KENYA PROPERTY DEVELOPERS ASSOCIATION

KPDA CEO BREAKFAST FORUM, TUESDAY 28TH AUGUST 2018 AT THE VILLA ROSA KEMPINSKI HOTEL, WESTLANDS - NAIROBI

THEME: *'ALTERNATIVE BUILDING TECHNOLOGIES FOR ENHANCING RETURNS ON INVESTMENT IN THE BUILT SECTOR'*

PROUDLY SPONSORED BY:

C-MAX ADVANCED BUILDING SYSTEM & QUESTWORKS

PROGRAM

MASTER OF CEREMONY: RAVI KOHLI

7.15am - 7.45am	Arrival and Registration
7.50am - 8.00am	Welcome and introductions **MC, KPDA**
8.05am - 8.25am	*'Opportunities and Challenges faced in Implementing ABTs'* Presentation by **Mburu Karanja, Managing Director - Cemex Holdings Ltd**
8.25am - 8.40am	*'Applications for Post Tensioned Concrete'* Presentation by **Raúl Figueroa, CEO - Questworks**
8.40am - 8.50am	*'Addressing Contractual Challenges in Applying ABTs'* Presentation by **Qs. Alex Magembe, Partner - Costek Alma**
8.50am - 9.10am	*'Site Planning for Affordable Housing Communities'* Presentation by **Felix Lati, Managing Partner - Lexicon + Ion**
9.15am - 9.25am	*'Alternative Green Building Construction Methods'* Presentation by **Muddy Ramrakha, Director - Kenya Green Building Society**
9.30am - 10.10am	**Panel Discussion** - Cemex Holdings Ltd - Costek Alma - Kenya Green Building Society - Kumkang Kind East Africa Ltd - Lexicon + Ion - Questworks
10.15am	Way Forward ***KPDA***
	Vote of Thanks and Departure

Kindly RSVP (with payment) by **latest Friday 24th August 2018** with the KPDA secretariat on telephone **0737 530 290** or **0725 286 689** or by email to ceo@kpda.or.ke and a copy to membership@kpda.or.ke

ADVANCED BUILDING TECHNOLOGIES TO DELIVER ENHANCED ROI

CONTENTS

- Who – An Introduction to CEMEX HOLDINGS LIMITED (CHL)
- What – We Produce
- Why – This is Important to Developers
  - Opportunities of ABTs
- How – We Can Help you Deliver Better ROI
  - Case Studies
  - Challenges of ABTs

CEMEX HOLDINGS LIMITED (CHL)

- **Cemex Holdings Limited** (CHL) has set up an **ultra-modern Expanded Polystyrene Sintered Panel factory** in Ruiru.

- CHL operates under the **trade name C-MAX Advanced Building System** which is powered by M2 Technology

- C-MAX is an alternative construction technology that **eliminates the use of columns and beams**

- Instead, the system works as an **integrated unit to maximize strength** and to bring various advantages that never before could be achieved

C-MAX PRODUCTS

BENEFITS OF BUILDING WITH C-MAX

C-MAX
ADVANCED BUILDING SYSTEM

Cost Saving

Load Resistance

Cyclones & Tornados Resistance

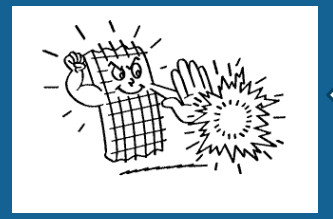
Fire Resistance

Thermal Insulation

Versatility

Rapid Installation

Sustainability & Energy Saving



Blast Resistance

Sound Proofing

Earth Quake Resistance

Lightness

C-MAX BUILDING PROCESS OVERVIEW

OPPORTUNITIES FOR DEVELOPERS

C - MAX ADVANCED BUILDING SYSTEM

COST SAVINGS

C - MAX Advanced Building System a new way of building; the system has the advantage of quality and affordability. Savings are achievable in three major areas

- **Time -** Time saving; labour reduction up to **50%** compared to conventional way of building.

- **Design -** The lightness of the panels allows in reduction of the design components; column bases, columns and beams reducing the overall dead weight of the building and bringing the cost down by up to **20%.**

- **Materials –** up to **15 %** Cumulative material savings ranging from; reinforcements, concrete, formwork, electrical conduits and cables is achievable.

A CASE STUDY

C-MAX Vs. Traditional


TIME IS THE NEW MONEY!!
C-MAX
ADVANCED BUILDING SYSTEM

NET PRESENT VALUE EXPLAINED

Net present value is the present value of the cash flows at the required rate of return of your project compared to your initial investment. In practical terms, it's a method of calculating your return on investment, or ROI, for a project or expenditure.

Source: Harvard Business Review

C-MAX VS. TRADITIONAL

Assumptions:

Construct 50 units

Land Cost at par = 10m

C-MAX construction time = 10 Months

Traditional Construction time = 24 months

Sell 40% of the units to cover costs of construction

Retain 60% of the units for rental income

PROJECTS	Traditional	C-MAX	
CONSTRUCTION			
Start Date	1-Jan-16	1-Jan-16	
End Date	1-Jan-18	1-Nov-16	
Duration of Construction (Months)	24	10	
No. of Units to be Constructed	**50**		
COST ASSUMPTIONS			
Land Purchase	10,000,000	10,000,000	
BQ Estimates	85,000,000	76,500,000	
Professional Charges			
Architect Fees	*4%*	*4%*	
Structural Engineer	*3%*	*3%*	
QS Fees	*3%*	*3%*	
Mechanical and Electrical Engineer	*2%*	*2%*	
	10,200,000	9,180,000	
Licensing, Fees and Permits	4,250,000	3,825,000	5.00%
Est. Total Project Cost	109,450,000	99,505,000	
FUNDING ASSUMPTIONS			
Proportion of Debt	45%	45%	
Debt Amount	49,252,500	44,777,250	
Cost of Debt	15%	15%	
Tenure (Years)	3	3	
Start Date of Loan	1/1/2016	1/1/2016	
Expiry Date of Loan	1/1/2019	1/1/2019	
Monthly Repayment *(Inc. Principle)*	**1,707,354**	**1,552,218**	

THE RESULTS….

C-MAX Advanced Building System delivers:

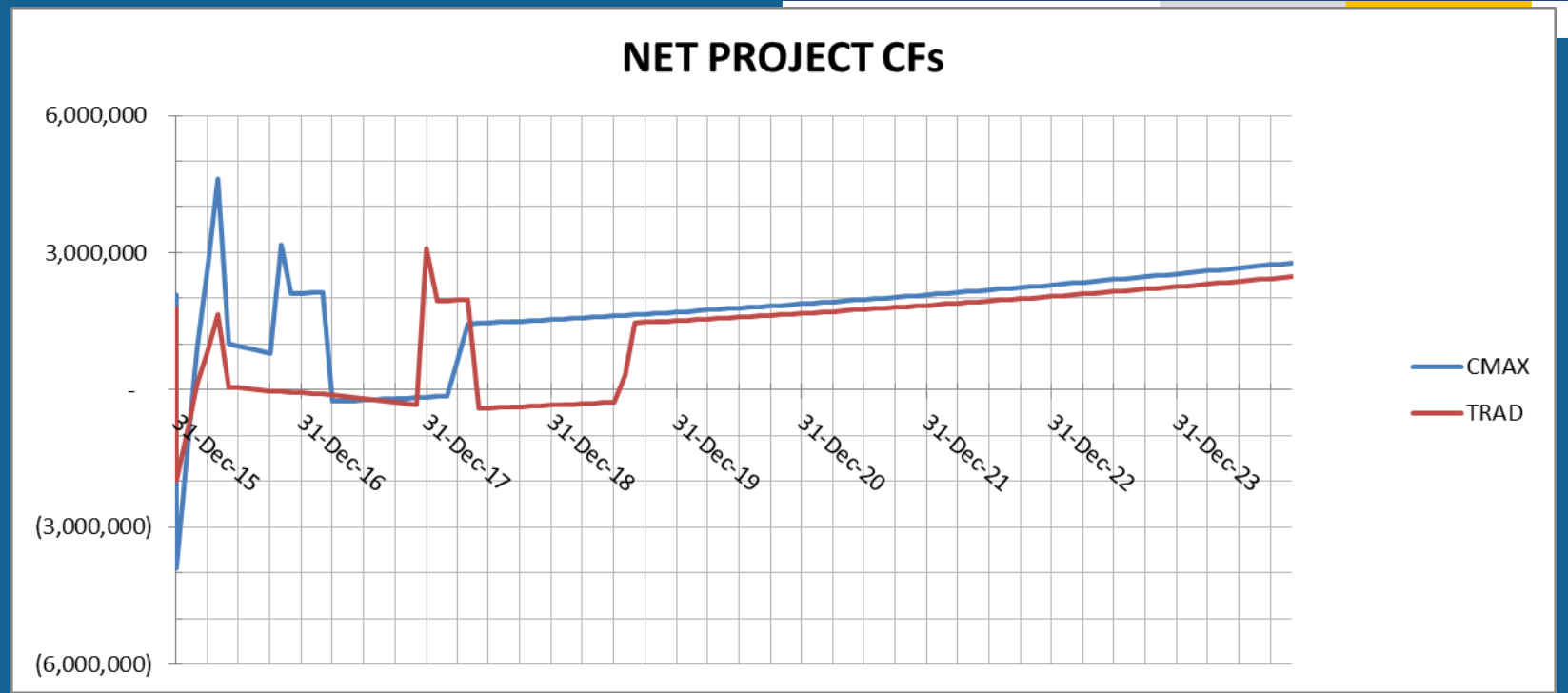
41m More Value

38% Extra Value

11% Saving on Construction Costs

23% Savings on Financing Costs

	Traditional Housing	CMAX	
SUMMARY			
			VALUE ENHANCEMENT
NPV	107,765,086	148,786,776	**41,021,689**
Extra-Value generated by CMAX		**38.07%**	
CONSTRUCTION SAVING			
Cost/Unit			**SAVING**
Construction costs	*85,000,000*	*76,500,000*	**11.11%**
Financing Costs	*54,933,361*	*44,558,404*	**23.28%**
Professional fees	*10,200,000*	*9,180,000*	**11.11%**
Licencing, Fees and Permits	*4,250,000*	*3,825,000*	**11.11%**
TOTAL	**150,133,361**	**130,238,404**	**15.28%**



CASE STUDY 2 – G+3 STORIED BUILDING

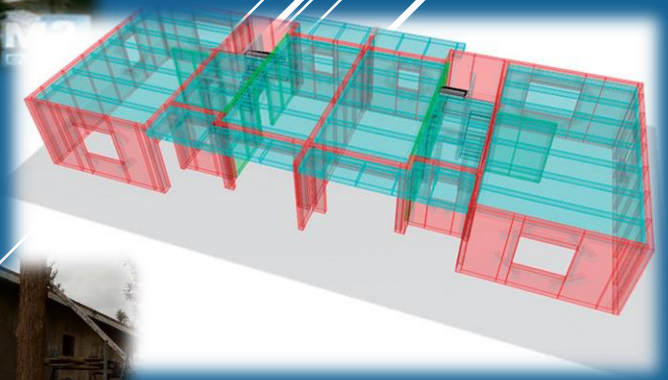
- Ground floor 562 square meters
- First floor 502 square meters
- Second floor 502 square meters
- Third floor 524 square meters
- Total floor area 2090 square meters
- Floor ceiling height 2.7 meters
- Execution of works; Structures can be built in three different ways
    1. Full C-MAX system – The shell is built from wall panels, slab panels with NO Columns and Beams
    2. Hybrid system - Integration of C-MAX panels and R.C. Columns and Beams
    3. Traditional system - Masonry wall and R.C. Columns and Beams

SHELL COST

BUILDERS WORKS (SUBSTRUCTURE & SUPERSTRUCTURE)				
ITEM	**DESCRIPTION**	**FULL SYSTEM**	**HYBRID SYSTEM**	**CONVENTIONAL SYSTEM**
1	**SUBSTRUCTURE**	6,623,360.00	6,623,360.00	6,623,360.00
2	**SUPERSTRUCTURE**	23,157,590.00	27,625,153.00	24,884,024.00
3	**TOTALS**	29,780,950.00	34,248,513.00	31,507,384.00
4	**AMOUNT VARIANCE TO E.P.S FULL SYSTEM**	-	4,467,563.00	1,726,434.00
5	**PERCENTAGE VARIANCE TO C-MAX FULL SYSTEM**	-	+15%	+6%
6	**BUILDING TIME**	4 MONTHS	6 MONTHS	9 MONTHS

CHALLENGES IN IMPLEMENTING ABTS

- **Off-Take –** Will Clients Buy units built with C-MAX?
- **Market Segment –** Will the High-end Market Segment Accept C-MAX?
- **Design –** Does my Team of Consultants know how to design for C-MAX?
- **Construction –** Will my Contractor be able to build with C-MAX?
- **Financing –** Will banks finance my project Built with C-MAX?



AFFORDABLE HOUSING – CASE STUDIES

"Every person has a right to affordable and adequate housing"

Thank You!!!

CEMEX HOLDINGS LTD, THIKA SUPERHIGHWAY, EXIT 10 (NEXT TO KENTIA CLAY PRODUCTS LTD) RUIRU, KENYA

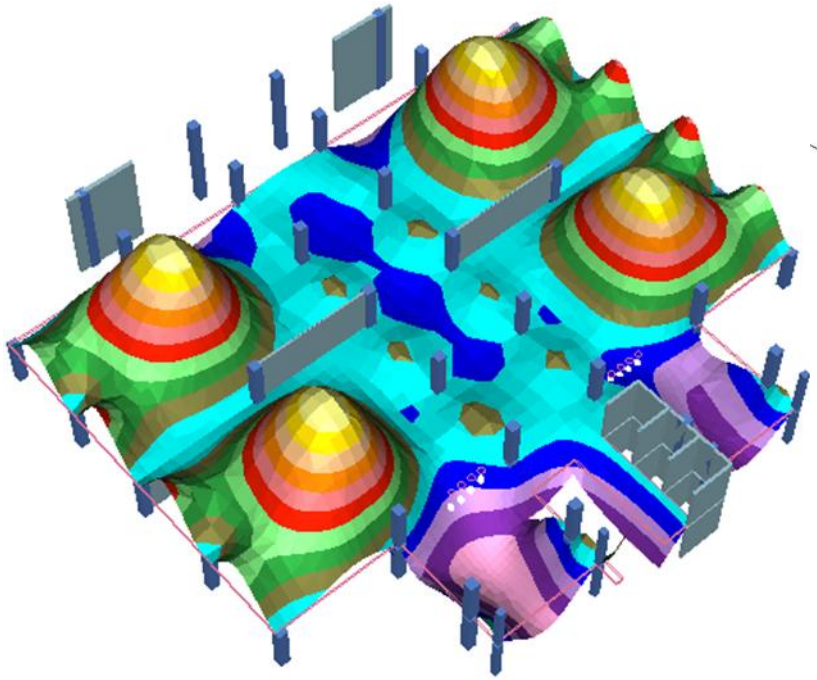
TEL : +254 722 76 44 33 P.O. BOX 45155 – 00100,
EMAIL : SALES@CMAX.CO.KE, WWW.CMAX.CO.KE

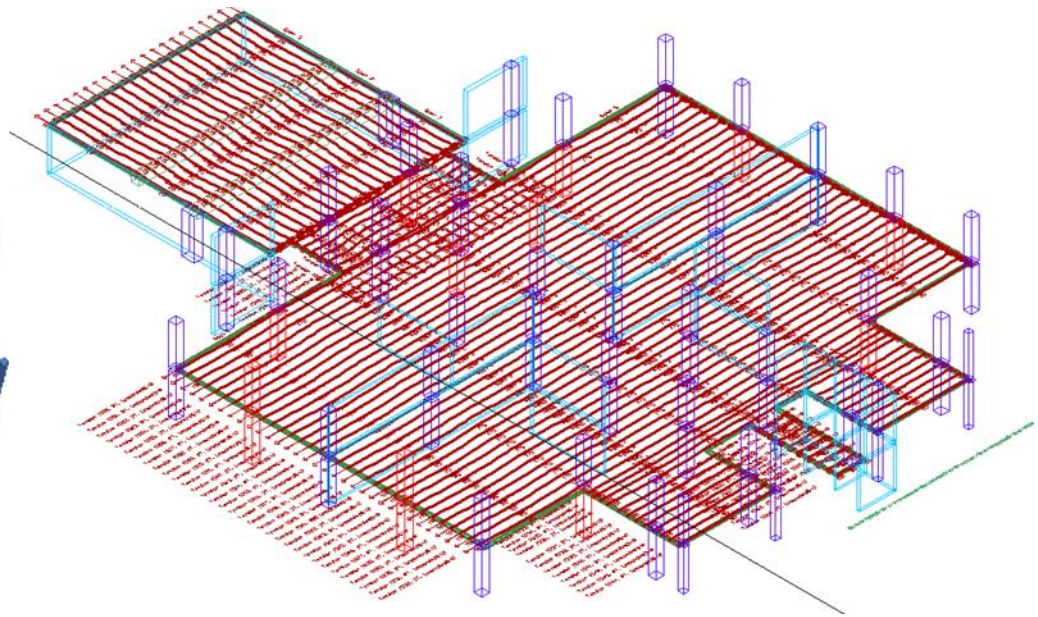
THANK YOU.

M2 real estate and university project https://www.youtube.com/watch?v=AZ9JLGRNecA

Private developer https://www.youtube.com/watch?v=efnCVD8p4jY&t=18s

POST-TENSIONING OF STRUCTURES, FOUNDATIONS AND SLABS ON GROUND





Questworks

Raul H. Figueroa PhD, P.E.
Questworks LTD

WHAT WE DO @QUESTWORKS

Questworks

Design-Build (Turn-Key)

Post-tensioned Concrete Design and Construction

Value Engineering & Project Quality Control

Project Audits

Procurement and Procurement Consulting

Renewable Energy Systems

SOME ADVANTAGES OF PT

Questworks

15% savings in structure cost

7% in overall building cost

Savings on excavation and refill on slabs on ground

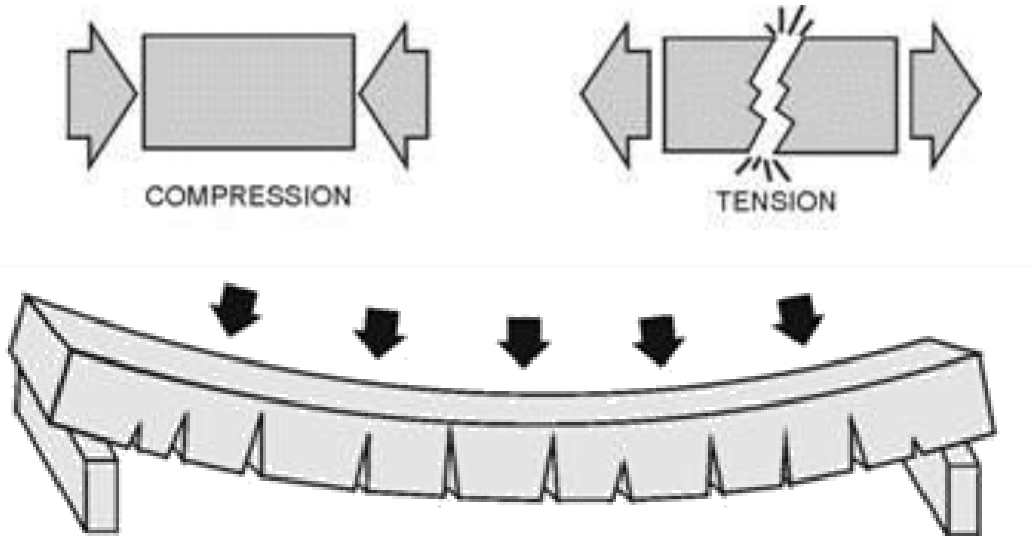
Larger spans without beams

Beamless slabs in most commercial applications

Economical transfer beams

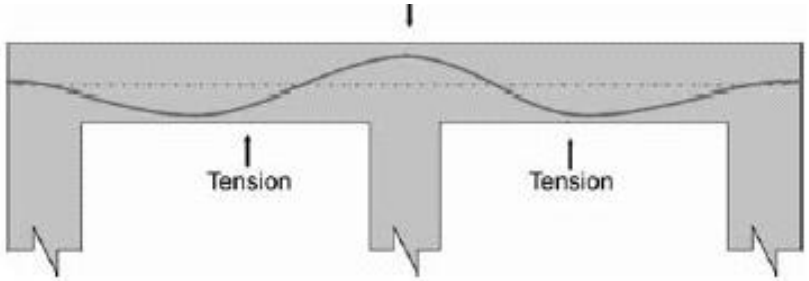
What is post-tensioning?

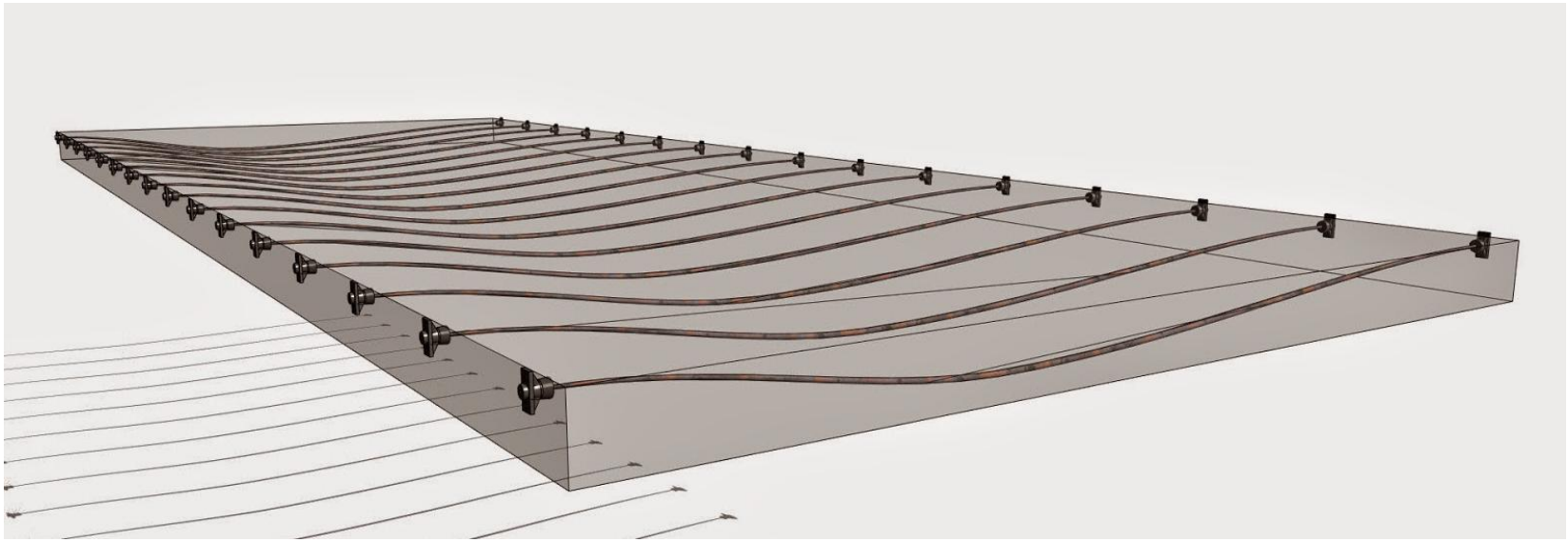
- Used as reinforcement for structural components.
- Post-stressing structural elements increases their tensile strength.



