

Beyond zero – construction for a regenerative future

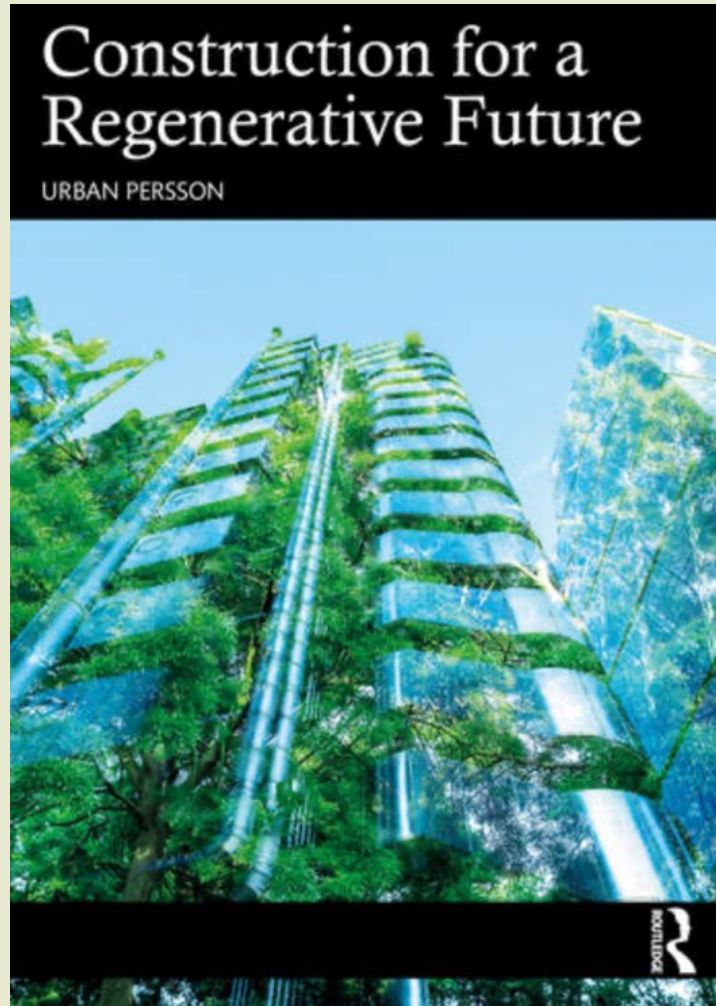
SBU 6/2 –24

- ▶ Sustainability and Regenerative development in the Construction Process
- ▶ Circular economy
- ▶ Nature-based Solutions, NbS
- ▶ A roadmap to a regenerative construction project

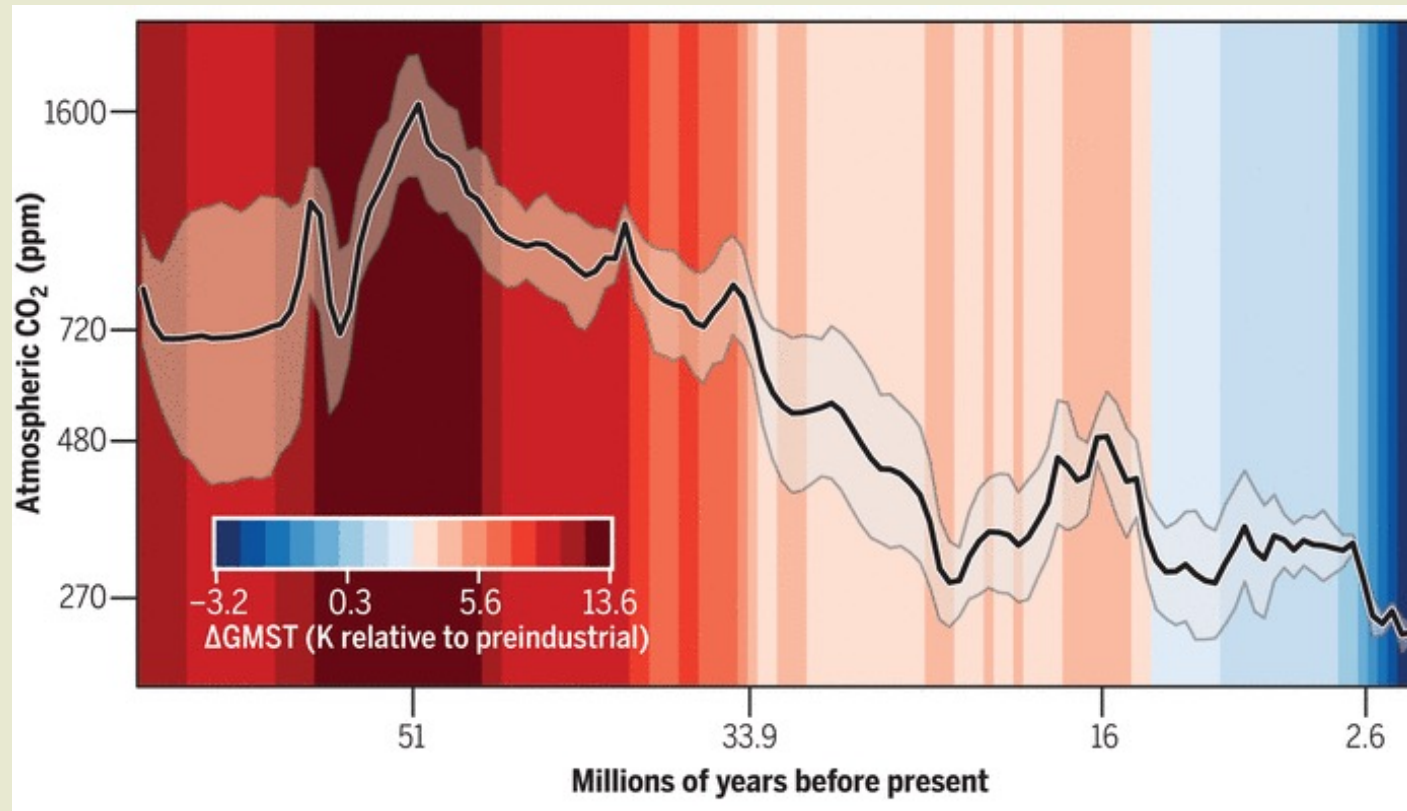


Urban Persson
Senior lecturer at Lund University

Construction for a regenerative future



- ▶ **Why** – introduction
- ▶ **The end?** – circularity and deconstruction
- ▶ **Who** – the client and the stakeholders
- ▶ **Where** – the location
- ▶ **When** – the project organisation
- ▶ **How** – the project performance
- ▶ **Verify** – assessment, rating and certification
- ▶ **Further on** – construction for a regenerative future



