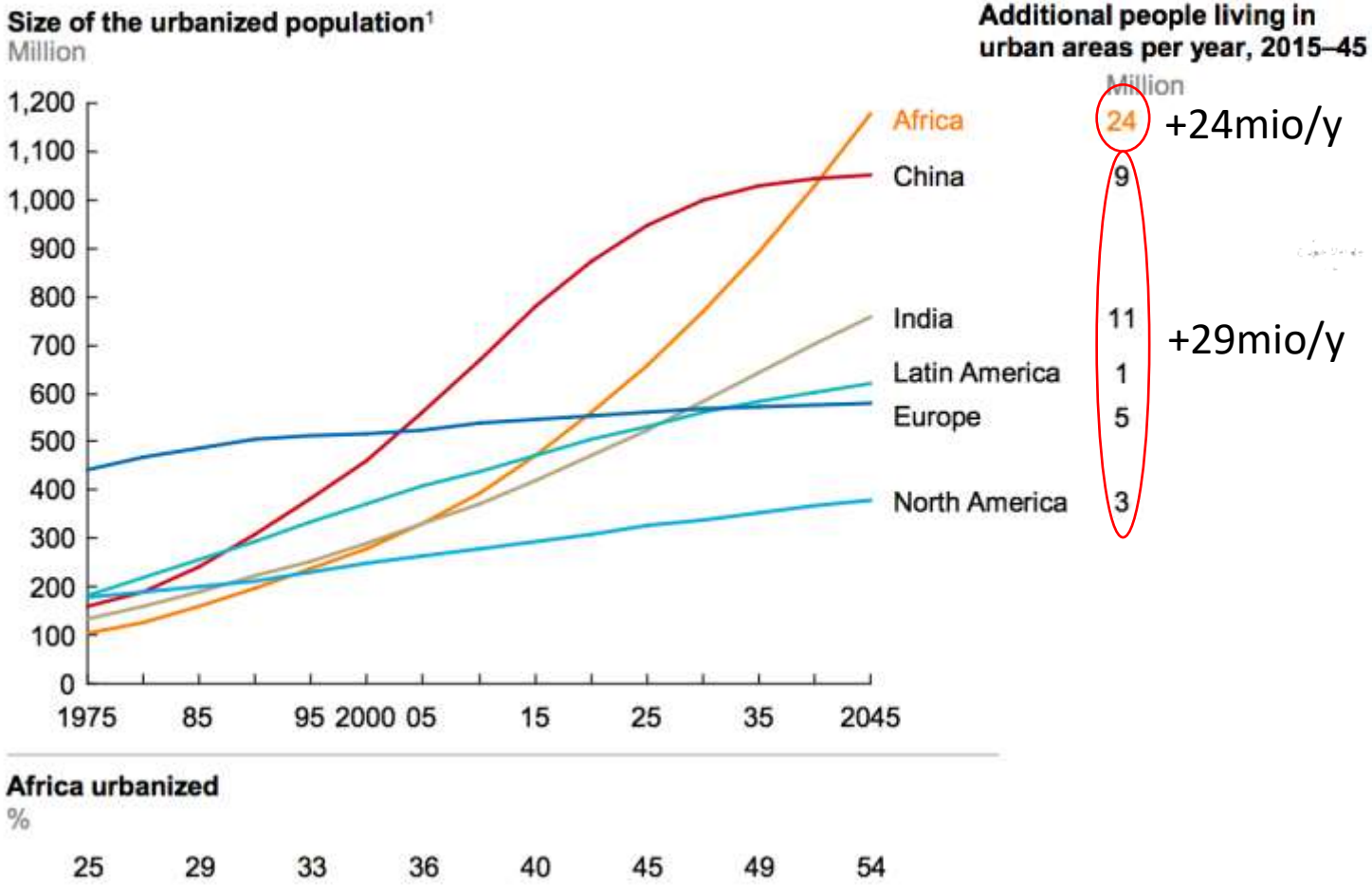
BREAK

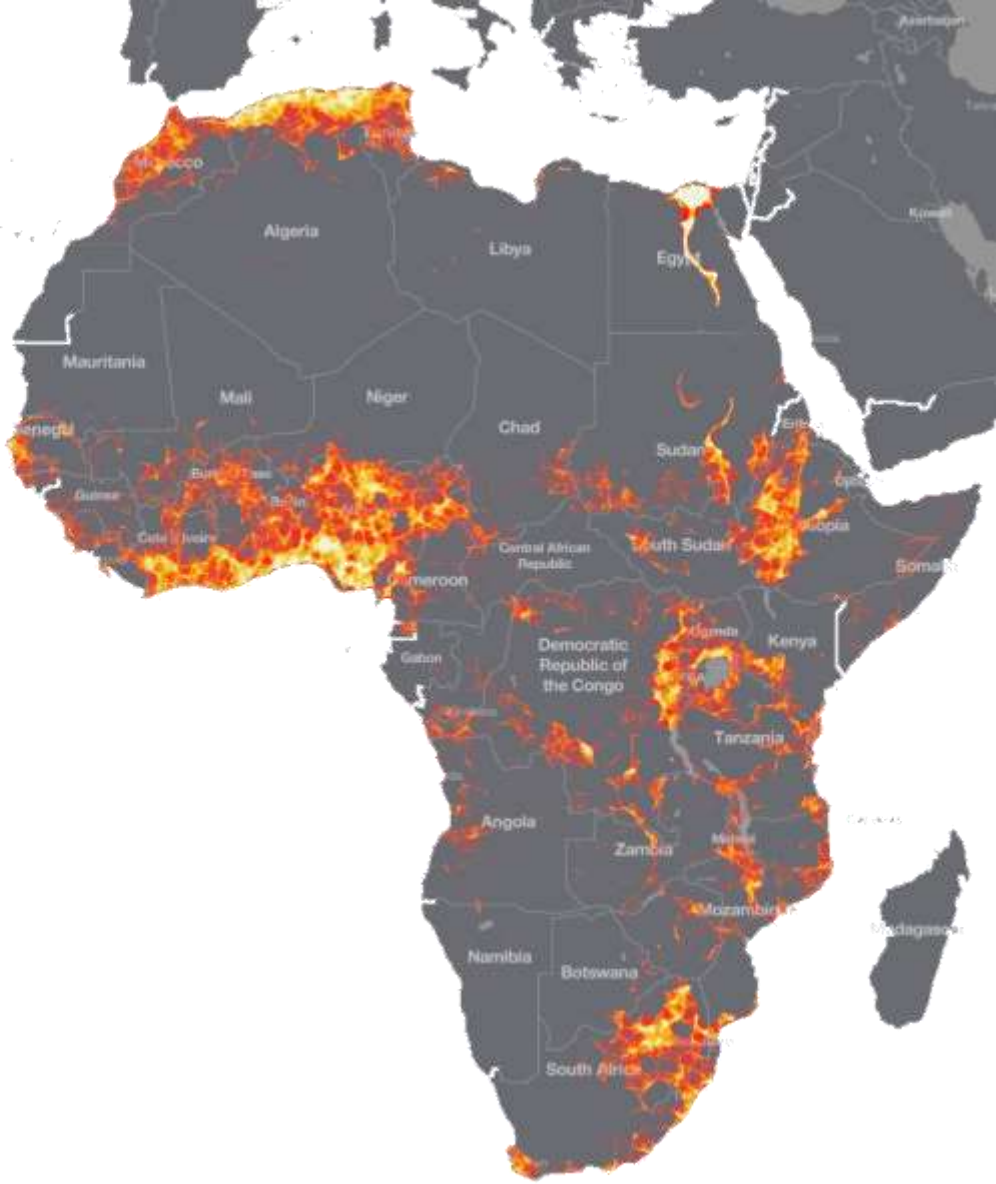
1. GROUP WORK 2
2. ESTABLISHING LOCALLY SOURCED HOUSING SUPPLY CHAINS

PART I:

ABOUT URBANIZATION IN THE GREAT LAKES REGION

Africa is urbanizing faster than any other region; its cities are expected to gain 24 million peo each year until 2045





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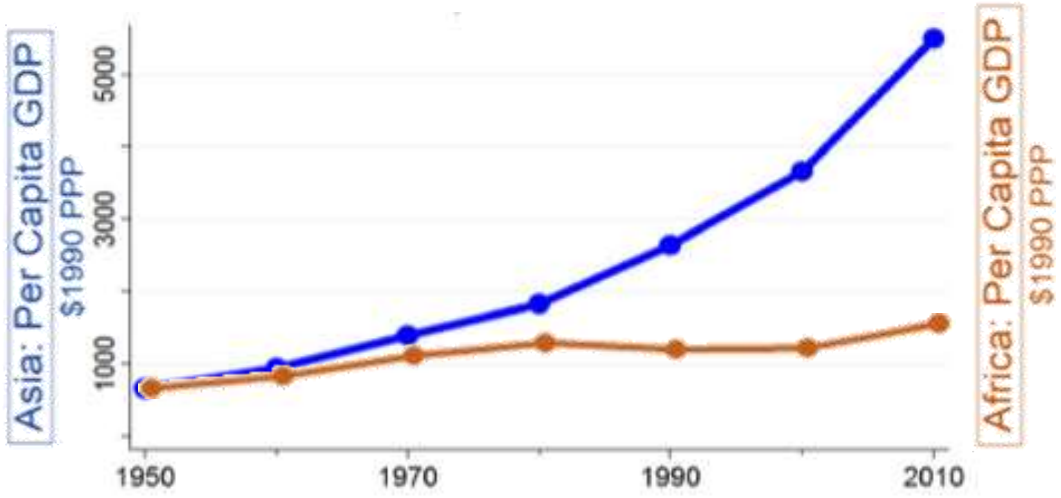
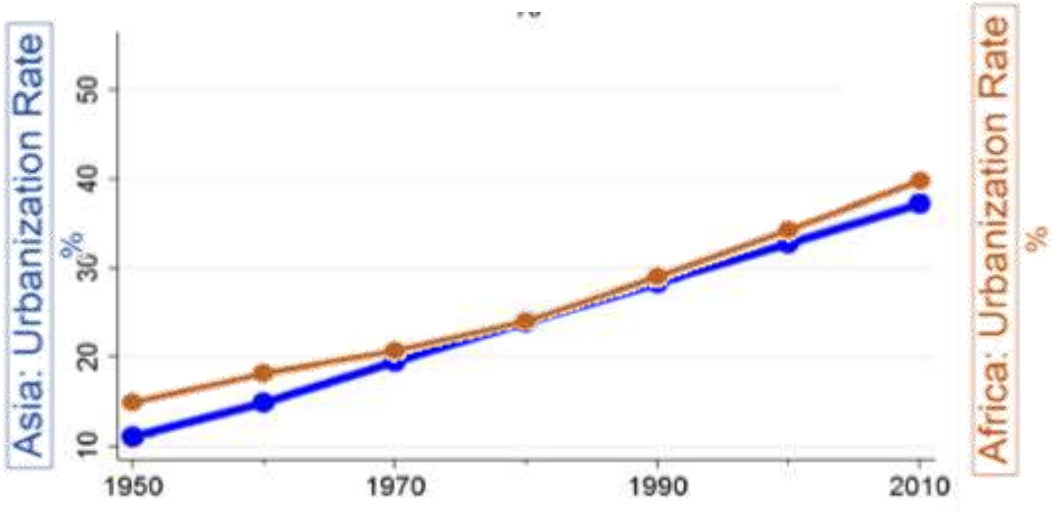
AFRICA'S URBANISATION HOTSPOTS

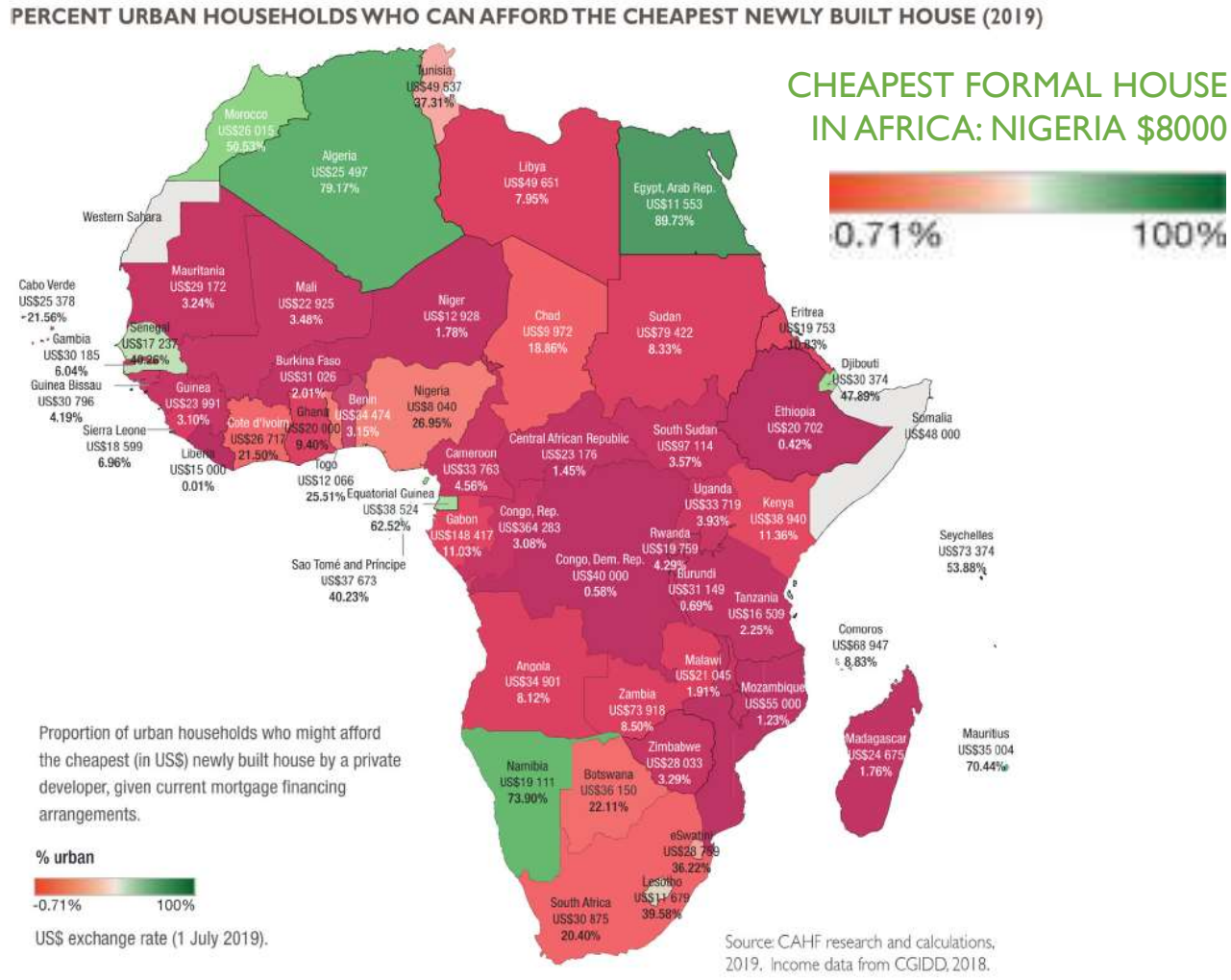
GDP IN ASIA AND AFRICA

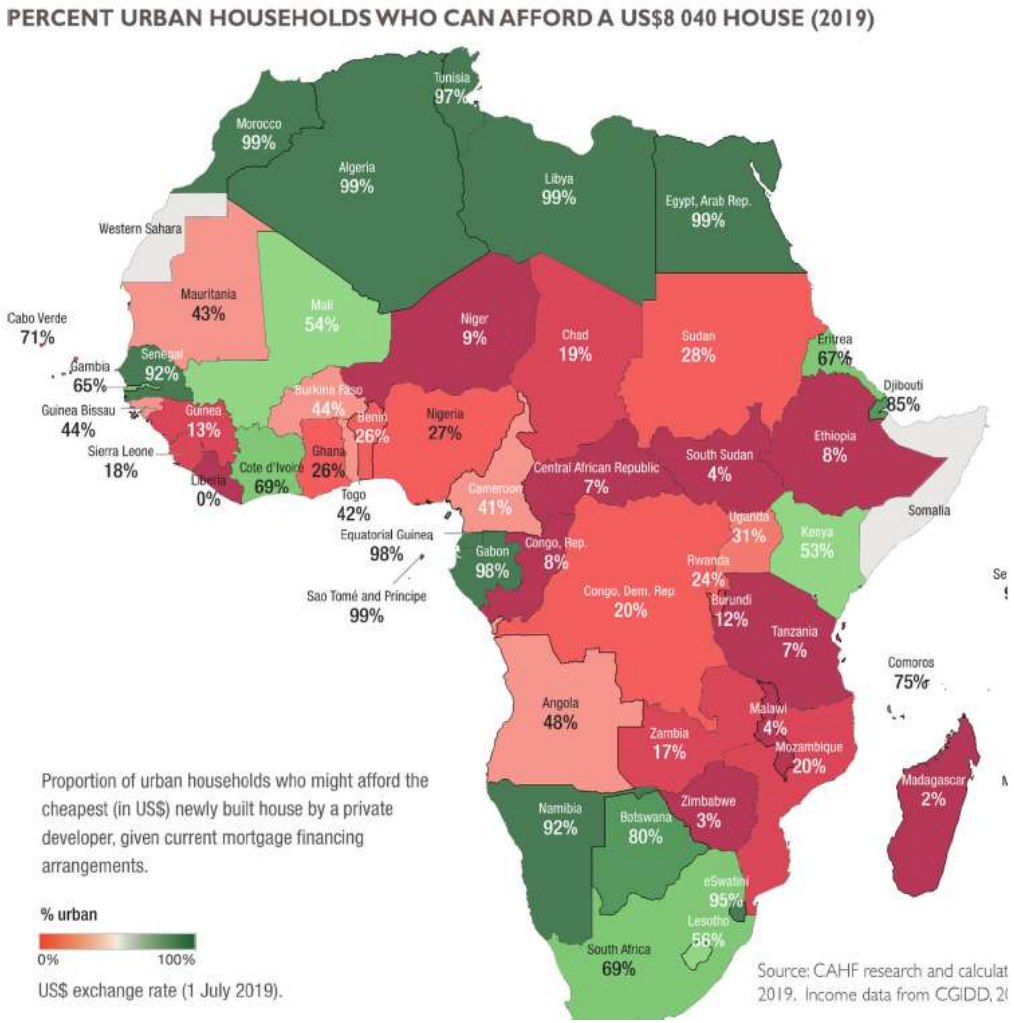


URBANISATION IN ASIA AND AFRICA



URBANISATION WITHOUT INDUSTRIALISATION





WHO CAN AFFORD THE CHEAPEST HOUSE ?

WHO CAN AFFORD AN $8000 HOUSE ?

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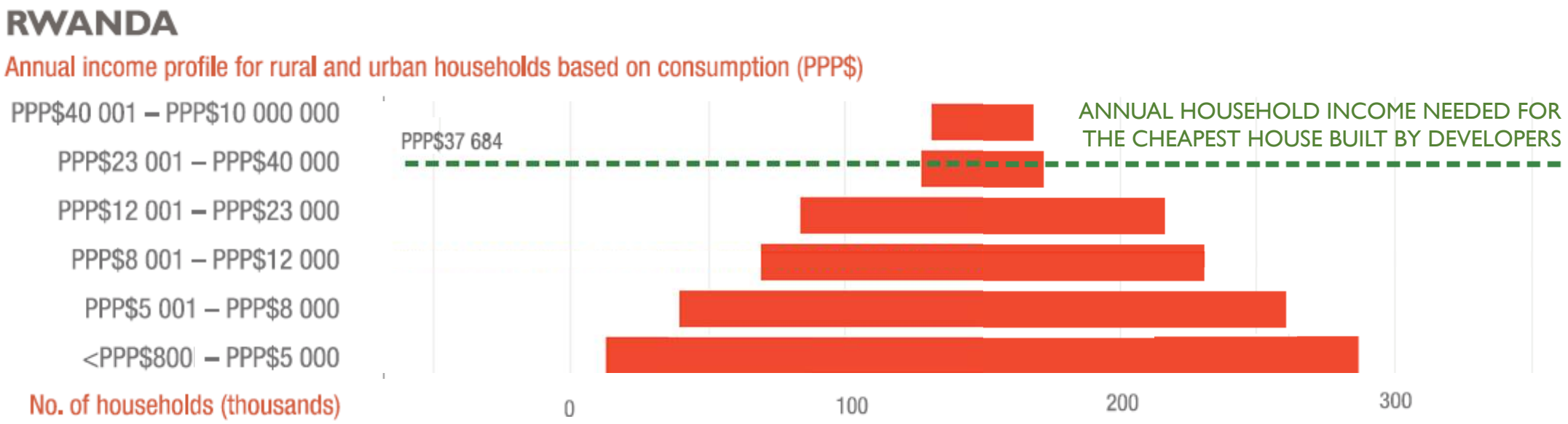
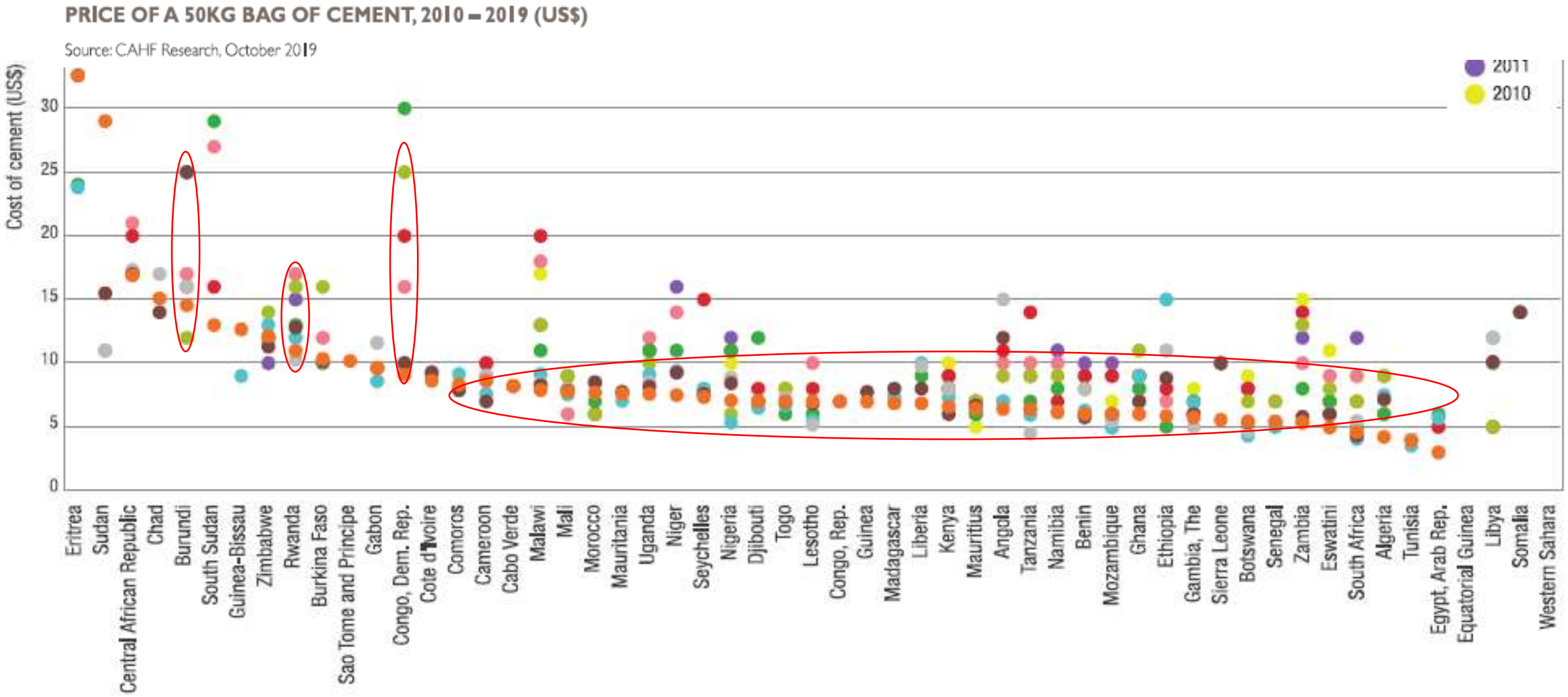
AFFORDABILITY OF FORMAL HOUSES

THE INCOME REQUIRED FOR THE MOST AFFORDABLE HOUSE BUILT BY DEVELOPERS

House price = 18 millions RWF
House price = 18'800 US $
House price = 60'938 PPP $
1 US $ = 3.24 PPP $



AFFORDABILITY OF FORMAL HOUSES IN RWANDA



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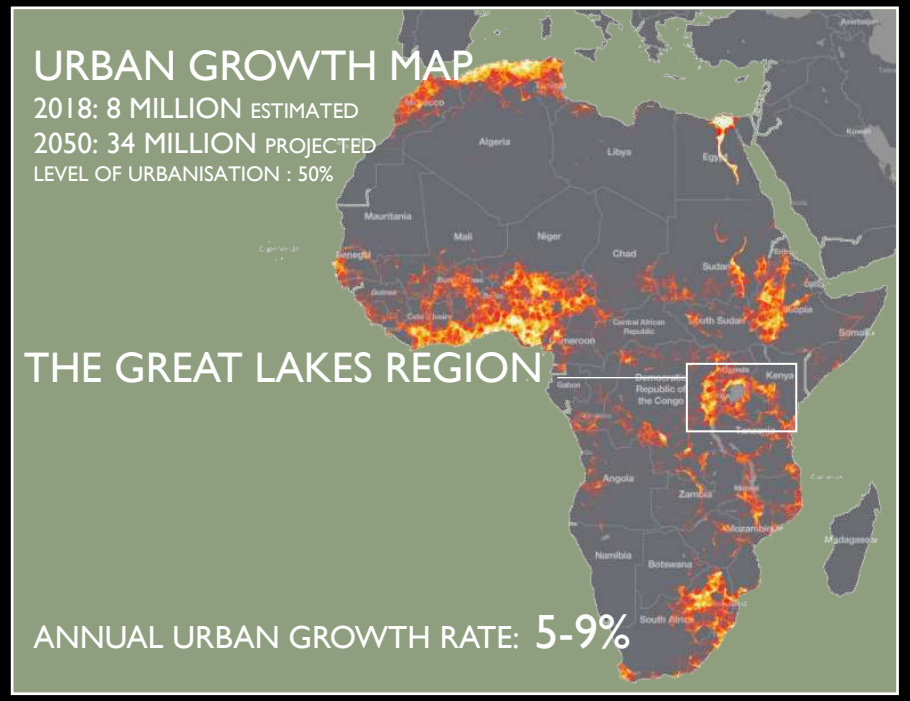
PRICES OF A 50KG BAG OF CEMENT

….AND NOW AFRICA’S GREAT LAKES REGION….

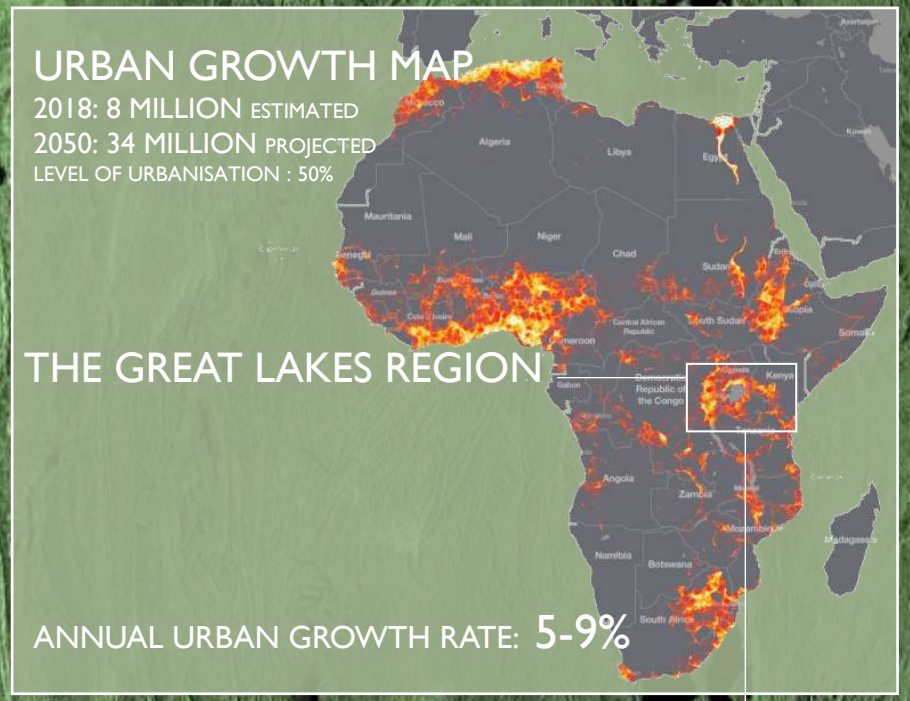


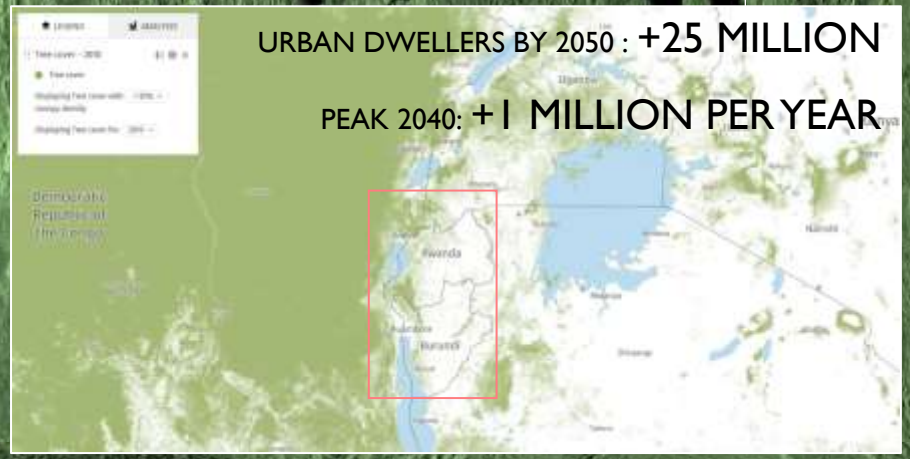
UN - WORLD URBANIZATION PROSPECTS

"Rwanda urbanized the fastest during the period 1990-2018, […] Burundi is projected to urbanize fastest in the coming decades."

The 2018 Revision, p.52

THE WORLD'S FASTEST URBANISING AREA





UN - WORLD URBANIZATION PROSPECTS

"Rwanda urbanized the fastest during the period 1990-2018, [...] Burundi is projected to urbanize fastest in the coming decades."

The 2018 Revision, p.52

GOMA 1.2 M

KIGALI 1.4 M

BUKAVU 1.3 M

BUJUMBURA 1 M

THE WORLD'S FASTEST URBANISING AREA

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Average agrarian area per farmer family in Rwanda 0.6-0.7ha
Minimum Area Required (FAO): 0.9ha

WHAT DRIVES THIS FAST URBANISATION?

