

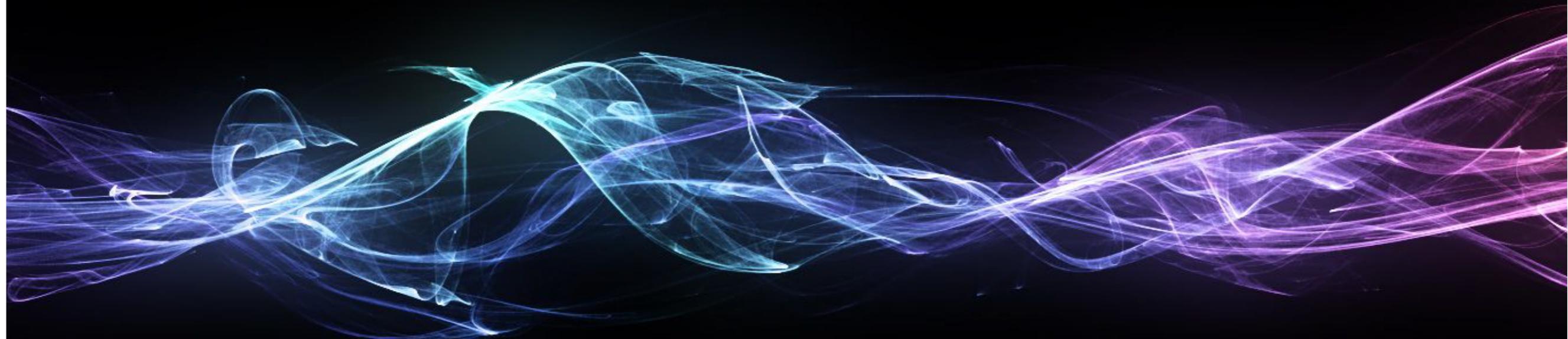
<http://youtu.be/sJXvav54z1c>

**HYPERBODY MSc DESIGN STUDIO | 2628CLIMATOR | FALL SEMESTER 2013 - 2014**  
Course code: AR1AUE010

**Course Tutors:** Kas Oosterhuis, Achilleas Psyllidis (Course Coordinator), Gijs Joosen, Matteo Baldassari, Florian Eckardt (Building Technology)

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**eCENTER | Group #4 | Marco Galli - Mia Tsiamis - Luca Vacchini - Kotryna Zvironaite**



**ENERGY [energy as potency]**

Energy is entropy. Activation of forces and efforts. **Vehiclisation of (new) bits of information.** Of interest are those processes, phenomena or situations capable of producing - or introducing - positive energy within the system. **Energy as open** - non disciplined - **(re) information** rather than as linear progress. Energy as catalysation (and fuelling) of potentials.

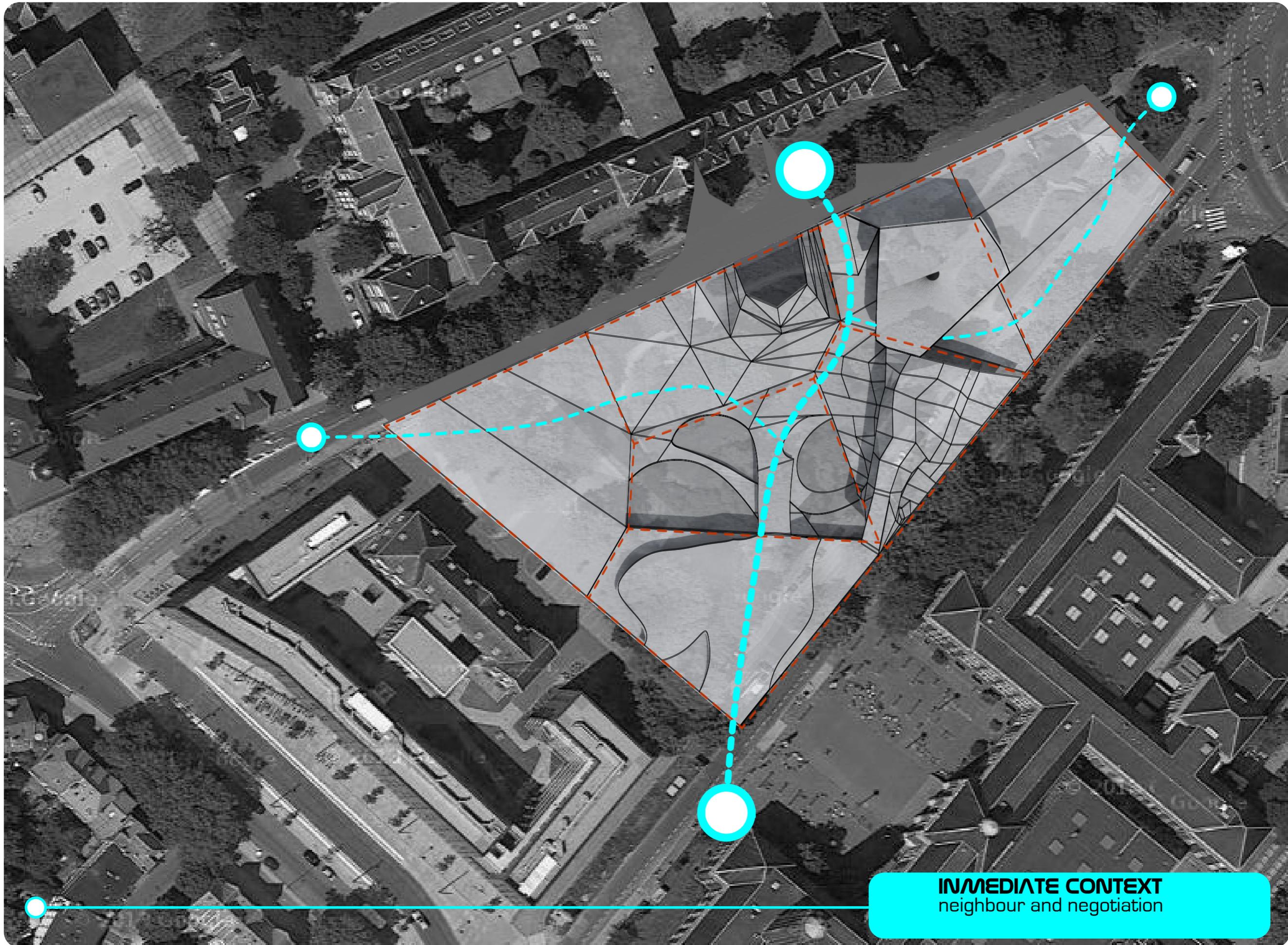
Actions or constructions, manifestations of trajectories. Impulses: stimuli and triggers.

**Always reactivations - and propolsions - of the enviroment.**

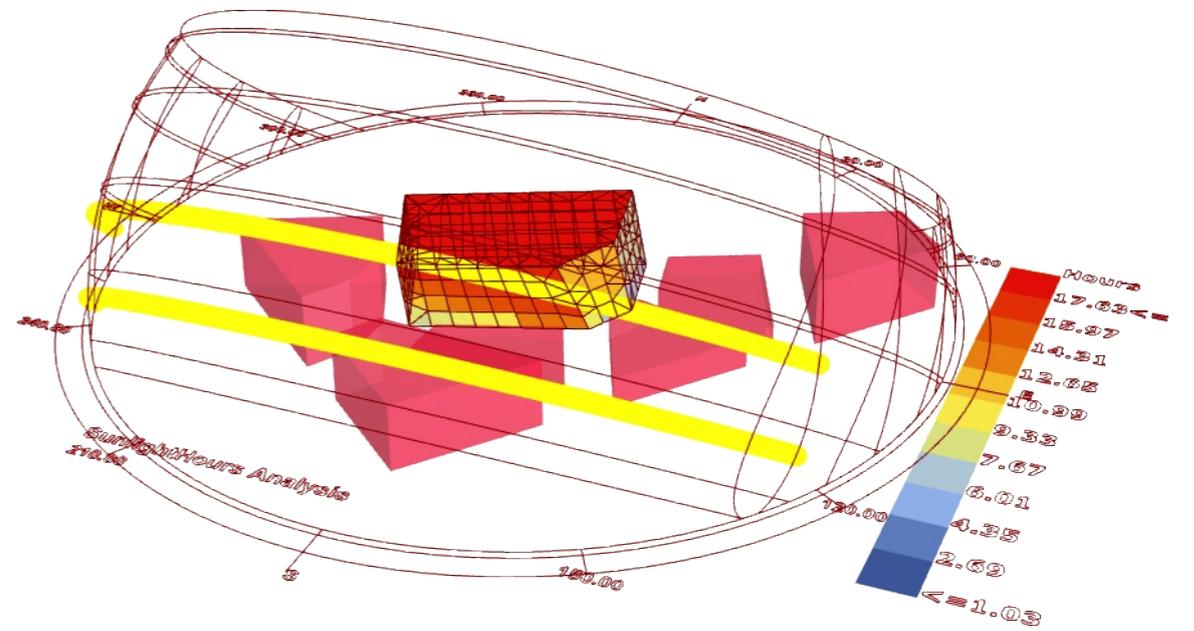
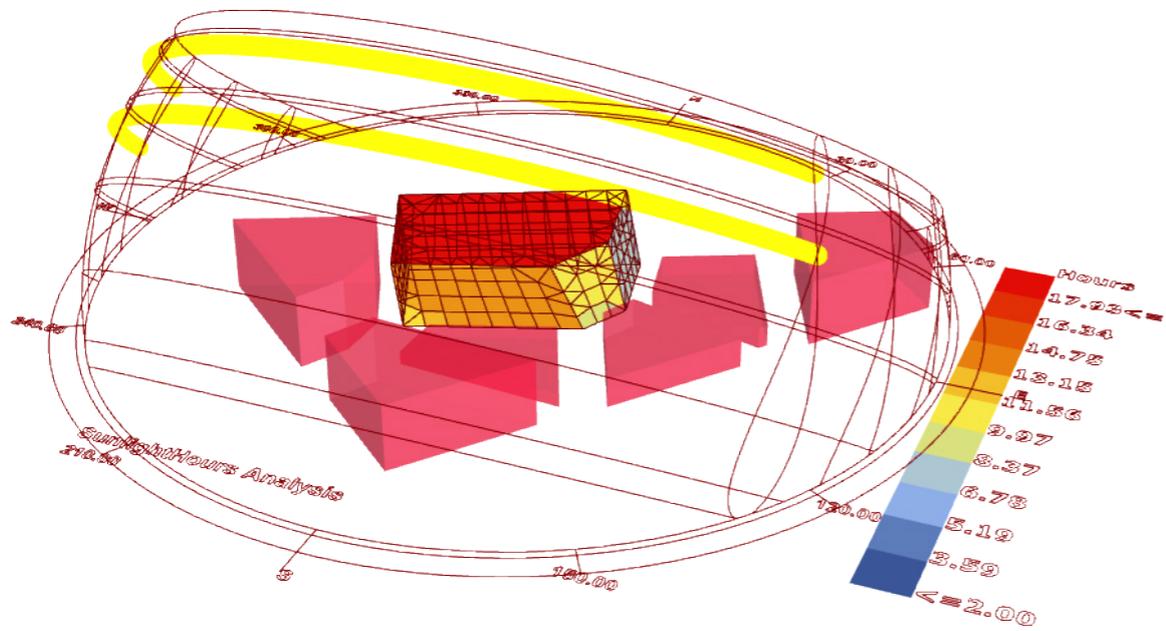
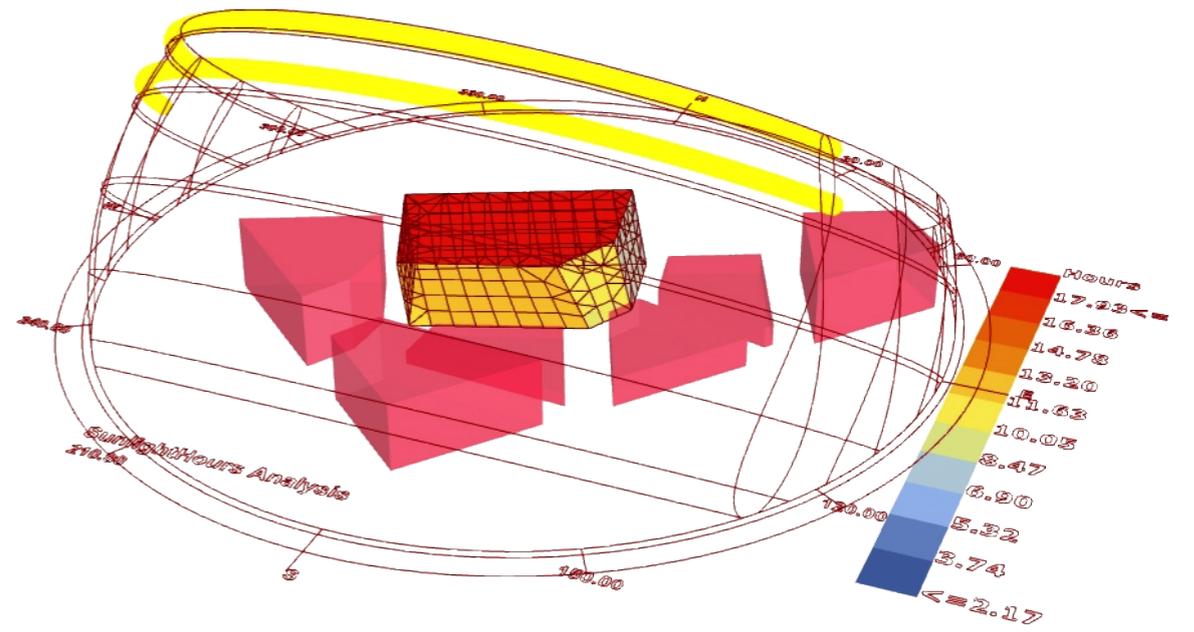
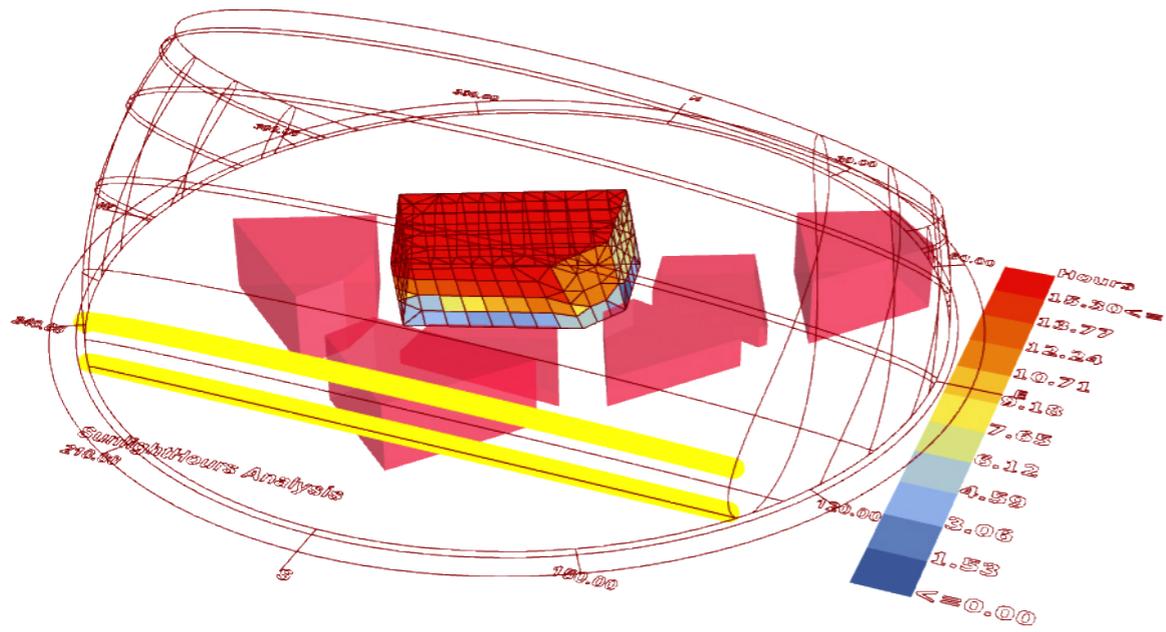
The Metapolis dictionary of advanced architecture - Manuel Gausa

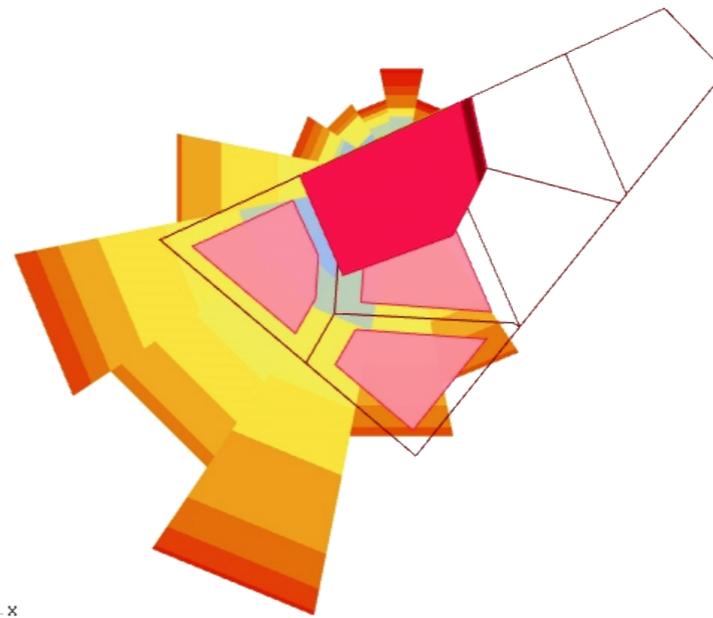
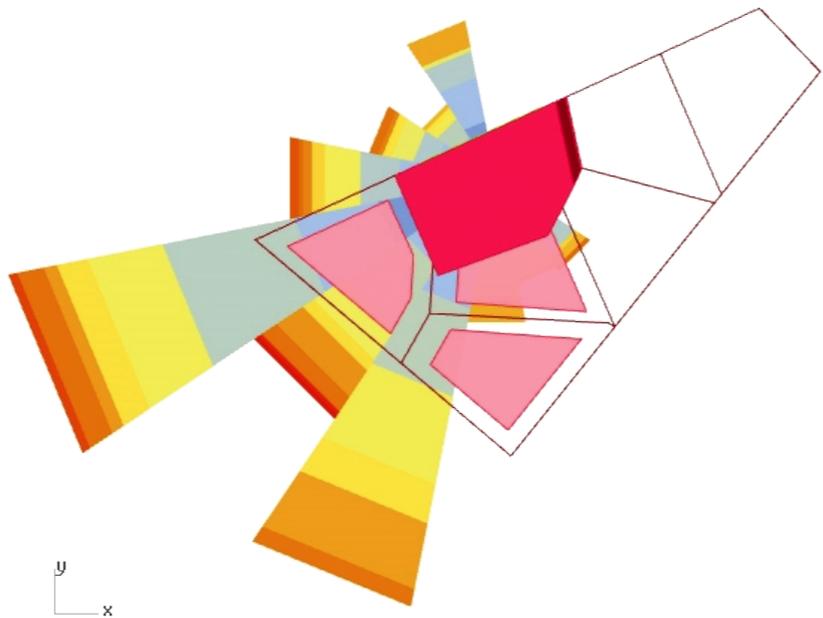
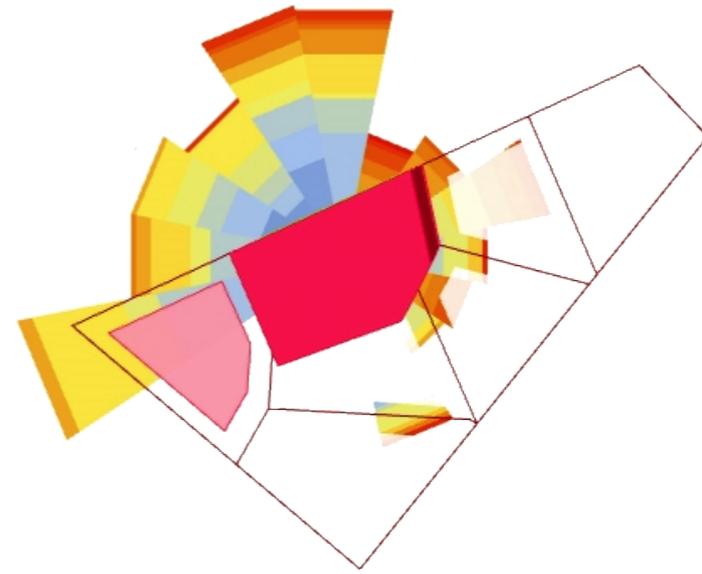
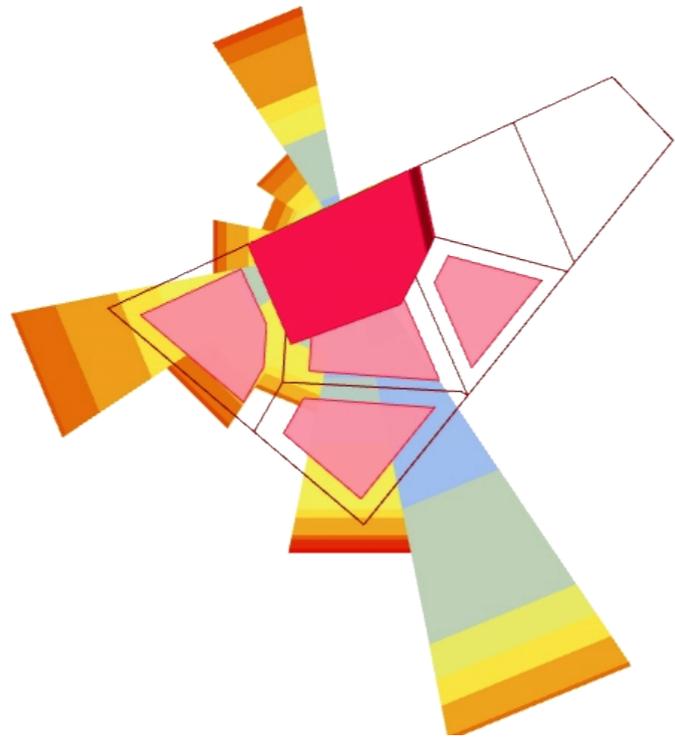


