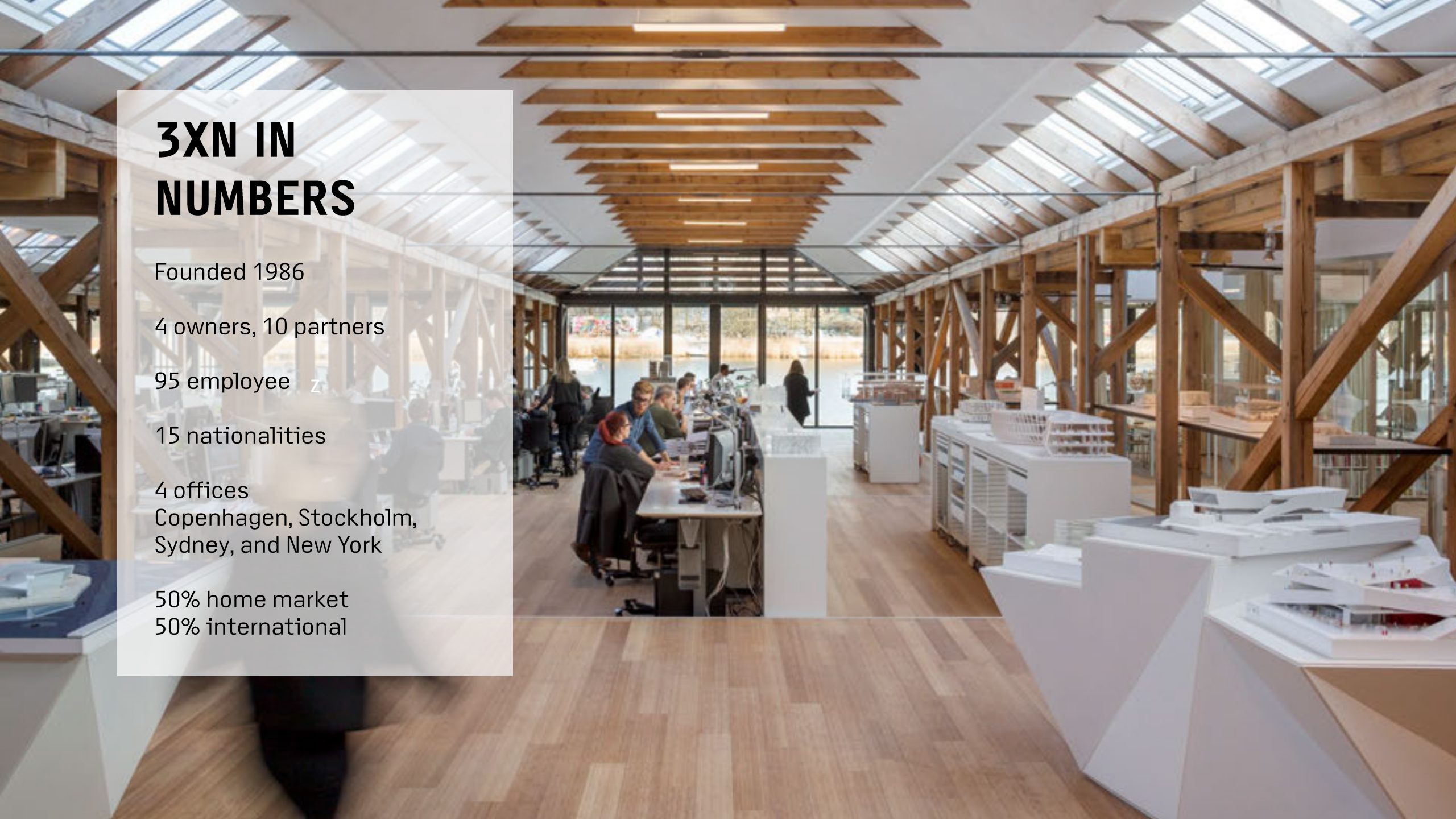
INNOVATING ARCHITECTURE

Kasper Guldager Jensen, Partner 3XN, Director GXN, March 10th 2017

3XN Architecture | GXN Innovation


RESEARCH
PROJECT DESIGN
COMPETITION



3XN IN NUMBERS

Founded 1986

4 owners, 10 partners

95 employee z

15 nationalities

4 offices
Copenhagen, Stockholm,
Sydney, and New York

50% home market
50% international

GXN IN NUMBERS

Founded in 2007

85 funded research projects

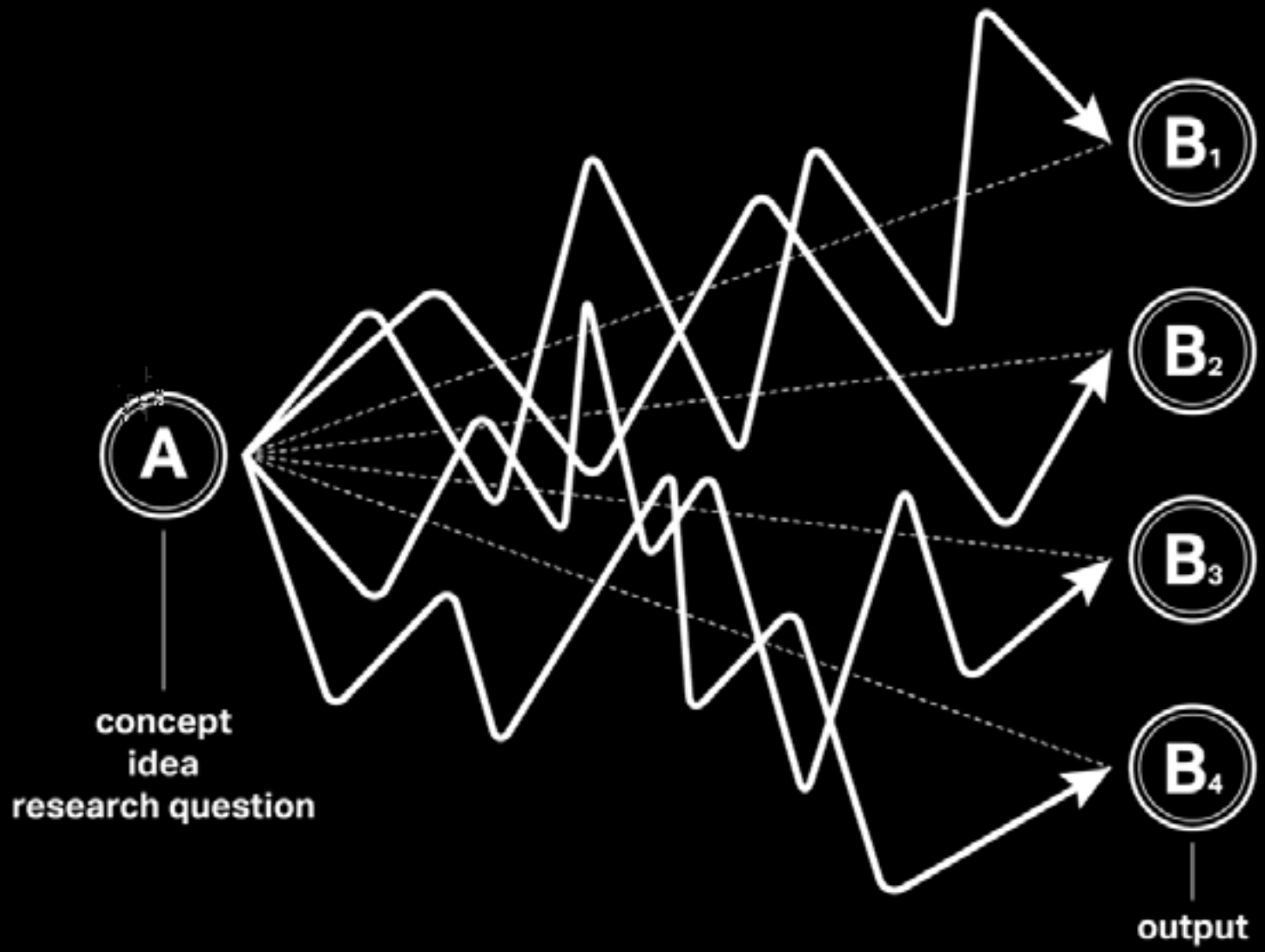
15 employees

50% work internally
50% work externally

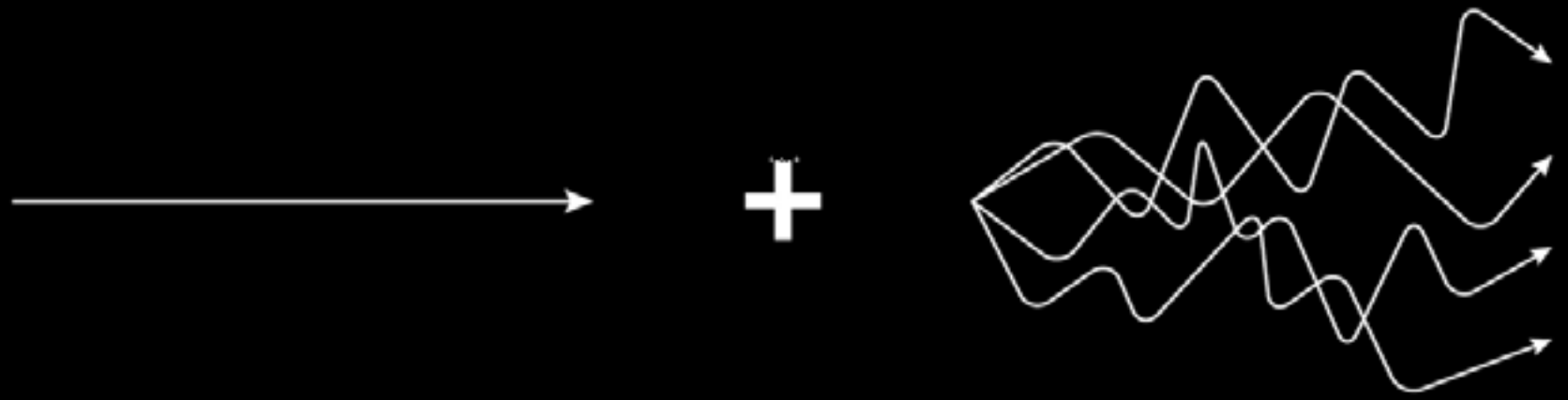
1 spin off company

10 royalties and 1 patent

3XN



GXN



3XN

GXN


CRADLE TO
CRADLE®
I DET
BYGGEDE
MILJØ
EN MANUAL TIL DEN DANSKE BYGGEINDUSTRI


Material
World
From materials
to new architecture


Building a
Circular Future

BEHAVIOUR DESIGN

We think of people as our greatest resource


ARCHITECTURE
SHAPES
BEHAVIOUR

Interaction design

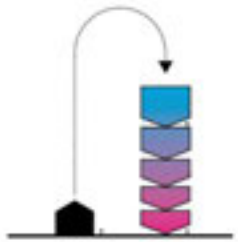
Multiple programmes

Flexible zones

Communal transport

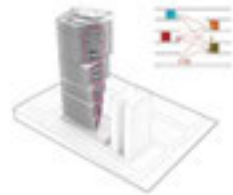
Different scales

Social comfort



Small social groups

Bounded spaces



Atriums

Open spaces

Business value

Synergies

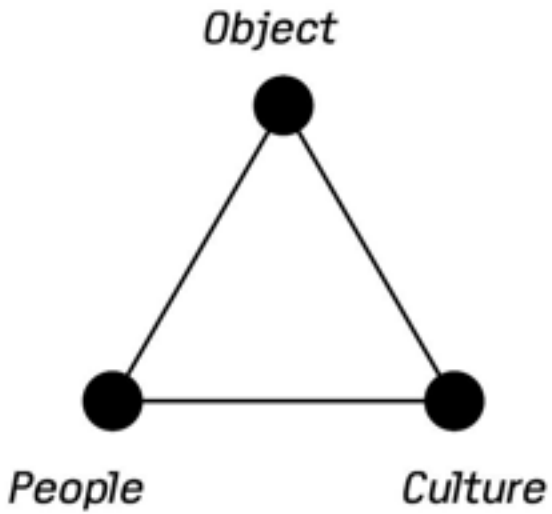
Effecient groups

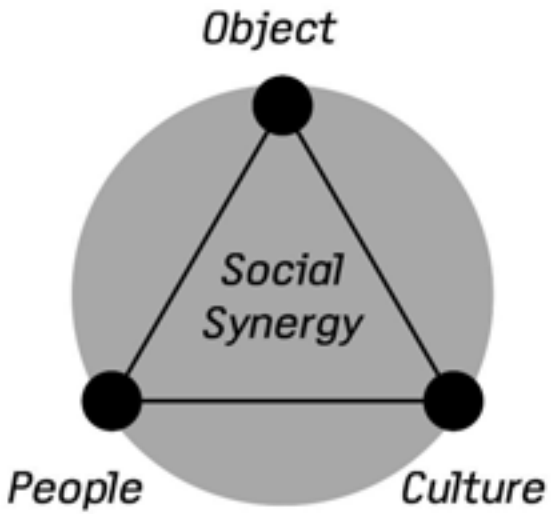
Work situations

Exhanges

SOCIAL AFFORDANCES

PROPERTIES OF AN OBJECT THAT INVITE SOCIAL ACTIONS





PLASSEN JAZZ HOUSE - NORWAY

URBAN STAIRCASE THAT BECOMES A STAGE FOR CONCERTS

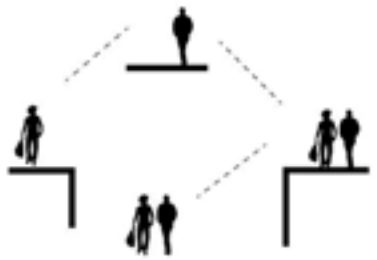
3XN - GODSBANEN CULTURAL CENTER - DENMARK

ROOFSCAPE THAT BECOMES A SOCIAL MEETING SPOT AND VANTAGE POINT IN THE CITY

SOCIAL AFFORDANCES

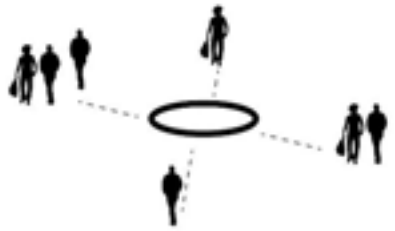
GXN DESIGN PRINCIPLES FOR CREATING SOCIAL SYNERGIES

1 OPEN



DESIGN: OPENESS AND CROSS ACTIVITY VIEWS
POTENTIAL: CURIOSITY, UNDERSTANDING AND TOLERANCE

2 SHARE



DESIGN: SPACES AND FUNCTIONS THAT BRING PEOPLE TOGETHER
POTENTIAL: INCREASED SOCILIALITY, KNOWLEDGE SHARING, TOLERANCE ETC

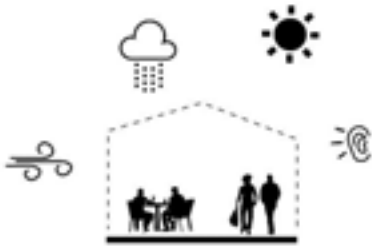
3 VARY

DESIGN: SPACTIAL VARIETY FOR VARIED USE
POTENTIAL.: ADAPTABILITY, OVERLAPPING PROGRAMS, BROADER USE

AFFORDANCES

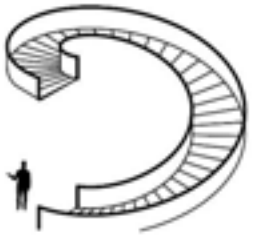
3XN & GXN DESIGN PRINCIPLES FOR CREATING SOCIAL SYNERGIES

4 COMFORT



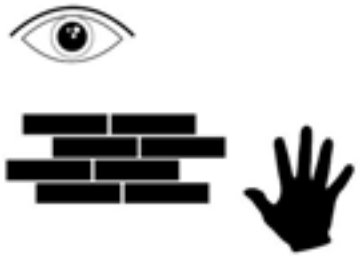
DESIGN: PLEASANT SPACES USING MICROCLIMATIC CONSIDERATIONS
POTENTIAL: INCREASED WELLBEING, PRODUCTIVITY AND HAPPINESS

5 INVITE



DESIGN: FORMS THAT INVITE PEOPLE
POTENTIAL: USER SATISFACTION, BETTER WAYFINDING, ENJOYMENT

6 STIMULATE

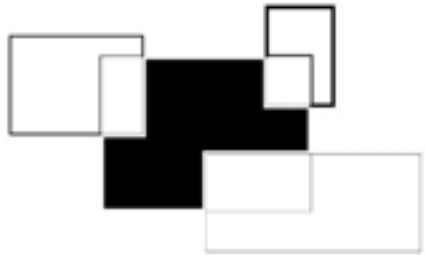


DESIGN: SENSE STIMULATION WITH TACTILE MATERIALS AND DETAILS
POTENTIAL: INCREASED ENJOYMENT AND WELL BEING

AFFORDANCES

3XN & GXN DESIGN PRINCIPLES FOR CREATING SOCIAL SYNERGIES

7 OVERLAP

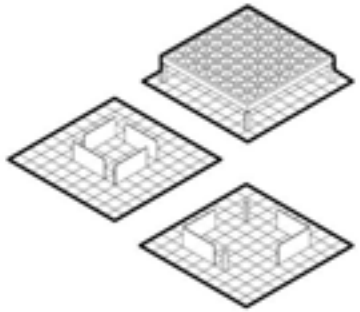


DESIGN: OVERLAPPIONG PROGRAMS AND USE SCENARIOS
POTENTIAL: BETTER OPERATIONS, MORE ROBUSTNESS

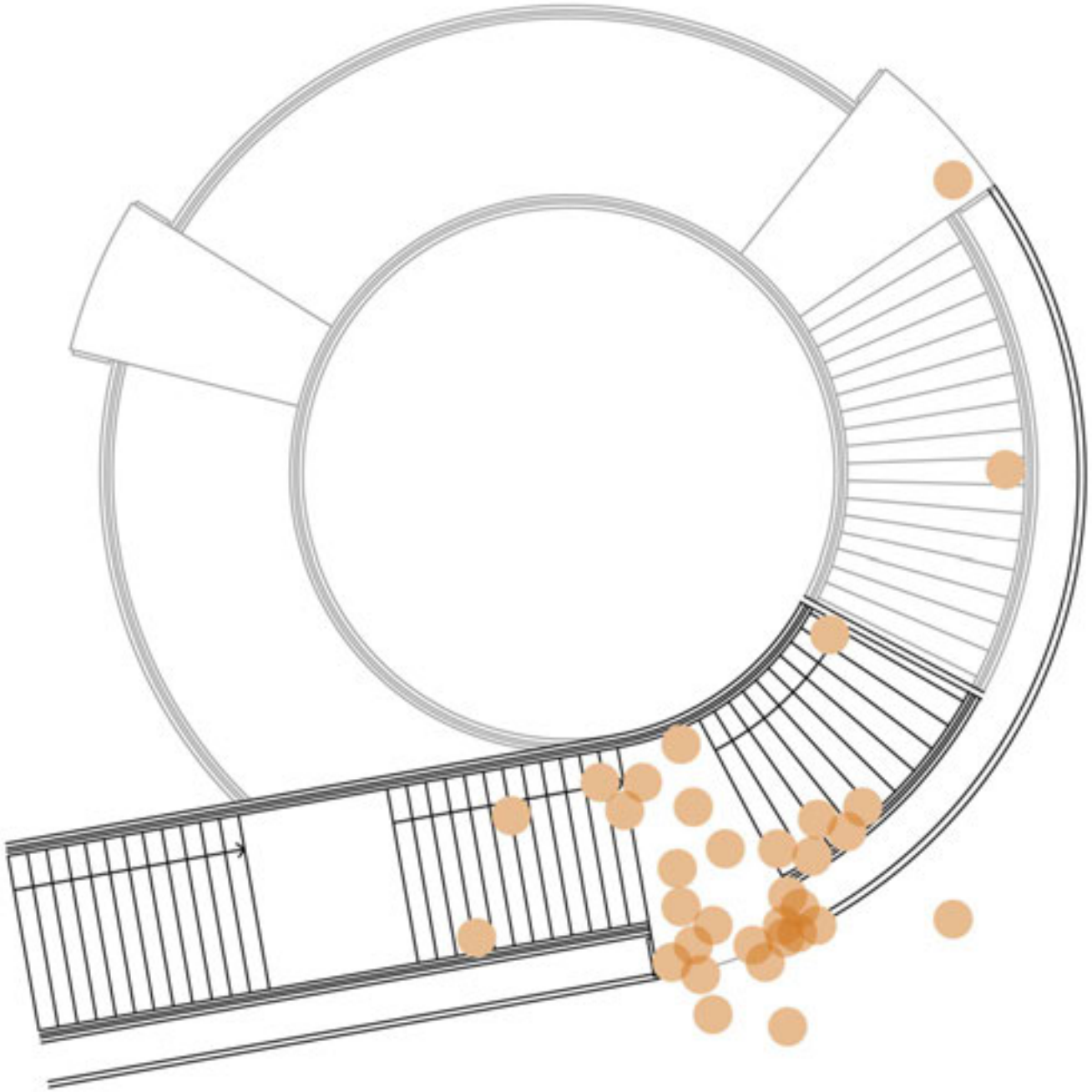
8 CONNECT

DESIGN: CONNECTIONS AND OVERLAPS BETWEEN INDOOR AND OUTDOOR
POTENTIAL: INCREASED WELLBEING, PRODUCTIVITY AND HAPPINESS

9 ADAPT

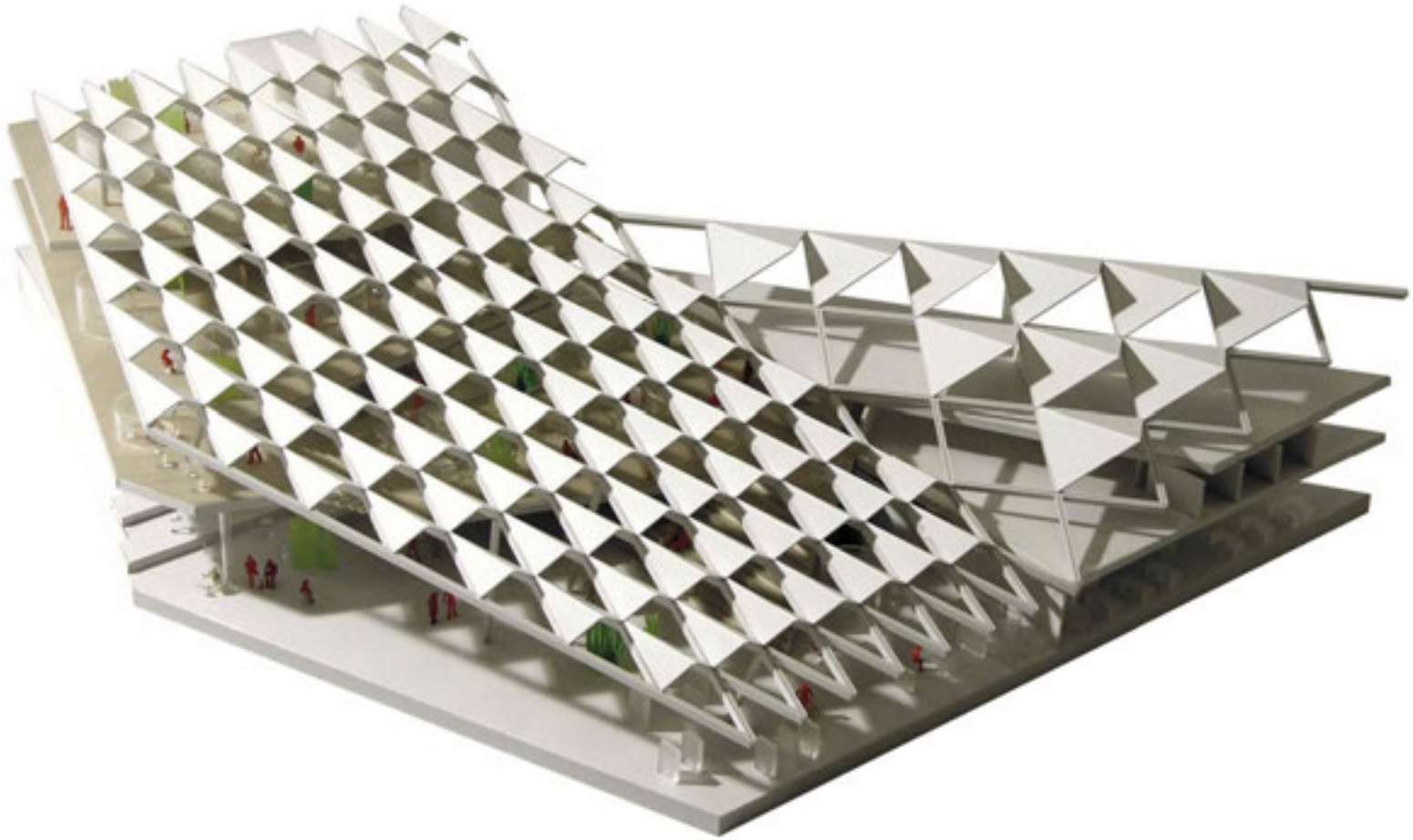


DESIGN: FLEXIBLE AND ADAPTABLE SPACES
POTENTIAL: BETTER USE, LONGER LIFETIME, LESS RESSOURCE WASTE



"...it matters a lot that you see people all the time. It makes you want to just talk to them and make a comment..."