THE REGION'S URBAN EXPANSION PATTERN

INFORMAL SETTLEMENTS: 80%

PREDOMINANT MATERIAL MUD & WOOD

BUILT OF VILLAGE HOUSES IN AN URBAN CONTEXT

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DENSIFICATION >>“SETTLEMENT INFARCTION”

STORM WATER DAMAGES & LAND SLIDES
DURING EVERY HEAVY RAIN

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VULNERABLE FOR LOW-INTENSITY DISASTERS

SETTLEMET FIRES:

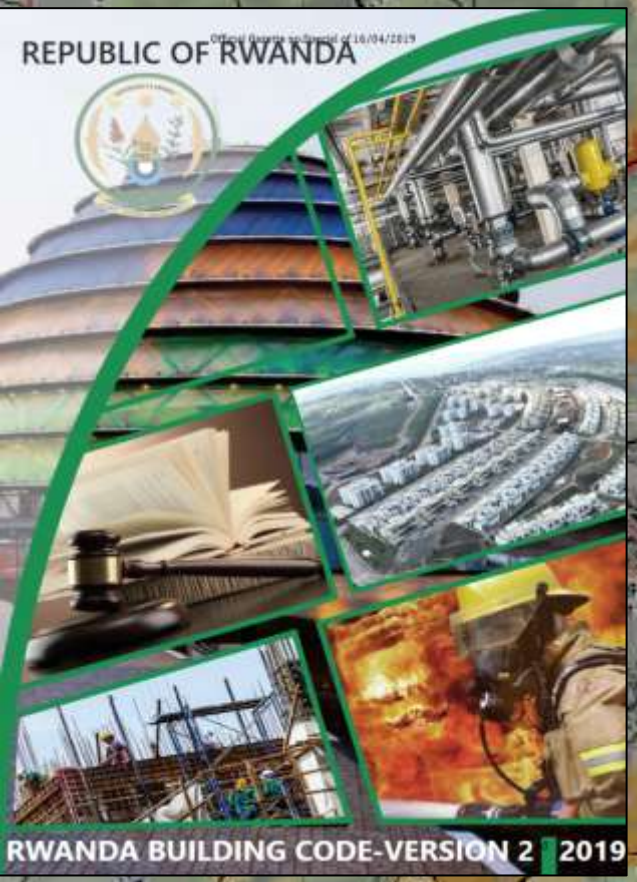
SEVERAL FIRES EVERY YEAR

VULNERABLE FOR LOW-INTENSITY DISASTERS

THE CURRENT (RE-)CONSTRUCTION REALITY

NEW CHALLENGES OF THE

VERTICALLY GROWING AFRICAN CITY



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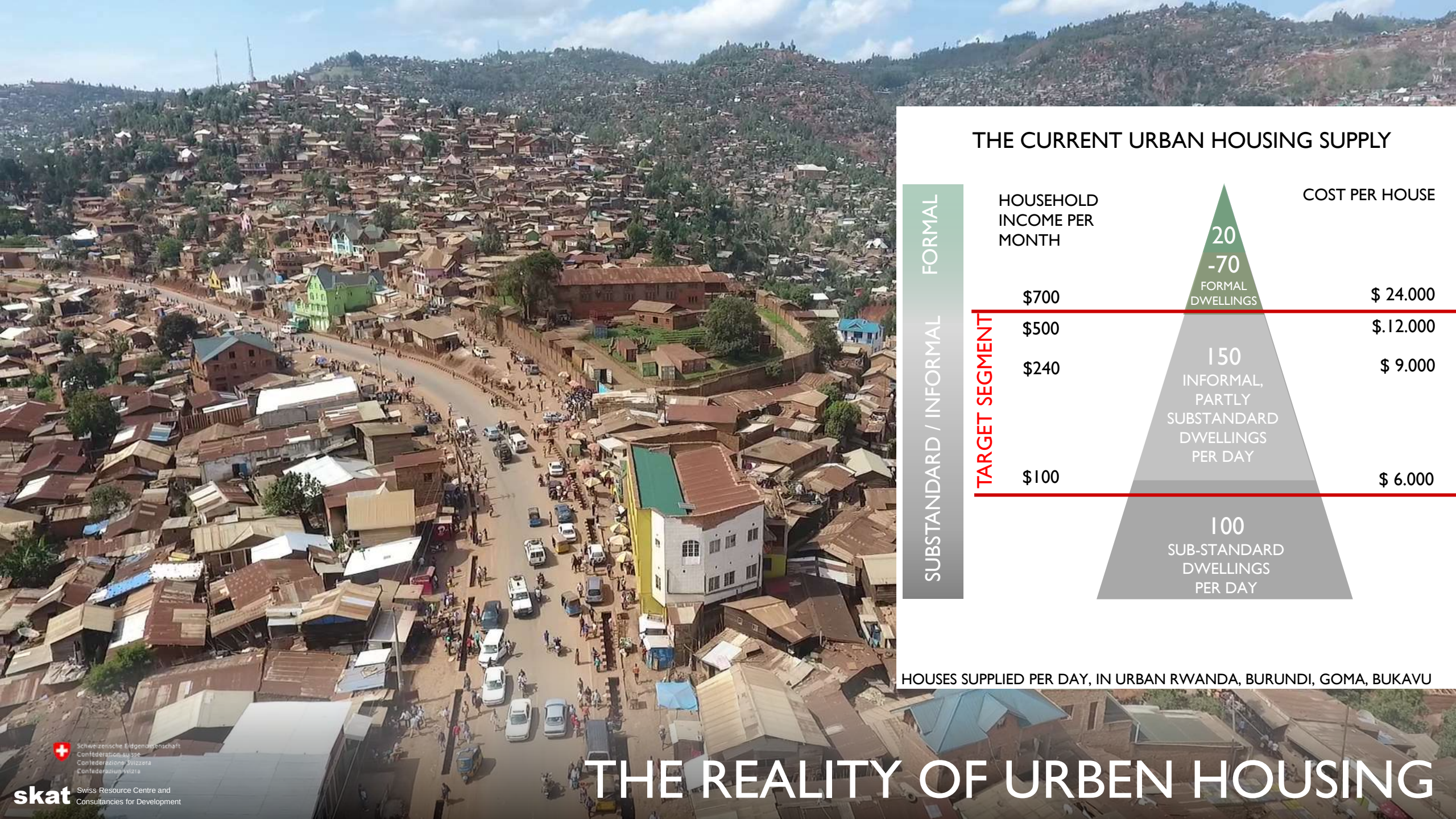
GOVERNEMENT VISIONS AND NEW REGULATIONS


THE CURRENT URBAN HOUSING SUPPLY
FORMAL
SUBSTANDARD / INFORMAL
TARGET SEGMENT
HOUSEHOLD INCOME PER MONTH
COST PER HOUSE
20 -70 FORMAL DWELLINGS
$700
$ 24.000
$500
$.12.000
150 INFORMAL, PARTLY SUBSTANDARD DWELLINGS PER DAY
$240
$ 9.000
$100
$ 6.000
100 SUB-STANDARD DWELLINGS PER DAY
HOUSES SUPPLIED PER DAY, IN URBAN RWANDA, BURUNDI, GOMA, BUKAVU
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THE REALITY OF URBEN HOUSING

MOST BUILDERS STRUGGLE WITH STORIED HOUSES

Rwanda: 4.8 Magnitude Earthquake Kills One, Injures Over 20

By Michel Nkurunziza

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CREATING NEW URBAN VULNERABILITY

CAPITAL DRAIN FROM CEMENT IMPORTS

2015 : USD 100.000.000

= WORKERS' INCOMES: 50.000

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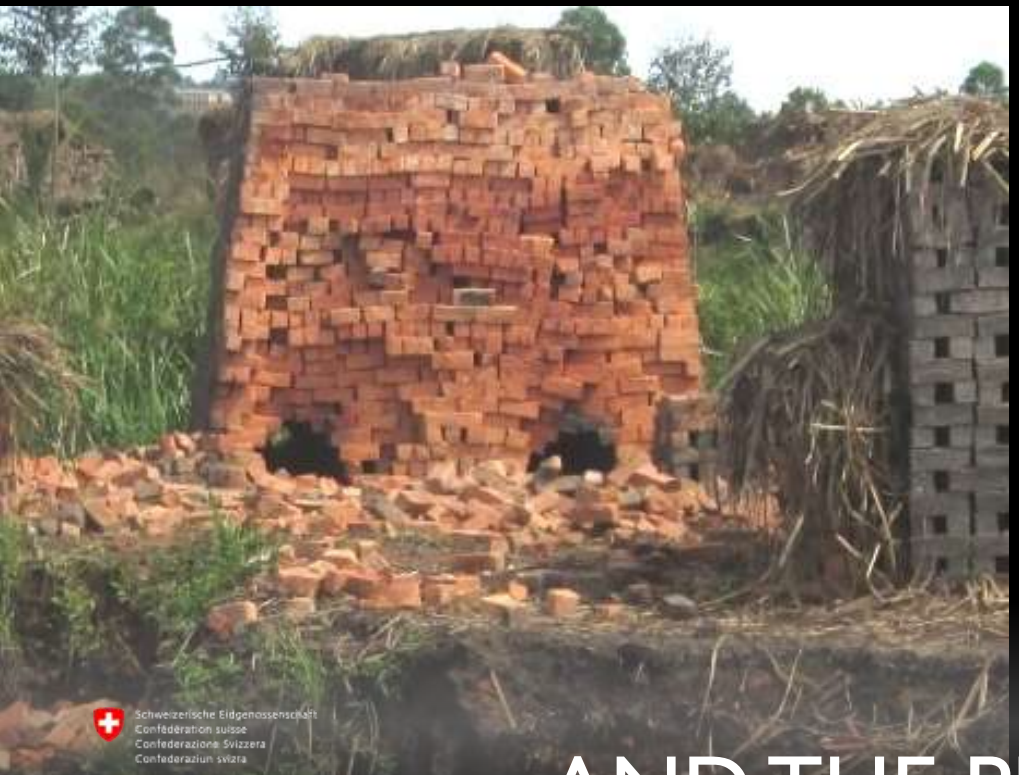
MULTIPLYING THE DEMAND FOR IMPORTED CEMENT



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…AND THE PRODUCTION OF TREE-FIRED BRICKS

WATER ABSORPTION:
25-30%

COMPRESSIVE STRENGTH:
2-7MPa

ENERGY LOSS : 80% (4-5MJ/KG)

ANNUAL BRICK AND BLOCK DEMAND BY 2035
4.000.000.000

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...POOR QUALITY, POOR WORKING CONDITIONS

URBAN DEVELOPMENT IN EASTERN AFRICA

QUESTIONS, OBSERVATIONS REMARKS

PART II:

WHAT IS OUR MISSION IN THE GREAT LAKES REGION?

THE SWISS AGENCY FOR DEVELOPMENT COOPERATION'S OBJECTIVES

TO REDUCE THE URBANISATION'S CLIMATE IMPACT
TO TAP ITS UNUSED EMPLOYMENT POTENTIAL

BY MAKING SAFE URBAN HOUSING AFFORDABLE AND AVAILABLE AT MASS SCALE

SKAT'S MANDATE

TO FACILITATE A "GREEN CHANGE" IN THE URBAN HOUSING SUPPLY CHAINS AND TO MAXIMISE THE SECTOR'S JOB CREATION

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GREEN INDUSTRIES, SAFE NEIGHBOURHOODS

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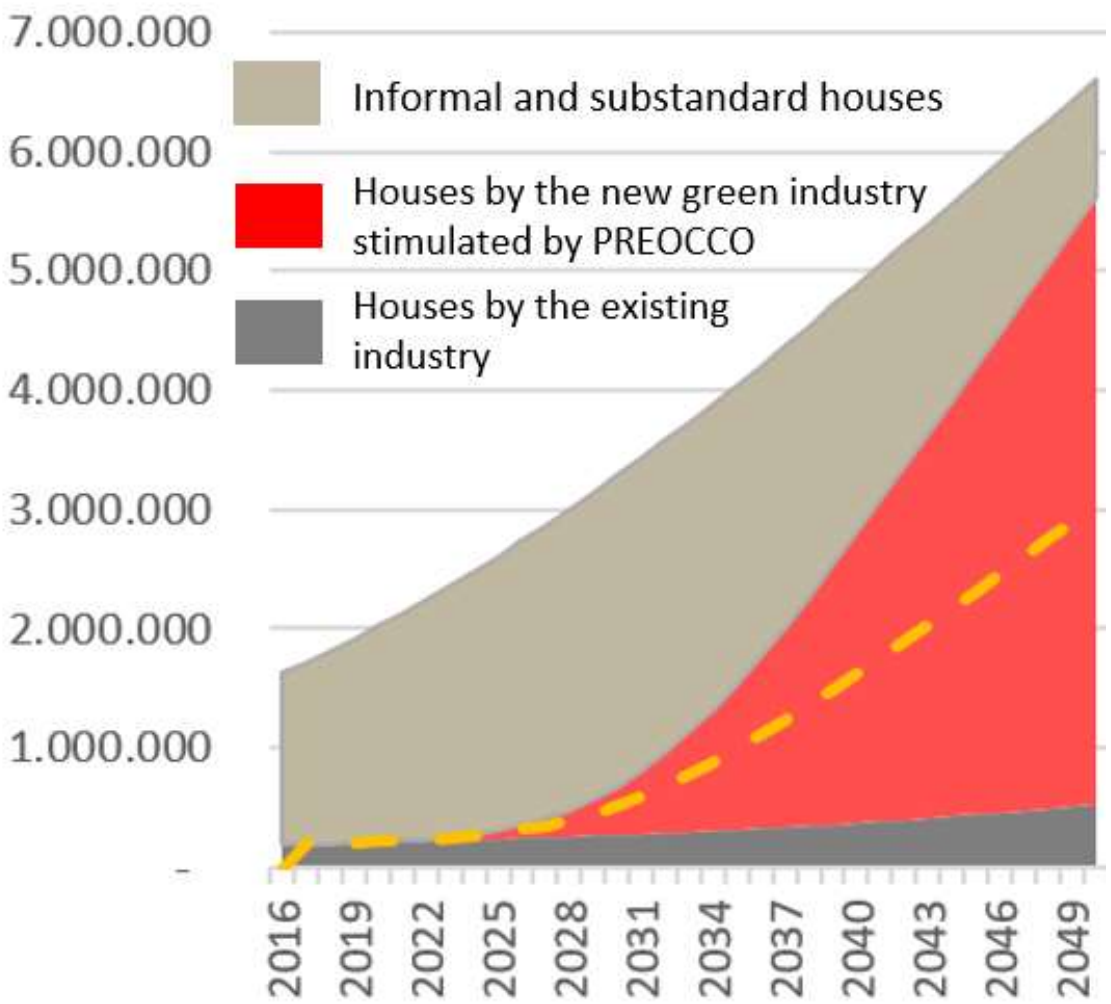
VOICES / FOOTAGE FROM THE FIELD



A complete transformation of the construction sector in the target region:

Market share of low-carbon houses 70-80%

+ 250.000 Local employments

+ 3.500.000 formal urban houses

- 40.000.000 t CO2

- 100.000.000 trees cut

THE TARGETED SECTOR TRANSFORMATION

THANK YOU FOR YOUR ATTENTION

URBAN DEVELOPMENT IN EASTERN AFRICA

QUESTIONS, OBSERVATIONS, REMARKS?

10 MINUTES BREAK

PART III:

GROUP WORK I

GROUP WORK 1

GETTING A FEELING ABOUT VOLUMES AND QANTITIES

IMAGINE YOU ARE

A MINISTER'S ADVISOR FOR URBAN DEVELOPMENT

CALCULATE / ESTIMATE AND ILLUSTRATE

- THE NUMBER OF URBAN HOUSES/DWELLINGS REQUIRED BY 2050
- THE QUANTITY OF CLAY AND SAND QUARRIED
- THE NUMBER OF MASONS AND BRICKMAKERS INVOLVED
- WOOD CONSUMED BY THE BRICK SECTOR

KEY DATA REQUIRED (These are approximate figures)

KIGALI CITY

- URBAN POPULATION: 1.500.000 (2020)
- ANNUAL URBAN GROWTH RATE: 6.5%
- AV. URBAN HOUSEHOLD SIZE: 3-4 PERSONS, 10M2 PER PERSON
- HOUSING AS PERCENTAGE OF OVERALL BUILDING NEEDS: 70%
- BRICKS PER 40m2 DWELLING: 10.000 BRICKS (10/5/21CM, 2 KG)
- WALLING AREA PER MASON TEAM OF 2 PERSONS: 5m2 / DAY
- BRICKS OUTPUT PER BRICKYARD: 2 MILLION/YEAR, 80 EMPLOYEES
- ENEGRY NEEDS FOR BRICKMAKING: 5MJ/KG CLAY (WOOD:14MJ/KG)

PART IV, V & VII

THE CASE STUDY: THE SWISS PROECCO (2012-2024)

SKAT'S MANDATE

TO FACILITATE A "GREEN CHANGE" IN THE URBAN HOUSING SUPPLY CHAINS AND TO MAXIMISE THE SECTOR'S JOB CREATION

THE VOLUME OF THE CHALLENGE BY 2050

- 5.000.000 URBAN DWELLINGS
- 300.000 EMPLOYMENTS LOST TO THE CEMENT INDUSTRY
- 100.000.000 TREES UNNECESSARILY CUT
- 40.000.000 tCO2 UNNECESSARILY EMITTED

TASK 1:

REDUCING THE COST OF HOUSING

REMEMBER KIGALI CITY

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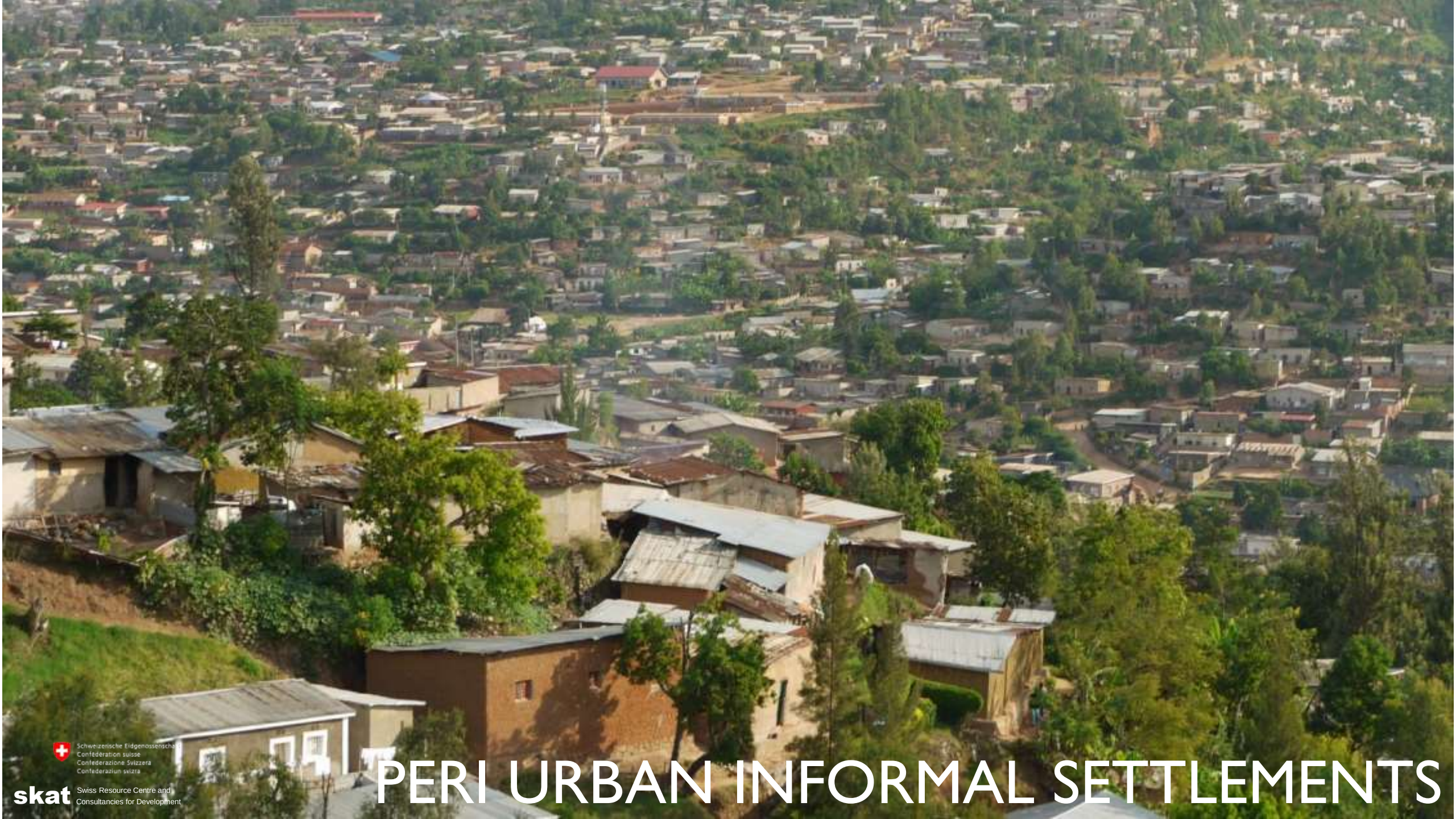
DOWN TOWN KIGALI CITY



PERI URBAN INFORMAL SETTLEMENTS

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CENTRAL INFORMAL SETTLEMENTS

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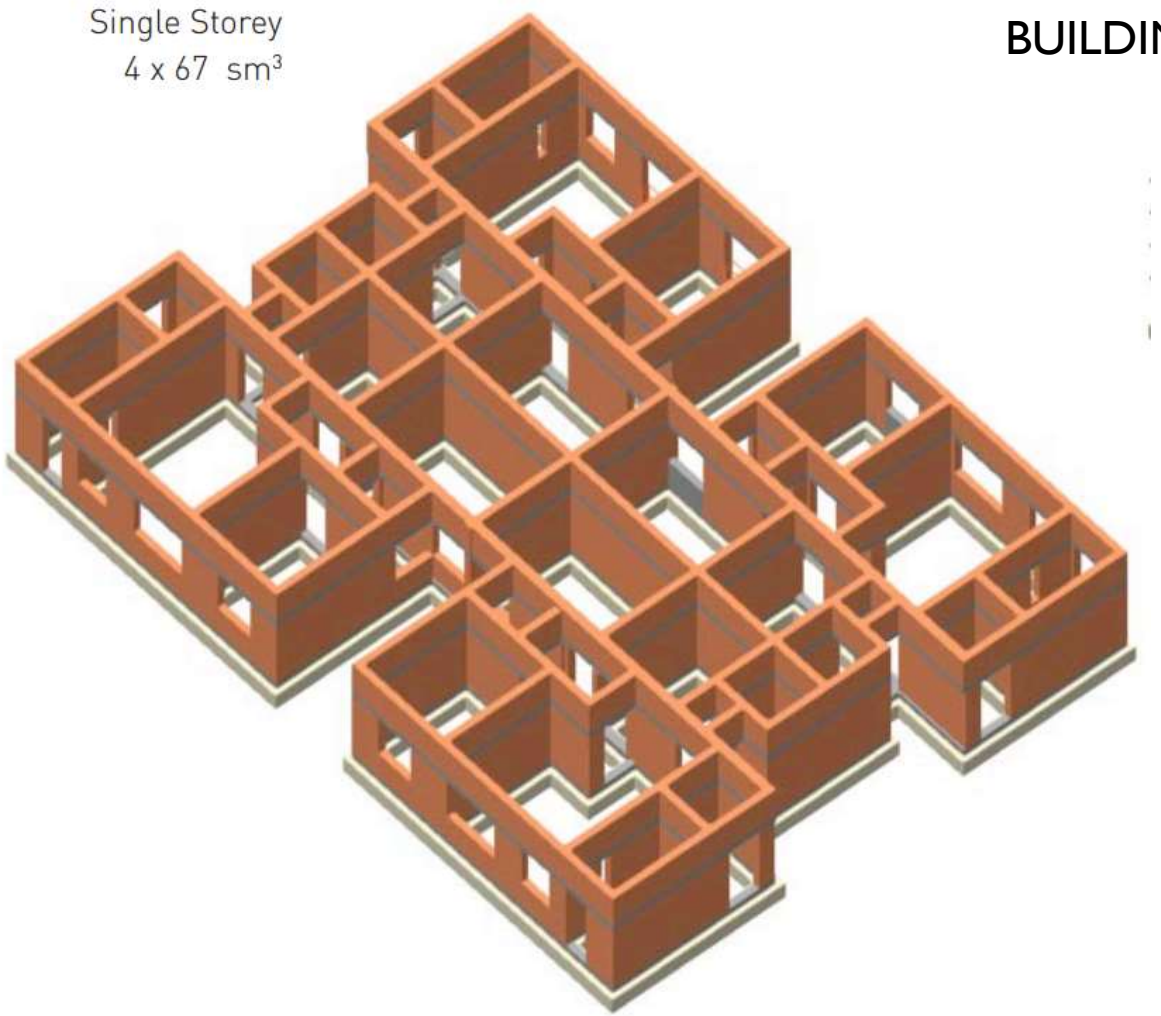
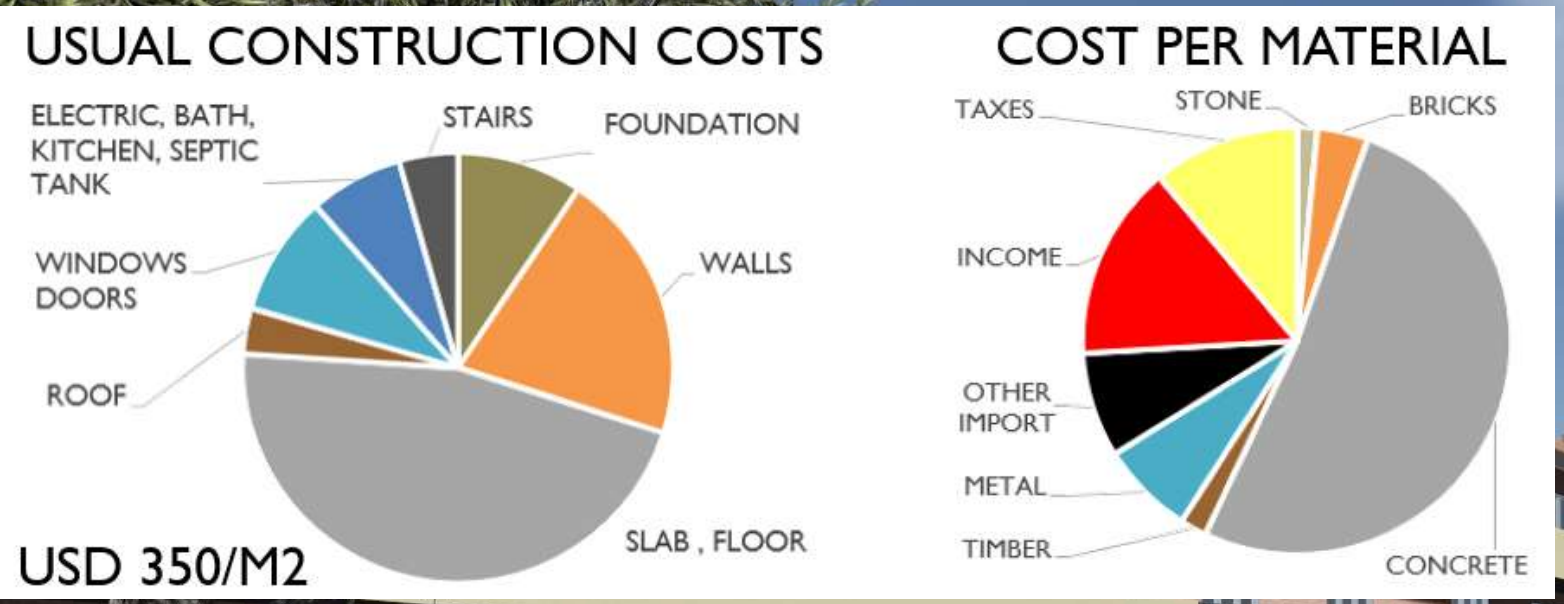
HOW TO REDUCE CONSTRUCTION COSTS

AFFORDABLE MODEL BUILDING

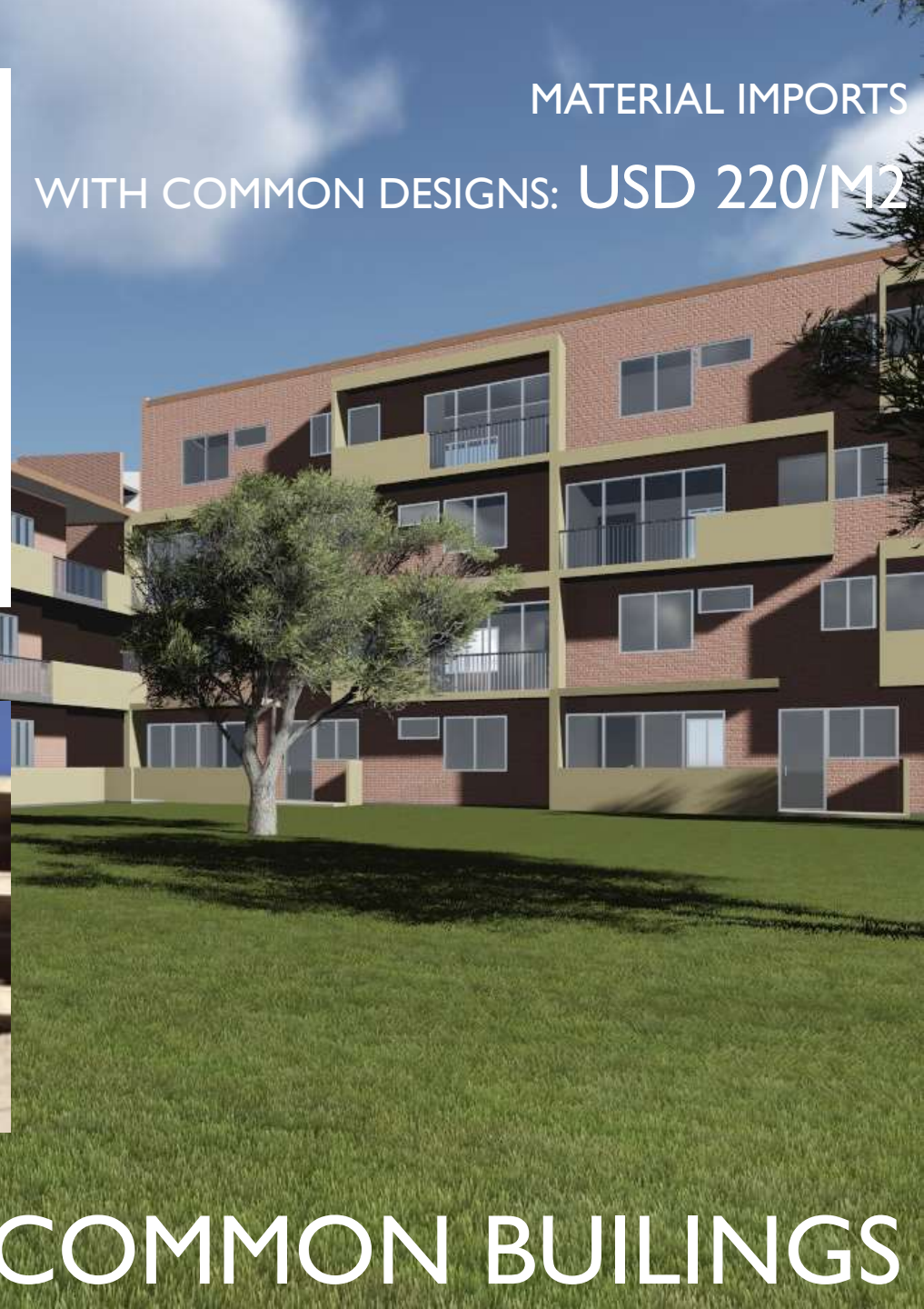


ANALYSING COMMON BUILING DESIGN



MATERIAL IMPORTS

WITH COMMON DESIGNS: USD 220/M2



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COST-ANALYSING OF COMMON BUILINGS