The Cenozoic CO₂ Proxy Integration Project (CenCO₂PIP) Consortium (2023) [Toward a Cenozoic history of atmospheric CO₂](https://doi.org/10.1126/science.adi5177), *Science*, Volume: 382, Issue: 6675, DOI: (10.1126/science.adi5177)

A map of climate tipping elements

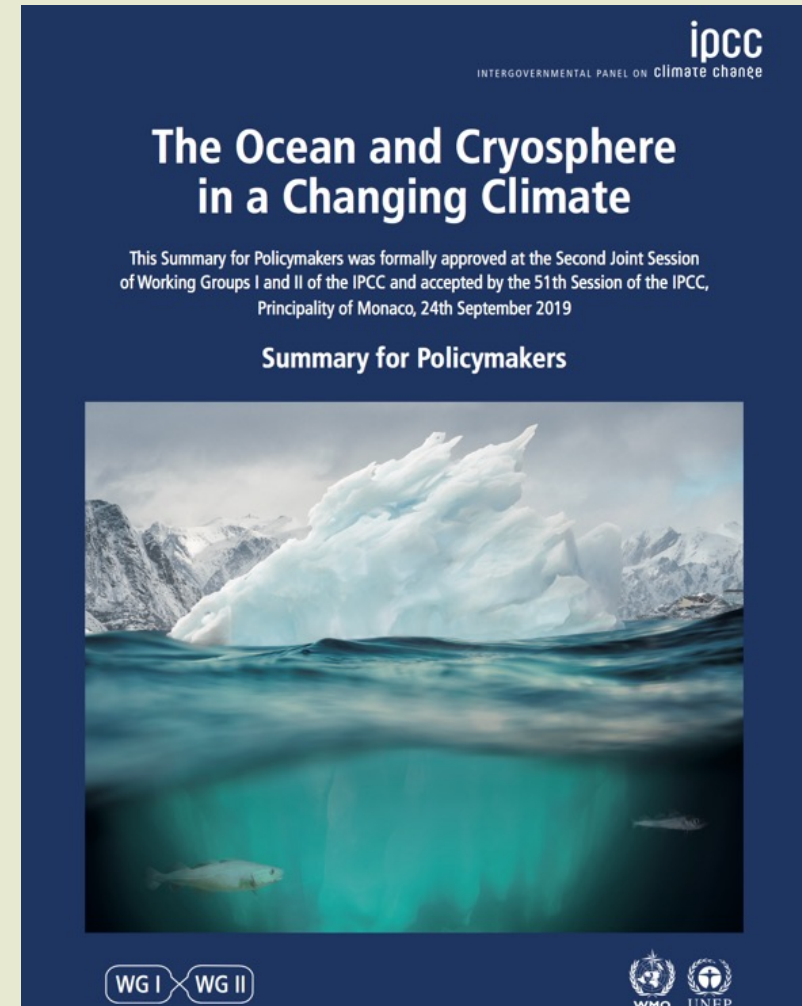
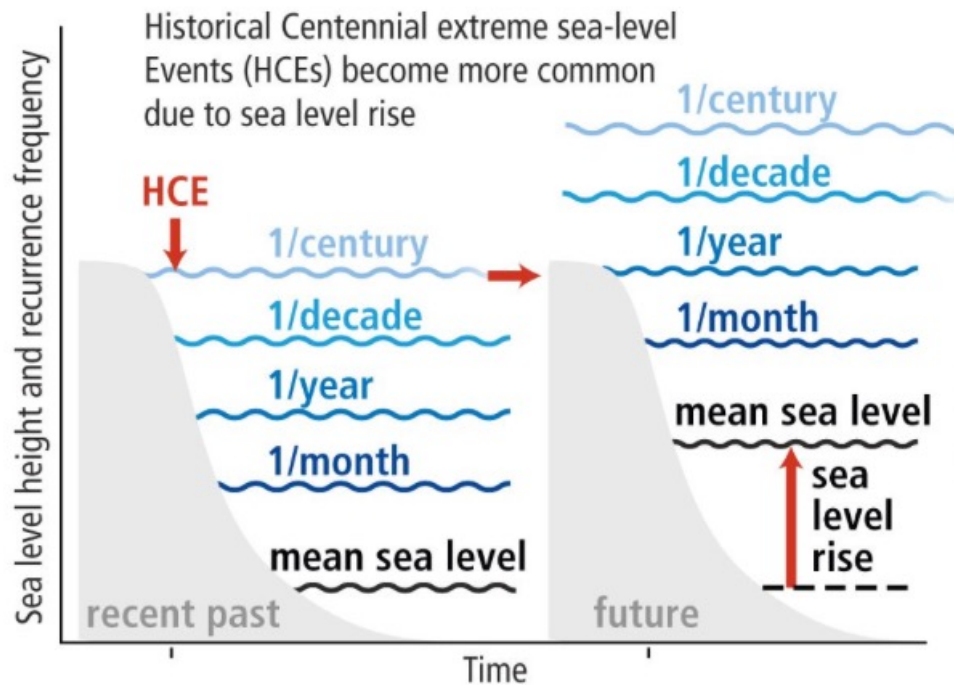


Rockström et al. (2024) PNAS. <https://doi.org/10.1073/pnas.2301531121>

PNAS

IPCC-rapport sept 19

(a) Schematic effect of regional sea level rise on projected extreme sea level events (not to scale)