**URBAN CONTEXT**  
relation definition  
no scale



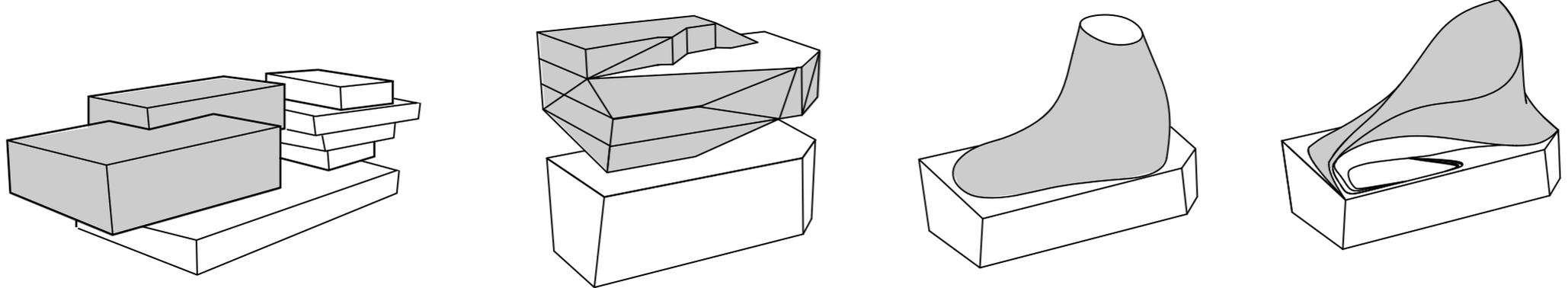
**IMMEDIATE CONTEXT**  
neighbour and negotiation



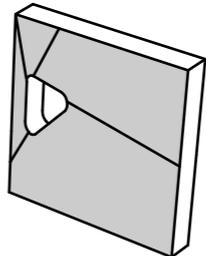
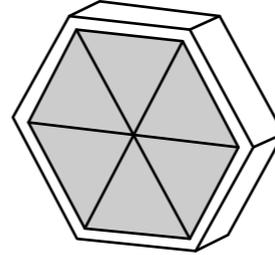
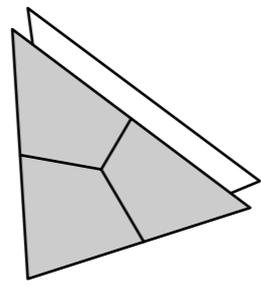
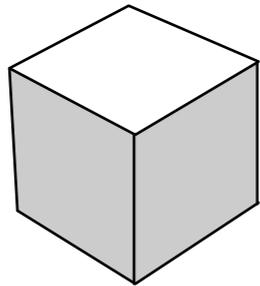
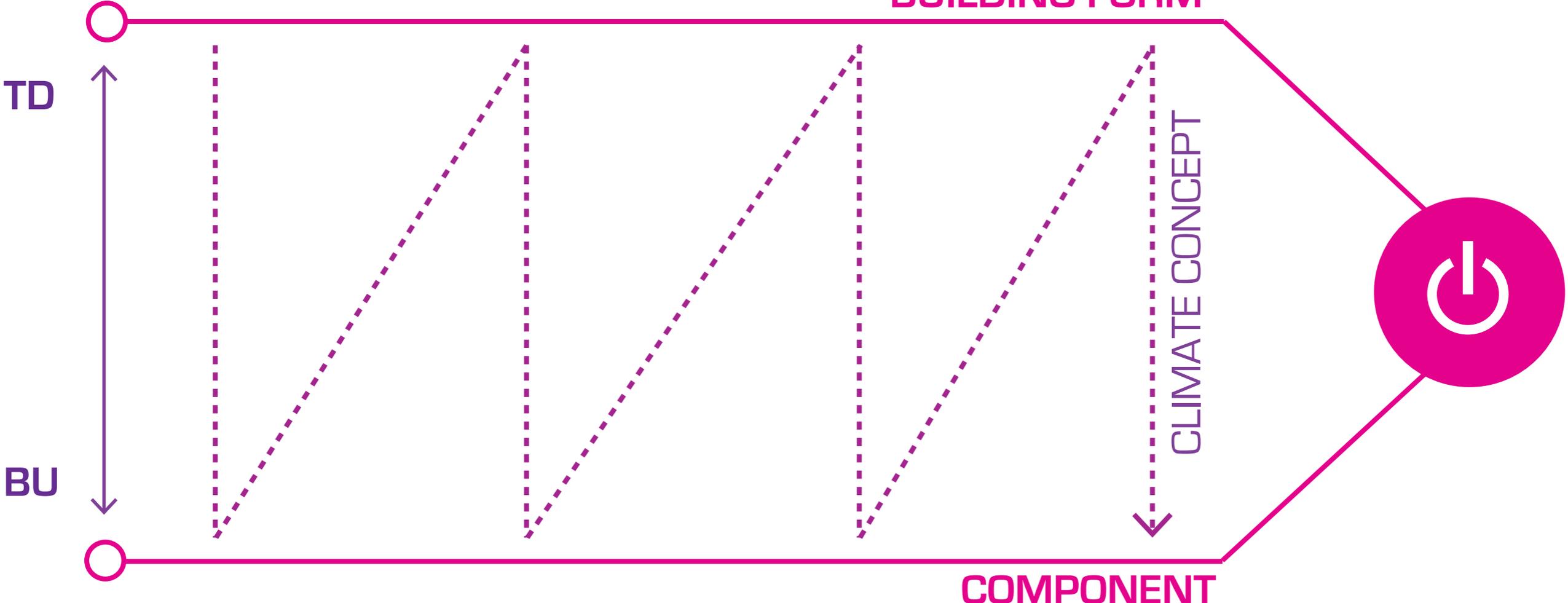


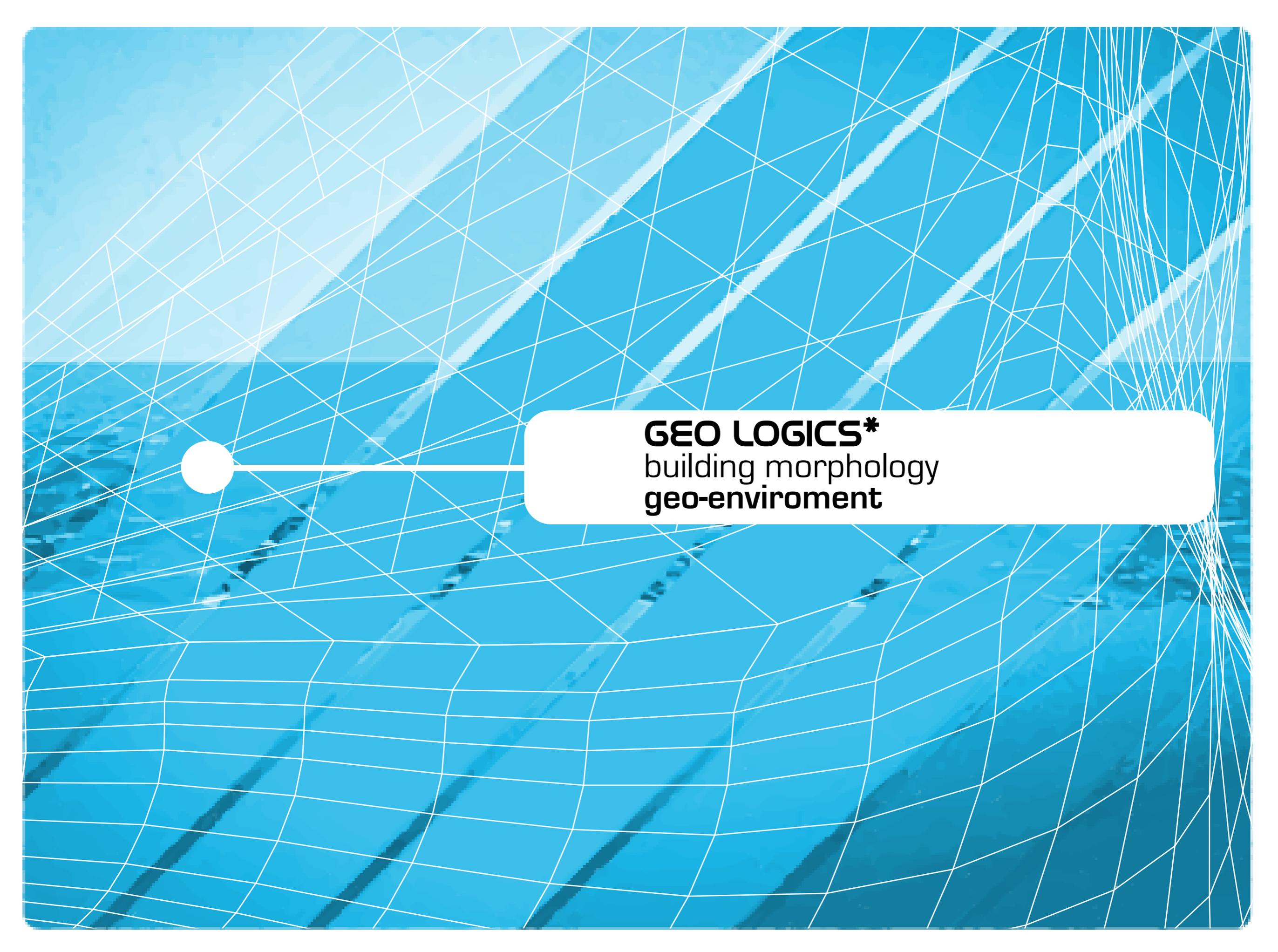
**OUR STORY!**



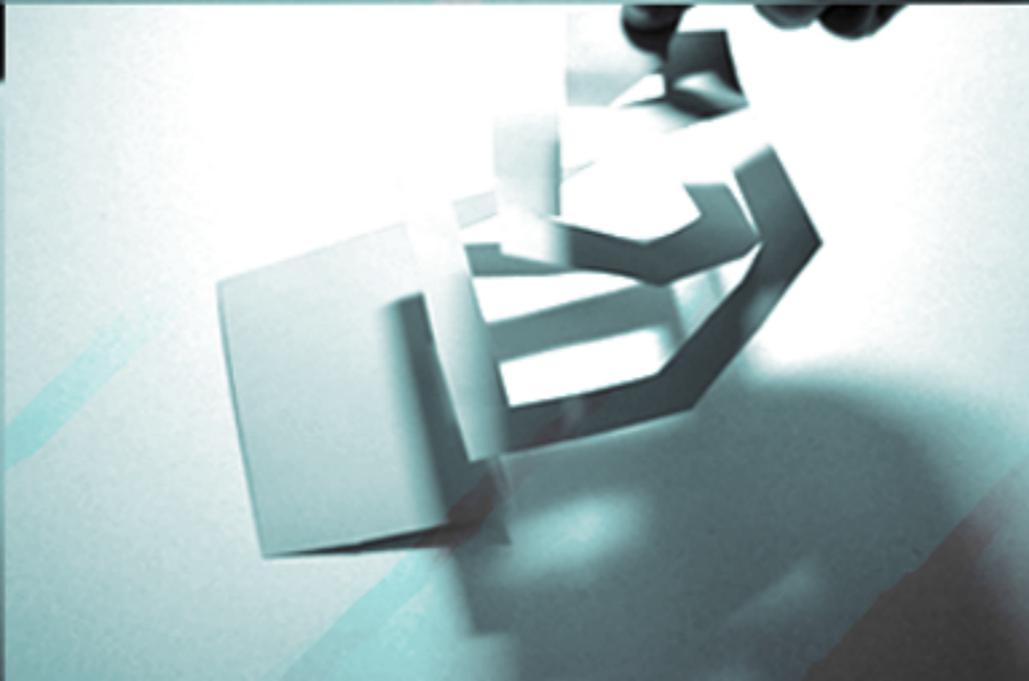
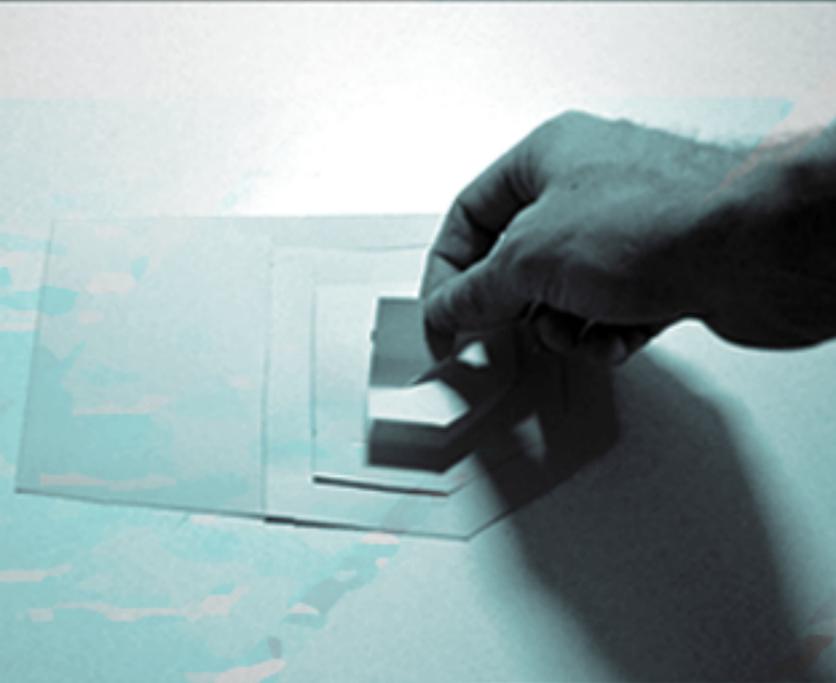
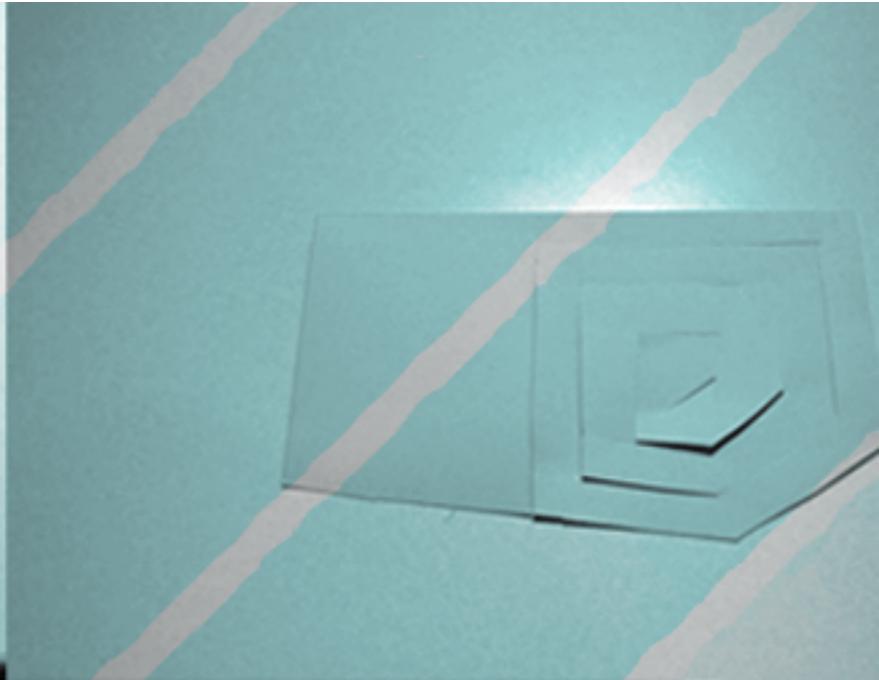
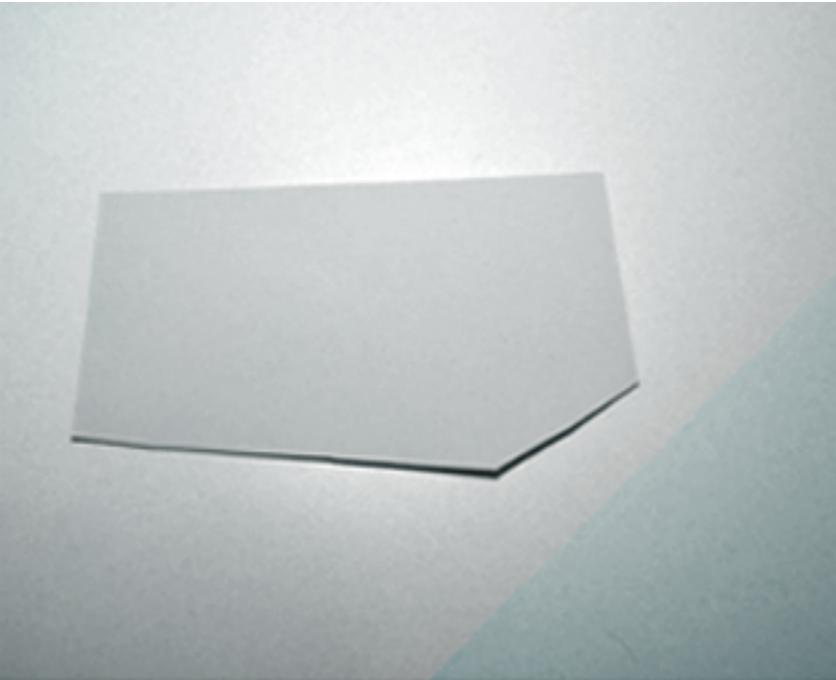


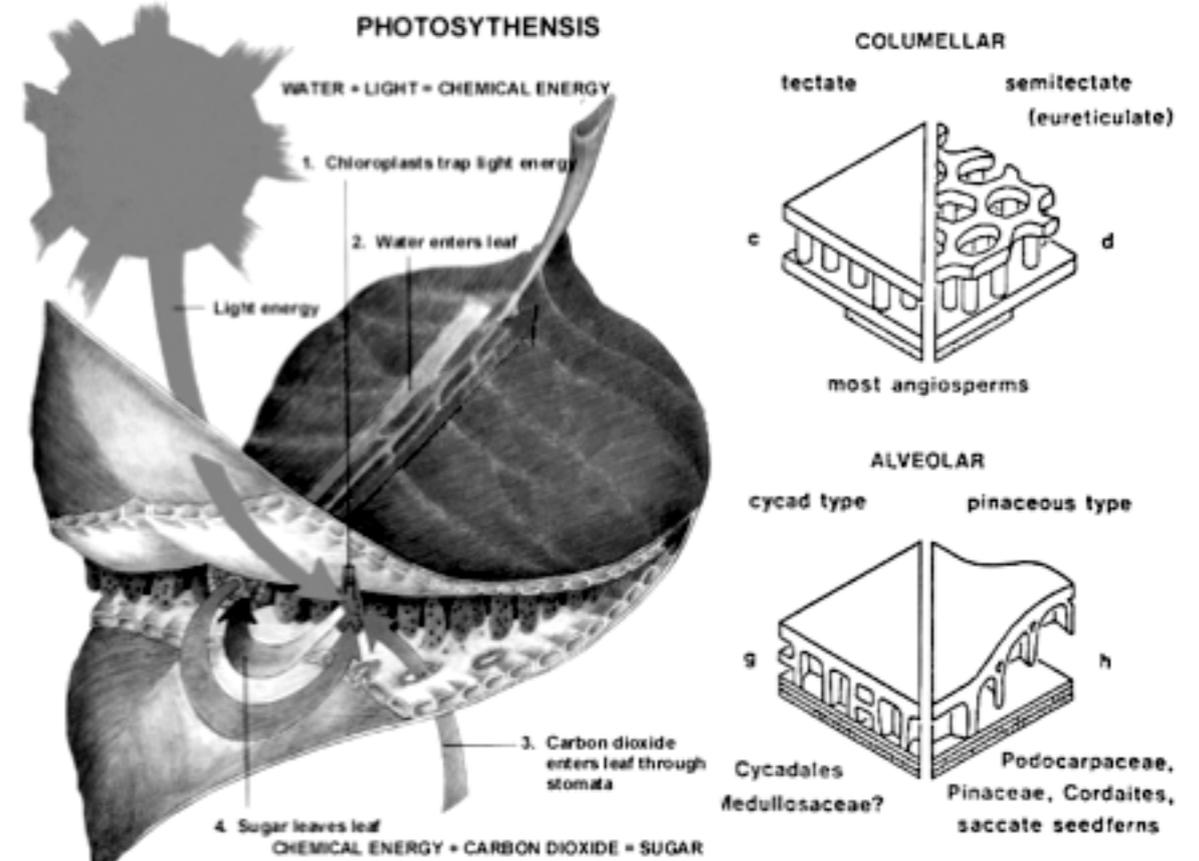
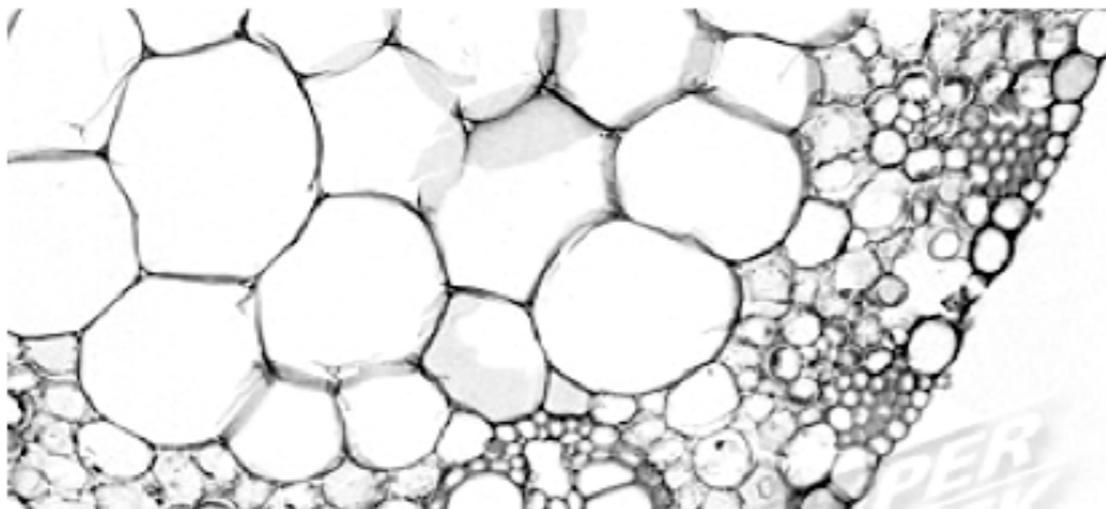
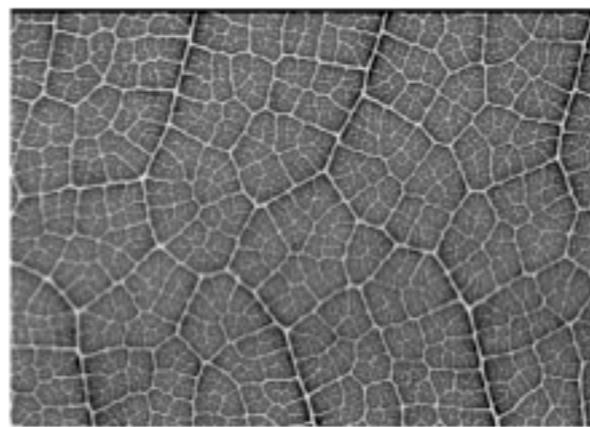
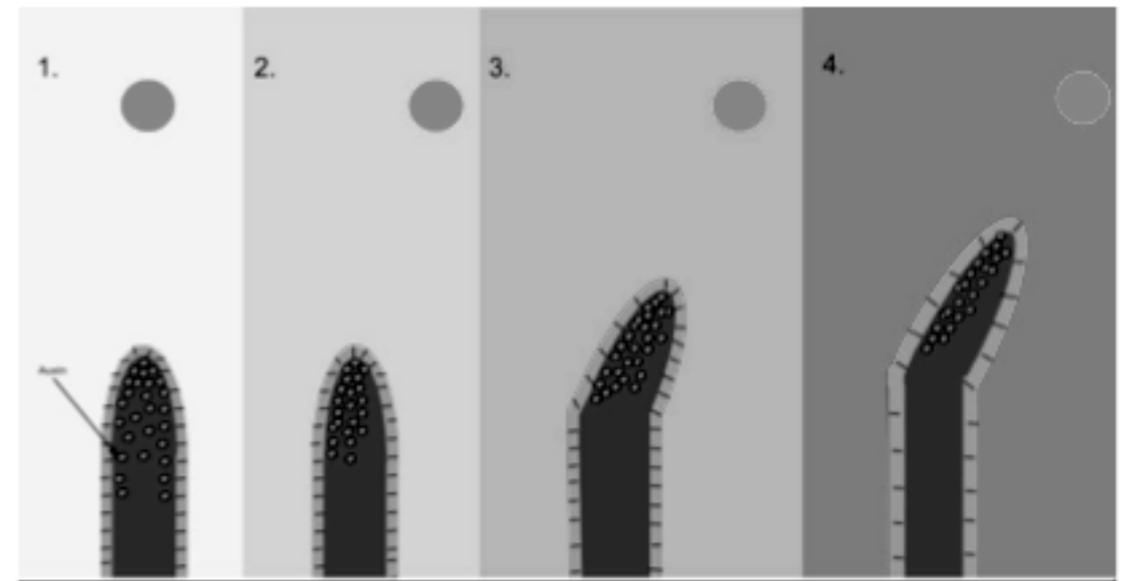
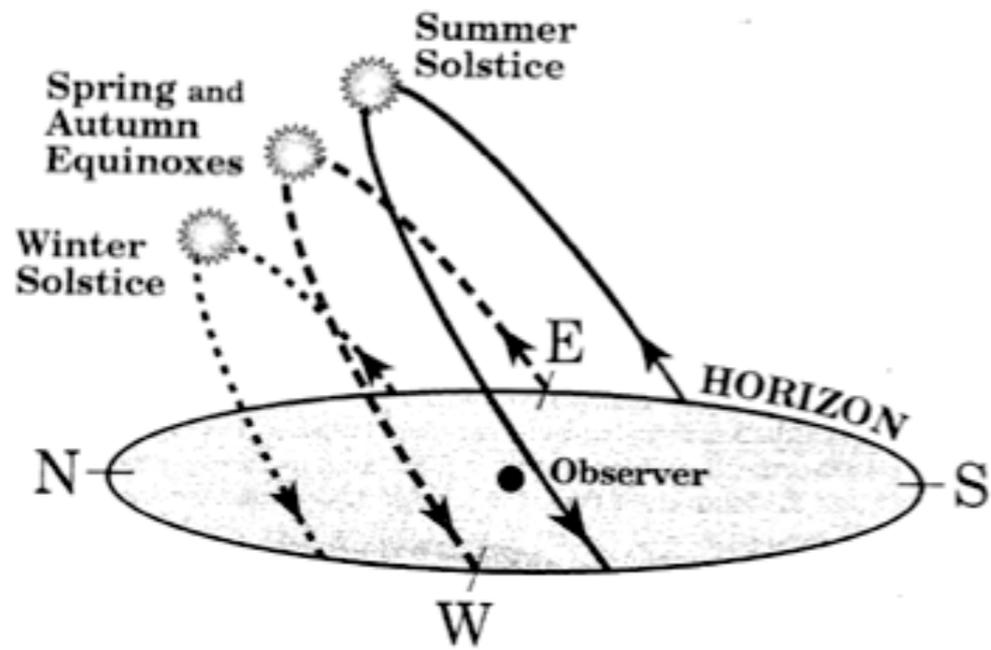
**BUILDING FORM**