RAW MATERIAL REQUIRED FOR BUILDING MATERIAL PRODUCTION

RED BRICKS: CLAY

CEMENT PRODUCTION: LIMESTONE

IDENTIFYING LOCALLY AVAILABLE MATERIAL

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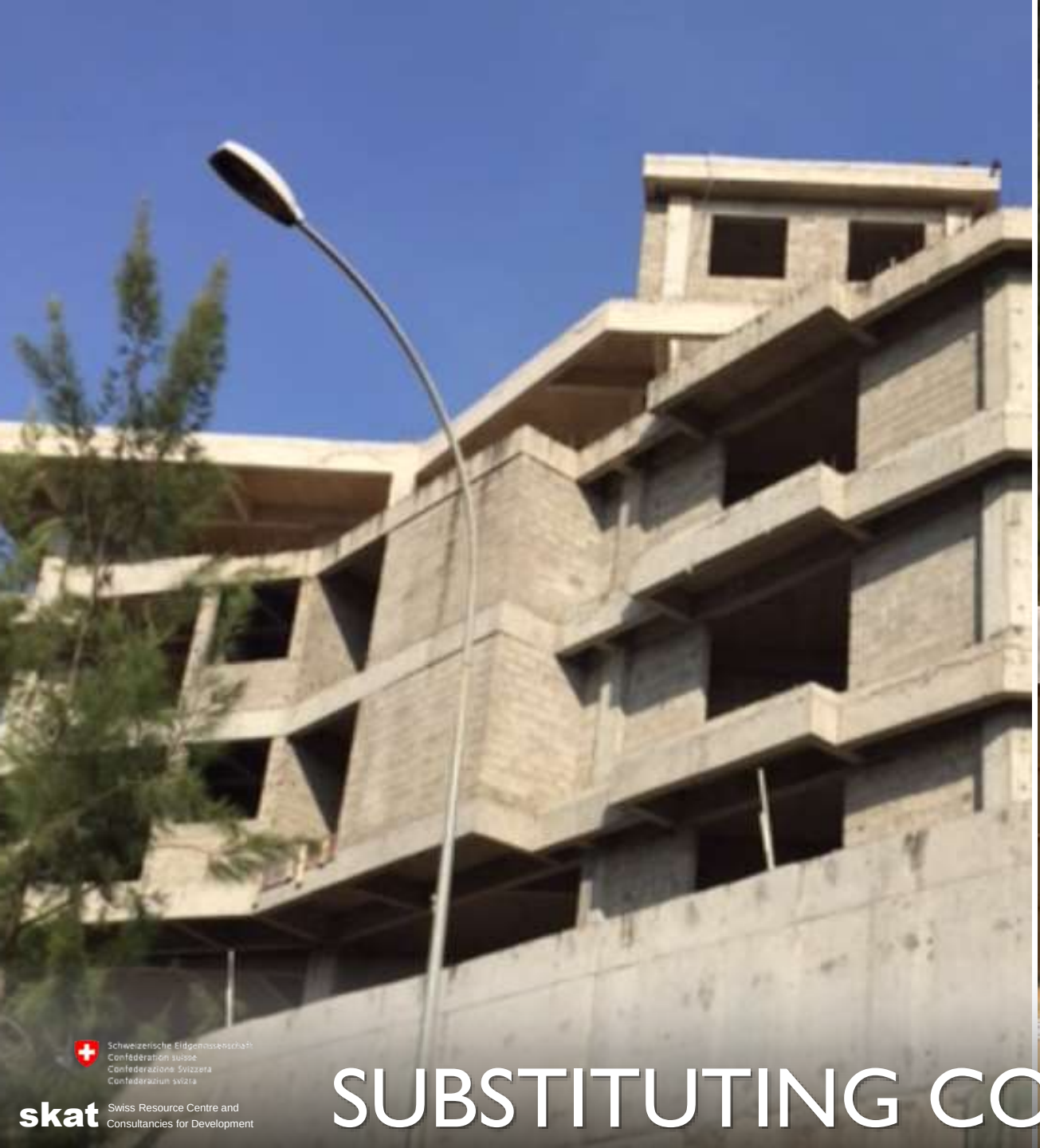

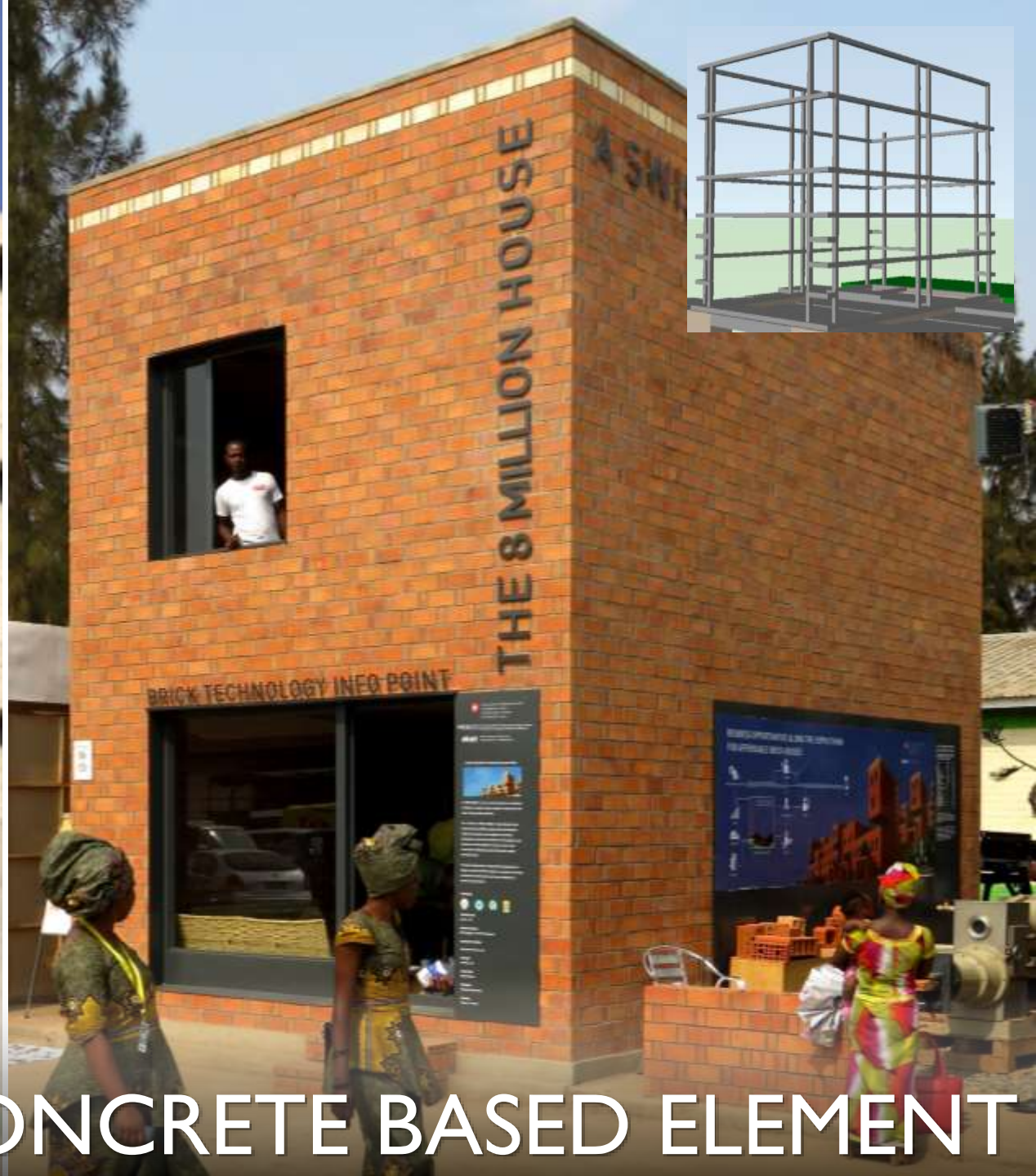

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SUBSTITUTING CONCRETE BASED ELEMENT

FOR SMALL CONTRACTORS WITH SIMPLE EQUIPMENT REQUIRING A MINIMUM OF CONCRETE

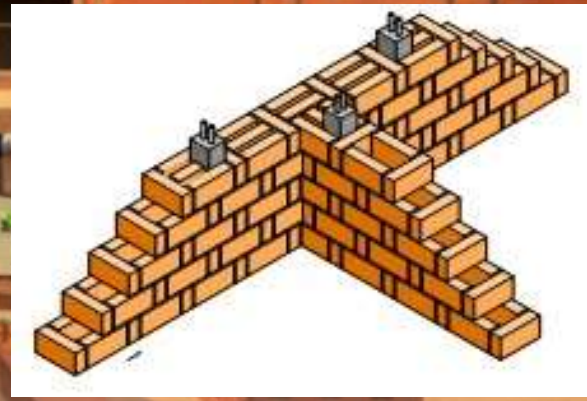
SELECTED STAGES IN THE HISTORY OF ROWLOCK BOND WALLING

HENLOW
UK- 1801
WORKING-CLASS HOUSES

PICTON
CAN- 1858
AFFORDABLE SETTLERS' HOUSES
WELSH BROTHERS

CHICAGO
USA-1949
LUNT LAKE APTARTMENTS
HOLSMAN, HOLSMAN KLEKAMP & TAYLOR

KATHMANDU AREA
NEPAL-2015
PARA-SEISMIC RECON-STRUCTION MANUAL
GOVERNMENT OF NEPAL AFTER THE GORKHA SEISM
MAGNITUDE: 8.1Ms



A WORKING-CLASS BOND'S UPGRADE 3.0

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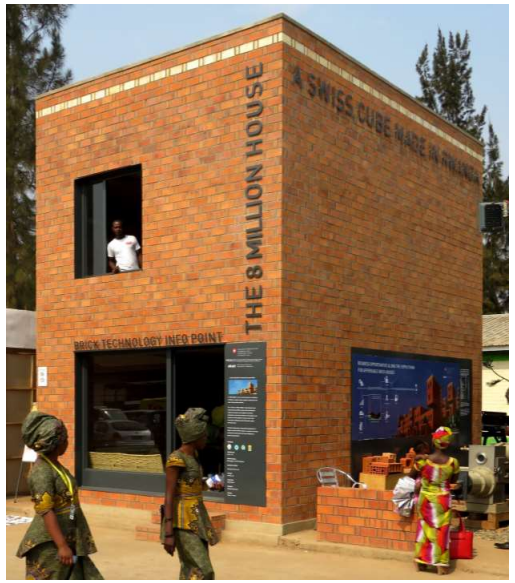
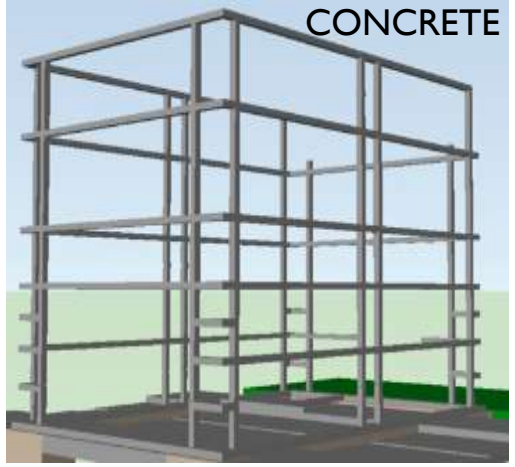
THE CUBE : ROWLOCK BOND MODULAR AND PARA-SEISMIC





FOR SMALL CONTRACTORS
WITH SIMPLE EQUIPMENT
REQUIRING A MINIMUM OF
CONCRETE

EASY-TO-BUILD URBAN WALLING & SLABS

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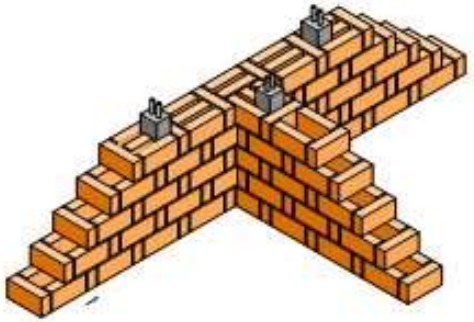

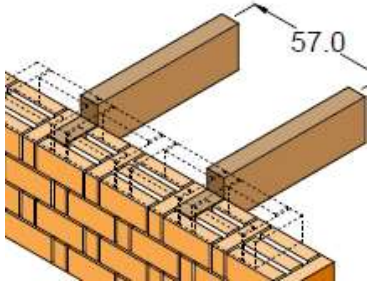

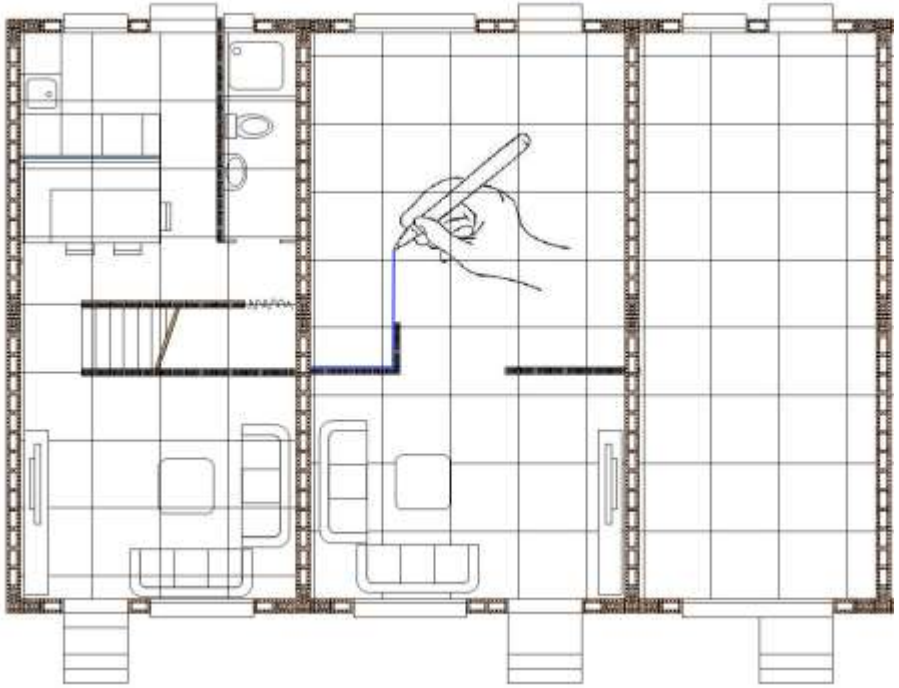

FOR SMALL CONTRACTORS
WITH SIMPLE EQUIPMENT
REQUIRING A MINIMUM OF
CONCRETE

EASY-TO-BUILD URBAN WALLING SYSTEMS & SLABS

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BRICKS 120

USD 5

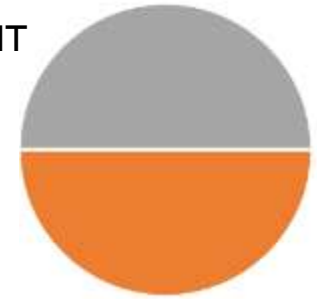
MORTAR 206kg

USD 13

TOTAL MATERIAL COSTS PER SQM

USD 18

IMPORTED CEMENT



LOCAL MATERIAL

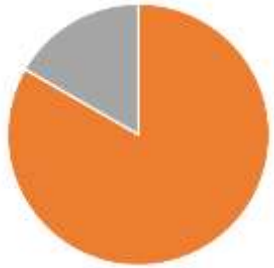
USD 9

BRICKS 100

USD 3

MORTAR 48kg

IMPORTED CEMENT



LOCAL MATERIAL

USD 12

TOTAL MATERIAL COSTS PER SQM

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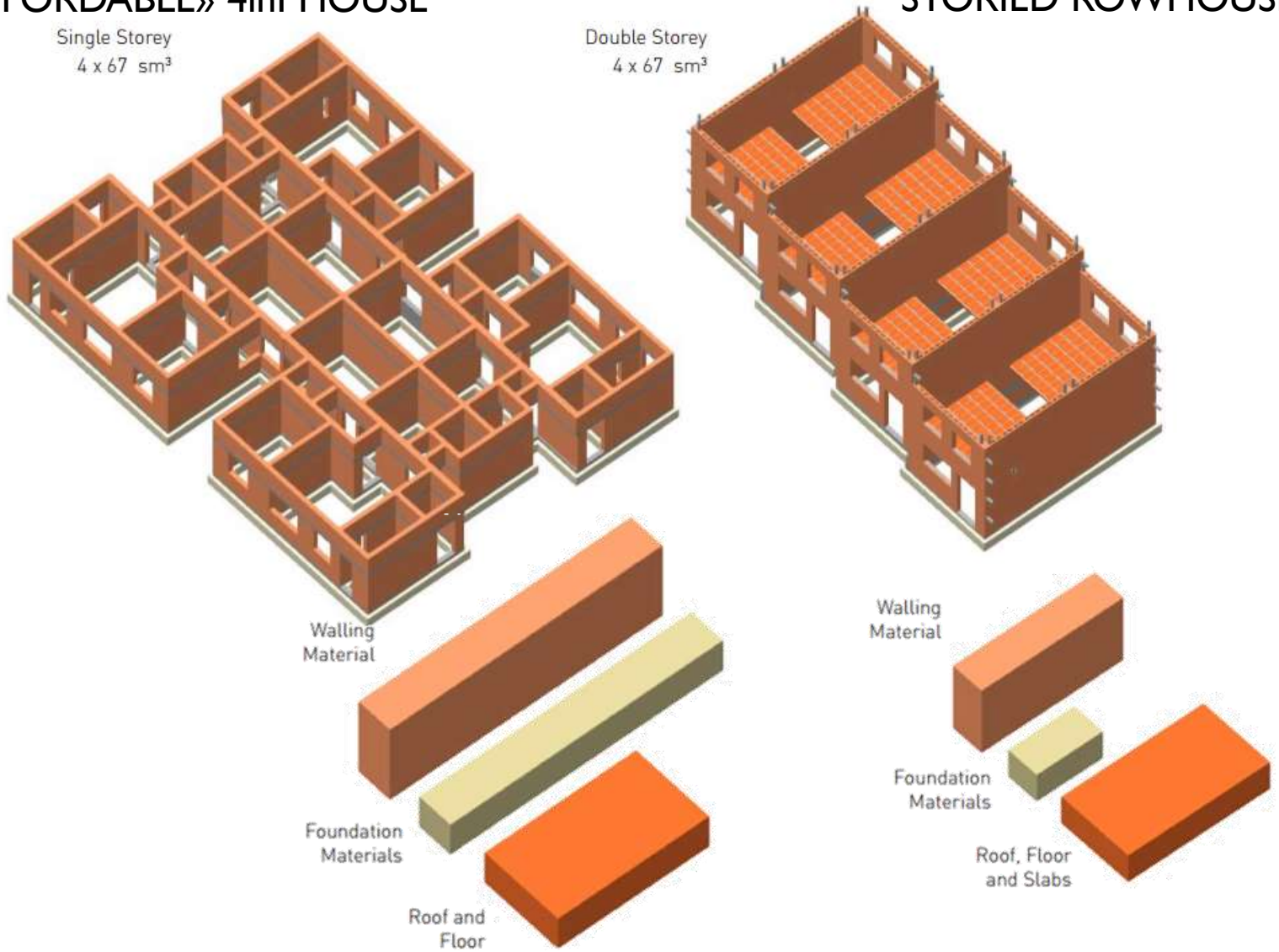
REPLACING IMPORTED CEMENT WITH BRICKS

«AFFORDABLE» 4inl HOUSE

STORIED ROWHOUSE



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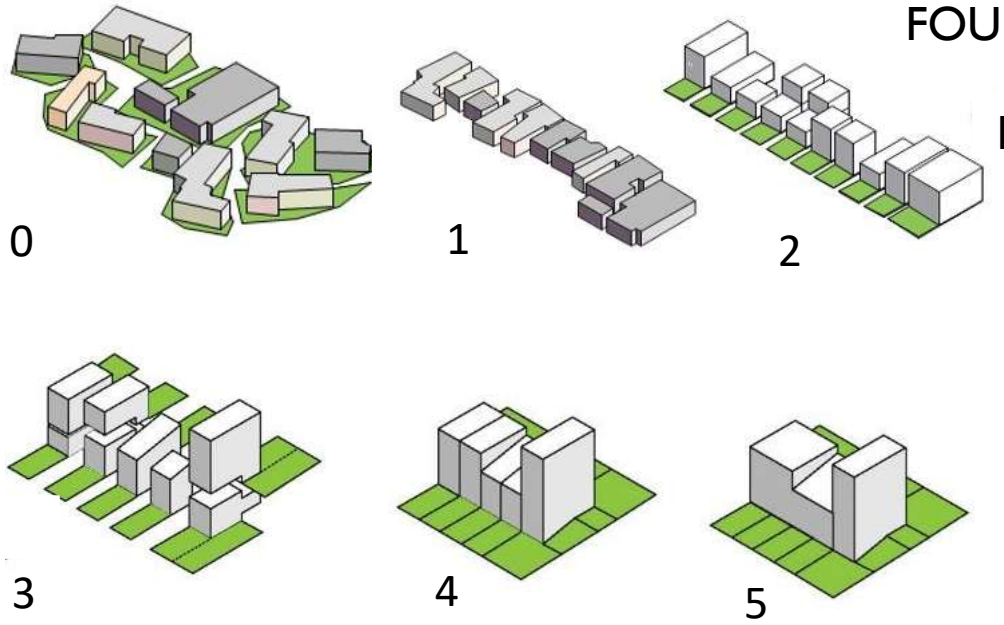
MINIMISING THE USE OF EXPENSIVE MATERIAL



FOUNDATION COSTS: >40%

LAND REQUIRED: >50%

IDEAL SLOPE: 10-15%

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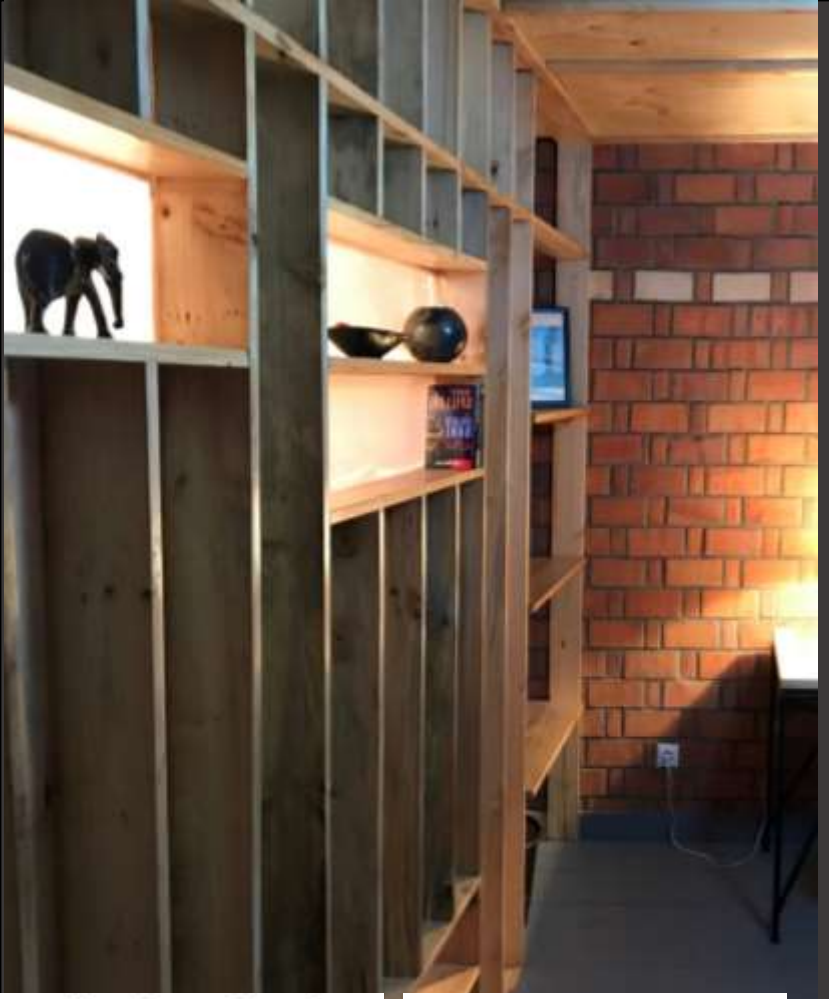
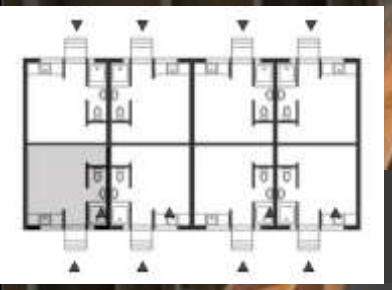
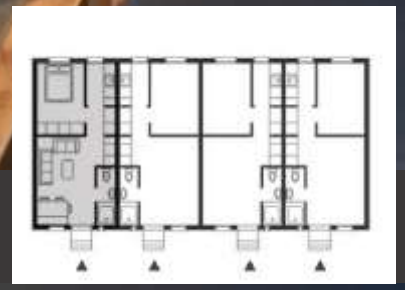
STACKED HOUSES WITH PRIVATE FRONTYARDS







INCREMENTAL ADAPTATION TO A NEIGHBOURHOOD'S GROWING INCOME

FLEXIBLE INTERIORS – EASY TO MAINTAIN

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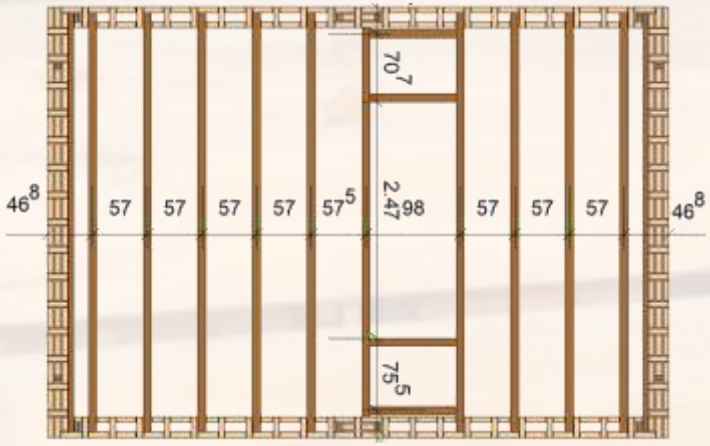
Ceramic Slab

Cost reduction +/- **10%**

Timber Slab



Cost reduction +/- **20%**

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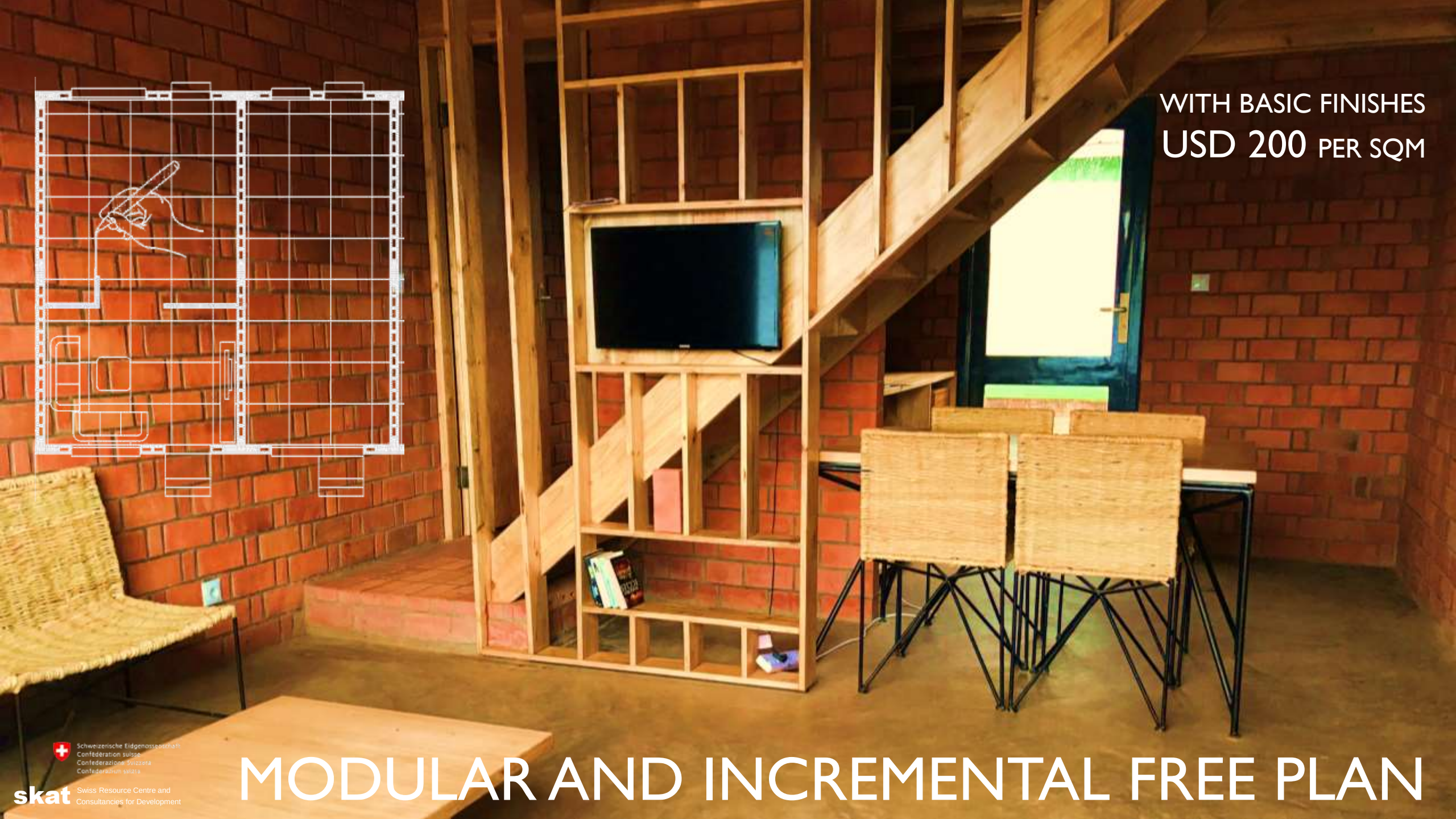
INTRODUCING TIMBER AND CERAMIC SLABS


WITH BASIC FINISHES
USD 200 PER SQM
MODULAR AND INCREMENTAL FREE PLAN
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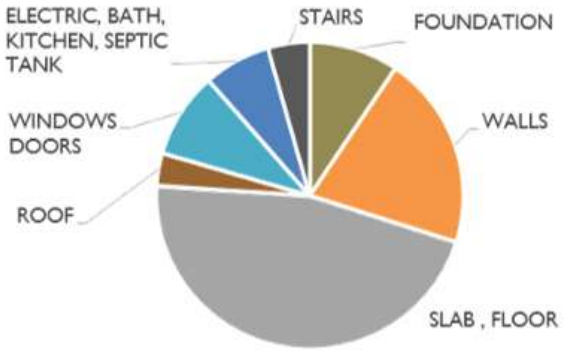
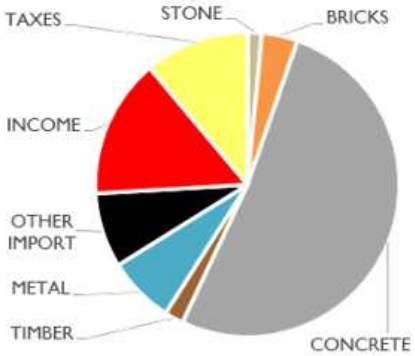
Green Social and Affordable

USUAL CONSTRUCTION COSTS

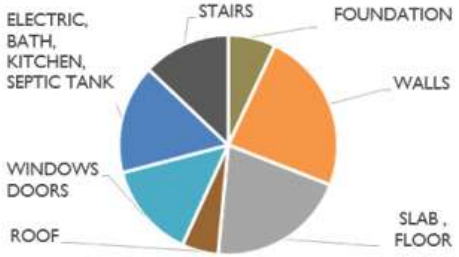


COST PER MATERIAL

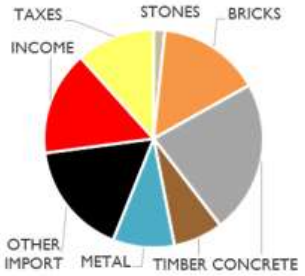


Construction costs	Imported material	CO2 emissions (walls)
USD >350/M2	**USD 220/M2**	**500kg CO_2/M2**

COSTS WITH OPTIMISED DESIGN



COST PER MATERIAL



Construction costs	Imported material	CO2 emissions (walls)
USD 200-250/M2	**USD 80/M2**	**70-150kg CO_2/M2**

MATERIAL IMPORTS

WITH COMMON DESIGNS: USD 220/M2

WITH OPTIMISED DESIGNS: USD 80/M2

OPTIMISING THE USE OF LOCAL MATERIAL

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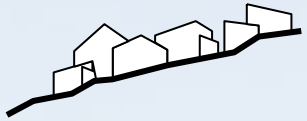
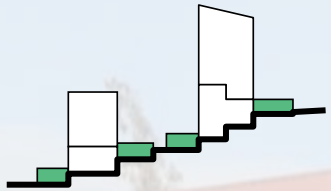
PRESENTATION OF A COST-EFFECTIVE BUILDING SYSTEM

