NY THE MAKING OF ZERO ENERGY ARCHITECTURE & THE UNITED NATIONS ENVIRONMENTAL COUNCIL

Femke Corporaal
273922
p5
31-01-2012
SADD

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Ir. Bas Gremmen

Tutors building technology:
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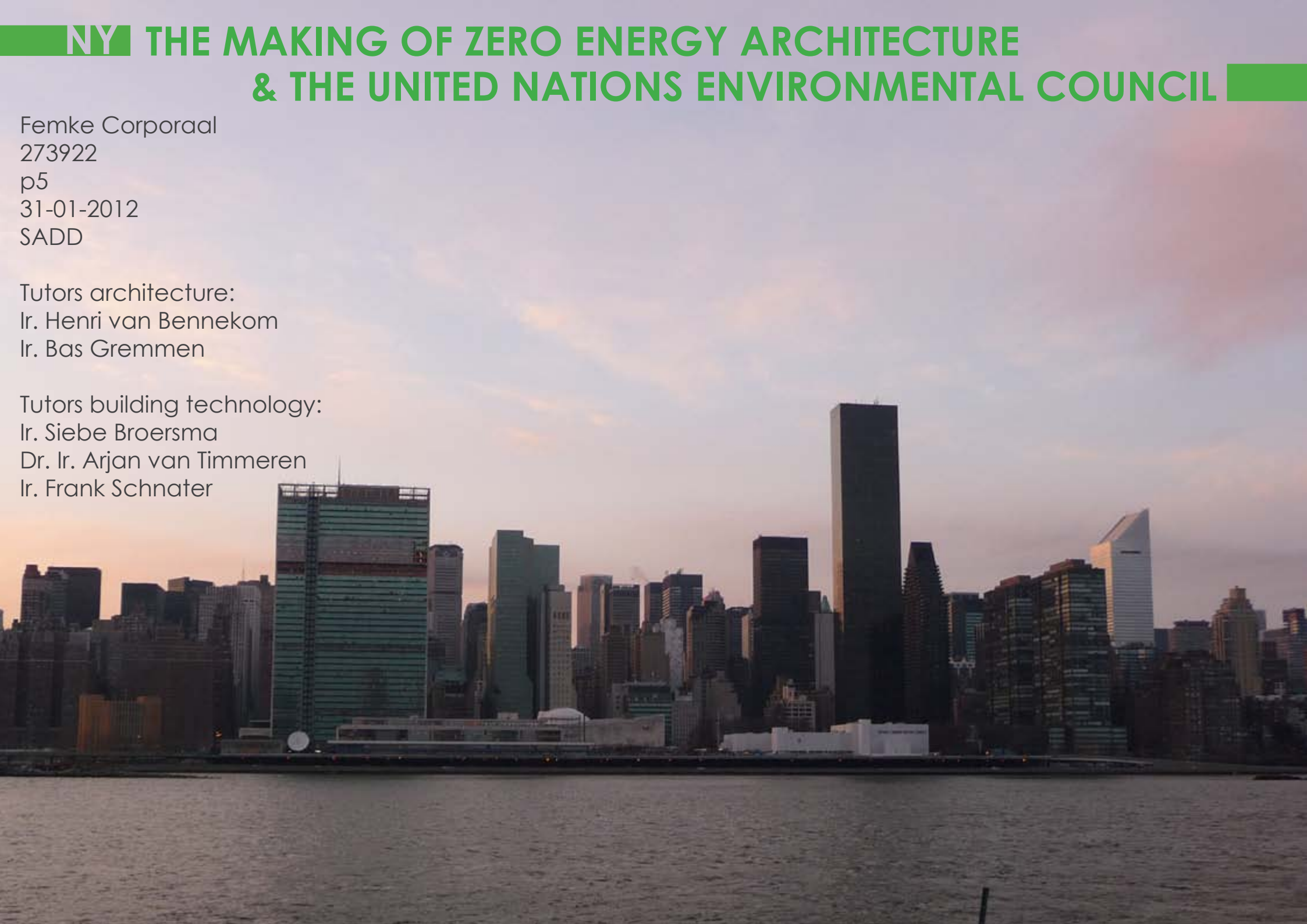
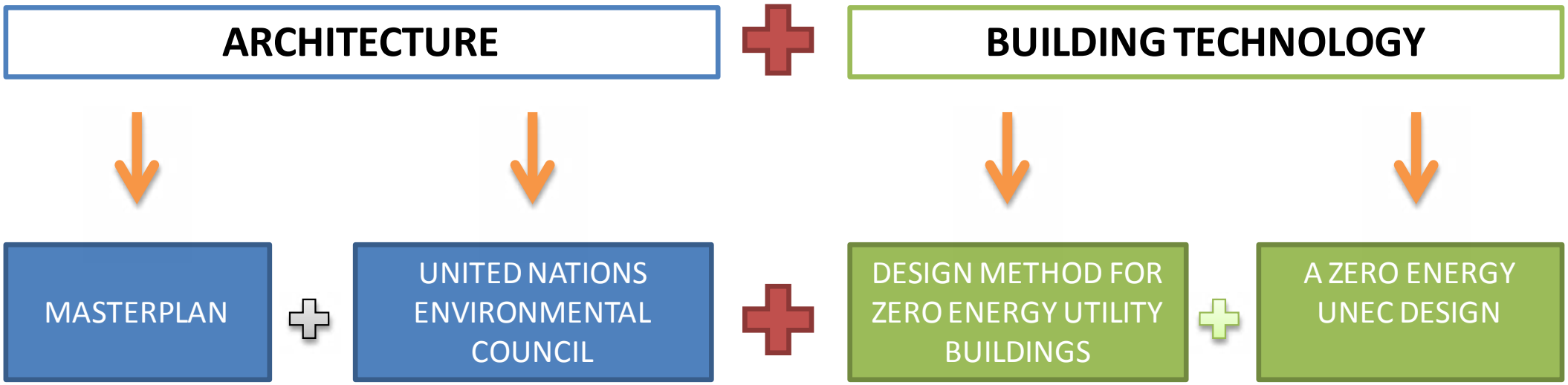
Dr. Ir. Arjan van Timmeren
Ir. Frank Schnater