Mille Sylvest 2016: "Situated Social Aspects of Everyday Life in the Built Environment"




2 Plateau


Plateau

80%

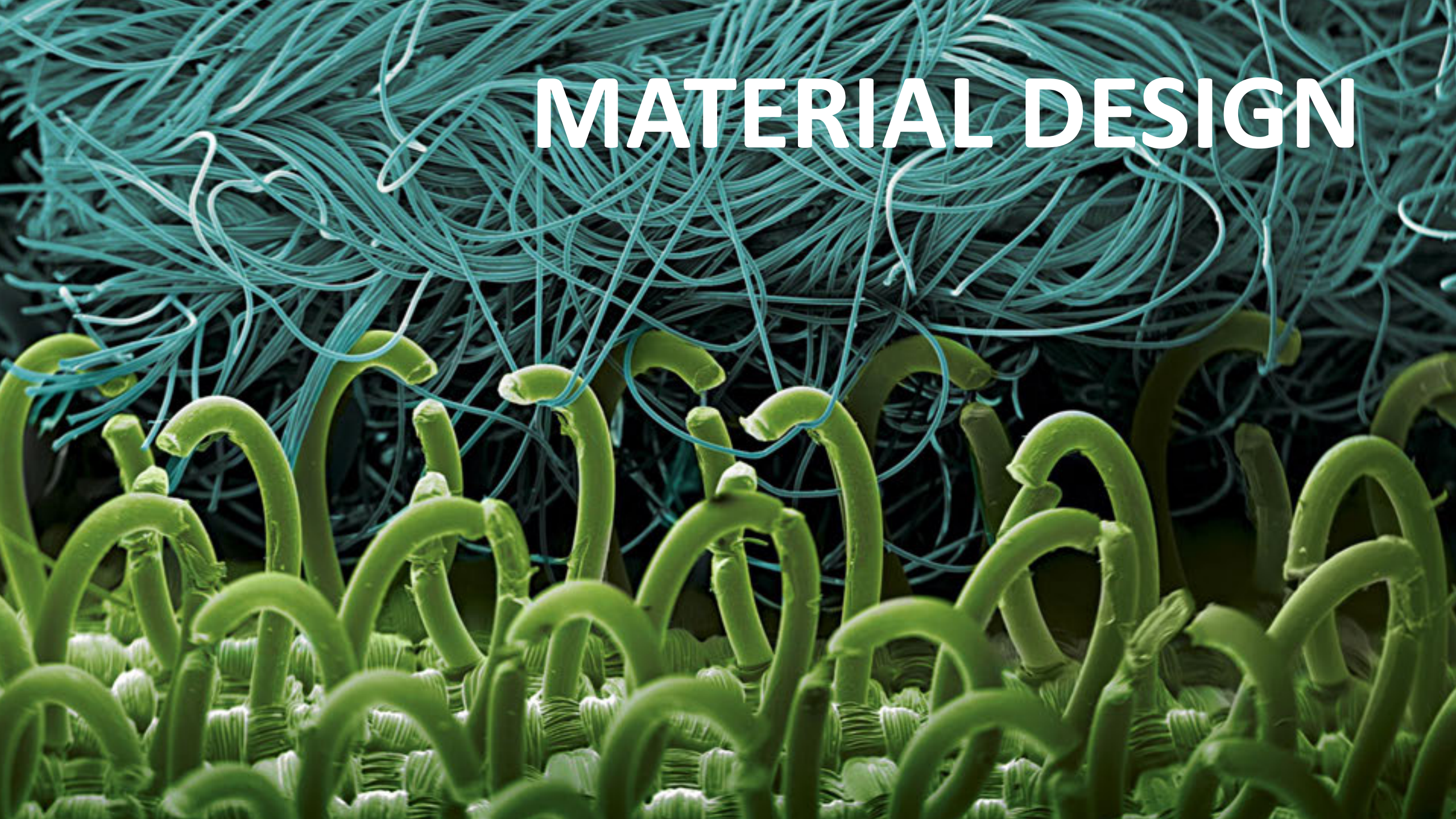
of the employees are more satisfied with working in the new building, rather than its past.

74%

of the employees eat lunch daily with colleagues from other rooms. It increases knowledge sharing.

92%

of the employees are satisfied with their location in the building.

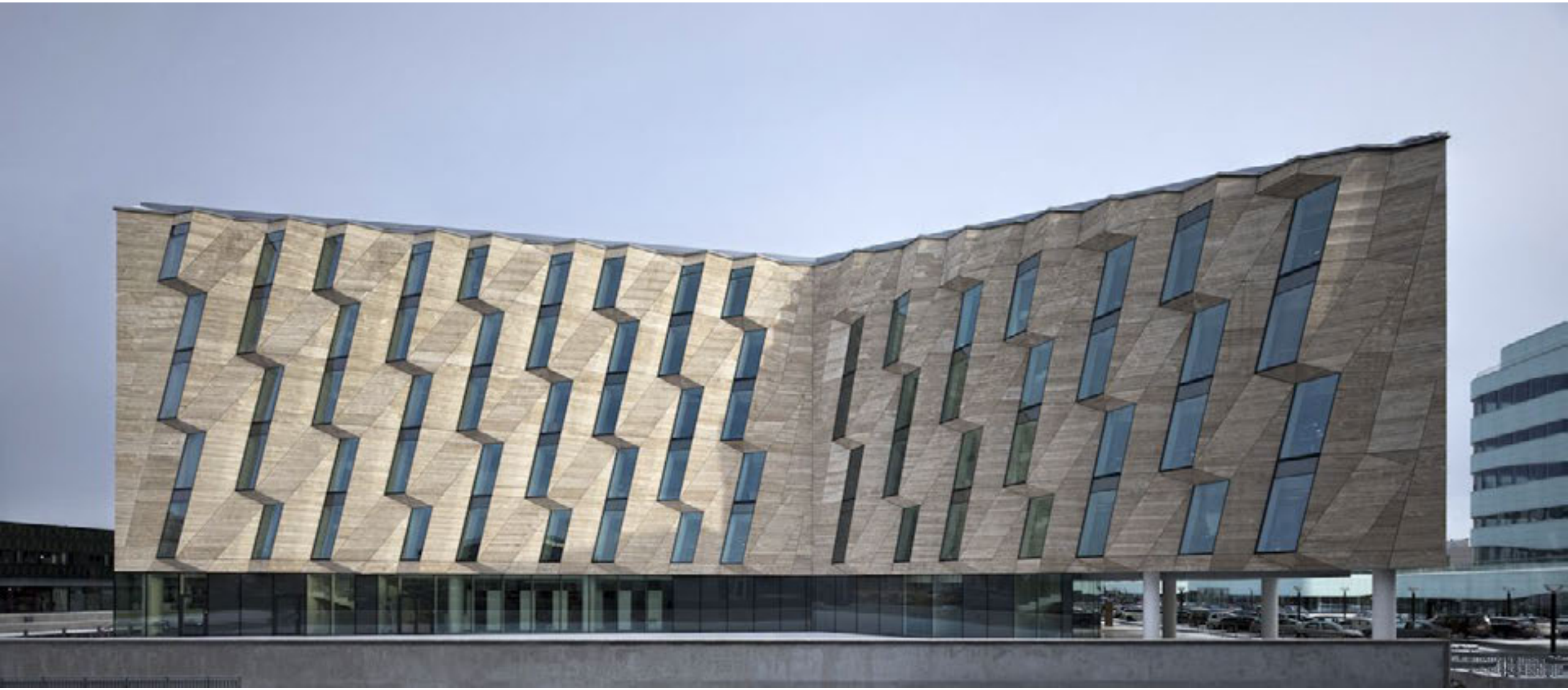

MATERIAL DESIGN

We believe that design takes place at all scales


RIWAL.COM
JLG ULTRA BOOM
R

Horten HQ

Copenhagen, Denmark




pihl
Horten


Material
World

00

Bendywood

Bendable wood

This material is a solid hardwood that can be bent in ways that seems impossible. In the process of the making blanks of hardwood are steamed to soften the cell walls, then, still damp, they are compressed along their length for about 20 % and finally dried in this compressed form. This allows the wood to be bent as much as to a radius of 10 times its thickness. Thin sections are bendable by hand, larger with the help of tools – far easier and faster than conventional wood-bending techniques.

Examples Of Use

Interior decoration, furniture, hand rails.

Similar Materials

01, 14, 44, 50, 51, 68, 84

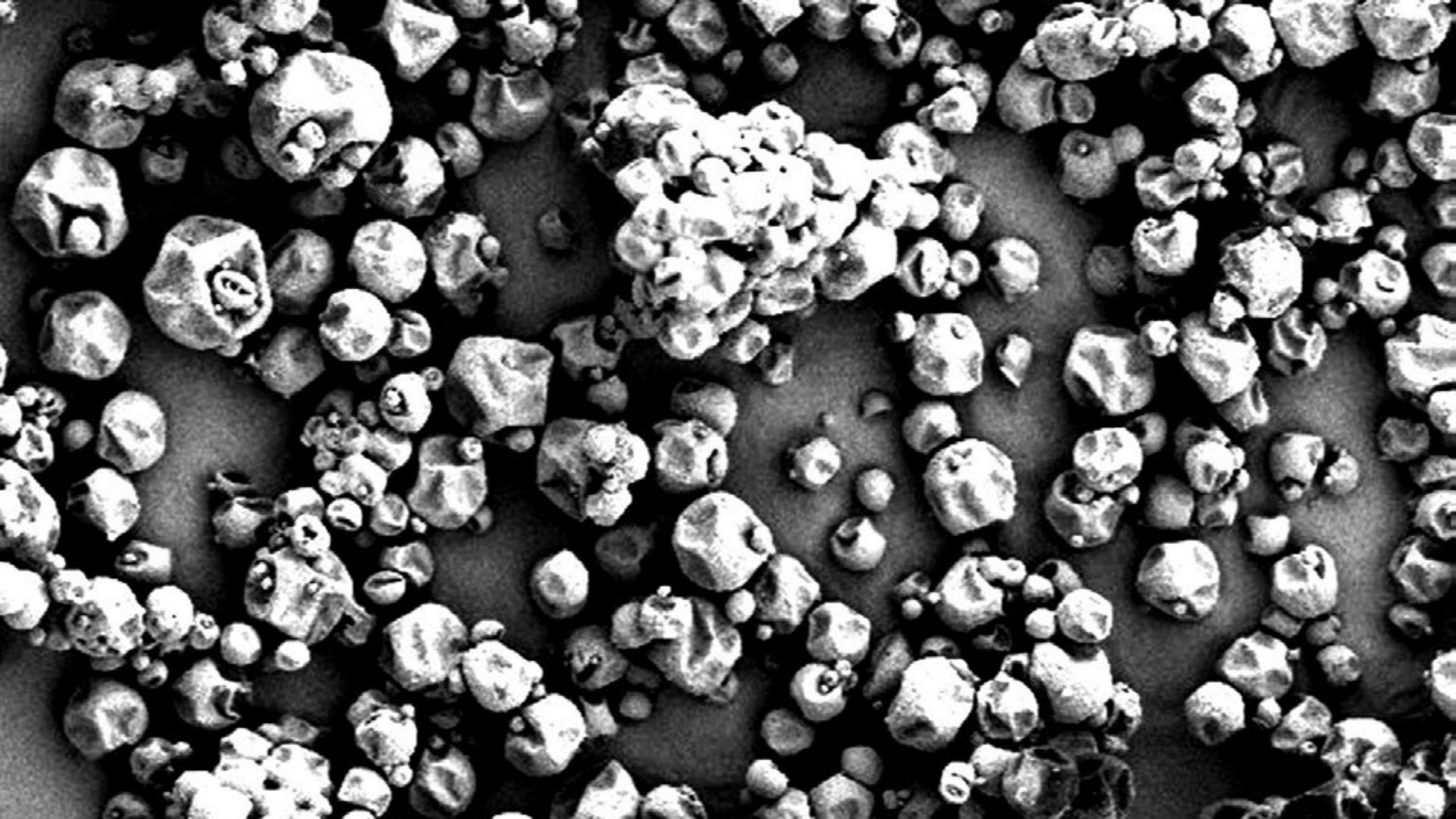
Material Data

Bendywood blanks max size: 120 x 120 x 2,200 mm (beech), 120 x 120 x 1,650 mm (ash, cherry, maple, oak and walnut).

Manufacturer

Bendywood, www.bendywood.info


CANDIDUS



Smart Materials
00–19

15

Micronal Smart Board

Active temperature regulation

These plaster boards include 3 kg/m² of heat-storing material in the shape of microcapsules containing a phase changing material (PCM). When heated to a certain point, the PCM will melt, absorbing thermal energy without any increase in temperature, while the reverse process releases the stored energy as heat, maintaining a pleasant room temperature. The heat storage capacity of a 15 mm PCM Smart Board is equivalent to that of a 90 mm concrete wall or a 120 mm brick wall.

Examples Of Use

Reducing shifts in indoor temperature between day and night and reducing the need for air conditioning and heating.

Similar Materials

02, 05, 40, 63, 65

Material Data

Two types available with 'switching points' temperatures at 23°C and 26°C; thickness: 15 mm; length: 2,000 mm; width: 1,250 mm.

Manufacturer

BASF, www.micronal.de

23

Jungbecker

Light-directing prisms

Jungbecker Optics manufactures a wide range of standard sheets and injection moulded applications as well as custom-designed project-specific solutions, all offering precision-engineered lighting control. By embossing acrylics, polycarbonate and other transparent materials with cone-shaped prisms optimised by numerical algorithms, it becomes possible to direct incident light. It may be split, reflected and directed to suit the lighting requirements of a given space while avoiding glare effects.

Examples Of Use

Lighting, skylights and partial façade glazing where a high degree of light control is required.

Similar Materials

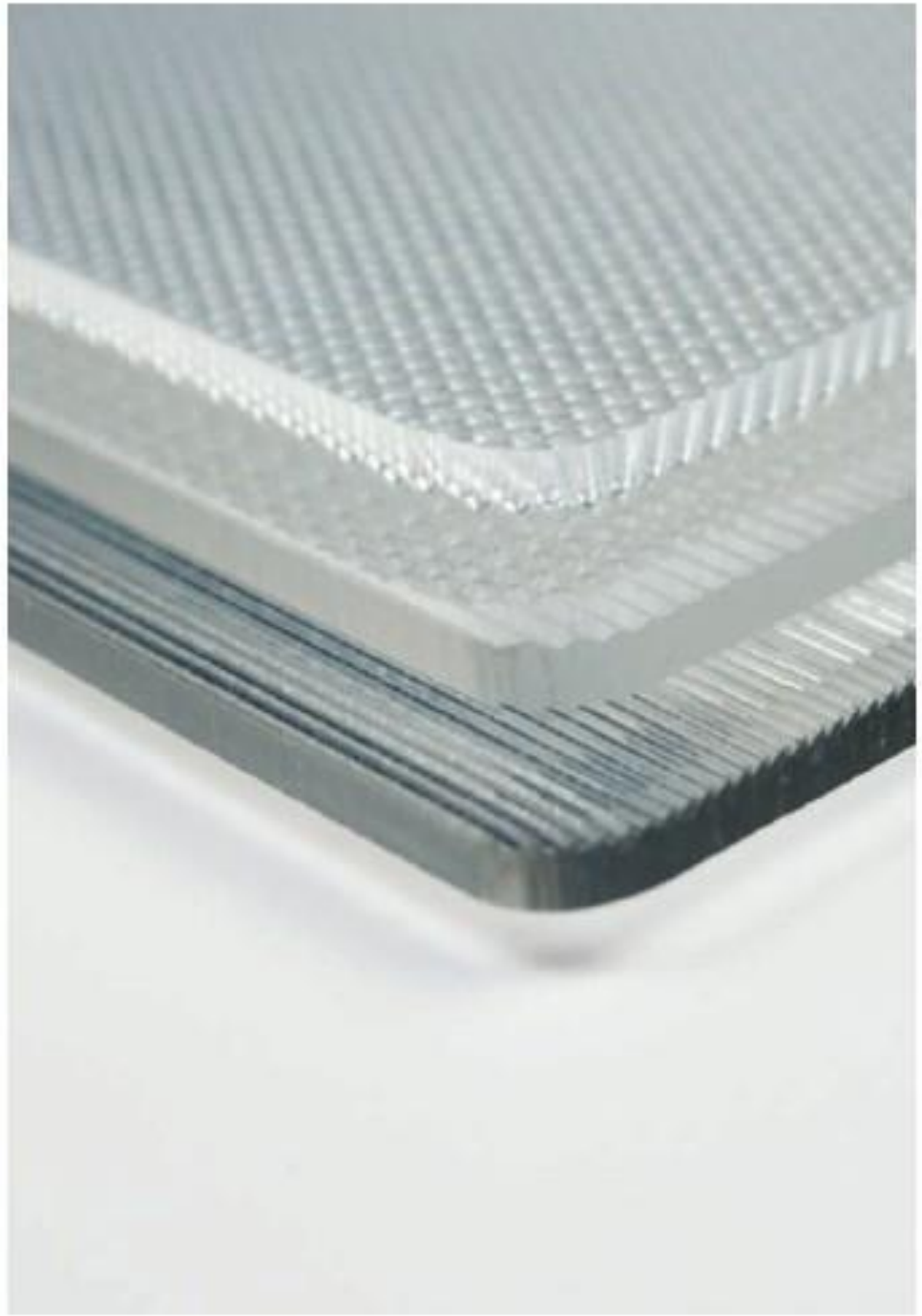
27, 32, 35, 36, 38

Material Data

Example: conical anti-glare prism; measurements: up to 1,200 x 600 mm; thickness: 3 mm; cone diameter: 2 mm; refractive index: 1.491; light transmission: 92% (clear acrylic).

Manufacturer

Jungbecker Optics, www.jungbecker.de



30

Okagel

Translucent insulation

Okagel is an insulating glass system, in which the inter-pane cavity is filled with a translucent, silica-based aerogel. Aerogel consists of 99.8% air restrained in nano-size pores. It weighs 75 g per liter, making it the lightest and best insulating solid in the world. The Okagel panels have a high light transmission. They diffuse daylight deep into the room while providing very good sun and glare control. They block IR radiation, attenuate sound and disperse transmitted light evenly.

Examples Of Use

The Okagel system is wellsuited for rooms where light diffusion as well as thermal and sound insulation are required.