**GEO LOGICS\***  
building morphology  
geo-environment





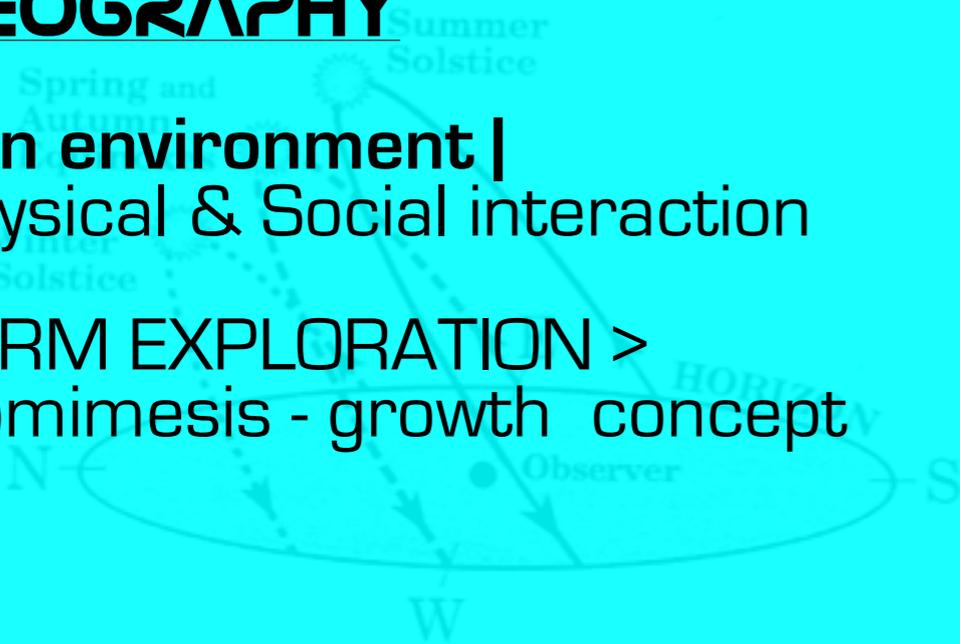
## GEOGRAPHY

### Sun environment |

Physical & Social interaction

### FORM EXPLORATION >

biomimesis - growth concept

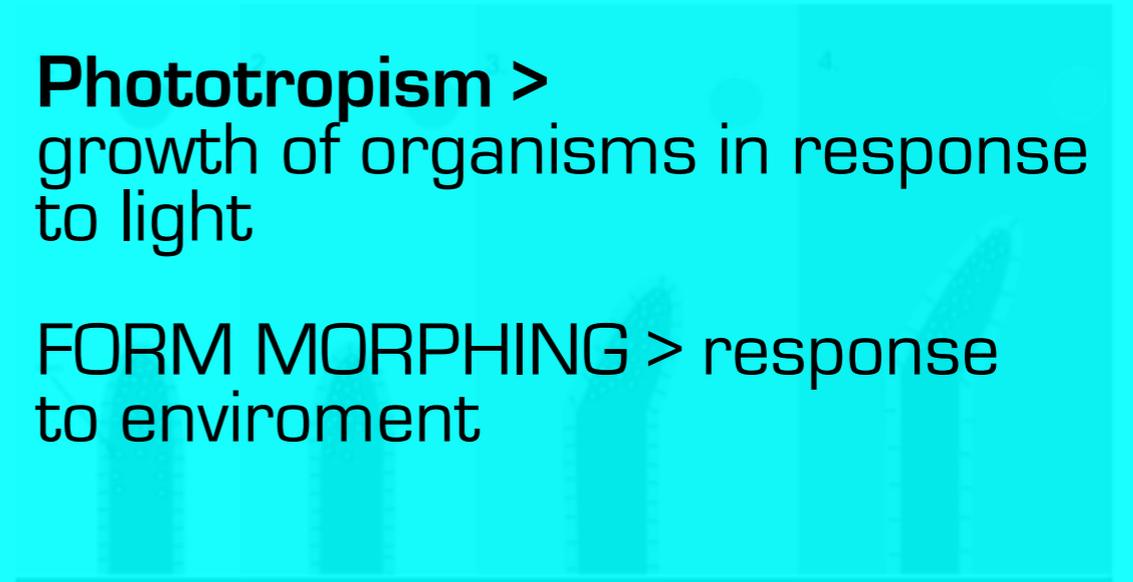


## LOGIC

### Phototropism >

growth of organisms in response to light

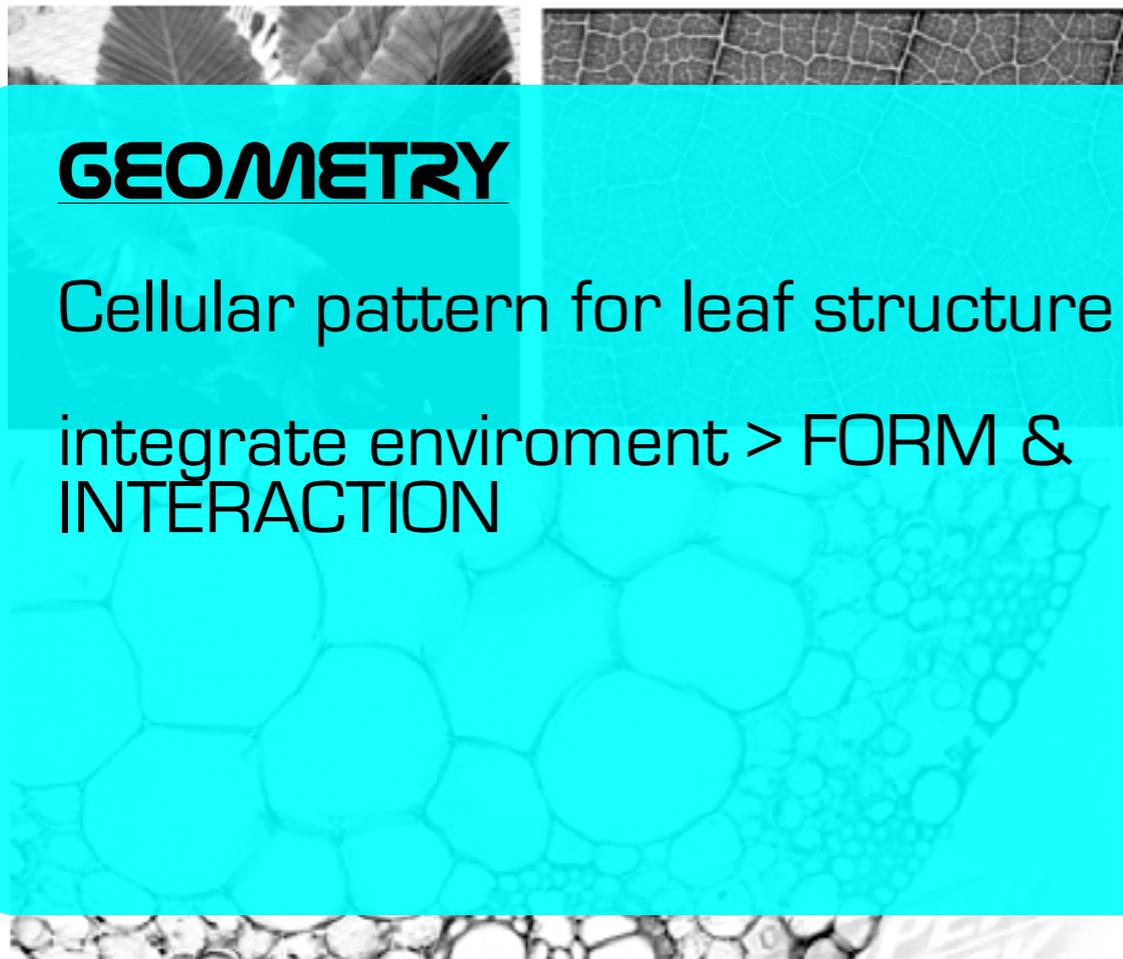
FORM MORPHING > response to environment



## GEOMETRY

Cellular pattern for leaf structure

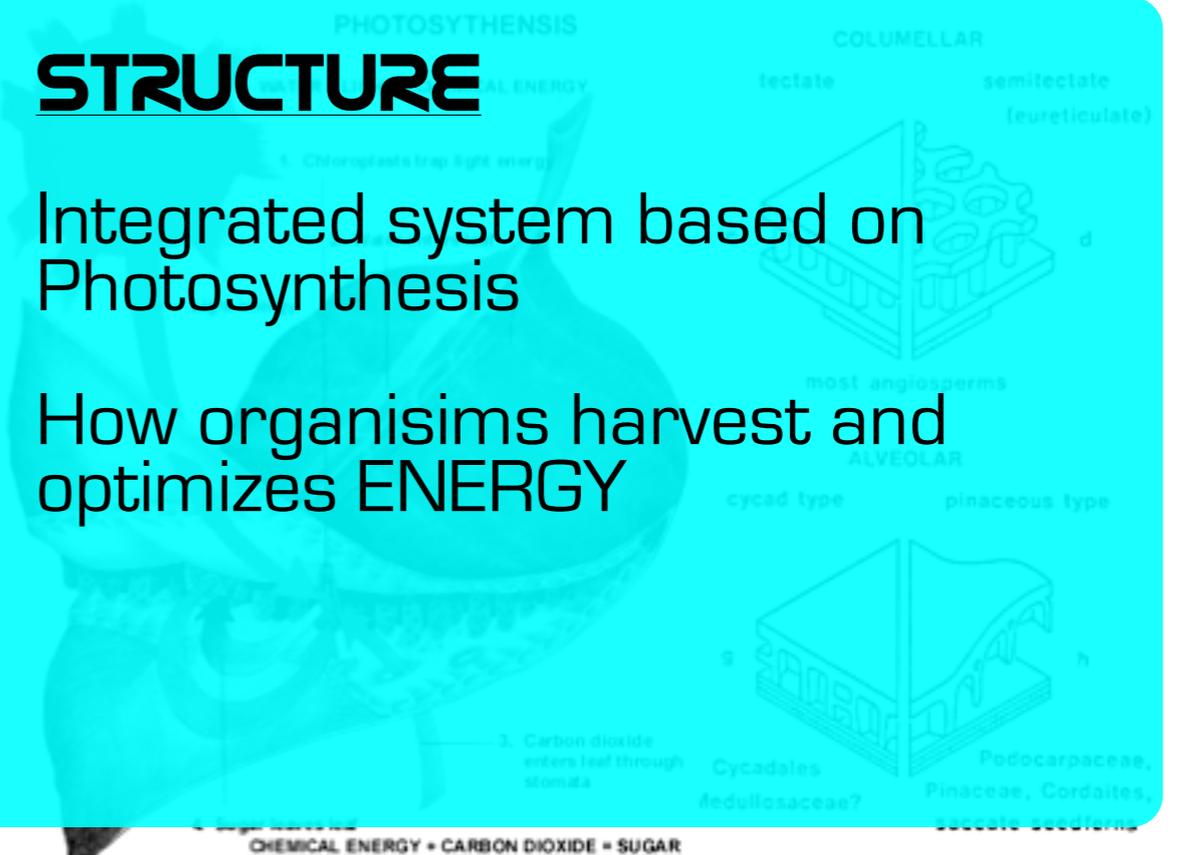
integrate environment > FORM & INTERACTION

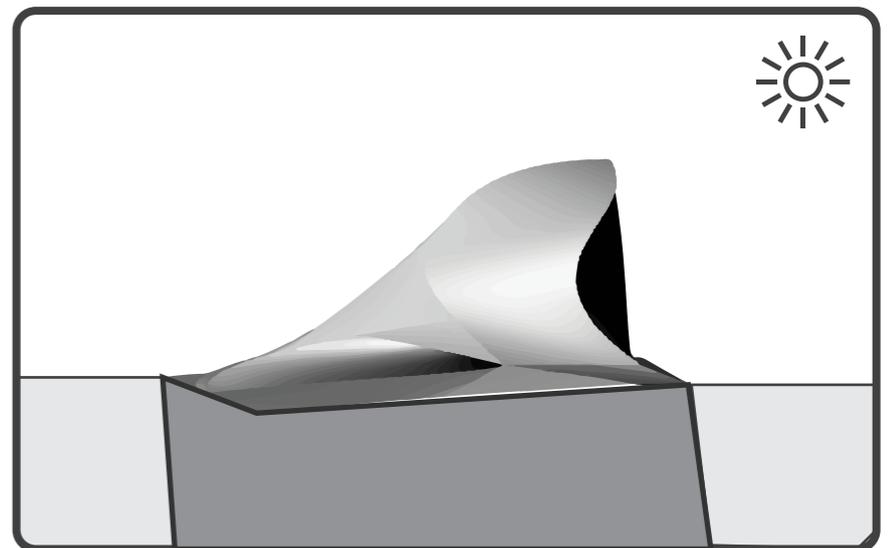
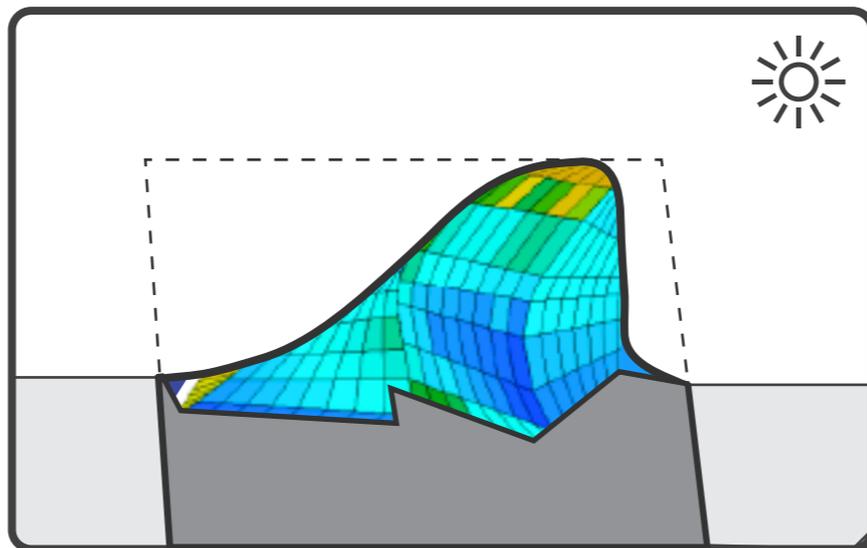
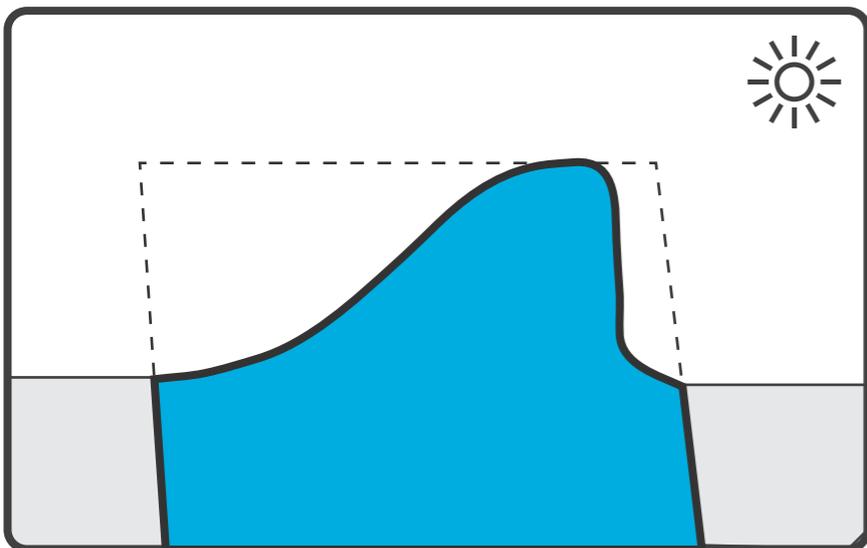
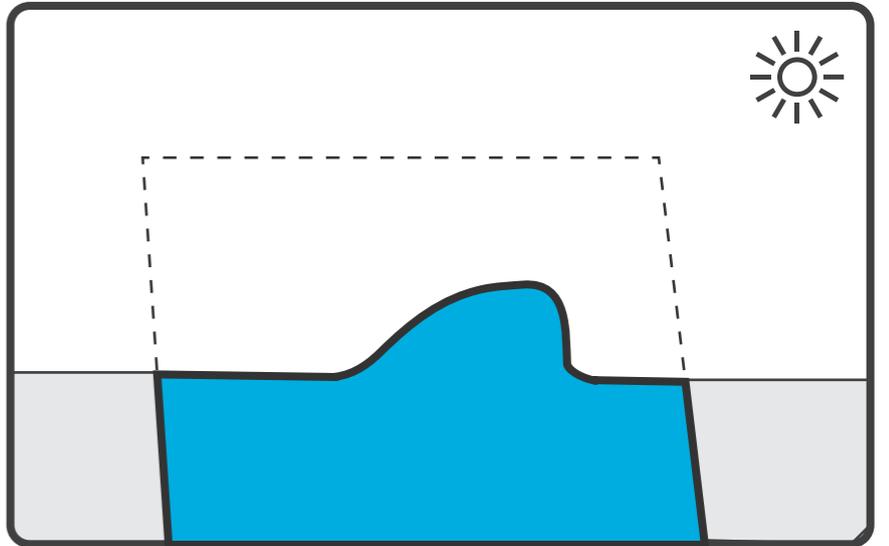
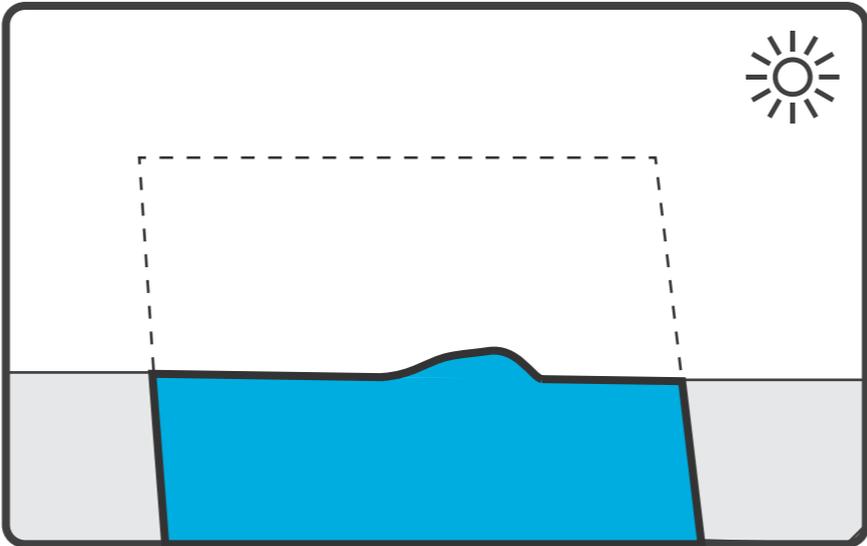
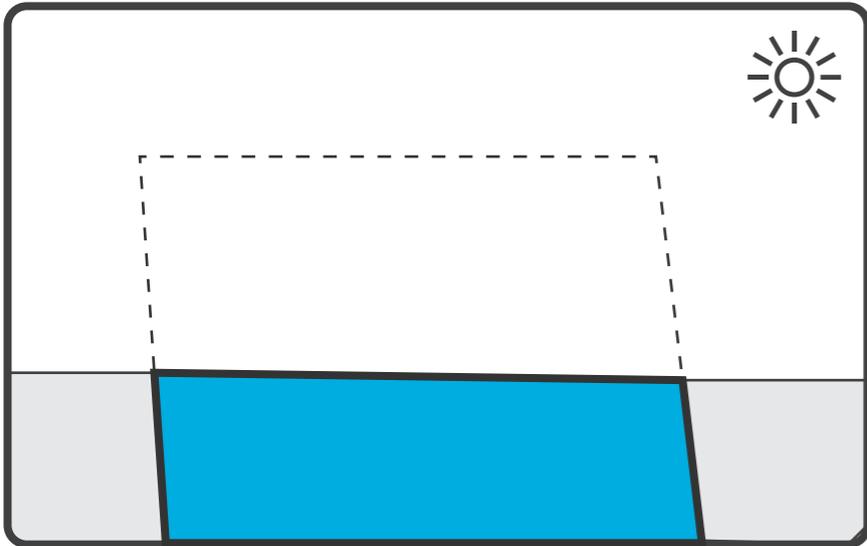
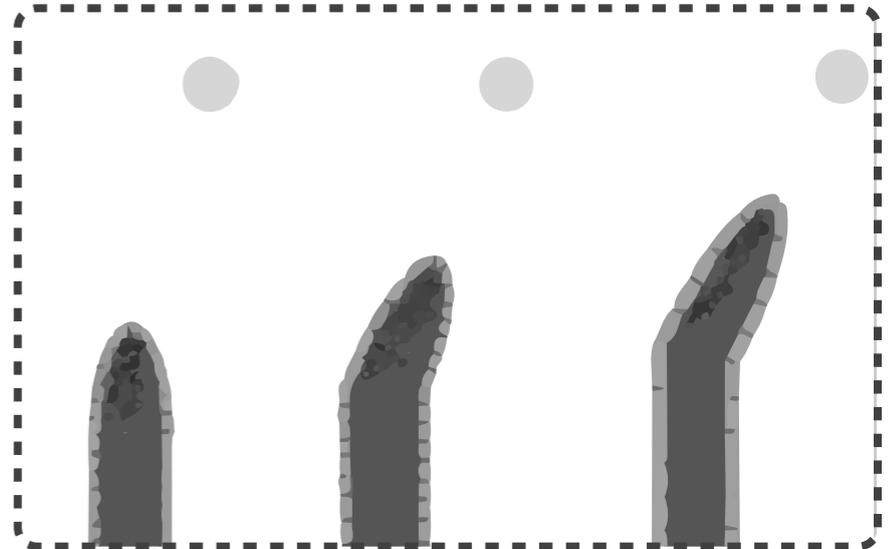
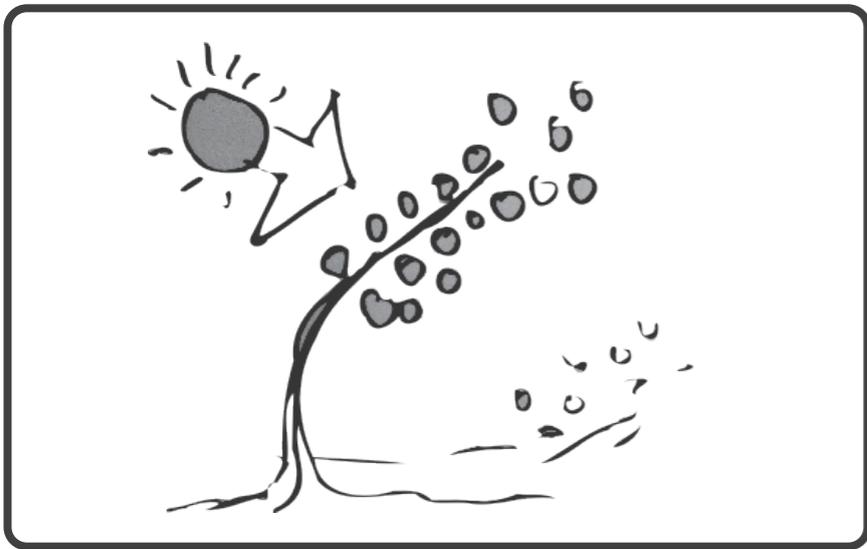