1. **Masterplan: Intervention on urban scale**
2. **Design of the United Nations Environmental Council on the UN plot in New York**
3. **Proposal for a design methodology for zero energy utility building**
4. **Energy concept and energy balance for UNEC design**

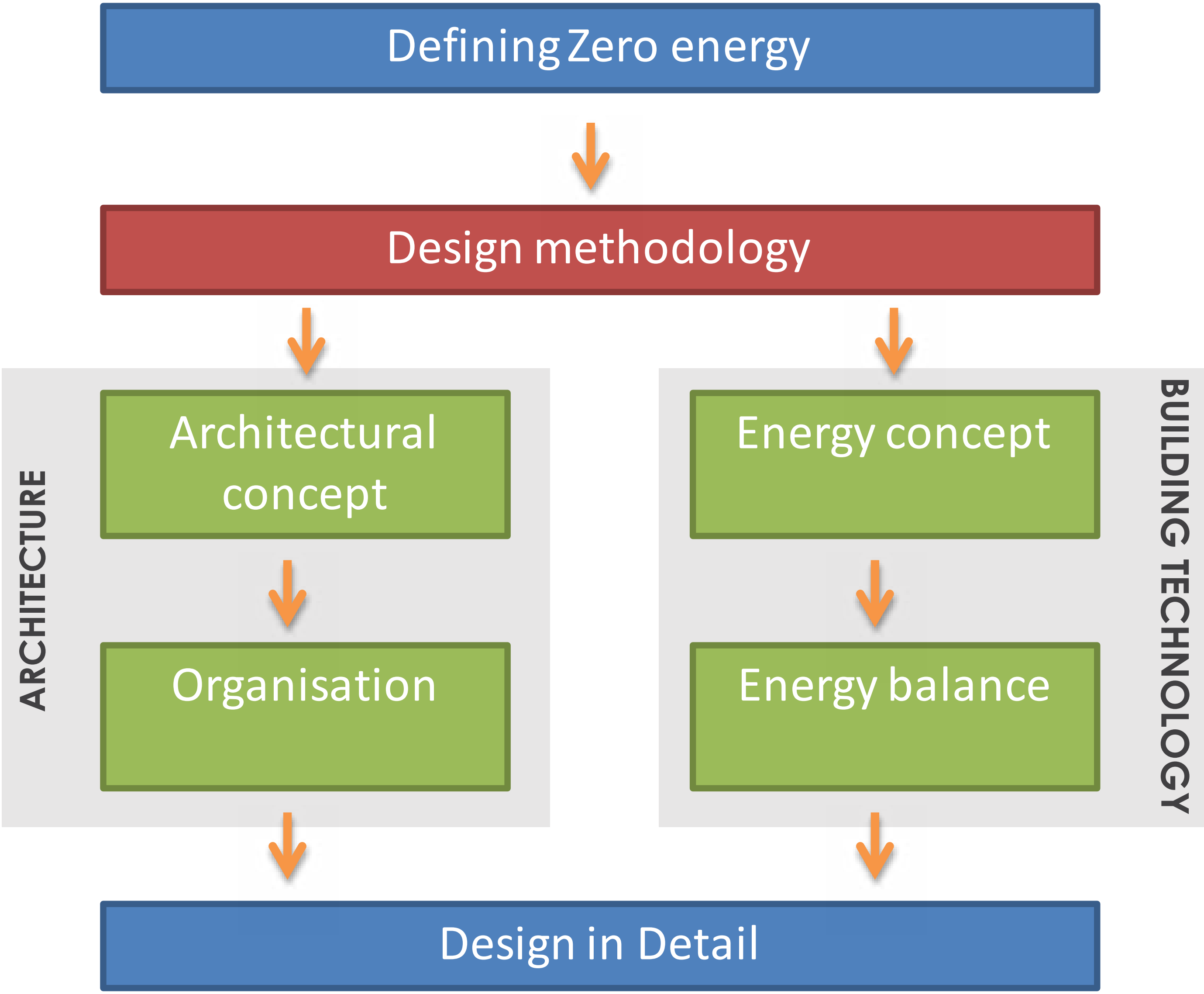
DESIGN ASSIGNMENT