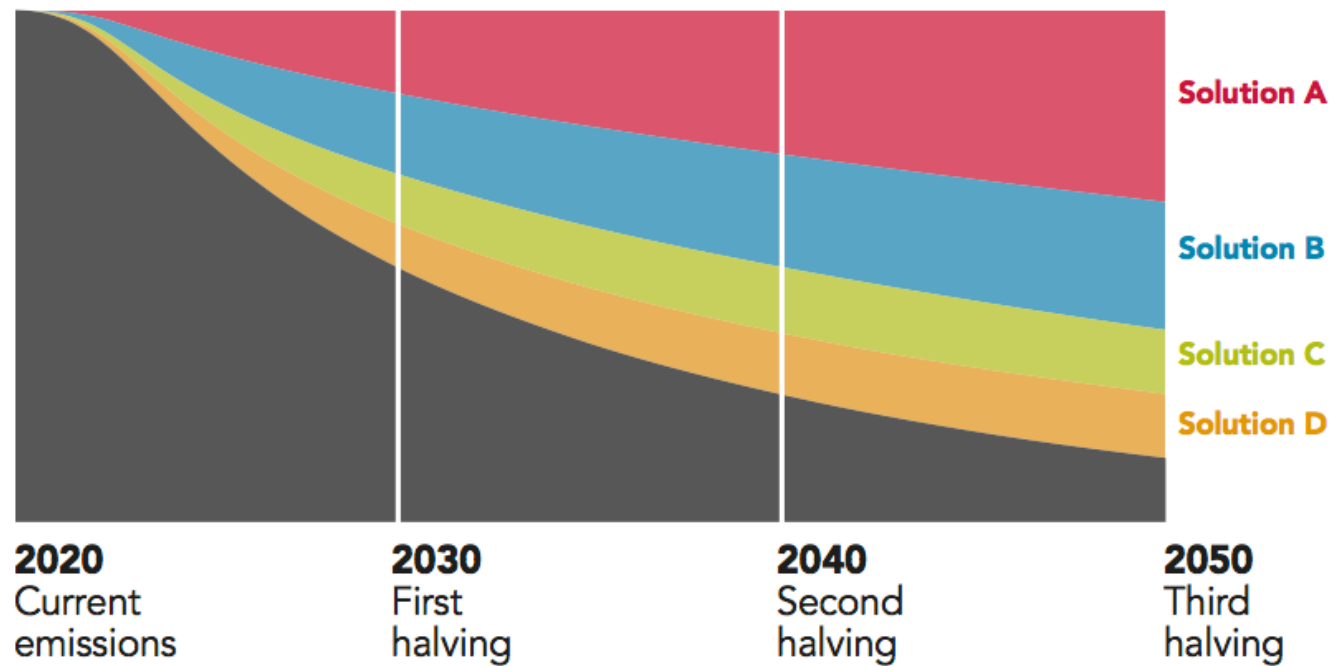
Buildings and sustainability

- A high impact sector

- 
- 30-50% of waste to landfill
 - 30-50% of mineral resource extraction
 - 40-50% of all energy use
 - 50-70% of electricity use
 - 40% of CO₂ emissions
 - 40% of all workplace fatalities
 - The sector with most labour practice issues
 - Low diversity – very few women employed

Carbon Law (Falk J., Gaffney O., et al. (2018))