COST REDUCTION PER DESIGN MEASURE

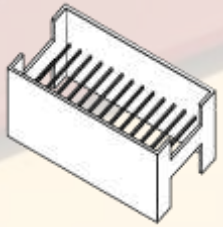


CURRENT SITUATION



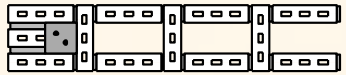
STACKING HOUSES

+/- 20%



SIMPLE FLOOR PLANS

+/- 20%



CAVITY BRICK WALLS

+/- 10%

LOW-COST SLABS

+/- 20%

COST-EFFECTIVE, CUSTOMISABLE DESIGNS

VISITORS

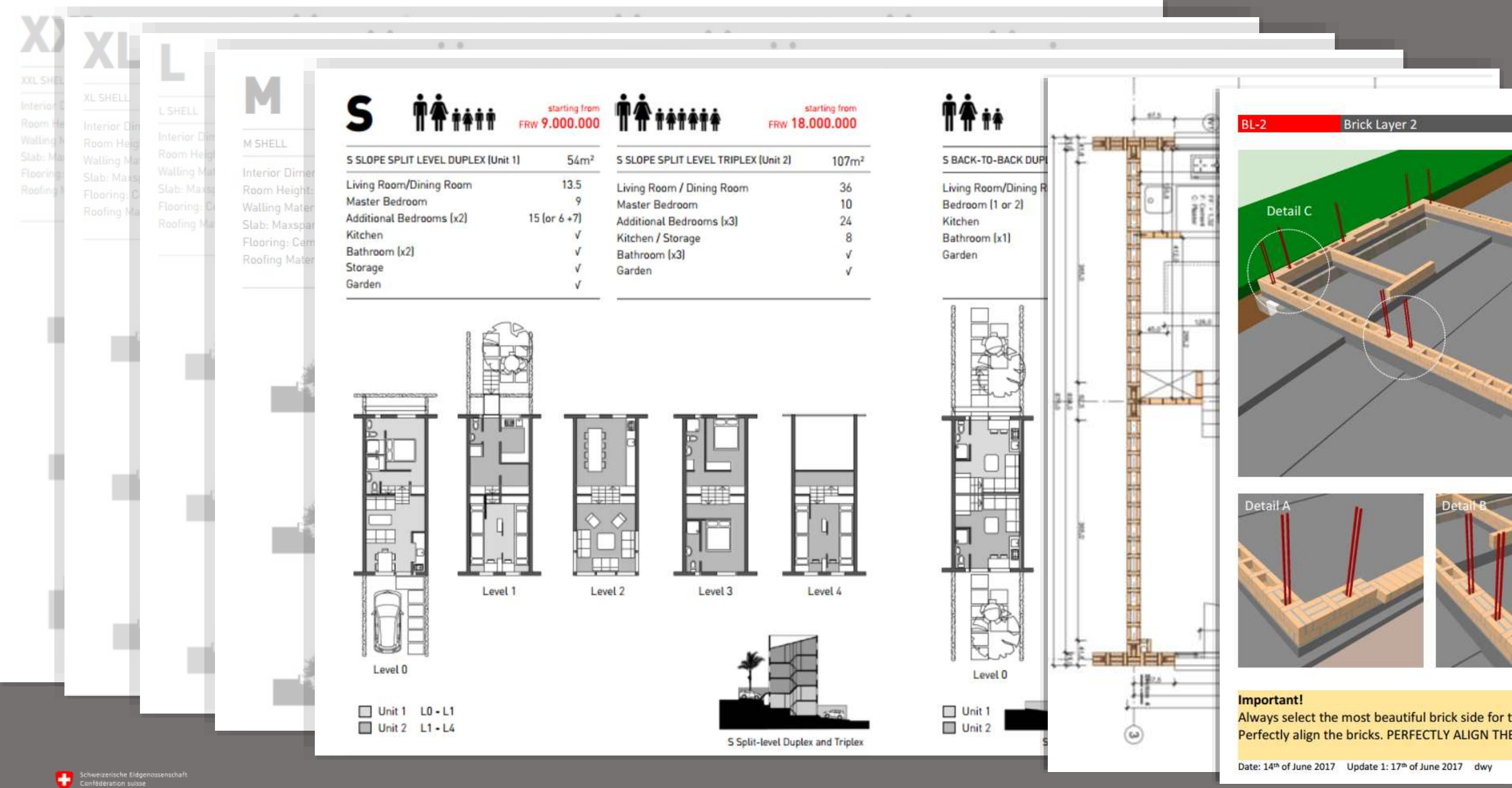
SINCE SEPTEMBER 2017: 50.000

DESIGN REQUESTS

DWELLING UNITS : 8000

FACTORIES : 20

PERMANENTLY ACCESSIBLE MODEL HOUSES



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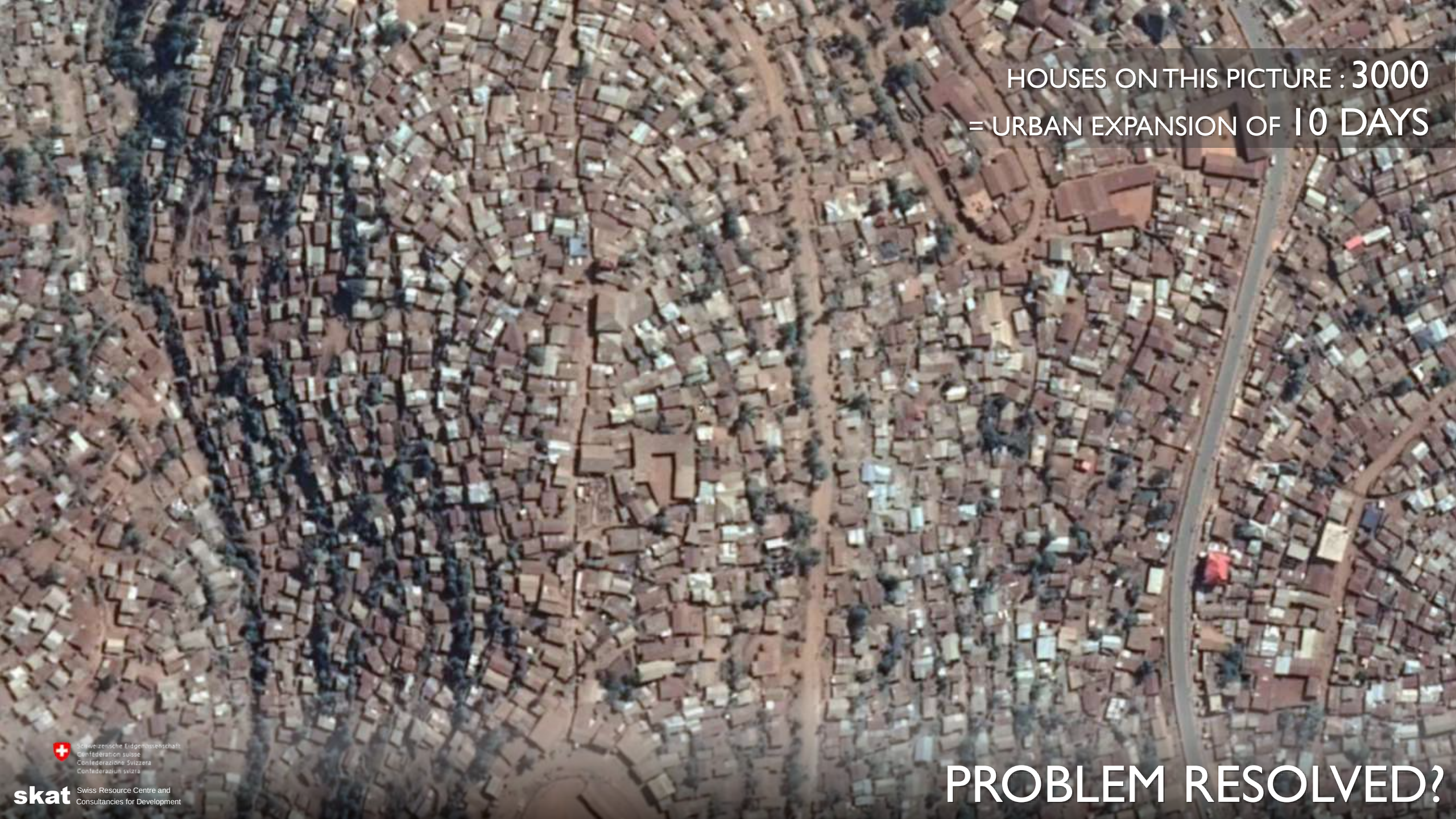
A CATALOGUE OF PRE-ENGINEERED DESIGNS


HOUSES ON THIS PICTURE : 3000
= URBAN EXPANSION OF 10 DAYS
PROBLEM RESOLVED?
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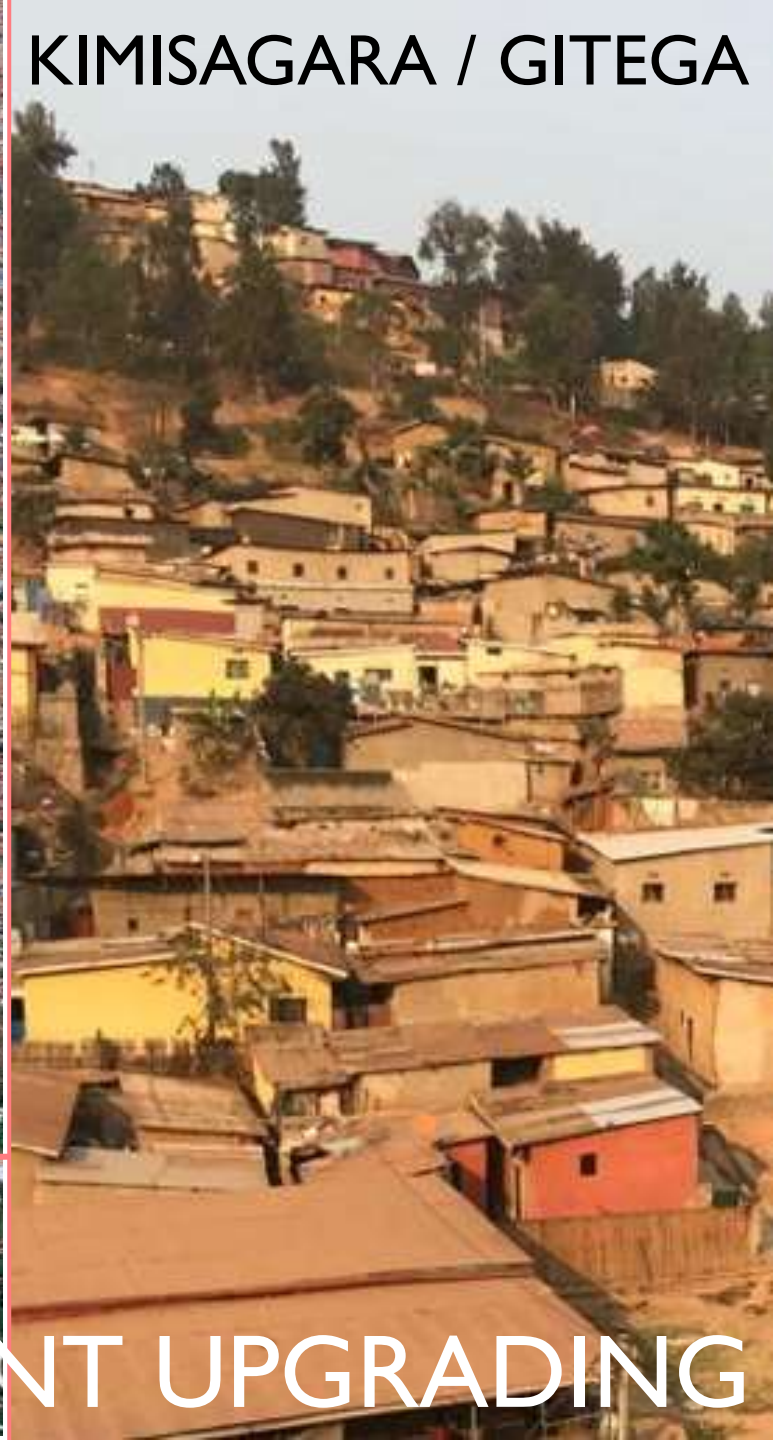
TASK 2:

THE UPGRADING INFORMAL NEIGHBOURHOODS



THE PILOT ZONE FOR SETTLEMENT UPGRADING

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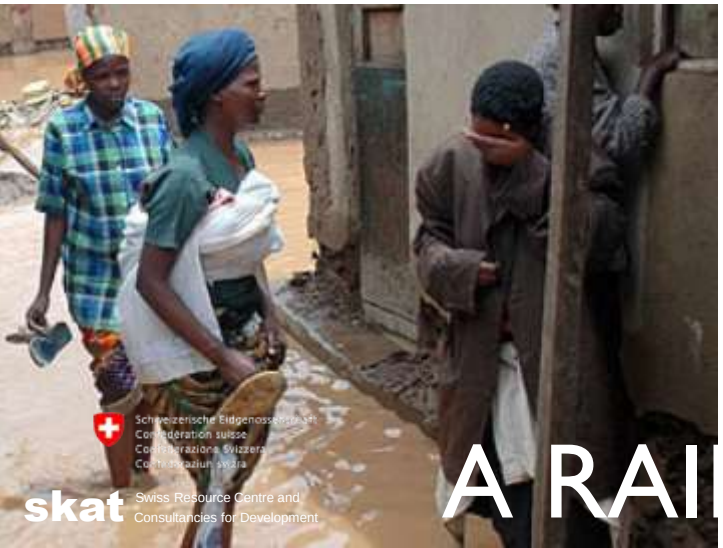

KIMISAGARA / GITEGA

A RAIN AND FLOOD PRONE CITY DISTRICT

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KIMISAGARA / GITEGA
THE 1ST NEIGHBOURGHOOD TO BE UPGRADED
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- SINGAPORE INSPIRED URBAN DEVELOPMENT VISION
- URBAN MODERNISATION THROUGH LARGE DEVELOPMENTS
- TABULA RASA OF THE UNPLANNED NEIGHBOURHOODS
- GENTRIFICATION
- IMPLEMENTED BY INTERNATIONAL COMPANIES
- CONSTRUCTION WITH IMPORTED BUILDING MATERIAL

KIGALI'S MASTER PLAN VISION 2013

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DEVELOPER-DRIVEN URBAN RENEWAL

KIGALI: "VISION CITY"

USD 179.000-560.000/DWELLING UNIT

DEVELOPER-DRIVEN URBAN RENEWAL

- SINGAPORE INSPIRED URBAN DEVELOPMENT VISION
- URBAN MODERNISATION THROUGH LARGE DEVELOPMENTS
- TABULA RASA OF THE UNPLANNED NEIGHBOURHOODS
- GENTRIFICATION
- IMPLEMENTED BY INTERNATIONAL COMPANIES
- CONSTRUCTION WITH IMPORTED BUILDING MATERIAL

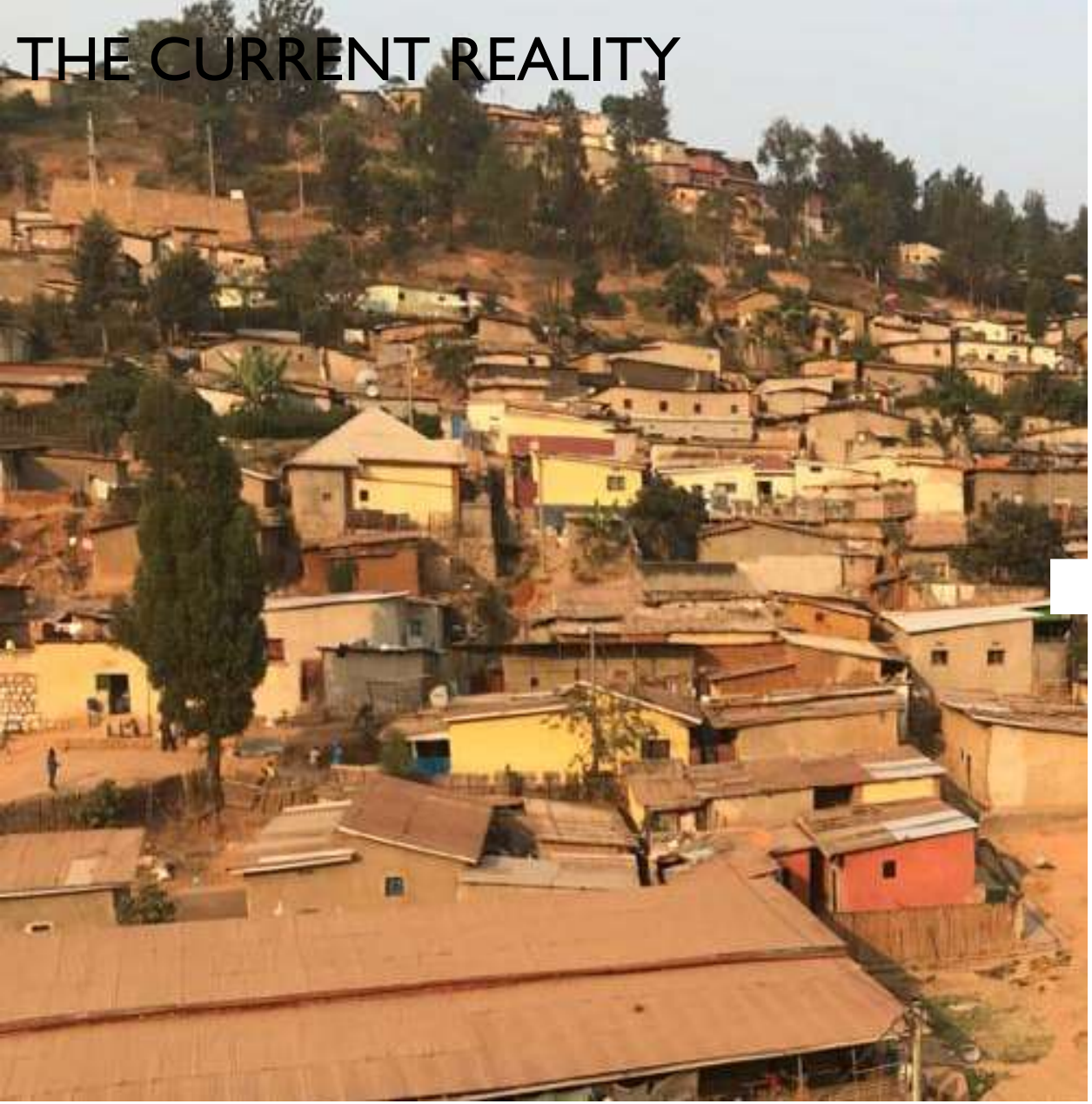
KIGALI'S MASTER PLAN VISION 2013

KEY ELEMENTS OF THE NEW MASTERPLA VISION:

- "ORGANIC AND FLEXIBLE REDEVELOPMENT"
- "BUILDING TYPOLOGY AND URBAN BLOCKS THAT FIT THE INCREMENTAL DENSIFICATION APPROACH"
- "STRONG INTERACTION BETWEEN THE BUILDINGS AND THE PUBLIC REALM"

>> A MASTERPLAN ZONE OF TOTALLY 32km2 REFERS TO (IS NAMED AFTER) THE SWISS CUBE TYPOLOGIE

KIGALI CITY MASTER PLAN VISION 2019



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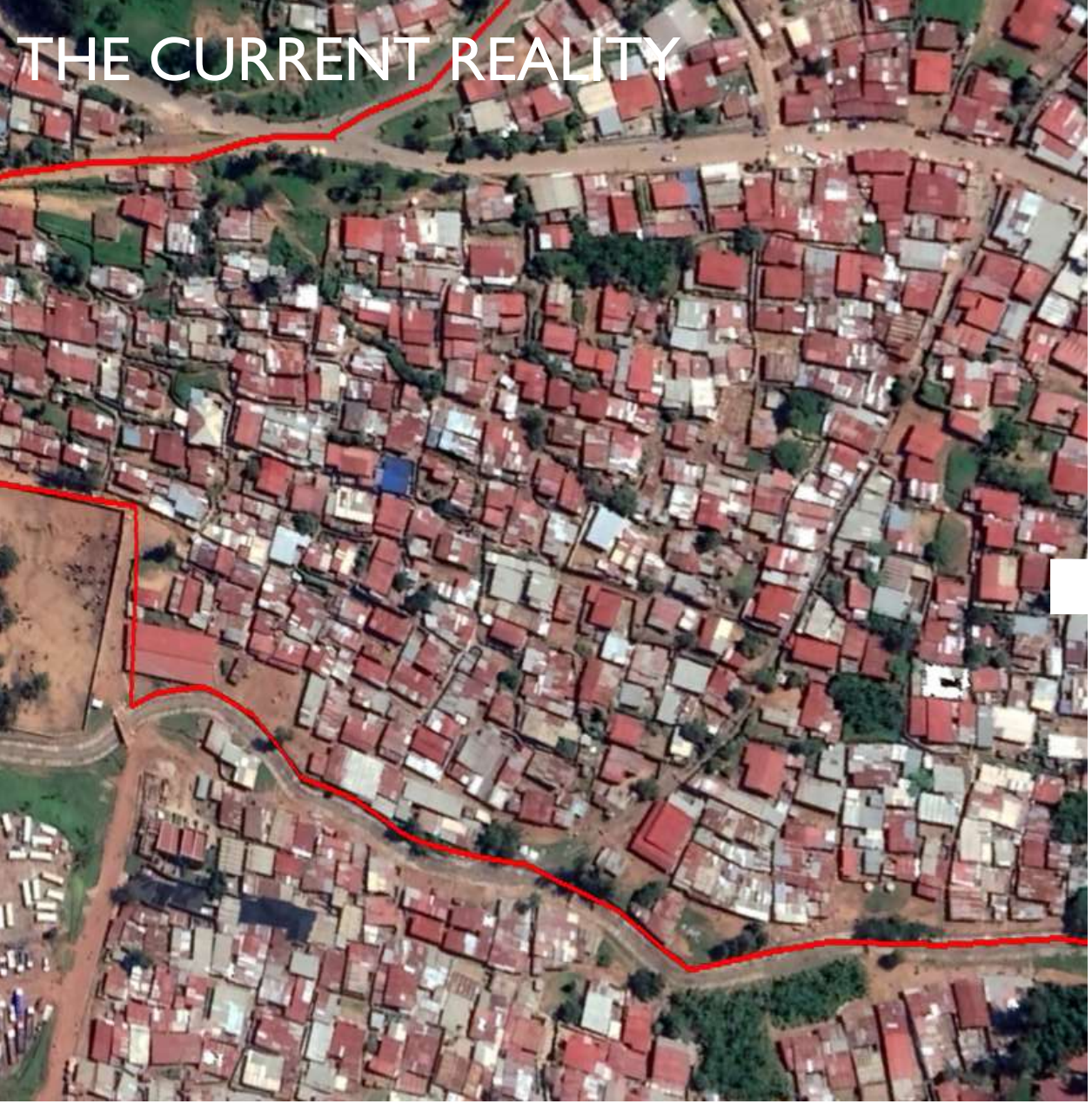
THE DECISION-MAKERS' AMBITION



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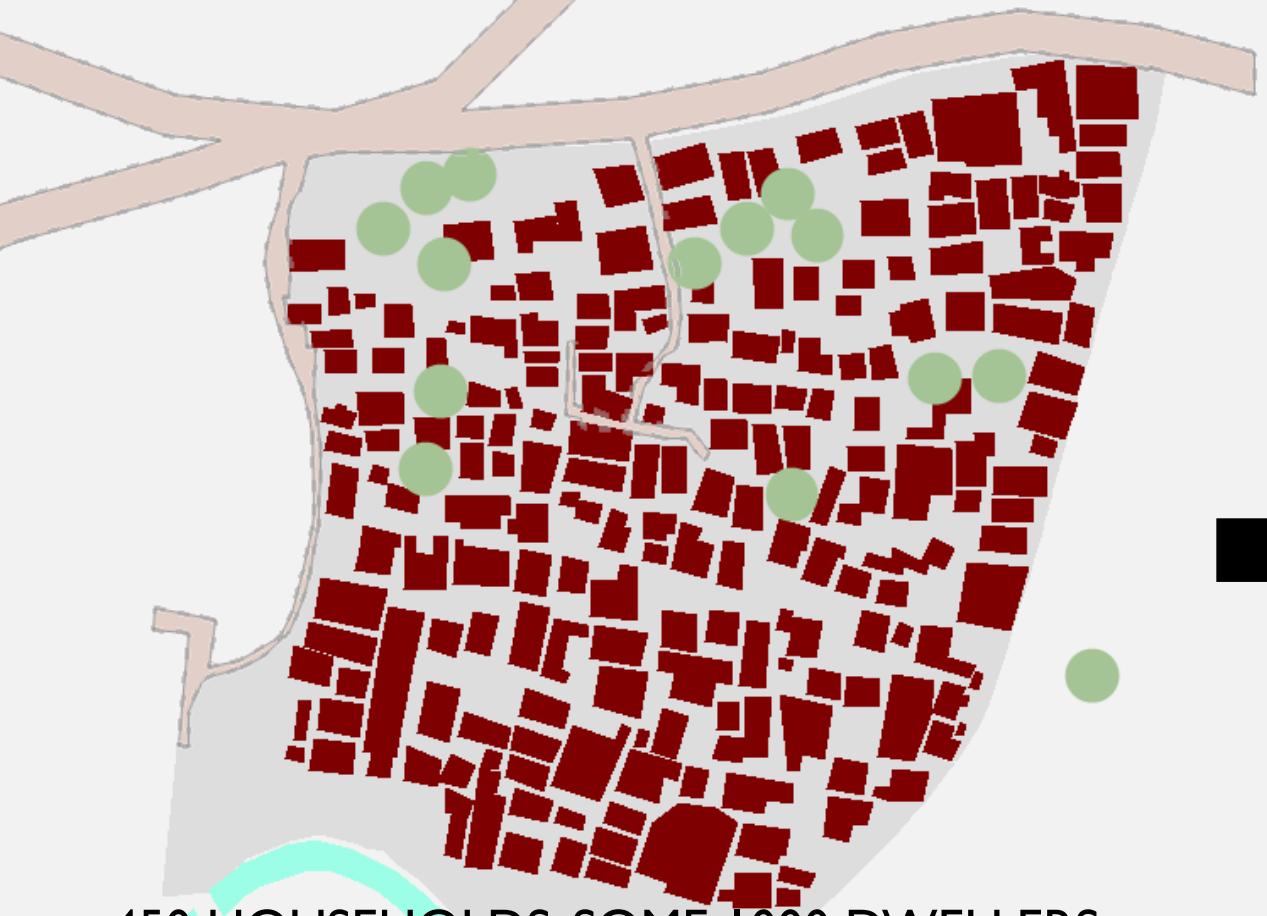
THE CITY AUTHORITIES' CHALLENGE

THE CURRENT SLUM PATTERN



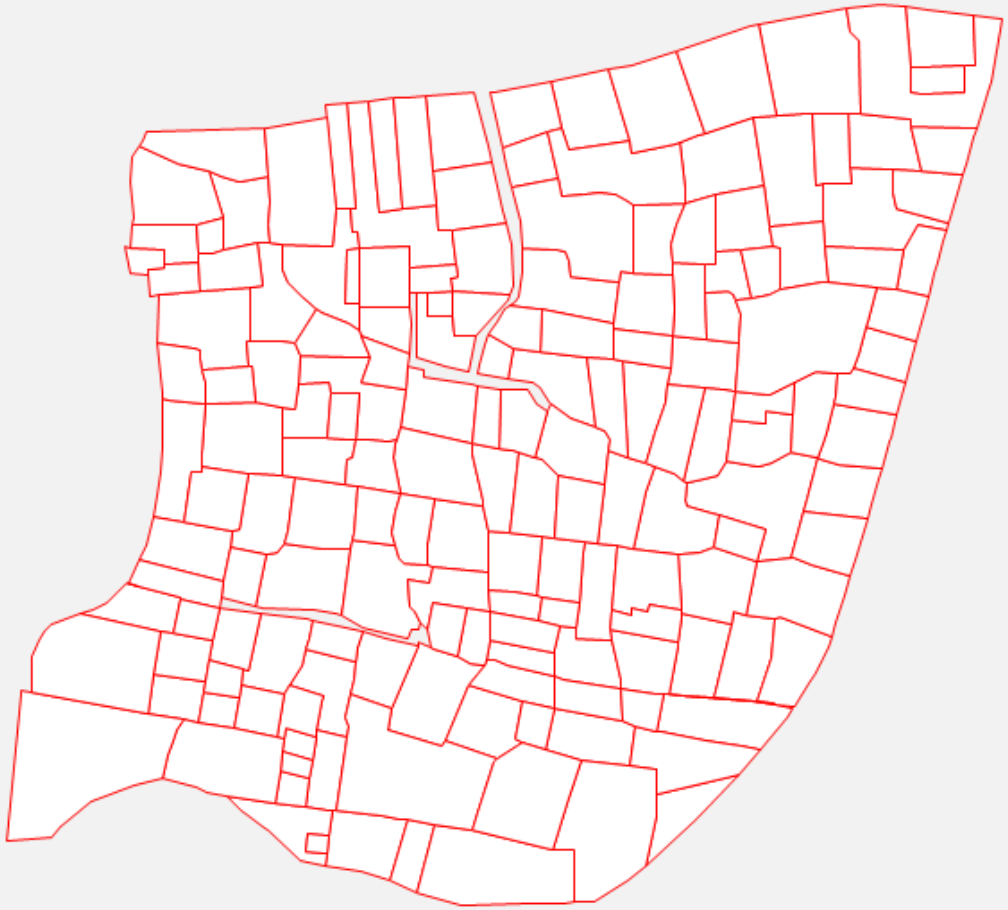
- 450 HOUSEHOLDS, SOME 1000 DWELLERS
- 200 SINGLE STOREY BUILDINGS
- NET FLOOR AREA NFA :11.500 m2
- FLOOR AREA RATIO : 0,36

A FORMAL NEIGHBOURHOOD PATTERN

- LARGE BUILDINGS & GREEN SPACE
- STORM WATER AND ACCESSIBILITY RESOLVED
- FLOOR AREA RATIO : 0,8-1,2 (NFA: >30.000M2)

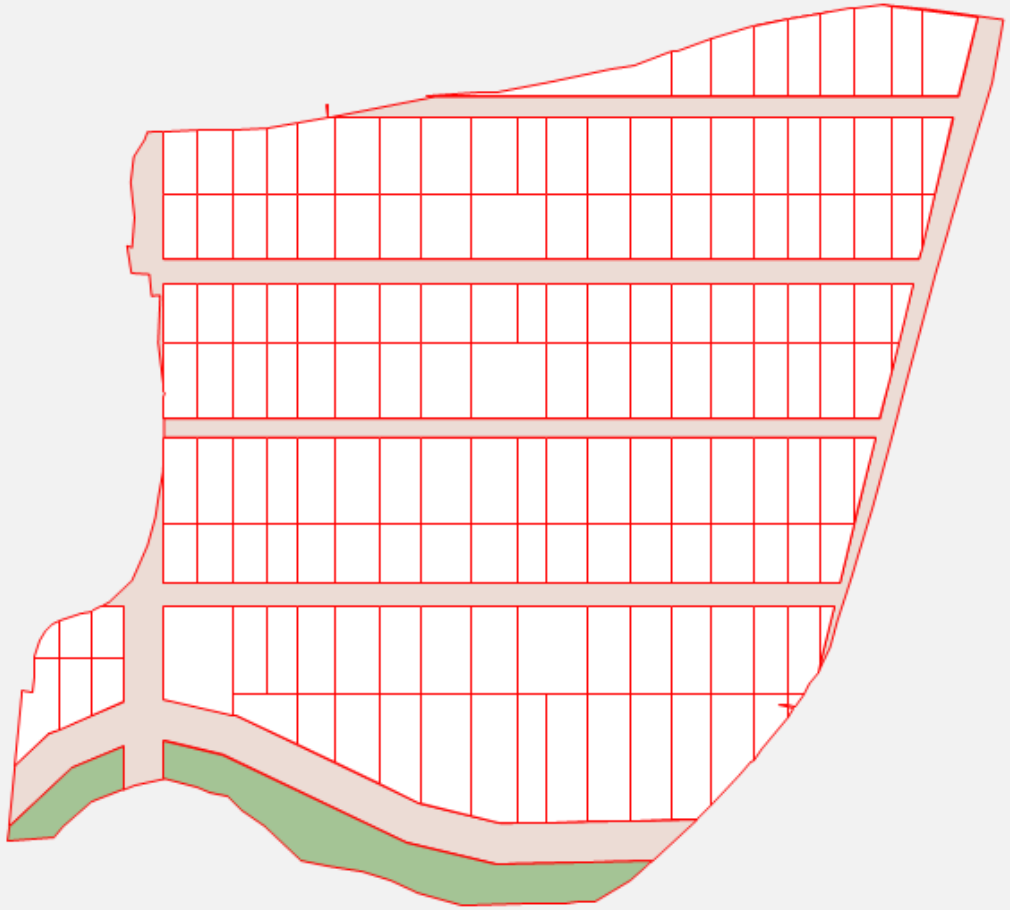
THE CITY AUTHORITIES' CHALLENGE

THE CURRENT SLUM PATTERN



- 170 PLOTS
- TOTAL LAND AREA: 37.000 m2
- MOST PLOTS ARE INACCESSIBLE

A SIMPLE SLUM REPLOTTING OPTION



- 170 PLOTS
- PRIVATELY OWNED LAND AREA: 29.000 m2
- LAND FOR ROADS AND PARKS : 8000 m2

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THE MOST DIRECT REPLOTTING SCENARIO…

THE CURRENT SLUM PATTERN

- 170 PLOTS / 200 BUILDINGS
- MOSTLY SUBSTANDARD, UNSAFE, UNBANKABLE
- INHABITABLE NET FLOOR AREA NFA : 11.500 m2

A SIMPLE SLUM REPLOTTING OPTION

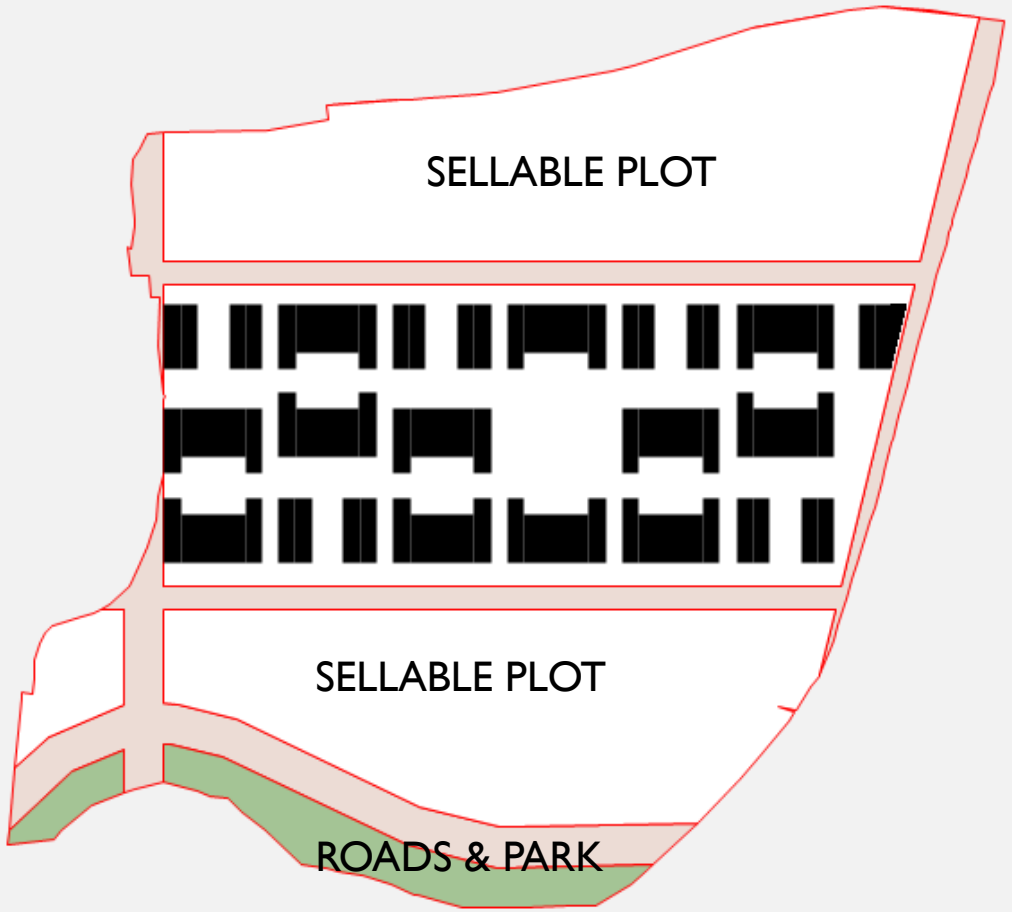
- 170-200 DUPLEX BUILDINGS, NFA : 11.500 m2
- MEET THE CODE - CAN SERVE AS COLLATERAL
- COSTS: $ 3 MILLION OR $ 20.000 PER AV. PLOT

…BUT UNAFFORABLE FOR SLUM DWELLERS

WHAT TO DO ?