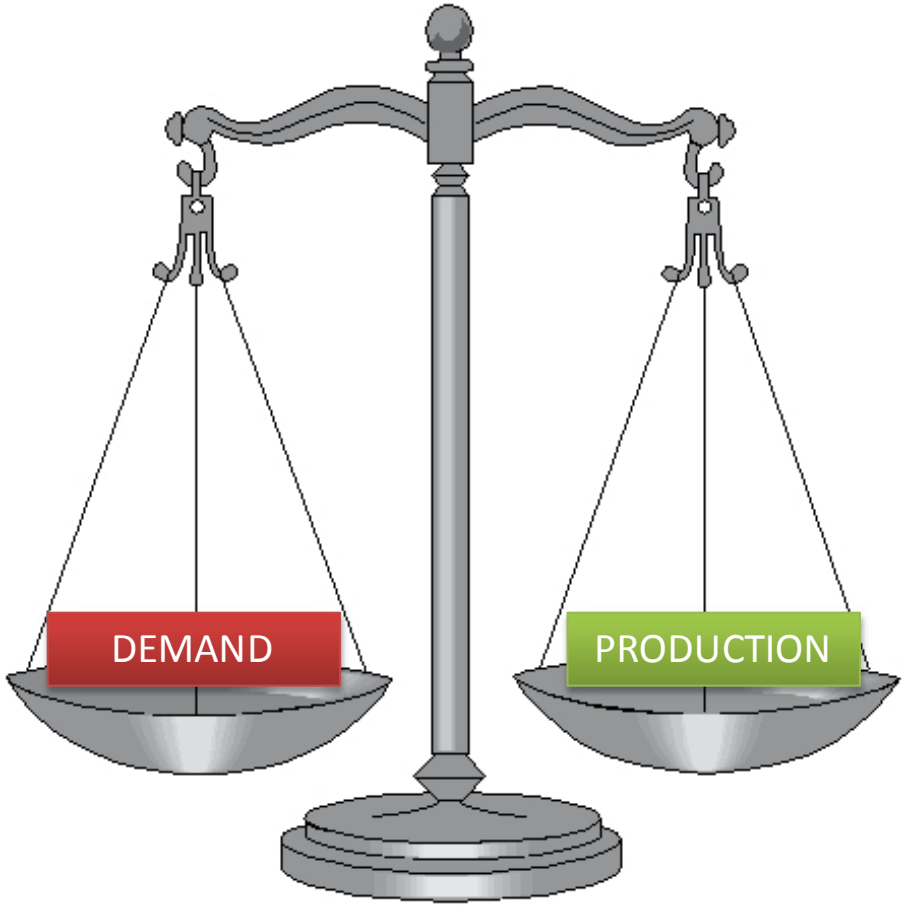
'To develop an architectural design for a sustainable building that houses the United Nations Environmental Council within the urban context of the current UN site on Manhattan, where a new infrastructure for the decisionmaking in the field of sustainability worldwide can take place.'

RESEARCH QUESTION