Halving CO₂-emissions every decade
between 2020 and 2050



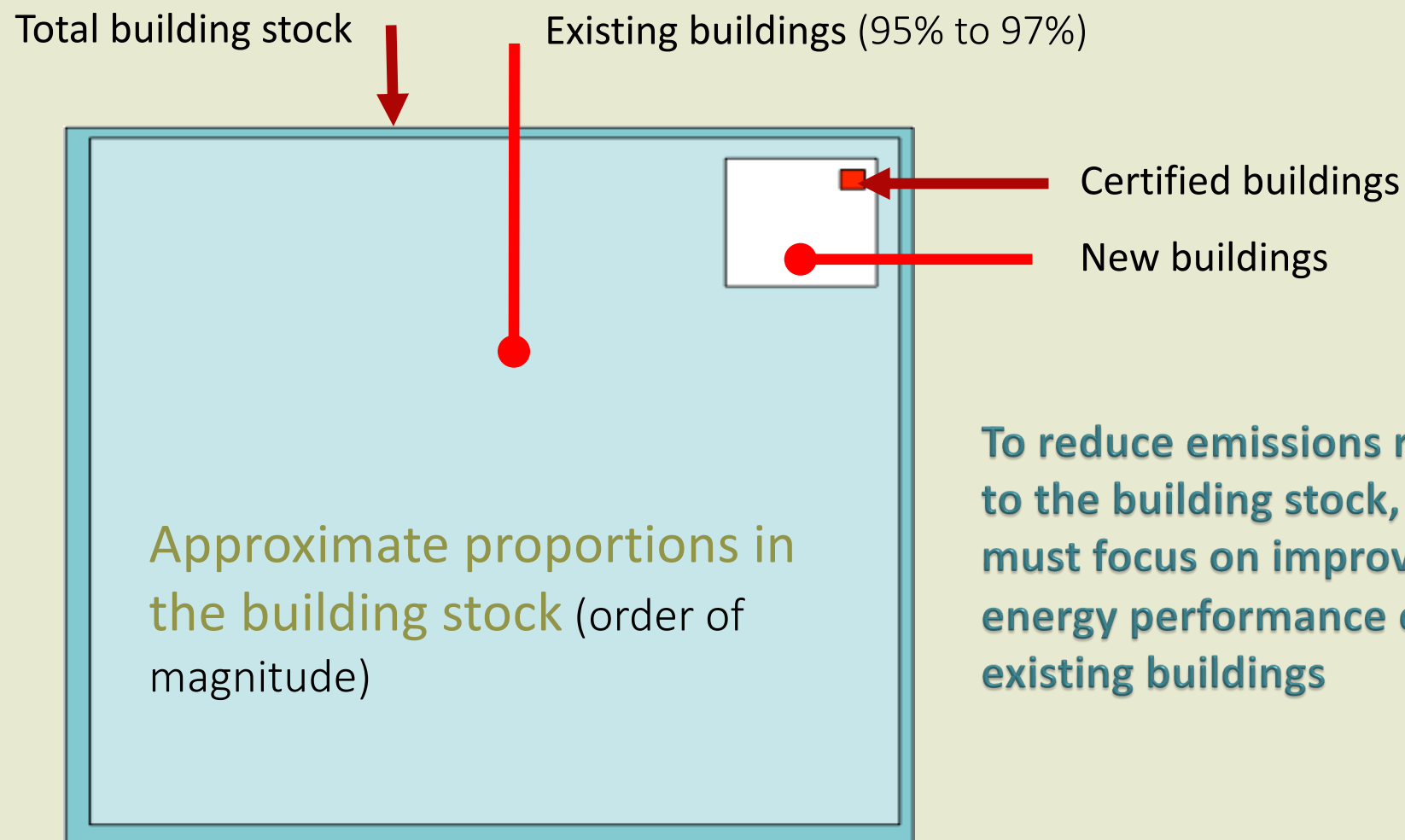
SDG:s and the built environment



Sustainability and construction

► Construction

- Fragmented and complex process
- Different clients with different demands and requirements
- Different stakeholders throughout the process
- Different needs and interpretations
- Different building cultures, aesthetic traditions
- Different sites, neighbourhoods
- Different climate conditions, regionally and locally
- Different construction regulations
- Different cultures of procurement
- ...

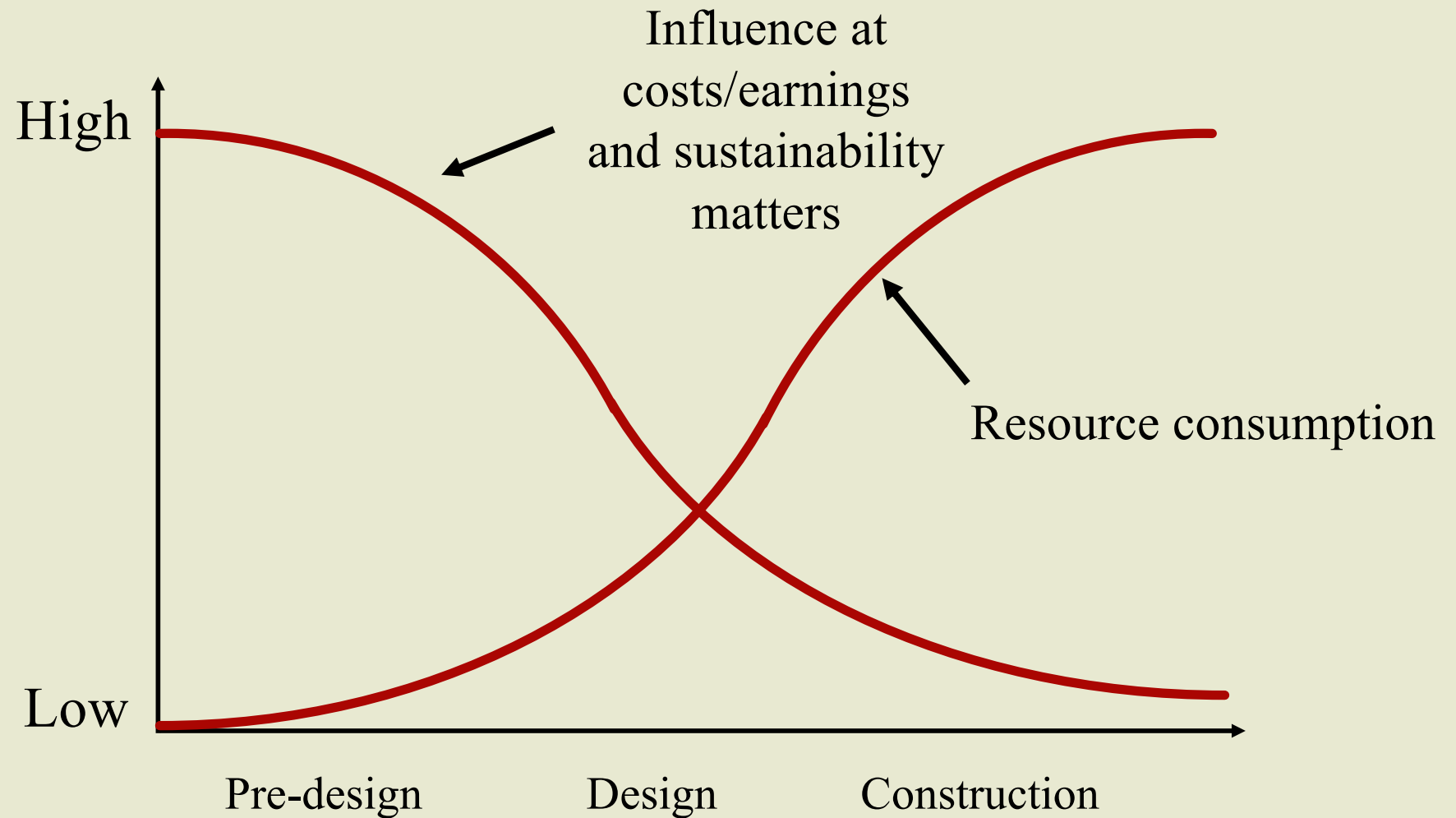


To reduce emissions related to the building stock, we must focus on improving the energy performance of existing buildings

New demands ..