THE CURRENT SLUM PATTERN

DENSIFIED AFFORDABLE NEIGHBOURHOOD



CONSTRUCTION COST – VALUE OF SELLABLE LAND = AFFORDABLE UPGRADING COSTS ?

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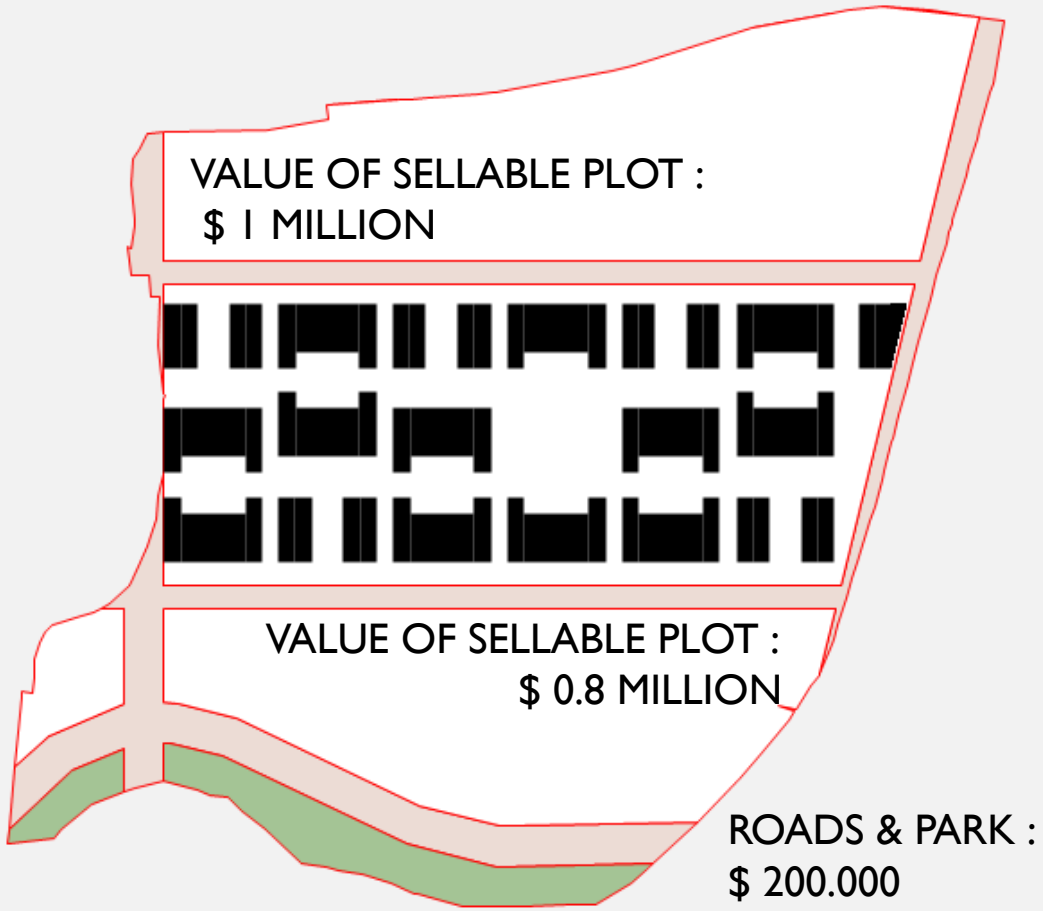
DENSIFICTION AND SELLING EXCESS-LAND

THE CURRENT SLUM PATTERN

- 450 DWELLINGS (SUBSTANDARD)
- INHABITABLE NET FLOOR AREA NFA: 11.500 m2

DENSIFIED AFFORDABLE NEIGHBOURHOOD



- 450 DWELLING UNITS (NFA: 11.500 m2)
- 60-70% OF THE 37.000 M2 PLOTS CAN BE SOLD
- VALUE OF SELLABLE LAND: $ 2 MILLION

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DENSIFICTION AND SELLING EXCESS-LAND

AFFORDABLE HOUSING BLOCK TYPOLOGIES

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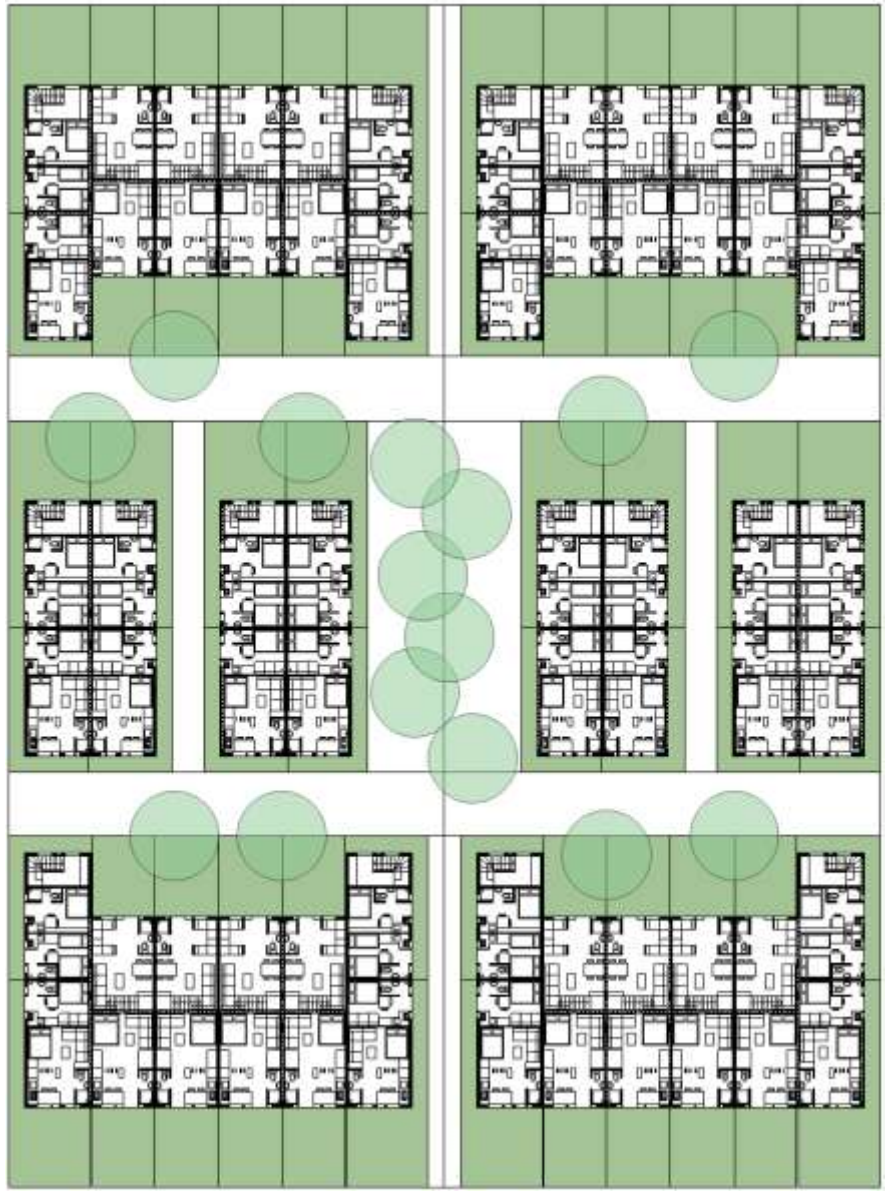
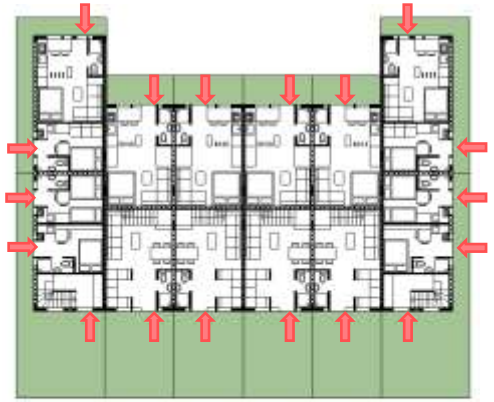
144 DWELLINGS BLOCK (MICRO-REAL ESTATE)



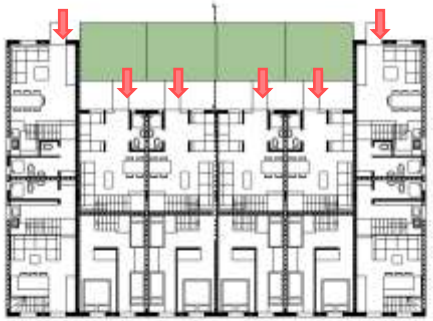
22-28 DWELLINGS PER BUILDING

GROUND FLOOR

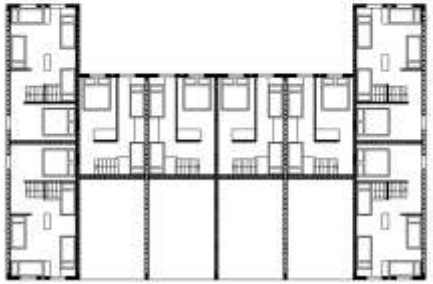
4 x 3-BEDROOMS
8 x 2 BEDROOMS
6 x 1 ROOM APART.
6 x EQUIPED ROOMS



1ST FLOOR



2ND FLOOR



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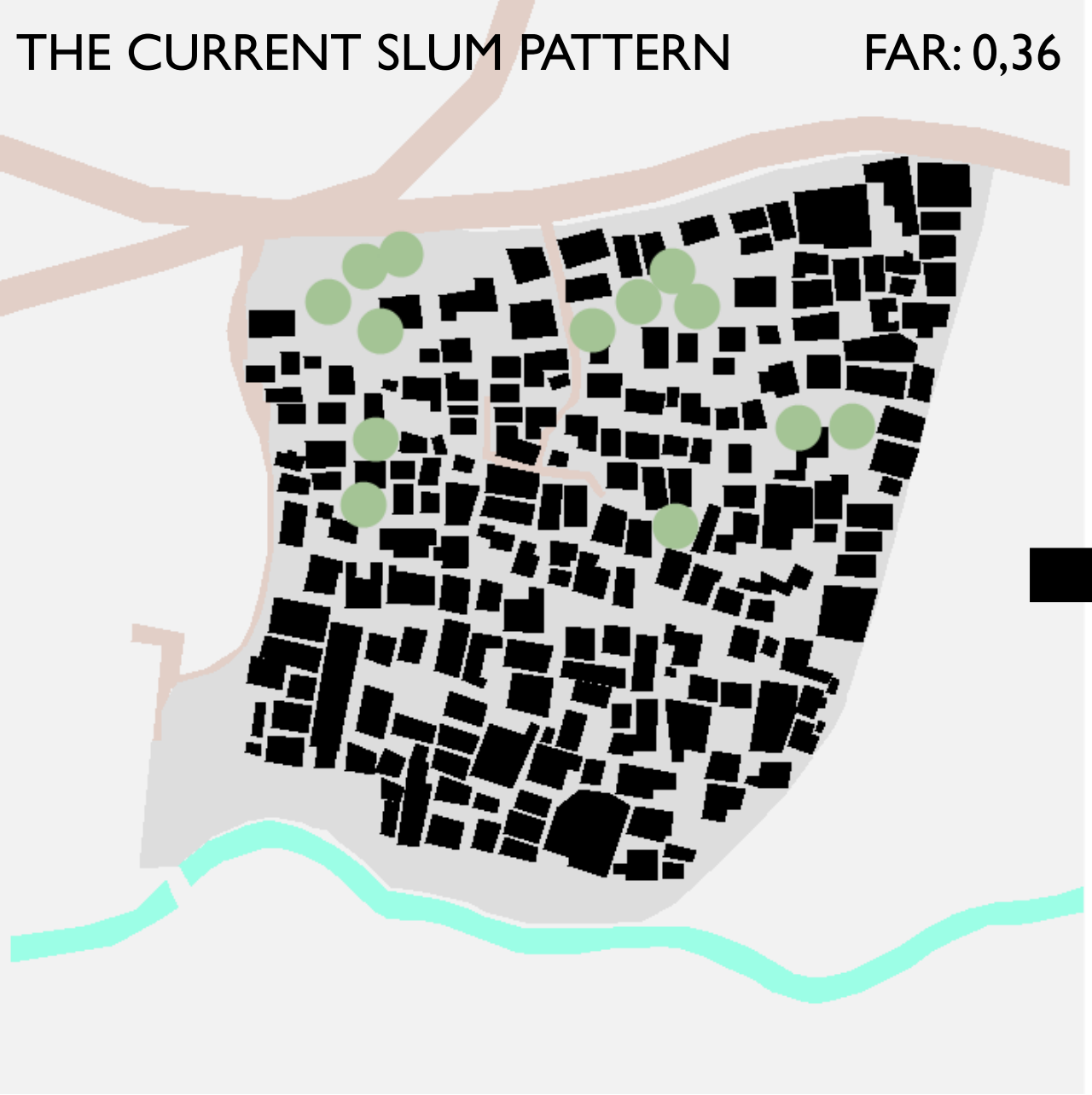
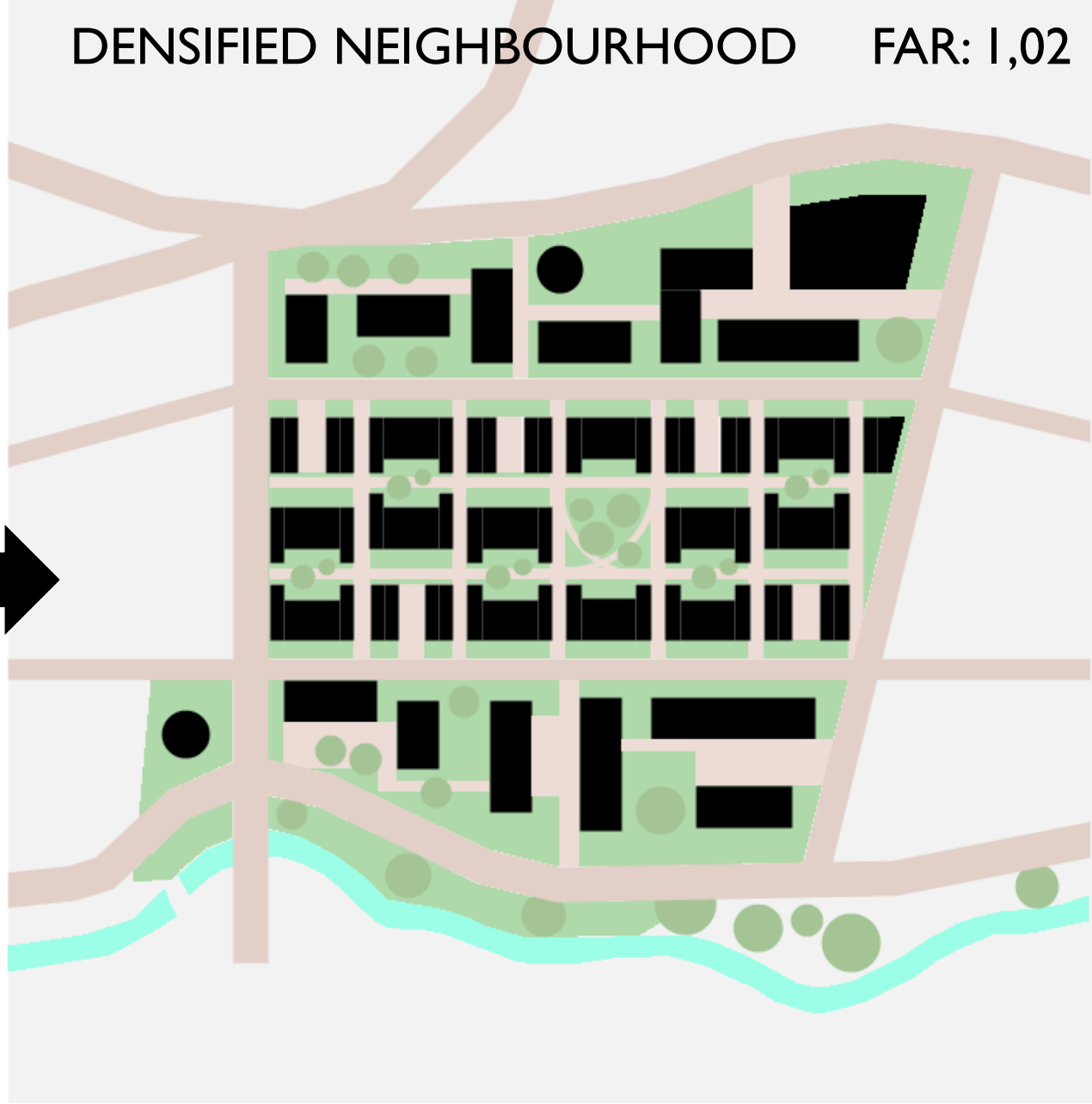
AFFORDABLE HOUSING BLOCK TYPOLOGIES

THE CURRENT SLUM PATTERN FAR: 0,36



DENSIFIED NEIGHBOURHOOD FAR: 1,02



TRANSFORMED NEIGHBOURHHOD

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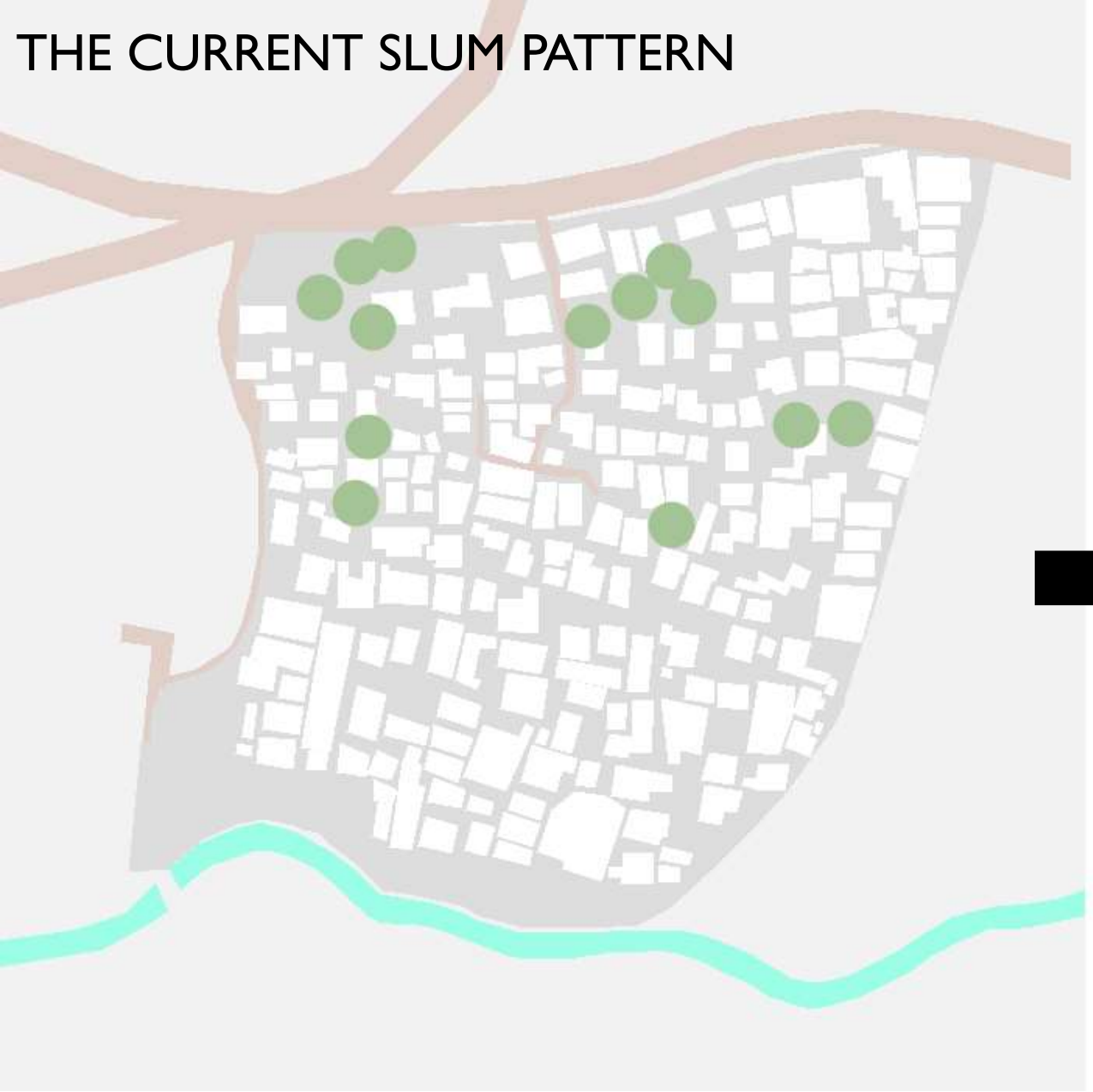

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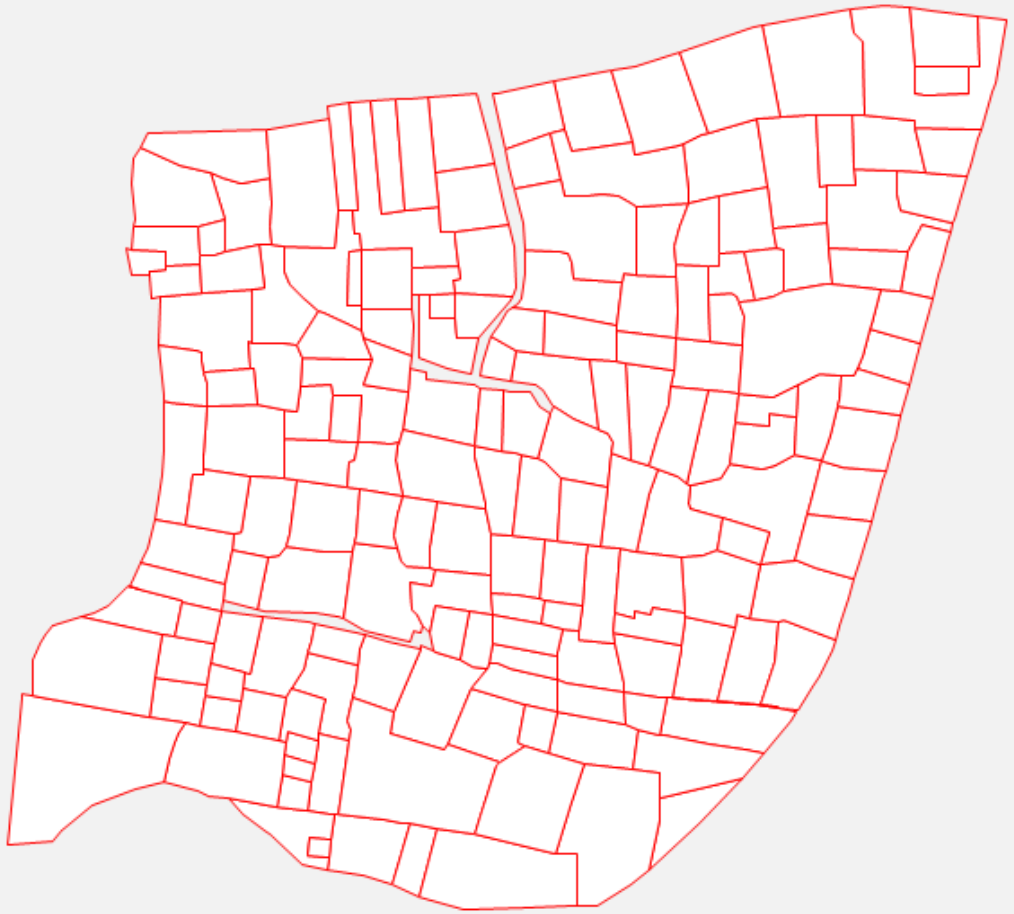
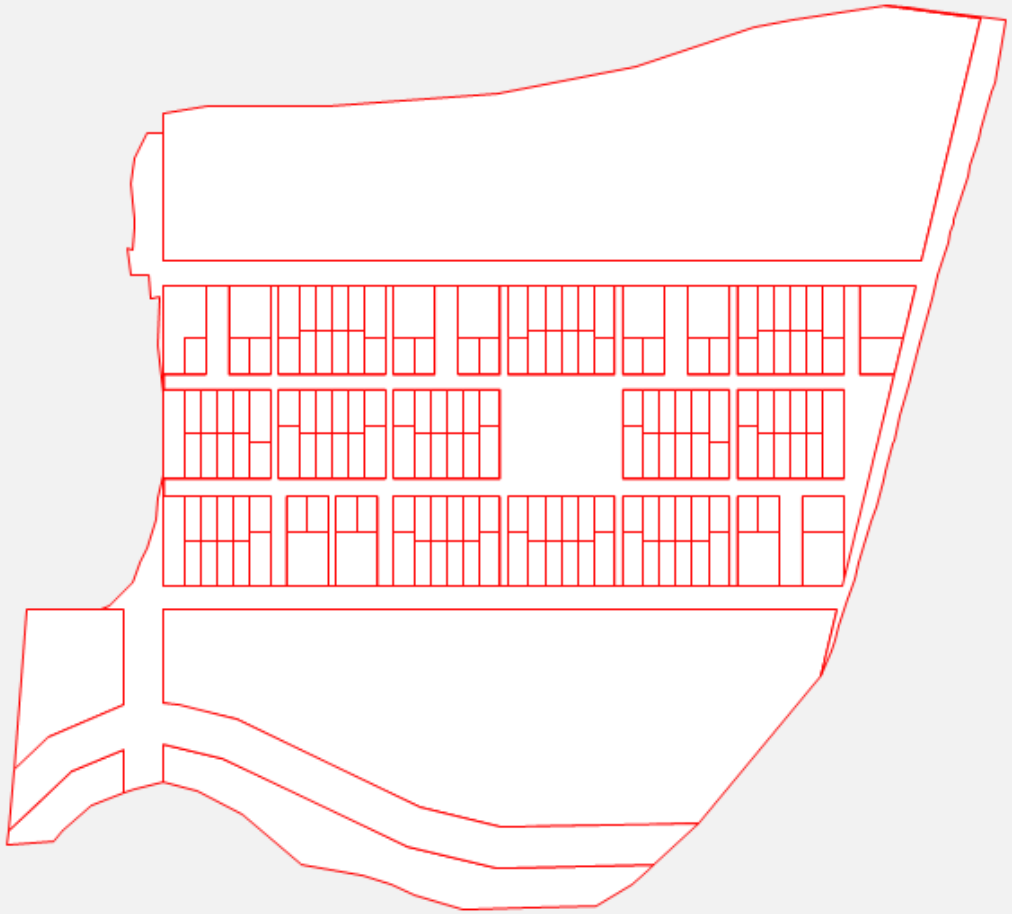
HOW TO ENSURE THAT EVERYBODY BENEFITS?