Similar Materials

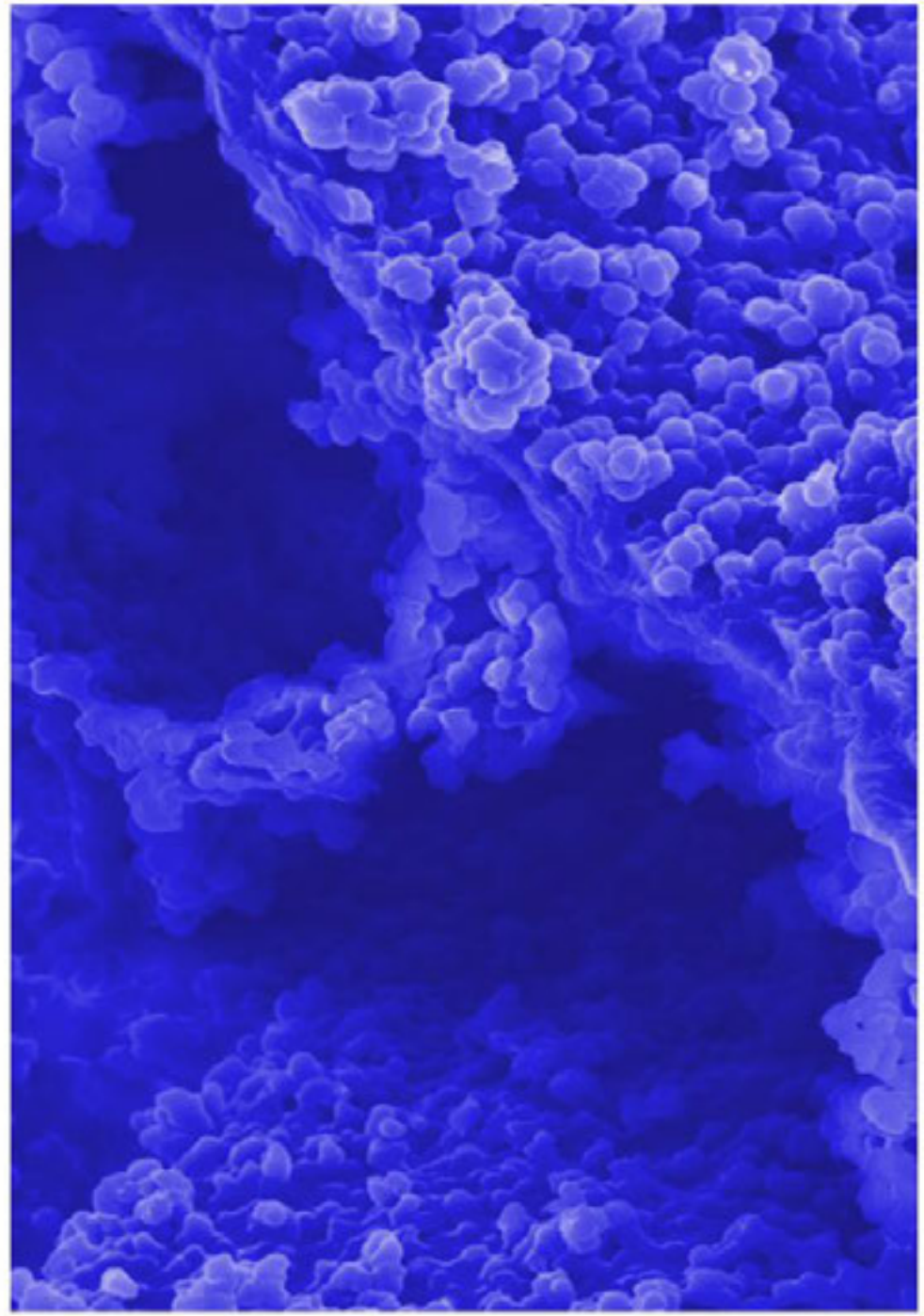
63, 65, 70, 79

Material Data

Okagel glass system: U-value: 0.3 W/m²K (60 mm nanogel filling) or U-value: 0.6 W/m²K (30 mm nanogel filling).

Manufacturer

Okagel: Okalux, www.okalux.de



39

Microshade

Micro structured solar shading

Microshade is a static, micro-structured shading that is mounted in the cavity of two- or three- layer window panes. Microshade offers effective, maintenance-free shading from direct sunlight while maintaining good transparency. The lamellas consist of stainless steel in strips less than 0.2 mm wide, angled so as to reflect the rays of the sun when it is high in the sky. On a typical summer day, when the sun is at its highest, the energy gain from the sunlight is reduced by up to 90 %.

Examples Of Use

South facing glass façades, integrated sun screening systems and solar shading.

Similar Materials

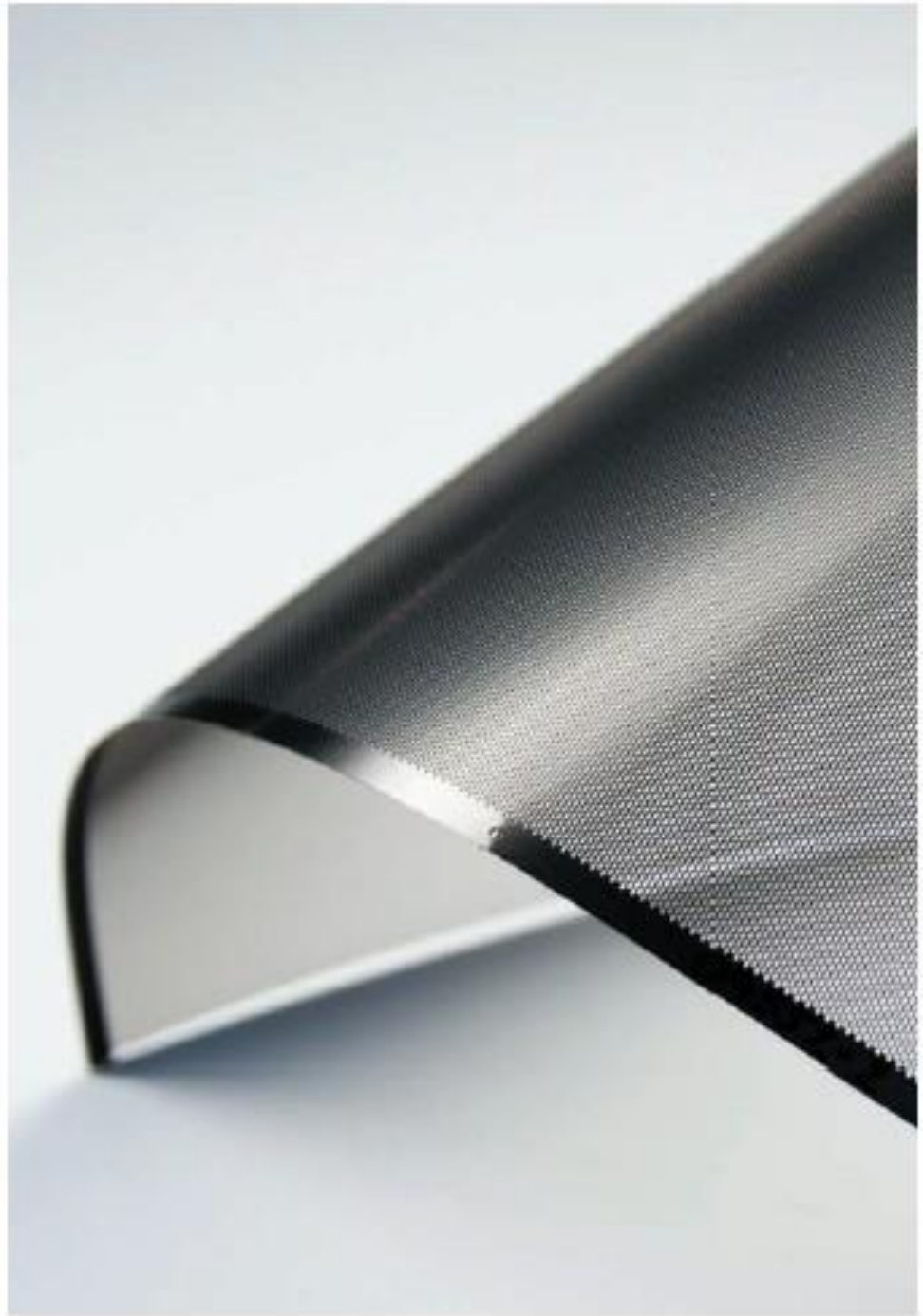
20, 24, 57, 78, 85, 94

Material Data

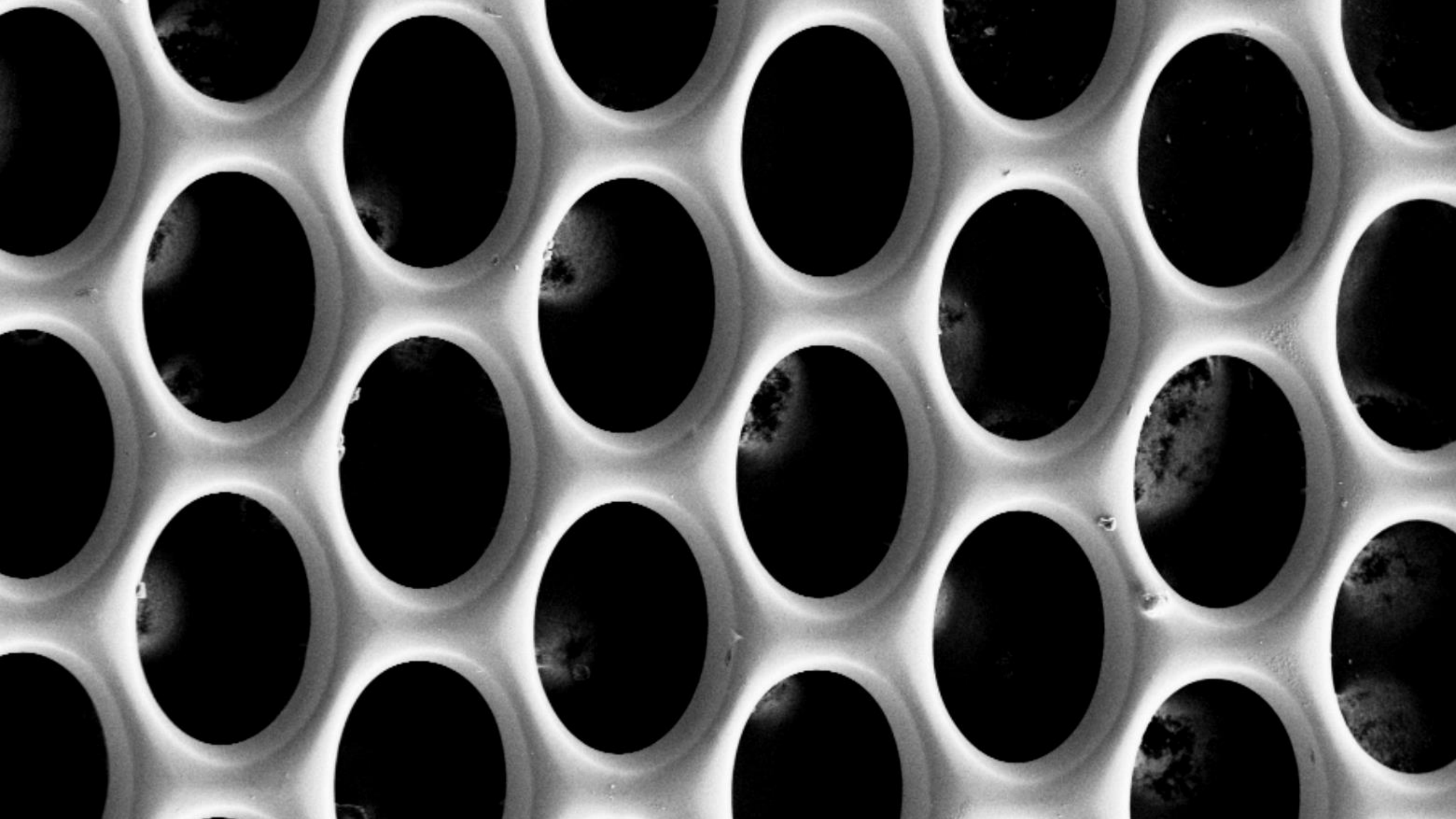
Available in rolls 140 mm wide; example: double glazing with Microshade MS-A; solar direct transmittance: 15 % at 45 degrees solar height, 28 % at 15 degrees solar height.

Manufacturer

PhotoSolar, www.photosolar.dk

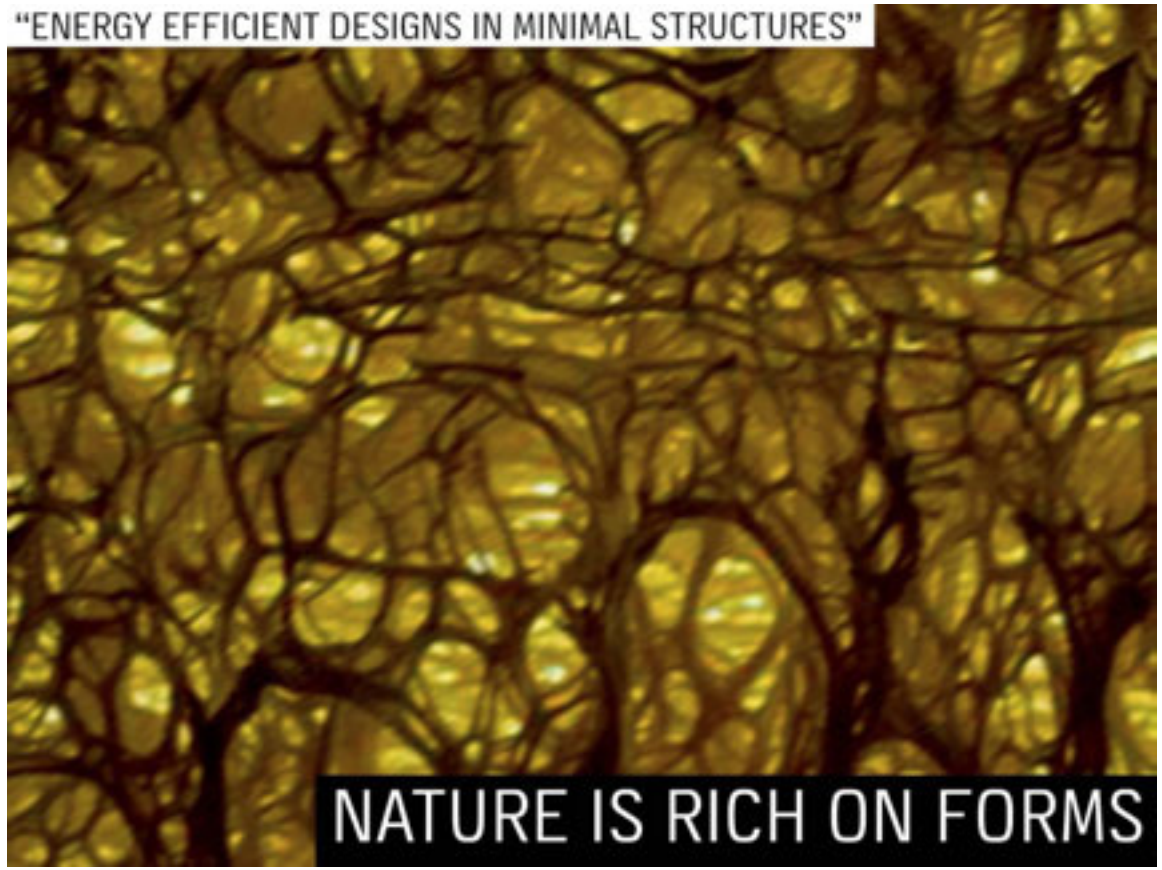


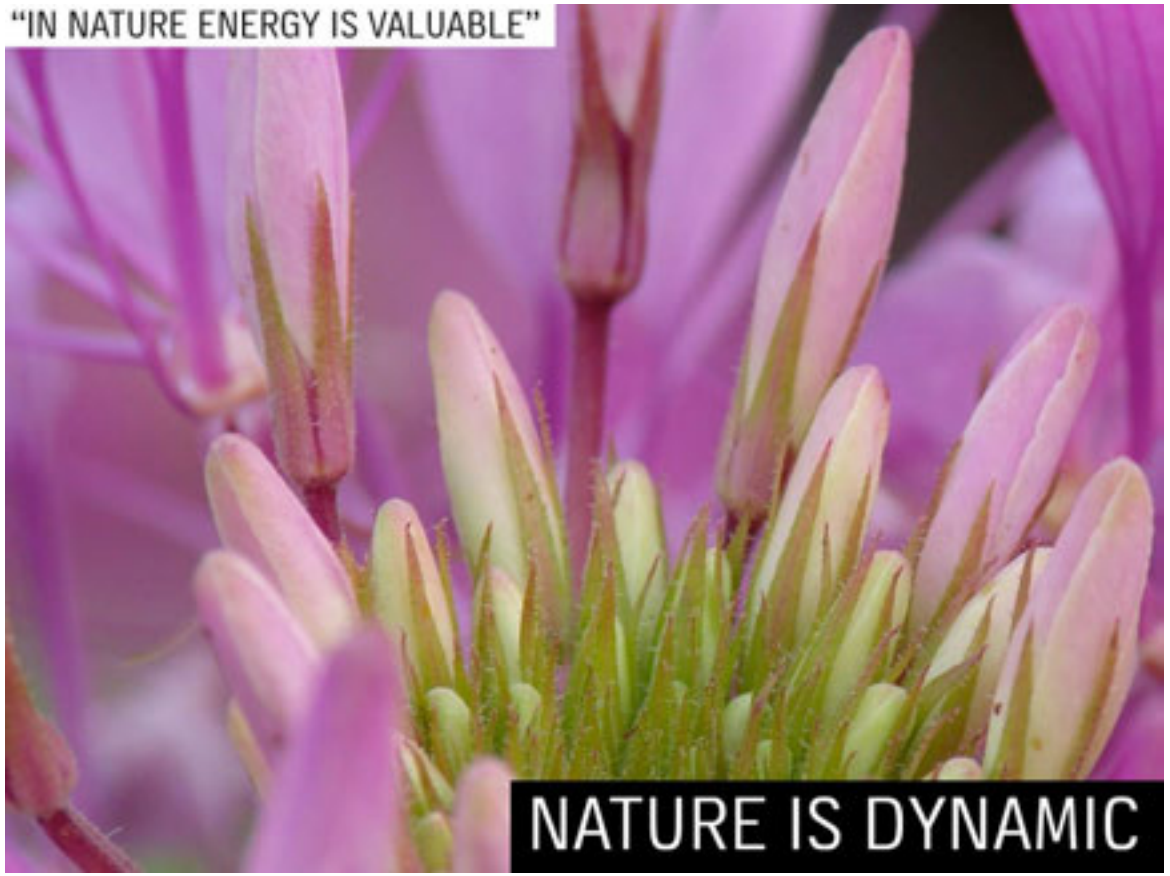

sun facing side !