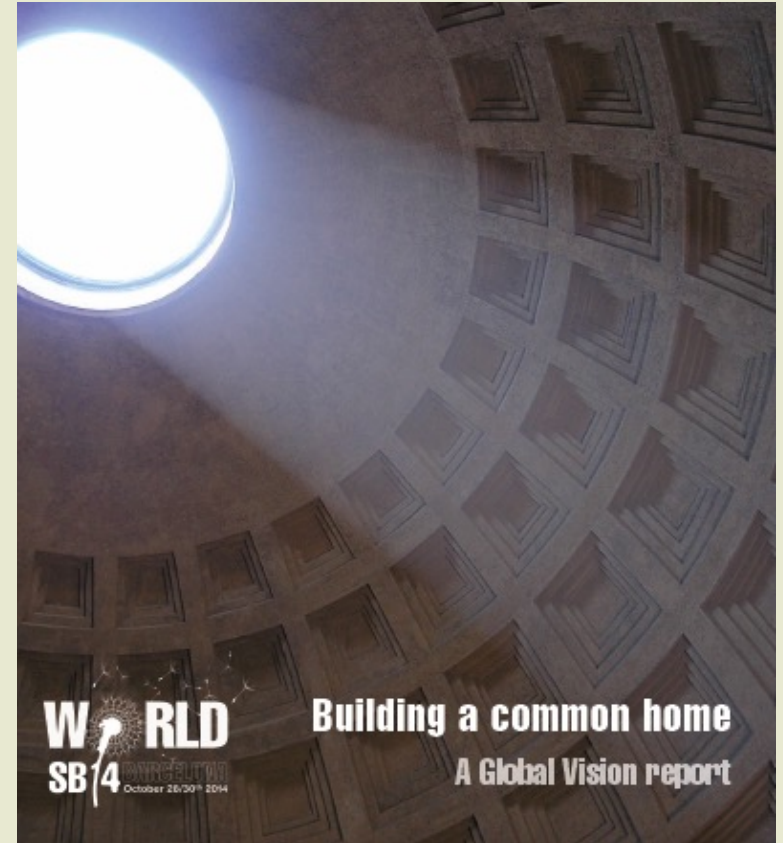


Possibilities to influence

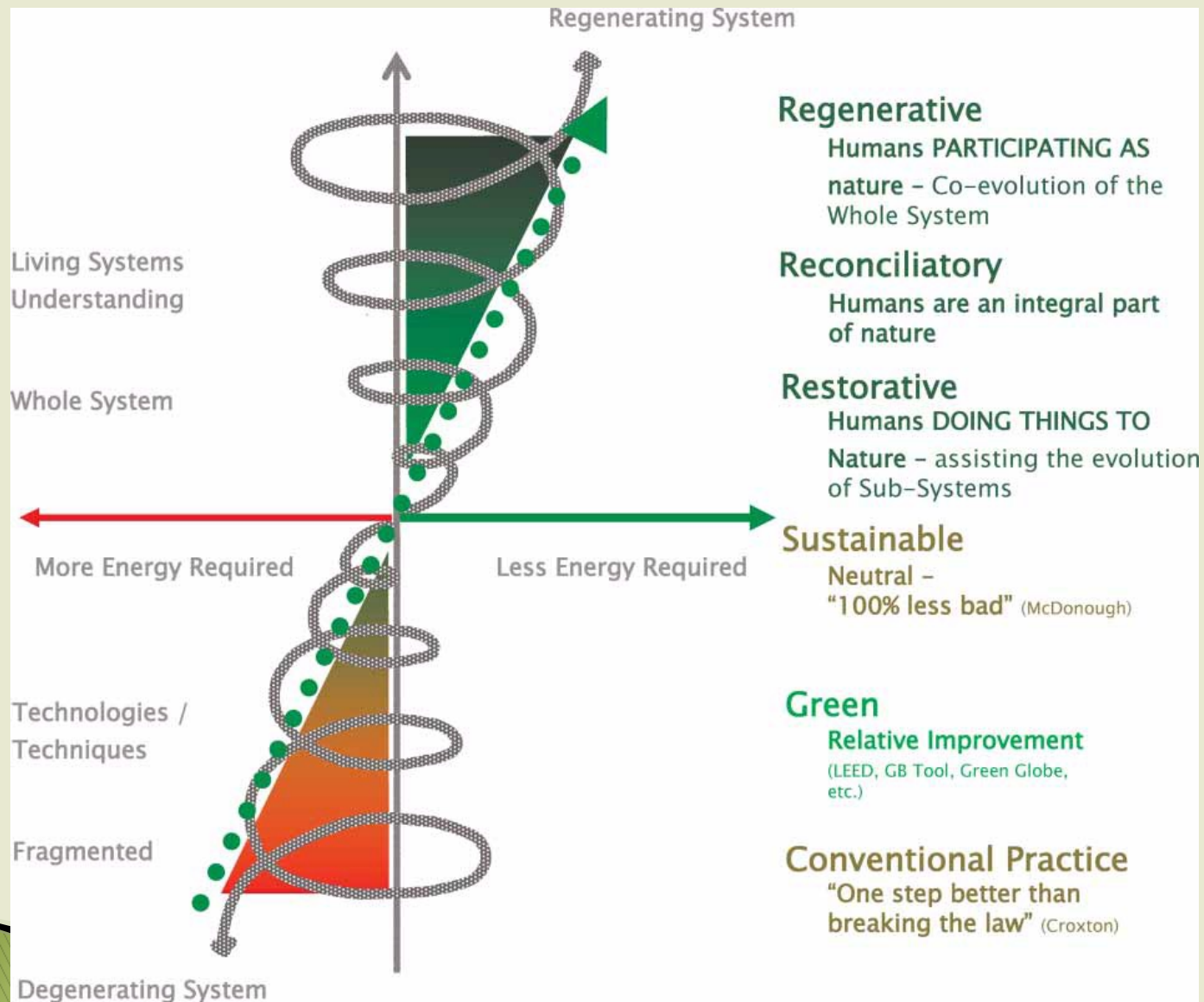


Sustainability in construction

- ▶ Green
 - Doing less harm
- ▶ Sustainable
 - Maintain things we have
 - Certified by LEED, BREAM etc..
 - Urban sustainability
- ▶ Regenerative
 - Retrieve we lost, doing more good