How can zero energy be defined and in wich manner can utility buildings in general and the United Nations Environmental Council in particular most effectively be designed as a zero energy building?

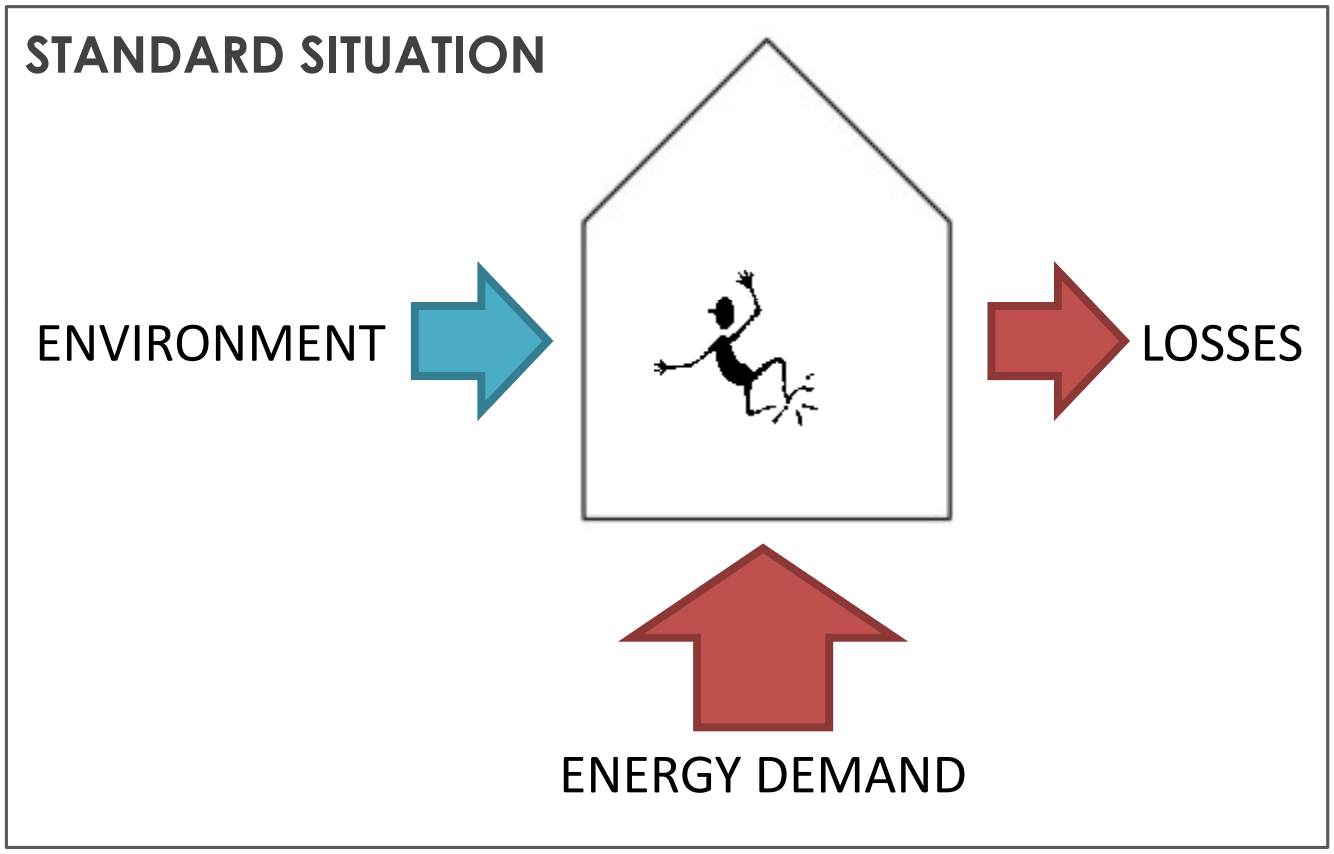
Which aspects are decisive and how can these be translated to a method for zero energy utility buildings?