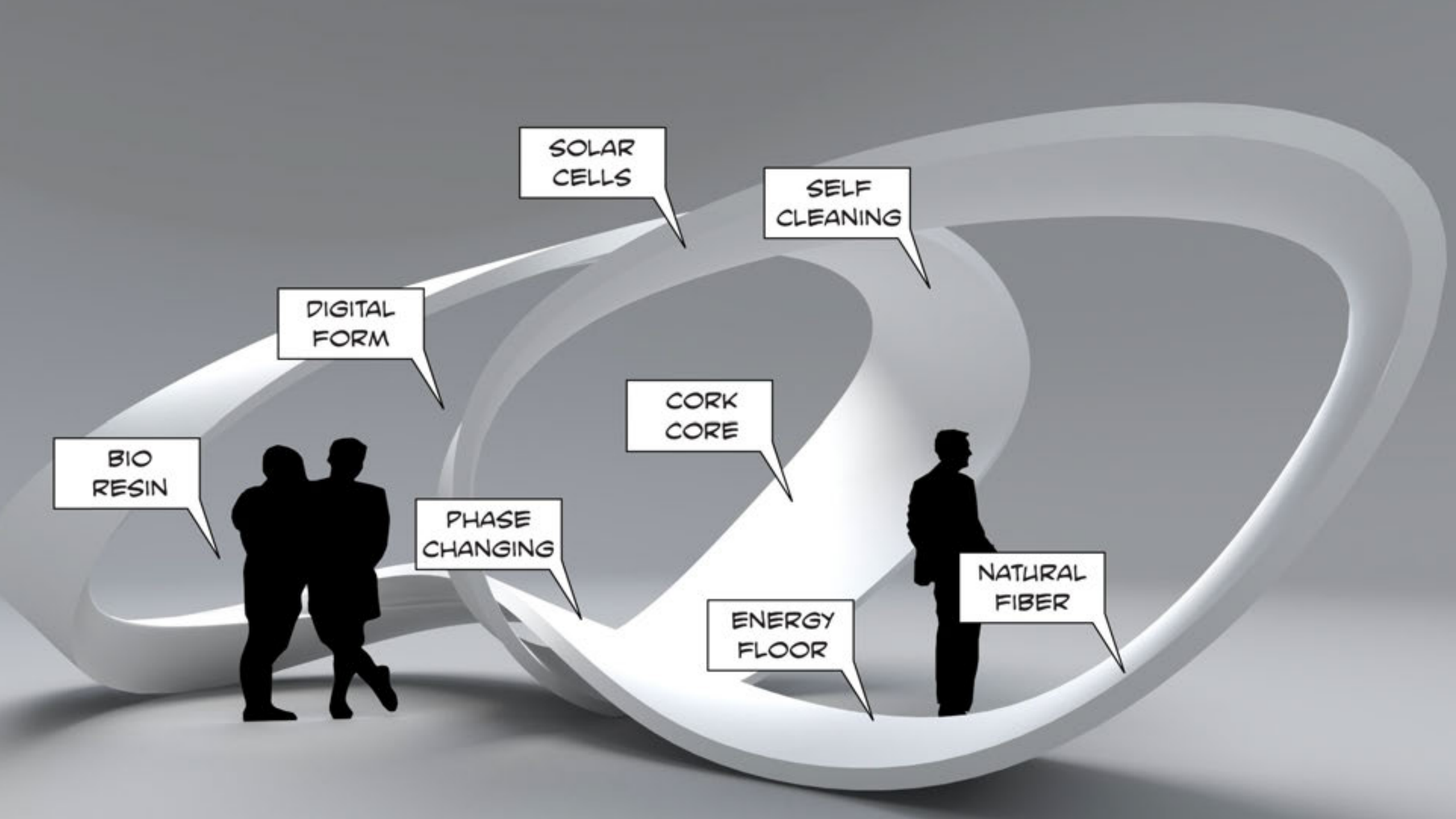


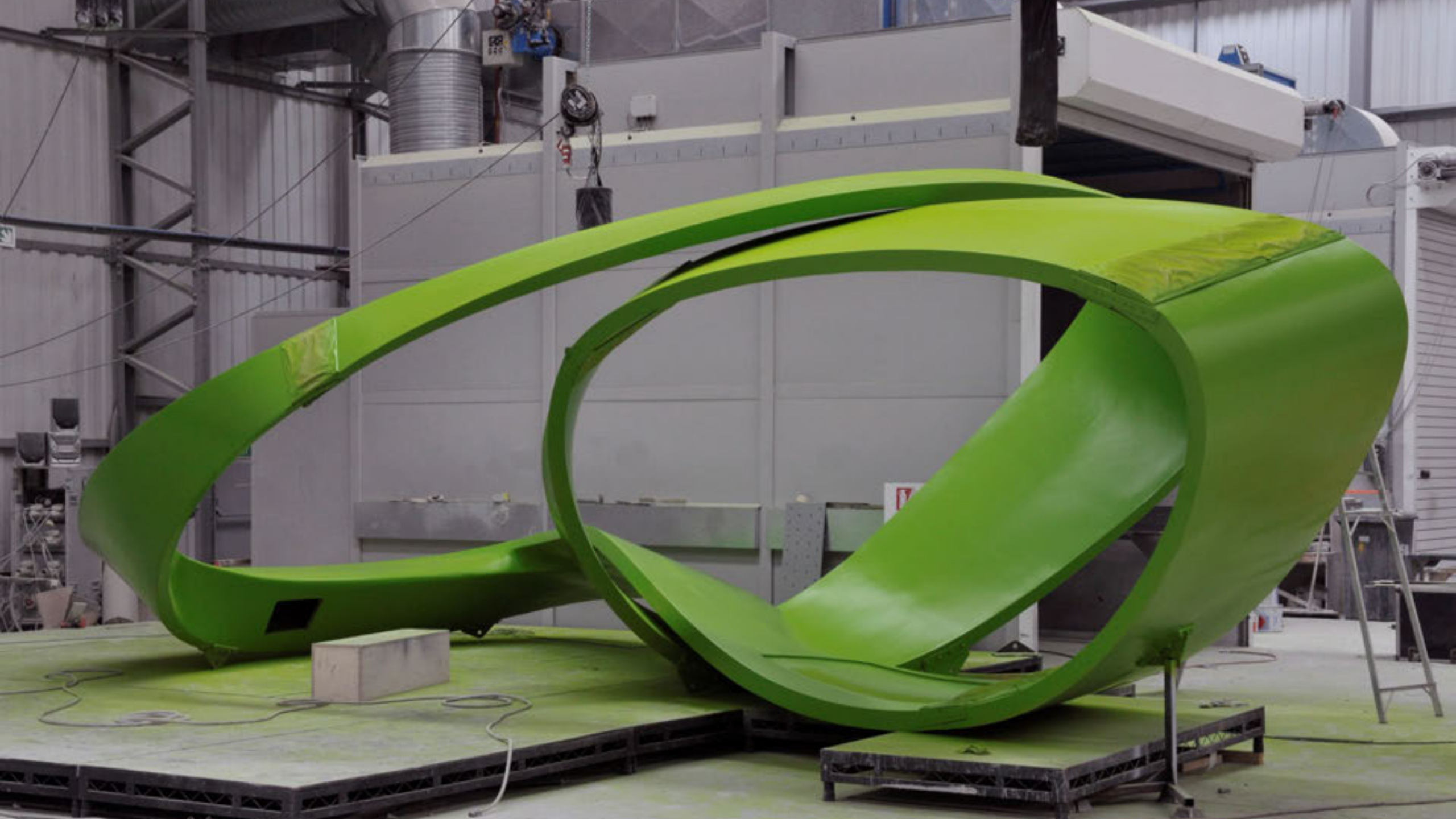
Louisiana Pavillon

Humlebæk, Denmark


"ENERGY EFFICIENT DESIGNS IN MINIMAL STRUCTURES"
NATURE IS RICH ON FORMS


"IN NATURE ENERGY IS VALUABLE"
NATURE IS DYNAMIC

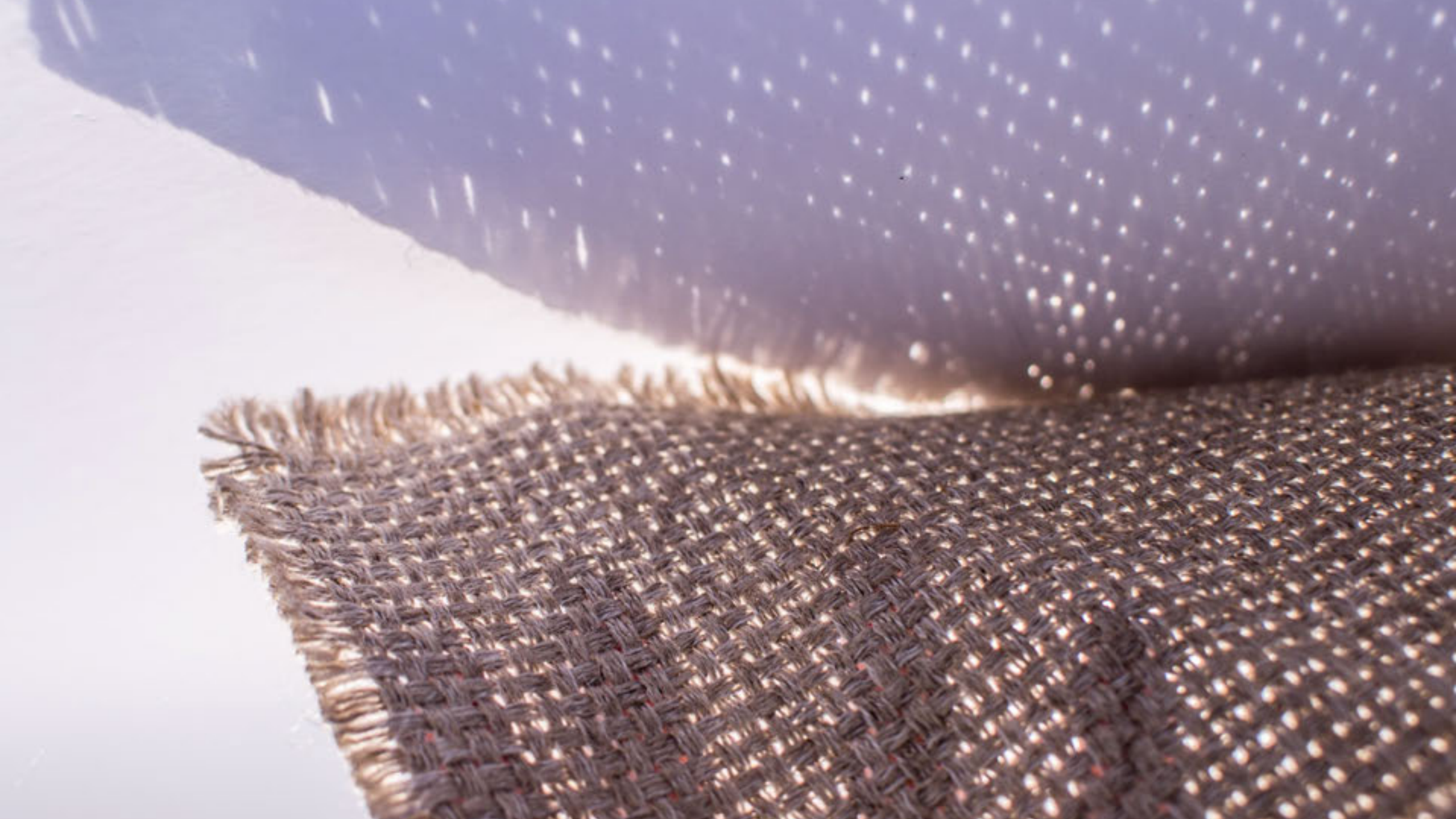

SOLAR CELLS
SELF CLEANING
DIGITAL FORM
CORK CORE
BIO RESIN
PHASE CHANGING
NATURAL FIBER
ENERGY FLOOR

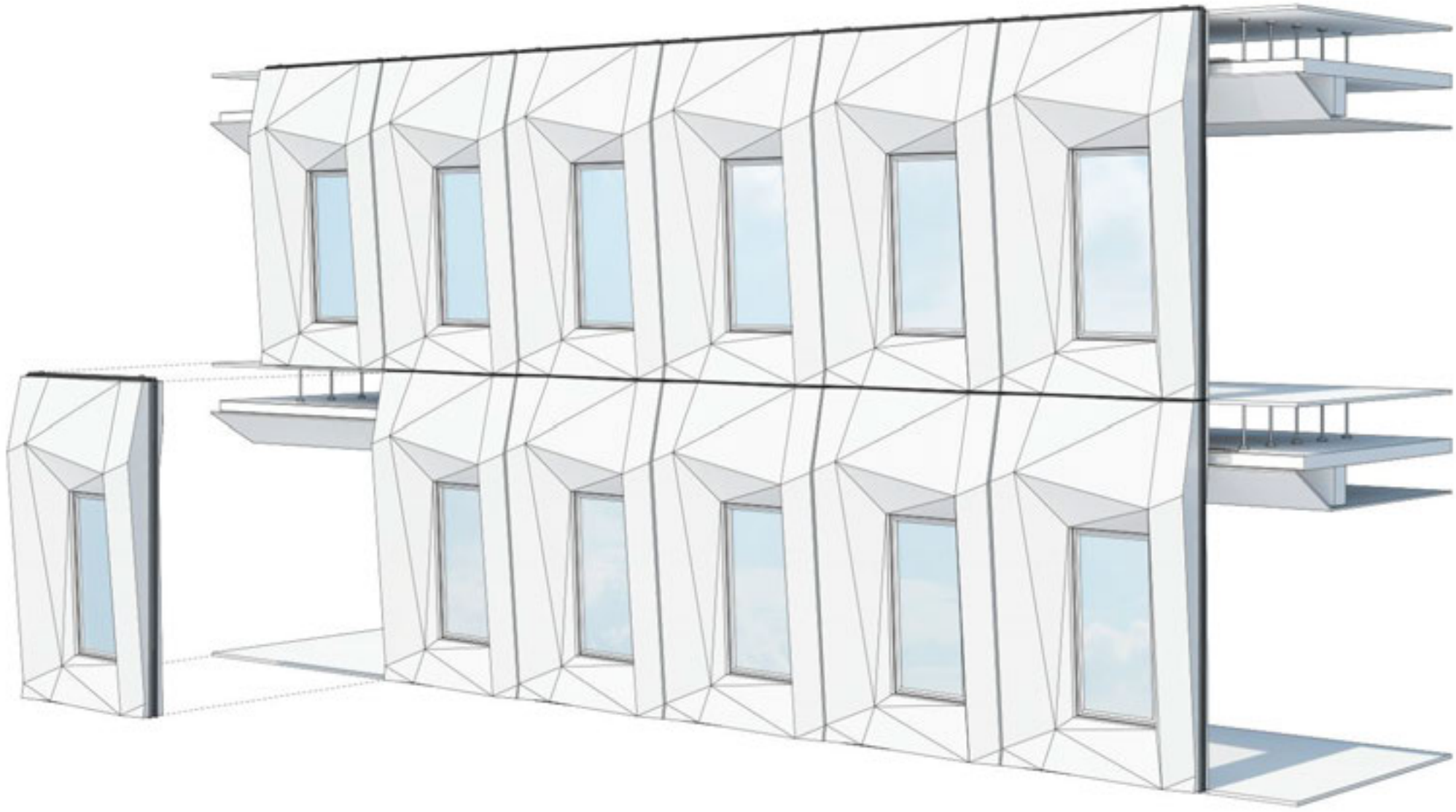



jec
COMPOSITES
jec
COMPOSITES

BioBuild

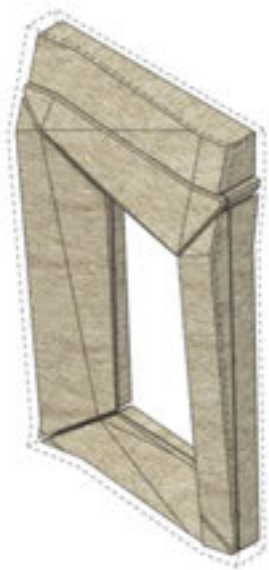
London, United Kingdom





External glass window

Bio-composite exterior

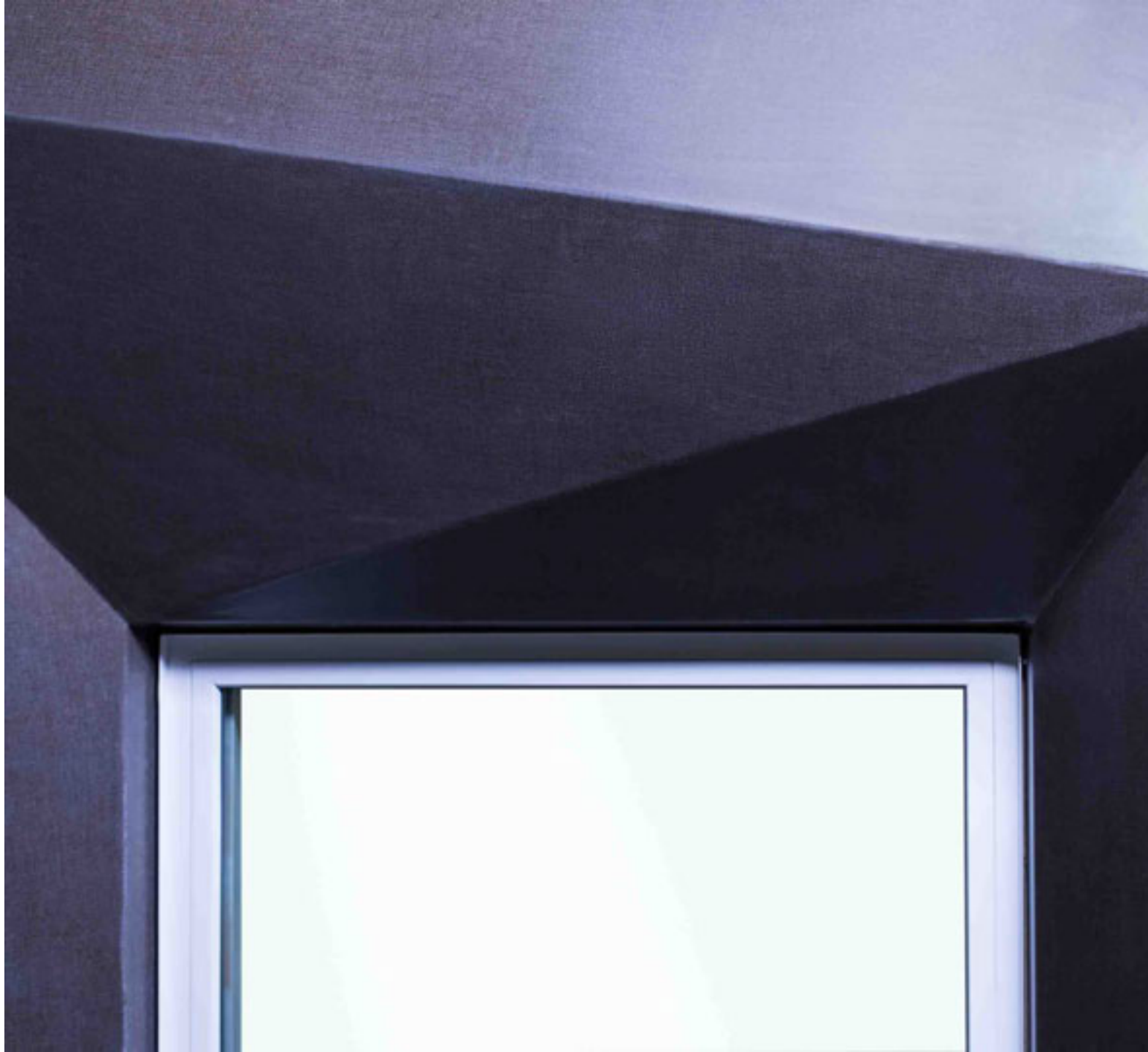


Wood-fibre insulation

Internal wood structure

Bio-composite interior

Aluminium interface



LIFE CYCLE DESIGN

We see buildings as man made ecosystems


CIRCULAR
SUSTAINABILITY

1 WOOD CONSTRUCTION

2 ENERGY FACADE AND ROOF

3 INTEGRATED GREEN

4 ALGAE WATER CLEANING

5 INTELLIGENT INDOOR CLIMATE

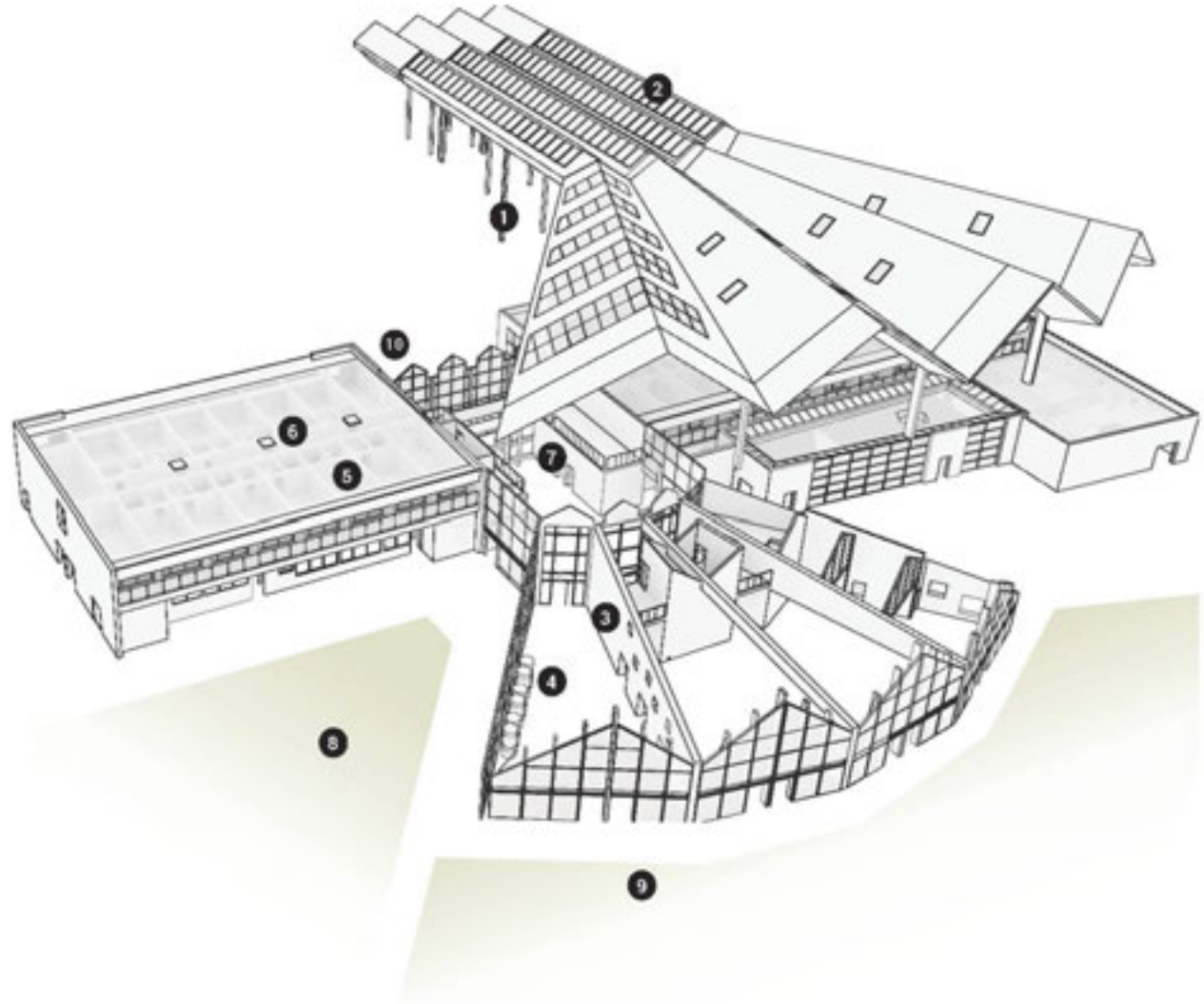
6 AIR CLEANING CARPETS

7 ACTIVE GYPSUM PLASTER

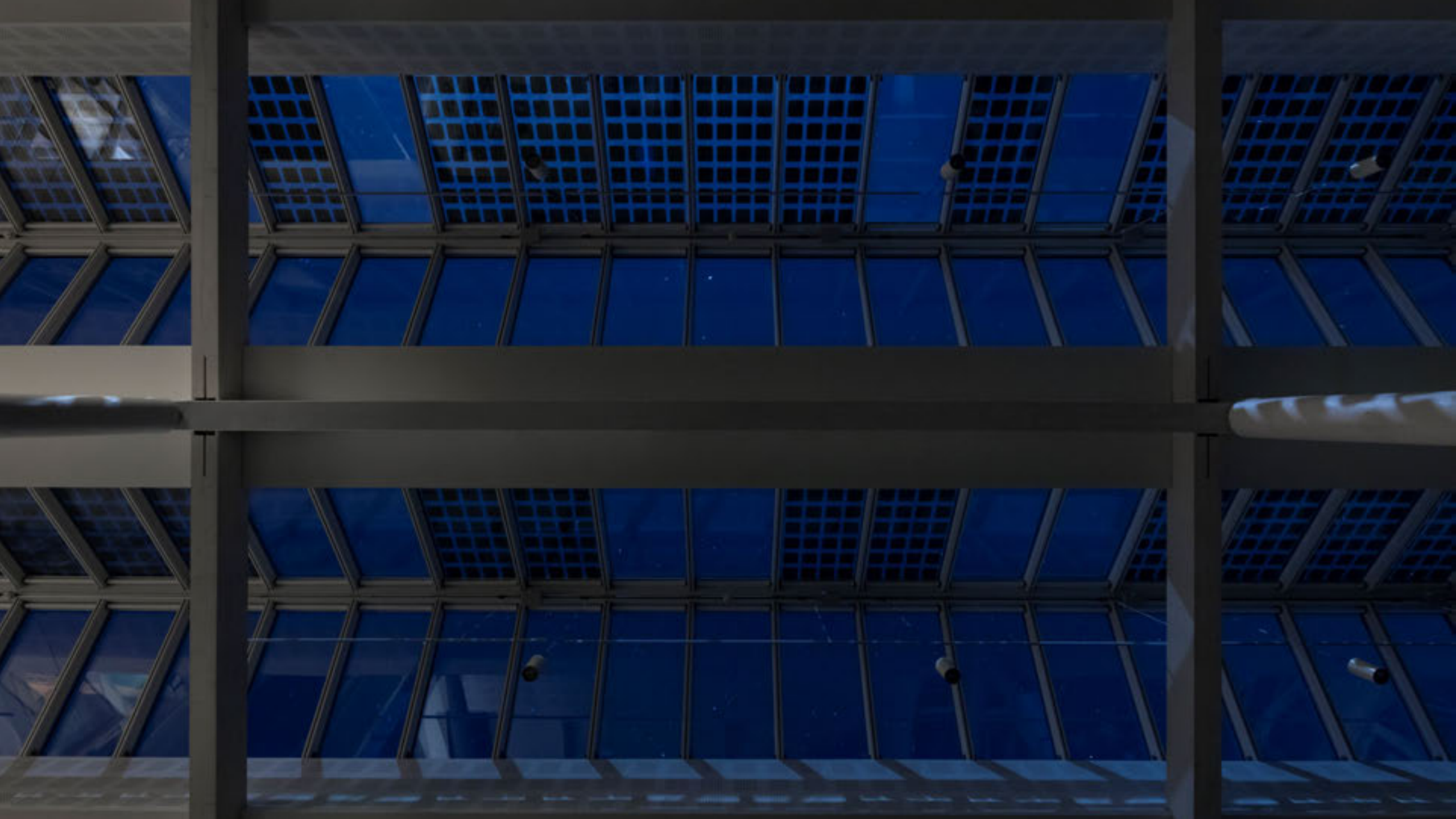
8 EARTH LUNG

9 BITUMEN TREE LANDSCAPE

10 UPCYCLED GLASS PAVEMENT




CIRCULAR
BUISNESS
MODEL



MATERIAL UPCYCLING

NATURE

MATERIALS

GREEN SOLUTION HOUSE

BITUMEN FREE LANDSCAPE

Natural Hardscape Design

Bitumen is a waste product from crude oil processing, and the binder of asphalt. Green Footprints Park is a bitumen free landscape, and the parking lot at Green Solution House demonstrates that it is possible to make a robust paving surface for driving, without asphalt. Where needed a plant-based binder, called Vegecol, is used as an environmentally friendly alternative to bitumen – elsewhere aggregate surfaces are simply compacted fill.