Design determines strand diameter, strands per tendon, drape and post-tension force

Questworks

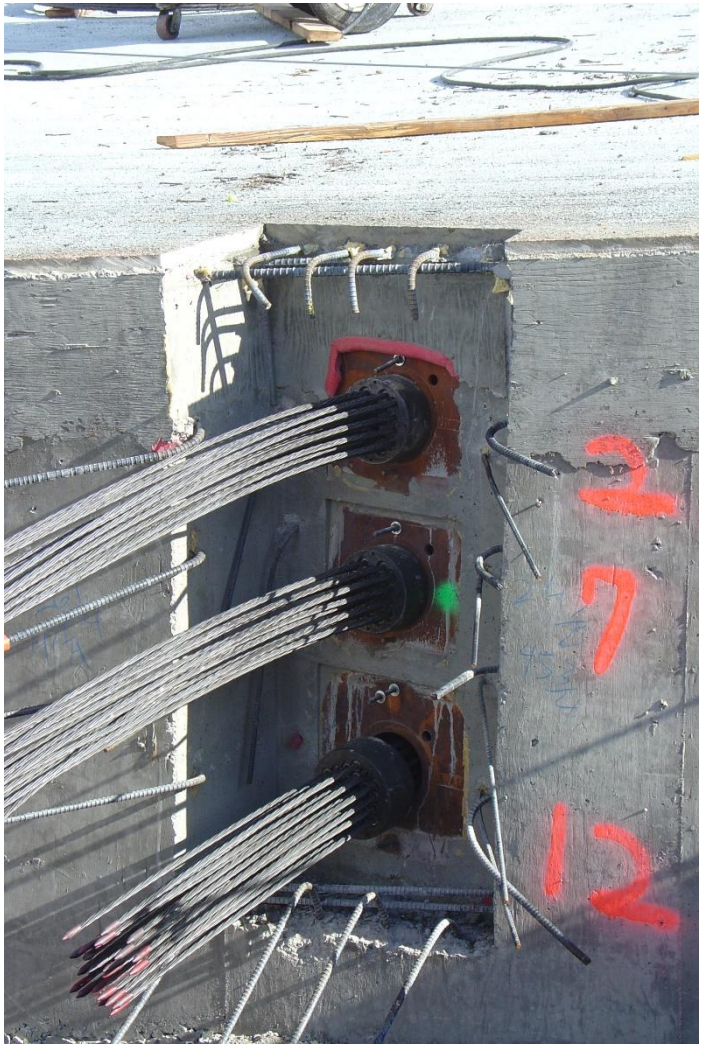




Questworks

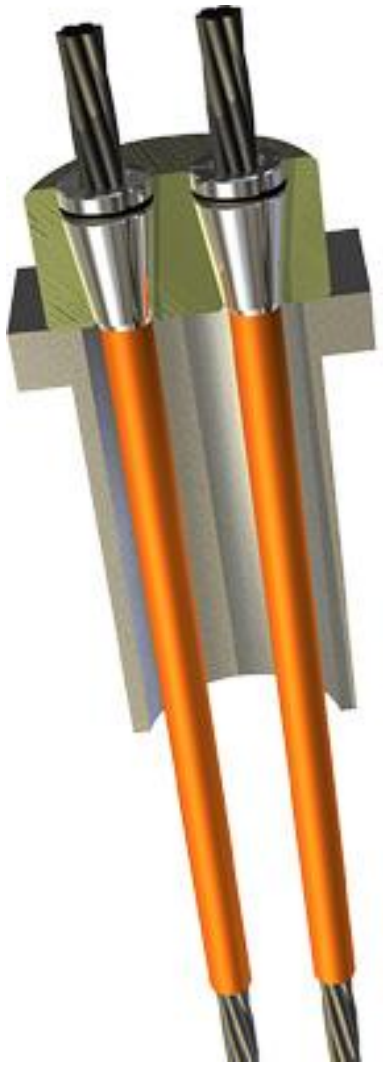
Structural elements that use post-tensioning:

- Many types of bridges
- Elevated slabs
- Foundations
- Walls and columns



PT IS FINISHED WITH ANCHOR PLATES & WEDGES

Questworks

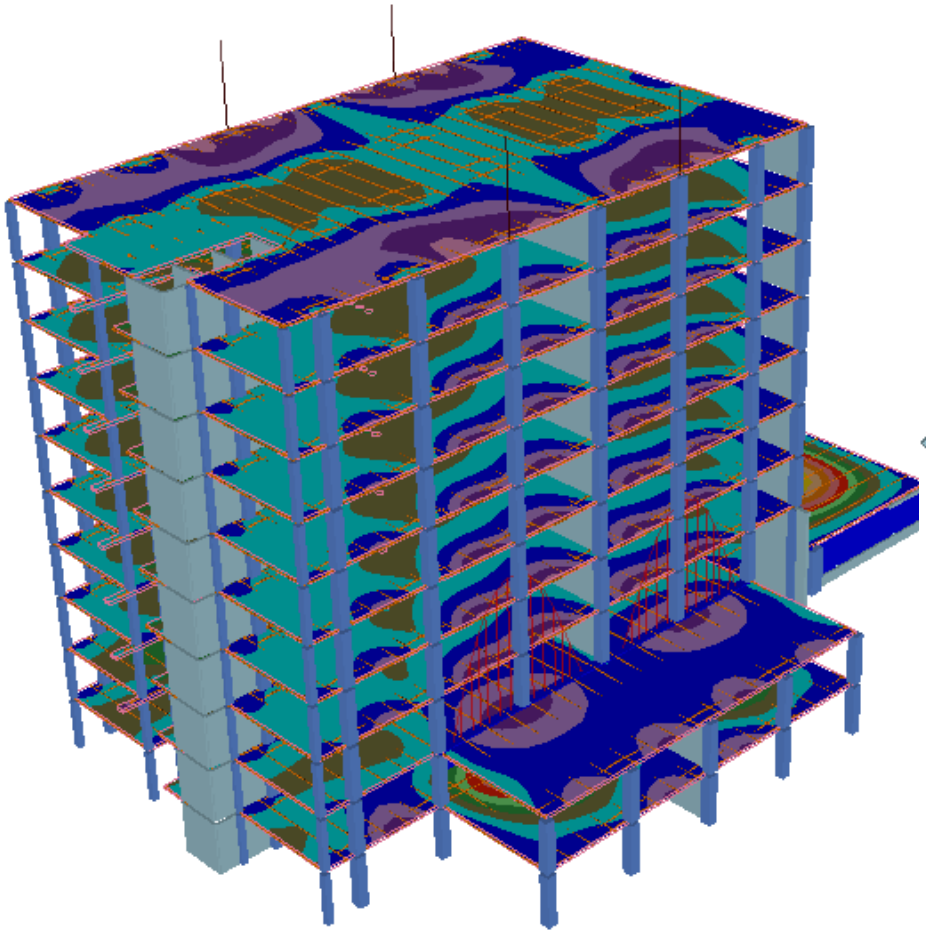


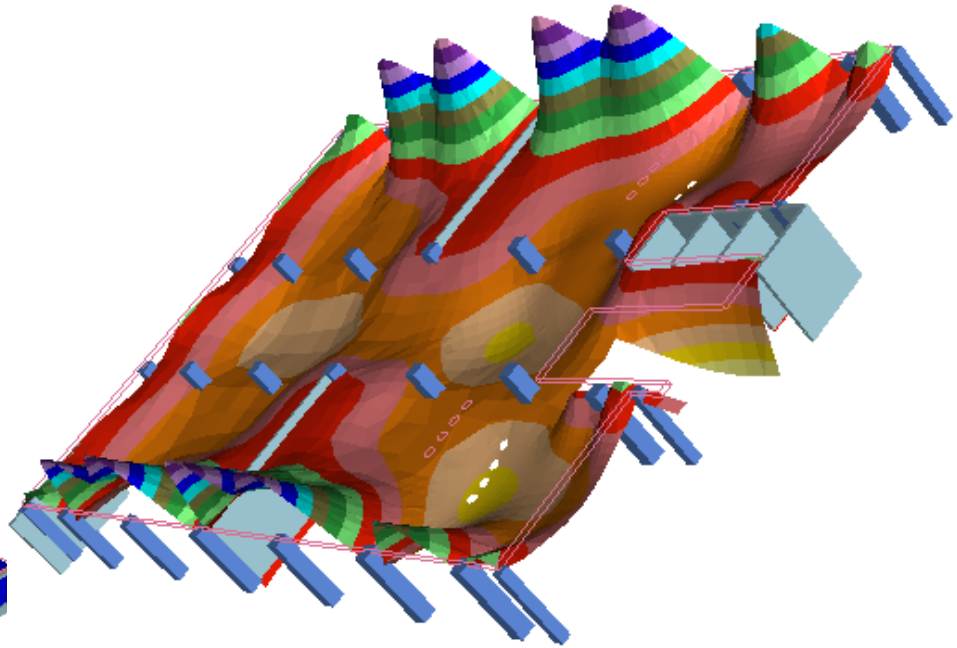
Two types of anchor plates (dead ends and live ends with cone former)

Questworks

OPTIMIZED DESIGNS THROUGH FEM AND SIMULATIONS

Questworks





Strathmore University Law School

PT enables longer spans (with and without beams), thinner slabs, more elegant construction, and faster construction

Questworks

Solid flat slab

Solid flat slab with drop panels

Solid flat slab with drop caps

Banded flat slab

Waffle slab with solid panels

Waffle slab with band beam

Ribbed slab

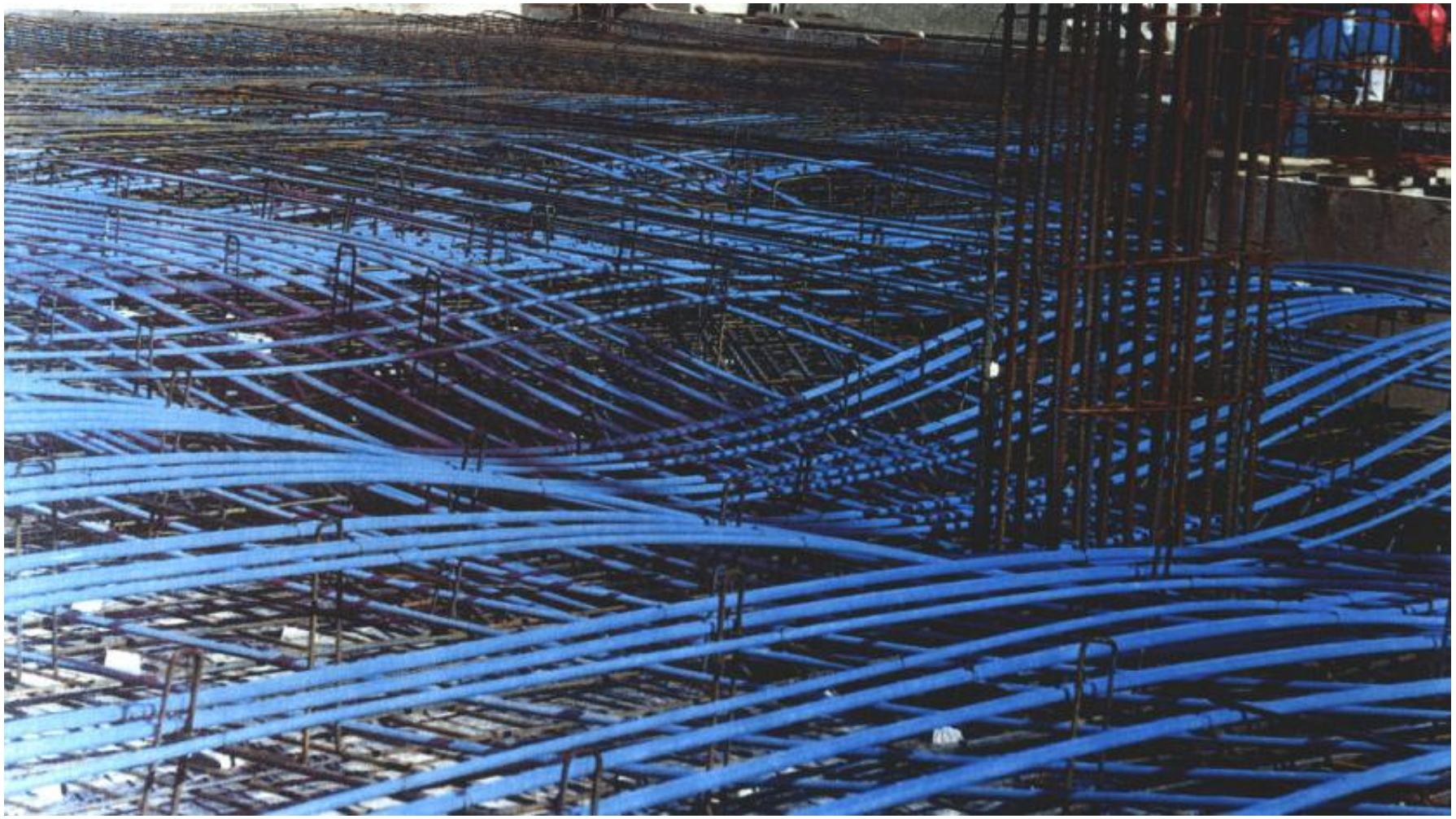
Solid slab with narrow beam

Parking silo with drop panels

Questworks

Foundations on expansive soils

Questworks



SLABS ON EXPANSIVE CLAYS (LIKE BLACK COTTON)

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Flat formwork can be installed faster

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PT requires attention to detail by trained technicians

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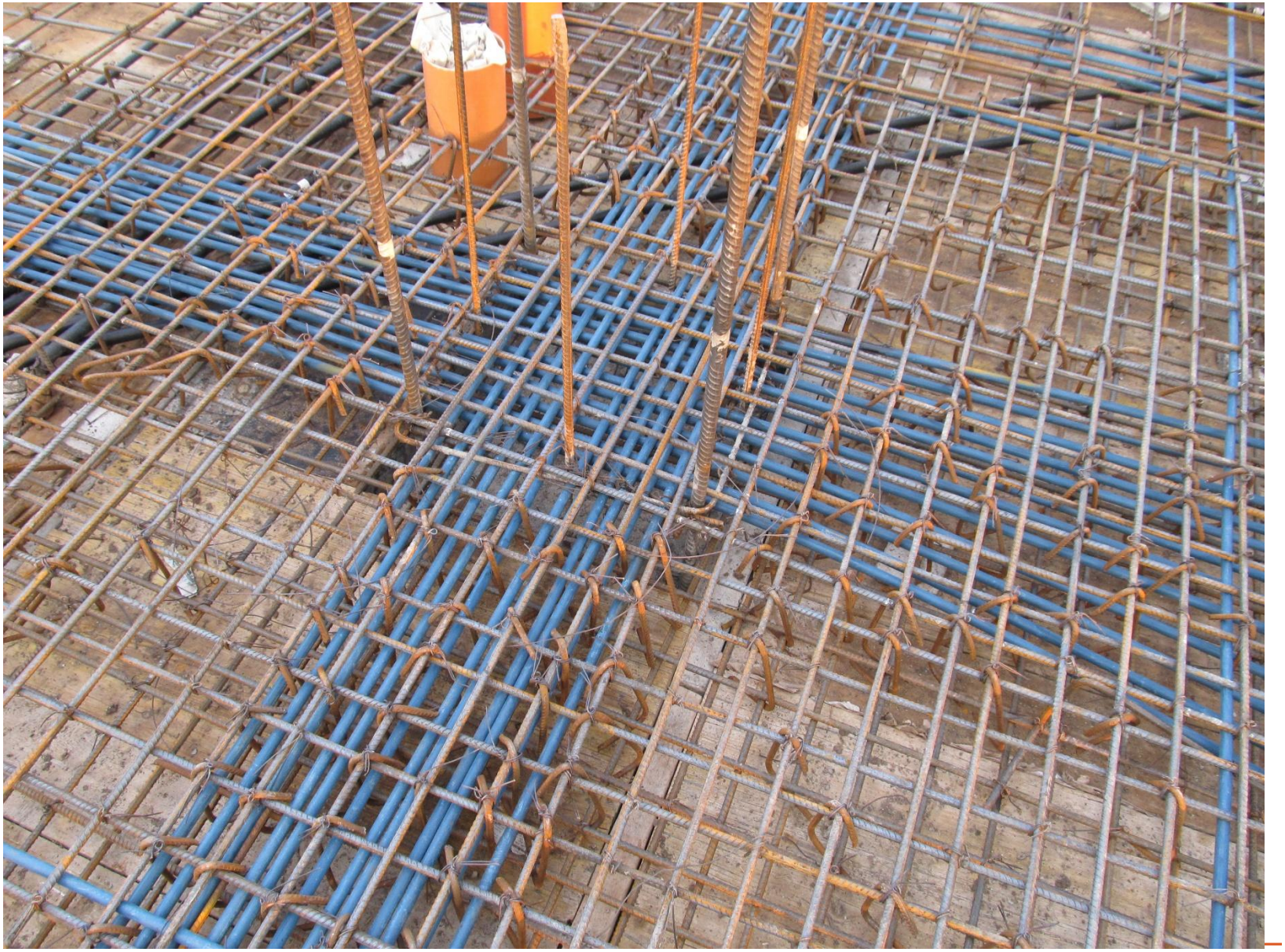


Questworks

Questworks

Questworks

Questworks

OUR EXPERIENCED AND HIGHLY CAPABLE TEAMS

Questworks

Dr. Raul Figueroa – Executive Director

Ph.D. Engineering and Public Policy Carnegie Mellon University,
B.S Electrical Engineering U. of Puerto Rico
28 years Experience

Dr. Tim Barry – Technical Advisor

Ph.D. Electrical Engineering Washington University in St. Louis
26 years of Experience

Dr. Ahmed Abdullah – Technical Advisor

Ph.D. EPP (Renewable Energy and Nuclear Power – Carnegie Mellon University and Princeton University)
5 years experience

Amarjit Virdi – Managing Director

B.S. Electrical and Electronic Engineer
27 years experience in Construction Industry

INTERNATIONAL PARTNERS

Questworks

ANTONIO PUERTA
Partner / CEO

ARTURO PERIS
Partner / Project Director

LUIS MORALES
Socio-ecologist

DAVID CARBAYO
Infographics / Illustration / Prototyping

CLARA MARTÍNEZ
Director of Operations

FERNANDO GIL
Quantity surveyor

JORGE PÉREZ PARADA
Visual Artist

FERNANDO RUBIO
Environmentalist

DRME Milano

JRGrou

PROEN

BETH Systems

SOME PREVIOUS WORK USING PT

Questworks

Paloblanco (1994)

Eli Lilly Labs (2002)

Plaza del Sol Parking (2001)

Questworks

Electoral Commission Building (1996)

Questworks

Ciudad Educativa (2012)

Lilly del Caribe (1991)

Walmart Bayamon Parking (2012)

Questworks

Torre de Plaza (1994)

Puertorreal (2013)

Questworks

Strathmore Law School (2016)

Questworks

THANKS !

ADDRESSING CONTRACTUAL CHALLENGES IN APPLYING ALTERNATIVE BUILDING TECHNOLOGIES

INTRODUCTION

Presentation on:

I. How specialist post tensioning subcontractors can be engaged and how they can indemnify the Contractor, the engineer and the building owner against risks arising from his work.

II. The cost of post tensioned structures vs the conventional structures

Introduction

- Outstanding housing deficit is to a large extent due to the cost of construction; Many are abandoned at feasibility stage because of this.
- High construction costs suppress demand for housing even though the need remains high.
- It is therefore desirable for both the developer and the consumer to reduce these costs.

Alternative Building Technologies

- Post tensioning as an alternative technology seeks to reduce building costs.
- This technology is not new. Railways used this technology many years ago in the construction of bridges.
- The benefits which this technology promises should be exploited by building capacity in the industry.

A. HOW TO ENGAGE A POST TENSIONING SPECIALIST:

The engagement of subcontractors is fairly routine and is provided for by both the JBC and FIDIC conditions of contract.

The JBC contract document provides for the engagement of the subcontractors under clause 31.

The salient points of this clause below:

a) The main contractor shall not have unreasonable objection to the nomination of the specialist

b) The nominated sub-contractor shall carry out and complete the sub-contract works in every respect to the reasonable satisfaction of the Contractor and of the Architect.

A. HOW TO ENGAGE A POST TENSIONING SPECIALIST:(CONTINUED)

c) The MC and Subcontractor shall enter into a **subcontract agreement** and the latter shall observe, perform and comply with all the provisions of the main contract to the extent that they apply to the subcontract.

d) That the nominated **sub-contractor shall indemnify the Contractor** against the same liabilities in respect of the sub-contract works as those for which the Contractor is liable to indemnify the Employer under this contract

e) That if the nominated sub-contractor shall fail to complete the sub-contract works within the period therein he shall pay at the rate therein agreed as **liquidated damages**.

A. HOW TO ENGAGE A POST TENSIONING SPECIALIST:(CONTINUED)

g) That payment shall be made **within fourteen days** after receipt by the Contractor of the sum to which the Contractor shall be entitled by virtue of the Architect's certificates

h) That the Employer and consultants shall have a **right of access** to the workshops and other places of the nominated sub-contractor where work is being prepared

i) If the contractor fails to pay the subcontractor monies due to him the **client may pay him directly** upon receiving the architect's certificate

j) The Contractor **shall not grant** to any nominated sub-contractor **any extension** of the period without the written consent of the Architect.

A. HOW TO ENGAGE A POST TENSIONING SPECIALIST: (CONTINUED)

k) Where the terms of a contract between the Contractor and a nominated sub-contractor so require or the Architect shall so authorize in writing, the Contractor shall **make advance payment** to the sub-contractor before delivery of the materials or goods.

l) Where a sub-contractor is required to give **a guarantee or warranty** relating to the subcontract works such guarantee or warranty shall be assigned by the sub-contractor to the Employer prior to the issue of the final certificate.

m) Neither the existence nor the exercise of the foregoing powers nor anything else contained in these conditions shall render the **Employer in any way liable** to any nominated sub-contractor.