## STRUCTURE

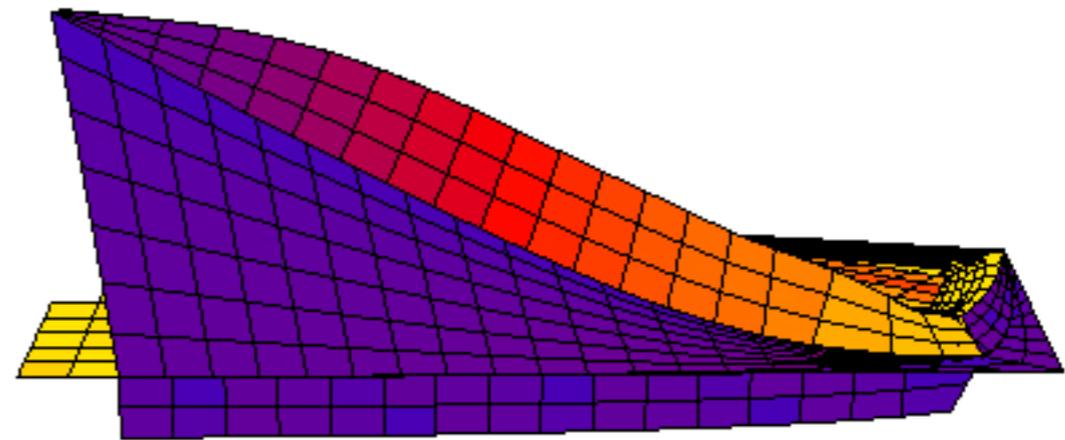
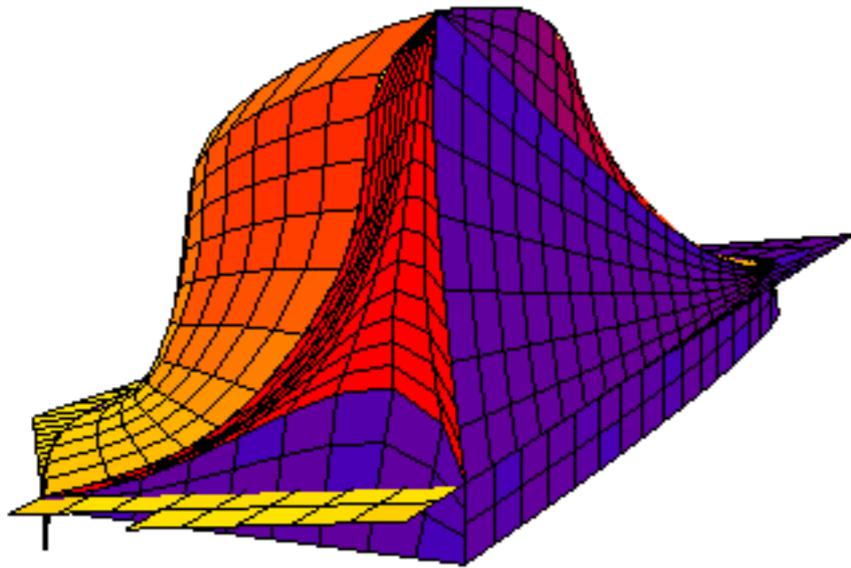
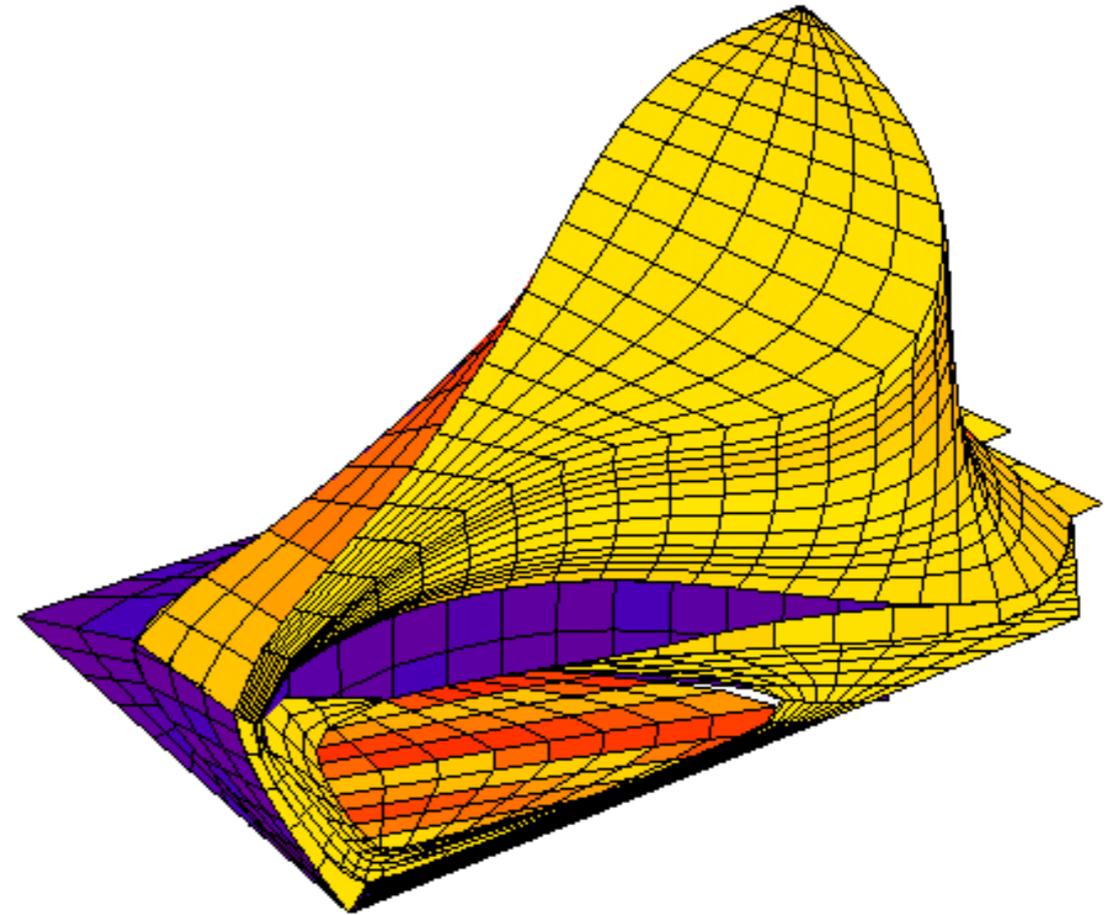
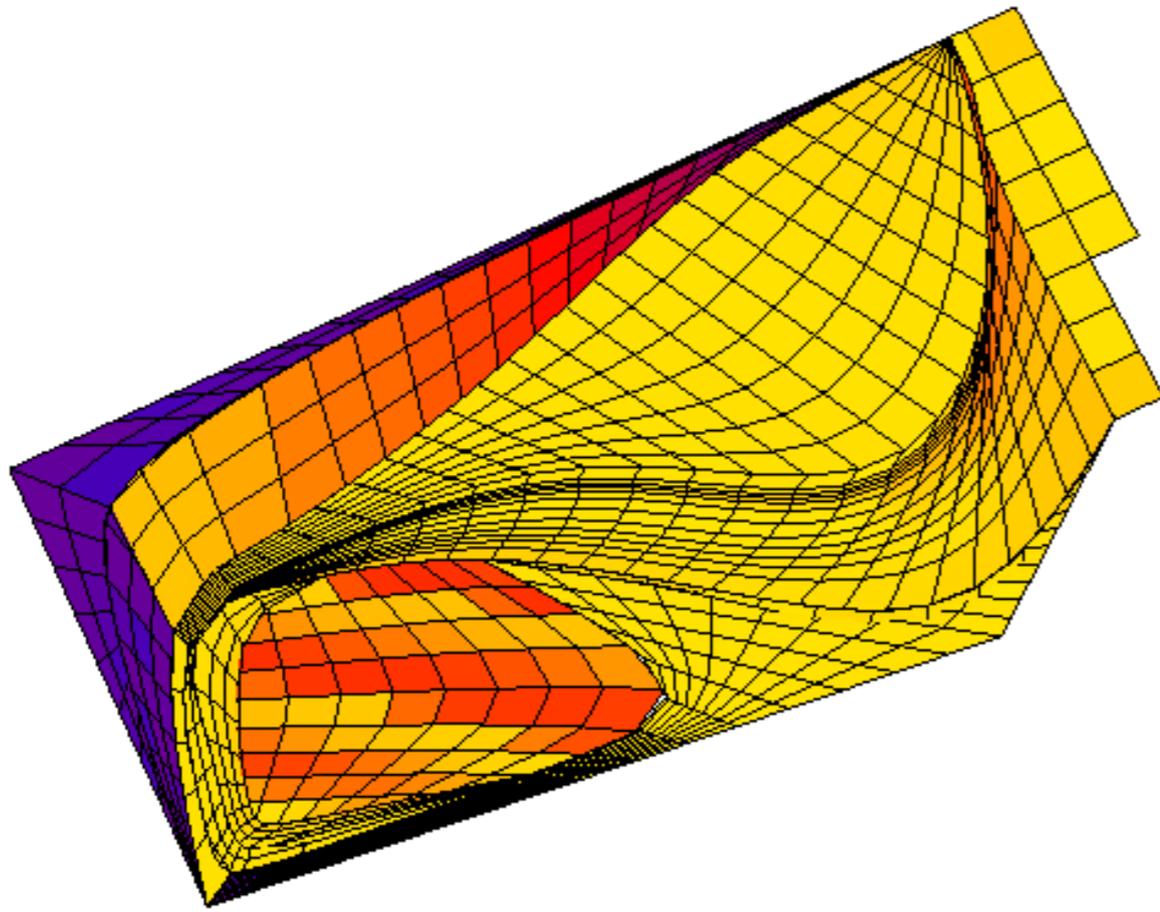
Integrated system based on Photosynthesis

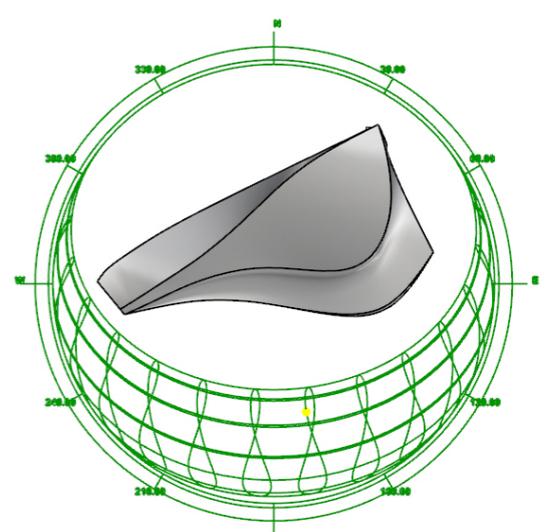
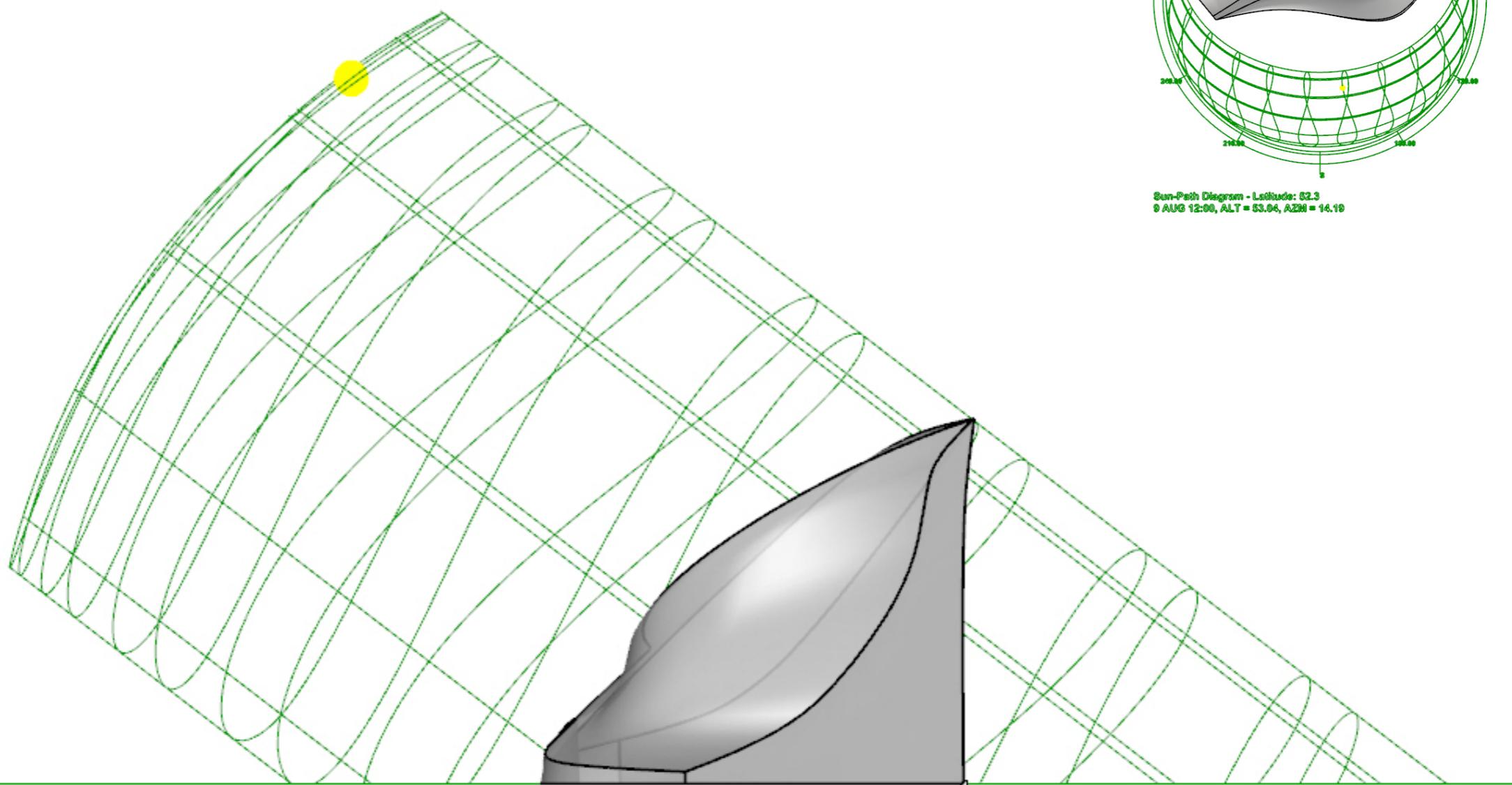
How organisms harvest and optimizes ENERGY





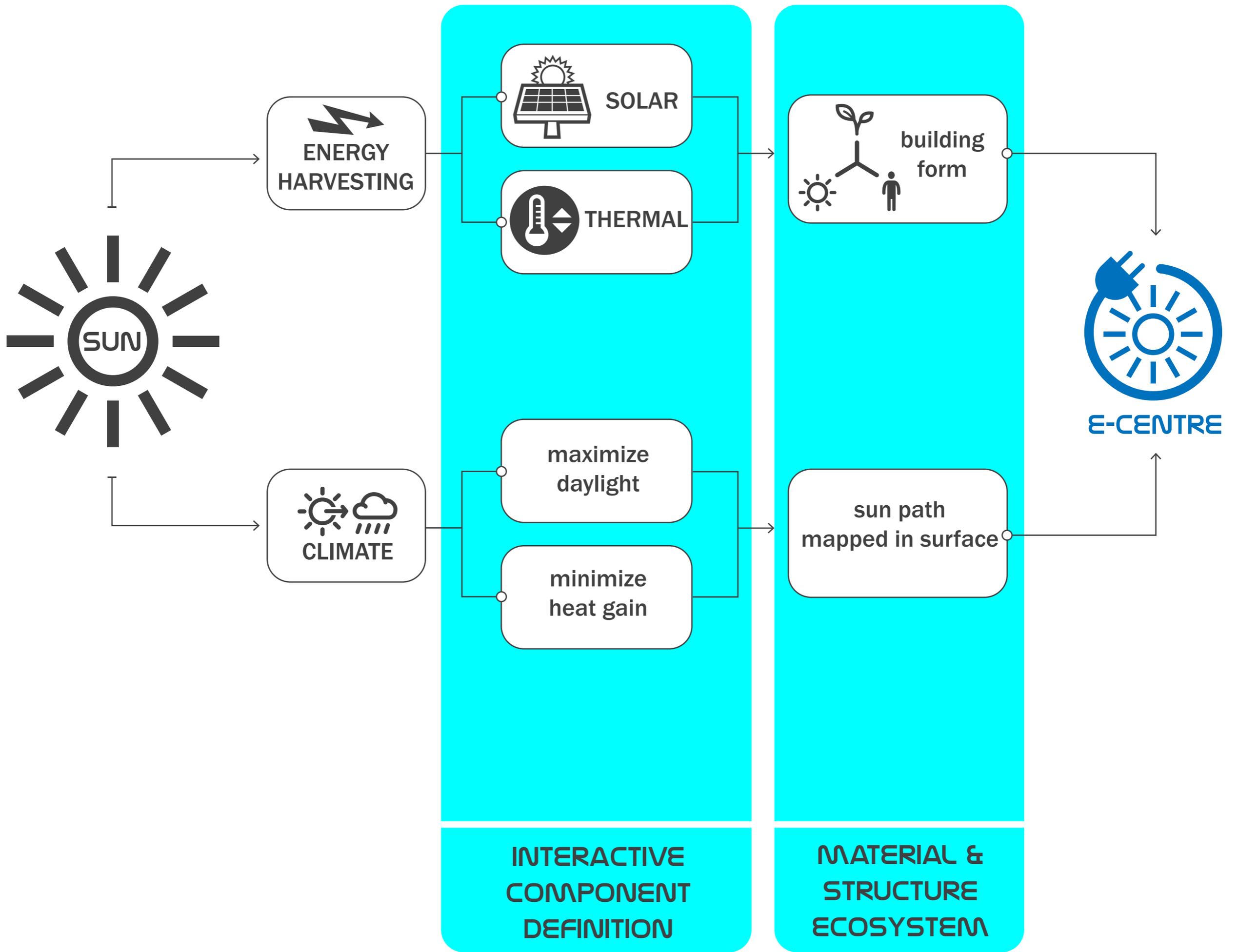
**GEOGRAPHY**  
form exploration  
BIOMIMESIS