Who's behind it: SLA and GXN


nord

NATURE WATER

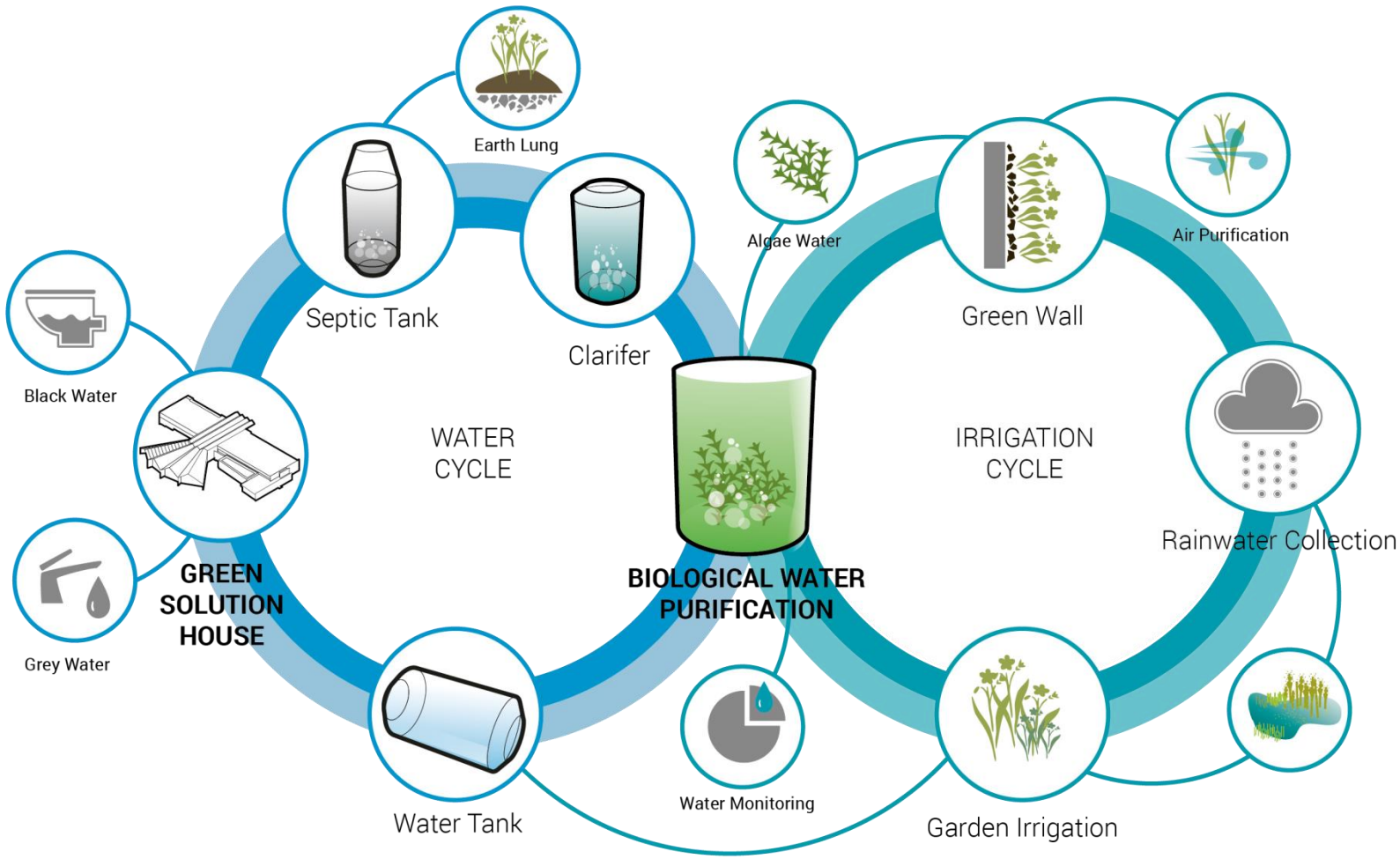
GREEN SOLUTION HOUSE

WATER AND SOIL BALANCE

Rainwater Landscaping

The high water table on the site poses a challenge, but instead of fighting nature and treating this as a problem, the landscape was designed around the element of water. The soil excavated for the foundation of the new building was retained on site and used to sculpt the land. Various watershed designs guide rainwater to seasonal ponds, creating an easy to maintain landscape, which increases biodiversity, provides natural irrigation, has a cooling effect in the summer months.

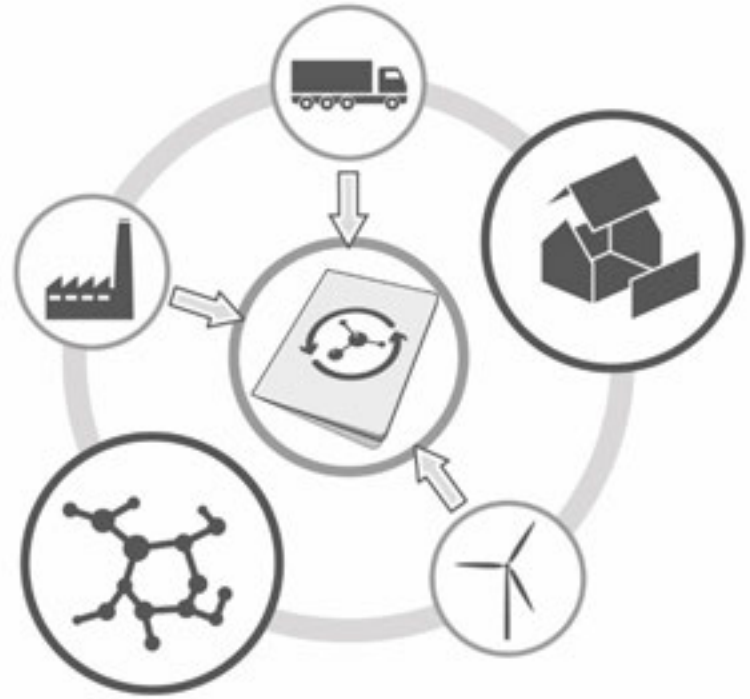
Who's behind it: SLA


Earth Lung
Septic Tank
Clarifer
Algae Water
Green Wall
Air Purification
Black Water
WATER
CYCLE
IRRIGATION
CYCLE
Rainwater Collection
GREEN
SOLUTION
HOUSE
BIOLOGICAL WATER
PURIFICATION
Grey Water
Water Tank
Water Monitoring
Garden Irrigation


LIVING
MACHINES


MATERIAL
FILTER

Material filter



Material passport

INTELLIGENT INDOOR CLIMATE

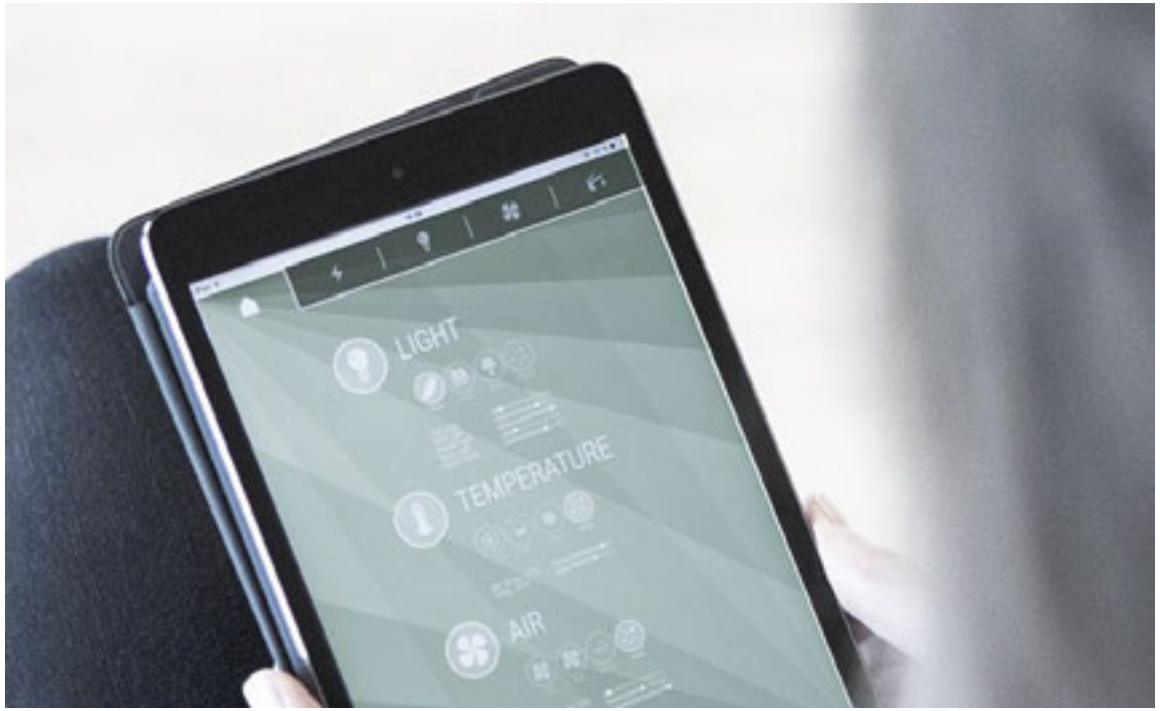
WATER LIGHT AIR ENERGY

INTELLIGENT INDOOR CLIMATE

Smart Room App

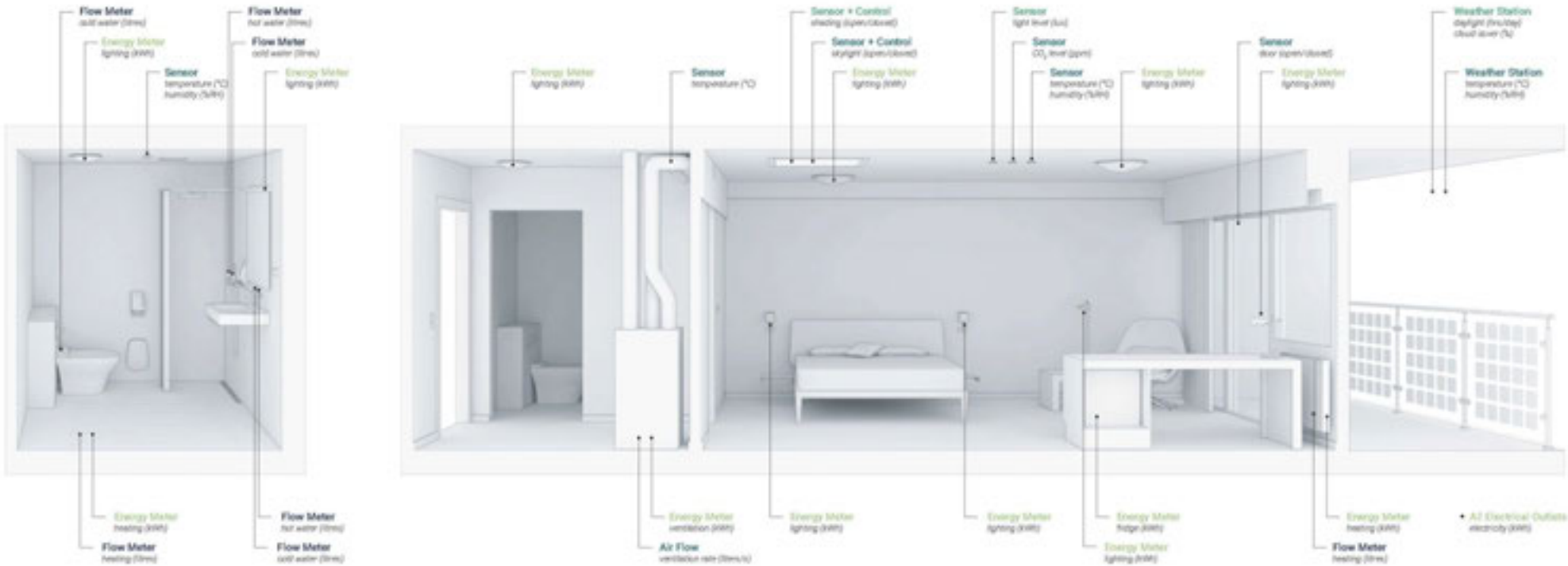
Interact with your room! At Green Solution House we custom-built a mobile app to track resource consumption and easily control the indoor environment in our Smart Rooms. Energy, light, air and water are the four themes on which live feedback is provided to our guests, helping to inform behaviour by increasing awareness at a personal level.

Who's behind it: GXN Innovation, Autodesk Research



SmartRooms

At check-in guests staying in our smart hotel rooms are provided with a tablet to control and gain feedback from their fully monitored hotel room. The system showcases their room's intelligent indoor environment which ensures ideal comfort, thanks to a variety of sensors and devices throughout the room.



Energy Consumption
Power consumption for each outlet or device

Light Levels
Illumination from natural and artificial sources

Air Quality
CO_2 and humidity levels, ventilation rate and type

Water Consumption
Total hot and cold water use

SmartRoom App

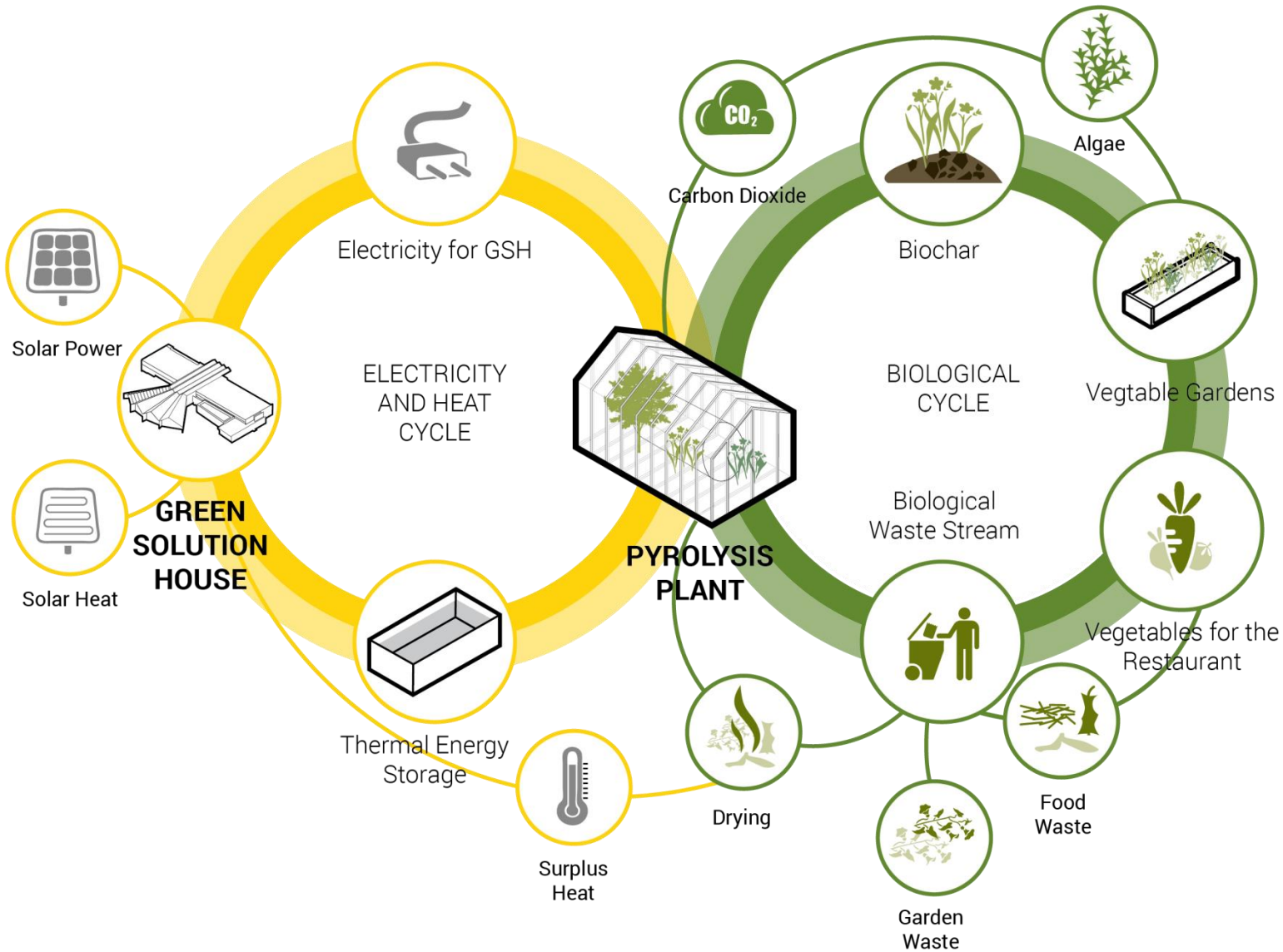
Being 'smart' about how resources are used, by understanding their availability, is the first step towards achieving self-supported sustainable living. Our tablet app is designed to help our guests on their way to understanding the nuances of everyday life and how personal habits influence energy demand, water consumption and indoor climate.

Login & Control
Whole Building Approach

Managing the indoor environment is made easy with preference based settings for lighting and climate. In real time the settings selected in the app affect the overall performance of the individual rooms. Light preferences are set based on mood and adapt according to the time of day and availability of natural light. Temperature and air settings control the mix of natural and mechanical ventilation – thus regulating the CO2 level, humidity and general comfort.

Monitor
On-Site | Off-Site

Four categories – energy, light, air, and water – summarize the real time conditions within each smart hotel room and provide data on relevant on-site systems, enabling guests to personally track their stay. Data trends from the past 24-hour period are displayed to help guests make correlations and understand the impact of their stay.


Electricity for GSH
Solar Power
Solar Heat
GREEN SOLUTION HOUSE
ELECTRICITY AND HEAT CYCLE
Thermal Energy Storage
Surplus Heat
PYROLYSIS PLANT
Carbon Dioxide
Biochar
Algae
BIOLOGICAL CYCLE
Vegtable Gardens
Biological Waste Stream
Vegetables for the Restaurant
Drying
Food Waste
Garden Waste


ELIMINATING
WASTE

ENERGY FROM WASTE

Pyrolysis Plant

All food scraps and organic materials from the main building are fed into our own stationary pyrolysis plant. The process heats the waste, breaking it down to produce natural gas and biochar, which is valuable as a soil additive for the gardens. The gas is combusted in a combined heat and power engine, generating heat and electricity for the building. Excess heat is stored onsite as hot water in a swimming pool, repurposed as a thermal energy storage system.