B. HOW THE SPECIALIST INDEMNIFIES THE ENGINEER, THE CONTRACTOR AND THE BUILDING OWNER.

- Risks in construction works are real and insurance covers are routinely taken .
- **The main contractor bears overall responsibility** to the employer and will take insurances sufficient to cover the entire range of risks. He will require that subcontractors including the specialists engaged in the project take insurances to cover him pro rata to their respective scopes.
- The post tensioning subcontractors take **professional indemnity** covers against design and execution.
- Both the **JBC and FIDIC** conditions of contract recognize these risks and **have made provisions** for them.

B. HOW THE SPECIALIST INDEMNIFIES THE ENGINEER, THE CONTRACTOR AND THE BUILDING OWNER – (CONTINUED)

- In the case of JBC under sub-clause 31.5.3 it provides that:

  "***That the nominated sub-contractor shall indemnify the Contractor against claims in respect of any negligence, omission or default of such subcontractor, his servants or agents or any misuse by him or them of any scaffolding or other equipment, and shall insure himself against any such claims and produce the policy or policies and receipts in respect of premiums paid as and when required by either the Architect or the Contractor".***

- FIDIC has the following provisions:

  The Subcontractor shall indemnify the Contractor against:

  (a) any breach, non-observance and/or non-performance by the Subcontractor of obligations under the main contract;

  (b) any act and/or omission of the Subcontractor which gives rise to the Contractor incurring liability to the Employer; and

  (c) any claim, loss, damage and/or expense due to, or resulting from, any act, omission, negligence or breach of duty by the Subcontractor.

  and;

B. HOW THE SPECIALIST INDEMNIFIES THE ENGINEER, THE CONTRACTOR AND THE BUILDING OWNER – (CONTINUED)

1 The Subcontractor shall immediately effect and thereafter maintain throughout the duration of the Subcontract Works:

(i) all insurances required under Law.

until the **twelfth anniversary** of the Completion Date professional indemnity insurance in respect of his professional duties.

2 The insurances shall be effected with such insurers as may be **approved from time to time by the Contractor**.

3 The Subcontractor shall not take any action or fail to take any action or permit anything to occur which would entitle any insurer to refuse to pay any claim

4 The Subcontractor shall provide to the Contractor, upon reasonable request that all relevant premiums in respect of the insurances have been paid and that the policies remain in force

C. COST OF POST TENSIONED VS CONVENTIONAL STRUCTURES

The cost benefits of post tensioned structures accrue from savings on materials and reduction in execution time:

1. Savings on materials

- Thinner concrete member sizes;
- Rebar in floor elements is reduced Decreased dead load reduces rebar and concrete in columns and foundations
- Reduction in building height decreases the cost of building cladding, vertical mechanical/service elements, and rebar and concrete in shear walls

C. COST OF POST TENSIONED VS CONVENTIONAL STRUCTURES – (CONTINUED)

2. Shorter execution time

- Potential pour cycle of 3-4 days reduces cost of equipment and labour.

CONCLUSION

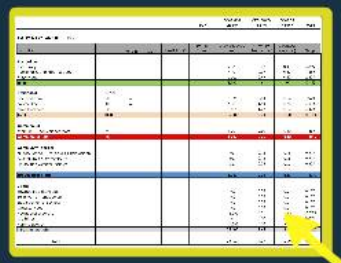
High construction costs are an obstacle to meeting the housing need in the country. It is upon the industry stakeholders with the potential of reducing these costs. Pre-stressed and Post tensioned structures promise lower construction costs and we all should endeavor to overcome whatever risks they pose. Investment in this technology will in the long run be worth while.

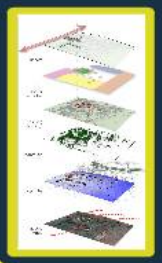
FOR MORE INFORMATION:

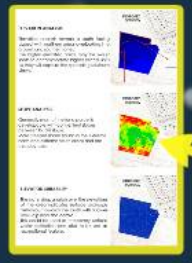
Qs. Alex Magembe, Partner – Costek Alma

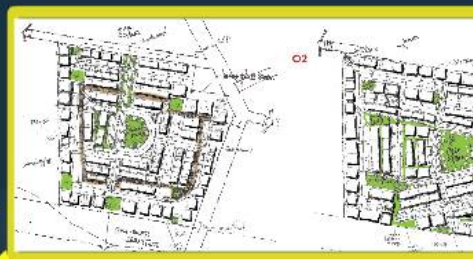
jammagembe@costekalma.co.ke

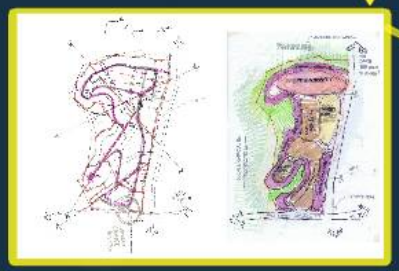
Site Planning for Affordable Housing Communities

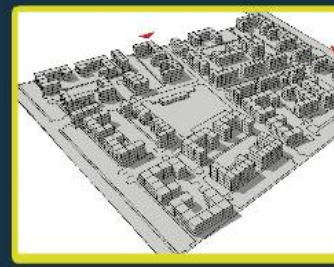


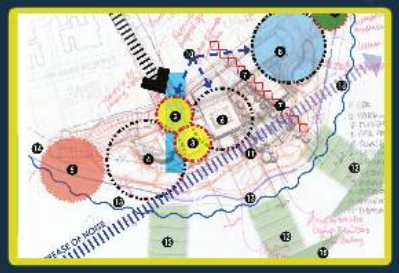


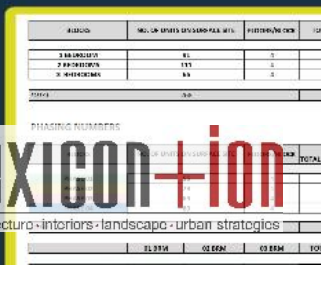






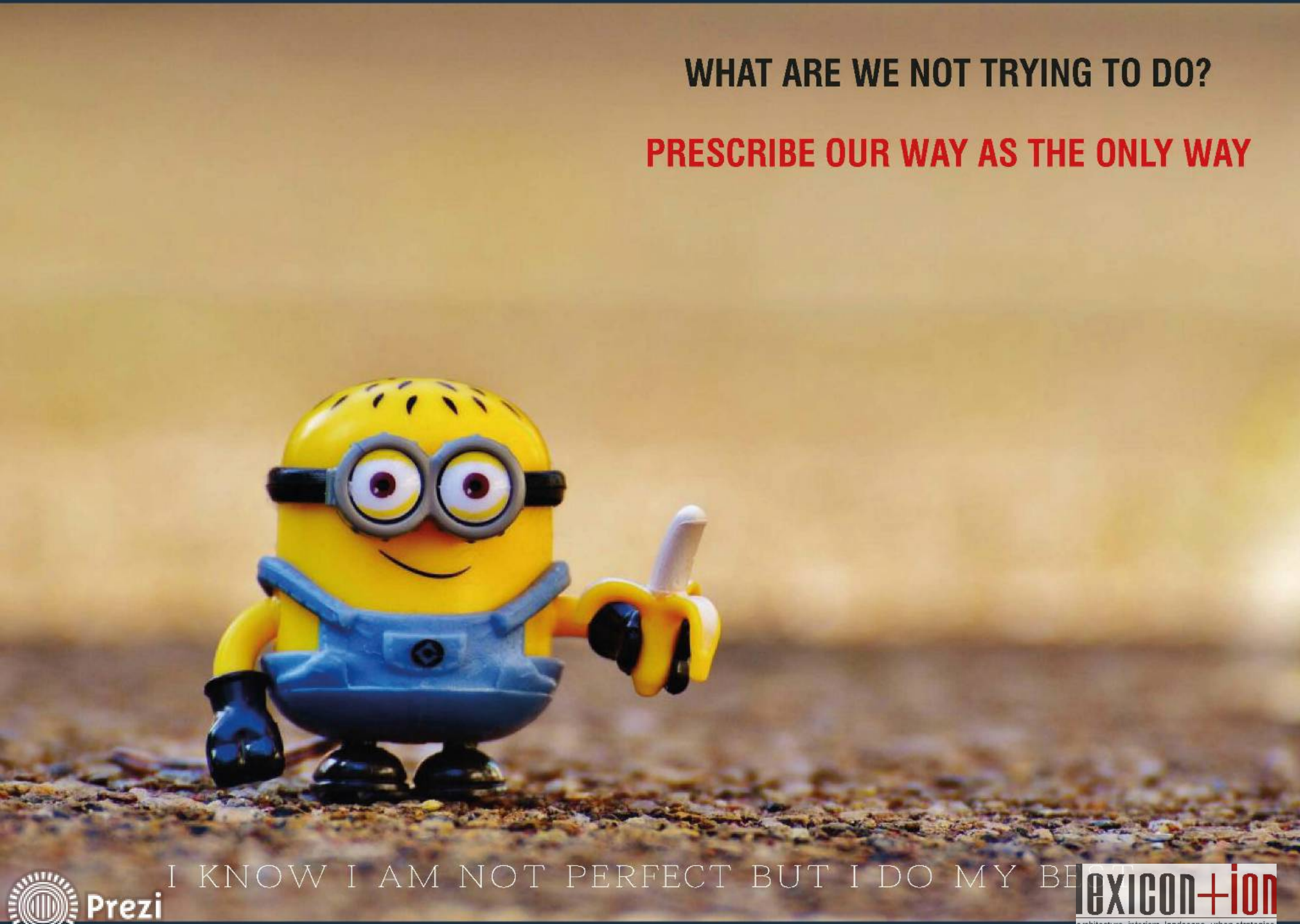






WHAT ARE WE NOT TRYING TO DO?

PRESCRIBE OUR WAY AS THE ONLY WAY



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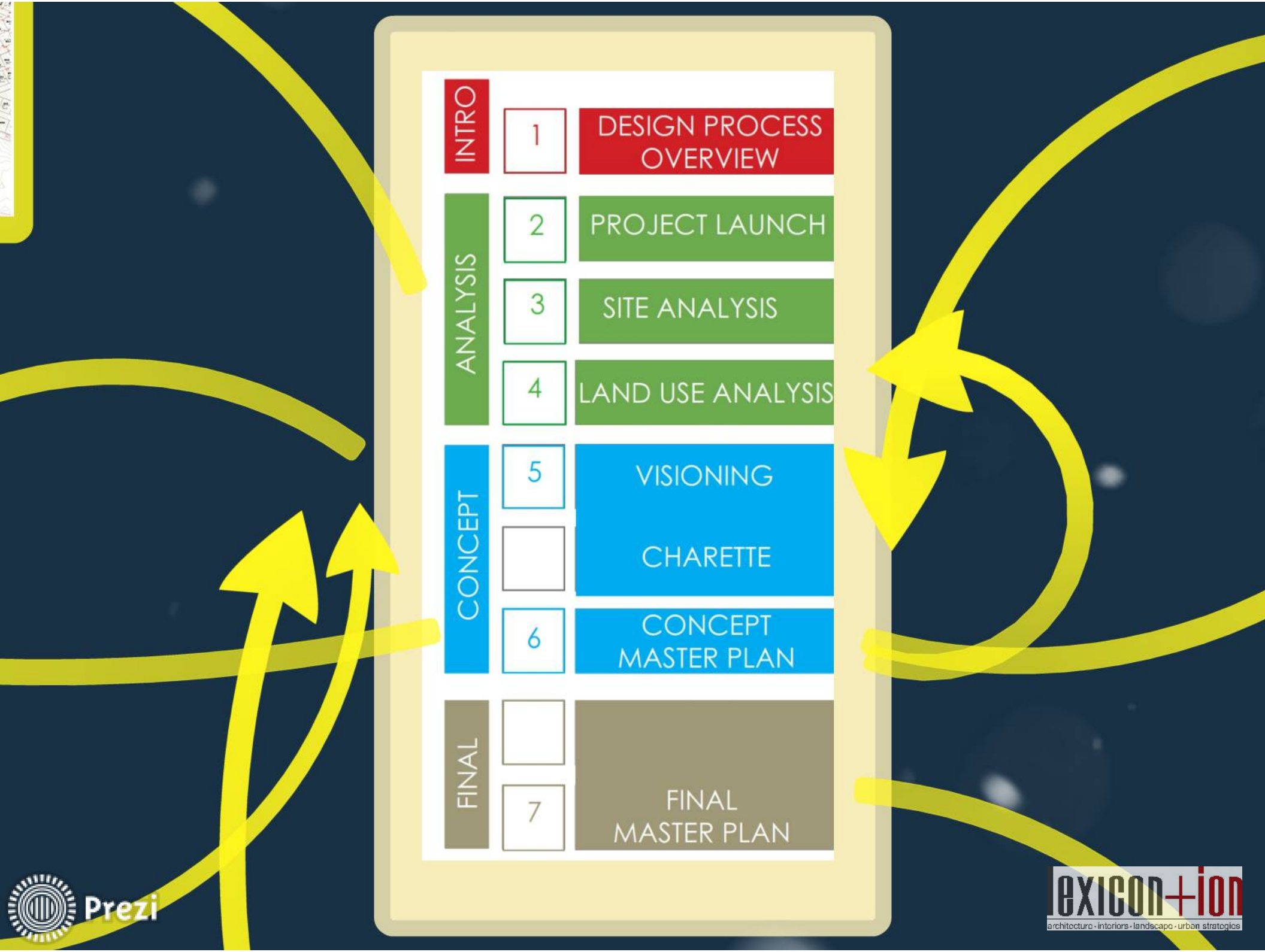
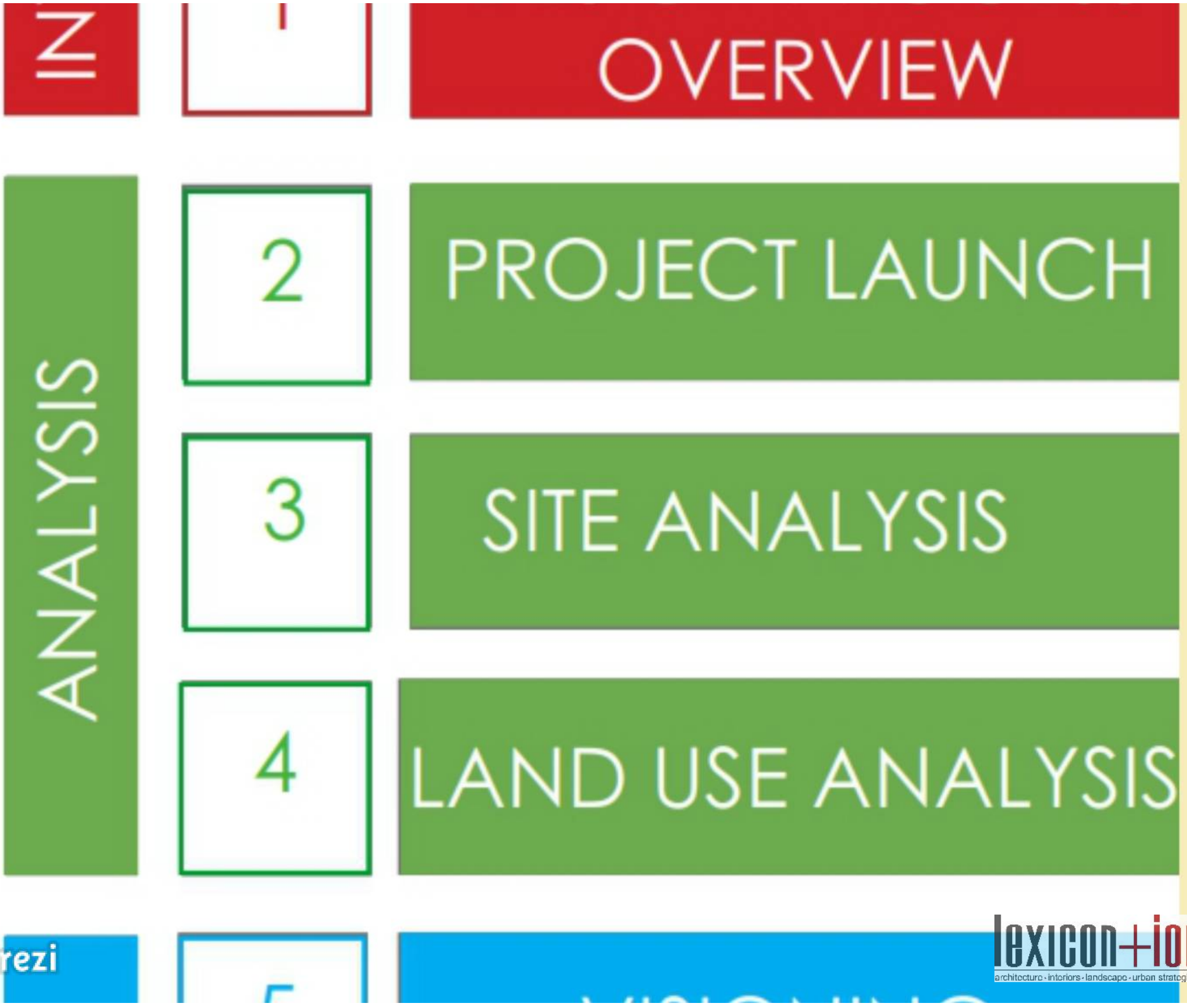




DESIGN PROCESS OVERVIEW

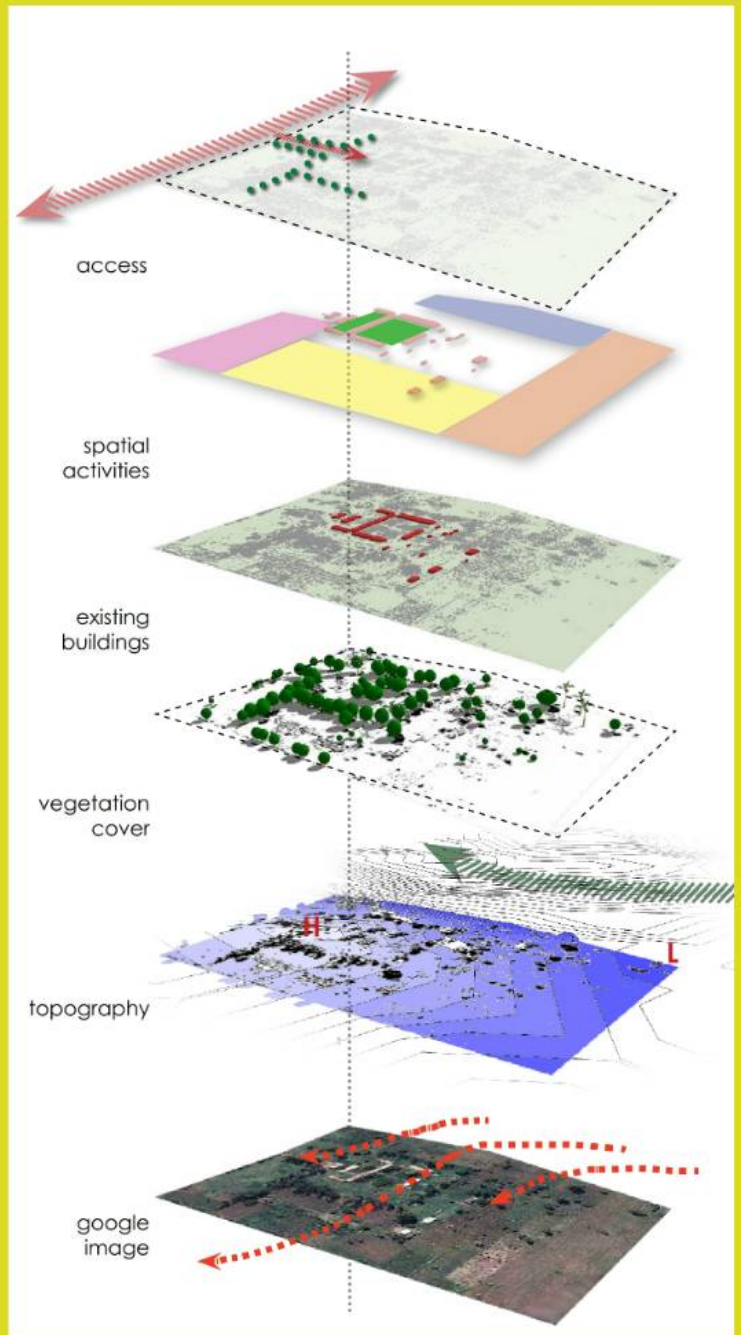
PROJECT LAUNCH

SITE ANALYSIS

PROJECT LAUNCH

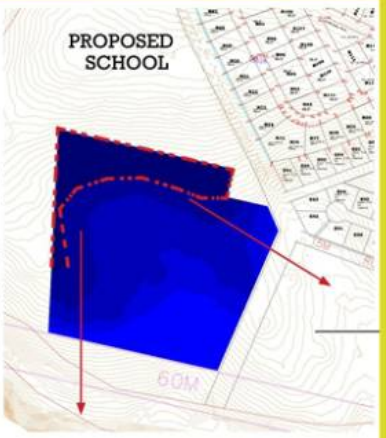
SITE ANALYSIS

LAND USE ANALYSIS



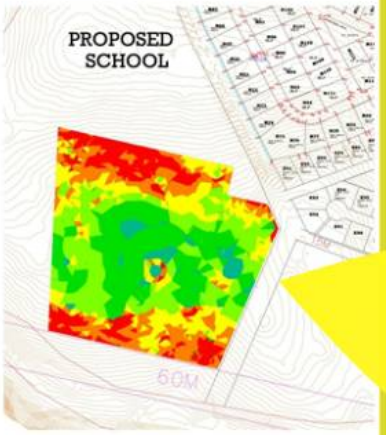
ELEVATION ANALYSIS

Elevation analysis reveals a south facing aspect with northern areas overlooking into a bowl and southern ones.
The higher elevated areas may be sweet spots to accommodate higher priced units as they will capture the spreading southern views.



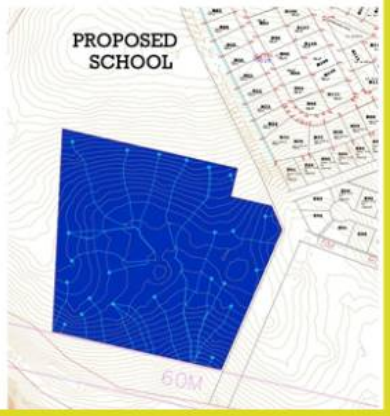
SLOPE ANALYSIS

Generally most of the land parcel is developable with convenient slopes between 0-15% slope.
More steeper slopes found in the extreme north and extreme south areas and are also desirable.

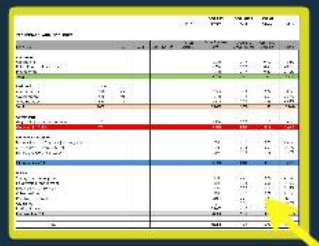


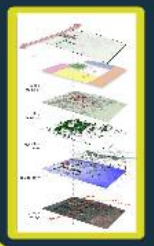
ELEVATION SUITABILITY

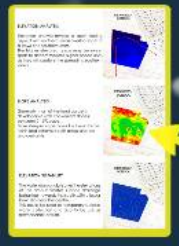
The water drop analysis over the elevations of the area indicates surface drainage behaviour towards the south with a lower bowl dip near the centre.
This could be used as temporary surface water collection and also to be use as recreational feature.