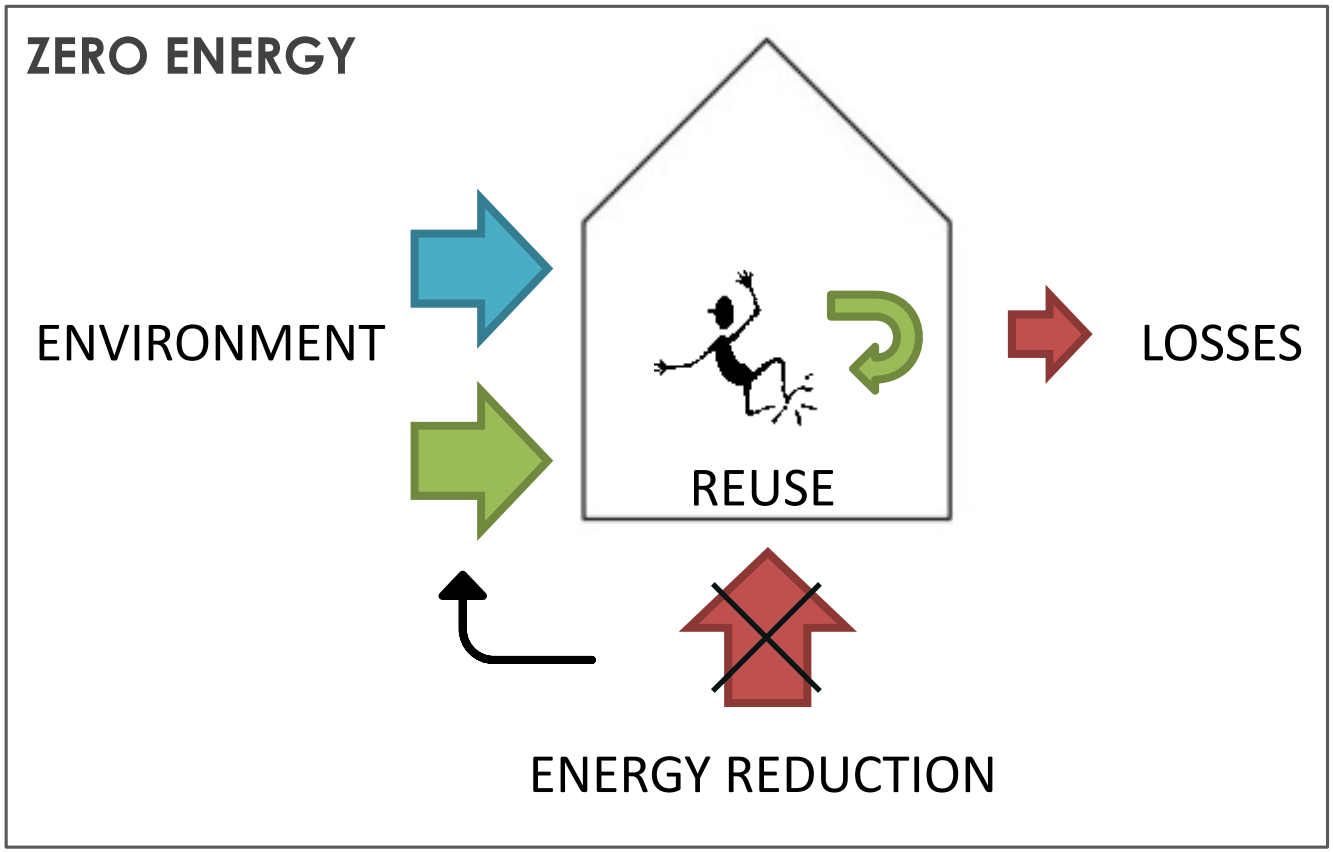

Defining Zero energy
Design methodology
ARCHITECTURE
Architectural concept
Organisation
Energy concept
Energy balance
BUILDING TECHNOLOGY
Design in Detail