THE CURRENT SLUM PATTERN



DENSIFIED AFFORDABLE NEIGHBOURHOOD



170 HOME-OWNERS JOINING THE PROCESS?

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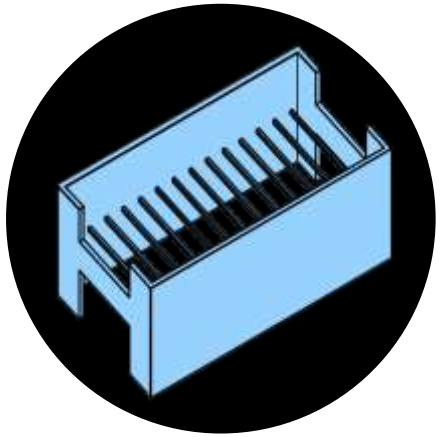
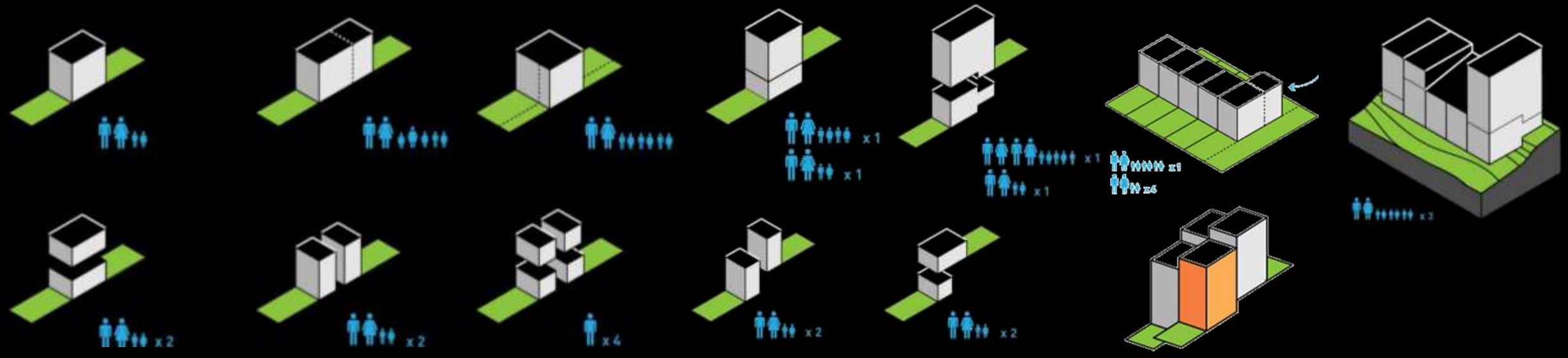
INTRODUCING THE UPGRADING PROCESS

ORGANISING COMMUNITY GATHERINGS

THE BASE UNIT FOR GROUPED URBAN HOUSING BLOCKS





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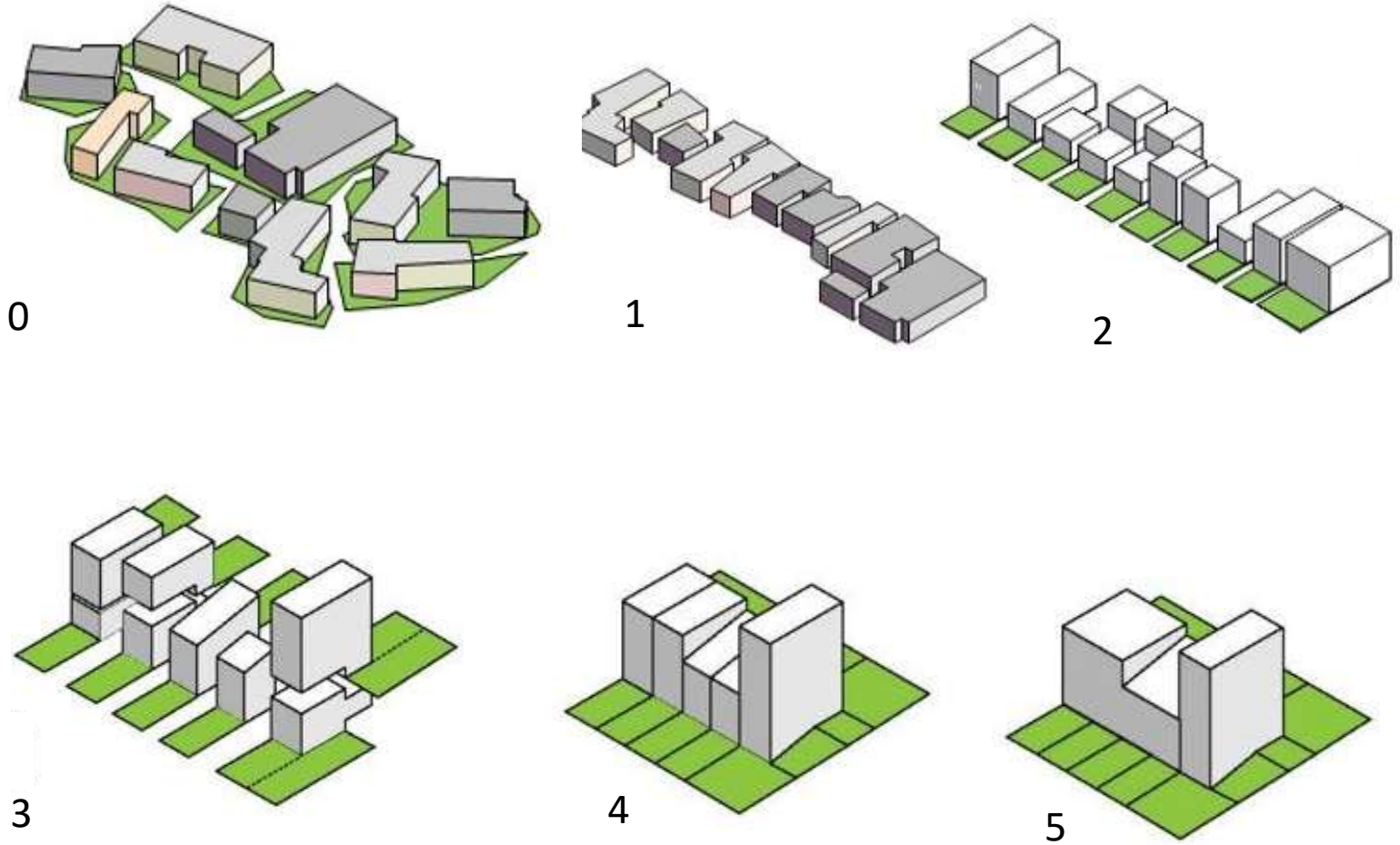
PREPARING MATERIAL FOR PARTICIPATORY DESIGN



DEMONSTRATION AND EXPLAINING …

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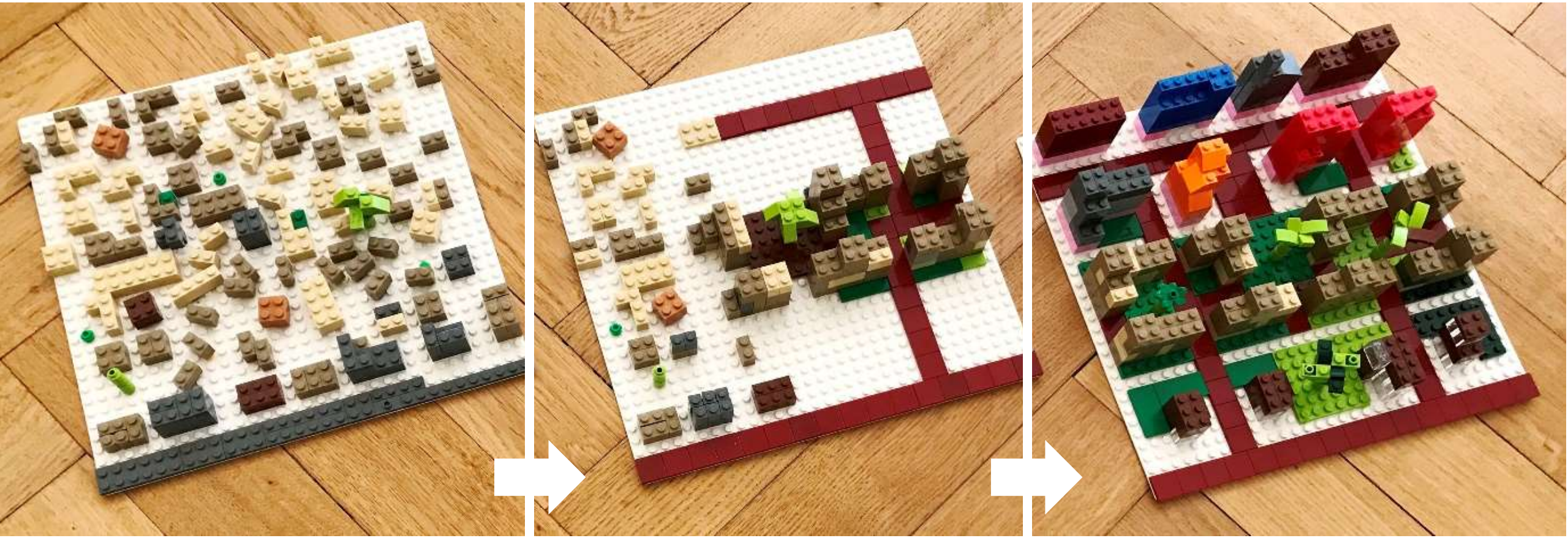
DEMO-BLOCKS AND NEIGBOURHOOD MODELS



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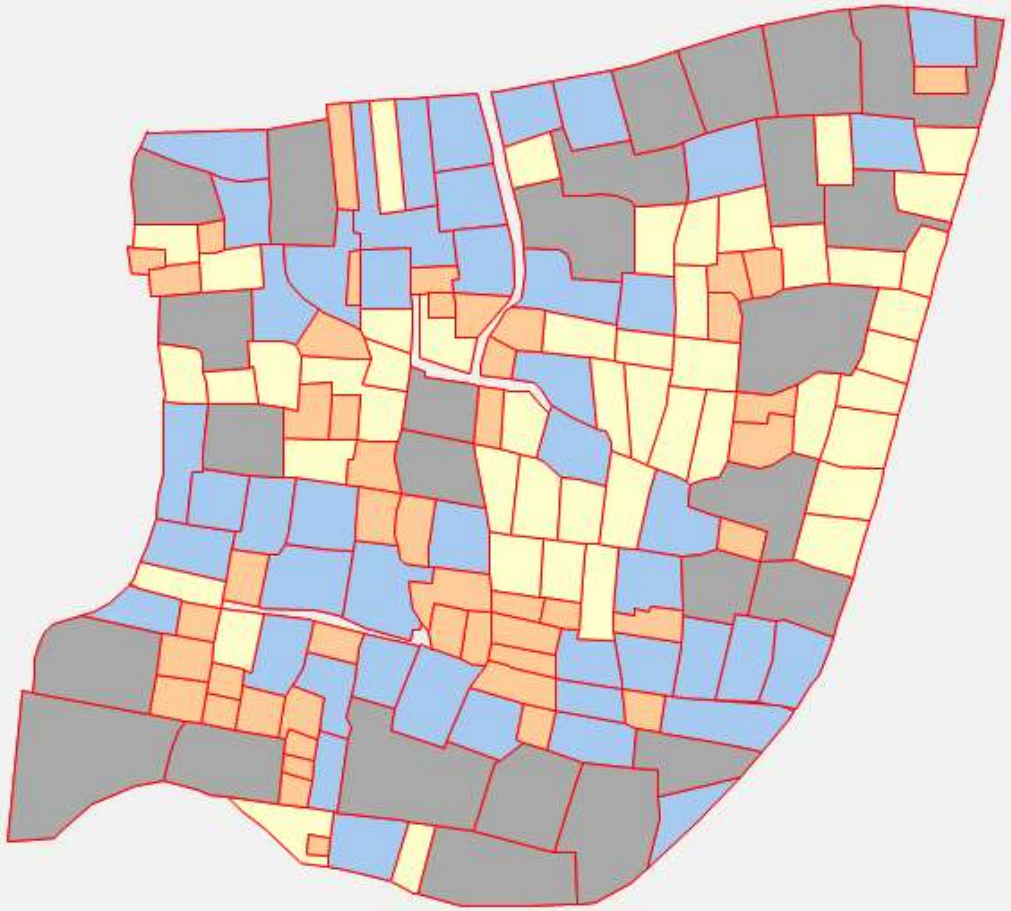
… MECHANICS OF INCLUSIVE DENSIFICATION

THE CURRENT SLUM PATTERN



DENSIFIED AFFORDABLE NEIGHBOURHOOD

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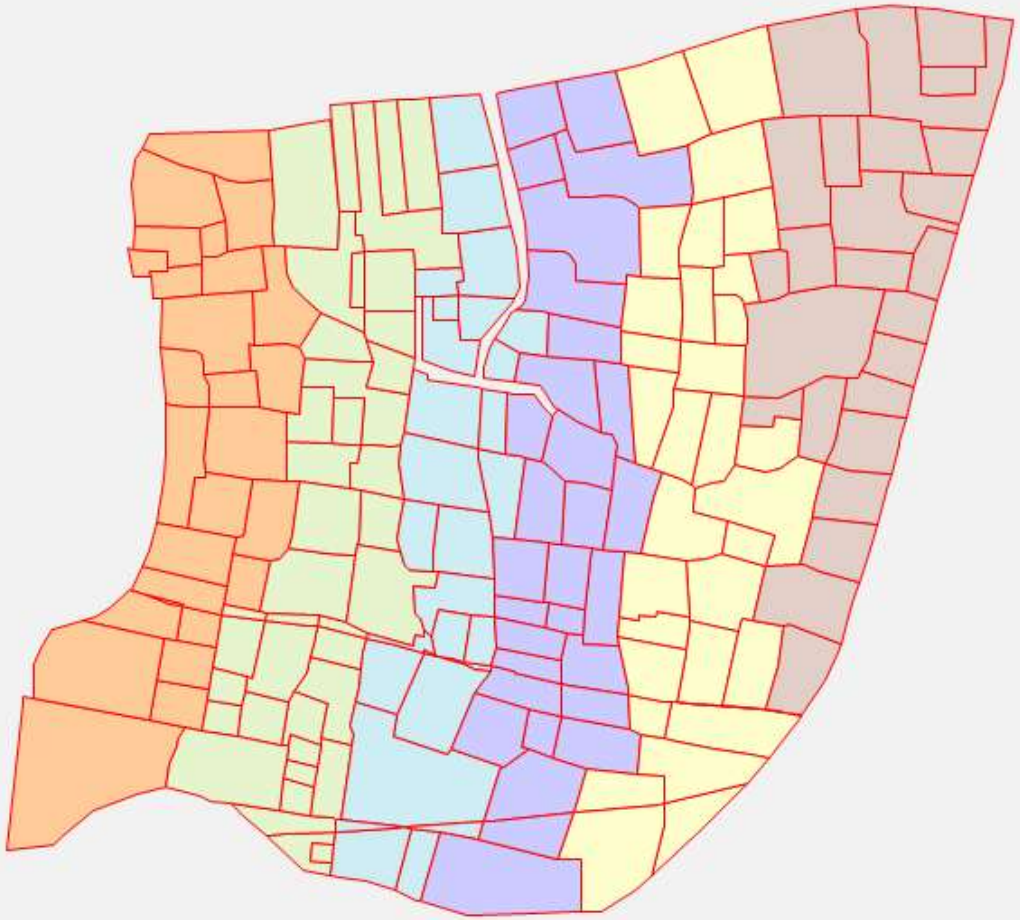
DESIGNING A PLOT REDISTRIBUTING PROCESS

COOPERATIVE OWNED HOUSING BLOCKS

IDEAL NEIGHBOURHOOD SUBDIVISION



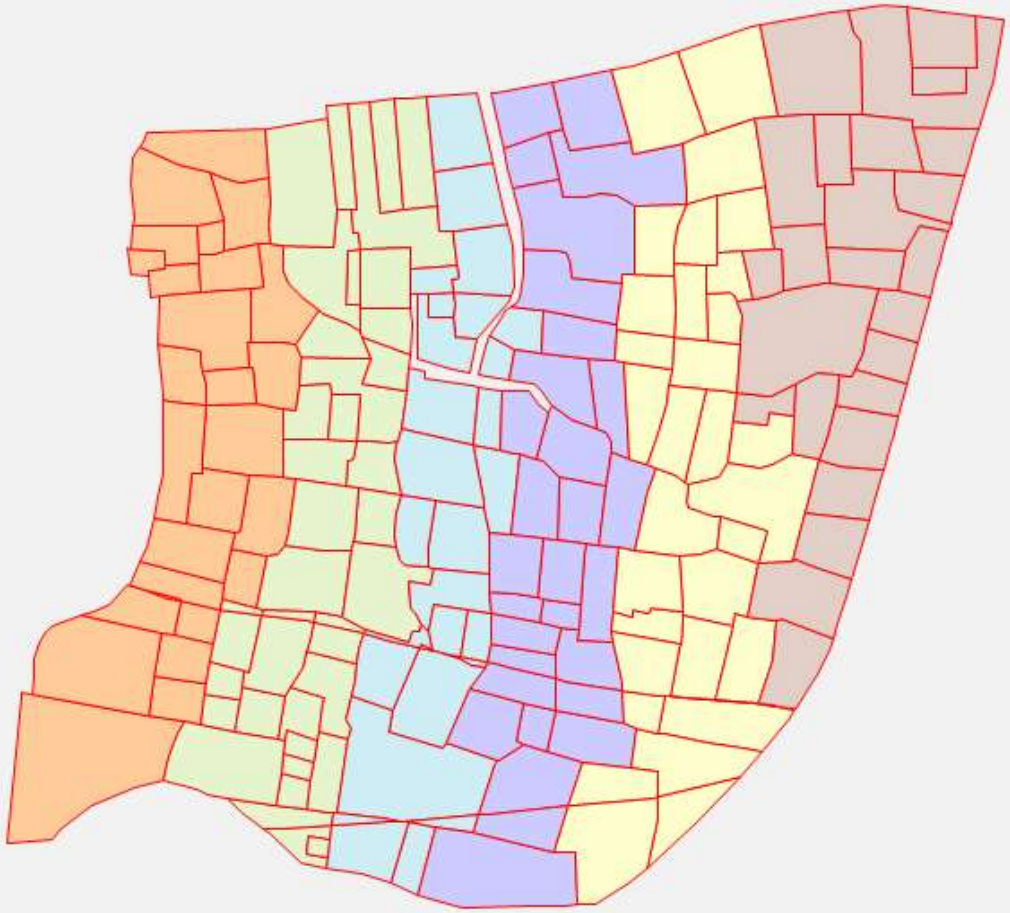
MINIMUM PROJECT SIZE :
2-3 BUILDINGS CREATING A SELF SUSTAINABLE HOUSING BLOCK A MARKETABLE "ADDRESS"

SMALLEST POSSIBLE HOUSING COOPERTIVE :

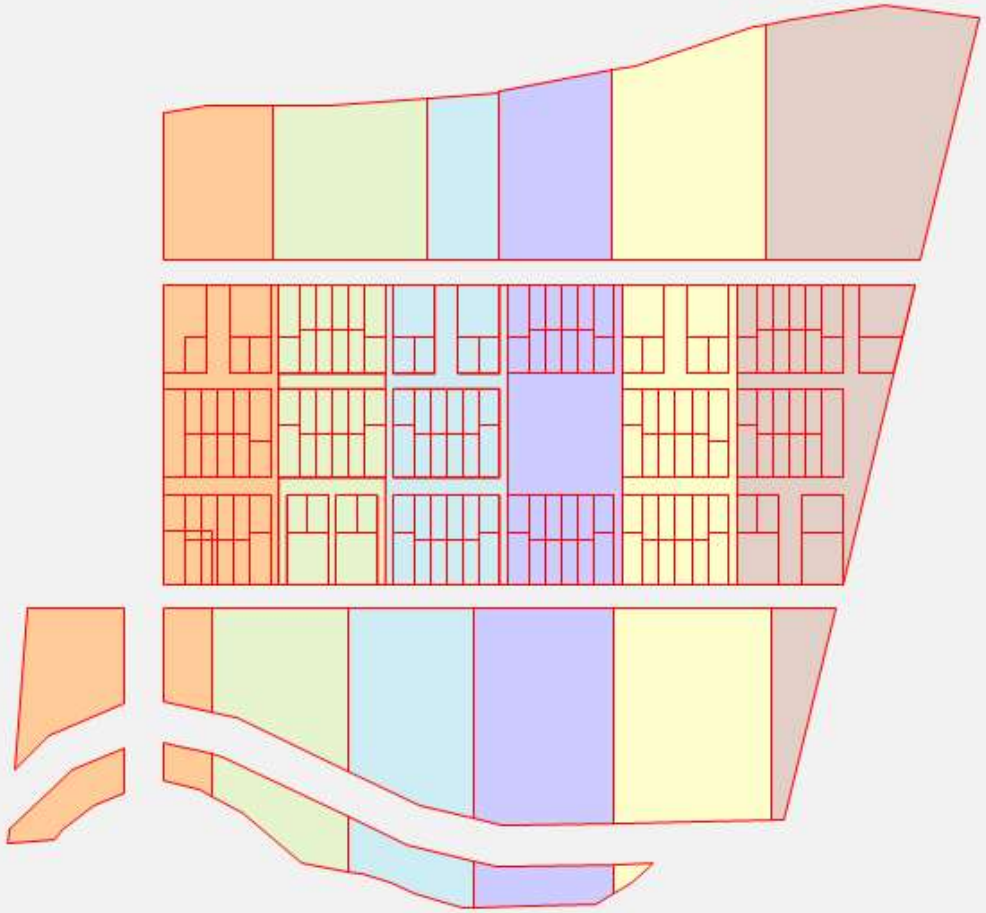
- >70 DWELLINGS (MIN. SIZE FOR WB FUND)
- +/- 30 HOME-OWNERS / PLOT-OWNERS

WHAT IS THE MOST SUITABLE PROJECT SIZE ?

COOPERATIVES BEFORE THE REPLOTTING



COOPERATIVES AFTER REPLOTTING



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REPLOTTING COOPERATIVE BY COOPERATIVE

THE PILOT COOPERATIVES

THE PILOT SLUM UPGRADING PROJECT

DRAFTING A FIRST HOUSING BLOCK PROJECT

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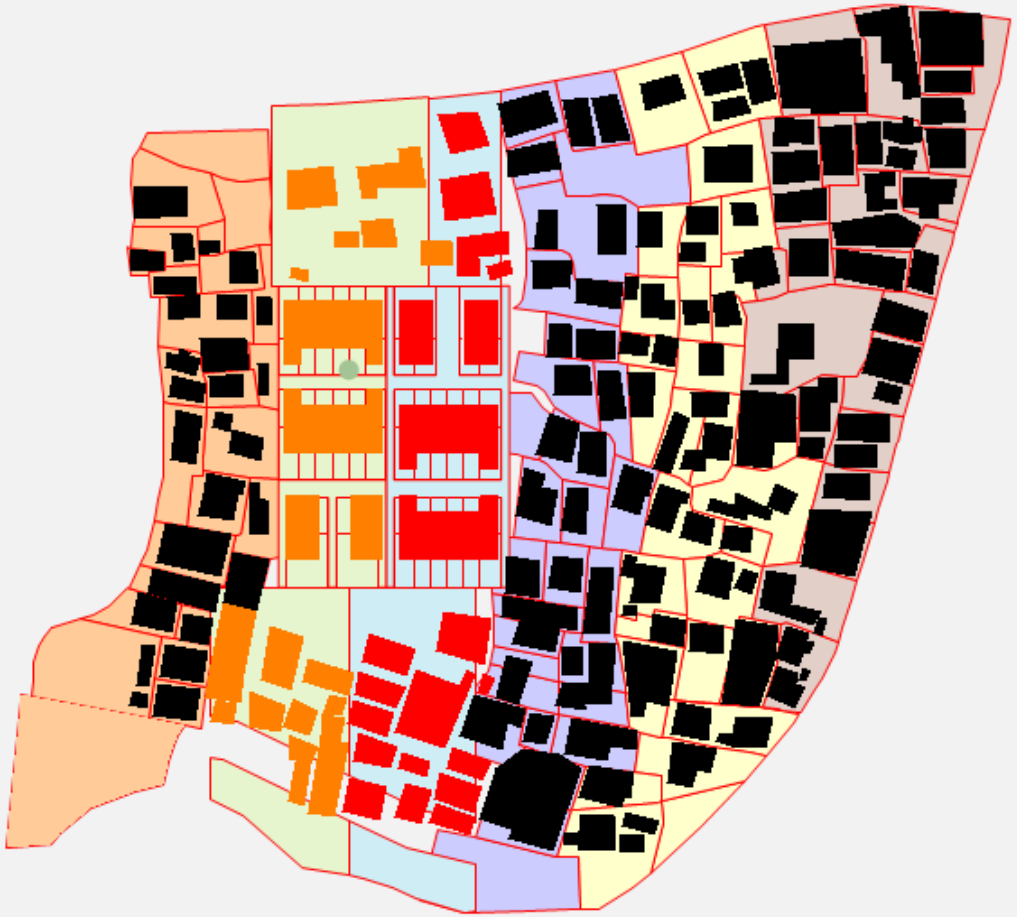
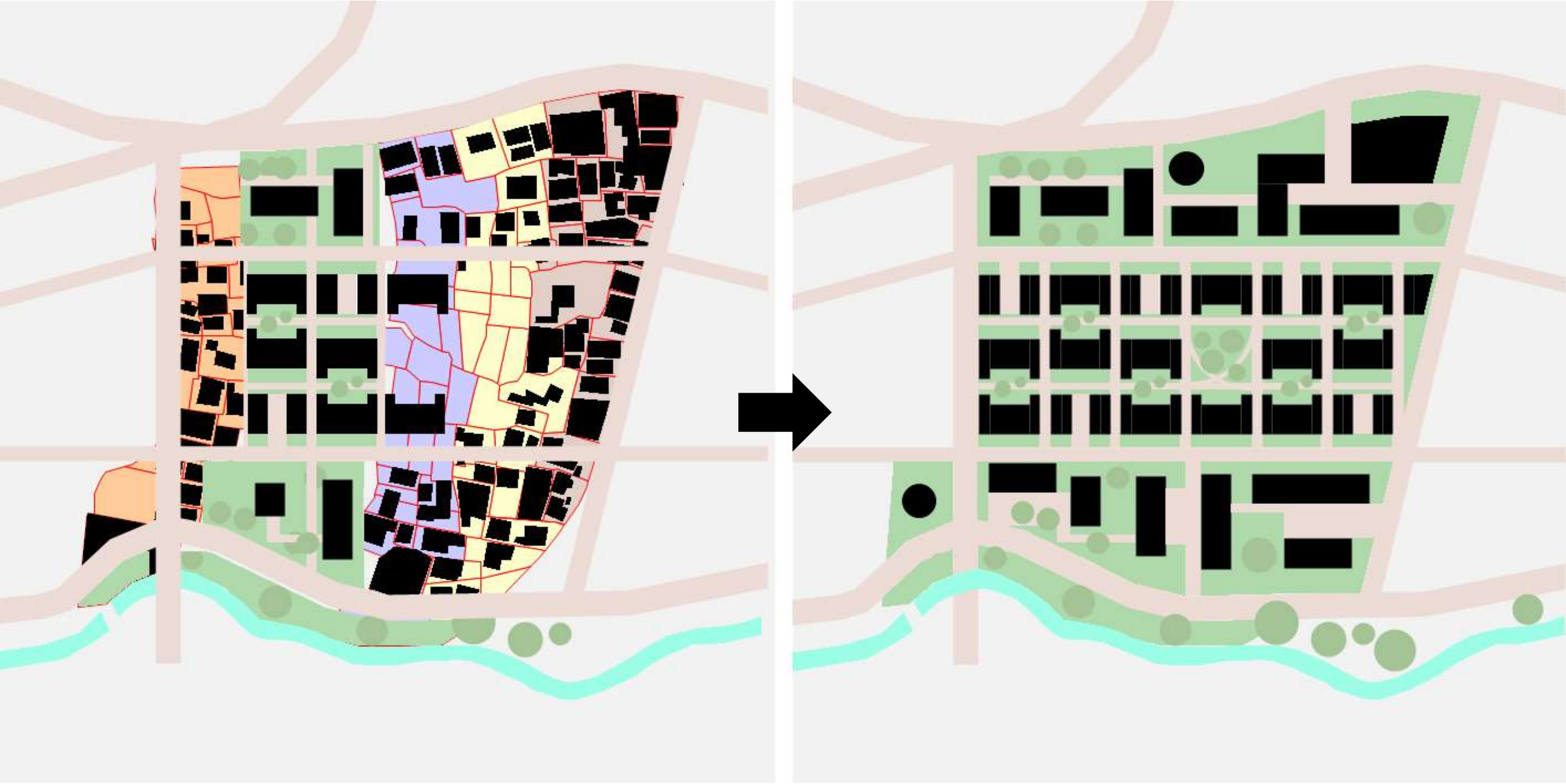


BUILD AND PRESENT THE PILOT PROJECT



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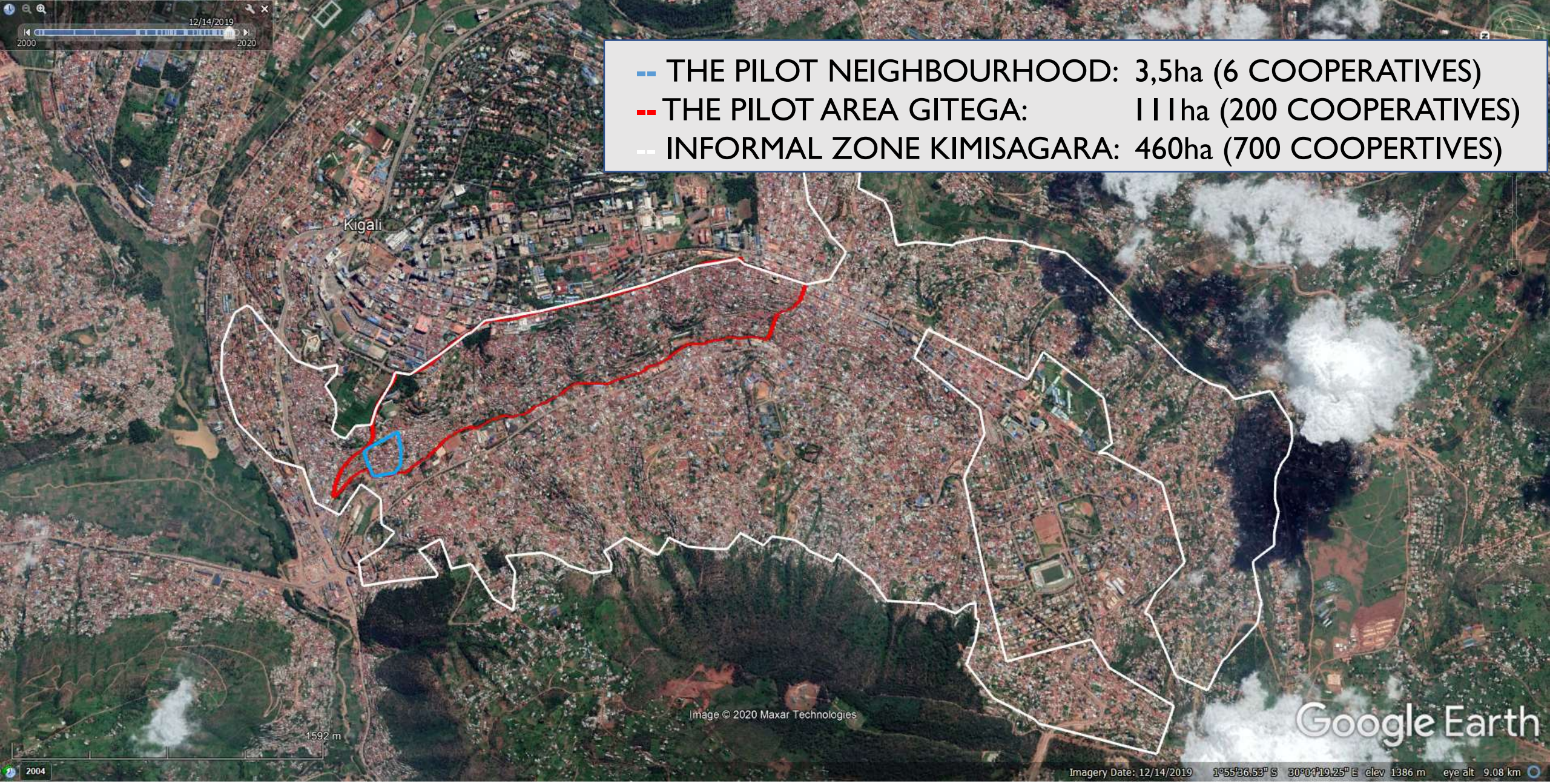
EXTENDING THE TRANSFORMATION PROCESS



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EXPANDING IT AT CITY DISTRICT SCALE

THANK YOU FOR YOUR ATTENTION

10 MINUTES BREAK

GROUP WORK 2

GROUP WORK 2

NEW HOMES FOR AN INFORMAL NEIGHBOURHOOD

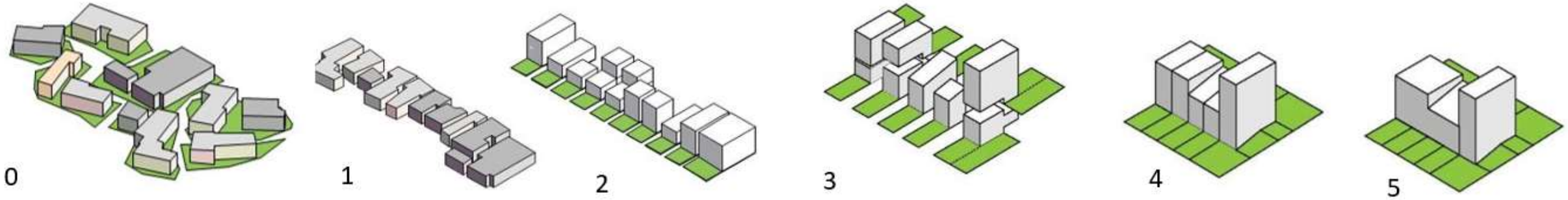
IMAGINE YOU ARE

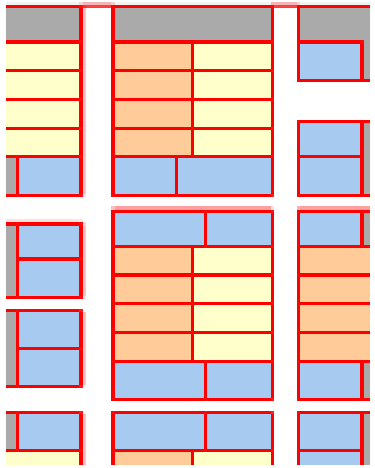
A GROUP OF NEIGHBOURS IN AN INFORMAL SETTLEMENT

- A FAMILY OF 5 WITH A SUB-TENANT RENTING A STUDIO (80M2)
- A FAMILY OF 4 WITH A TAILOR SHOP (TODAY A MUD-HOUSE 65M2)
- A WELL-OFF FAMILY WITH 4 CHILDREN GARDEN AND CAR (120M2, ROAD ACCESS 50M AWAY)
- 2 LOW-INCOME FAMILIES WITH 3 + 2 CHILDREN (TOGETHER 65M2)
- AN OLD COUPLE WITH 2 RENTAL 2-ROOM HOUSES (45M2)

TASK:

DISCUSS ABOUT PROS &CONS AND THE CONDITIONS REQUIRED TO CONVINCE YOU TO JOIN THE HOUSING COOPERATIVE, DEMOLISH YOUR HOUSE AND TO MOVE INTO A JOINT HOUSING BLOCK


0
1
2
3
4
5



…AND NOW? IS THE PROBLEM RESOLVED NOW?