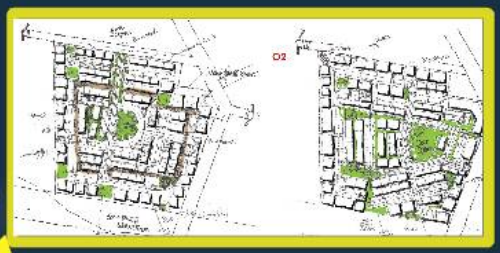


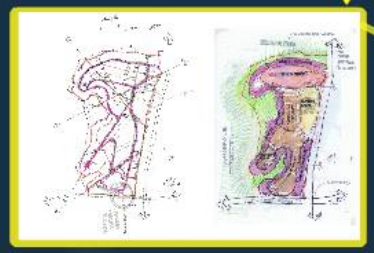
Site Planning for Affordable Housing Communities

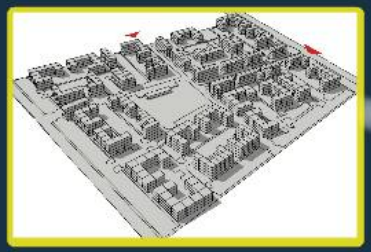


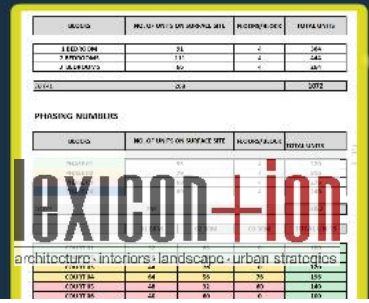












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SITE ANALYSIS

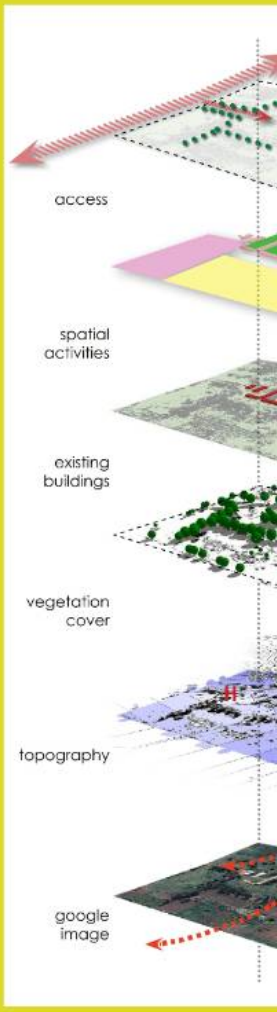
LAND USE ANALYSIS

VISIONING

						Area sqm	Area Acres	Area Ha	
					4047	82507	20.39	8.2507	100%

PRELIMINARY LAND USE BUDGET

Land Use		length	width	Site/Unit (M^2)	Site/Unit (acres)	Gross Site Area (m^2)	Gross Site Area (acres)	Gross Site Area (Ha)	%age
Recreation									
Greenways						2,000	0.49	0.40	4.85%
Public Parks and open spaces						4,000	0.99	0.40	4.85%
Playgorunds						2,000	0.49	0.20	2.42%
Total						**8,000**	**1**	**0**	**12.12%**
Residential	Number								
one bedroom	300	45				3,375	0.83	0.34	4.09%
two bedroom	400	60				6,000	1.48	0.60	7.27%
three bedroom	300	75				5,625	1.39	0.56	6.82%
Total	**1000**					**15,000**	**3.71**	**1.50**	**18.18%**
Commercial									
shop units | convinience stores	20					1,200	0.30	0.12	1.45%
Commercial Total	**20**					**1,200**	**0.30**	**0.12**	**1.45%**
Community Facilities									
Nursery School | Daycare | Kindergarten						500	0.12	0.05	0.61%
Auditorium & Community Hall						500	0.12	0.05	0.61%
Library and Cultural Museum						250	0.06	0.03	0.30%
Site Amenities Total						**1,250**	**0.31**	**0.13**	**1.52%**
Utilities									
Sewage treatment plant						100	0.02	0.01	0.12%
Solid waste management						100	0.02	0.01	0.12%
Electrical Power Services						100	0.02	0.01	0.12%
Other services						100	0.02	0.01	0.12%
Roads and circulation						13,000	3.21	1.30	15.76%
Clothlines						0	0.00	0	0.00%
Parking Spaces						25,000	6.18	2.5	
Infrastructure Total						**38,400**	**9.49**	**3.8**	**4%**
Total						**63,850**	**15.3**	**5.79**	**7**



Site Planning for Affordable Housing Communities

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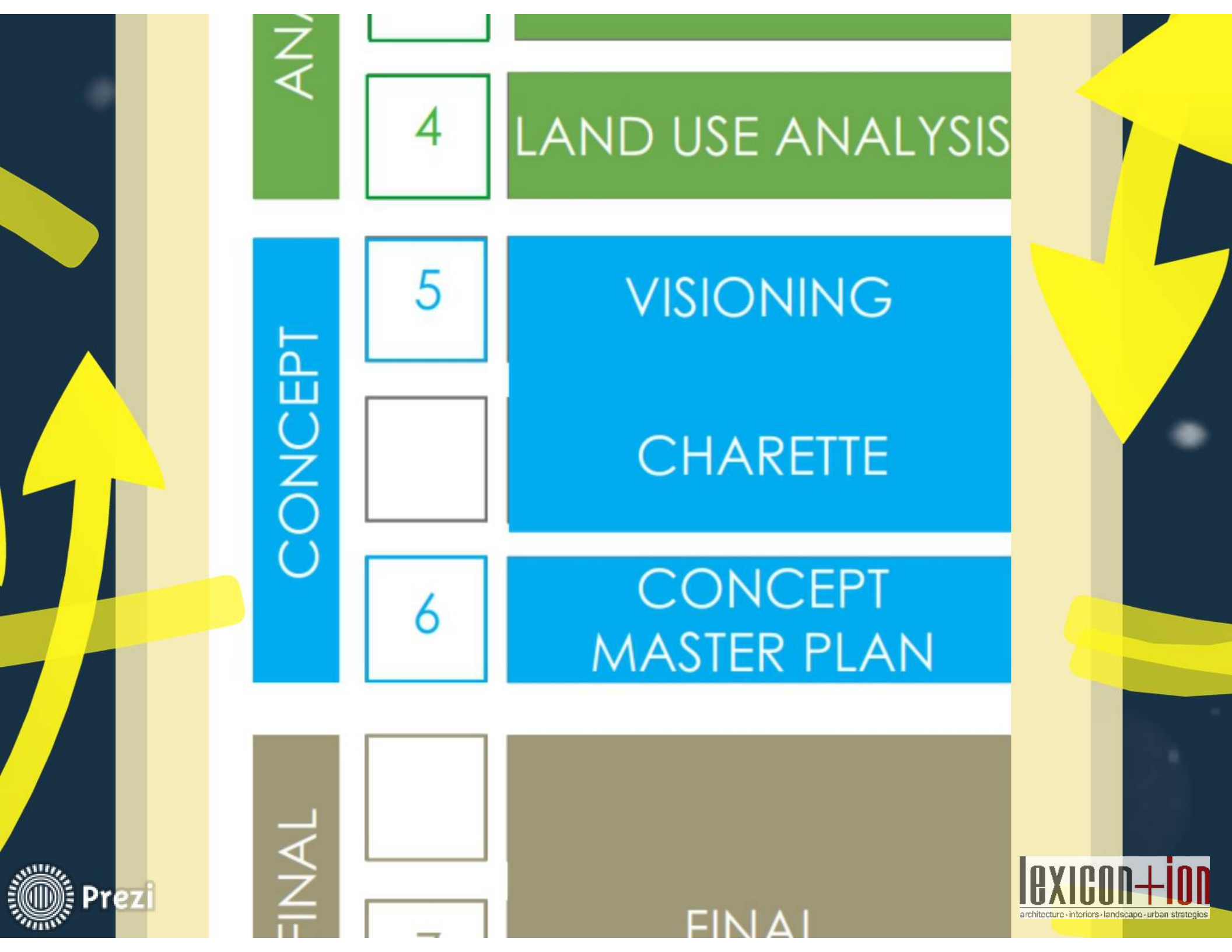
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4
LAND USE ANALYSIS
CONCEPT
5
VISIONING
CHARETTE
6
CONCEPT
MASTER PLAN
FINAL
FINAL
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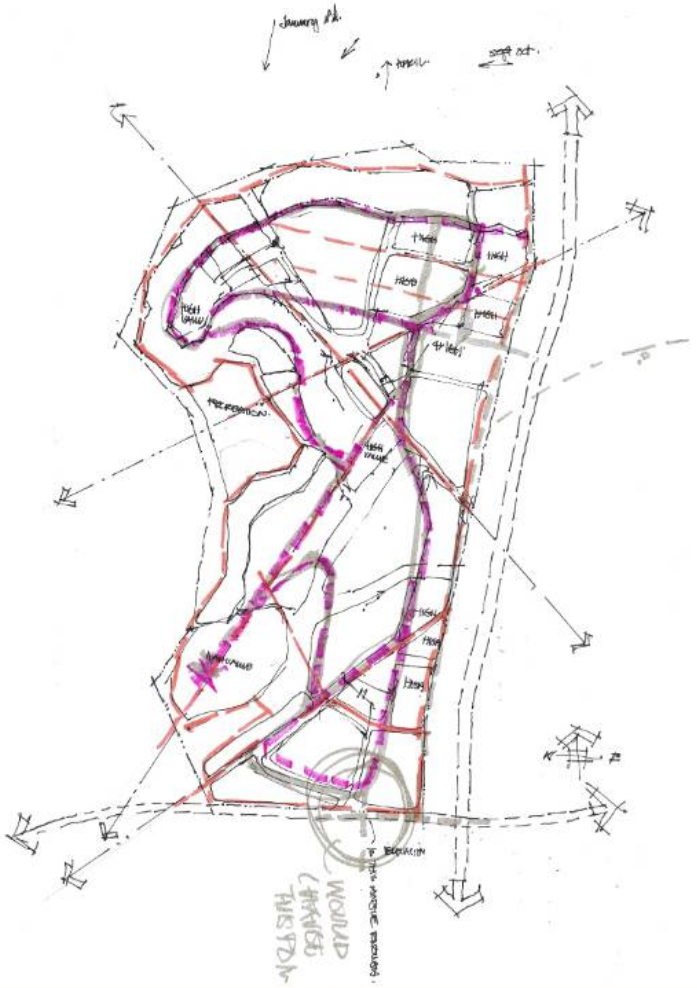
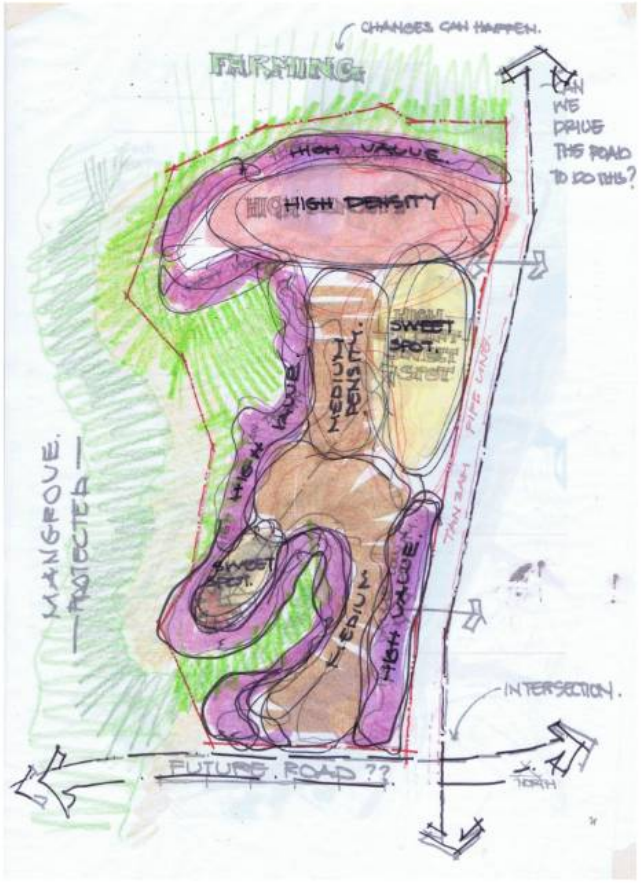
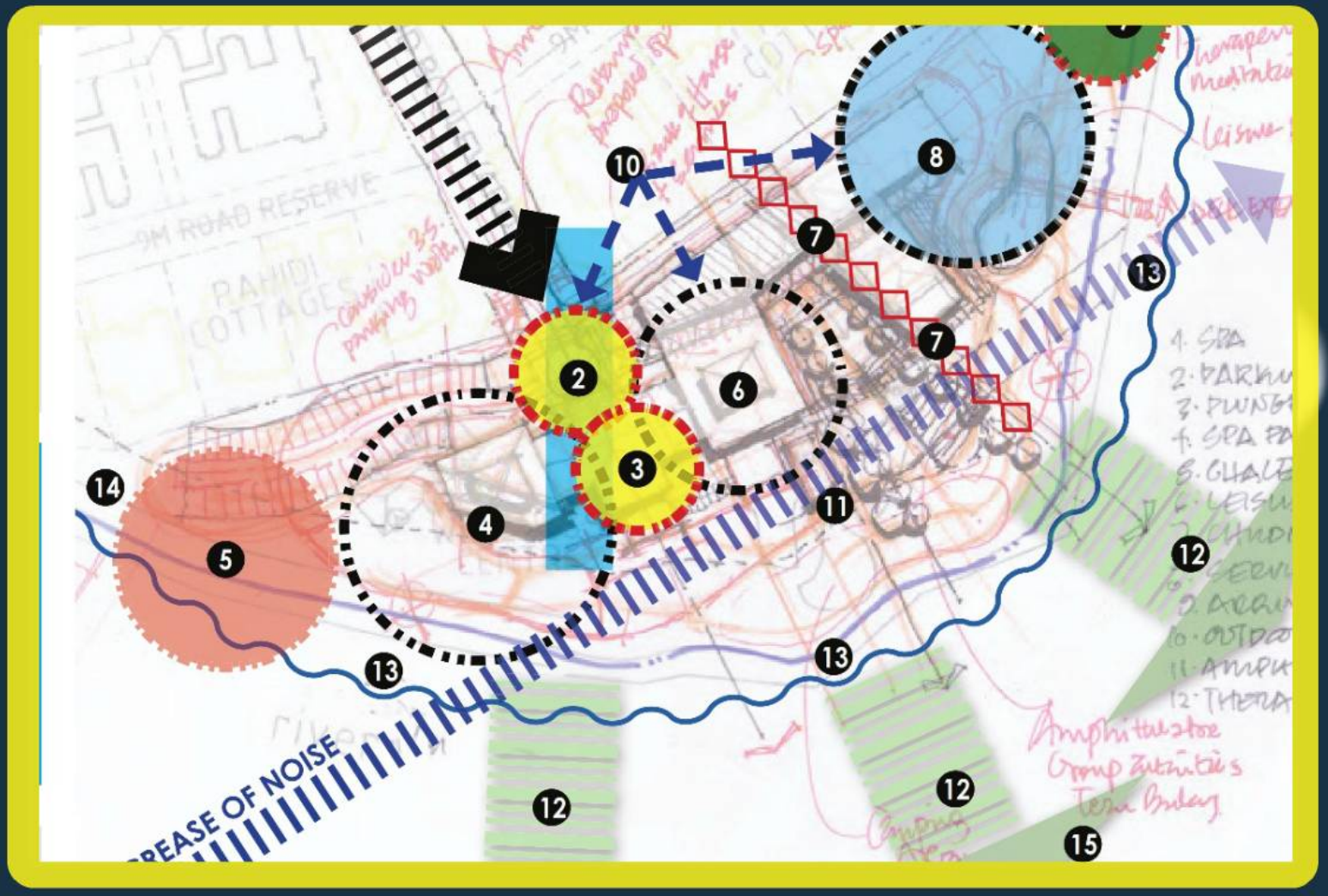
VISIONING

CHARETTE







Site Planning for Affordable Housing Communities

CHARETTE

CONCEPT MASTER PLAN

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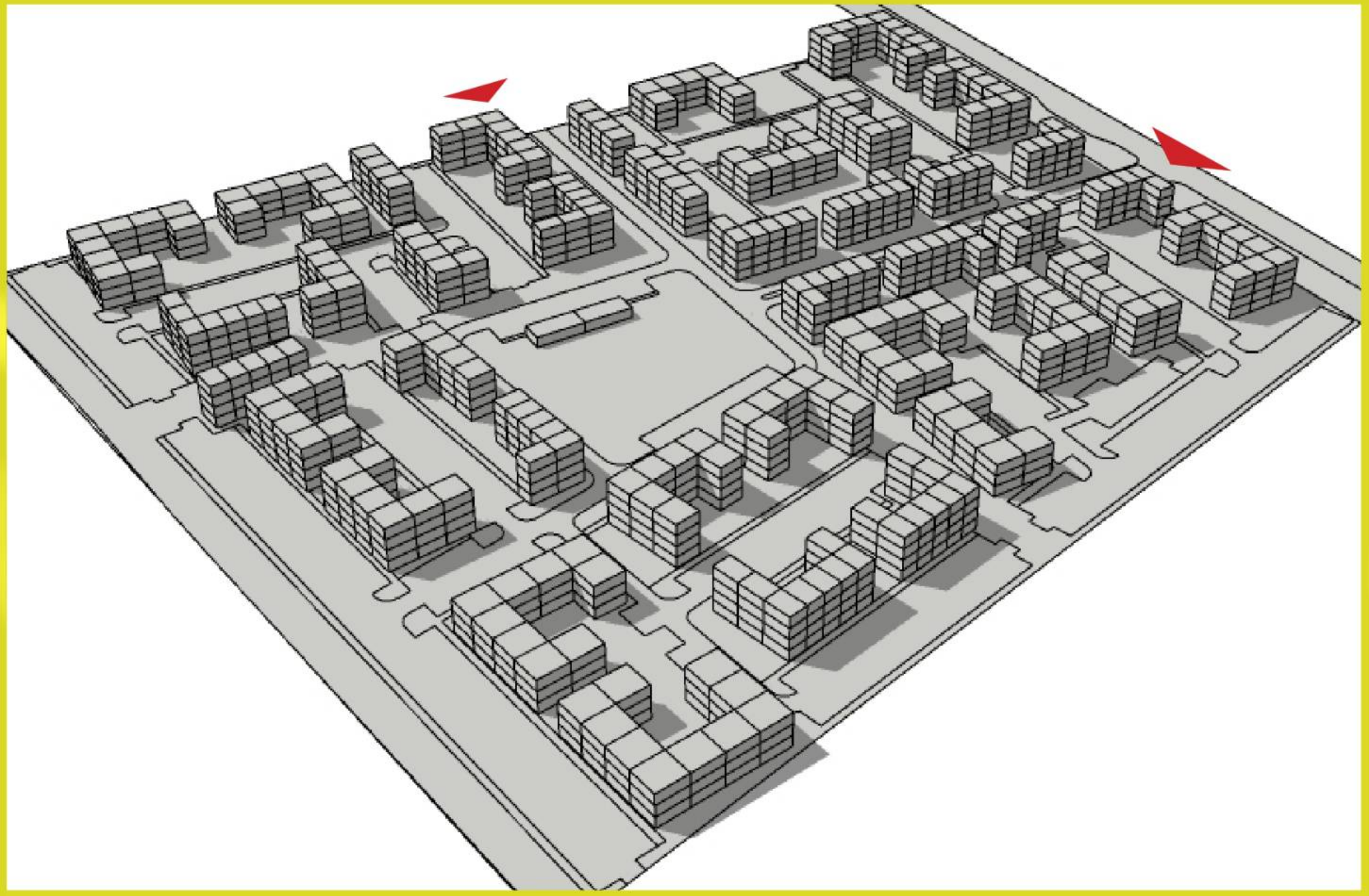
COURTS AND OPEN SPACES

COURTS AND OPEN SPACES



BLOCKS	NO. OF UNITS ON SURFACE SITE	FLOORS/BLOCK	TOTAL UNITS
1 BEDROOM	91	4	364
2 BEDROOMS	111	4	444
3 BEDROOMS	66	4	264
TOTAL	268		1072

PHASING NUMBERS

BLOCKS	NO. OF UNITS ON SURFACE SITE	FLOORS/BLOCK	TOTAL UNITS
PHASE 01	55	4	220
PHASE 02	79	4	316
PHASE 03	69	4	276
PHASE 04	60	4	240
TOTAL	263		1052

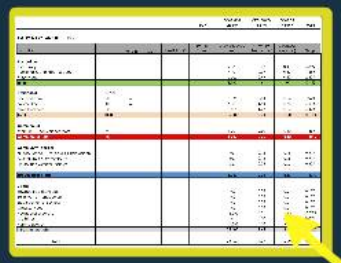
	01 BRM	02 BRM	03 BRM	TOTAL UNITS
COURT 01	32	68	0	100
COURT 02	28	20	72	120
COURT 03	44	76	0	120
COURT 04	64	56	76	196
COURT 05	48	32	60	140
COURT 06	40	60	0	100
COURT 07	40	96	0	136
COURT 08	48	36	56	140
TOTALS	344	444	264	1052

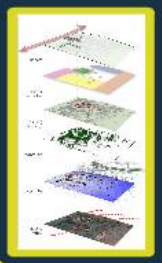
PARKING	NO.
RIGHT ANGLE PARKING	1052
TOTAL PARKING COUNT	1052

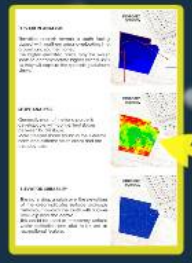
Site Planning for Affordable Housing Communities

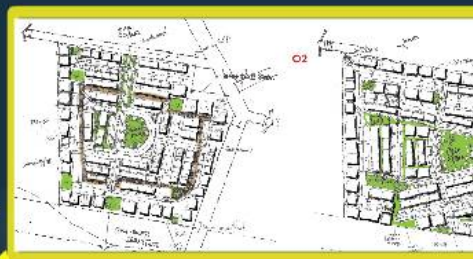
FINAL MASTER PLAN

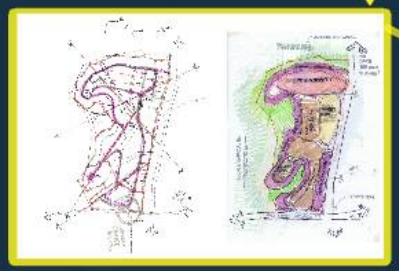
Site Planning for Affordable Housing Communities