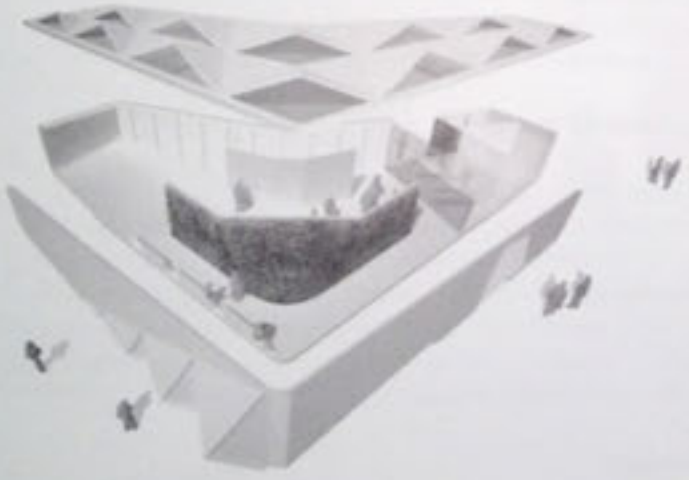
Who's behind it: GXN Innovation


CRADLE TO CRADLE®
I DET BYGGEDE MILJØ
EN MANUAL TIL DEN DANSKE BYGGEINDUSTRI

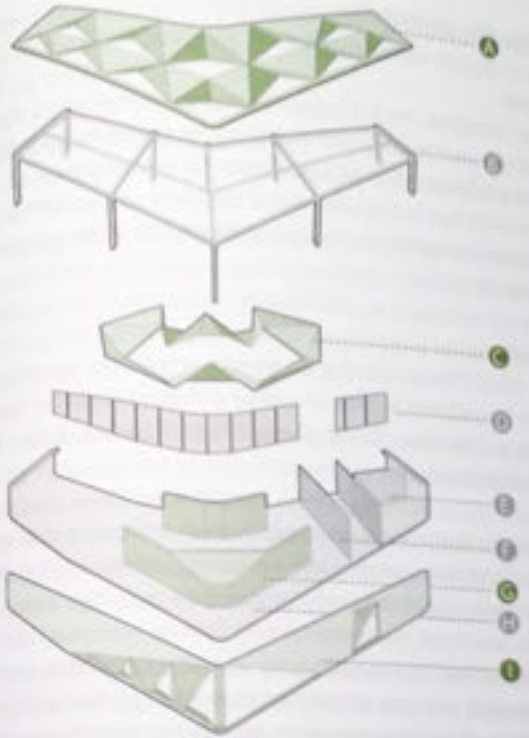
sign) kombineret med et energieffektivt installationskoncept og bygningsintegreret energiproduktion. Der er integreret ca. 45 m² solceller på kassetterne til markante overlys, som er orienteret og vinklet for at opnå høj effektivitet fra solcellerne. De integrerede solceller dækker hele bygningens energibehov hen over året. Herudover integreres en række teknologier til at nedsætte pavillonens forbrug, bl.a. termoaktive konstruktioner.

I pavillonen integreres intelligent styring for tilslutning og udveksling af strøm med den offentlige elforsyning. Dette sikrer, at pavillonen kan levere overskydende, ren energi fra solcellerne til den offentlige forsyning. Det intelligente system er derudover åbent for løbende integration af andre energikilder, som f.eks. bevægelses- og vindenergi.

Herudover etableres en eldreven varmepumpe til opvarmning og afkøling. Varmepumpen producerer varme-energi svarende til minimum tre gange den el-energi, som den forbruger. Endvidere producerer varmepumpen afkøling svarende til minimum to gange den energi, som den forbruger til køleproduktionen.



Rendering af sprængt perspektiv af den Cradle to Cradle inspirerende Pavillon



	Komponent	Klassifikation	Materiale
	Tag		
A	Tagfolie	Biologisk næringsstof	Biokompost
	Konstruktion		
B	Kammerkonstruktion	Teknisk næringsstof	Stål
C	Tagkonstruktion	Biologisk næringsstof	Træ
D	Isoleringsring	Teknisk næringsstof	Glasfiber
	Interiør		
E	Vægelementer	Teknisk næringsstof	Stål med PCM
F	Indre skillevæg	Teknisk næringsstof	Glas
G	Grønne vægge	Biologisk næringsstof	Planter og filtermåtter
	Facade		
H	Ydre vægge	Biologisk næringsstof	Biokompost
I	Facademoduler	Teknisk næringsstof	Glas og Aluminium

Opdeling af bygningens hovedkomponenter i tekniske og biologiske materialer


BIOLOGICAL MATERIALS

WHAT IF WE CAN BUILD TOMORROW WITH THE WASTE OF TODAY?


EENTILEEN
GXN
NCC
Deloitte.
TEKNOLOGISK INSTITUT


Dør lidt åben

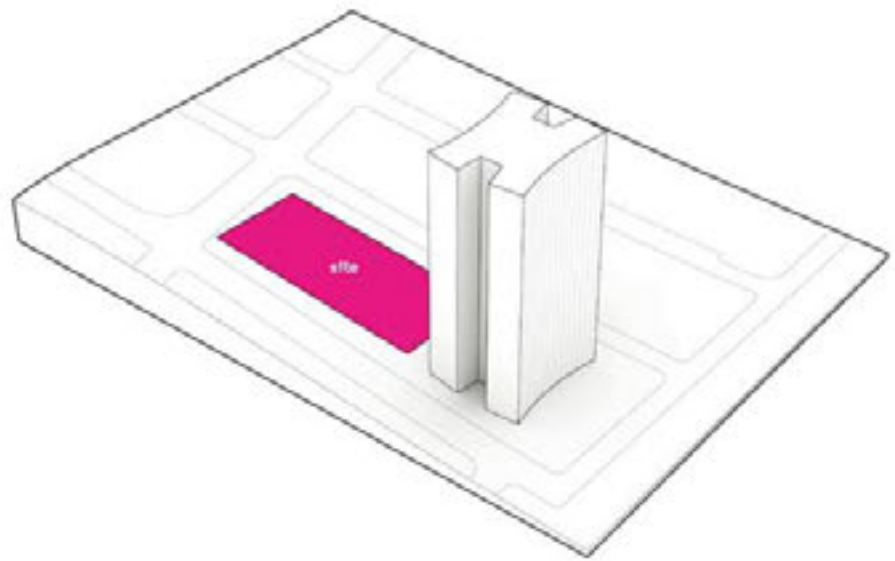
TECHNICAL MATERIALS

WHAT IF WE BY DESIGN CAN ELIMIATE THE CONCEPT OF WASTE?