REMEMBER THE QUANTITIES YOU CALCULATED FOR THE MINISTER

THE VOLUME OF THE CHALLENGE BY 2050

- 5.000.000 URBAN DWELLINGS
- 300.000 EMPLOYMENTS LOST TO THE CEMENT INDUSTRY
- 100.000.000 TREES UNNECESSARILY CUT
- 40.000.000 tCO2 UNNECESSARILY EMITTED

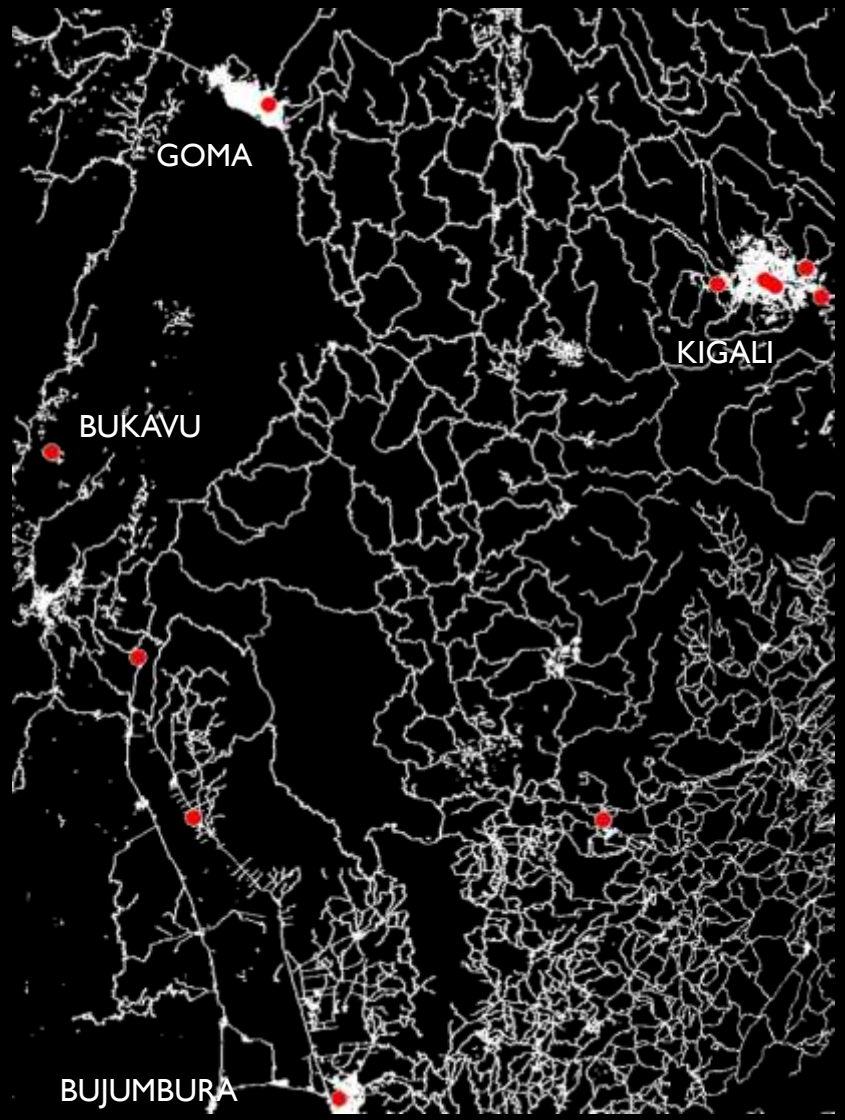
GREAT LAKES CITIES
8 MILLION INHABITANTS

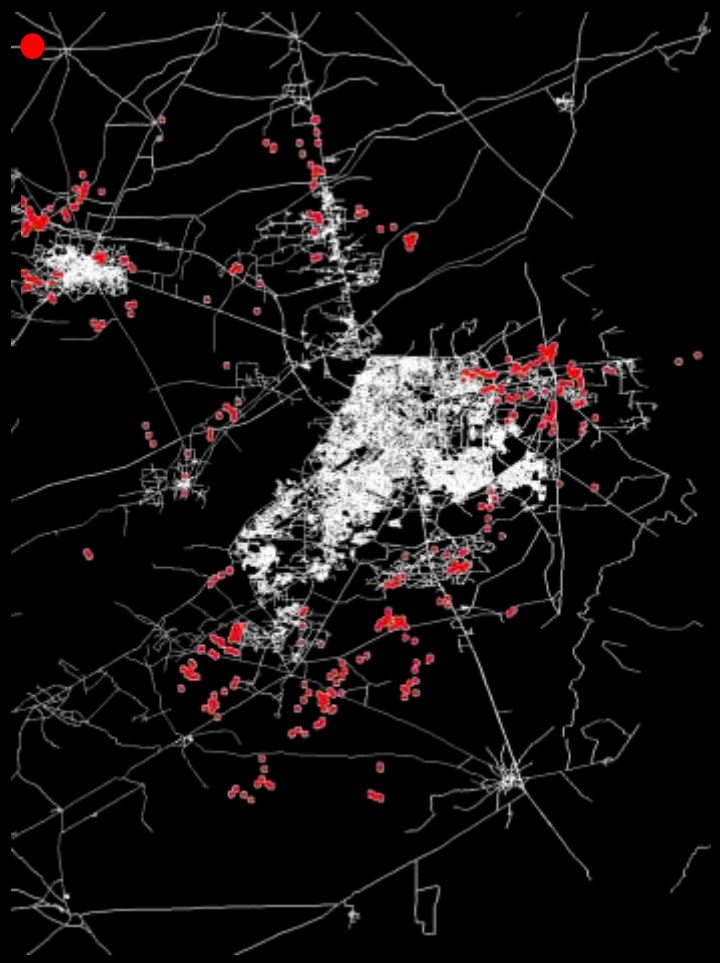
BUILDING MATERIAL FACTORIES

LAHORE
9 MILLION

BRICK FACTORIES IN LAHORE (PAKISTAN) : 500

BUILD. MAT. FACTORIES IN AFRICA'S «GREAT LAKES» : 20





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NO INDUSTRY FUELING URBAN GROWTH

PICTURE: A TYPICAL SOUTH ASIAN BRICK FIELD
EACH KILN PRODUCES BRICKS FOR 2-3 HOUSES PER DAY

SKAT CONSULTING INTENSIVELY WORKED ON THE SUBSTITUTION OF THESE HIGHLY POLLUTING KILNS WITH THE INTRODUCTION OF ENVIRONMENT FRIENDLY TECHNOLOGIES

BRICK FACTORIES IN LAHORE (PAKISTAN) : 500

BUILD. MAT. FACTORIES IN AFRICA'S «GREAT LAKES» : 20

ASIAN INDUSTRY FUELING URBAN GROWTH

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FACTORIES THAT FUELED OUR URBANISATION

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Buitengoed

TODAY'S BRICK FACTORIES

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SUPPLY CHAINS MEETING THE DEMAND

WATER ABSORPTION:
25-30%

COMPRESSIVE STRENGTH:
2-7MPa

ENERGY LOSS : 80% (4-5MJ/KG)

ANNUAL BRICK AND BLOCK DEMAND BY 2050

>4.000.000.000

WOOD CONSUMPTION

2.000.000 t

BRICKS: A FAST GROWING WOOD-CONSUMER

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ENERGY CONSUMPTION : 10-12MJ/BRICK
REQUIRED ENERGY: 2-3MJ /BRICK
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WASTING 75% OF THE FUELWOOD'S ENERGY

ANNUAL BRICK AND BLOCK DEMAND BY 2035

4.000.000.000

WATER ABSORPTION:

25-30%

COMPRESSIVE STRENGTH:

2-7MPa

ENERGY LOSS : 80% (4-5MJ/KG)

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OFFERING POOR WORKING CONDITIONS

TASK 3:

TO TRIGGER HEAVY-DUTY HOUSING SUPPLY CHAINS

OUR SUPPORT:

- LOW-CARBON TECHNOLOGIES FOR LOAD BEARING BRICKS
- MACHINE DESIGNS FOR PRODUCTS REQURING LESS CEMENT
- COACHING BRICK MAKERS

CLIMATE-RESPONSIVE BUILDING MATERIALS

INTRODUCING EFFICIENT BIO-WASTE KILNS

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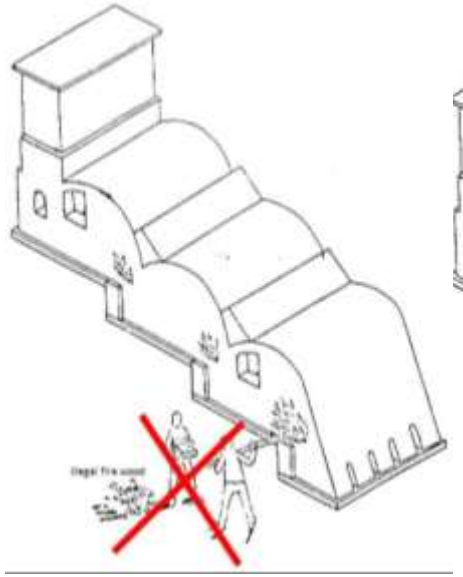
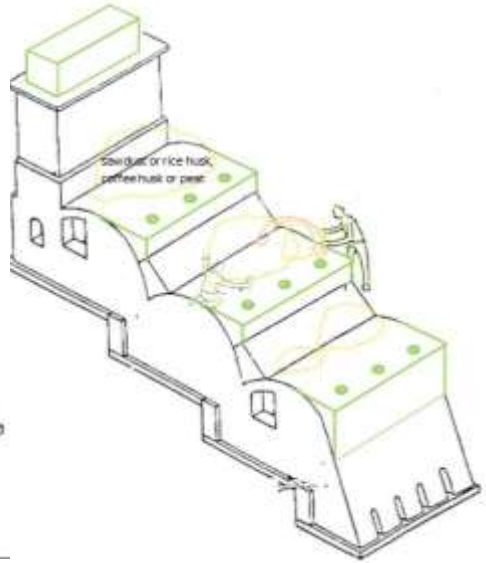
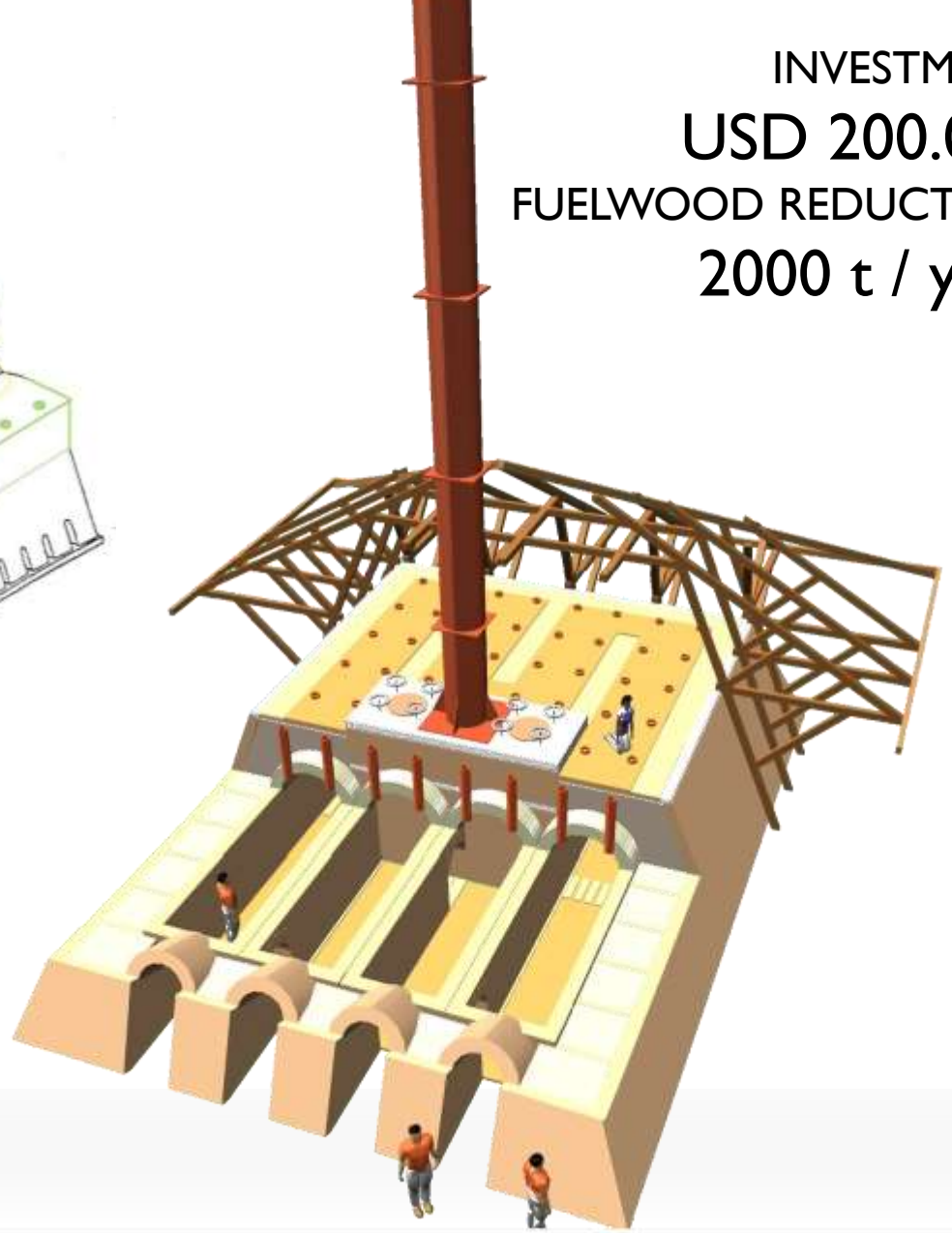
ADVISING ENTREPRENEURS AND AUTHORITIES

INVESTMENT
USD 3-10.000
FUELWOOD REDUCTION
200 t / year

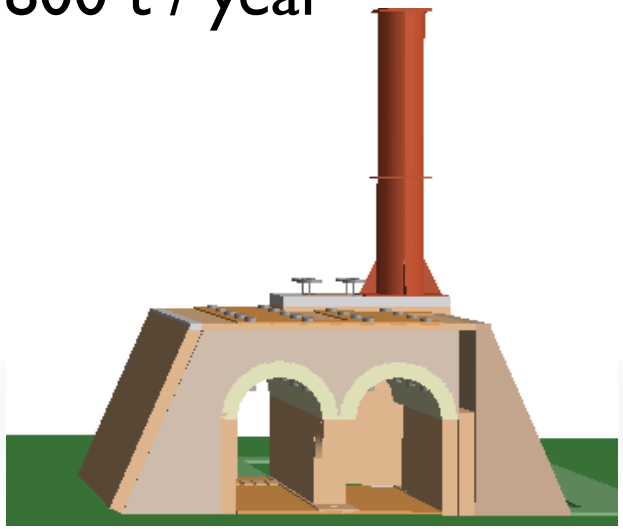


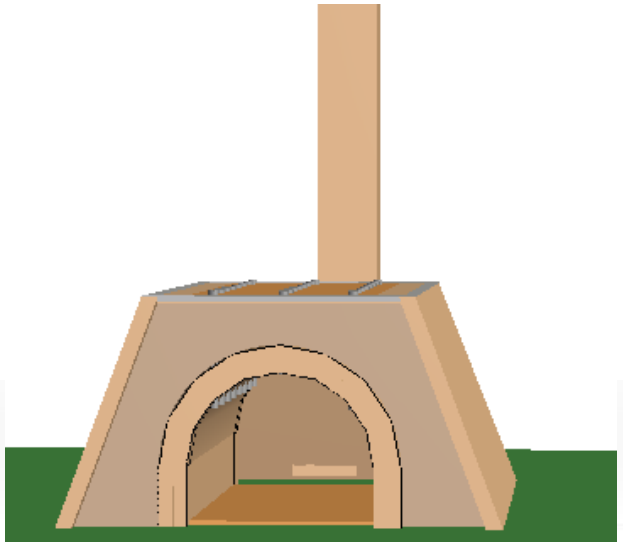


INVESTMENT
USD 200.000
FUELWOOD REDUCTION
2000 t / year



INVESTMENT
USD 50.000
FUELWOOD REDUCTION
800 t / year





ARTISANAL AND INDUSTRIAL SOLUTIONS

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SEMI-MECHANISED BRICK YARD SOLUTIONS

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MANUAL BRICK EXTRUDER

INVESTMENT COSTS USD 2000

= BRICKS FOR 1 HOUSE IN 2 WEEKS

WATER ABSORPTION:

10-15%

COMPRESSIVE STRENGTH:

5-12 MPa

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PERFORATED, LOAD-BEARING, FACING BRICKS

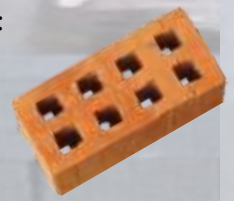
UPGRADING EXISTING BRICKYARDS

3%
MAX MARKET SHARE

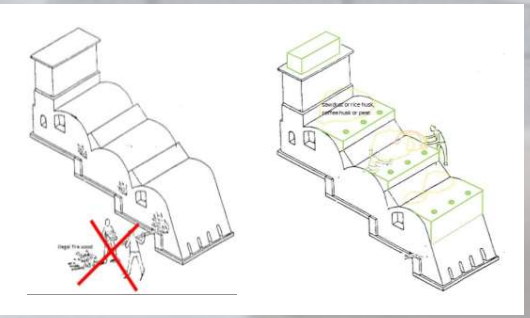
MANUAL BRICK EXTRUDER

INVESTMENT COSTS USD 2000
= BRICKS FOR 1 HOUSE IN 2 WEEKS

WATER ABSORPTION:
10-15%



COMPRESSIVE STRENGTH:
5-12 MPa



UPGRADE OF TILE KILNS

FIRE WOOD BIO >> WASTE FUEL

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WATER ABSORPTION:
10-15%

COMPRESSIVE STRENGTH:
5-12 MPa

FACTORIES BY 2035
+1500

FACILITATING INDUSTRIAL INVESTMENTS

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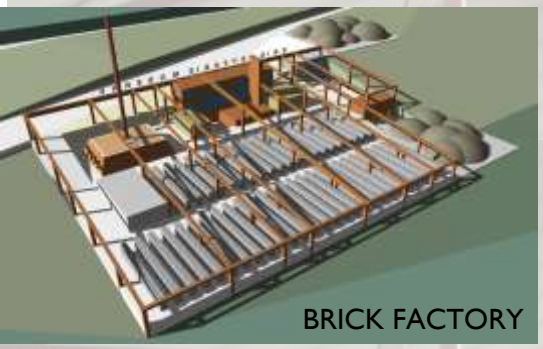

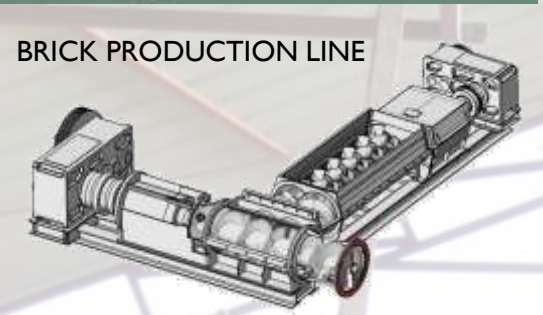

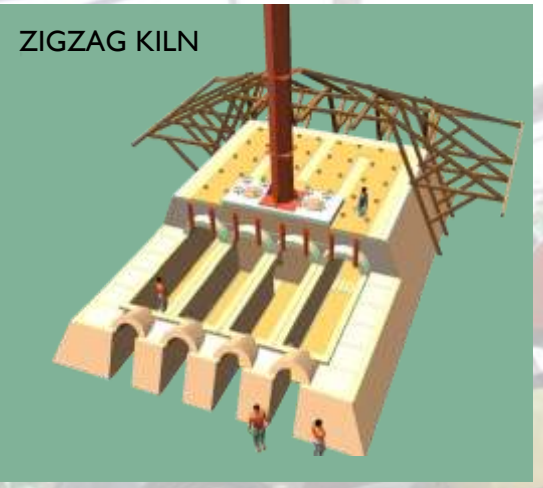

FACTORIES PER YEAR

+30

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JUMP-START FACTORY CONSTRUCTION FIRMS

STIMULATING 2000 COPYCAT DWELLINGS IN 2 YEARS

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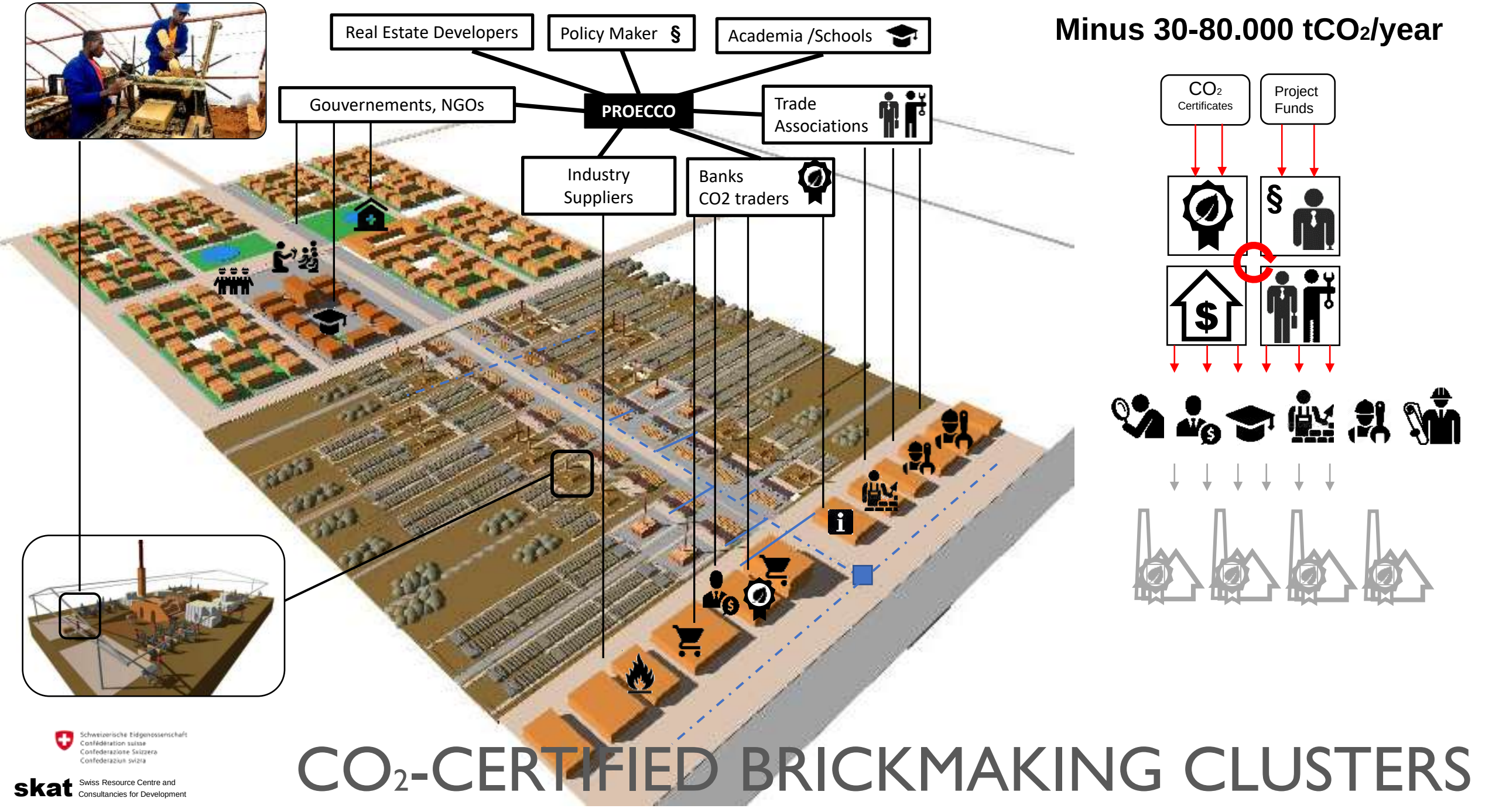

CO_2-CERTIFIED BRICKMAKING CLUSTERS

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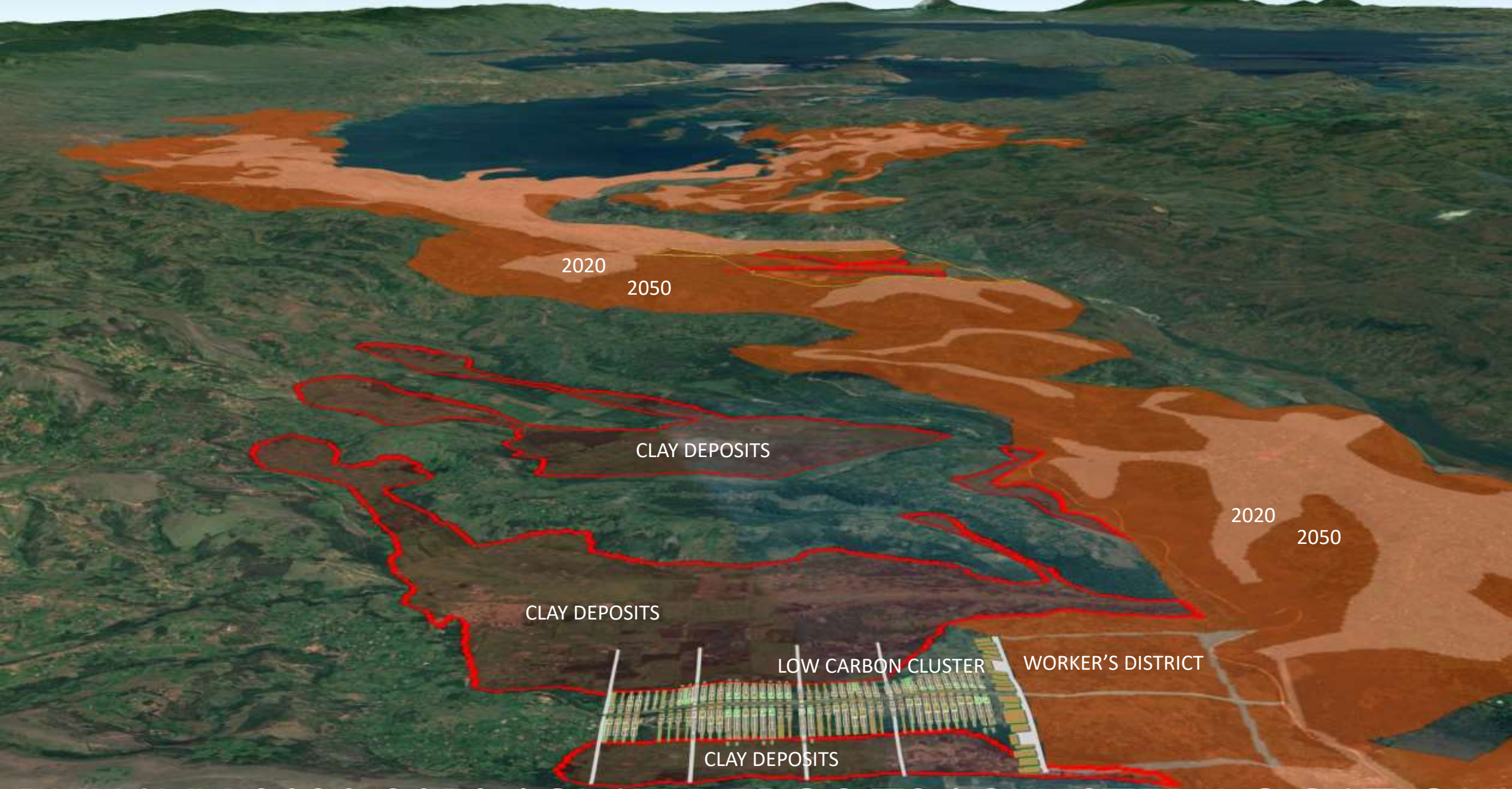
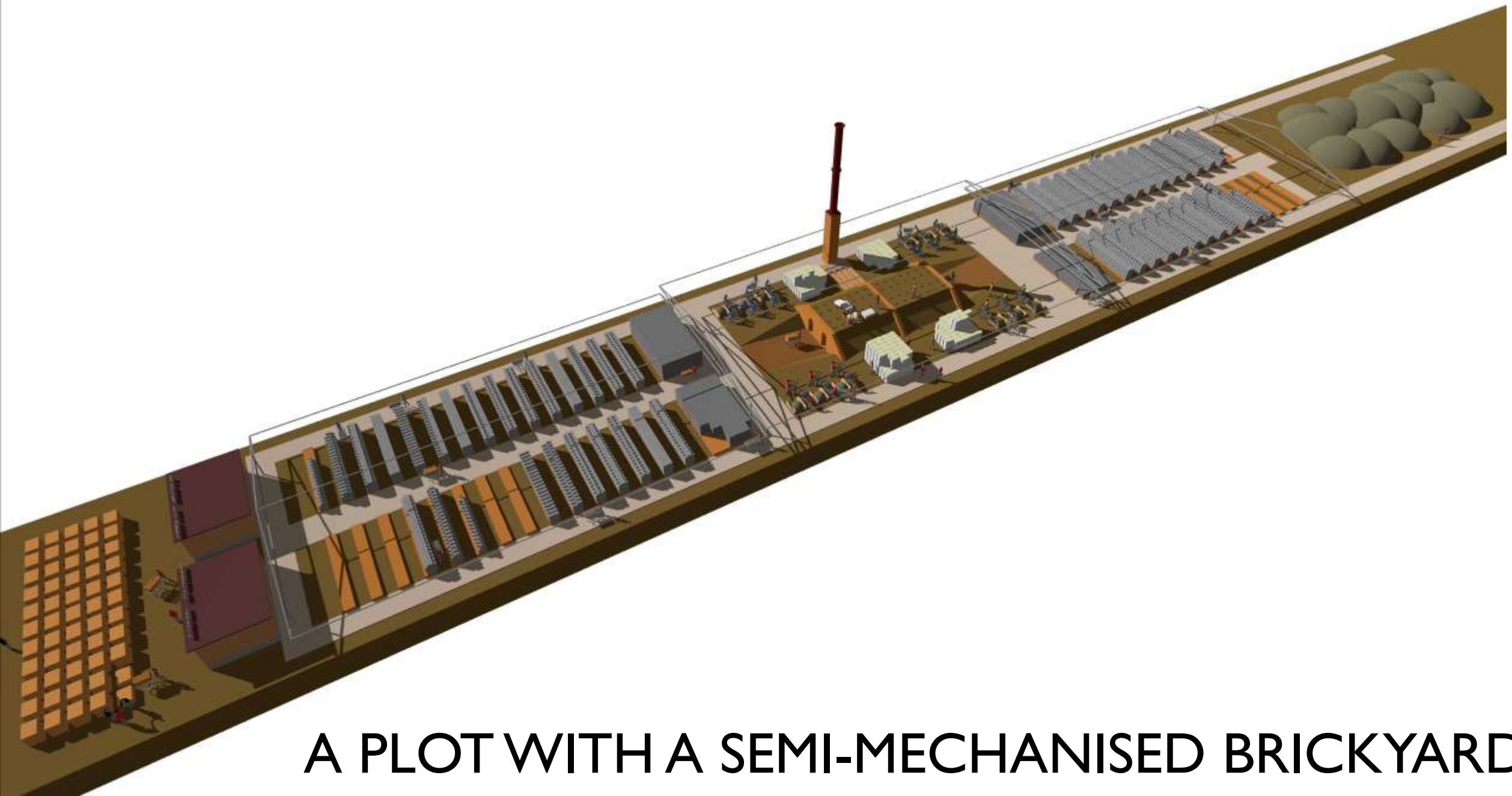