Regenerative development



Regenerative certification

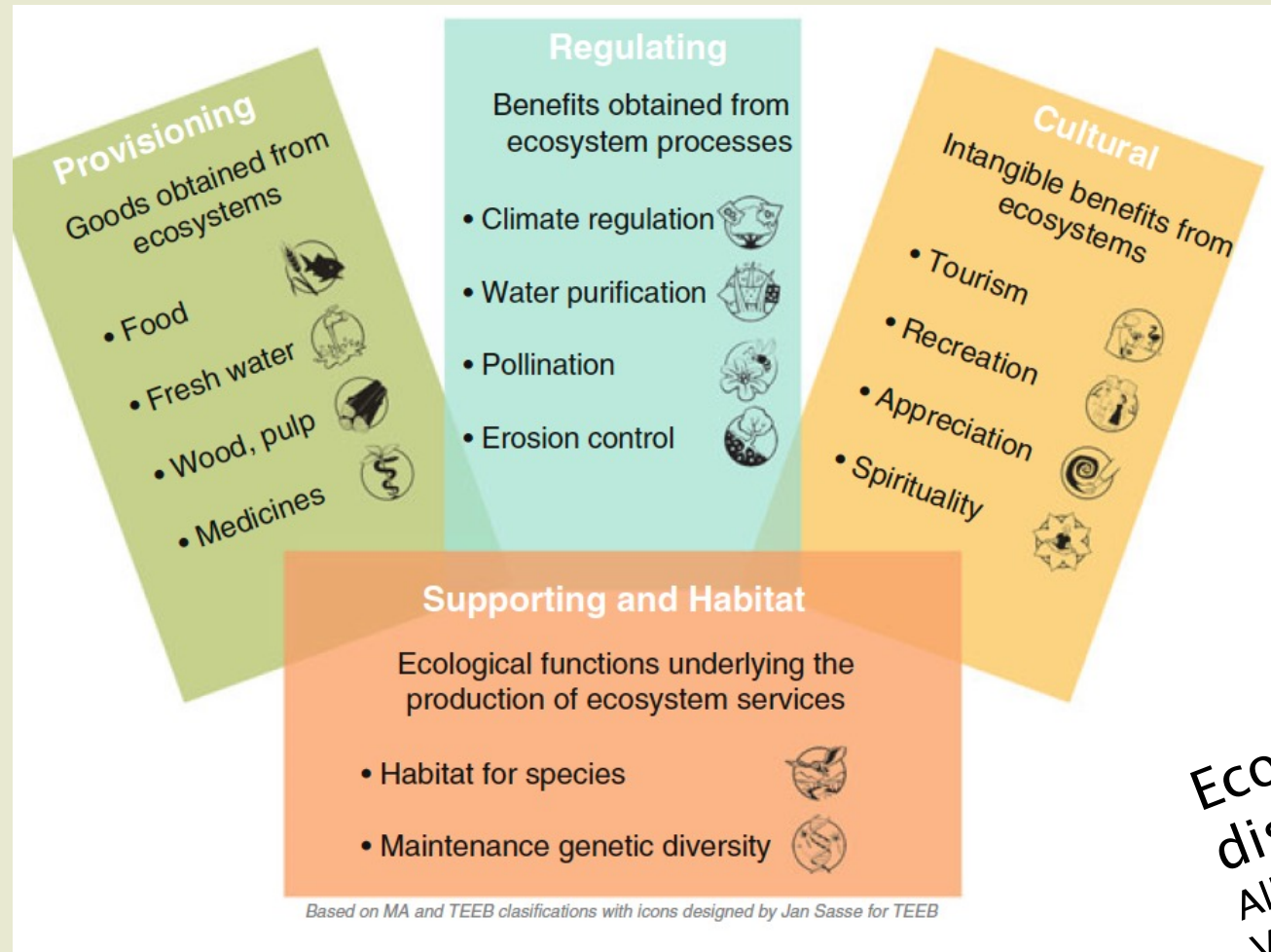


Label E+C-

Un label pour contribuer à la lutte contre le changement climatique pour la construction neuve

Afin de généraliser les bâtiments à énergie positive et à faible empreinte carbone, l'État a lancé un label volontaire dédié à la valorisation de ces deux objectifs : le label Énergie + Carbone - (E+C⁻).

The story of the place – Urban Ecosystem Services



**Ecosystem
disservices**
Allergies
VOCs and TVOCs
Accidents
Fear and stress

Supporting Services		Habitat provision	Cultural services		Aesthetic & artistic inspiration - Aesthetic value - Artistic inspiration
		Nutrient cycling - Retention of nutrients - Regulation of biogeochemical cycles			Recreation and psychological wellbeing - Sport - Outdoor activities - Tourism - Socialization - Relaxation & psychological benefit
		Species Maintenance			Sense of place and cultural diversity - Celebration of cultural diversity/history - Sense of place
		Fixation of solar energy			Spiritual and religious inspiration
		Soil building - Soil formation - Renewal of soil fertility - Soil quality control - Soil retention			Education and knowledge - Educational - Inspiration & innovation - Cognitive development - Knowledge building
Regulation Services		Disturbance prevention - Noise - Wave - Erosion - Earthquake - Drought - Flood/Storm events - Wind	Provisioning Services		Provision of fuel and energy - Water energy - Wind energy - Active/passive solar energy - Human body heat - Hydrogen energy - Biomass energy - Geothermal energy
		Climate regulation - UV protection - Moderation of temperature - Climate adaptation strategies - GHG mitigation			Provision of fresh water - Drinking water - Sanitation - Irrigation - Industrial processes - Recreational
		Purification - Water purification - Soil purification - Air purification			Provision of food - Small to large scale urban agriculture
		Decomposition - Biodegradation - Material reuse/recycling - Consumption reduction			Biochemicals - Medicine - Natural chemicals
		Biological control - Control of invasive species - Disease/pest regulation			Raw materials
		Pollination			Genetic resources

Zari Pedersen, M. and Hecht, K.
(2020): *Biomimicry for Regenerative Built Environments: Mapping Design Strategies for Producing Ecosystem Services*, Biomimetics 2020, 5, 18