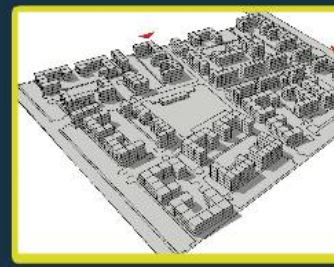


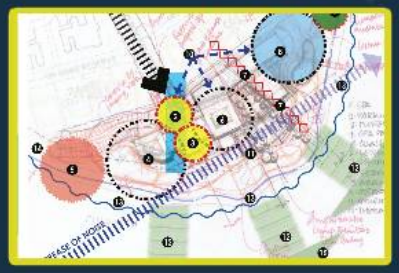


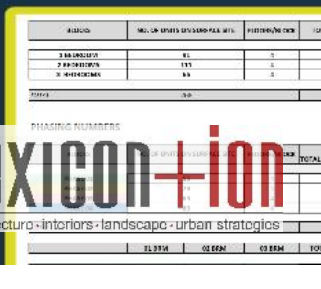












WORLD GREEN BUILDING WEEK
24 – 30 SEPT 2018

Alternative Green Building Construction Methods

#homegreenhome

Alternative Green Building Construction Methods

Presentation to KPDA CEO Forum
Madhur (Muddy) Ramrakha, muddy@kgbs.co.ke
Board Treasurer, KGBS; and Director, iJenga
28th August 2018
Vila Rosa Kempinski

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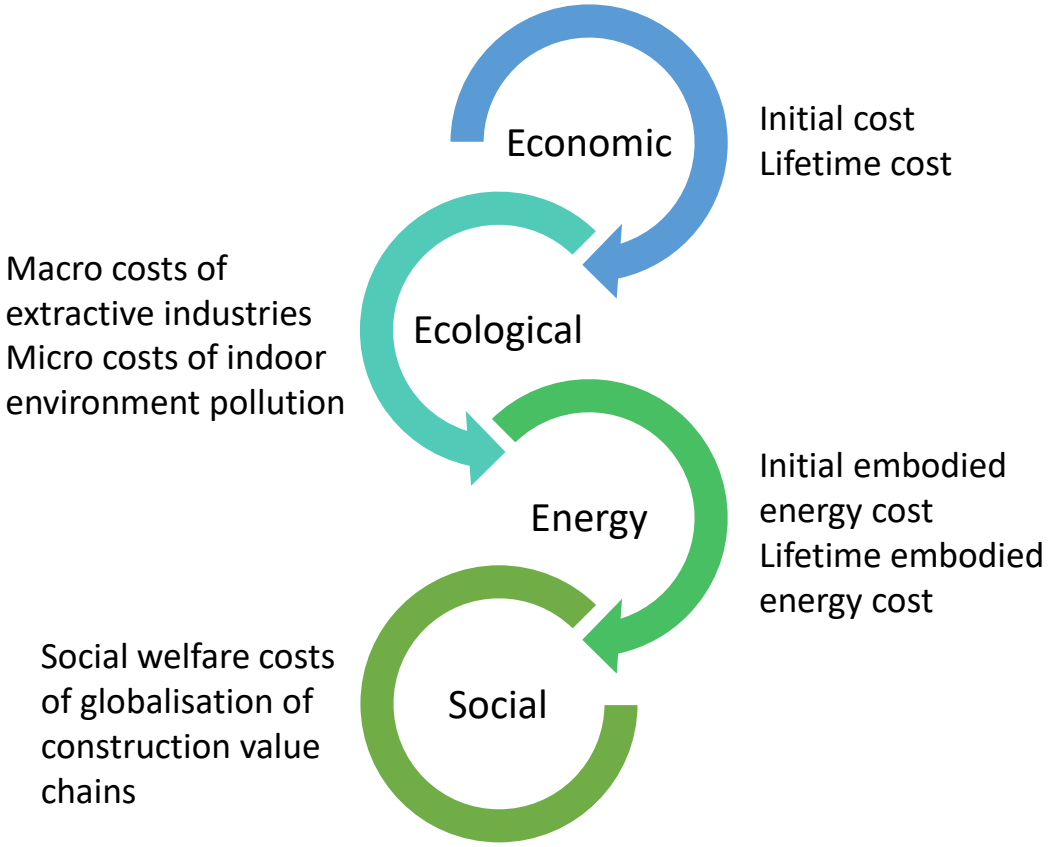
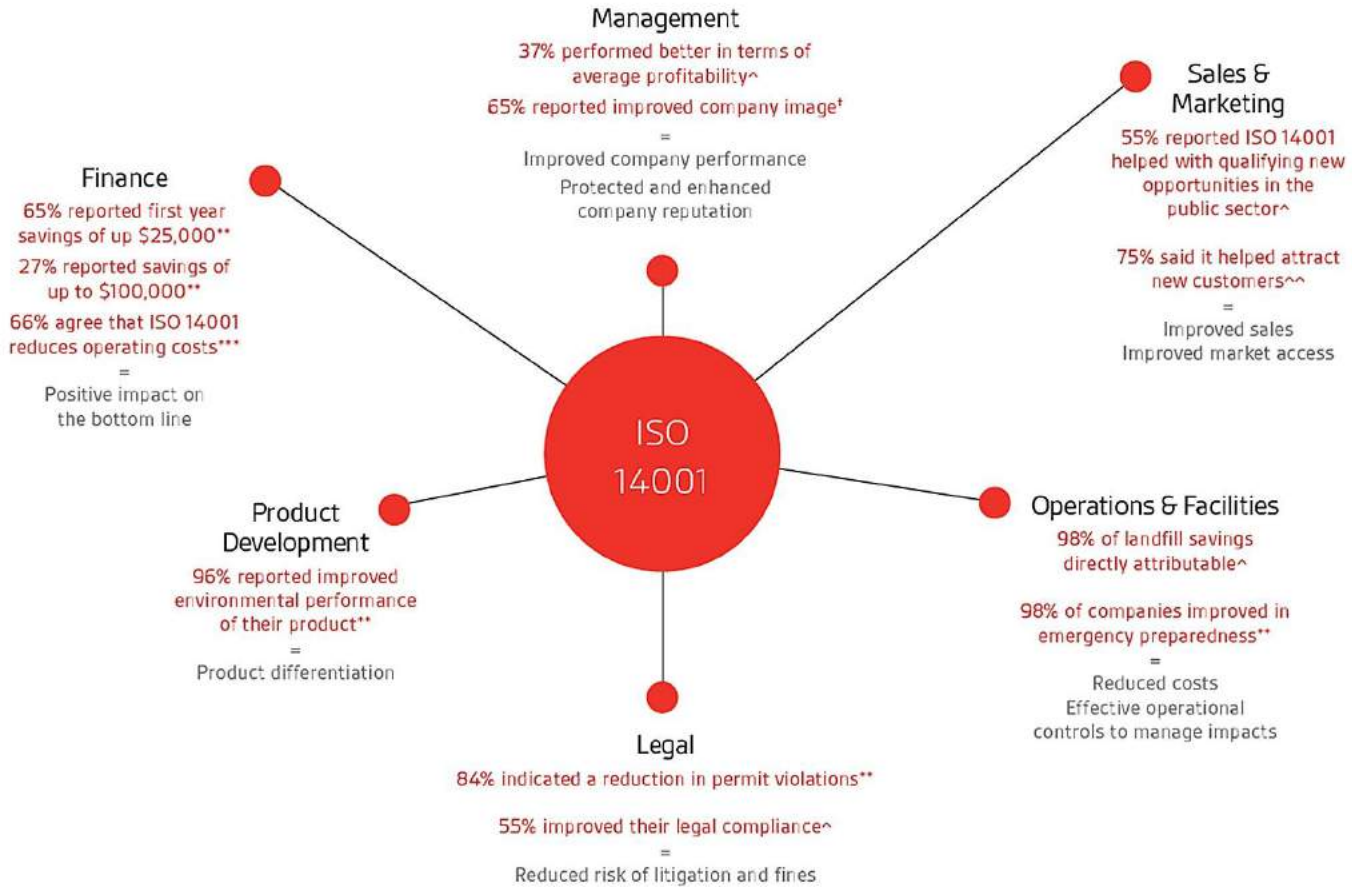
The virtuous cycle of green building products & their costs



The manufacturing sector for the built environment needs to produce, consume, reuse and recycle responsibly



ISO green certifications for products and certification providers in Kenya

ISO 14020:2000

- Environmental declarations for products

ISO 14044:2006

- Lifecycle assessments

ISO 15804:2006

- Environmental Product Declarations (EPDs) for construction products

Source: ISO

Select green certifications for products

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EDGE : Adaptation groups used for classification of embodied energy in construction materials

Group 1

- Energy-intensive, high cost materials, such as aluminum, steel and glass.
- Both electricity and fuel sources used have a significant influence on the impact, as do the efficiency of the process and the use of recycled content.

Group 2

- Fuel-intensive, lower cost materials, such as cement , bricks and kiln-dried timber. Fuel source and technology significantly affect the impact.

Group 3

- Input-related products such as concrete blocks and gypsum –based products ,where the input materials such as cement & gypsum have the greatest effect on impacts.
- Use of alternative raw materials such as ground granulated ballast furnace slags (GGBS), pulverized fuel ash (PFA) or flue gas desulfurized (FGD) gypsum has a strong influence over impacts.

Group 4

- Electricity-intensive, high cost goods such as flooring and board products. Electricity source and recycled content have the most influence on impacts.

Group 5

- Low- cost, less-processed products such as aggregates, straw, etc. These materials are generally produced locally, with predictable production processes and lower impacts.

Source: www.edgebuildings.com

Construction materials classified by EDGE embodied energy ratings

Materials	Group 1	Group 2	Group 3	Group 4	Group 5
Masonry		Brick, common brick, honeycomb clay block	Autoclaved aerated block (aircrete), lightweight concrete block, medium weight concrete block (hollow), dense concrete block, FaLG (flayash/lime/gypsum) block, cement stabilized earth block	Local stone block	Fly ash stabilized soil block
Flooring	Linoleum sheet, carpet, vinyl flooring	Ceramic tiles, terracotta tile	Terrazzo tiles	Stone tiles/slabs, laminated wooden flooring	
Glass & window	Float glass, steel window frames, aluminium window frames, PVC-u window frames, wood/plastic composite window frames.			Timber window frames	

Source: www.edgebuildings.com

Construction materials classified by EDGE embodied energy ratings

Materials	Group 1	Group 2	Group 3	Group 4	Group 5
Insulation	Expanded polystyrene, polystyrene polyurethane			Mineral wool insulation	Straw bale, jute
Metal products	Reinforced steel, structural steel section, aluminium profiled cladding corrugated galvanized steel, coated steel profiled cladding				
Plaster Products			Gypsum plaster, gypsum panel, plasterboard, phosphogypsum panel, cement based plaster		Mud plaster
Precast Concrete	.		"Ferrocement" wall panel, precast reinforcement concrete panels/flooring		

Source: www.edgebuildings.com

Construction materials classified by EDGE embodied energy ratings

Materials	Group 1	Group 2	Group 3	Group 4	Group 5
Ready mix concrete			Cement screed, OPC concrete, PFA concrete, CGBS concrete		
Roofing tiles		Clay roofing tile	Micro concrete roof tile		
Timber products		Kiln-dried timber		Plywood sheathing	Sawn timber

Source: www.edgebuildings.com

Sample ABTs available in Kenya

Flooring

Group	Product
1	Poly-vinyl chloride flooring
2	Self-levelling epoxy
3	Terrazo
4	Ceramic
5	Red oxide

Walling

Group	Product
1	Expanded polystyrene
2	Prefabricated modular units
3	Precast concrete panels
4	n/a
5	Interlocking soil stabilised blocks (ISSB) Compressed agricultural fiber panels Prefabricated timber panels & buildings

Roofing

Group	Product
1	Light gauge steel
2	Hollow pot technology
3	n/a
4	n/a
5	Building integrated solar photovoltaic tiles Ekoboard (recycled tetrapak) Modroof roofing material

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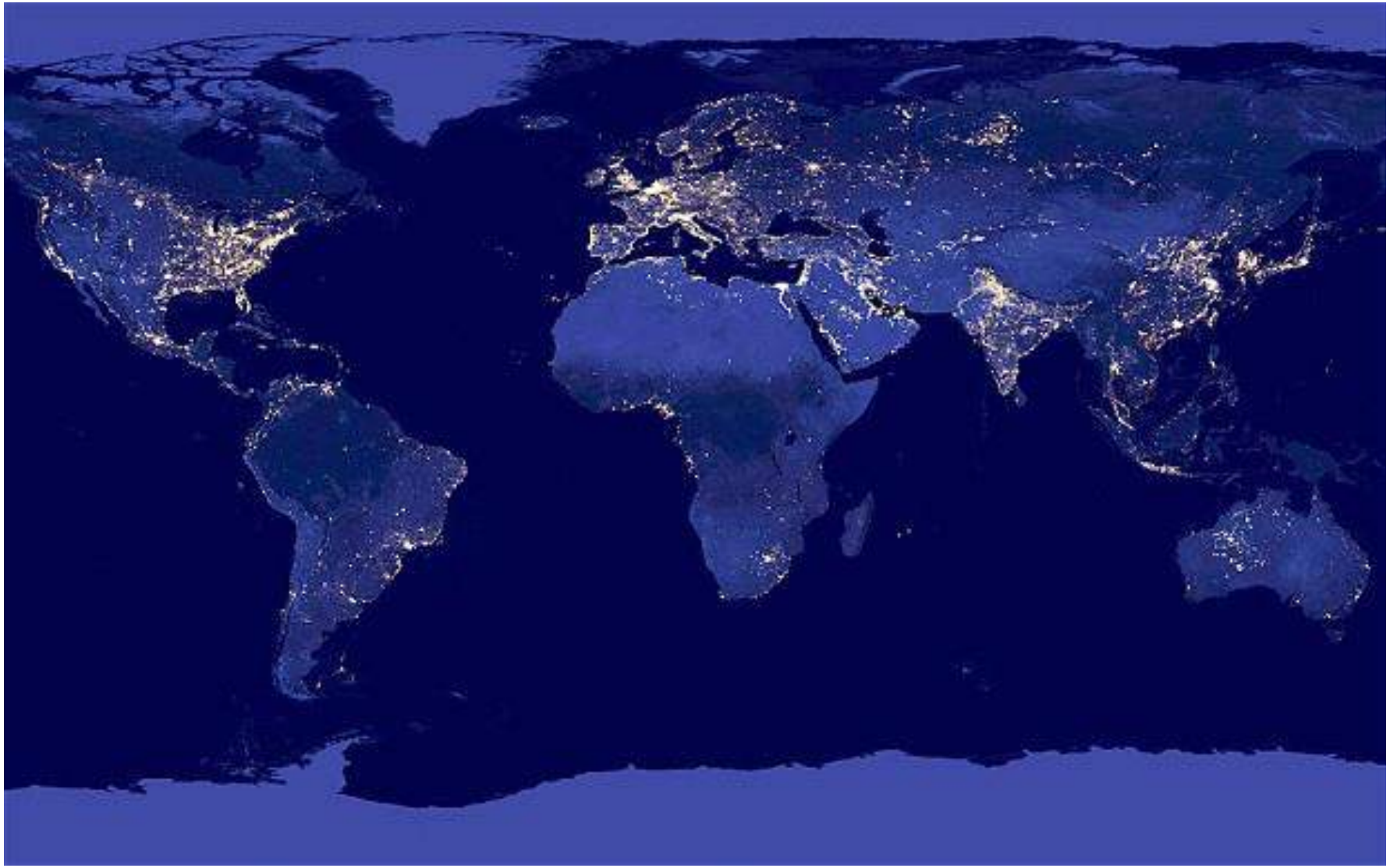
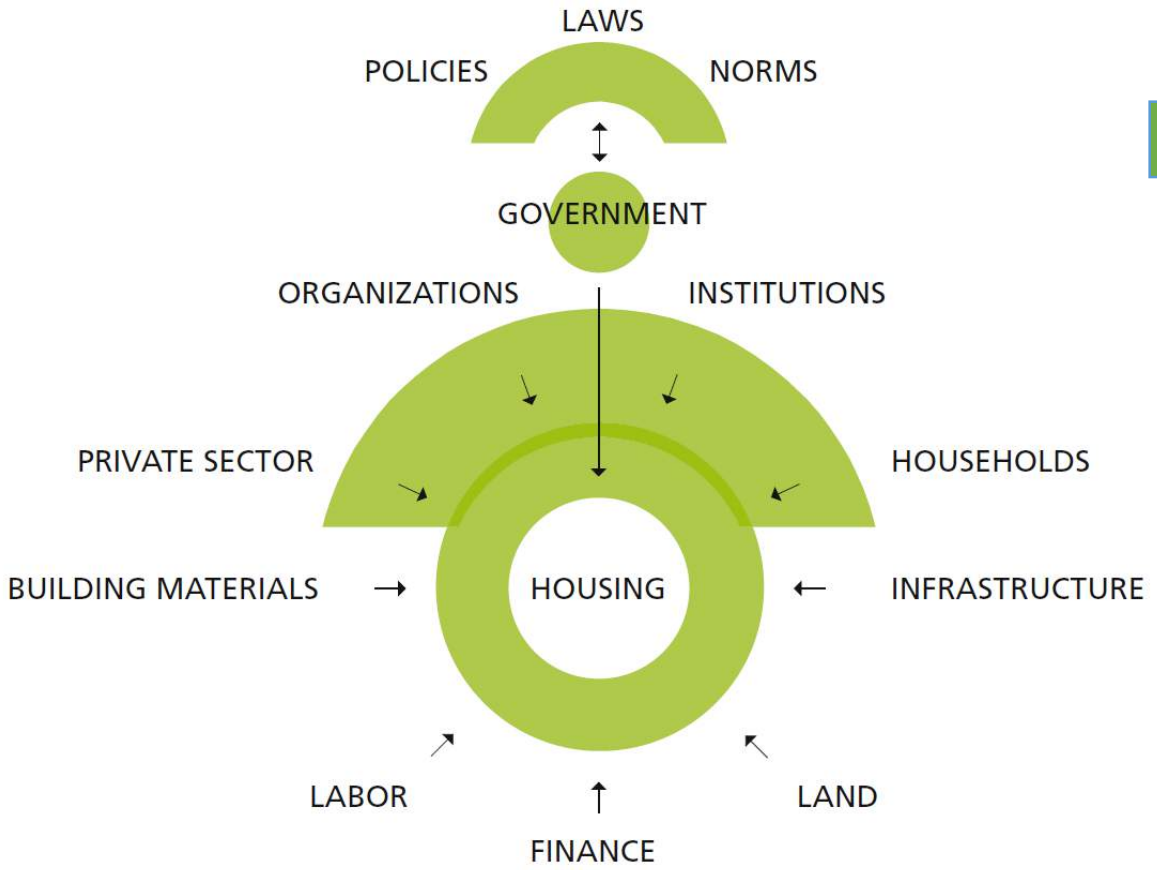
Africa is yet to build out much of the infrastructure for its growth and can still do it sustainably



Source: http://blogs.worldbank.org/developmenttalk/night-lights-and-pursuit-subnational-gdp-application-kenya-rwanda

Meanwhile, the desertification of Kenya is visible

Stakeholders, opportunities & challenges



Big 4 Agenda priority for affordable housing

Opportunity to unlock public and private land

Local and multi-national capital to deploy

Sovereign & corporate green bond for local currency green projects

Outdated building code

Tenure of title

Graft

Shallow skilled labour market

Poor state of bulk infrastructure

High dependency on imported building material

High interest rates

Highly inflationary land prices

Sustainable construction materials

Wood & straw construction

- Easy to work with without a high level of required technical expertise or expensive tools
- Allow good insulation possibilities: straw has a good insulation value on its own and skeletal wood construction allows easy insulation in comparison monolithic constructions.
- Bamboo construction has a lot of potential in the affordable housing sector but the treatment and proper jointing of bamboo need to be ensured.

Earth & stone construction

- Earth and stone construction presents good thermal mass opportunities and a lot of potential in the affordable housing sector to produce comfortable housing interiors, especially in the hot and dry climate zone.
- New ways of producing and using mud bricks, for example through stabilized soil block technologies, has enhanced the abilities of traditional adobe bricks and made them more attractive as an affordable construction material and building system.

Sustainable concrete uses

- Concrete is one of the most used construction materials in the world today.
- Concrete has many advantageous characteristics, which explains its wide use, but it also has a high embodied energy and its production can emits harmful substances.
- Additionally, the production of steel needed for reinforcement of concrete has a major environmental impact.
- New ways of producing more environmentally friendly concrete materials and construction systems should be developed and promoted.

Timber

- **Cross-laminated timber(CLT)** is becoming an increasingly well-known and popular product for residential construction.
  - Timber boards (typically spruce, pine or larch) are stacked and glued with the orientation of the grain crossed at every layer for 3, 5 or 7 layers (though more is possible).
  - The newly laminated boards can then be prefabricated to make interior and exterior walls, floor and ceiling panels, and roof elements that do not need additional finishing.
  - Cross-laminated timber is good for multi-unit residential buildings since structurally it can span long distances and is lightweight and long-lasting. Currently, the cost of using CLT is equivalent to traditional timber construction.
- **Reclaimed and recycled timber**
  - Effective way of repurposing old wood. Reclaimed timber is salvaged when wooden structures such as factories, warehouses and bridges are deconstructed. Reclaimed timber is appealing since in addition to reducing the need for virgin materials, it is often of varieties that are expensive and in low-supply today.
  - Reclaimed timber is also valued for its aesthetic quality, and is better suited for flooring or façades than for structural framing. Recycled timber can be used to make various composite boards such as oriented strand board, medium-density fiberboard, or particle board, though its important to consider the safety of the resins that bind them.

Source: UN Habitat

Natural material

Few environmental impacts of the process of preparing timber for construction

Can lower carbon emissions related to transportation when used locally, bamboo construction

Sustainably harvested timber **may help communities sustain forest resources and promote traditional crafts and building types through the use of local materials**

Wood structures usually require other materials such as metals and insulation in order to be properly constructed

Affordable fire-proofing can be a challenge as well as achieving resistance to insects, water-damage, and rot

Deforestation and illegal logging also threaten sustainable usage of timber

Bamboo

- **Bamboo products can stimuate local economic development and create employment opportunities** (China's bamboo industry alone employs 5 mil people) if workers are successfully trained
- **Engineered bamboo products** such as various types of bamboo composite lumber and bamboo panel products are becoming more widely available. In some instances the usage of many of these products is preferable to wood given the specific structural or material needs of the project
- In addition to construction materials, the products fabricated from bamboo also include textiles, jewellery, woven mats and other trades more typically accessible to women. The possibility for **inclusion at multiple levels** lends bamboo processing to community-based growth and production

Natural material

Few environmental impacts of the process of preparing bamboo for construction

Can lower carbon emissions related to transportation when used locally

High productivity makes it an ideal substitute for timber, since it can be grown and harvested at a much faster rate.