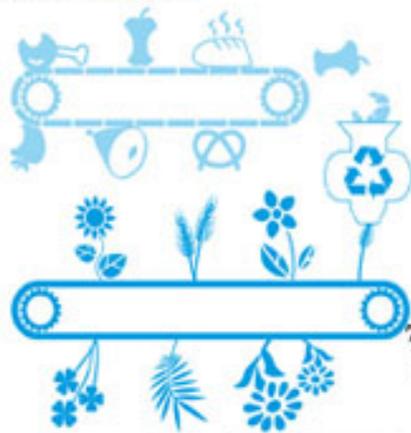


Sun-Path Diagram - Latitude: 52.3  
9 AUG 12:00, ALT = 53.04, AZIM = 14.19





## waste



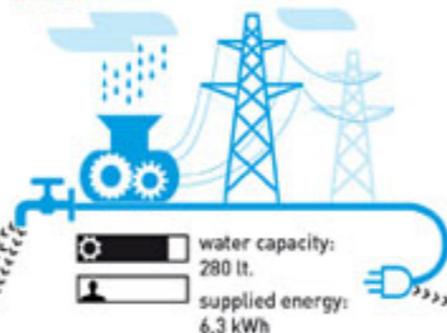
average amount produced pp:  
1 kg/day  
recycled inorganic: 70%  
recycled organic: 30%

## self-house



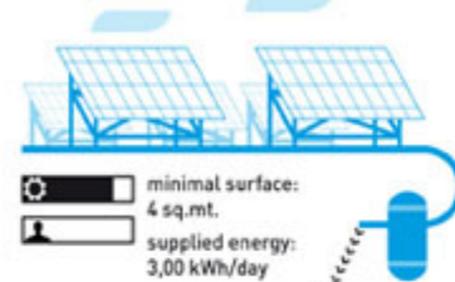
energy (produced = employed):  
12 kWh/day

## h<sub>2</sub>O



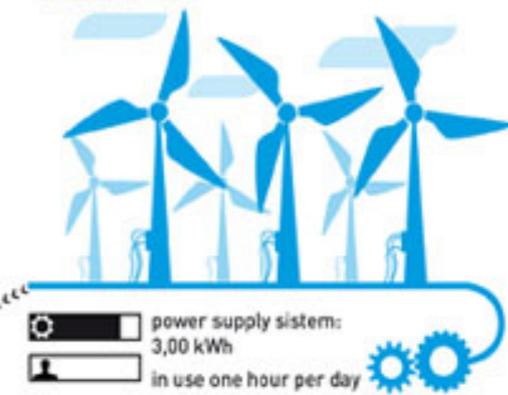
water capacity:  
280 lt.  
supplied energy:  
6,3 kWh

## solar



minimal surface:  
4 sq.mt.  
supplied energy:  
3,00 kWh/day

## wind



power supply sistem:  
3,00 kWh  
in use one hour per day

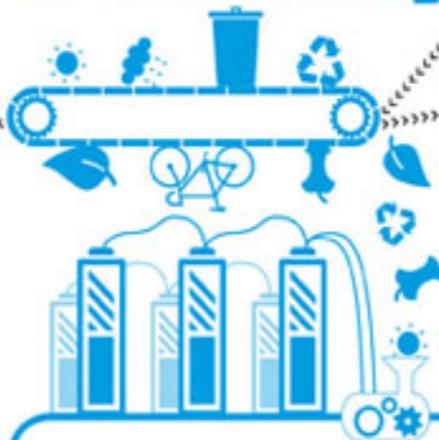
## renewable resources

ch<sub>4</sub>  
produced methane: 800-1000  
lt./day per adult cow (average  
weight 550 kg)

## recycling

prevents energy waste  
in order to produce new  
materials

## Great Battery



$$\sum E_{in} = \sum E_{out}$$

## research & development

## research

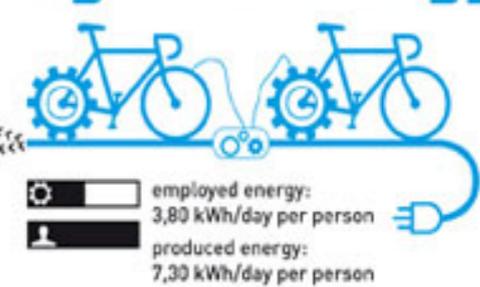


auxiliary energy (devices):  
5,60 kWh/day  
employed energy:  
2,33 kWh/day

## education

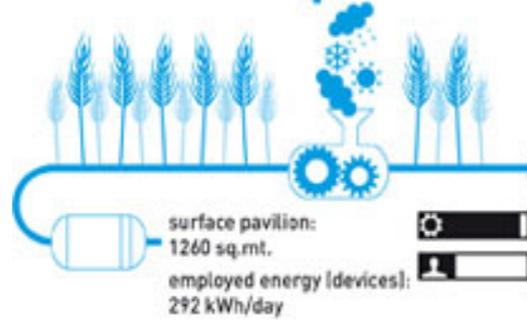
auxiliary energy (devices):  
0,30 kWh/day  
employed energy:  
0,14 kWh

## cyclical energy



employed energy:  
3,80 kWh/day per person  
produced energy:  
7,30 kWh/day per person

## seasonal pavilions



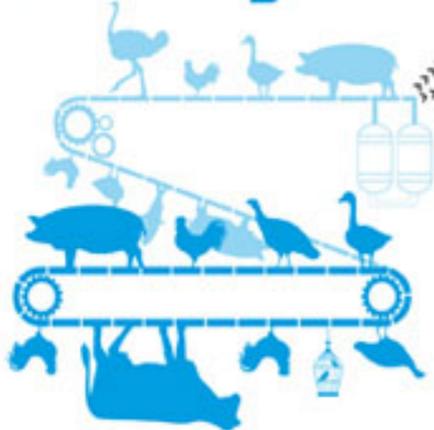
surface pavilion:  
1260 sq.mt.  
employed energy (devices):  
292 kWh/day

## farm & crops

## products

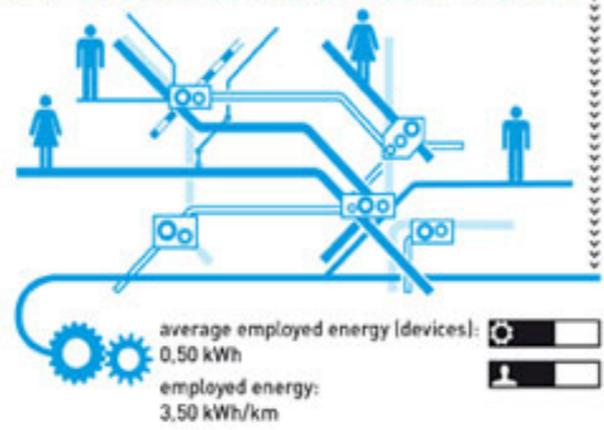
calorie needs (man): 3000 kCal  
calorie needs (woman): 1800 kCal  
calorie needs(child): 200 kCal

## breeding



employed energy (devices):  
11 kWh/day  
obtained products:  
40 kg

## urban movements



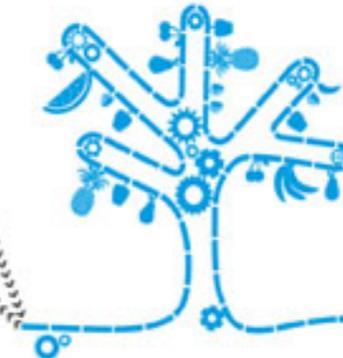
average employed energy (devices):  
0,50 kWh  
employed energy:  
3,50 kWh/km

## human occupation

## teleworking

auxiliary energy (devices):  
0,60 kWh/day  
employed energy:  
2,33 kWh/day

## farming



employed energy (devices):  
25,70 kWh/day  
employed energy:  
3,49 kWh/day

	A	B	C	D	E	F	G
1	type		power: W per hour		equal to power a:		
2							
3							
4	average workout (typical user)		50-150		mobile phone for 1 week	}	gym stuffs
5	each equipment		50 - 400 (average 100)				
6	elliptical cross trainer		100		laptop for 2 hours		
7	spin bike		50-150 ( 1 year = 18,2 kW and 4380 liters of CO2)		television for 1 hour		
8	green-system-pod		2000				
9	green-micro-gym (cross trainers and spin bikes)		250				
10	power-walker		12		in 1 hour it charges 4 mobile phones		
11							
12							
13							
14	piezo-sensor		5-20 per person (tile = 75cm*75*20)			}	floor sensors
15	rotterdam-dancefloor		20 per dancer				
16	walking street		2,1 per tile				
17							
18							
19							
20	CO2 PRODUCTION		liters per hour				
21							
22	normal jogging man (83 kg) at 10 km/h		198				CO2 production
23							
24							
25	renewable energies		kWh per year		dimension		
26							
27	wind turbines		4200 at 5,5 km/h		3 m2	}	renewable energies
28	photovoltaic		3376 with a 1,85 W system		13,8 m2		
29	biogas		10950 (1,25 kWh)		1 m3		
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							

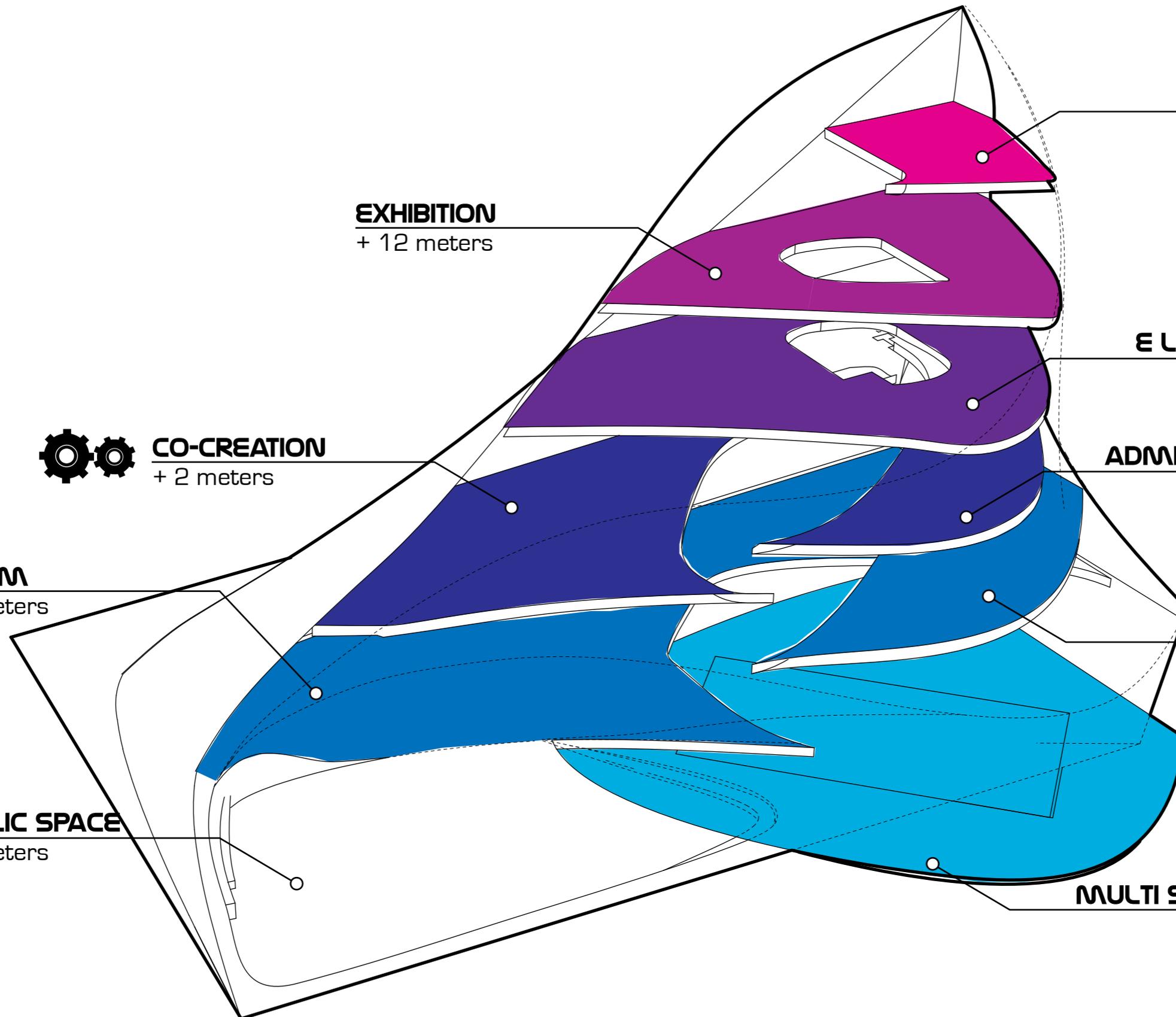
```

energy.txt
biogas 1.25 kw      per 1m3
pv 1kw             per 7m2
wind 2.48 kw       per 1m2
piezo floor 20 w   per 75 cm2
gym stuff (spin bike, elliptical cross trainer) 150w per person

```



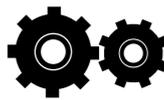
**ECENTRE**  
building architecture  
geo-environment