Circular economy: Three principles

1

Eliminate waste
and pollution

2

Circulate products
and materials, at
their highest value

3

Regenerate nature

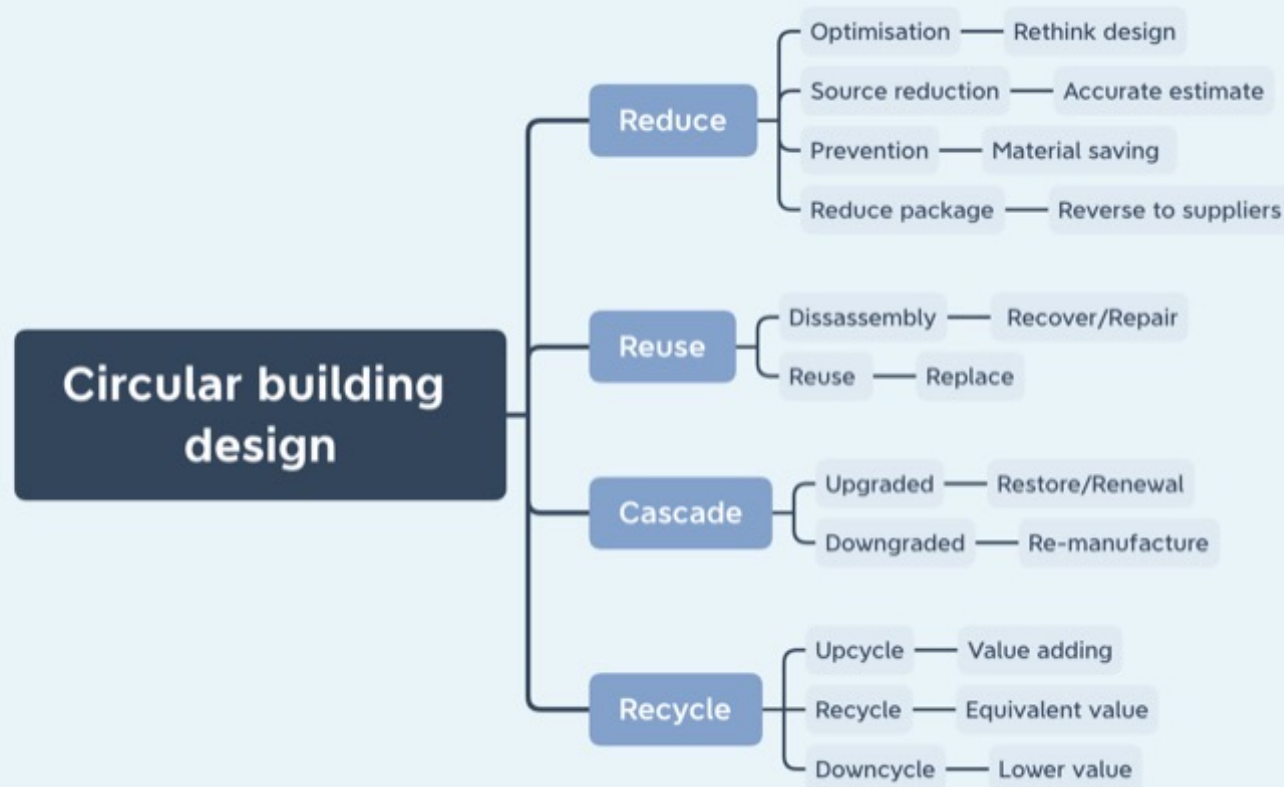
1. Eliminate waste and pollution

The circular economy should ensure materials re-enter at the end of use to be **used again in a new way**

Waste is a product of design choices

Nature does not leave any waste, it's a human 'innovation'

2. Circulate products and materials at the highest value



3. Regenerating nature



**No
degrading
of nature**



**Reinforce
natural
capital**

Allow nature to
rebuild soils

Increase the
biodiversity

Return
biological
materials to the
earth



**Natural
systems have
regenerated
for billions of
years**

ReSOLVE



Regenerate –
regenerate/resto
re natural capital



Share –
maximise asset
utilisation



Optimise –
optimise system
performance



Loop – keeping
things in cycles,
highest value



Virtualise –
displacing
resource use
with virtual use



Exchange –
selecting
resources and
technology
wisely

Nature based Solutions (NbS) green roof examples around the globe

- ▶ Berlin, Thousand green roof incentive
- ▶ Toronto, green roof bylaw, 20–60% of available roof bigger than 2000 m²: green roofs
- ▶ Shanghai, 2 million m² green roofing to meet heat, pollution and flooding challenge
- ▶ Melbourne, green factor assessment includes green infrastructure
- ▶ Singapore, regulations implying site greenery eqv size of the developed site



Everywhere, rooftop gardening (Paris)

Bioclimatic approach (vernacular, tradition)

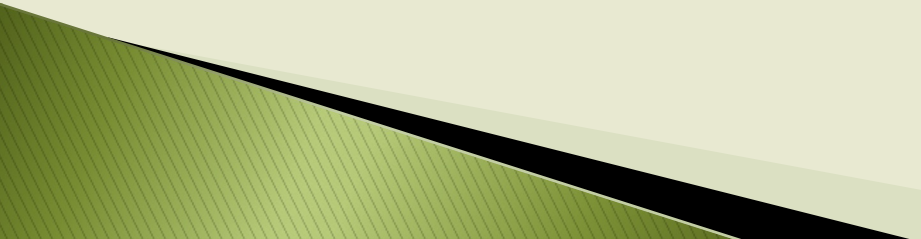
Conduction – The direct contact between hot and cool (insulation)

Convection – The airflow between hot and cool (e.g. delaying the flow by layers and wind conditions)

Radiation – From hot to cool in direct view (thermal bridges)

Evaporation – The change between a liquid to a gaseous state (moisture airflow)

Thermal storage – Heat charge and discharge depending on material-specific heat, mass, and conductivity (store solar impact)



Biophilic approach

(nature –human)

Visual connection,
NY Times, New
York



Dynamic and diffuse
light, Levine
Residence, LA



Nature in the space

- **Visual connection** (view nature)
- **Non-visual connection** (natural sounds, aromas, and textures)
- **Non-rhythmic sensory** (non-regular natural sounds rustling leaves, falling water)
- **Thermal and airflow variability** (subtle changes)
- **Presence of water**
- **Dynamic and diffuse light** (mimicking nature variations)
- **Connection with natural systems** (seasonal changes, see left)

Natural analogies

- **Biomorphic patterns** (originated from nature)
- **Material connection with nature** (real local nature material)
- **Complexity and order** (see below)