Can also curtail deforestation by reducing the need for wood and help with the regenerationof forest on degraded land.

Since bamboo maintains a thick canopy of the over forest ground, it has tremendous ability to **decrease soil erosion, provide both food and habitat for wildlife, aid with biomass regeneration, and increase carbon sequestration**

Biodegradation

Vulnerability to fire and insects

Short service life

Some **difficulty forming secure joints and connections.**

Since bamboo construction is not well established in many countries, bamboo may not be widely available or face regulatory problems which restrict its usage in construction

Source: UN Habitat

Concrete production

- **Governments can make sustainable usage of concrete more feasible** by providing subsidies for alternative stabilizers or facilitating access to industrial waste
- **Portland cement substitutes**: mixture of lime and pozzolana (industrial waste like fly ash and foundry slag or natural materials like volcanic sands) known as CP40, which has half the embodied energy of cement and can replace it by as much as 40 percent
- **Ferro-cement construction:** involves reinforcing concrete with wire-mesh and narrow rebar, and can be used to make wall panels, ceiling and floor slabs and roofs
- **Concrete recycling** is another way of reducing the environmental impacts of the material. Recycling concrete takes the aggregate left when buildings and other concrete structures such as roadways, highways and sidewalks are demolished, and uses it to replace natural aggregates like stone, sand and gravel.

Source: UN Habitat

BES 6001
Responsible Sourcing
www.greenbooklive.com

Durable

Not susceptible to water damage, mold or pests

Inclusive social activity

Portland cement: airborne pollutants; high embodied energy

Steel: negative environmental impact; minimal insulation value

Sand: non-sustainable dredging activity

Water: Scarce in many parts of Africa

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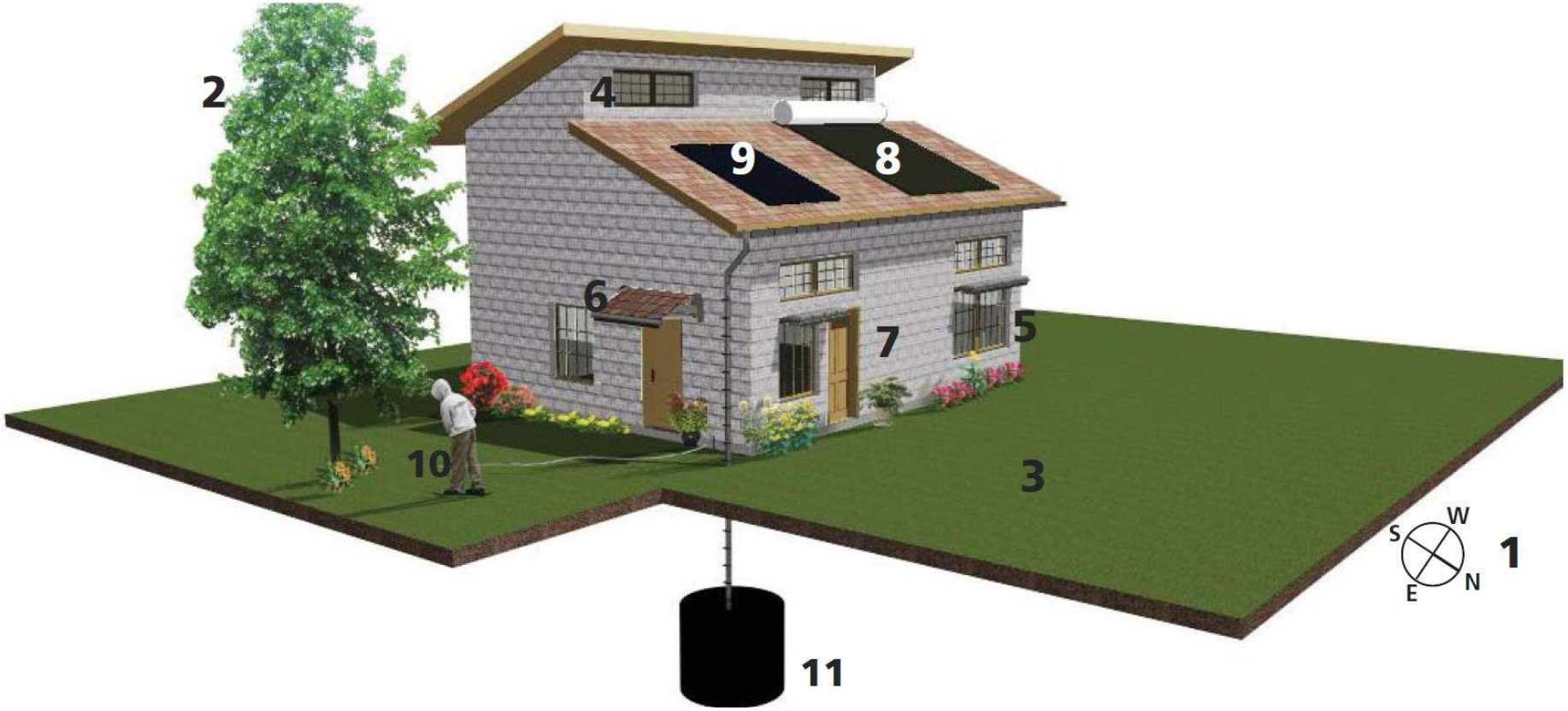
How green homes can provide the building blocks towards several UN Sustainable Development Goals
#homegreenhome
1 NO POVERTY
Green building can curb unemployment and provide local employment and training opportunities
3 GOOD HEALTH AND WELL-BEING
Green buildings can improve people's health & wellbeing
6 CLEAN WATER AND SANITATION
Green buildings help solve the water crisis by conserving every precious drop
7 AFFORDABLE AND CLEAN ENERGY
Green building can use renewable energy, becoming cheaper to run
8 DECENT WORK AND ECONOMIC GROWTH
Building green infrastructure creates jobs & boosts the economy
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
Green building design can spur innovation & contribute to climate resilient infrastructure
11 SUSTAINABLE CITIES AND COMMUNITIES
Green buildings are the fabric of sustainable communities & cities
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
Green buildings use 'circular' principles, where resources aren't wasted
13 CLIMATE ACTION
Green buildings produce fewer emissions, helping to combat climate change
15 LIFE ON LAND
Green buildings can improve biodiversity, save resources & help to protect forests
17 PARTNERSHIPS FOR THE GOALS
Through building green we create strong, global partnerships
WORLD GREEN BUILDING WEEK
24 – 30 SEPT 2018

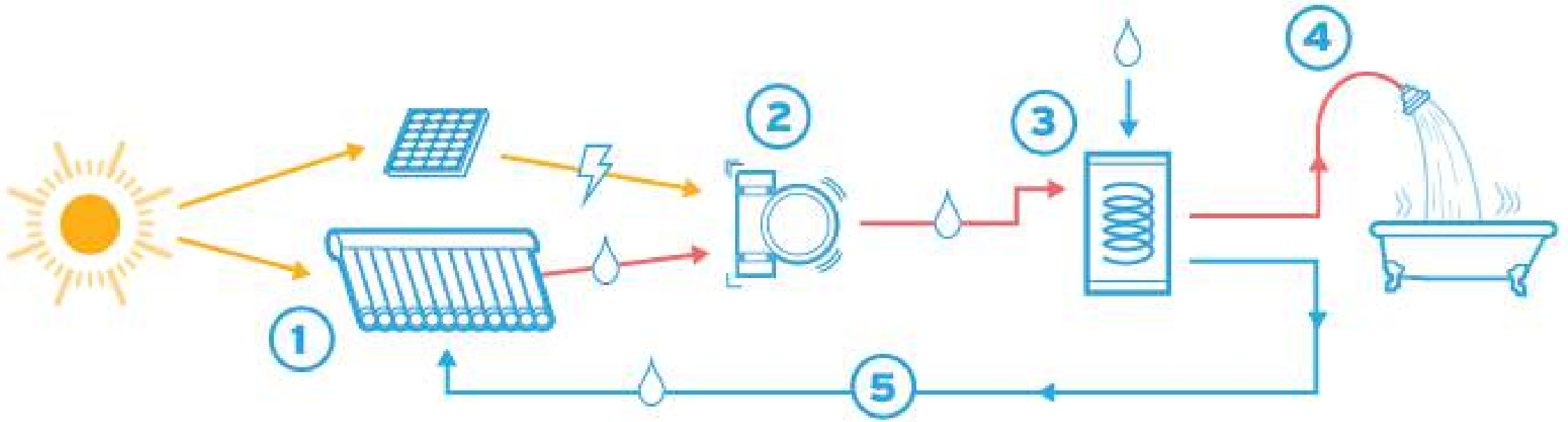
Examples of green building strategies



Source: UN Habitat

1. Orientation
2. Vegetation
3. Permeable area
4. Natural vertical ventilation
5. Natural lighting
6. Overhang for shading
7. Local building materials
8. Solar Water Heaters (SWH)
9. Solar Home System (SHS)
10. Waste water reuse
11. Rain water collection

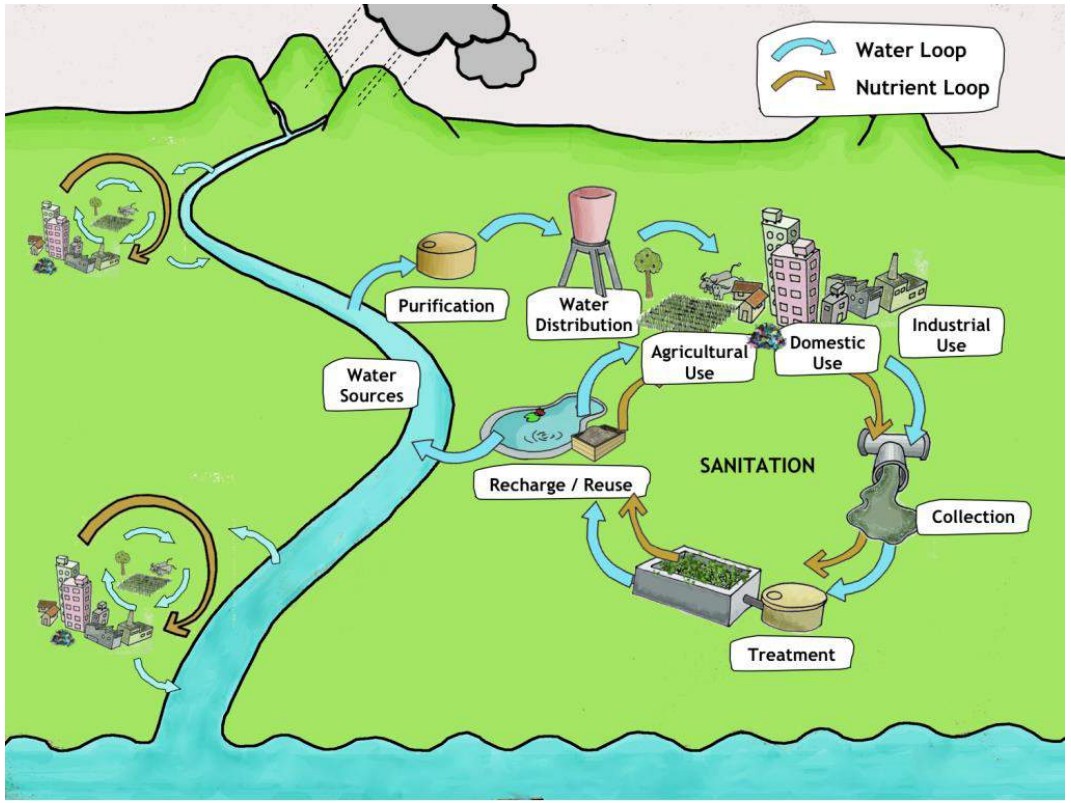
Solar energy for power and water heating



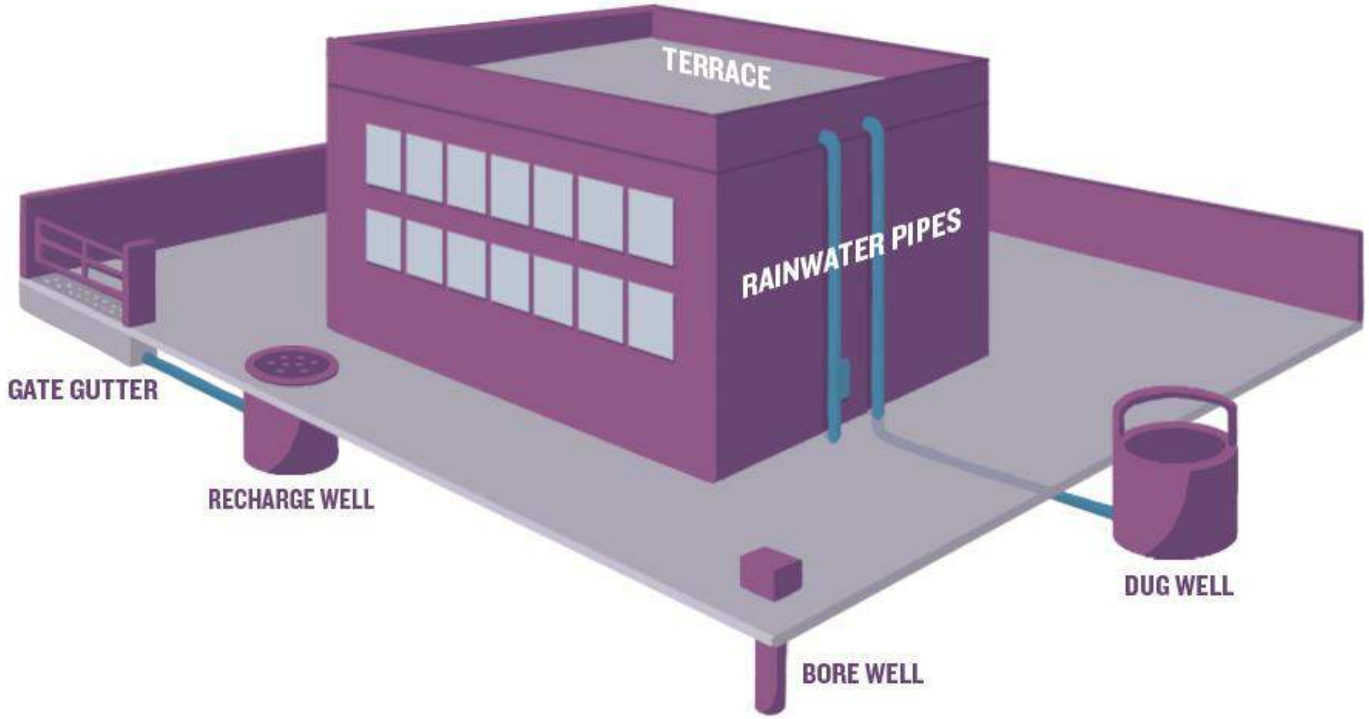
The sun heats the mixture in the tubes (#1 on the above illustration) which is then transferred via a solar powered electric pump (#2) to a water storage tank (#3 ,which looks like a typical water heater) located in the ceiling. In the storage tank, heat is transferred to potable water through a heat exchanger, which renders the potable water hot and ready for use (#4). The cooled water/coolant mixture is then cycled back to the rooftop tube installation to start the process over (#5).

Source: https://greatercea.org/solar-thermal-home-water-heating-and-portable-stoves/

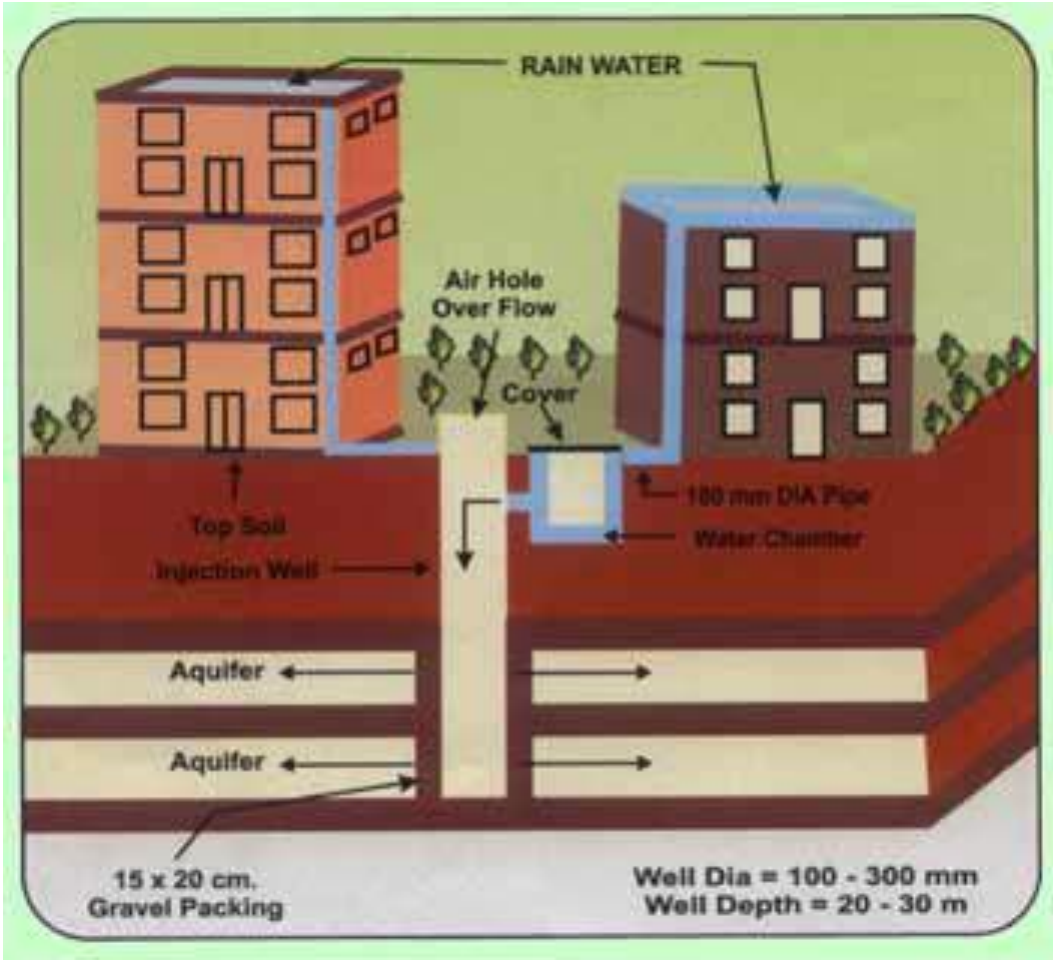
Solid and liquid waste management are increasingly dependent on offgrid non-governmental solutions



Boreholes aren't sustainable unless we recharge the aquifers



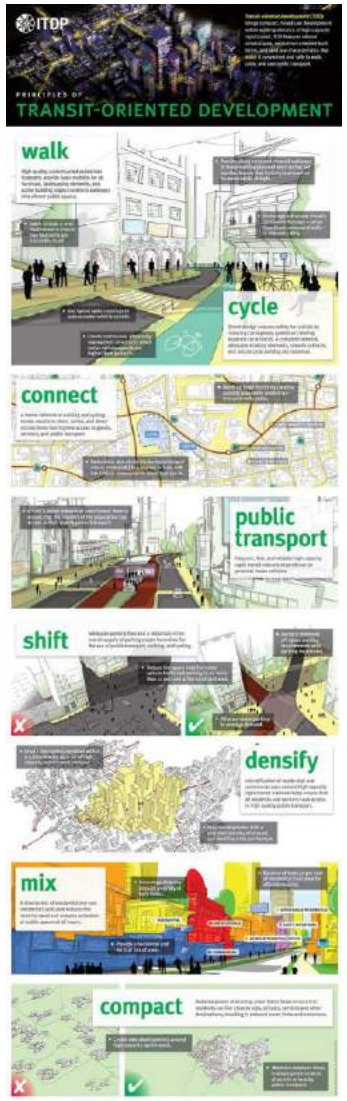
Source: http://www.thealternative.in/lifestyle/recharge-wells-and-why-we-need-them/



Source: http://www.thealternative.in/lifestyle/recharge-wells-and-why-we-need-them/

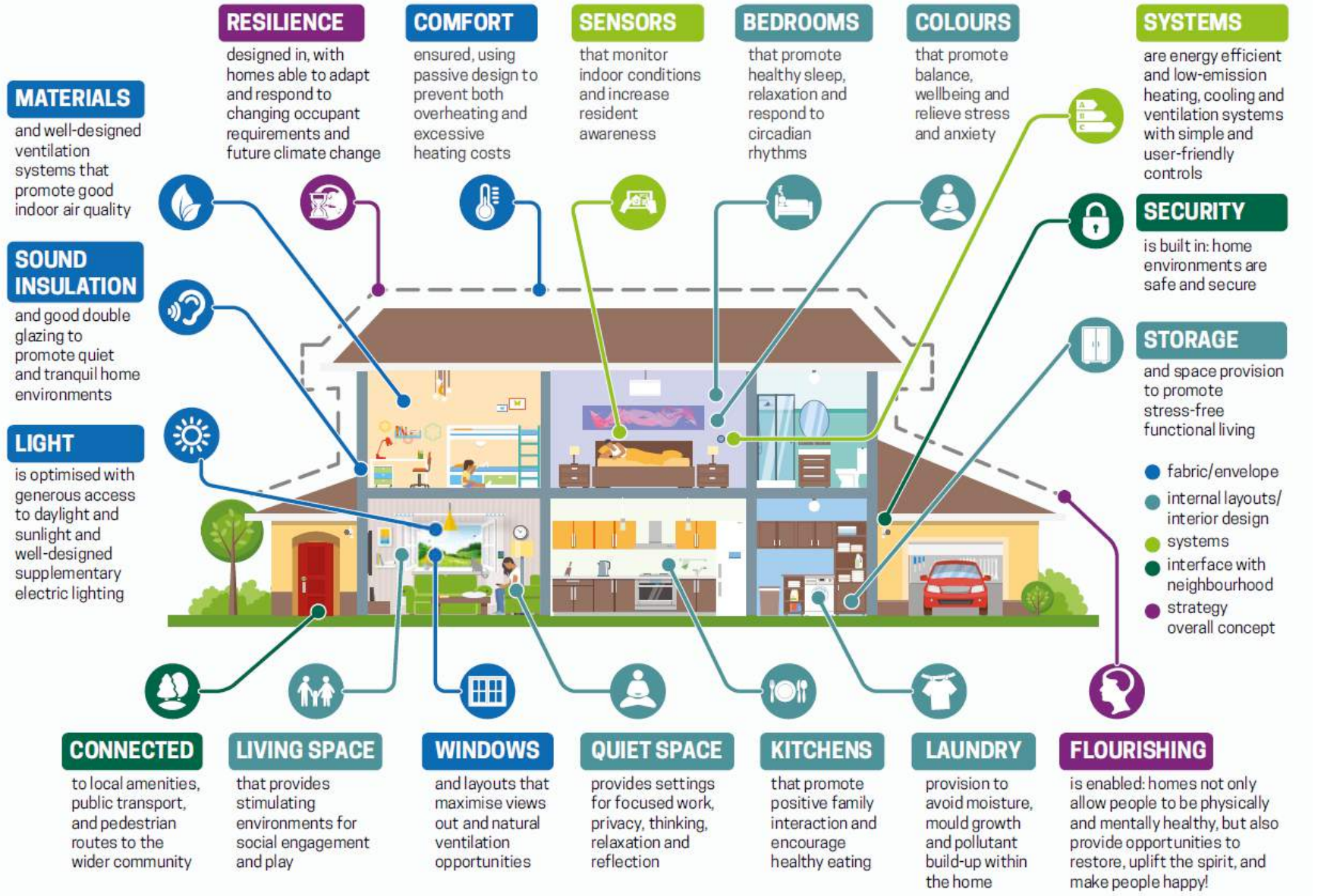
Affordable housing will never be affordable if it's far from everything that matters