**VIEW POINT**  
+ 16 meters

**EXHIBITION**  
+ 12 meters

**E LABORATORY**  
+ 8 meters

 **CO-CREATION**  
+ 2 meters

**ADMINISTRATION**  
+ 4 meters

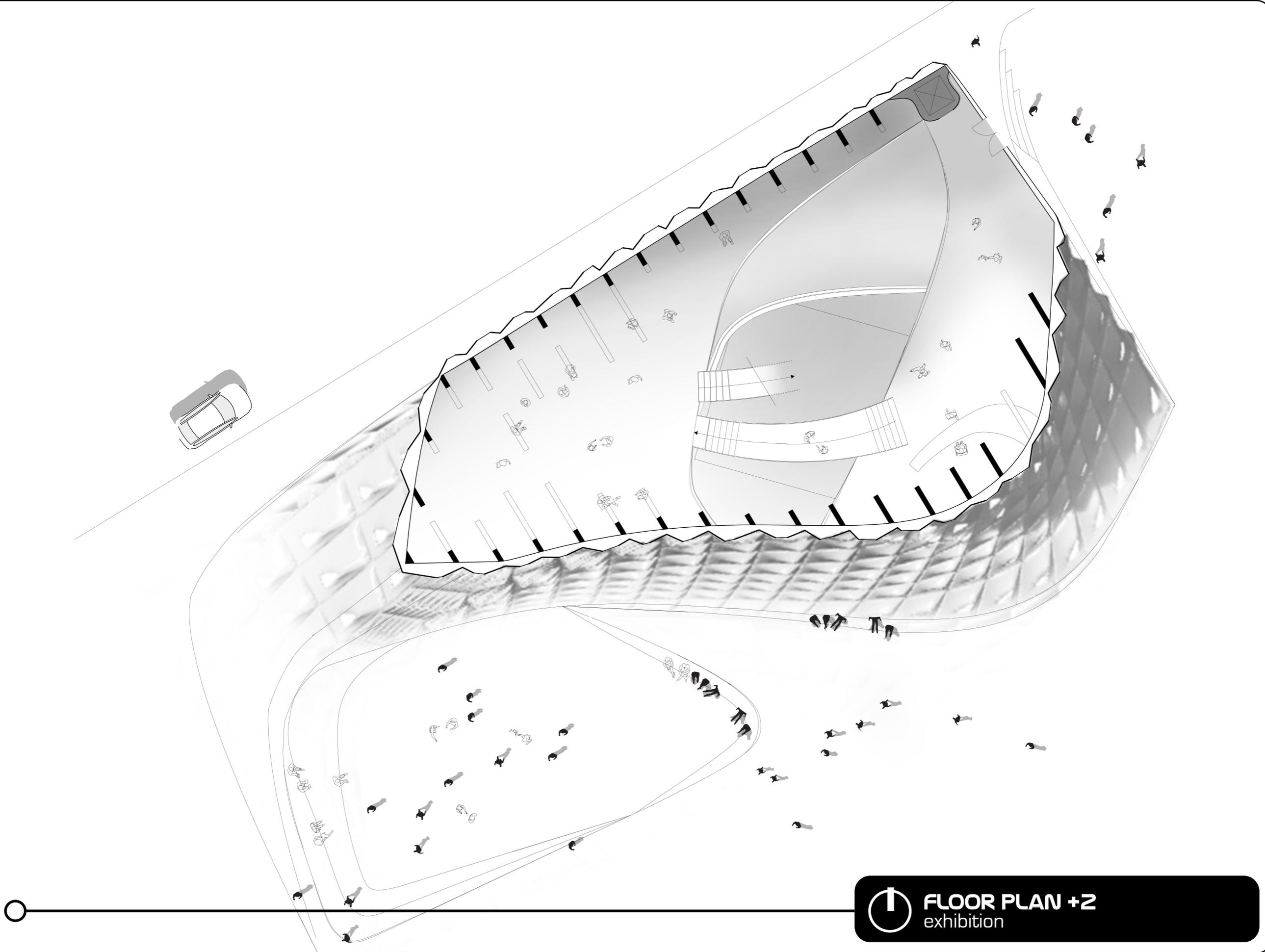
 **GYM**  
- 4 meters

**RECEPTION**  
+ 0 meters

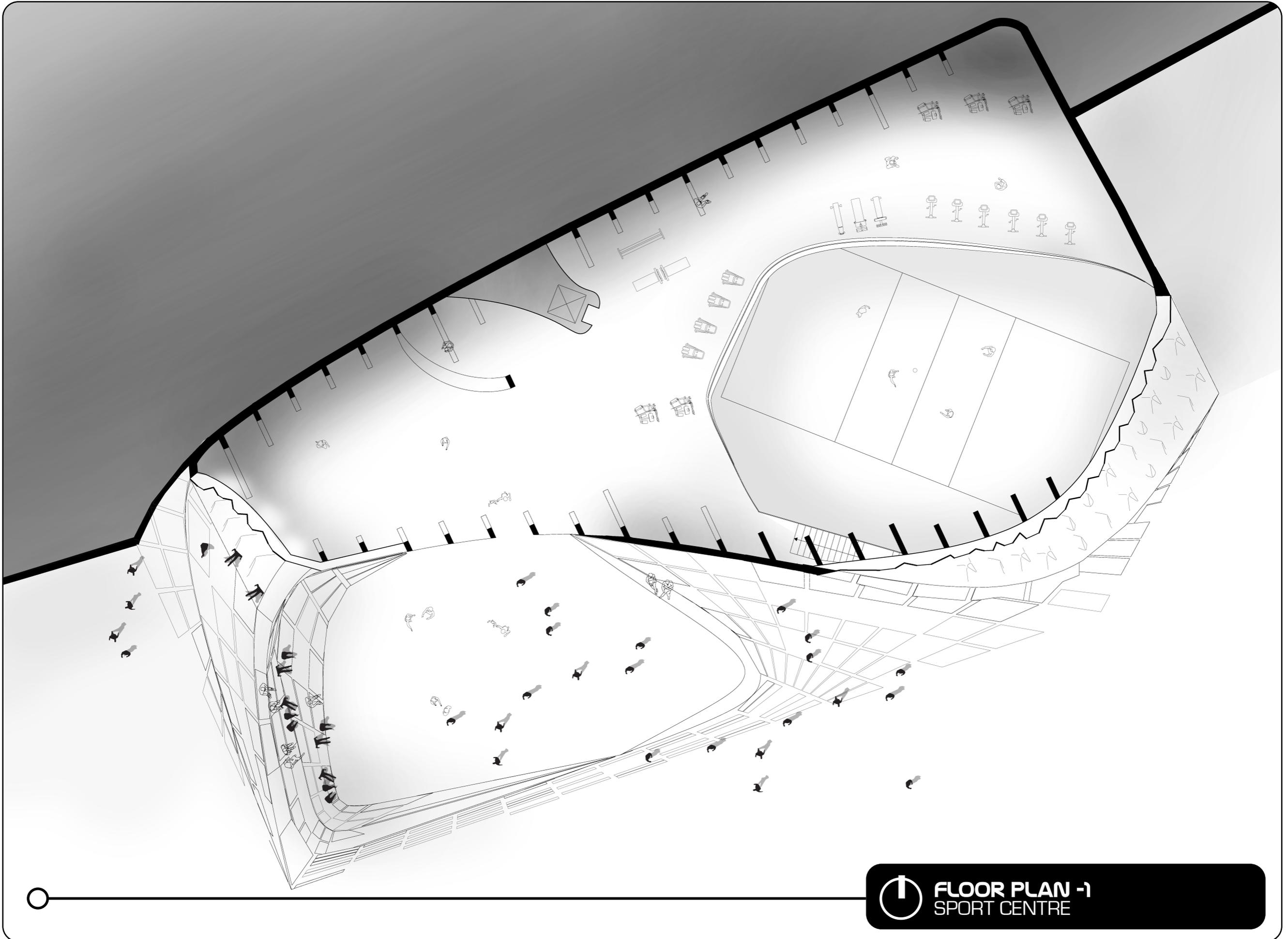
 **PUBLIC SPACE**  
- 4 meters

**MULTI SPORT FIELD**  
- 10 meters

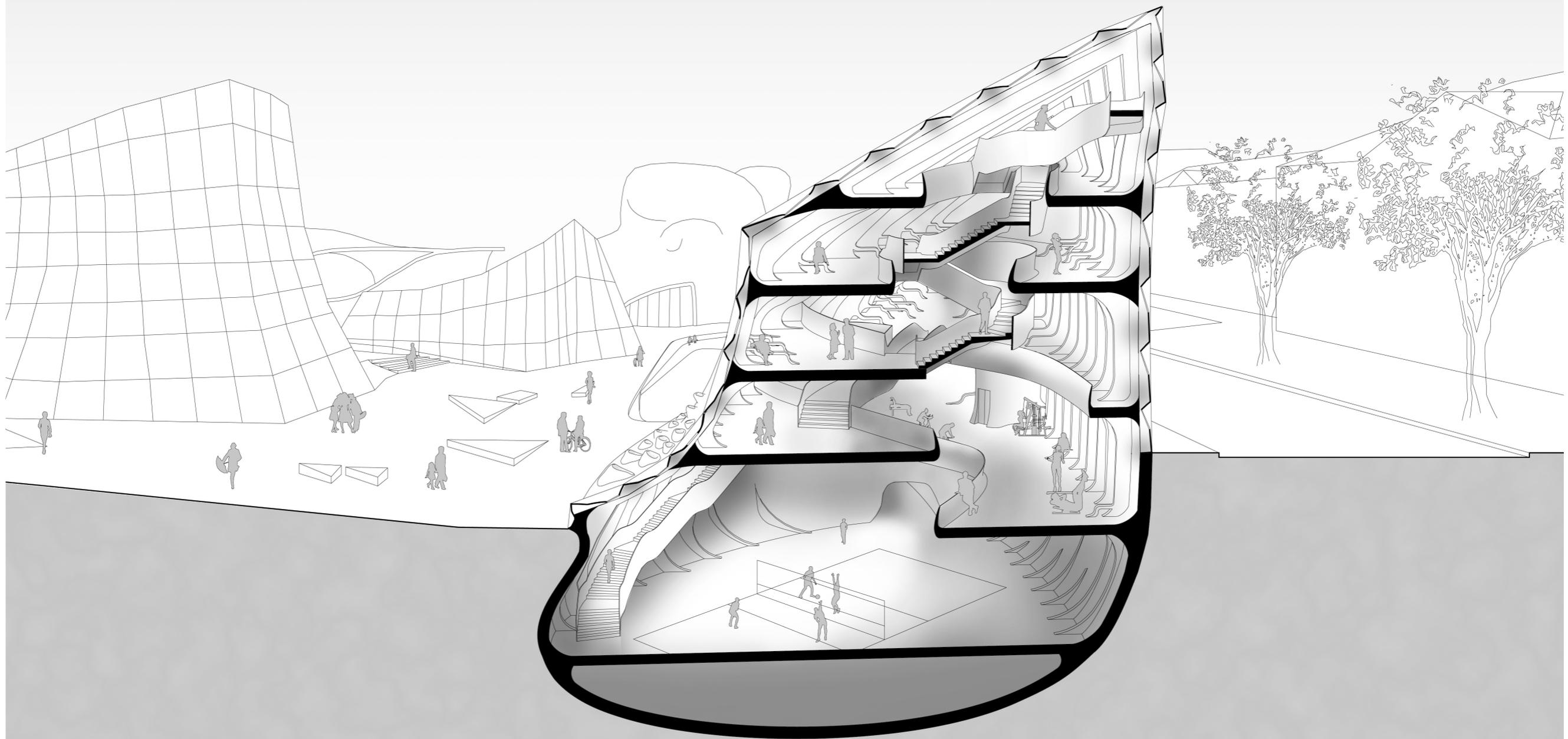
**MAIN PROGRAMME**  
eCENTRE



**FLOOR PLAN +2**  
exhibition

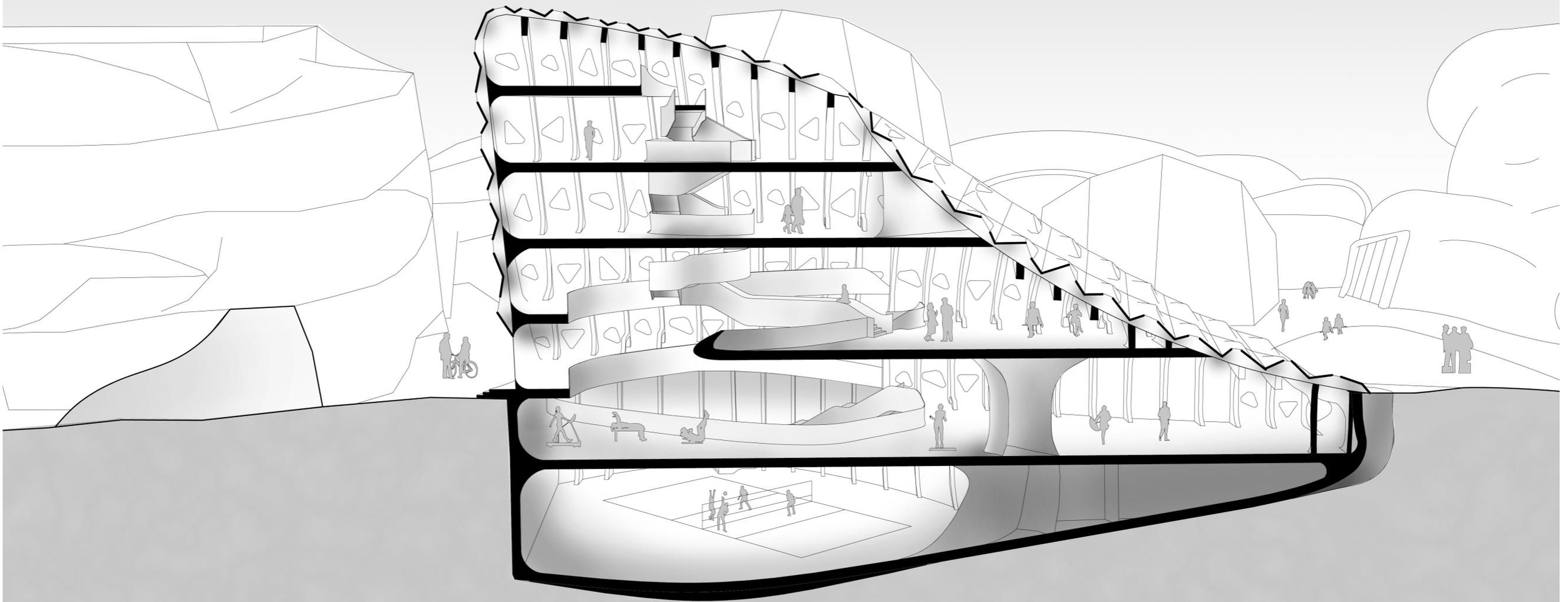


 **FLOOR PLAN -1**  
SPORT CENTRE

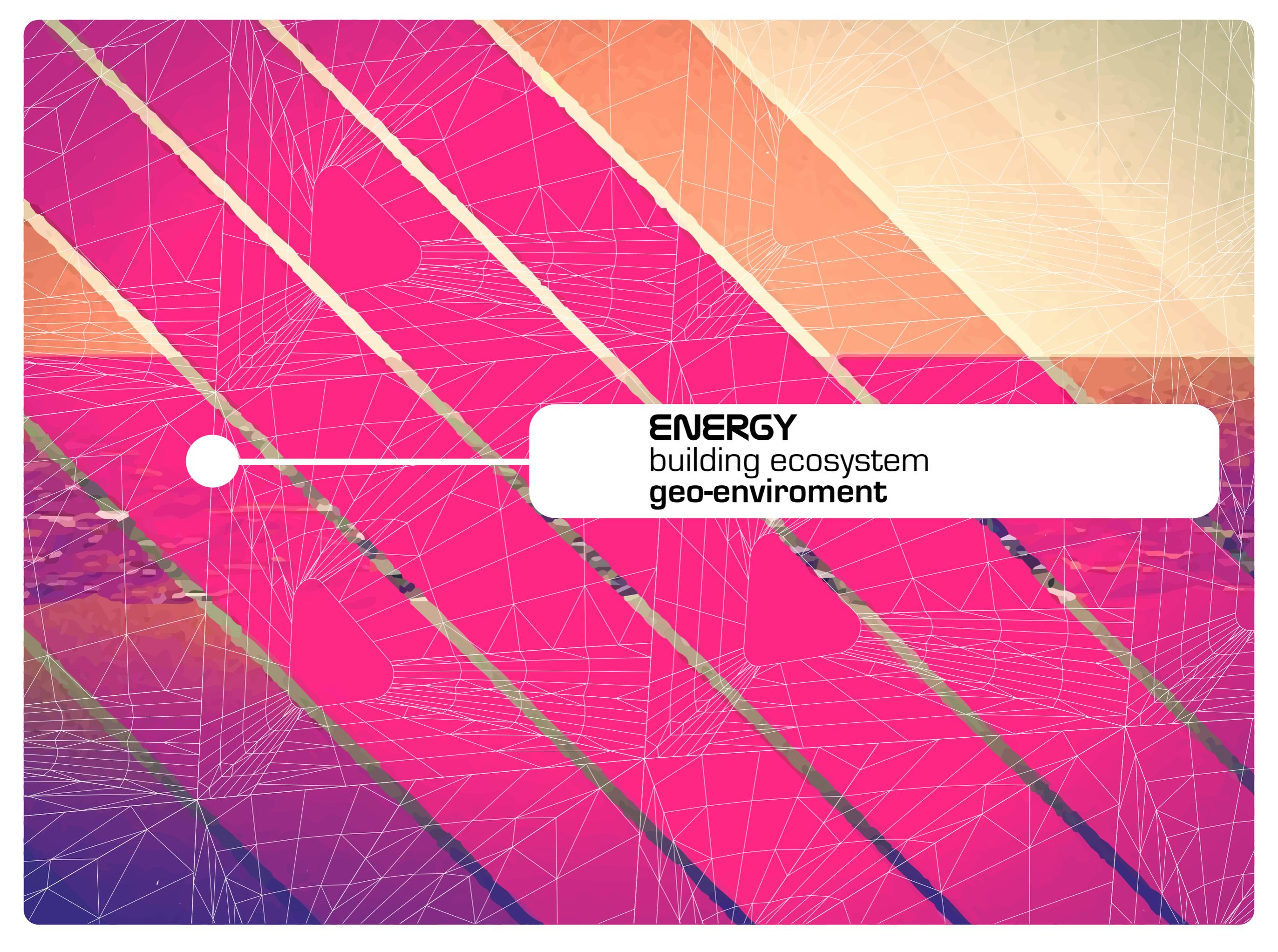


**CROSS SECTION**  
relation public/private space





LOGITUDINAL SECTION



**ENERGY**  
building ecosystem  
**geo-environment**



**WINDBELT**  
harvest component

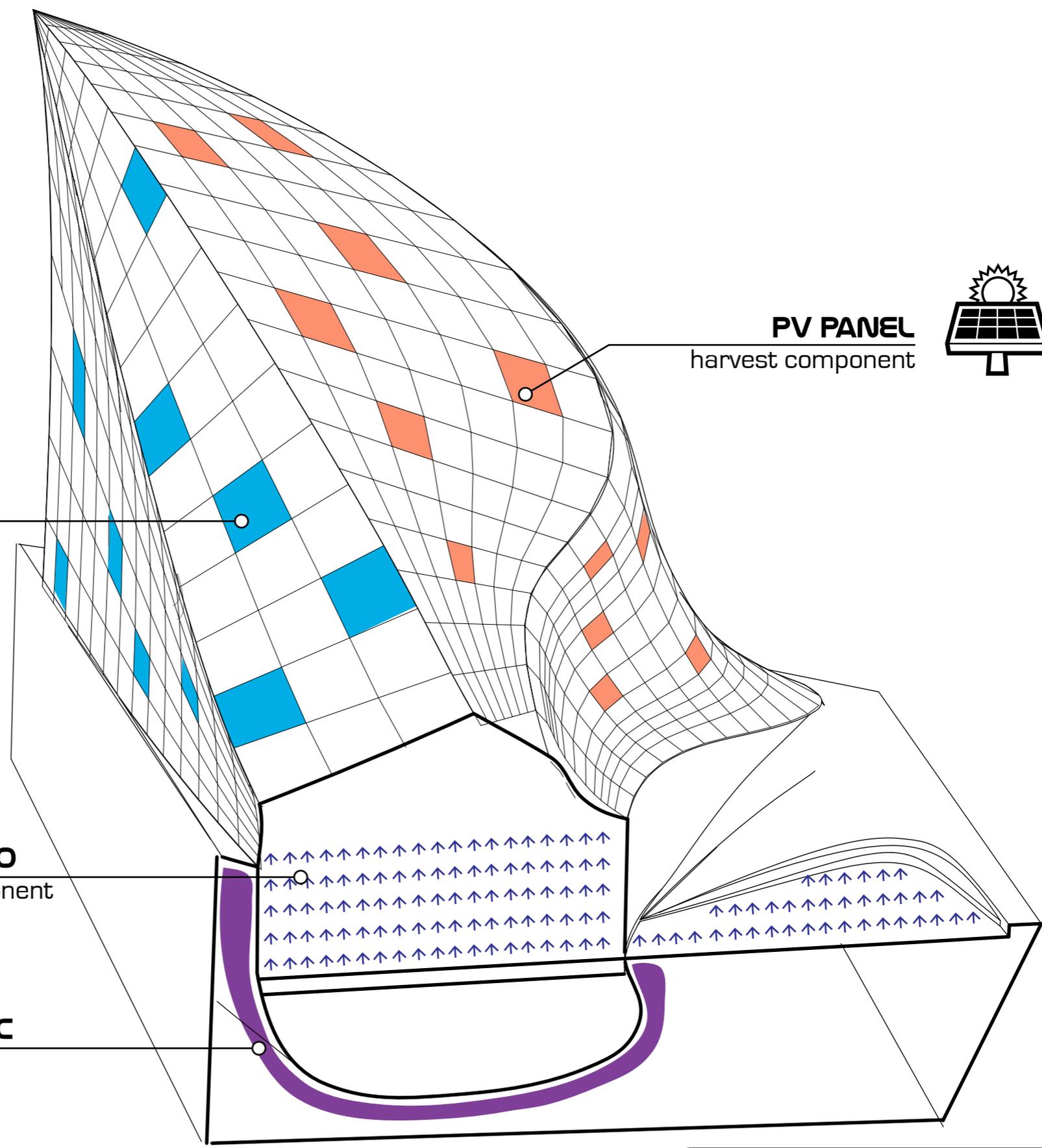
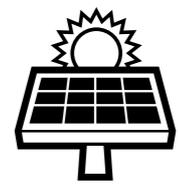


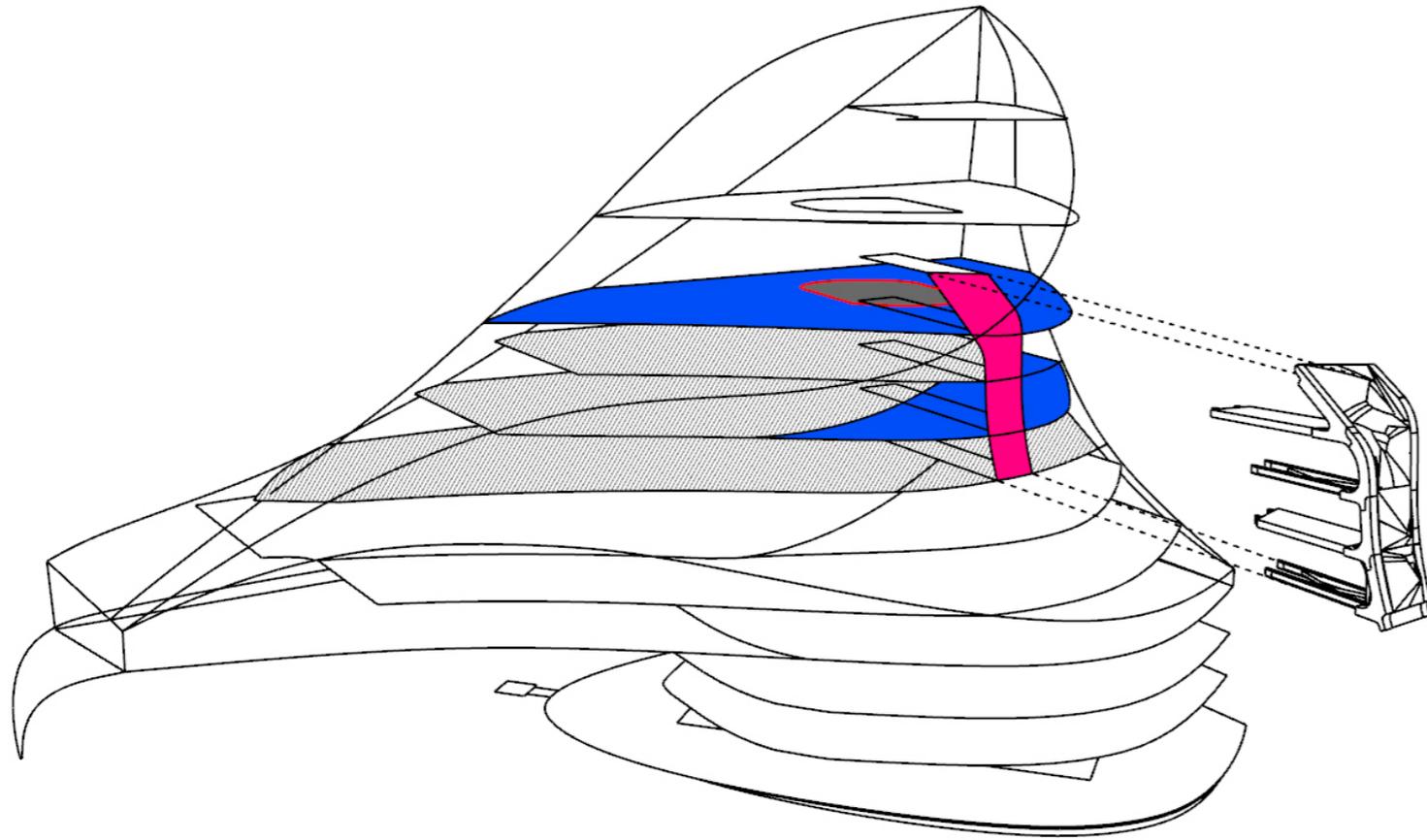
**FLOOR PIEZO**  
harvest component



**THERMO ELECTRIC**  
harvest component

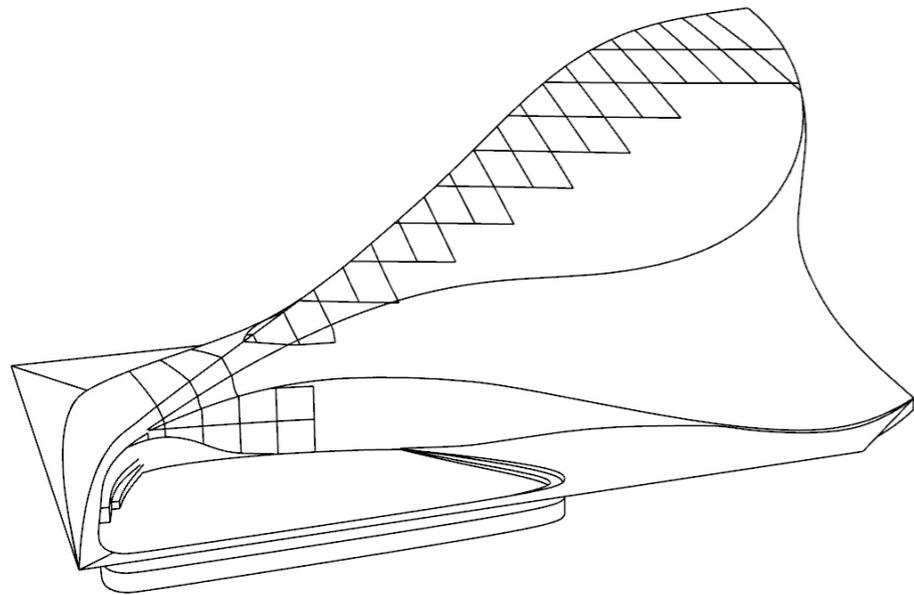
**PV PANEL**  
harvest component



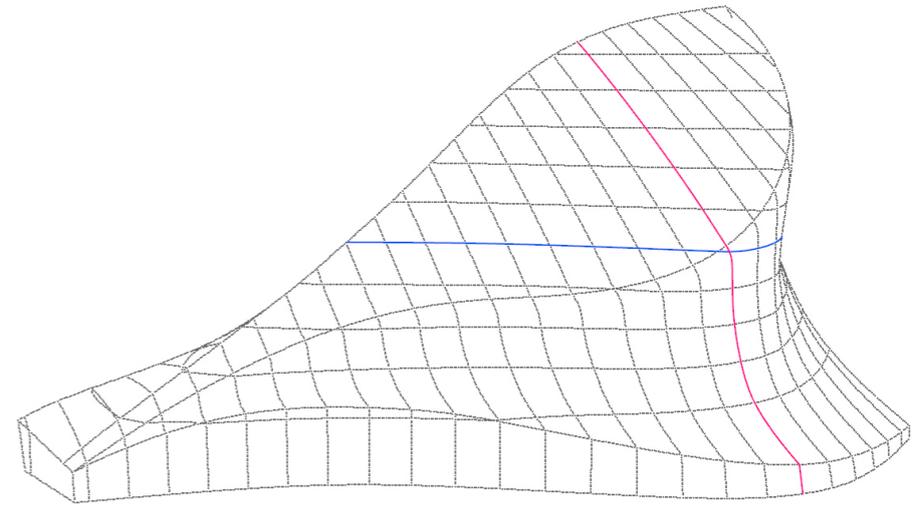
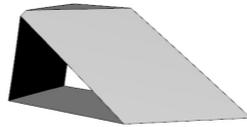


modules incorporate temporary bracing where there is no permanent slab

temporary bracing allows for stacking of full volume

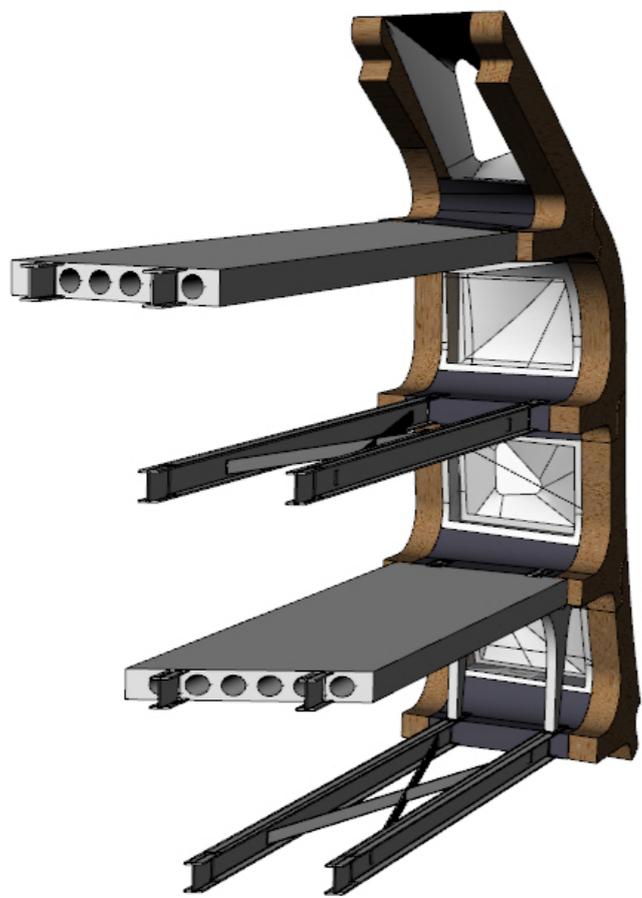


modules that are less than 10m in length form a closed unit which unifies the rib components