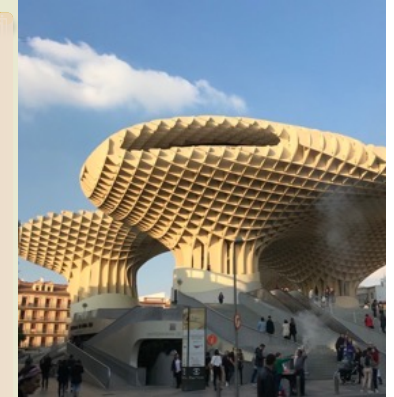


Hays Galleria,
London, UK

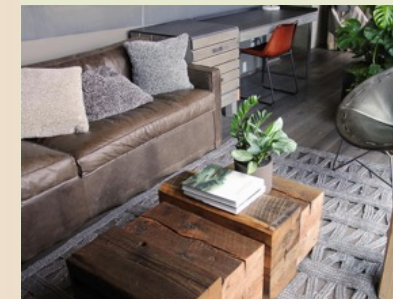
Nature of the space

- **Prospect** (visual long-distance connection indoor-outdoor)
- **Refuge** (places to be alone, to hide)
- **Mystery** ("What ´s behind the corner?")
- **Risk/peril** (threat and danger with safety and should be irresistible)

Biomorphic, Las
Setas Seville



Material
connection with
nature, One Hotel
New York



Biomimicry approach

(mimicking natural functions)

Organism
level

Behaviour
level

Ecosystem
level



Turning Torso,
Malmö, Sweden



Las Setas,
Seville, Spain



Tour Eiffel
Paris, France



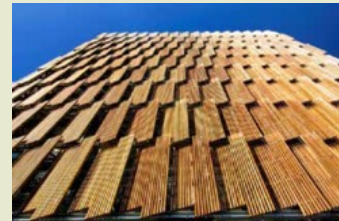
The Eastgate
Center, Harare,
Zimbabwe



The Gherkin, London
,UK



The BIQ-House
Hamburg, Germany



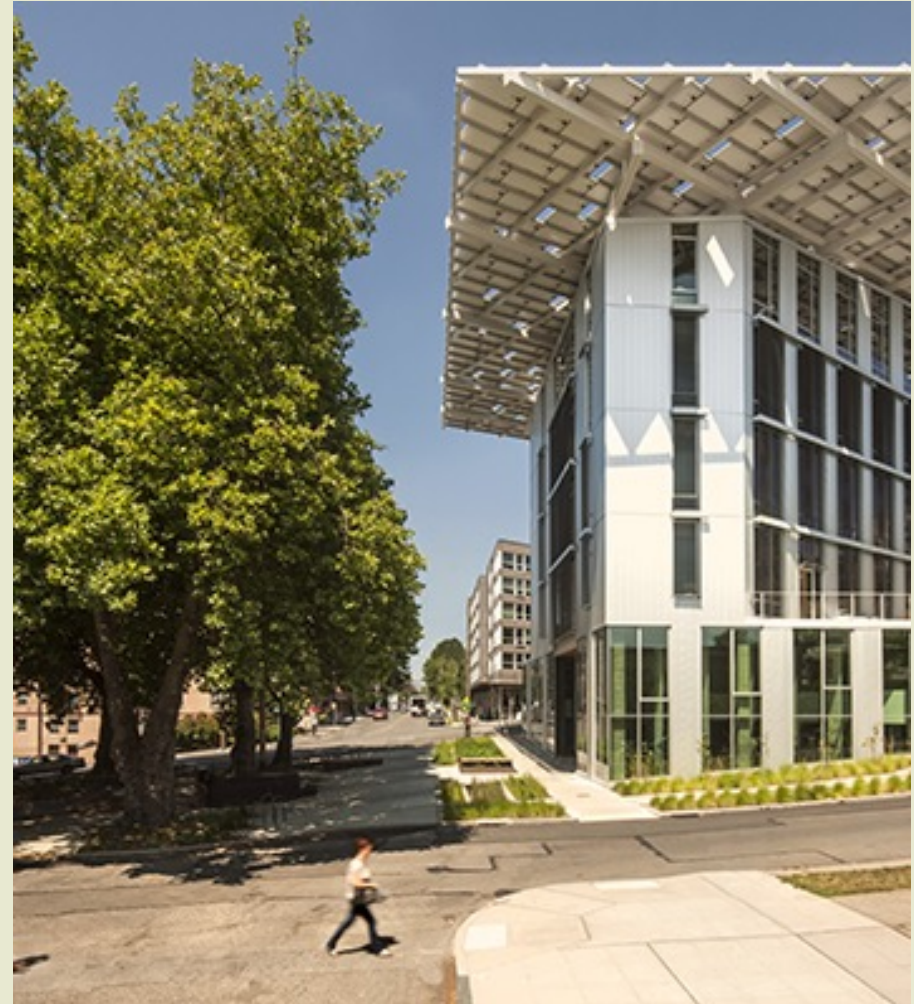
The Council
House 2,
Melbourne, AU



Garage building
San Francisco

A condensed roadmap to a regenerative construction project

- ▶ The story of the place
- ▶ Client commitment and creating a core team for the project
- ▶ Capacity building or knowledge transfer
- ▶ Circular design with Nbs
- ▶ Choosing contractor with subcontractors very early
- ▶ Operation and maintenance organization with sufficient skills
- ▶ Verify with e.g. Living Building Challenge scheme



Bullit Center, 1501 East Madison Street

Seattle, Wa, USA
Certified Living, Living Building Challenge, ILFI



Cal Guerxo, Bresca, Spain

Certified Living, Living Building Challenge, ILFI



Aktiv-Stadthaus Speicherstraße, Frankfurt am Main ,Germany

Carbon positive DGNB cert 2019



Sustainable buildings research centre (SBRC)

University of Wollongong, Wollongong, NSW, Australia

Certified Living, Living Building Challenge, ILFI



The Ridge, V&A Waterfront, Cape Town, SA

6 star, Gren Star design



Te Kura Whare,

Tuhoe, Taneatua, New Zealand
Certified Living, Living Building Challenge, ILFI