Source: http://zoningnews.tumblr.com/



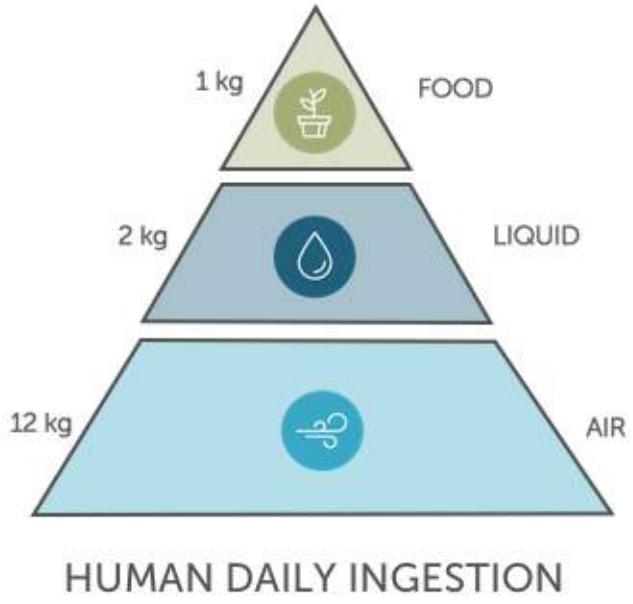
Source: ITDP

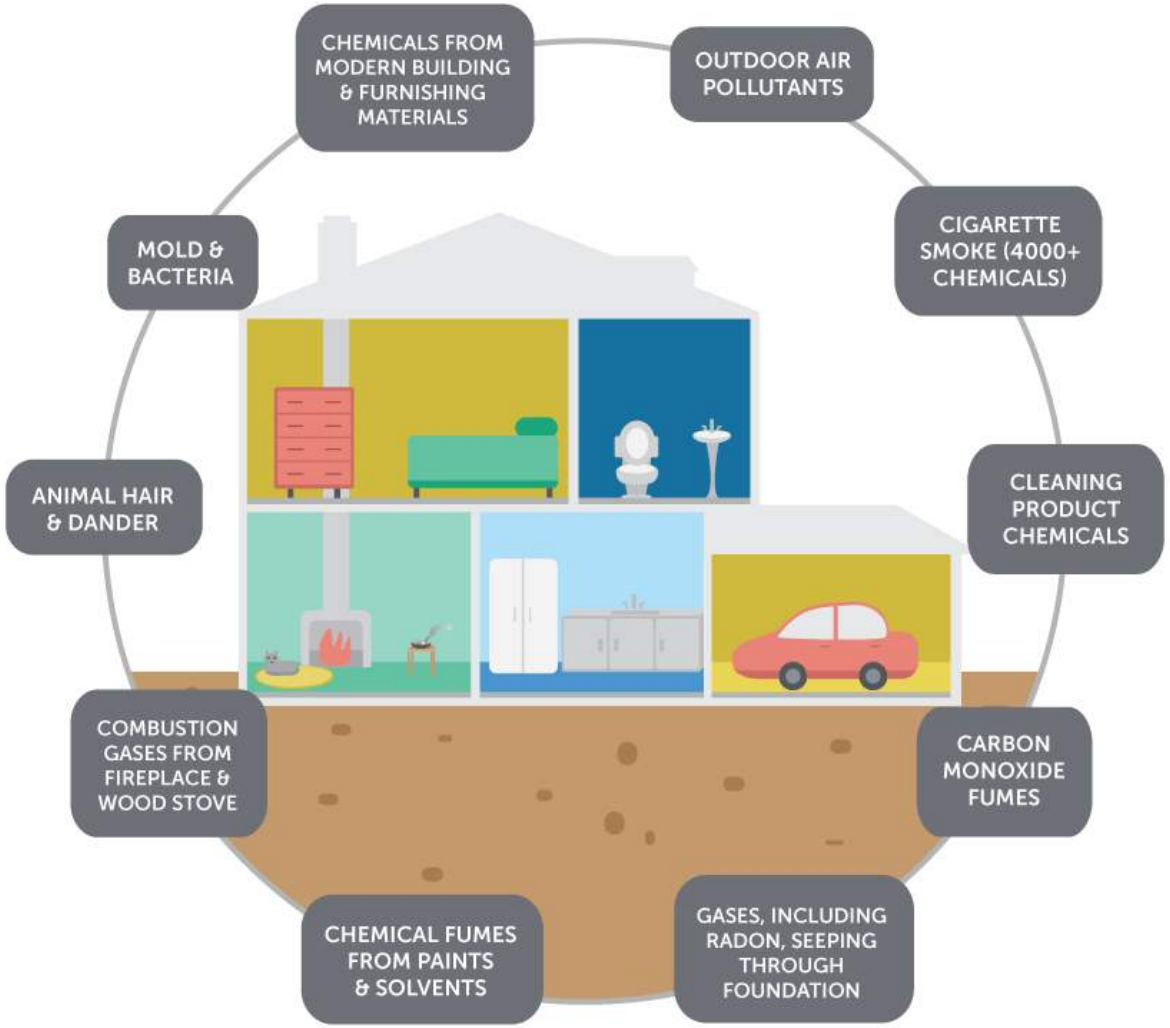
What is a healthy home?



Source: HEALTH AND WELLBEING IN HOMES JULY 2016; UK Green Building Council

Air Wellography – you are what you breathe





Source: https://www.wellcertified.com/en/articles/top-5-takeaways-air-wellography

IEQ

While businesses are increasingly recognizing that buildings that better support their employees also result in better organizational outcomes, they are less certain of how they should be leveraging buildings to positively impact people. In addition, many businesses believe that people can adjust to any environment and so often make changes to the environment only when it directly interferes with work performance, rather than being proactive and exploring how the environment can positively influence productivity and well-being.

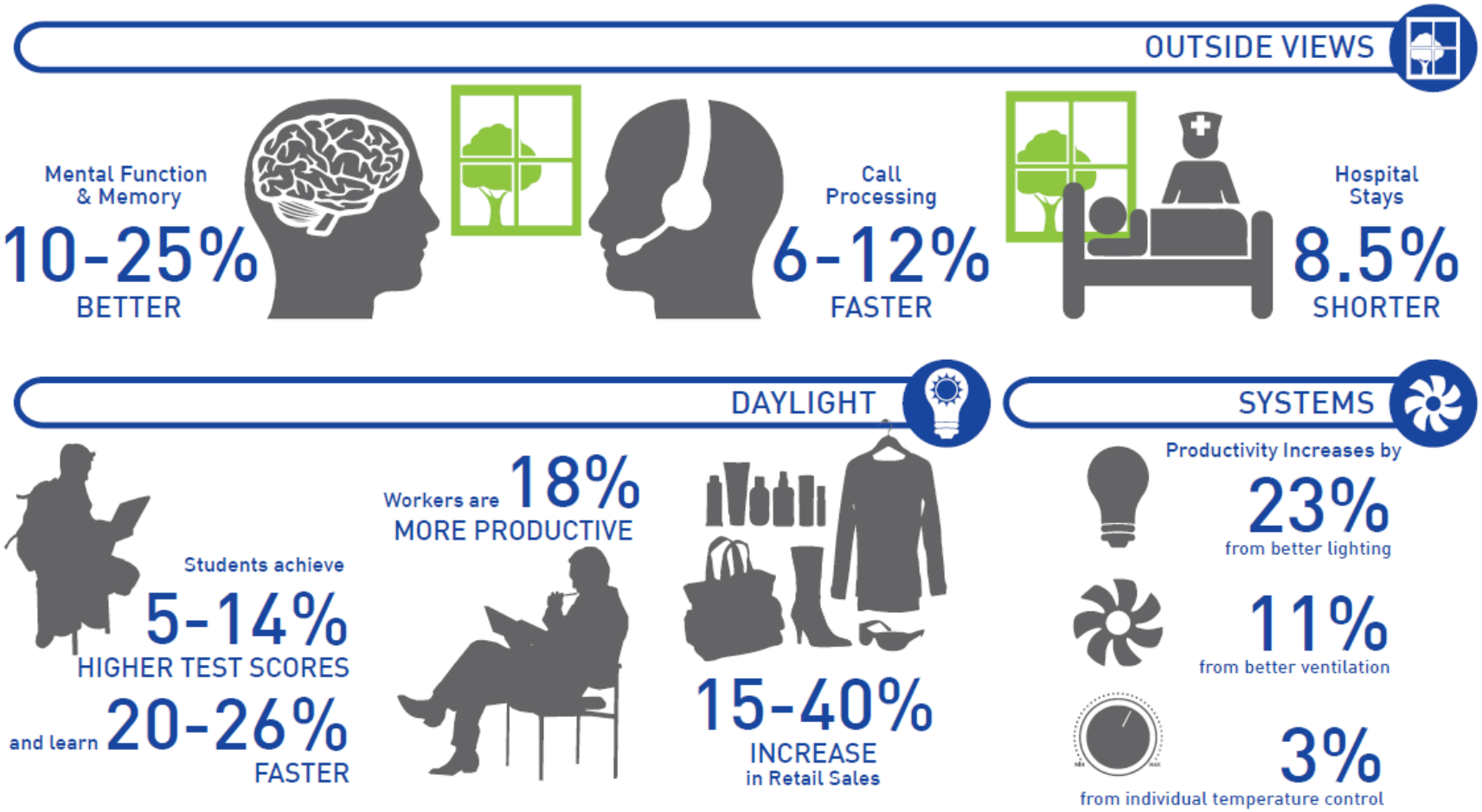


Figure 11
Net present value analysis of the operational cost and productivity and health benefits of LEED certified buildings

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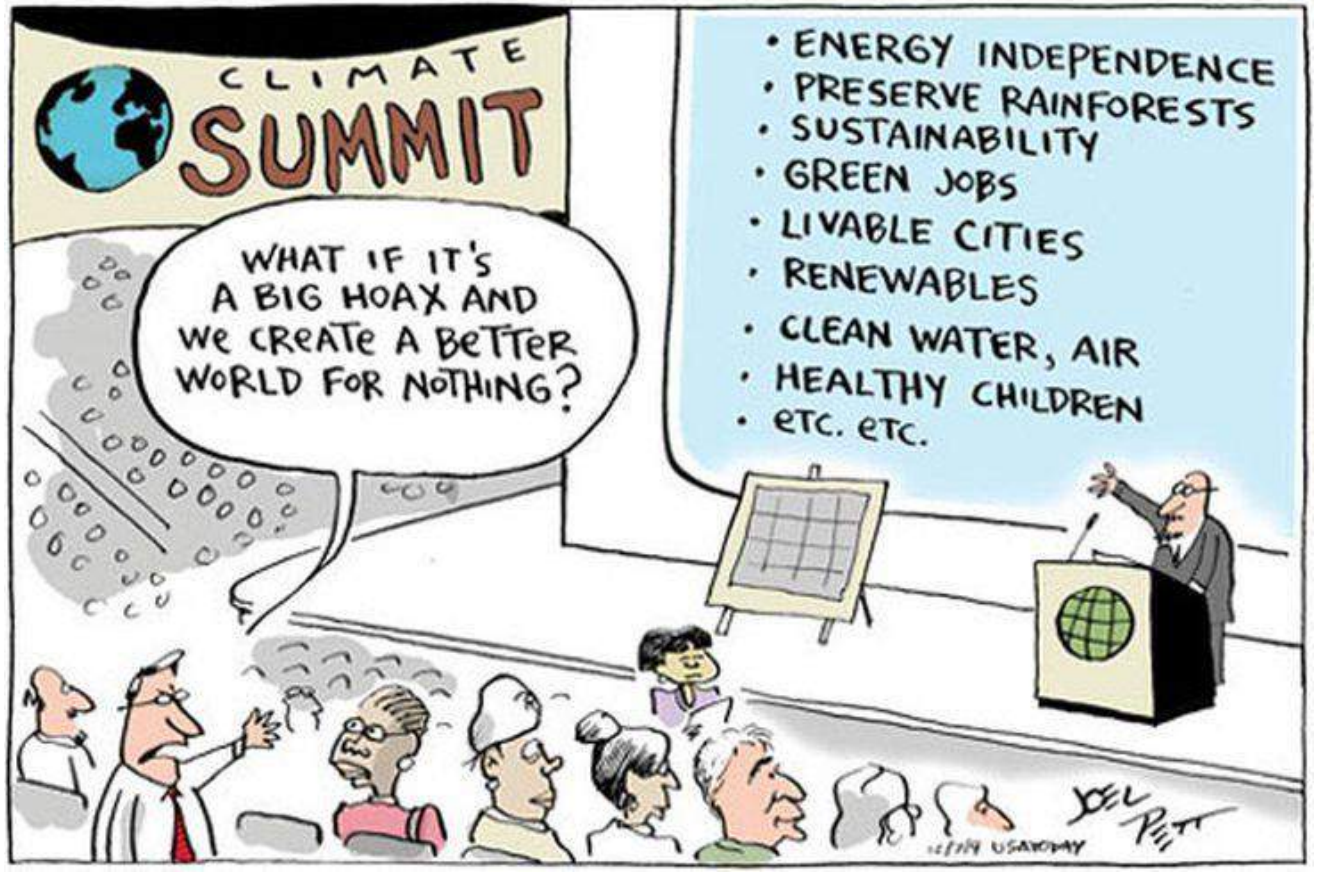
The business case for sustainability



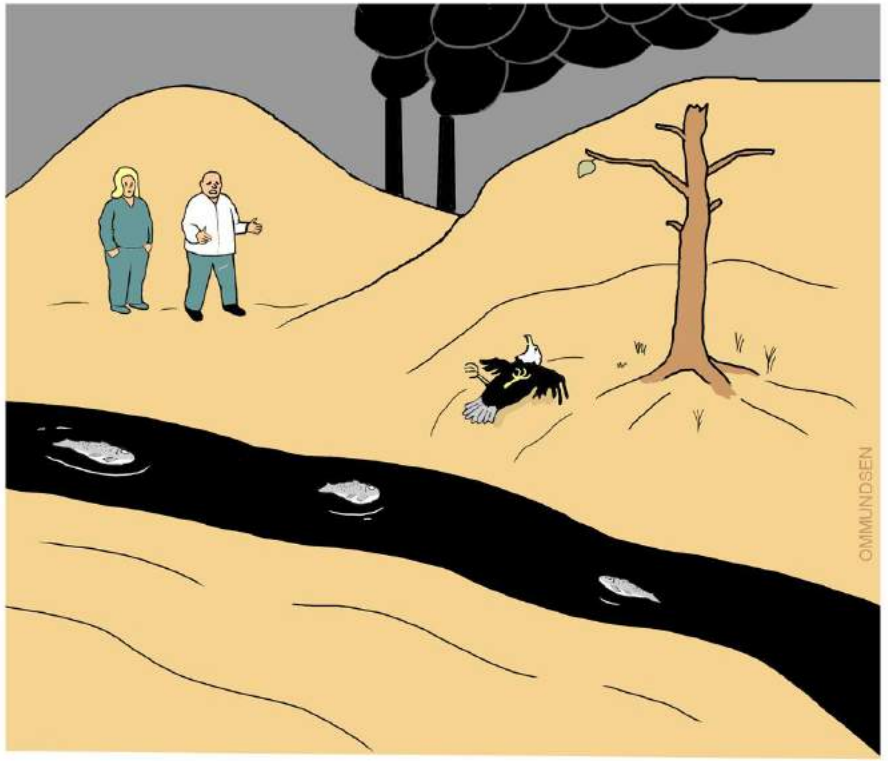
"Yes, the planet got destroyed. But for a beautiful moment in time we created a lot of value for shareholders."

Source: New Yorker Magazine

Building to outdated building codes & poor governance

"A high-rise block of flats would give many people a chance to enjoy a rural life..."

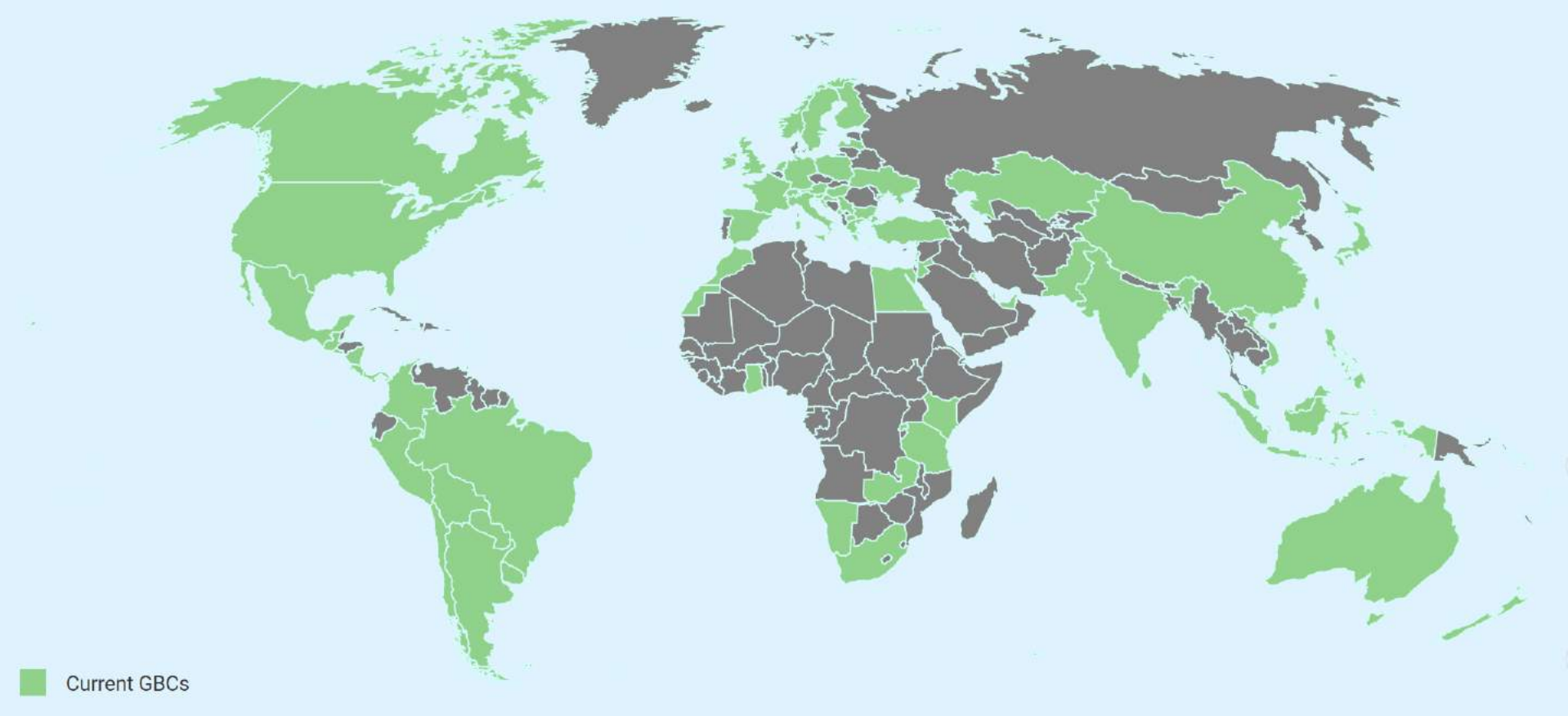
Impact of poor planning on our ecosystems



"They may not be *healthy* ecosystems, but we like to think that they're *happy* ecosystems."