Quey Quarter

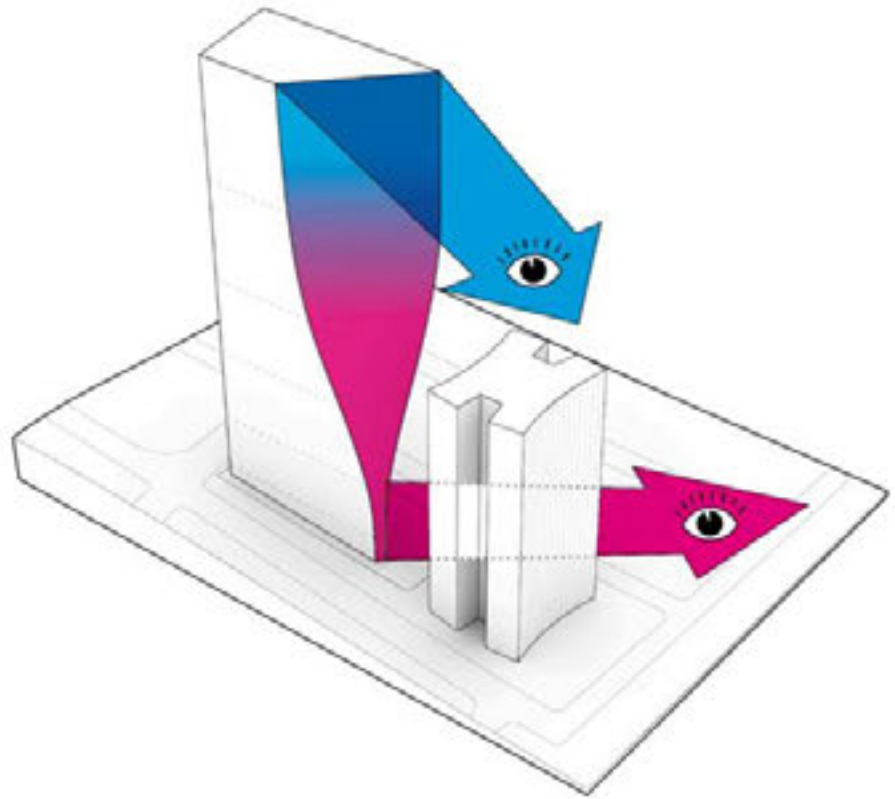
Sydney, Australia

TOWER CONCEPT Site

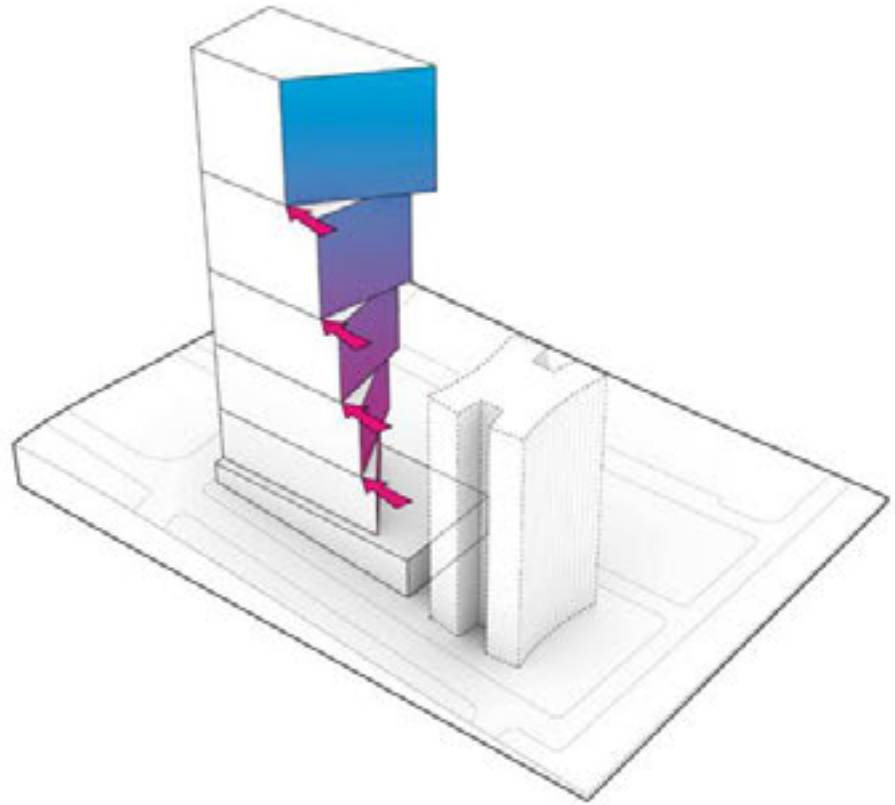


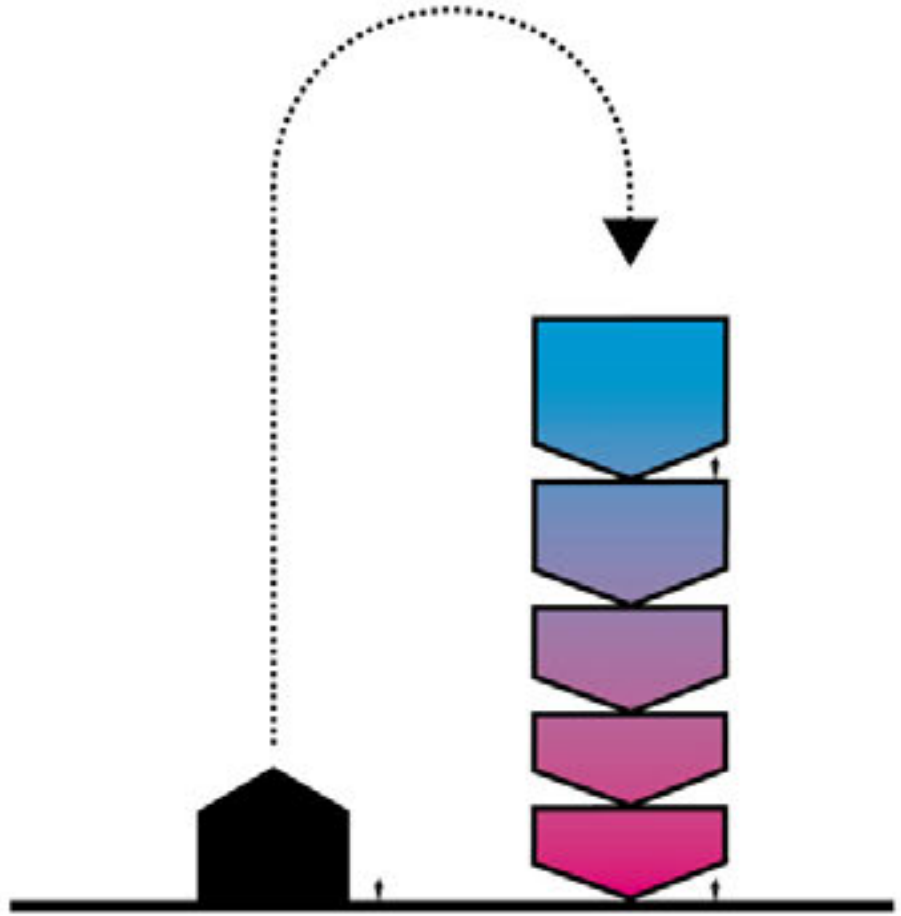
Site Boudary

TOWER CONCEPT Optimized Volume / Daylight & Views



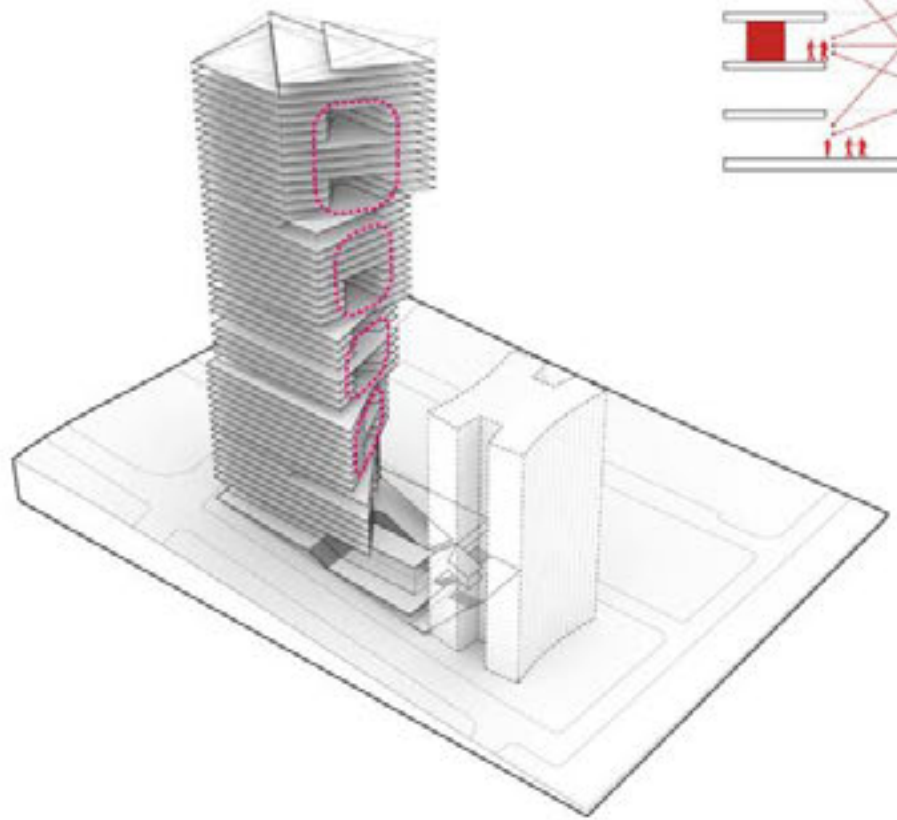
TOWER CONCEPT Stacked Highrise

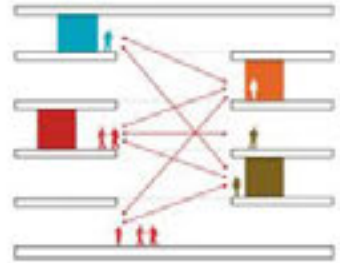


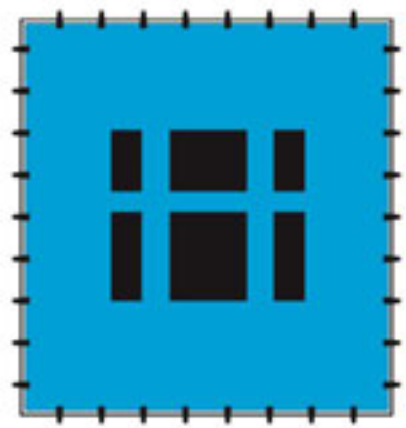


Human scale + City scale

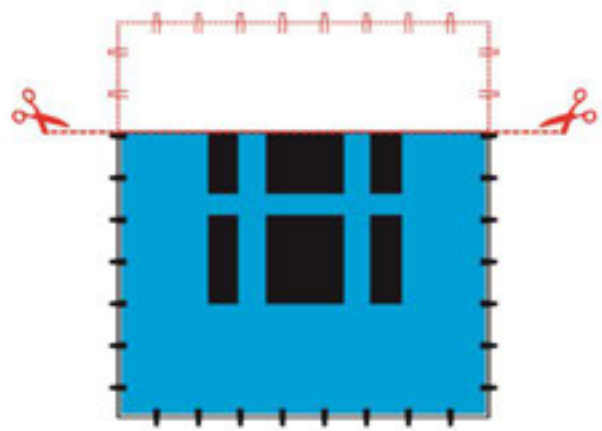
TOWER CONCEPT Stacked Atriums



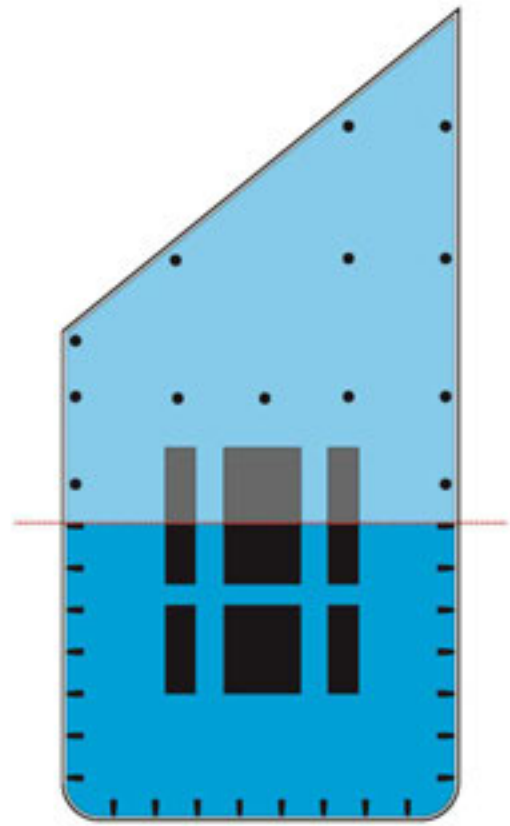




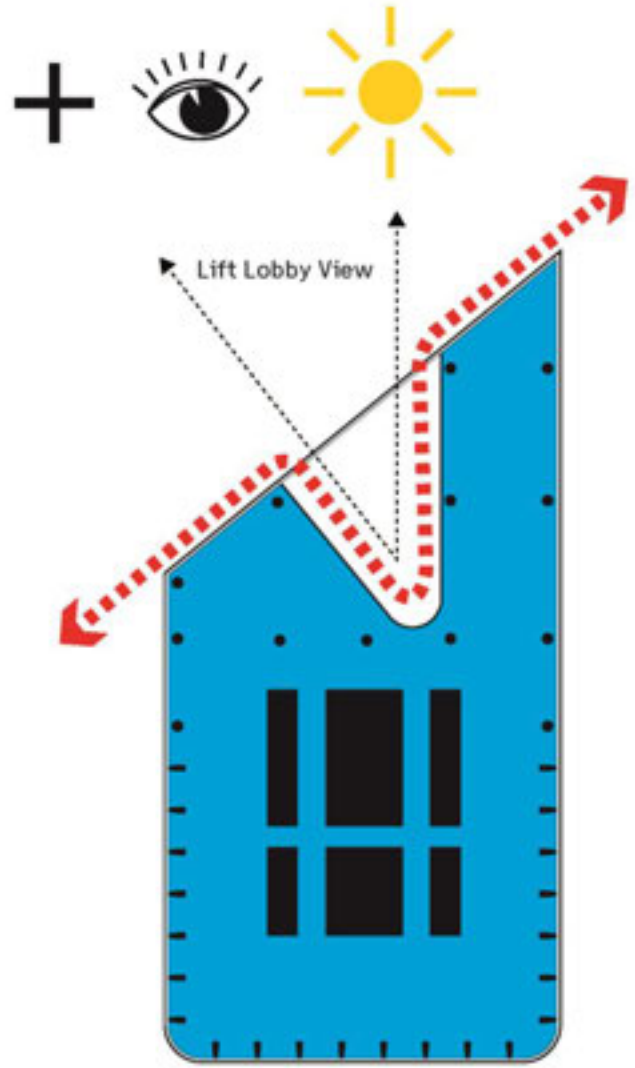
Existing



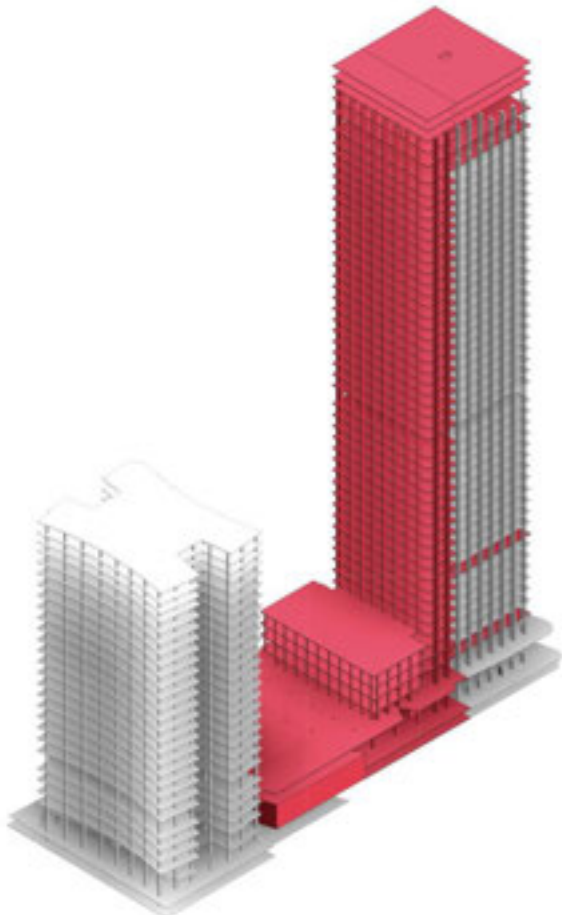
Remaining

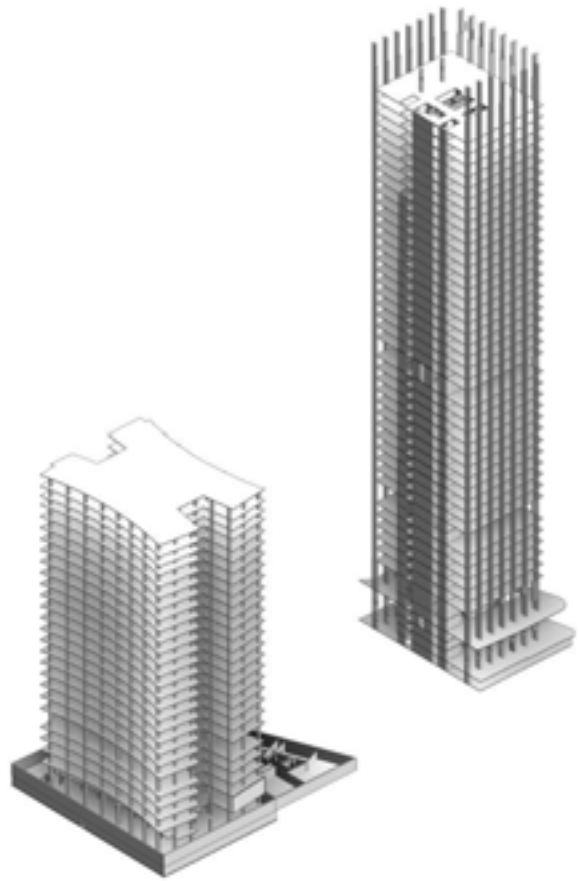


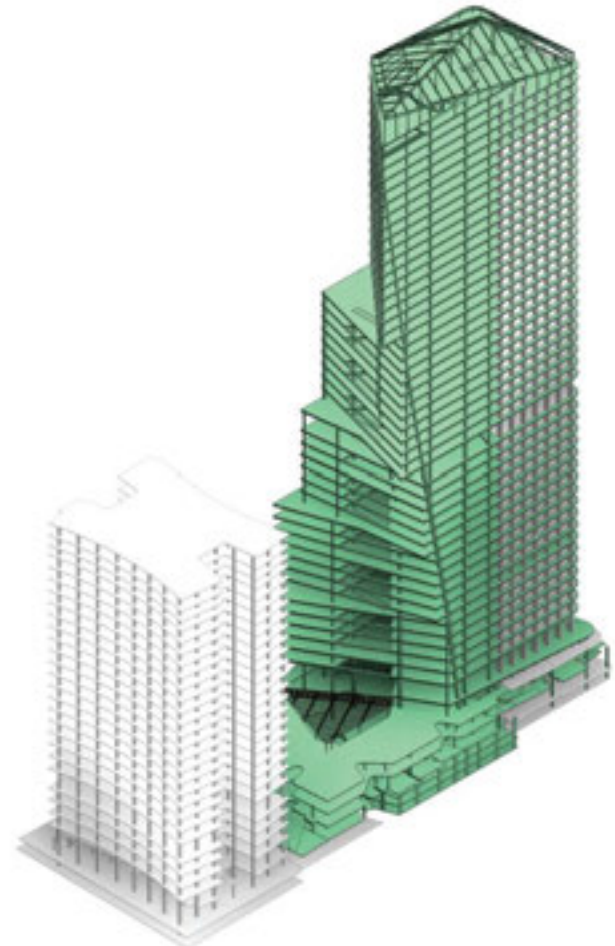
Existing / New



Increased Views / Daylighting







Building a Circular Future

Copenhagen, Denmark

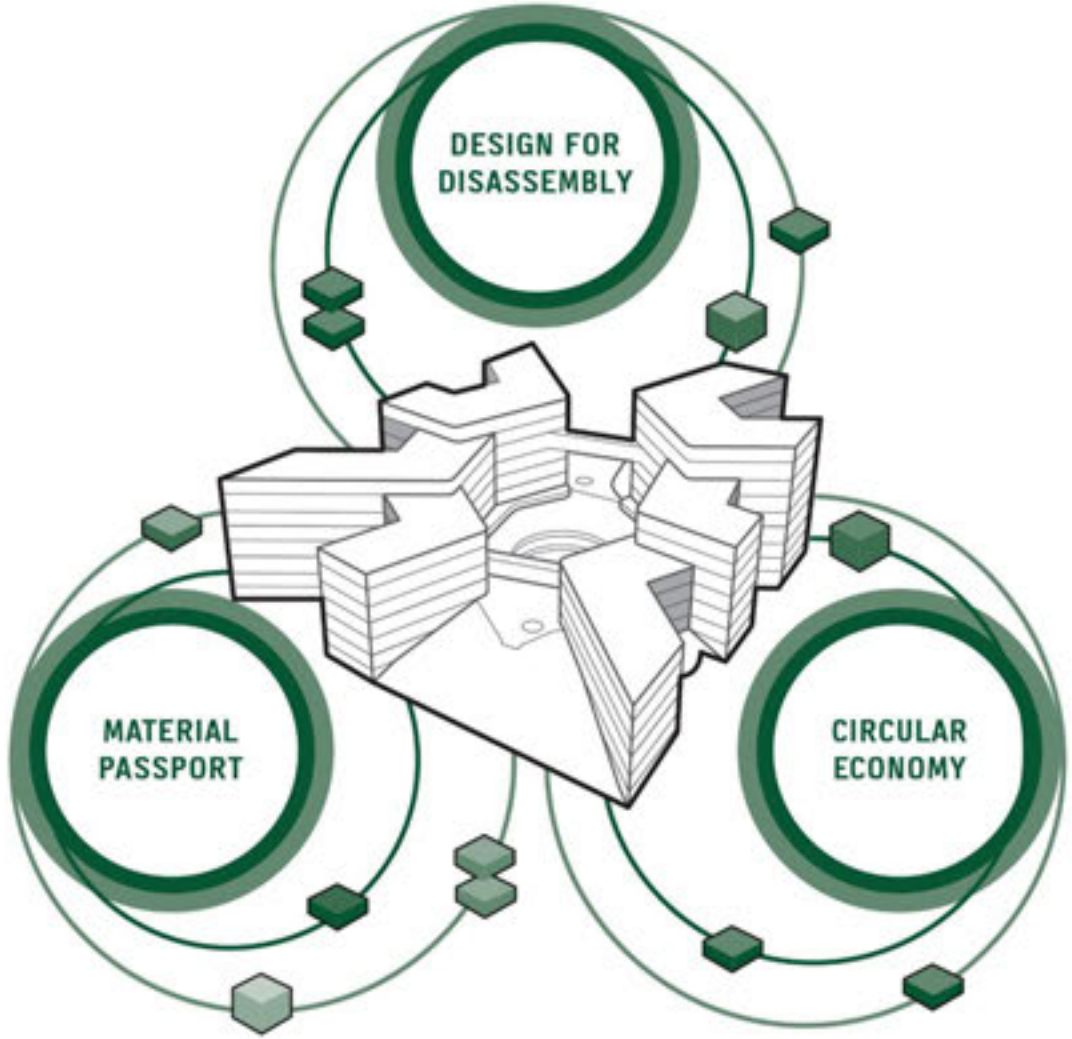
Building a Circular Future

Redesigning the way we put buildings together

architects

contractors

demolitioners



BUILDING A CIRCULAR FUTURE

Growth in Building Industry

2015

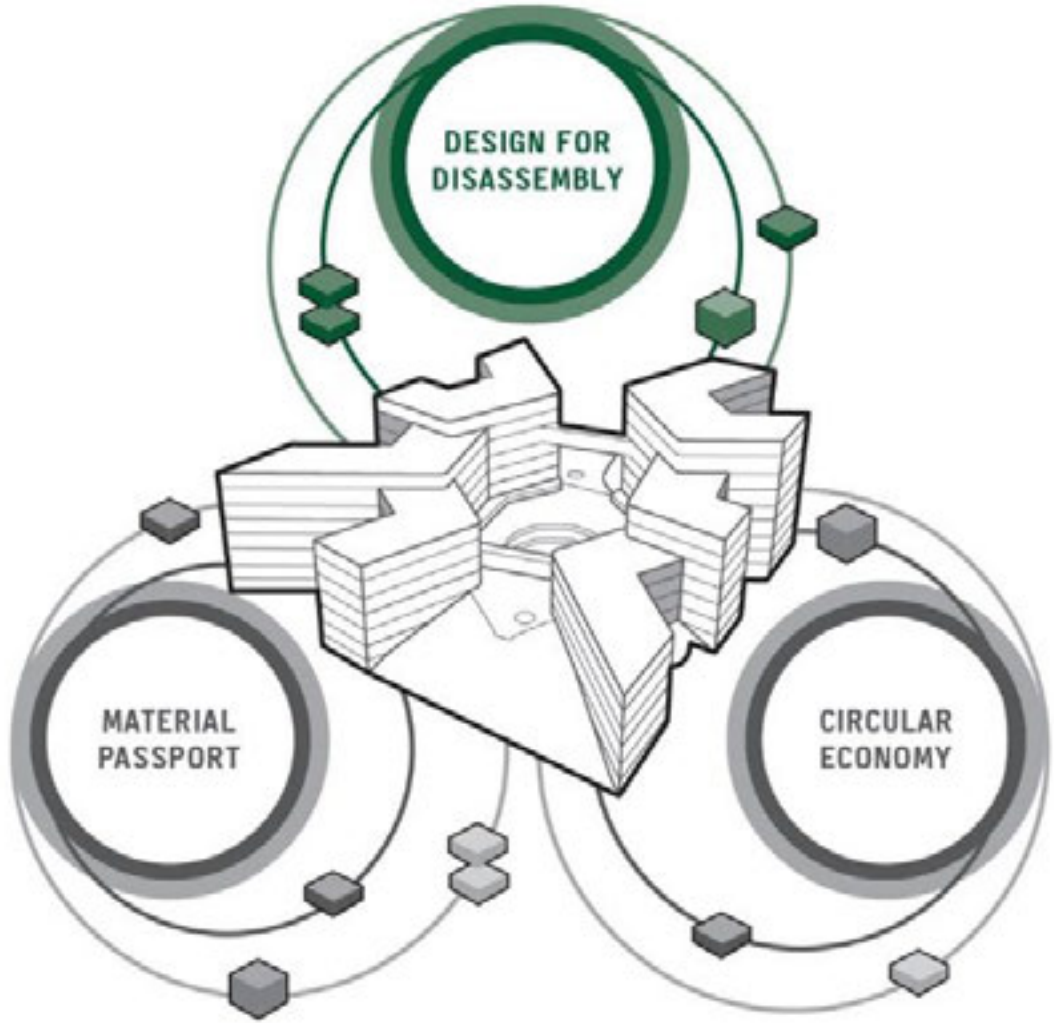
2065


Shanghai 1987

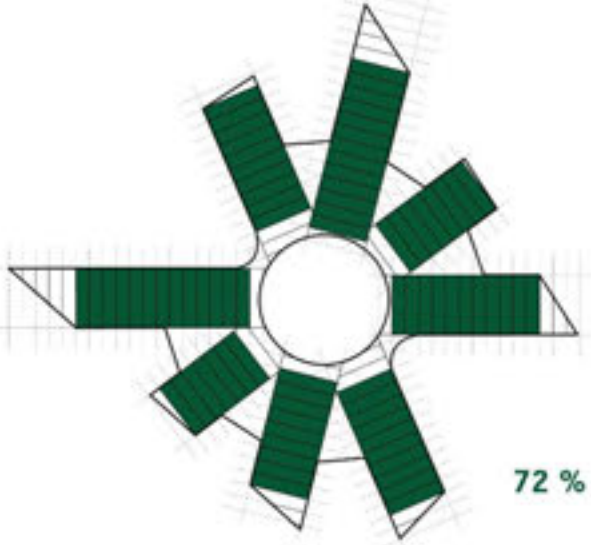

Shanghai 2013
AURORA

Intension: ’*We have a proof of concept, if todays demolition cost can be turned into a positive business case*’

Conclusion: *'Reusing building parts today is good business, increasing ressource prices of tomorrow will only accelerate this'*

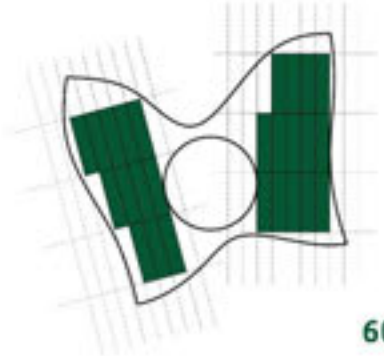


DESIGN FOR DISASSEMBLY



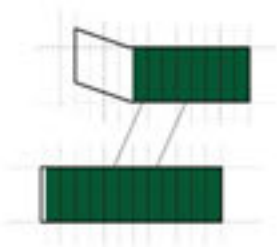
72 %

DE FIRE STYRELSER 3XN Architects,
Kalvebod Brygge, Denmark 2014,
Offices, 42.000 m²



60 %

IOC HEADQUARTERS 3XN Architects,
Lausanne, Switzerland 2014
Offices, 15000 m²

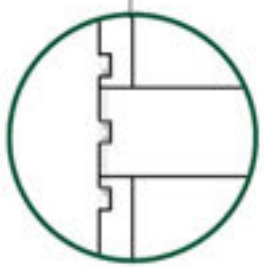


82 %

BELLA SKY 3XN Architects,
Copenhagen, Denmark 2011,
Hotel, 42.000 m²

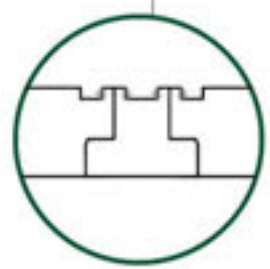
72 %

SAXO BANK 3XN Architects,
Hellerup, Denmark 2008,
Offices, 16.000 m²

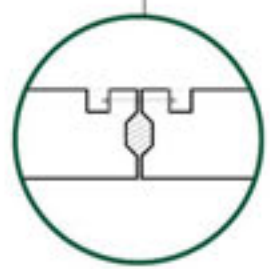


SLAB - WALL New separable joints using mechanical connections with nuts and bolts.

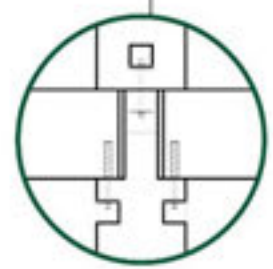
WALL - WALL New separable joints using mechanical connections with nuts and bolts.



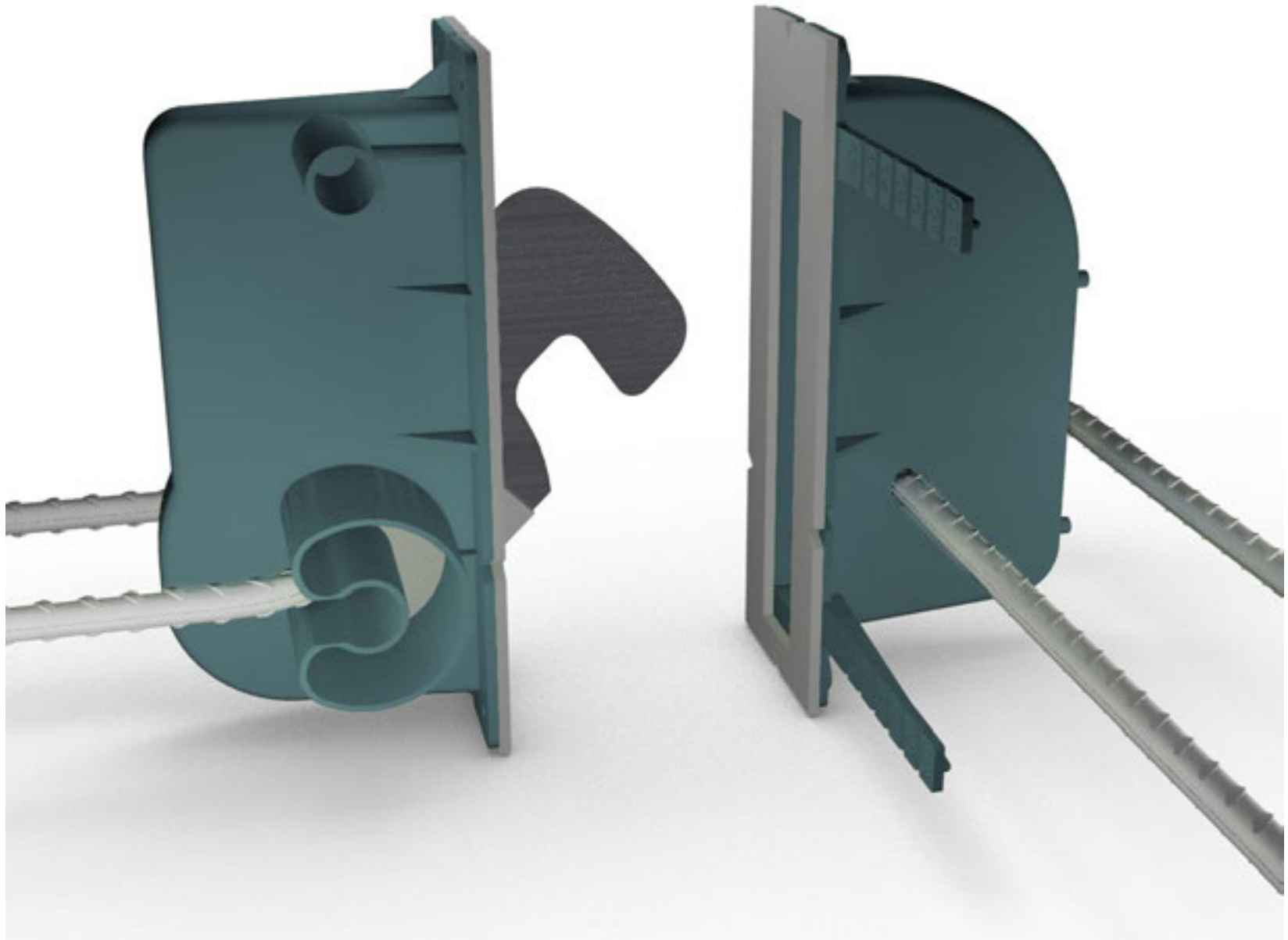
SLAB - BEAM New separable joints using mechanical connections with nuts and bolts.

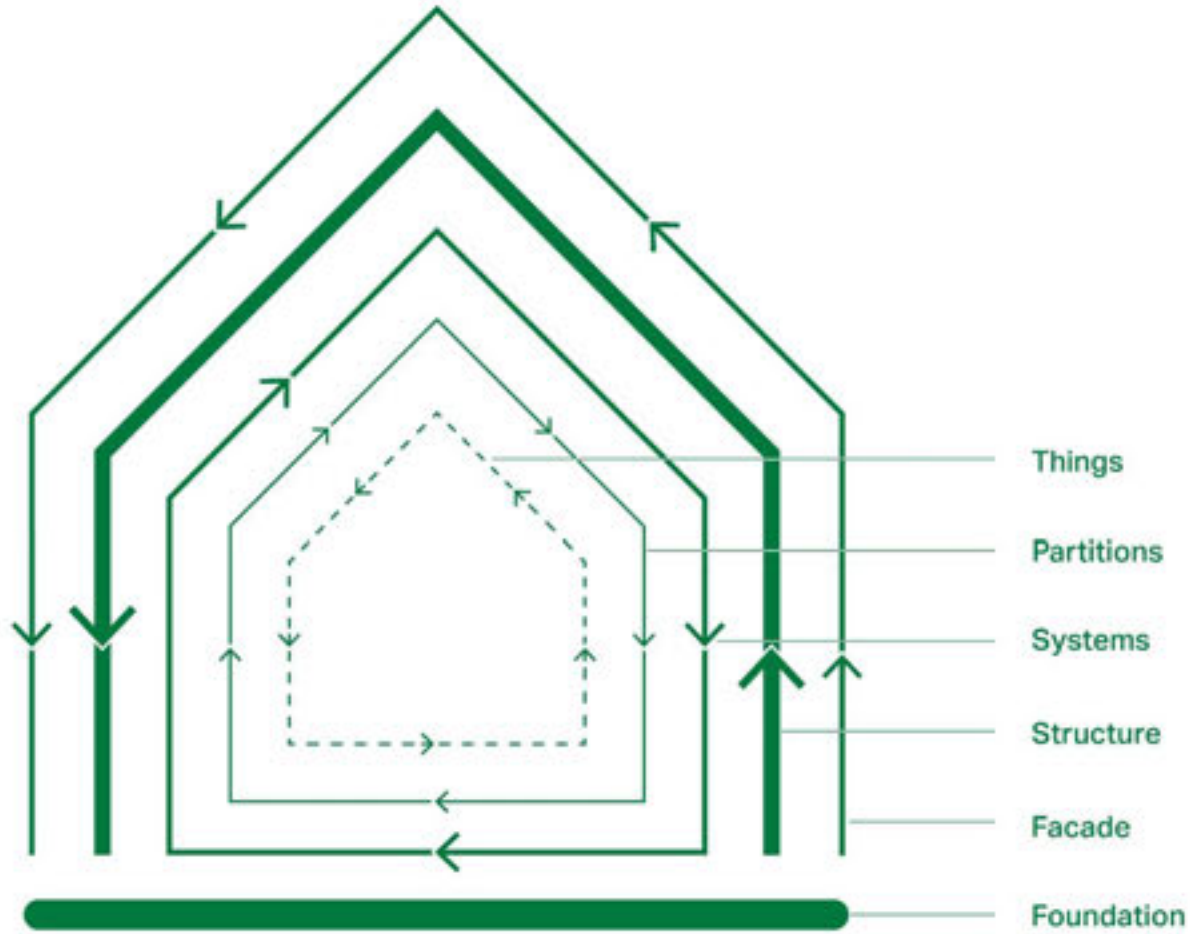


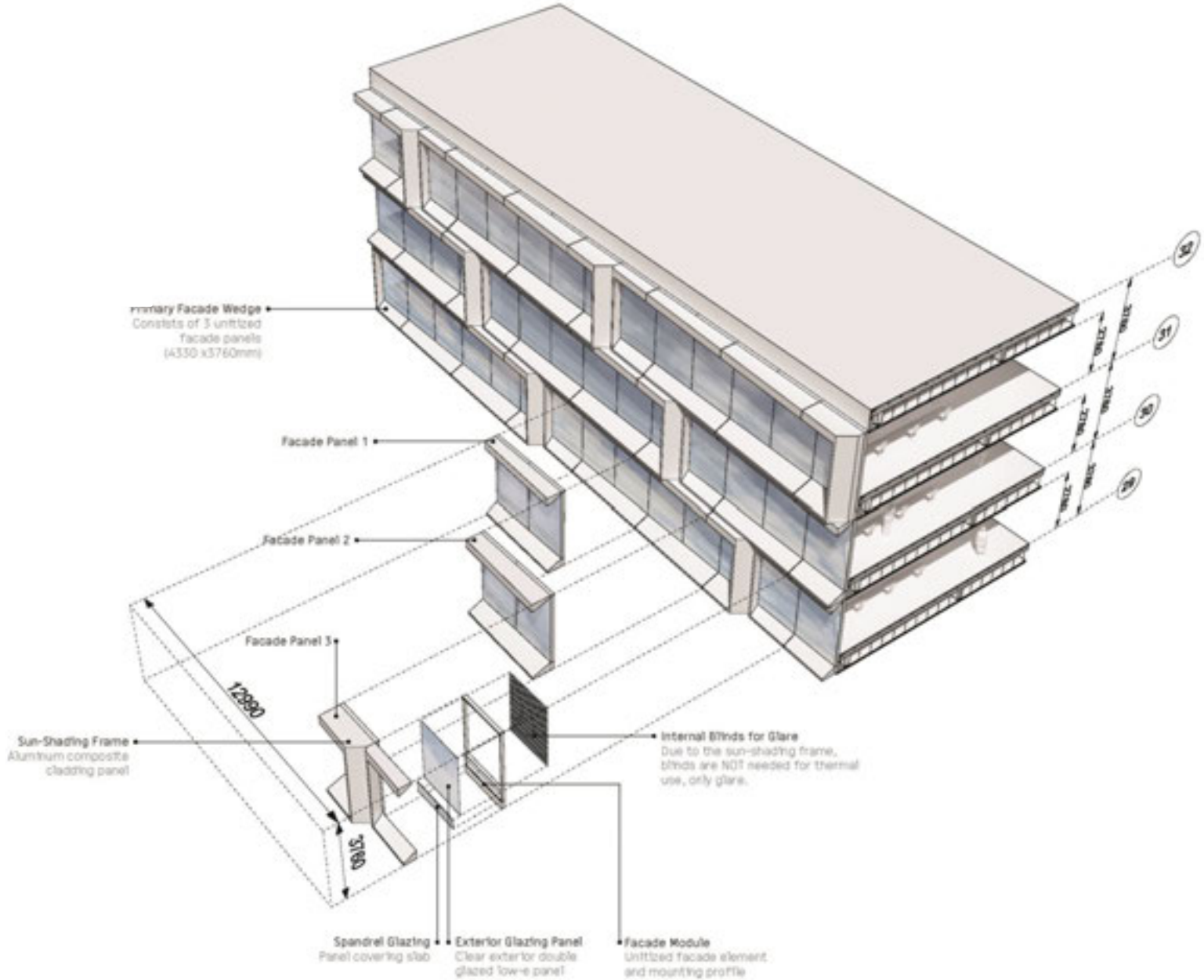
SLAB - SLAB New separable joints using mechanical connections with nuts and bolts and lime mortar.