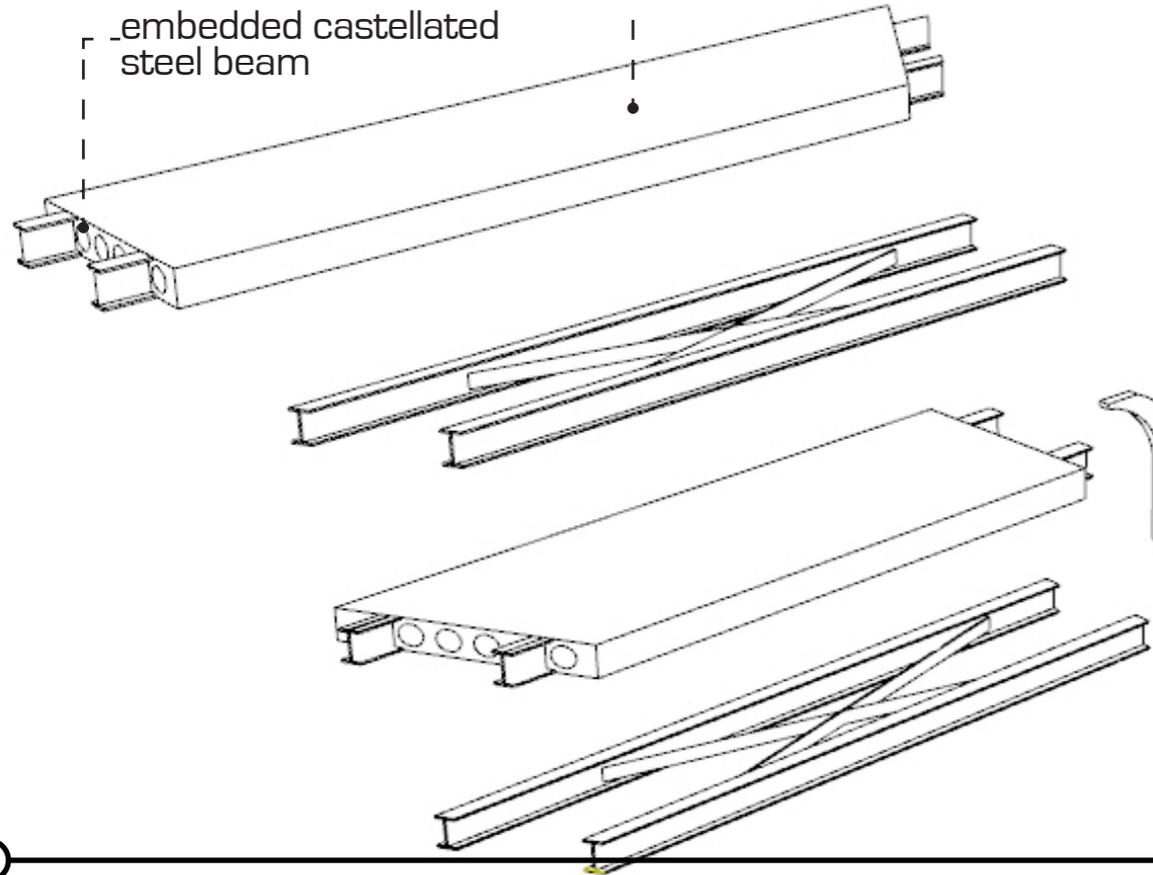
global structural scheme  
ribs + lateral bracing  
achieved when all components are in place





embedded castellated steel beam

hollow core slab



glulam column for cantilever slab support

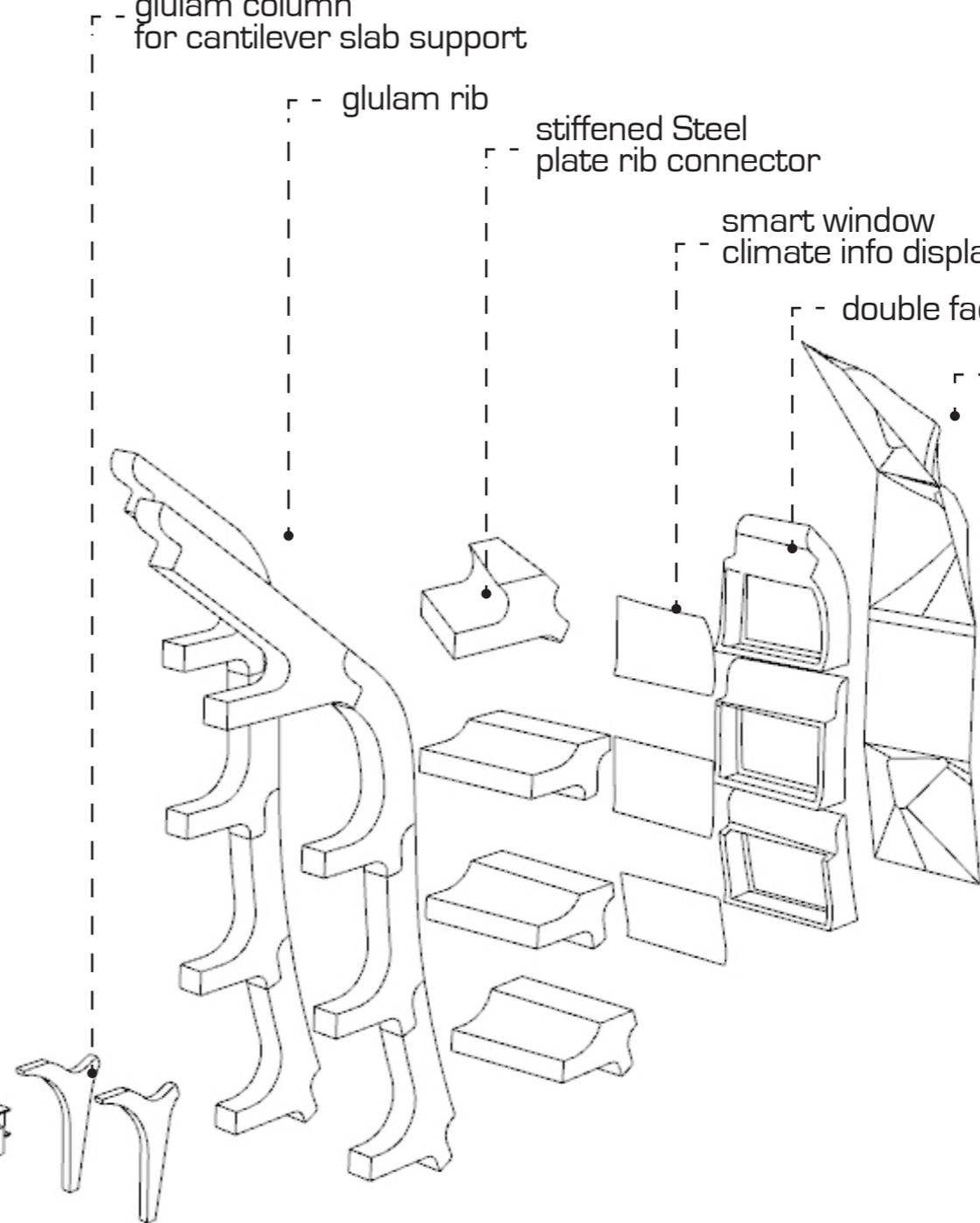
glulam rib

stiffened Steel plate rib connector

smart window climate info display

double facade frame

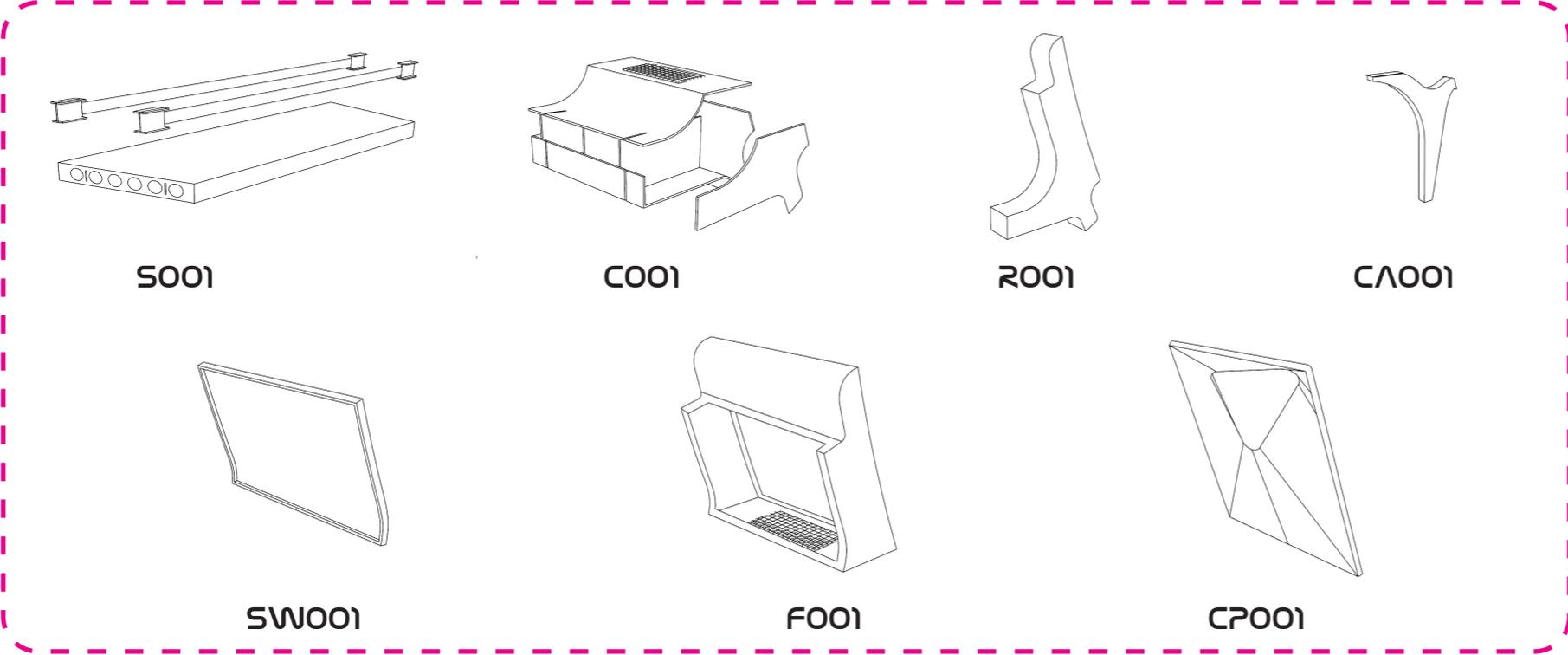
PV facade component



**STRUCTURAL MODULE**  
mass customization

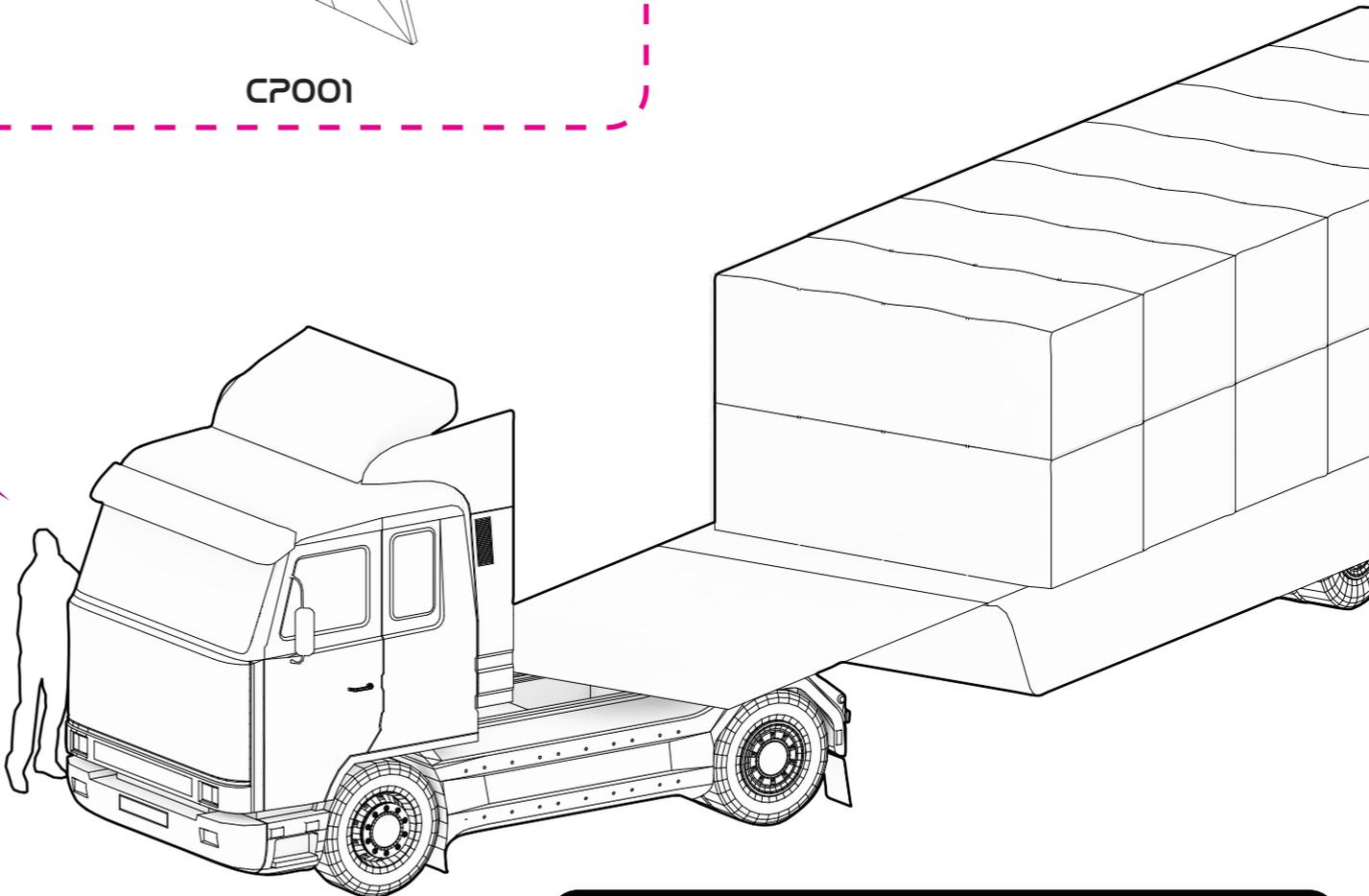
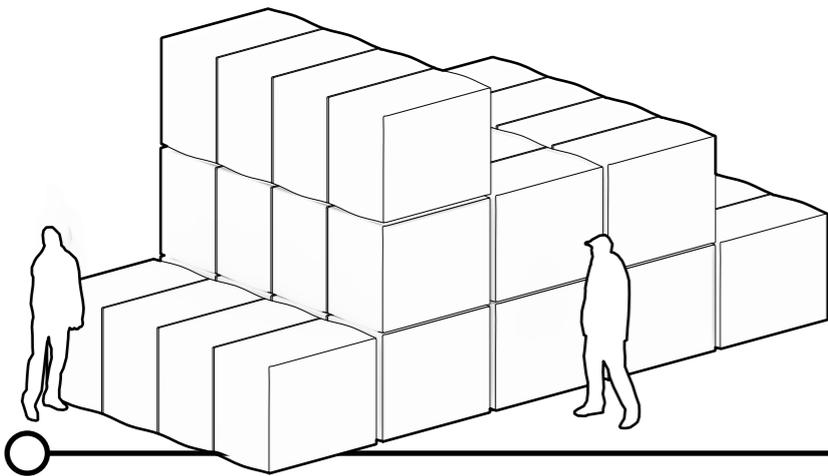
# COMPONENT LIBRARY

structural and facade components are prefabricated off site each with a unique label for assembly



stack it!

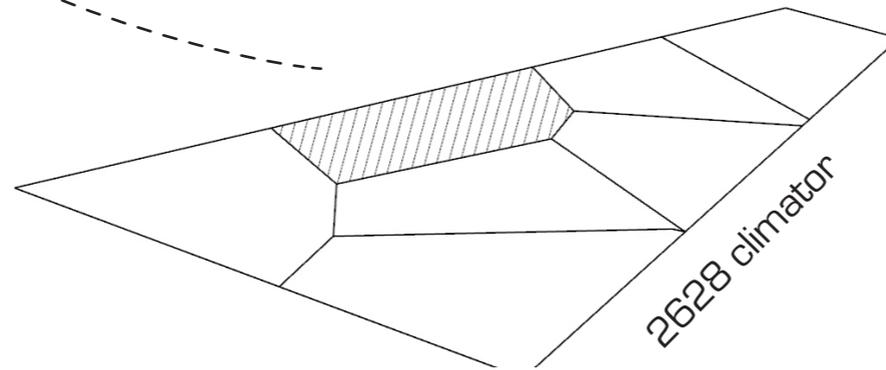
transport it!



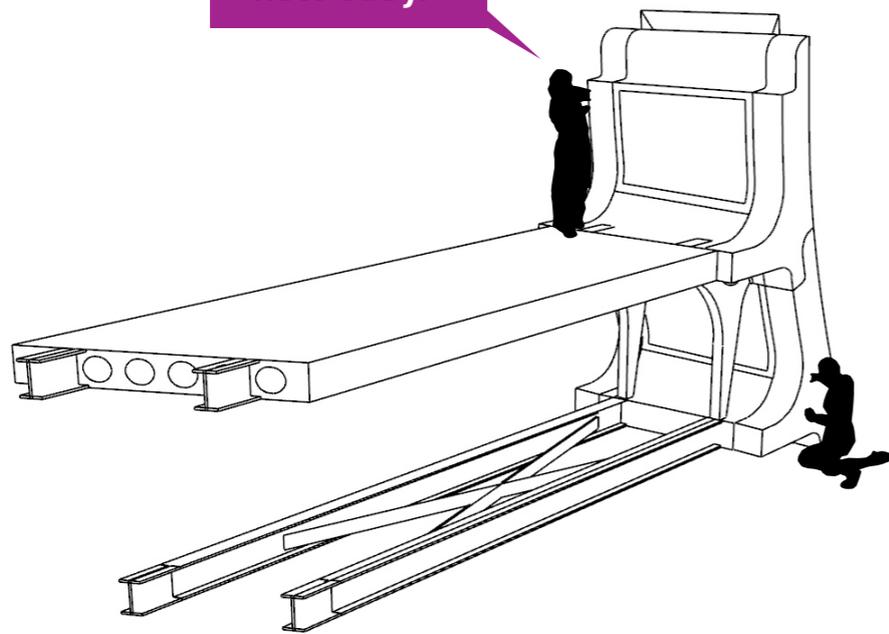
**GEOMETRY**  
build trough component

each component is sized to fit on a truck

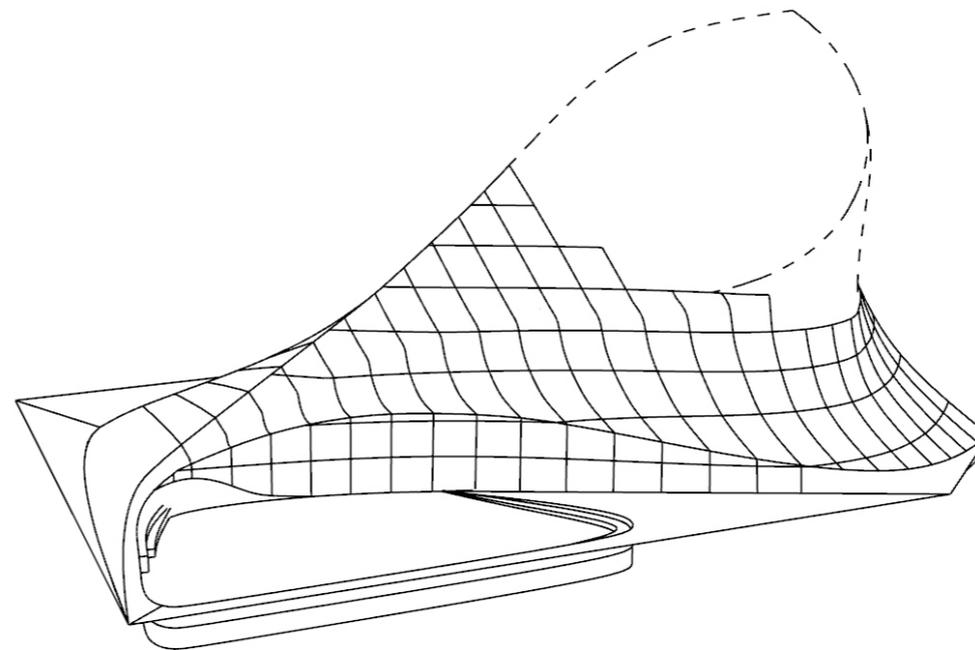
individual components are transported to site