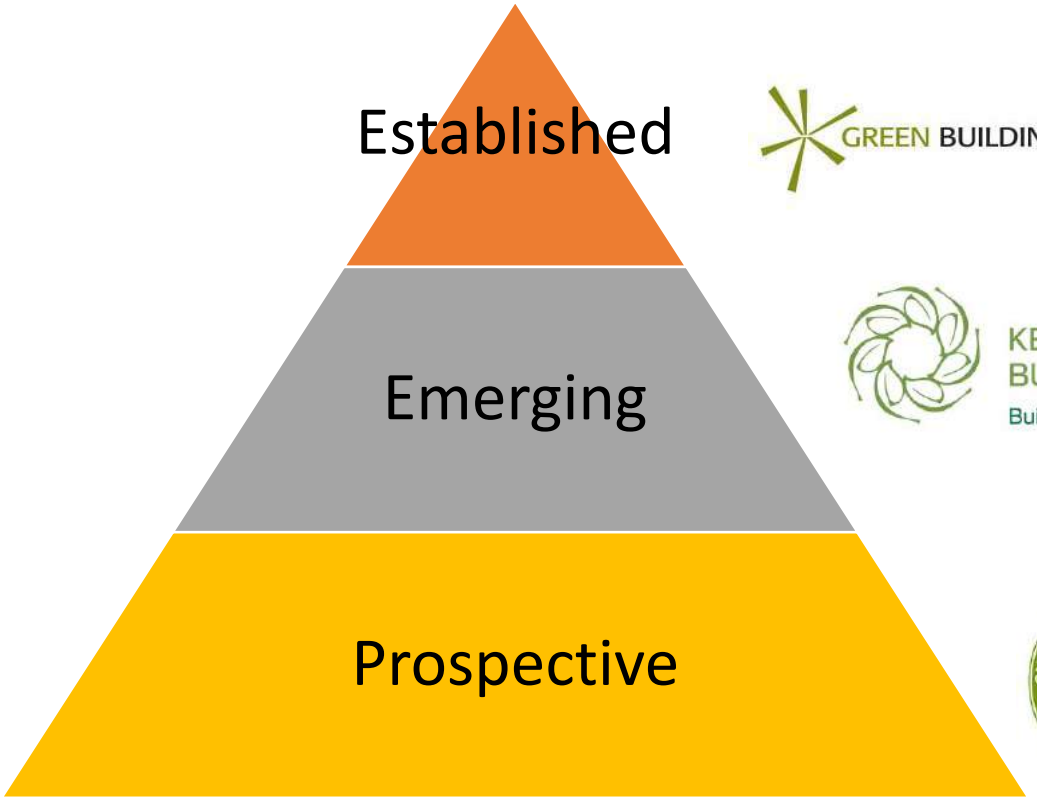
Greenwashing

Africa's green building movement remains under-developed



Source: www.worldgbc.org

There are seven WGBC registered green building councils in sub-Saharan Africa



GREEN BUILDING COUNCIL SA

KENYA GREEN BUILDING SOCIETY
Build Green Save Kenya

Showing Interest
Botswana
Cameroon
Democratic Republic of Congo
Ivory Coast
Libya
Nigeria
Senegal
Sudan
Tunisia
Uganda

GHANA GREEN BUILDING COUNCIL GHGBC

gbcm

GREEN BUILDING COUNCIL NAMIBIA

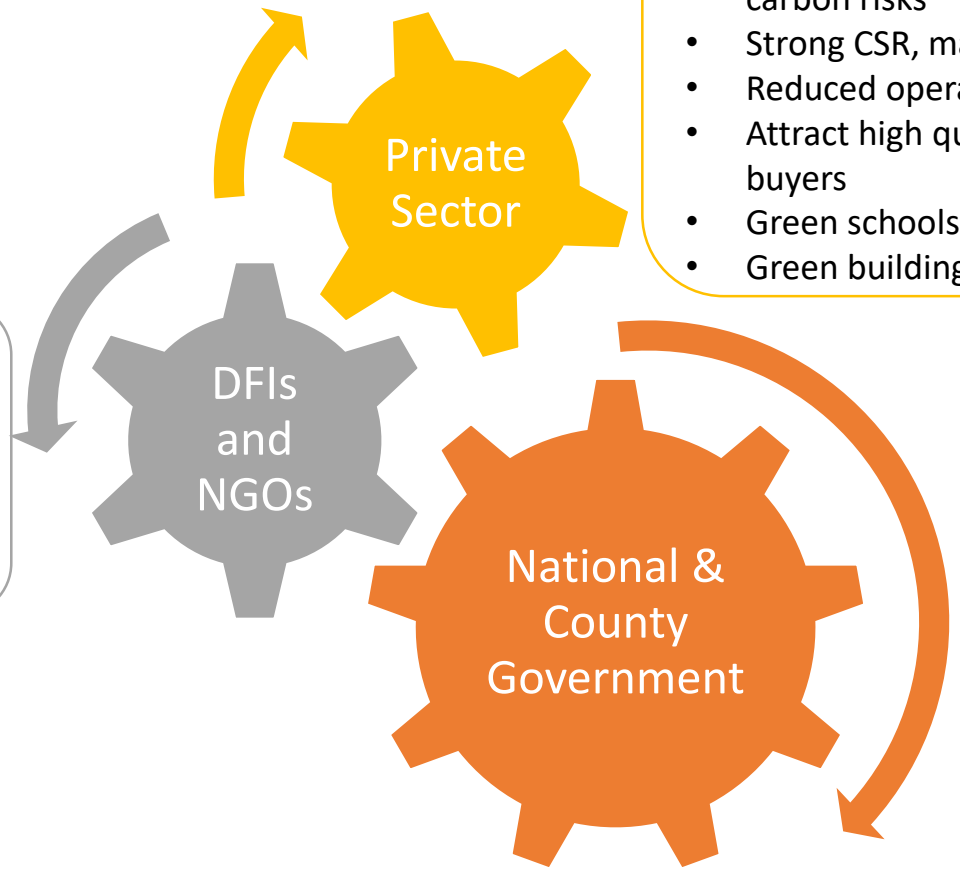
RwGBO
Rwanda Green Building Organization

TANZANIA GREEN BUILDING COUNCIL

Source: www.worldgbc.org

KGBS' Theory of Change

- Corporate & individual engagement
- Assets of high quality and value
- Long-term resiliency to mitigate carbon risks
- Strong CSR, market recognition
- Reduced operating costs, good ROI
- Attract high quality tenants & buyers
- Green schools initiative
- Green buildings for everyone



- Collaborate with complementary organisations
- Unlock green finance
- Capacity building within public and private sector
- Boost a circular green economy

- Achieve Paris Agreement commitments for GHG emissions
- Advocate for built environment solutions to achieve national climate change agenda at national and county level
- Align Kenya's Medium Term Plan 3 and Green Economy Strategy Implementation Plan
- Benchmark & track green building data

KGBS' Vision, Mission, Values

Vision

To transform the construction industry and built environment to a sustainable future, promoting healthy and sustainable environment for the nation.

Mission

To advocate and educate on green building design principles, practices, technologies and operations

Enabling objective measurement and recognition of green buildings by use of a set framework in order to achieve an environmentally, socially and economically progressive built environment

Values

Integrity

Professionalism

Resilience

Equality

Wellbeing for all

About Kenya Green Building Society

Who

Independent

Non-profit

Non-political

Member-based organization

“Emerging” status member of the World Green Building Council

What

Lead the transformation of the built environment in Kenya toward environmentally sustainable buildings

Build a green economy value chain

How

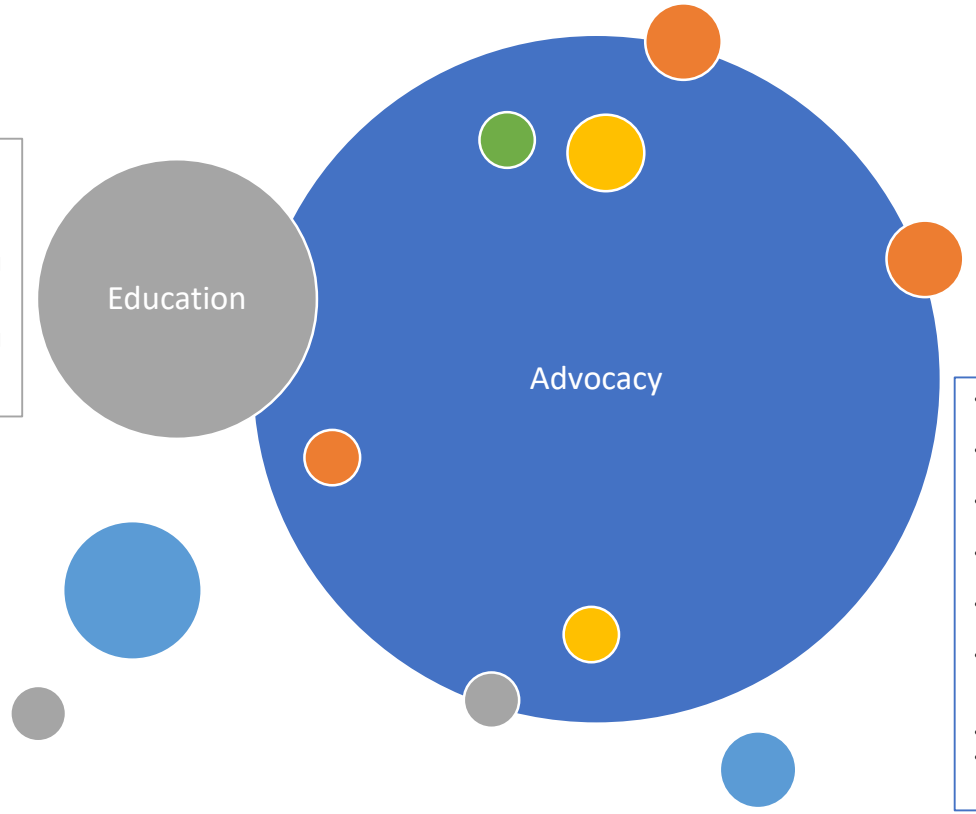
Advocacy

Education

Certification of green buildings

Goals aligned with KGBS' core objectives

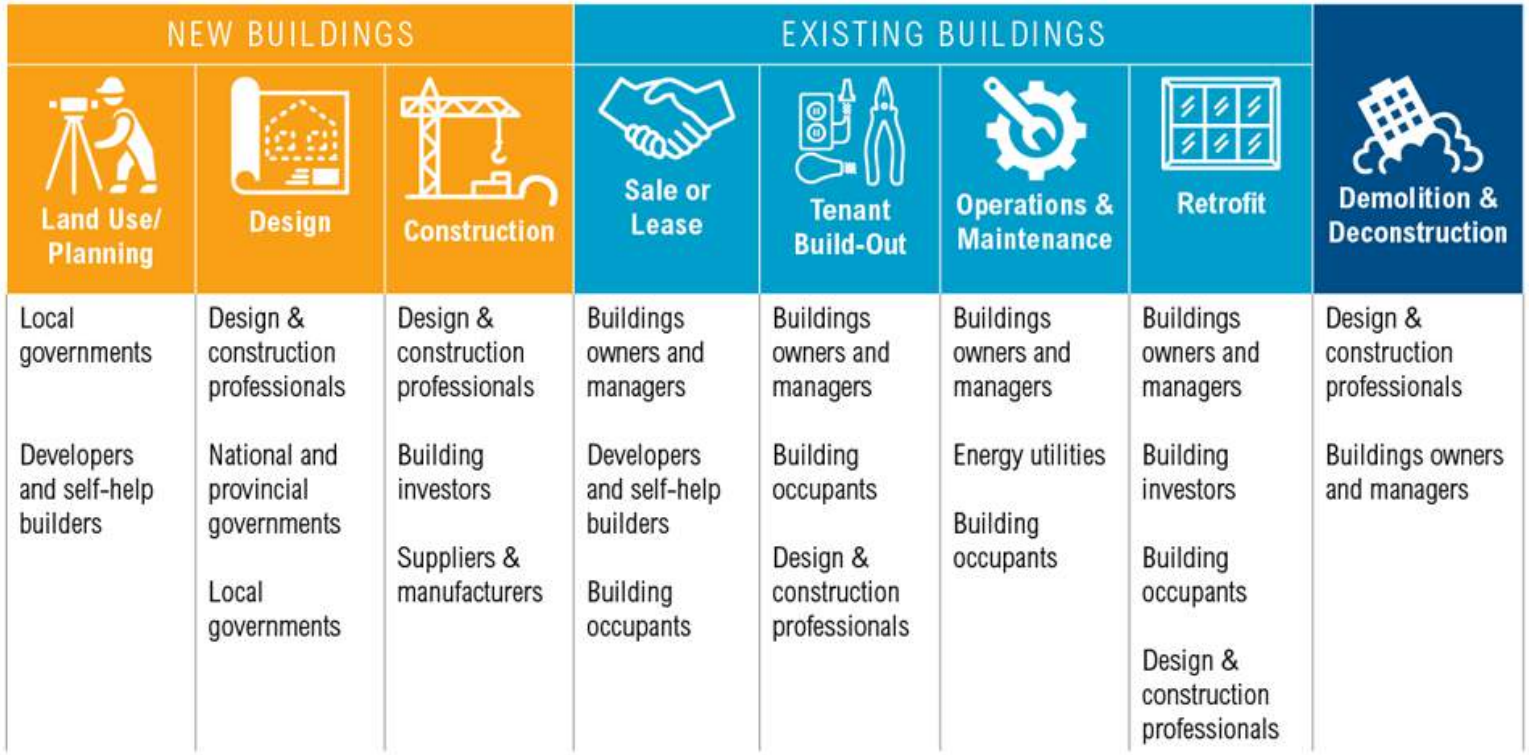
- To raise professional and ethical standards by publicizing environmentally responsible practices within the building industry and the wider community.
- To support and encourage teaching programs aimed at raising the knowledge and awareness of green buildings.
- To support and encourage teaching programs aimed at raising the knowledge/awareness of green buildings.



- To develop a standard which is recognized as a quality management system for design, building and construction, and to develop and publish a code of conduct and a standards measurement, and seek their recognition as quality management systems for building.
- To independently assess and ensure that members conform to requisite standards.

- To provide and sustain a forum for members to address issues of common interest geared towards achieving the goal of promoting green buildings.
- To lead the transformation in the construction industry towards environmentally sustainable buildings, promoting healthy and efficient environments.
- To promote and improve the awareness of green building designs, practices, programs, technologies and operations.
- To campaign for the wider recognition of environmentally responsible buildings and lead a market transformation of the building industry.
- To raise professional and ethical standards by publicizing environmentally responsible practices within the building industry and the wider community.
- To affiliate and/or co-operate with, or subscribe to any association, society, corporation or organization in any part of the world, whose objects are in general respects, similar to the Objects of this Society.
- To form branches of the Society in any part of the country.
- To campaign, solicit or otherwise obtain funds to be applied towards the above objectives.

Stakeholder mapping

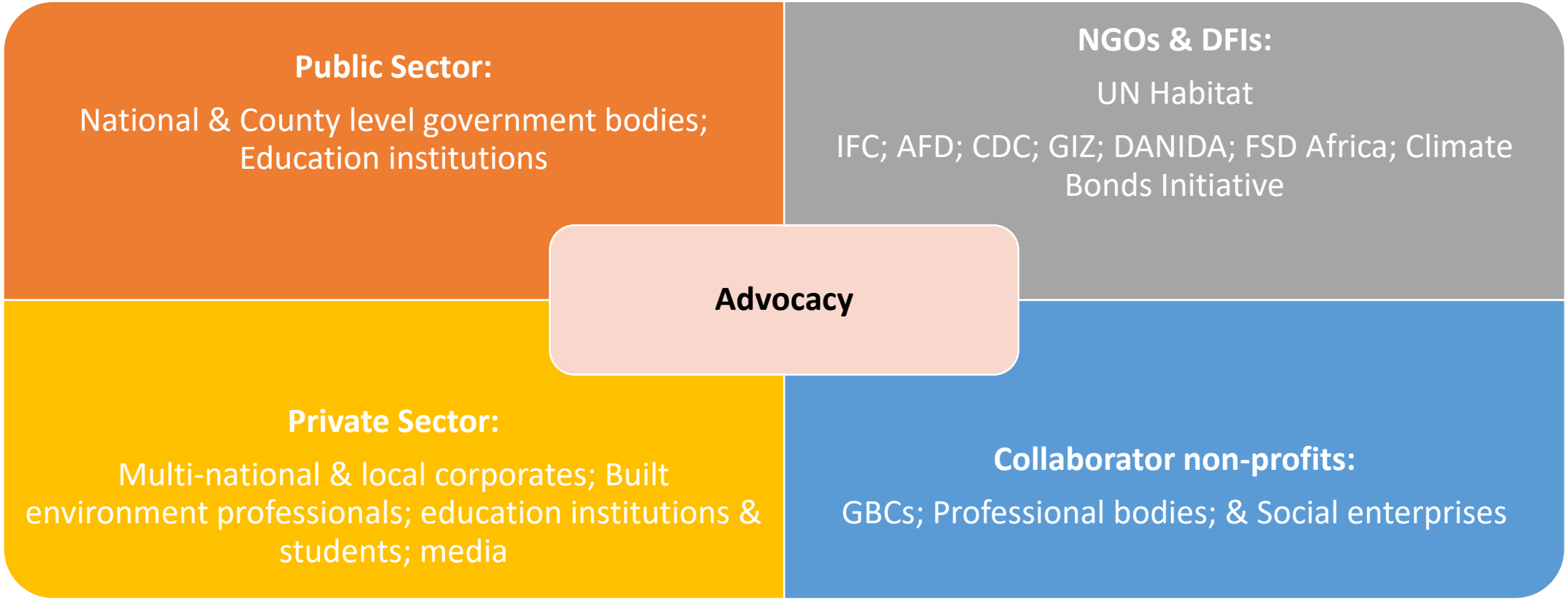


NEW BUILDINGS			EXISTING BUILDINGS				
Land Use/ Planning	Design	Construction	Sale or Lease	Tenant Build-Out	Operations & Maintenance	Retrofit	Demolition & Deconstruction
Local governments Developers and self-help builders	Design & construction professionals National and provincial governments Local governments	Design & construction professionals Building investors Suppliers & manufacturers	Buildings owners and managers Developers and self-help builders Building occupants	Buildings owners and managers Building occupants Design & construction professionals	Buildings owners and managers Energy utilities Building occupants	Buildings owners and managers Building investors Building occupants Design & construction professionals	Design & construction professionals Buildings owners and managers

Source: World Building Institute

KGBS' stakeholder community for its Advocacy

KGBS' membership of the World Green Building Council gives it access to global thought leadership on the green building movement & ability to mobilise advocacy resources far beyond its grassroots capability would indicate



KGBS' strategic collaborators

Public sector & NGO

Climate Bonds Initiative

Green Building Council SA

ICLEI Local Governments for Sustainability

IFC International Finance Corporation World Bank Group

Institute of Quantity Surveyors of Kenya IQSK

KPDA Kenya Property Developers Association

NCA National Construction Authority www.nca.go.ke

nema

Republic of Kenya Ministry of Transport, Infrastructure, Housing and Urban Development

TCPAK Town and County Planners Association of Kenya

UN Habitat For a Better Urban Future

World Green Building Council

KGBS' strategic collaborators

Private sector

THE BIG 5 CONSTRUCT EAST AFRICA

East Africa PROPERTY INVESTMENT SUMMIT

INFRA EAST AFRICA

REAL ESTATE DEVELOPMENT SUMMIT

SOITA & ASSOCIATES ADVOCATES
COMMISSIONERS FOR OATHS & NOTARIES PUBLIC

SPACE
Efficient properties.
Maximising investments.

KGBS remains rating tool agnostic & educates / certifies accordingly

GreenStar Africa - Kenya:

New Buildings; Existing Building Performance; Commercial Interiors; Communities

Leadership in Energy & Environmental Design (LEED) [US]:

Building Design & Construction (D&C); Interior D&C; Building Ops & Maint.; Neighbourhood Devt; Homes

Education

Certification

Excellence in Design for Greater Effiiencies (EDGE) [IFC Global]:

EDGE Expert; EDGE Auditor

On the horizon:

WELL; IFLI

Green Star green building rating categories – if it's not certified, it can't be objectively benchmarked

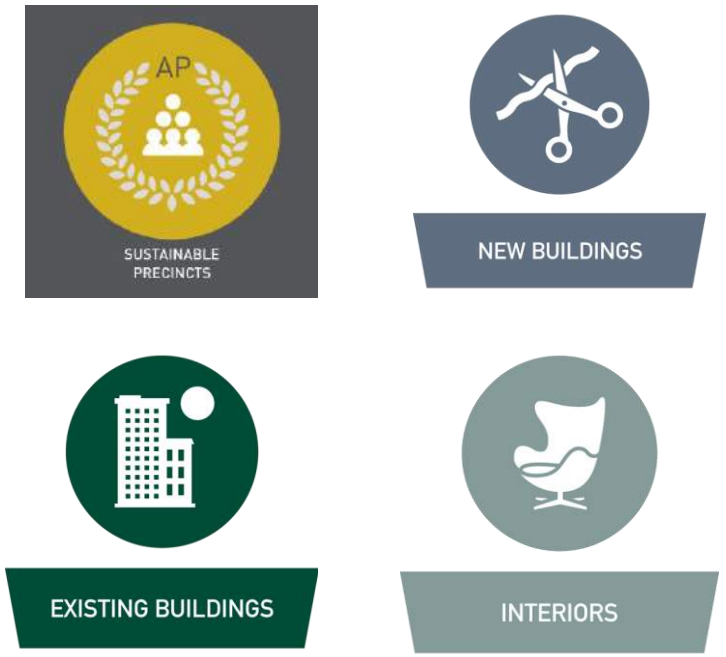
Management: Addresses the way a building site and completed building is designed for ease of good management, waste management,building commissioning as well as the development of building user guides.

Indoor Environmental Quality: Assess the wellbeing and comfort of building occupants by addressing thermal comfort, pollutants, natural daylight and ventilation.

Energy: Aims to reduce a buildings energy consumption, increase it efficiency and encourage the generation of power from alternative sources.

Transport: Aims to disincentivise motor vehicles use for single persons by encouraging use of public and alternative transport.

Water: Aims to target reduced use of potable water by encouraging specification of low flow items and the recycling of grey and black water.



Green Star green building rating categories – if it's not certified, it can't be objectively benchmarked, contd.

Materials: Aims to reduce the use of virgin material and encourage the use of materials from a sustainable sources

Land Use and Ecology: This category helps to reward initiatives that aim to increase and protect our natural biodiversity

Emissions: This category rewards buildings that reduce their greenhouse gas emissions and resulting impact on the environment.

Innovation: The main aim of this category is to recognize, rewards and encourages innovative initiatives incorporated into building projects.

Socio-Economic: Moving beyond green to address aspects of social and economic importance by addressing skills transfer, employment creation and community benefits.

LEED green building categories

Integrative thinking	Energy	Water	Waste
Materials	Location & Transportation	Sustainable Sites	Health & human experience
Regional impacts	Innovation	Global, Regional, Local	

Source: USGBC

EDGE green building categories

Energy

Water

Materials

Excellence In Design For Greater Efficiencies

IFC International Finance Corporation WORLD BANK GROUP

Creating Markets, Creating Opportunities

Source: EDGE

GreenStar certified buildings in Kenya

Multi-unit residential	Commercial	Industrial
• Garden City Residential Ph 1– Targeting GreenStar™ Multi Unit Residential Design Certification • Garden City Residential Ph 2A– Targeting GreenStar™ Multi-Unit Residential Design Certification • Garden City Residential Ph 2B– Targeting GreenStar™ Multi-Unit Residential Design Certification		• Stay tuned for updates

Source: GBCSA

Registered but yet to be GreenStar-certified buildings in Kenya

Multi-unit residential	Commercial	Industrial
• Stay tuned for updates	• Dunhill Towers	• Stay tuned for updates

Source: KGBS

LEED certified buildings in Kenya

CERTIFIED

Multi-unit residential	Commercial	Industrial
• Stay tuned for updates	• World Bank HQ – LEED™ Gold Certified Commercial Interiors; 28 May 2015 • Citibank – LEED™ Gold Certified Commercial Interiors; 2 July 2015 • Eaton Place – LEED™ Certified Core and Shell; 8 Sep 2015	• Stay tuned for updates

Source: USGBC

Registered but yet to be LEED-certified buildings in Kenya

Multi-unit residential	Commercial	Industrial
• Capital M	• Garden City Retail – LEED™ Gold Pre-certified; Core and Shell • AL Jamea Tus Saifiyah, Nairobi • Ascot (Block F) • French Embassy • JKIA Greenfield Terminal • GARDEN CITY RETAIL • Leadership Centre • Lumen Square • Newmarket Aintree Block D-E • Strathmore University Phase III • The Grove Ltd • Vienna Court	• Wrigley Nairobi Confection

Source: USGBC

EDGE certified buildings in Kenya

Multi-unit residential	Commercial	Industrial
• Stay tuned for updates	• Britam Towers; July 2018	• Stay tuned for updates

Source: EDGE

Registered but yet to be EDGE-certified buildings in Kenya

Multi-unit residential	Commercial	Industrial
• Stay tuned for updates	• Stay tuned for updates	• Africa Logistics Properties

Source: EDGE