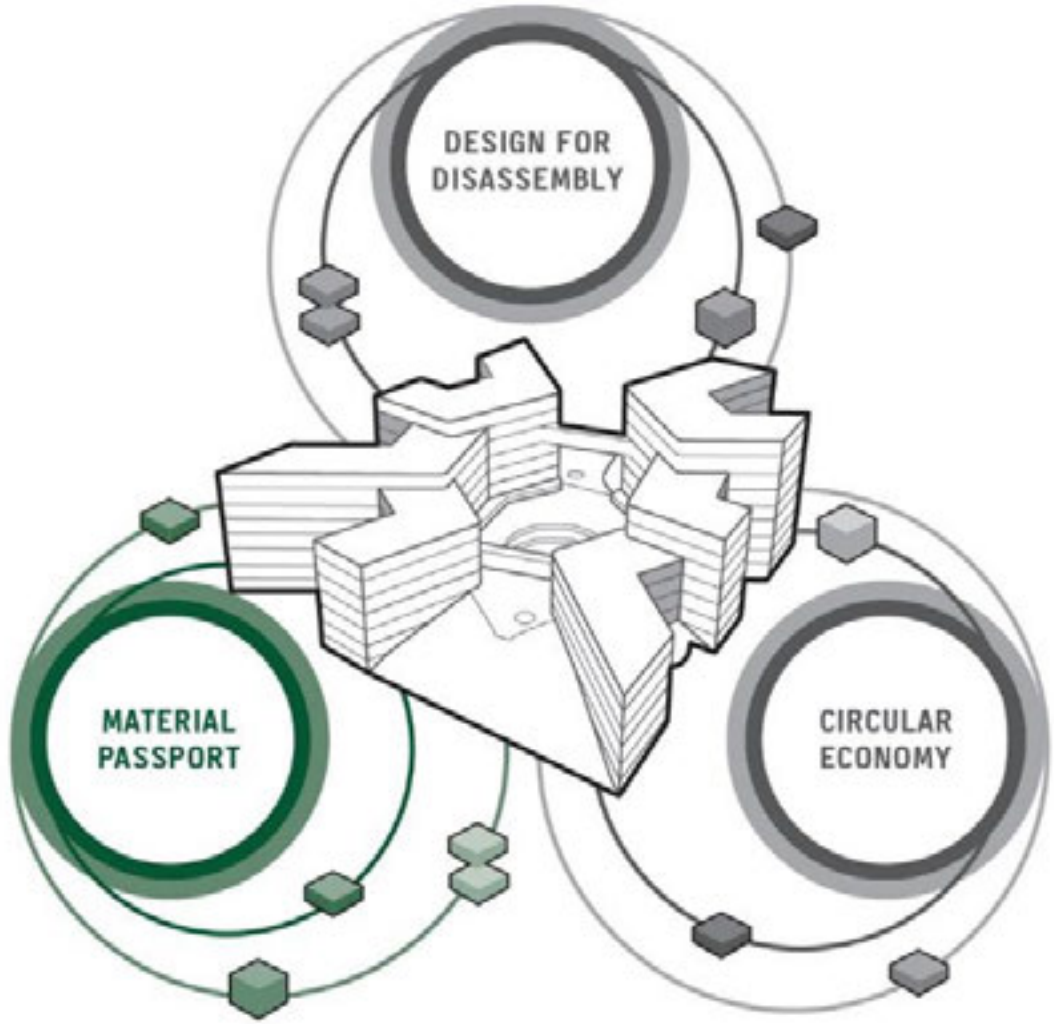


COLUMN - SLAB New separable joints using mechanical connections with nuts and bolts and lime mortar.




Things
Partitions
Systems
Structure
Facade
Foundation

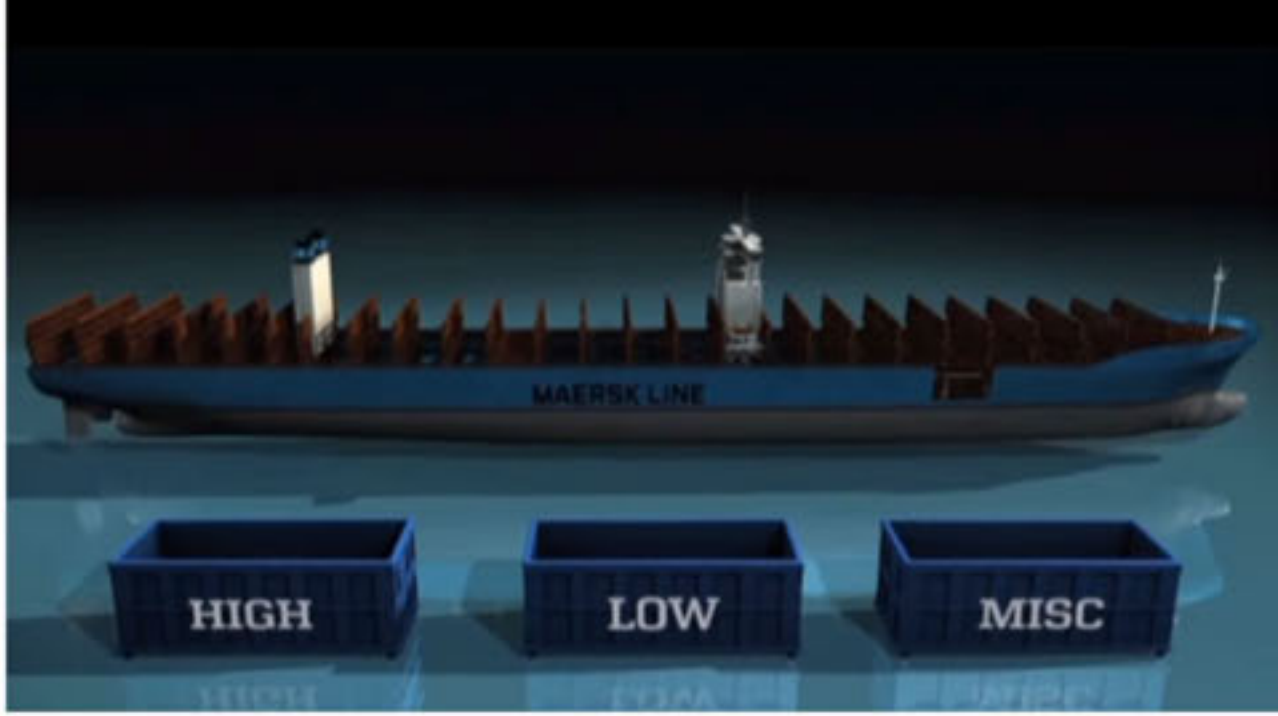

rimary Facade Wedge
Consists of 3 unitized facade panels (4330 x3760mm)
Facade Panel 1
Facade Panel 2
Facade Panel 3
12990
Sun-Shading Frame
Aluminum composite cladding panel
Internal Blinds for Glare
Due to the sun-shading frame, blinds are NOT needed for thermal use, only glare.
Spandrel Glazing
Panel covering slab
Exterior Glazing Panel
Clear exterior double glazed low-e panel
Facade Module
Unitized facade element and mounting profile
32
31
30
29



MATERIAL PASSPORT


SOUTH MARINA
MAERSK


Maersk Triple-E
Total vessel recycling

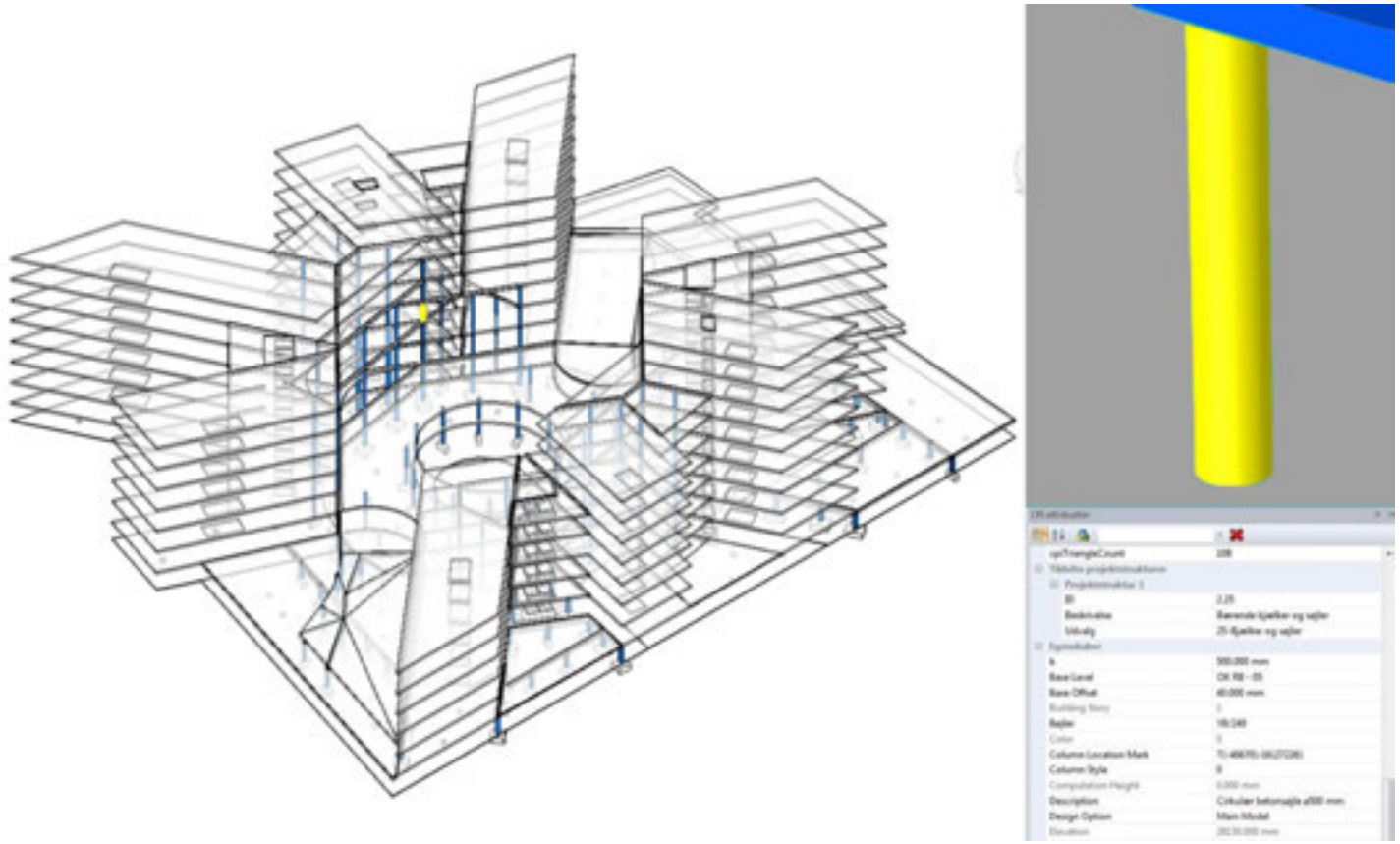

MAERSK LINE
HIGH
LOW
MISC


MAERSK LINE

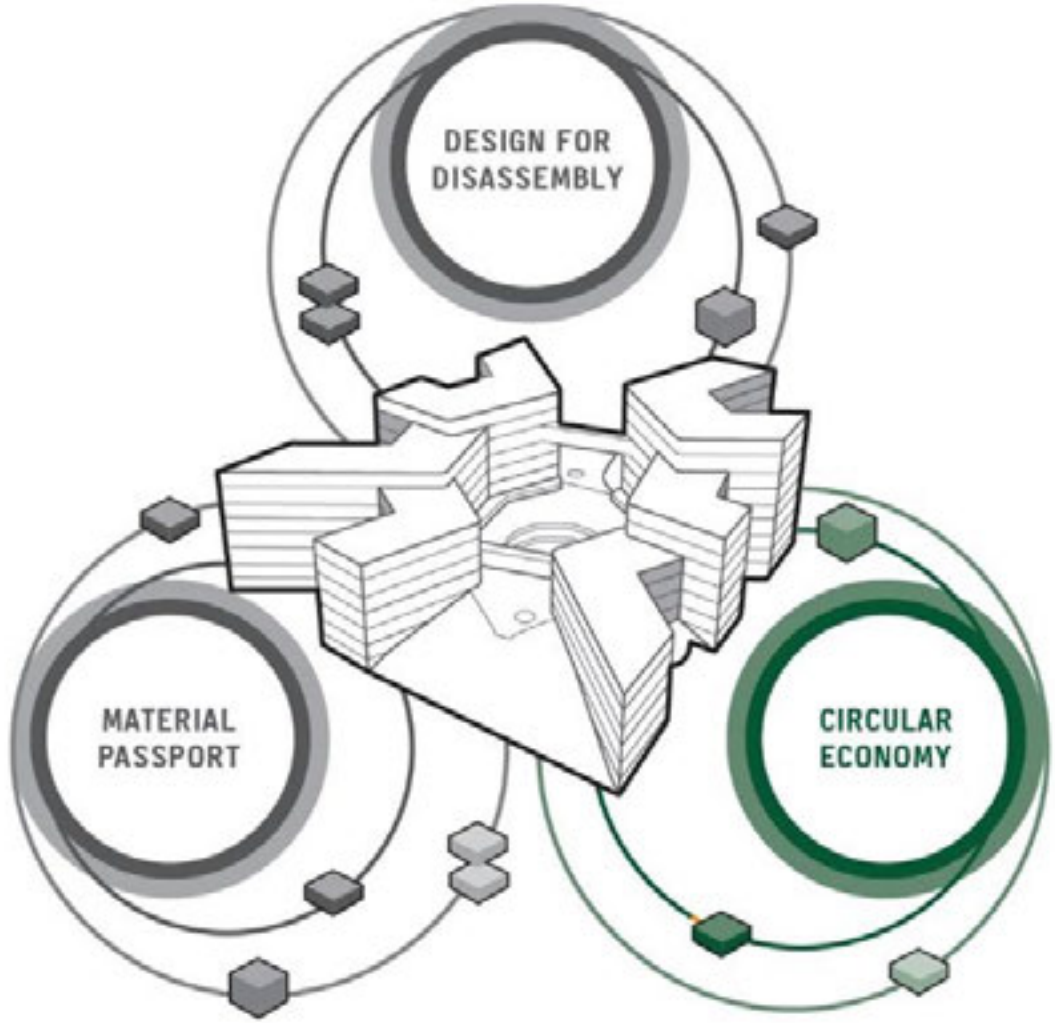
3D 4D 5D 6D

Virtuel Design & Construction


SAMSUNG




1: HEIGHT
2: WIDTH
3: DEPTH
4: TIME
5: ECONOMY
6: OPERATION
7: REUSE



CIRCULAR ECONOMY

A Building Practice with immediate and short term gains

improved flexibility

faster construction

optimized operation

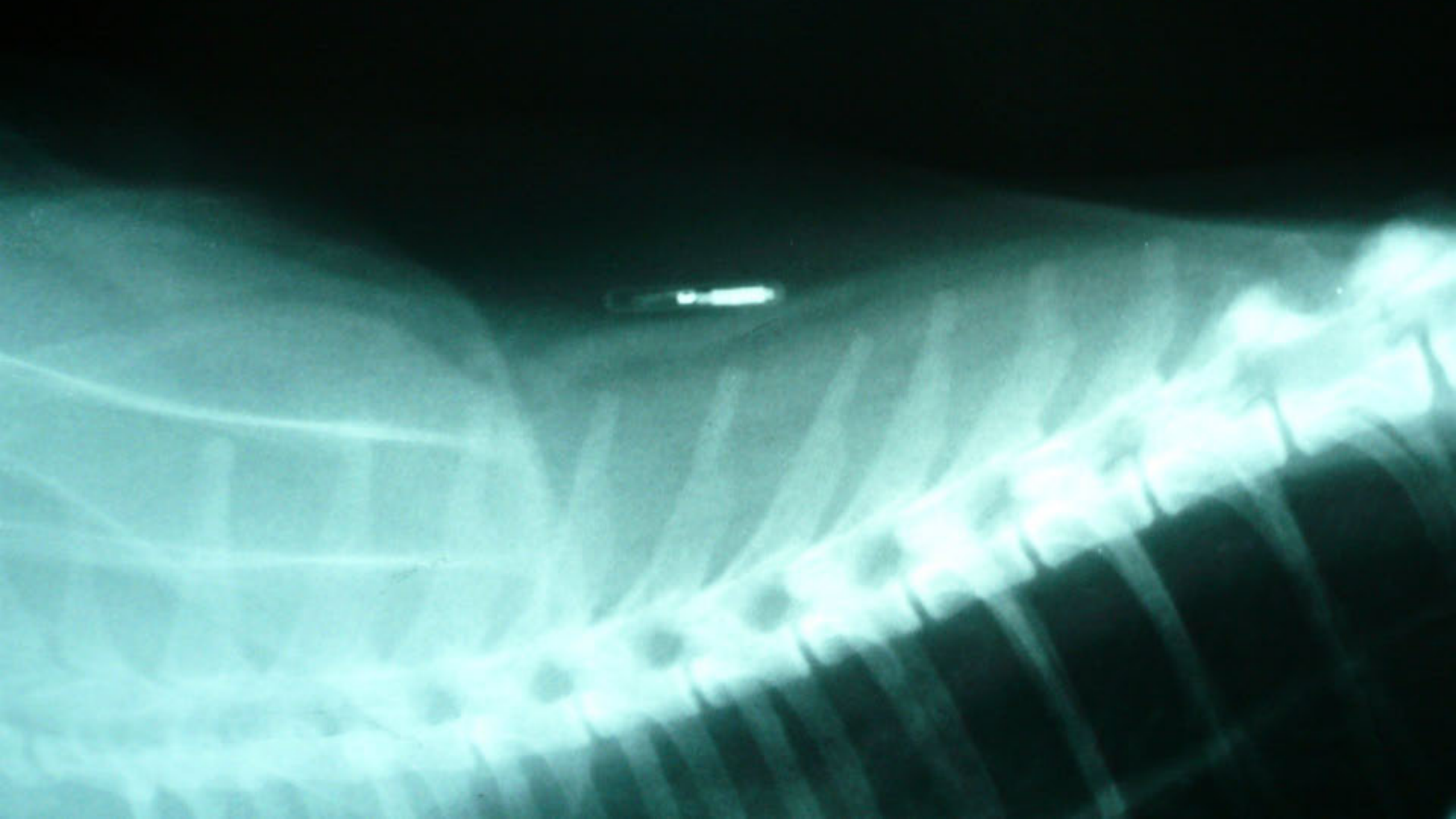
Implementation of the circular principles, not only result in long term benefits.
Positive side effects from low hanging fruits creates a better building here and now.


NYSE
NYSE
NYSE
NYSE
NYSE
NYSE
10


FECHA NA MAXIMA, EM ALTA DE

WHAT IF OUR MATERIALS CAN TALK IN THE FUTURE?

Material Google



WWW.BUILDINGACIRCULARFUTURE.COM

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