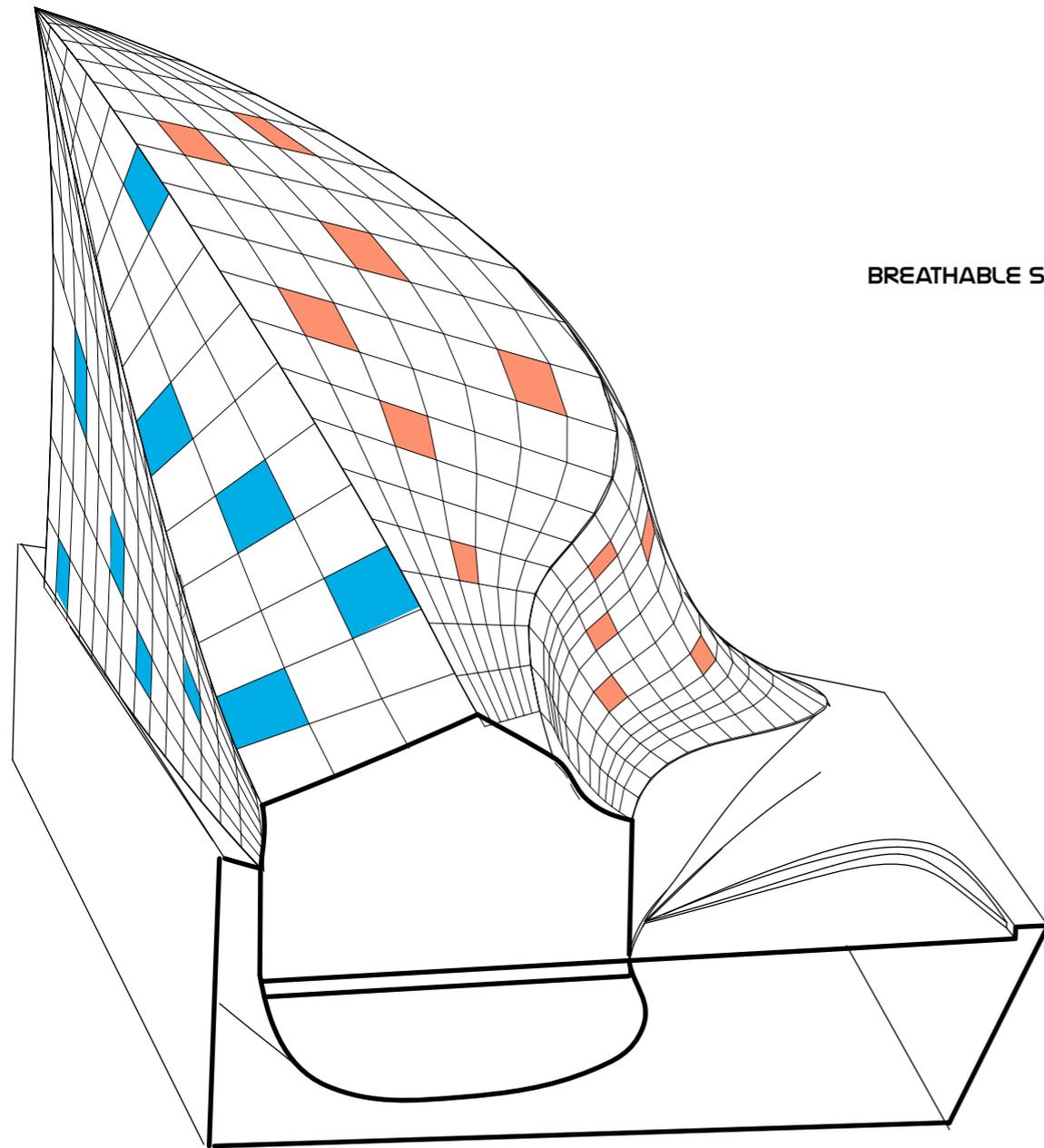
how easy!



prefab pieces are assembled into modules 2m wide x 4m tall



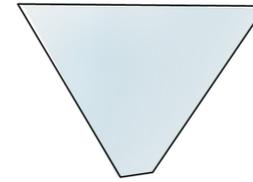
modules are stacked  
temporary supports are removed  
when full rib is formed



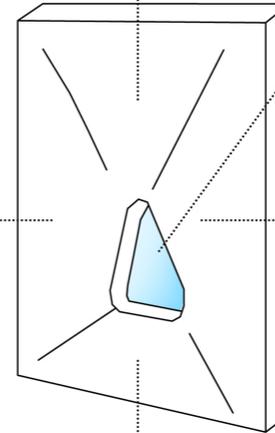
BREATHABLE SKIN



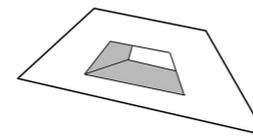
PV PANEL



WINDOW OPENING

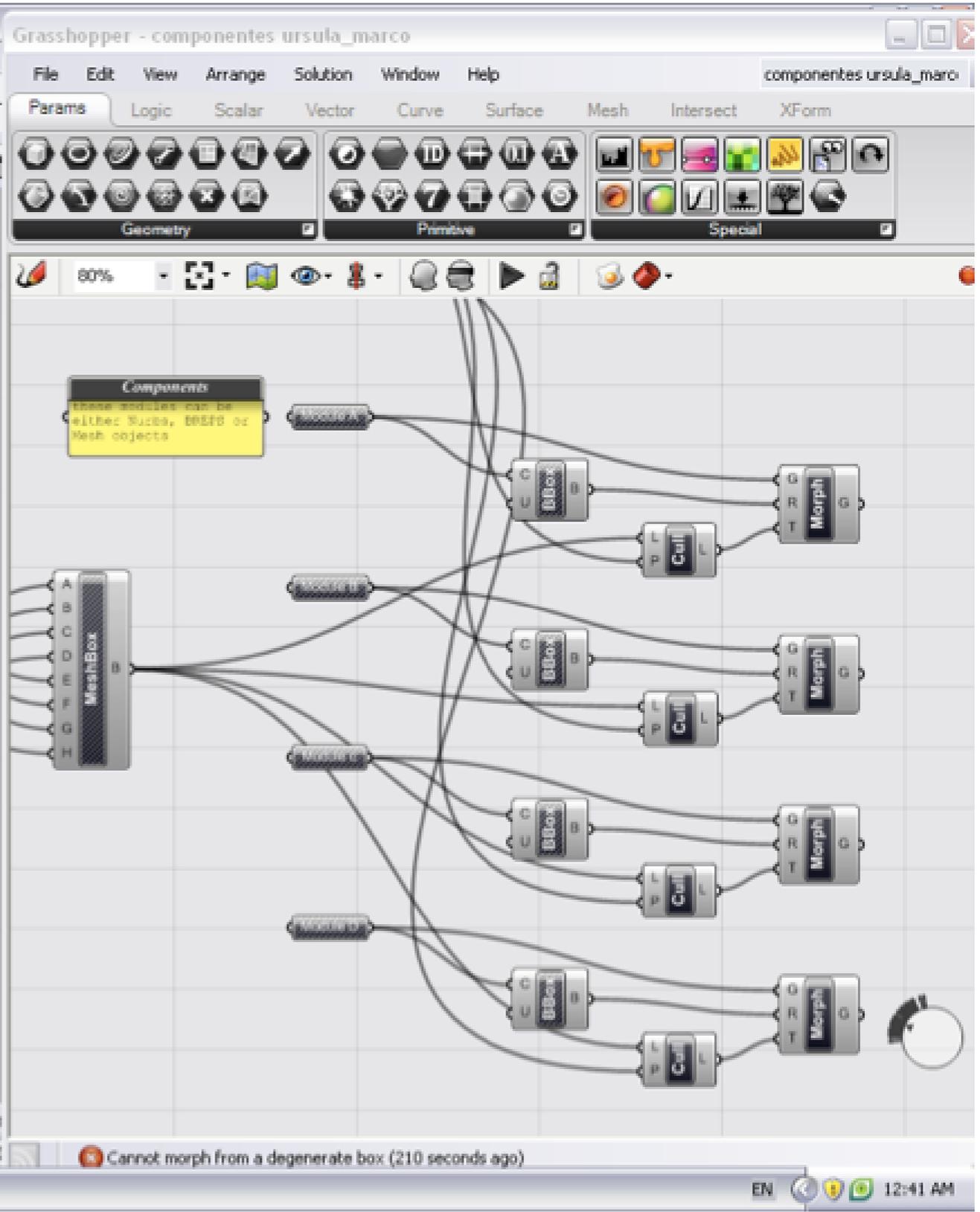
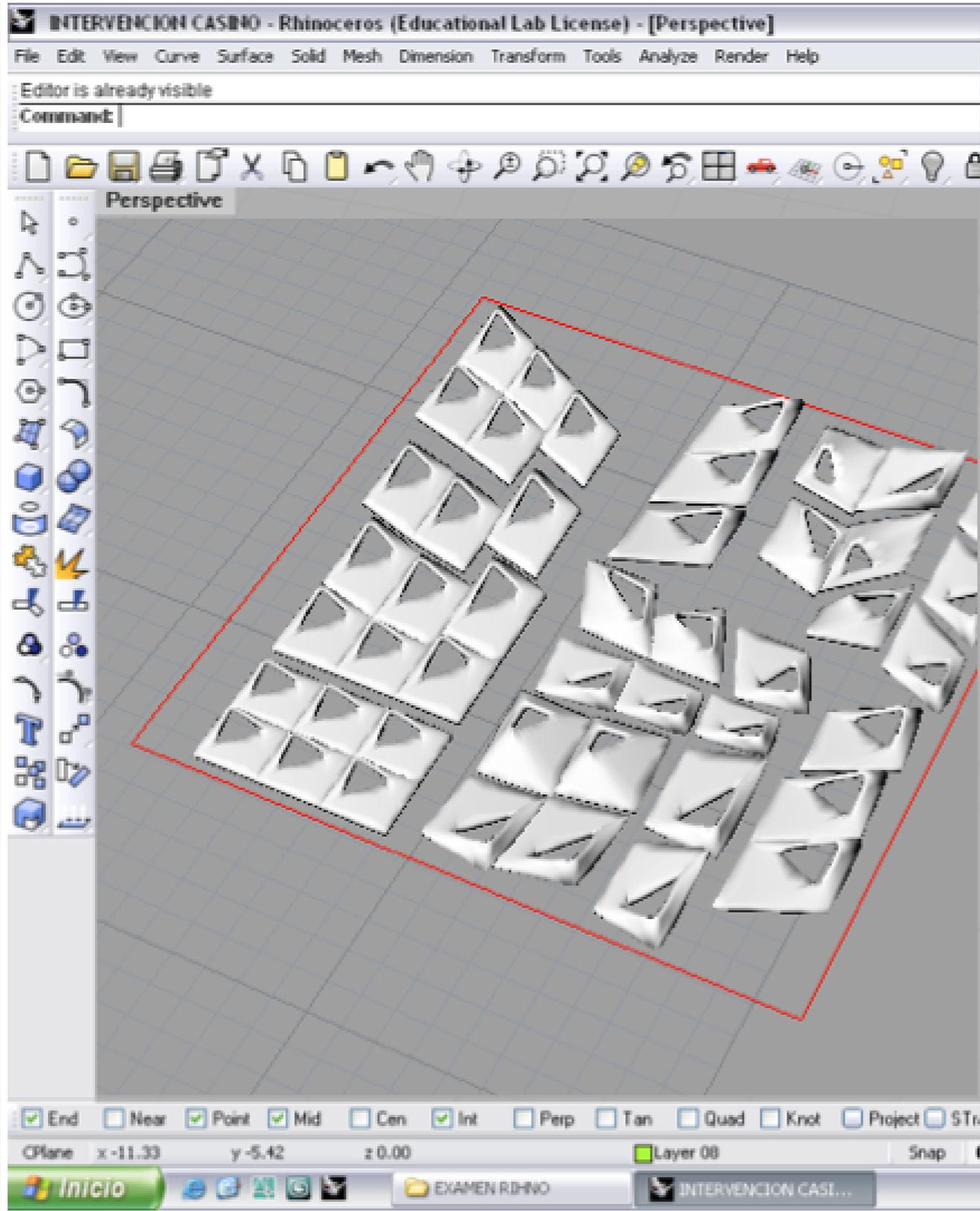


PV PANEL



WIND OPENING

**GEOMETRY**  
component mapping



**GEOMETRY**  
component mapping

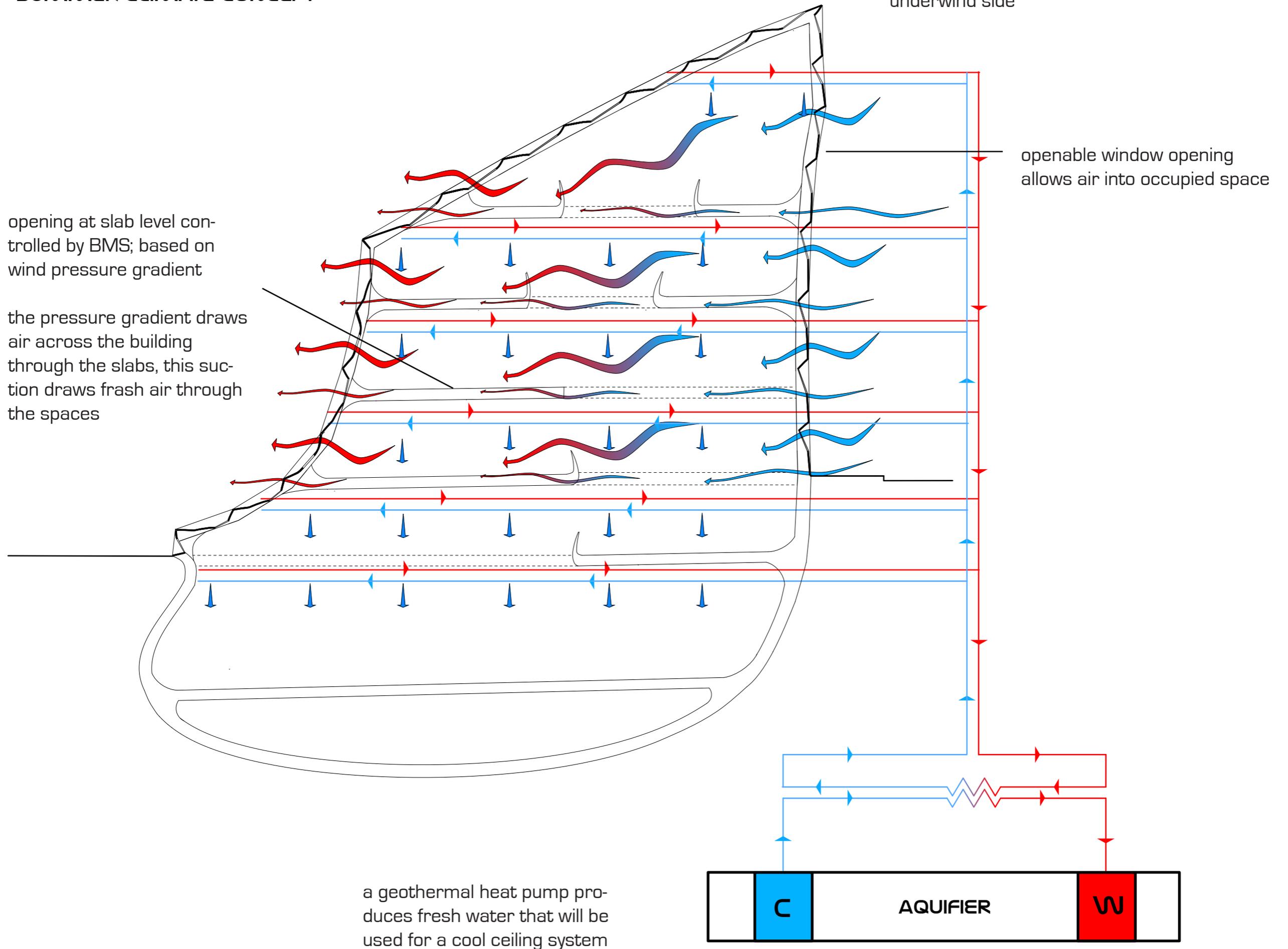
# SUMMER CLIMATE CONCEPT

opening at slab level controlled by BMS; based on wind pressure gradient

the pressure gradient draws air across the building through the slabs, this suction draws fresh air through the spaces

underwind side

openable window opening allows air into occupied space



a geothermal heat pump produces fresh water that will be used for a cool ceiling system

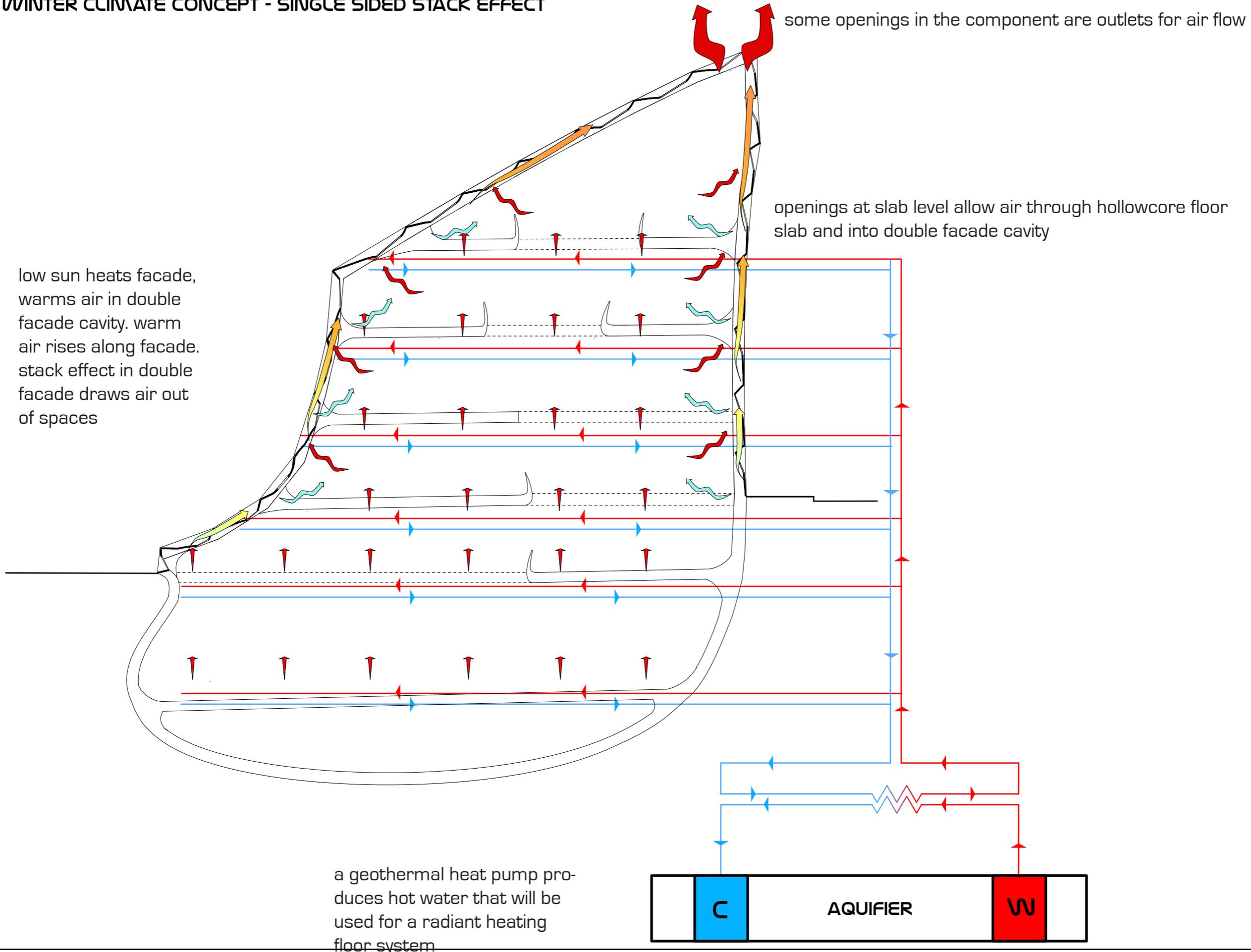


# WINTER CLIMATE CONCEPT - SINGLE SIDED STACK EFFECT

low sun heats facade, warms air in double facade cavity. warm air rises along facade. stack effect in double facade draws air out of spaces

some openings in the component are outlets for air flow

openings at slab level allow air through hollowcore floor slab and into double facade cavity



a geothermal heat pump produces hot water that will be used for a radiant heating floor system



ENERGY OBJECTIVES = PRODUCE + REDUCE USE

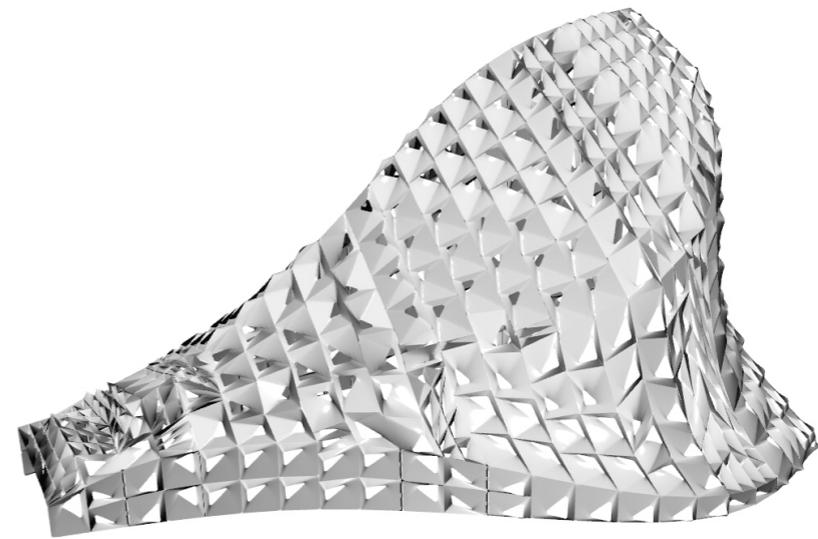
## PRODUCE

PV SURFACE AREA = 1944M<sup>2</sup> OF COMPS.

EMBEDDED PIEZO = 2205M<sup>2</sup>

WINDBELT = #372

THERMOELECTRIC



## REDUCE

NATURAL VENTILATION

RADIANT HEATING AND COOLING

NIGHT COOLING

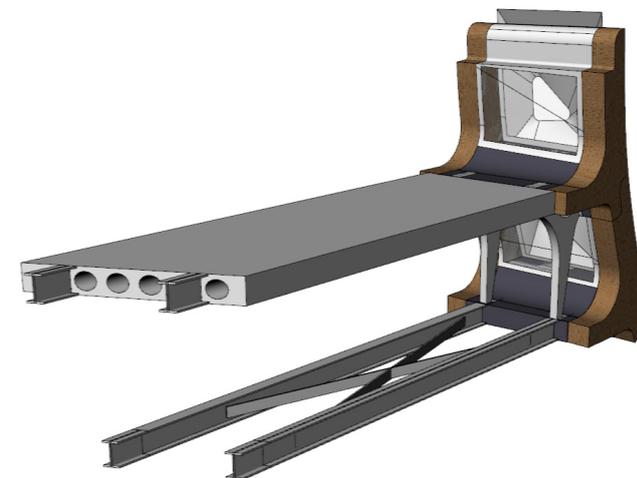


CO<sub>2</sub> FOOTPRINT (BASED ON VALUES FROM THE INVENTORY ON CARBON&ENERGY)

CONCRETE = 363000 M<sup>3</sup>

STEEL = 100 M<sup>3</sup>

WOOD = 0.6M<sup>3</sup> PER RIB = 120M<sup>3</sup>



THE eCENTRE experience !