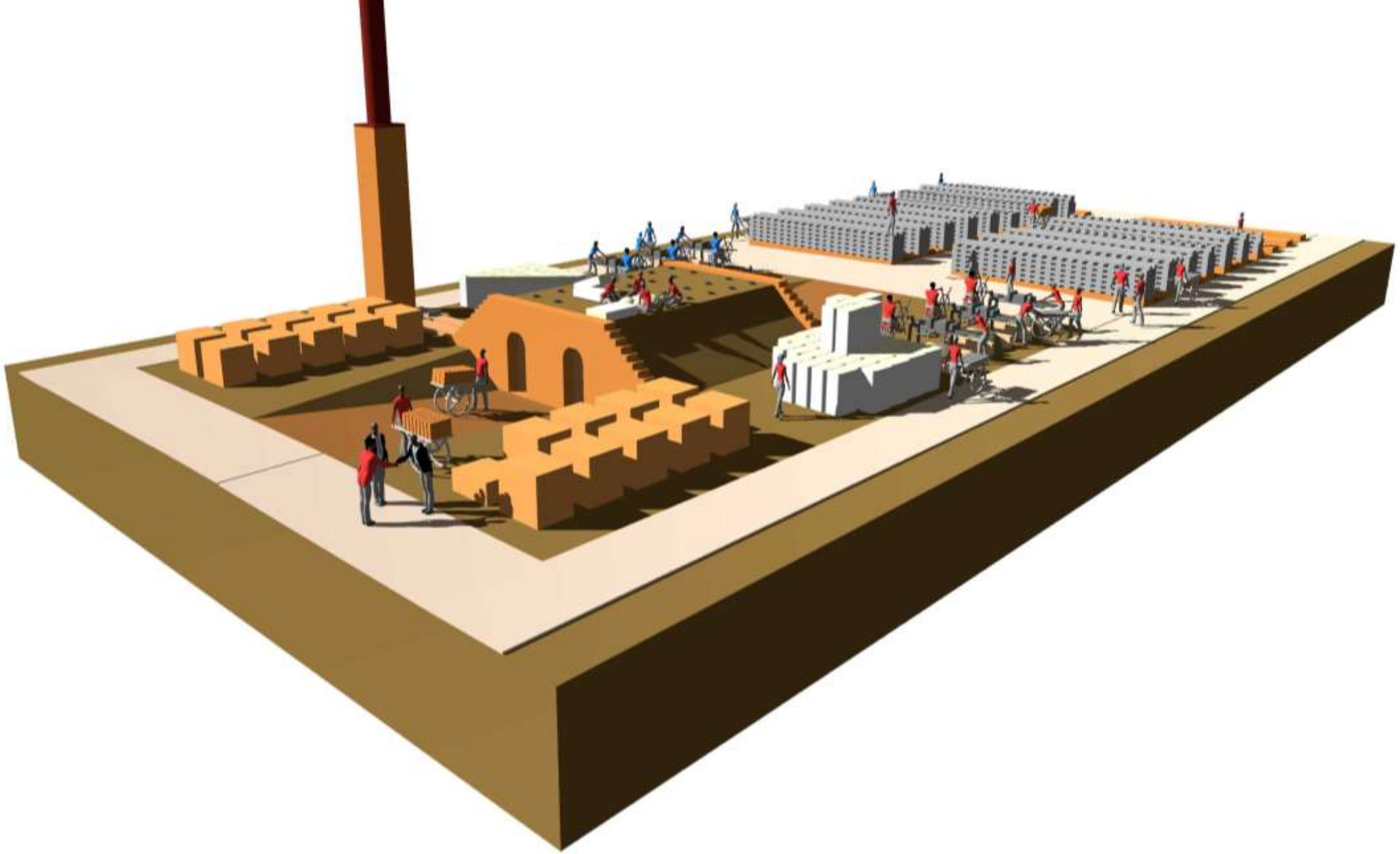
BUKAVU 2020-2050 / CLAY DEPOSITS / CLUSTER LOCATION

A LOW-CARBON CLUSTER INCL. THE WORKERS' DISTRICT

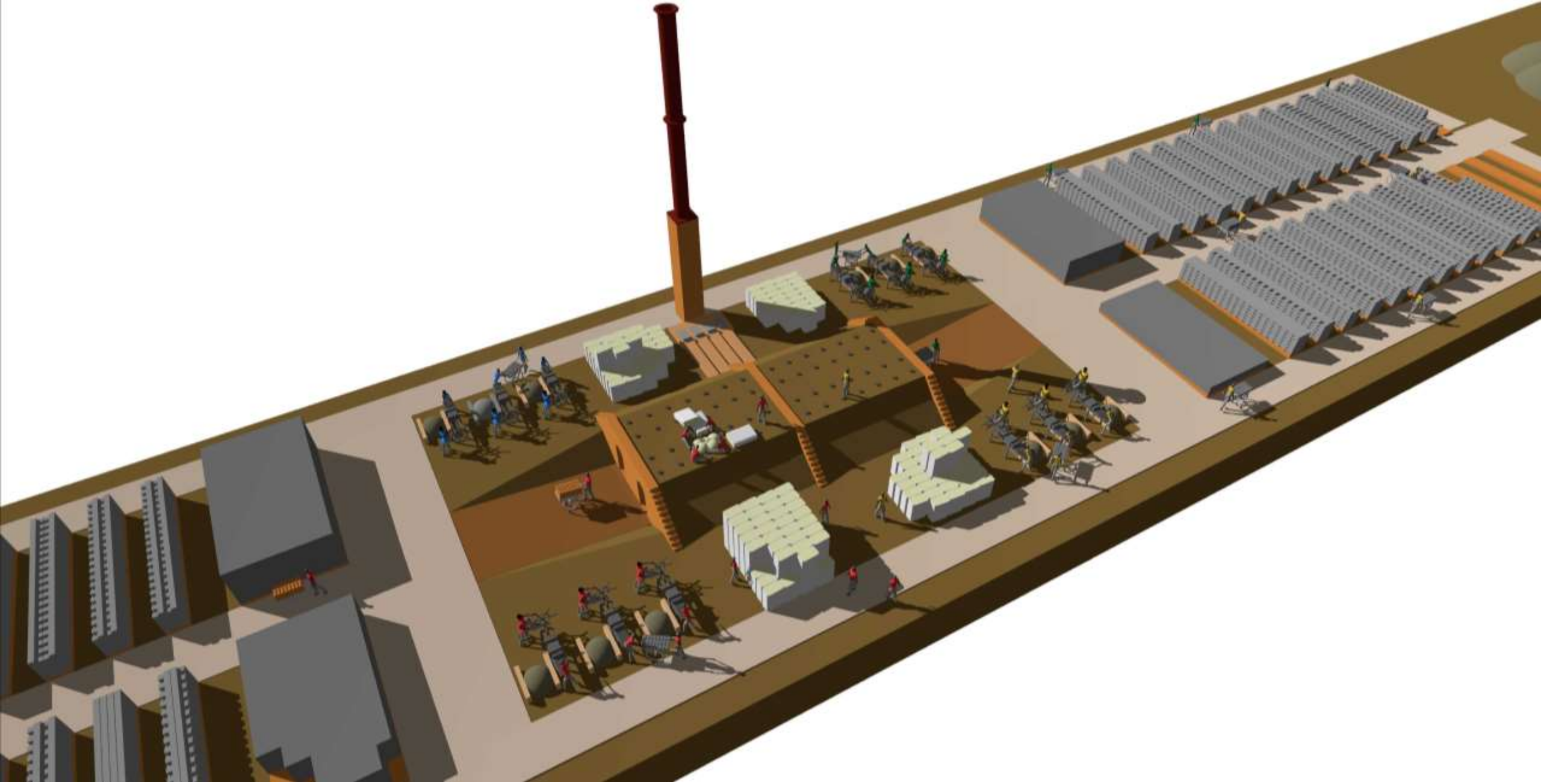
BUKAVU 2020-2050 / CLAY DEPOSITS / CLUSTER LOCATION



A PLOT WITH A SEMI-MECHANISED BRICKYARD



2 TEAMS ESTABLISH A FIRST SMALL ARTISANAL BRICKYARD



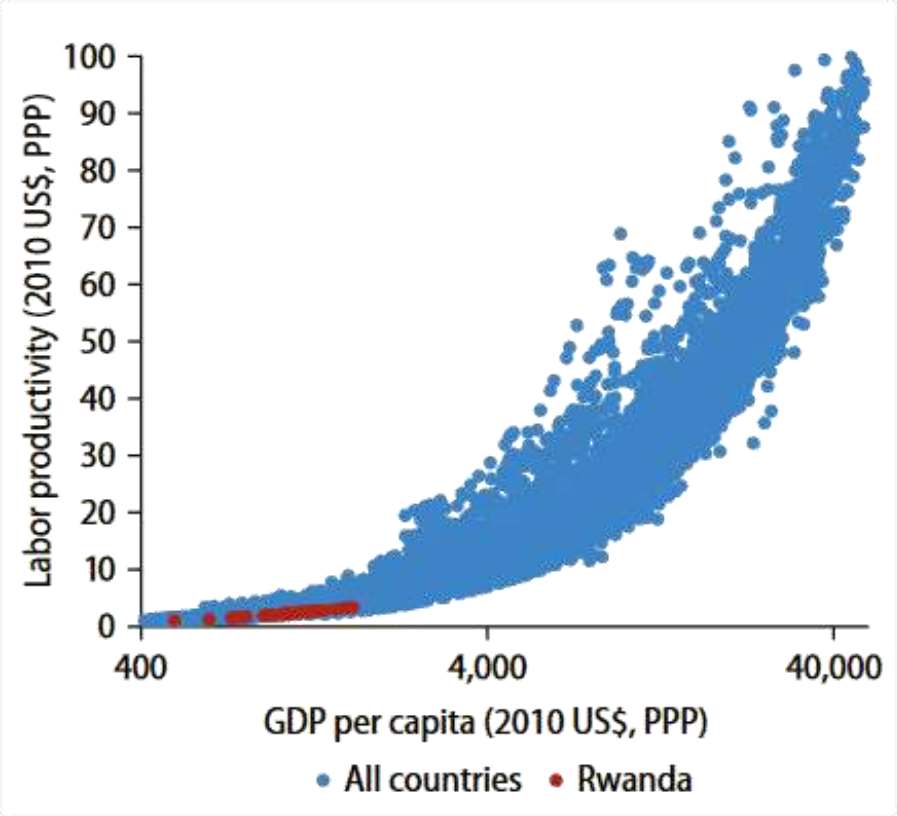
FOUR TEAMS SHARE A SEMI-MECHANISED BRICK KILN

2 TEAMS ESTABLISH A FIRST SMALL ARTISANAL BRICKYARD

THE CLUSTER GROWS FOR 20 YEAR BEFORE RENATURATION

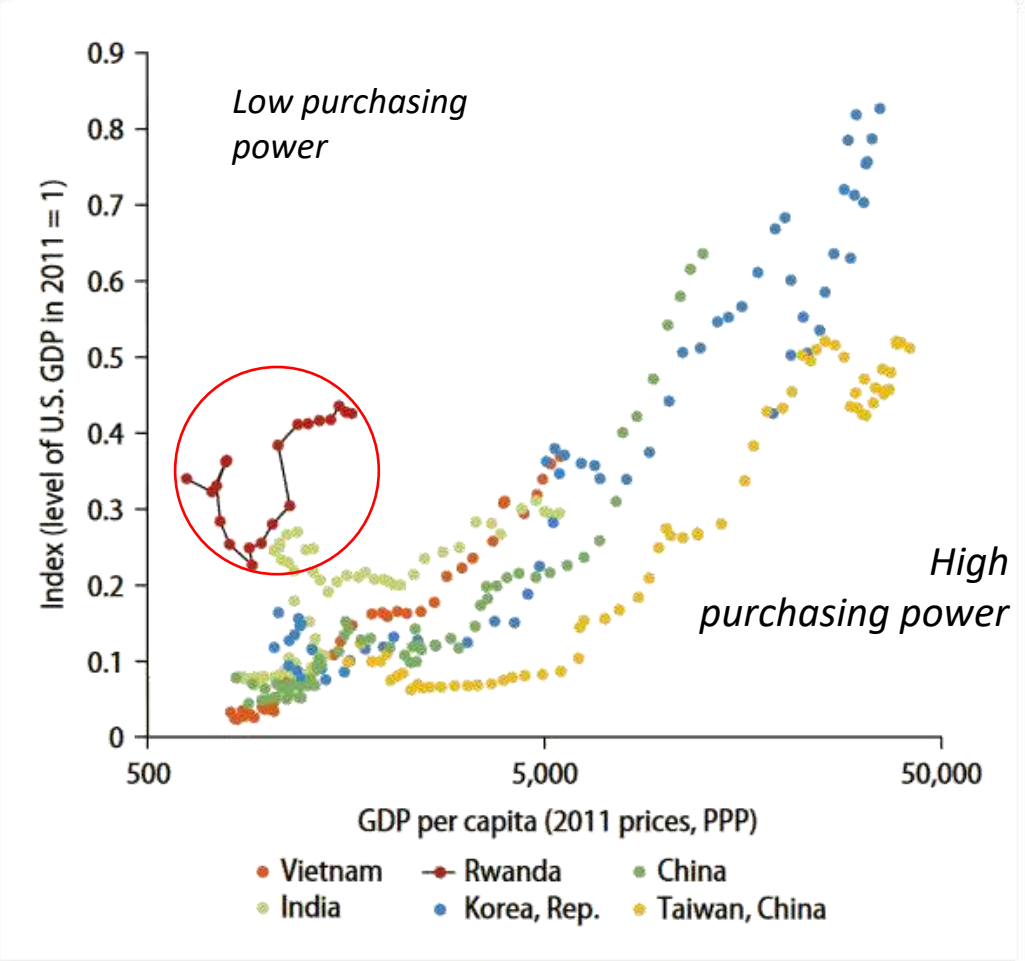
THANK YOU FOR YOUR ATTENTION

FIGURE O.7 Labor productivity and GDP per capita in Rwanda and other countries



Source: Calculations based on Penn World Tables 9.0 data (Feenstra, Inklaar, and Timmer 2015).
Note: PPP = purchasing power parity.

FIGURE O.10 Price levels and GDP per capita in Rwanda and comparator countries and economies, 2011

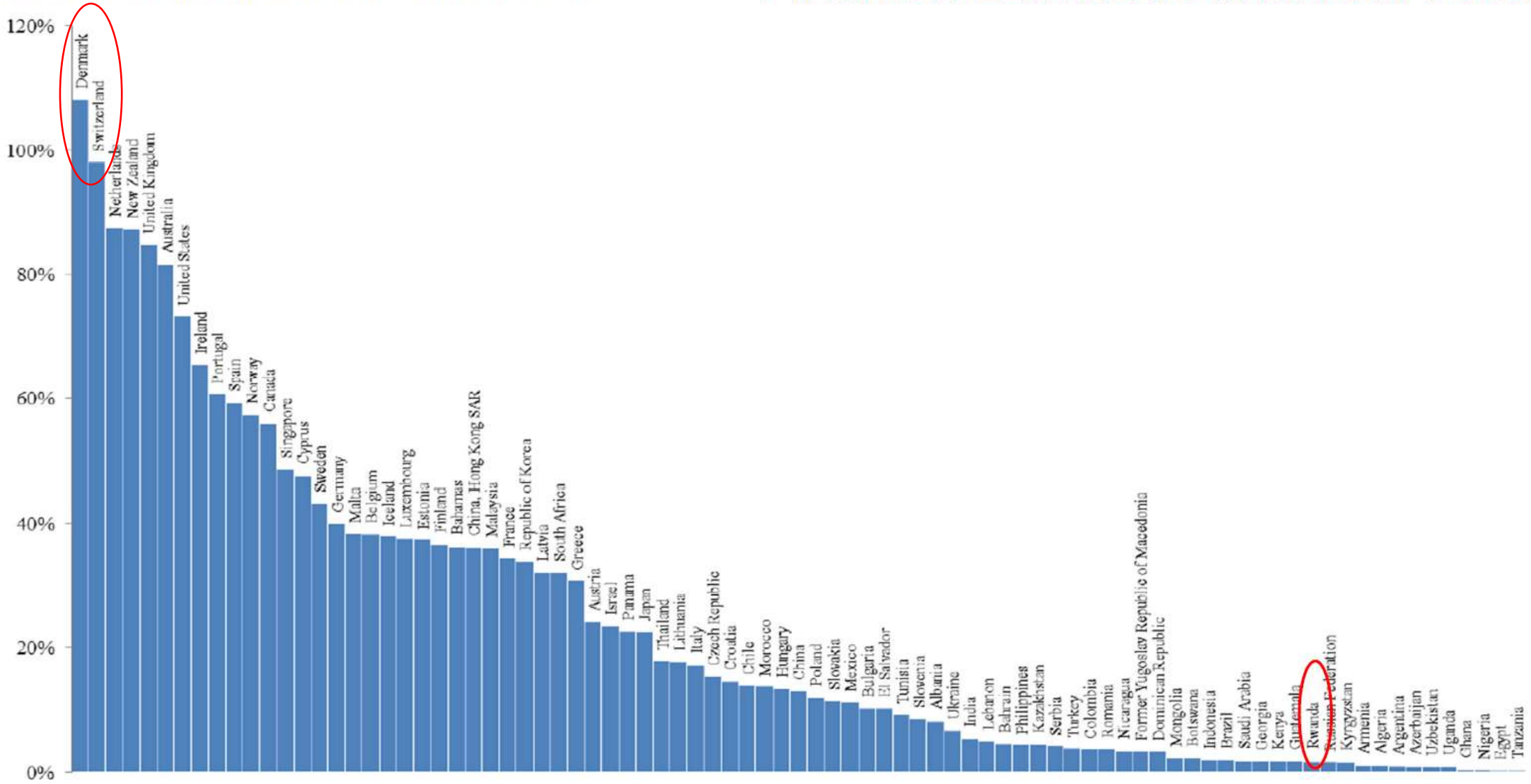


Source: Calculations based on Penn World Tables 9.0 data (Feenstra, Inklaar, and Timmer 2015).
Note: PPP = purchasing power parity.

LABOUR PRODUCTIVITY & PRICE LEVEL

Finance: Domestic financial sector

Figure 1: Mortgage Depth across Countries (2006-2010)



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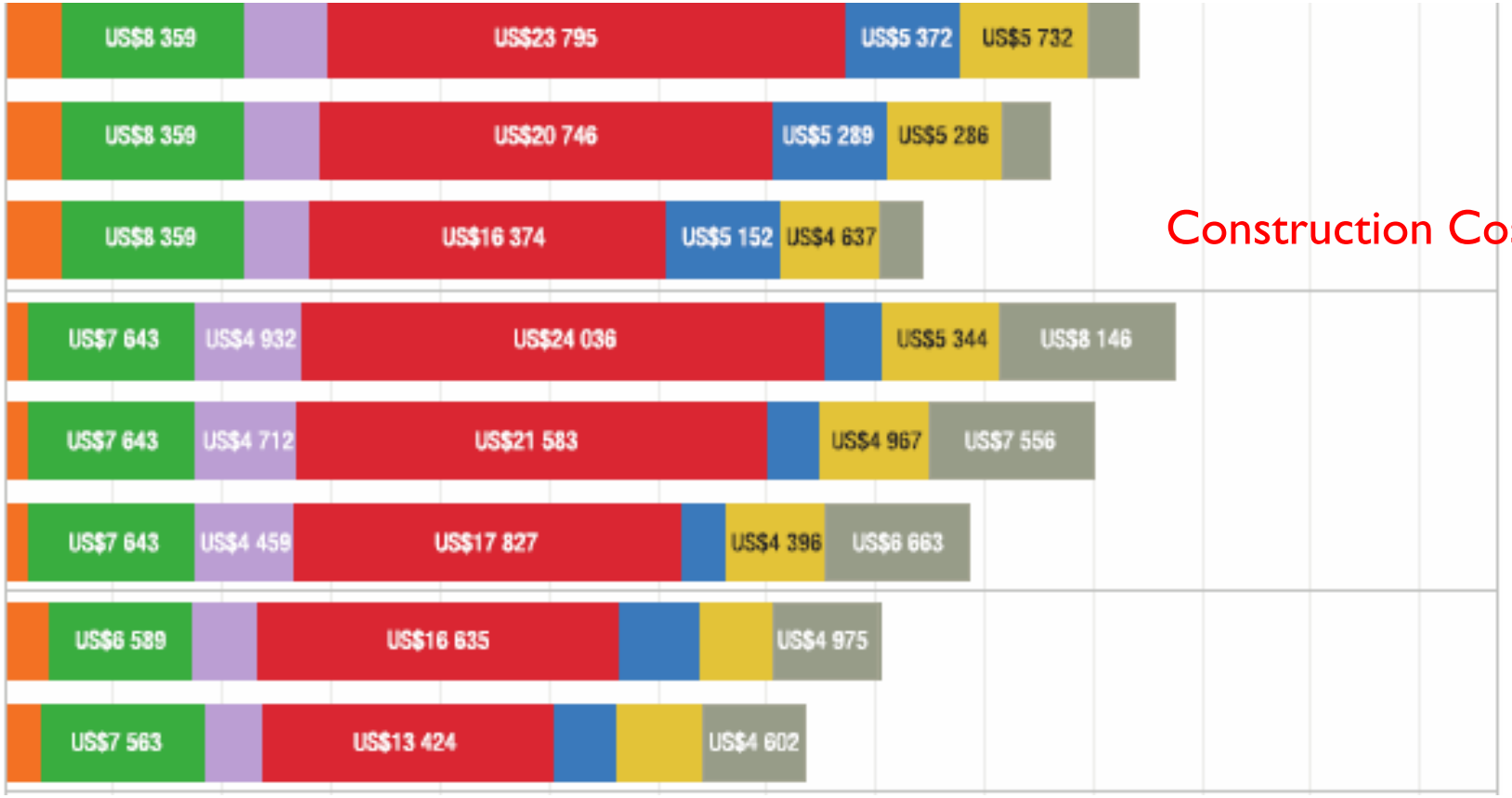
ACCESS TO AFFORDABLE HOUSING FINANCE



Construction Costs + VAT

$500/M2

$540/M2

$585/M2

A. Land costs
B. Infrastructure costs
C. Compliance costs
D. Construction costs
E. Other Development costs
F. Developer overhead
G. Value Added / Sales Tax

This graph includes the pricing of a 55m2 CAHF house for each of the cities studied. This is a standardised house that we use for benchmarking, based on our original study which surveyed 15 countries. For more details on this house, please visit http://housingfinanceafrica.org/documents/benchmarking-housing-construction-costs-africa/

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PRICING OF HOUSING IN 3 AFRICAN COUNTRIES

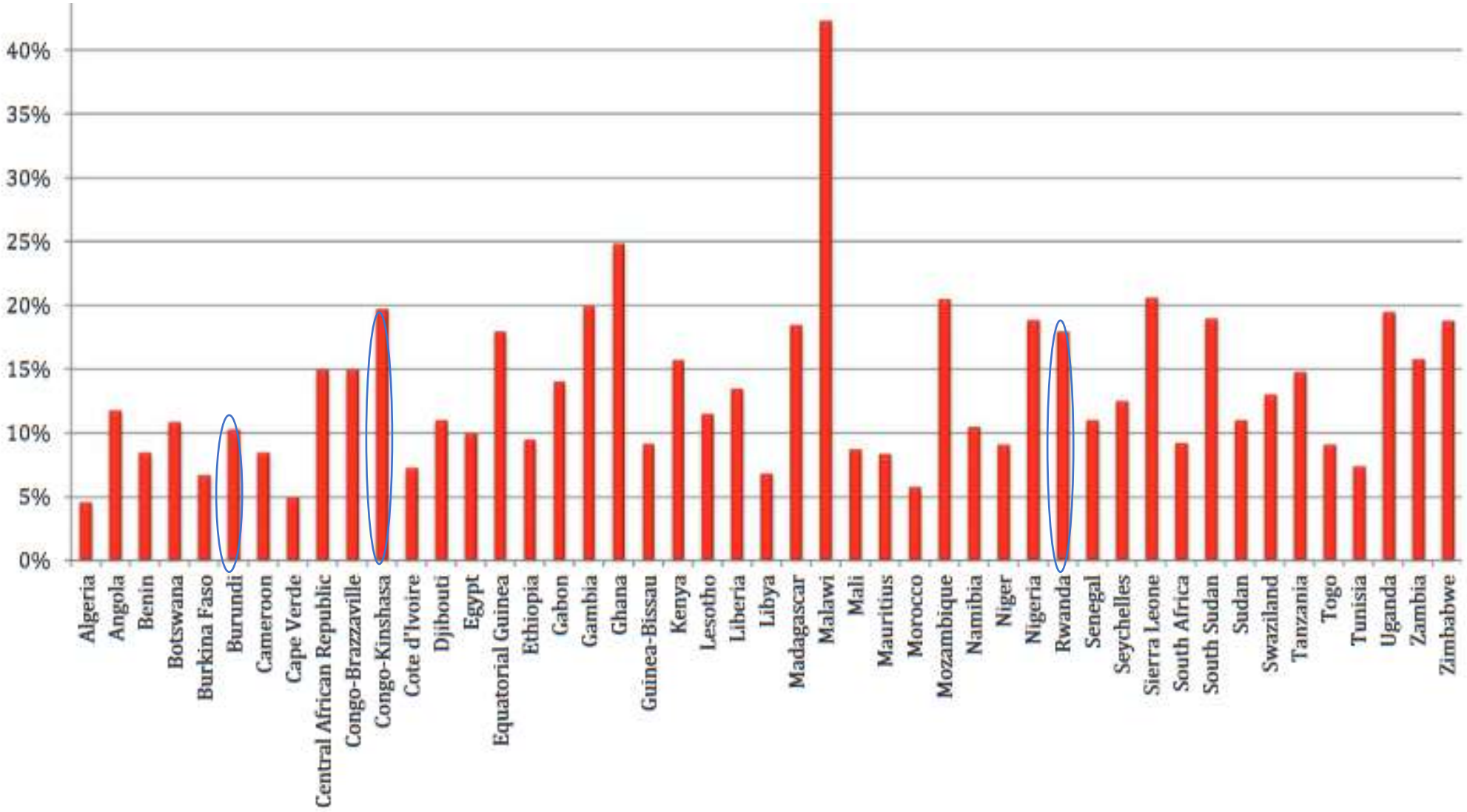

Fig. 1.4 Average mortgage interest rates in selected countries (%) (Sources: Author's analysis, BCEAO, CAHF, Numbeo)

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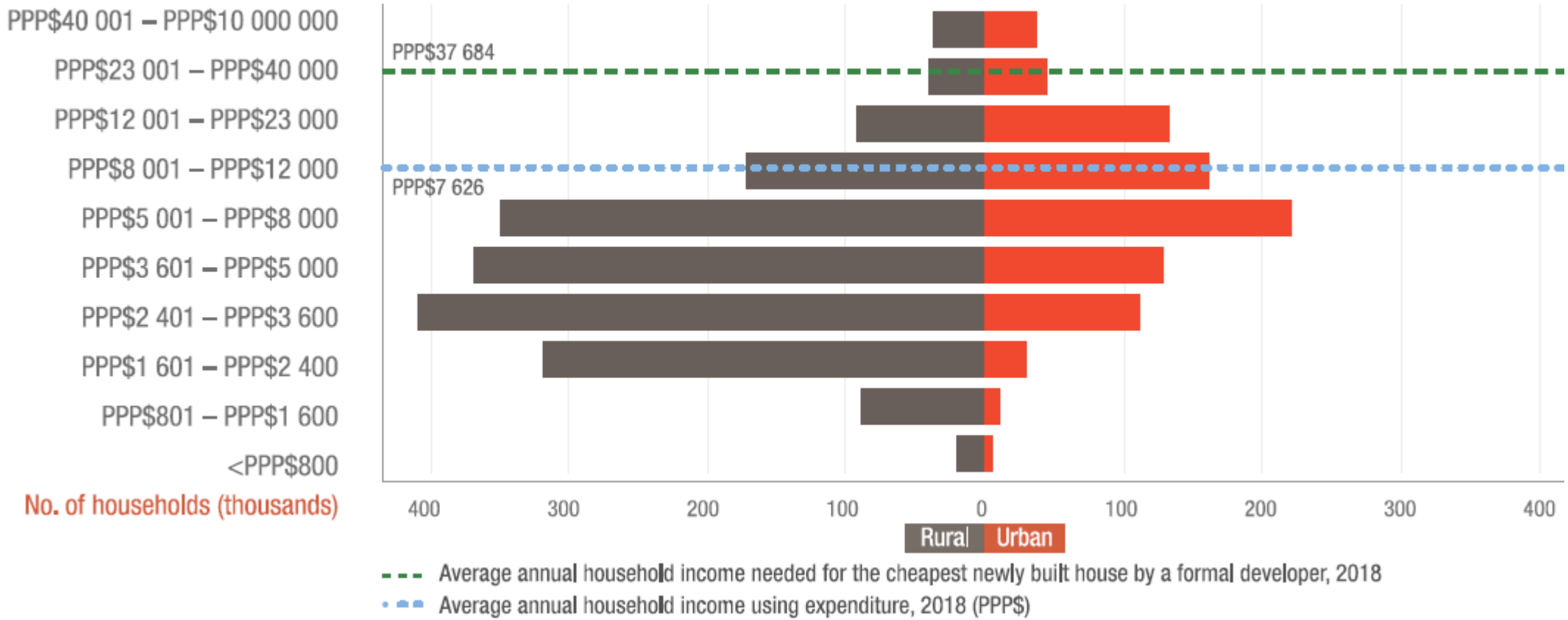
MORTGAGE INTEREST RATES IN THE GREAT LAKES

RWANDA

Rwandan franc

Annual income profile for rural and urban households based on consumption (PPP$)



Average annual household income needed for the cheapest newly built house by a formal developer, 2018

Average annual household income using expenditure, 2018 (PPP$)