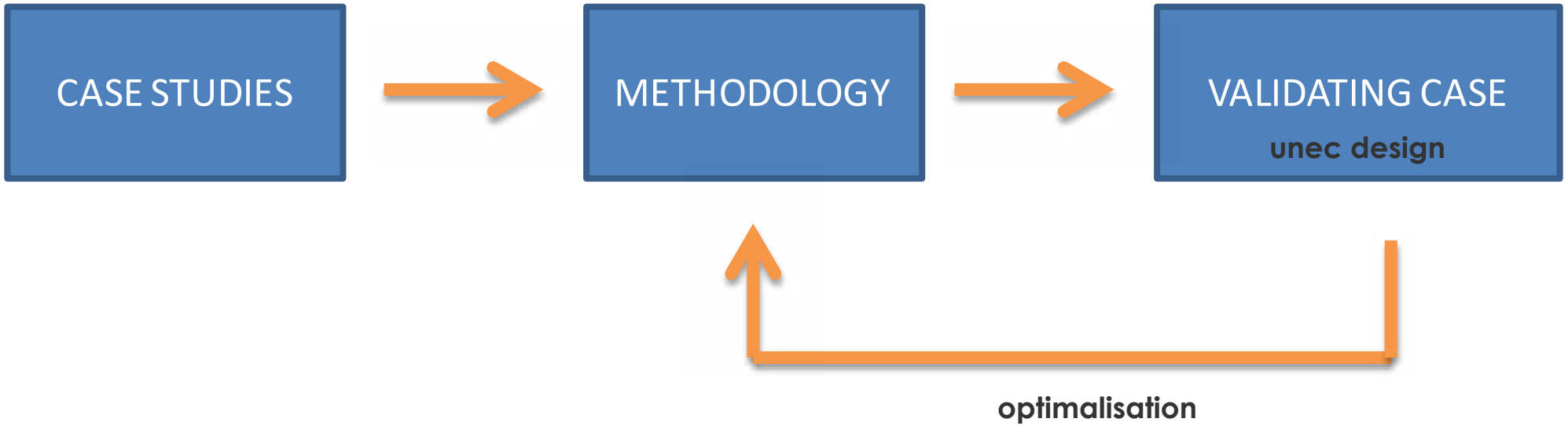


Zero Energy

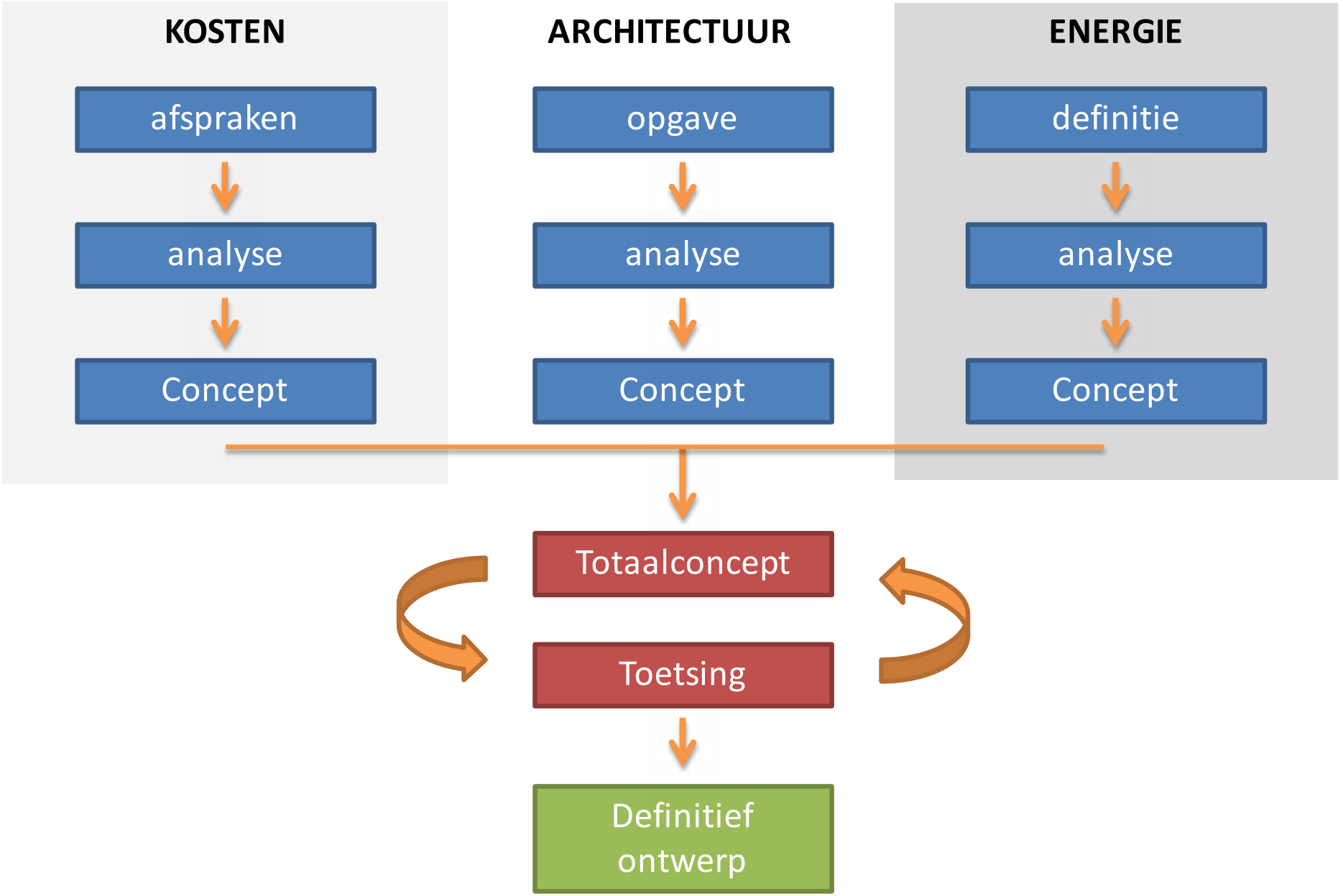
- Building related and users related energy use
- No net energy demand
- Energy balance in energy-units
- Define boundaries
- Use energy from renewable sources

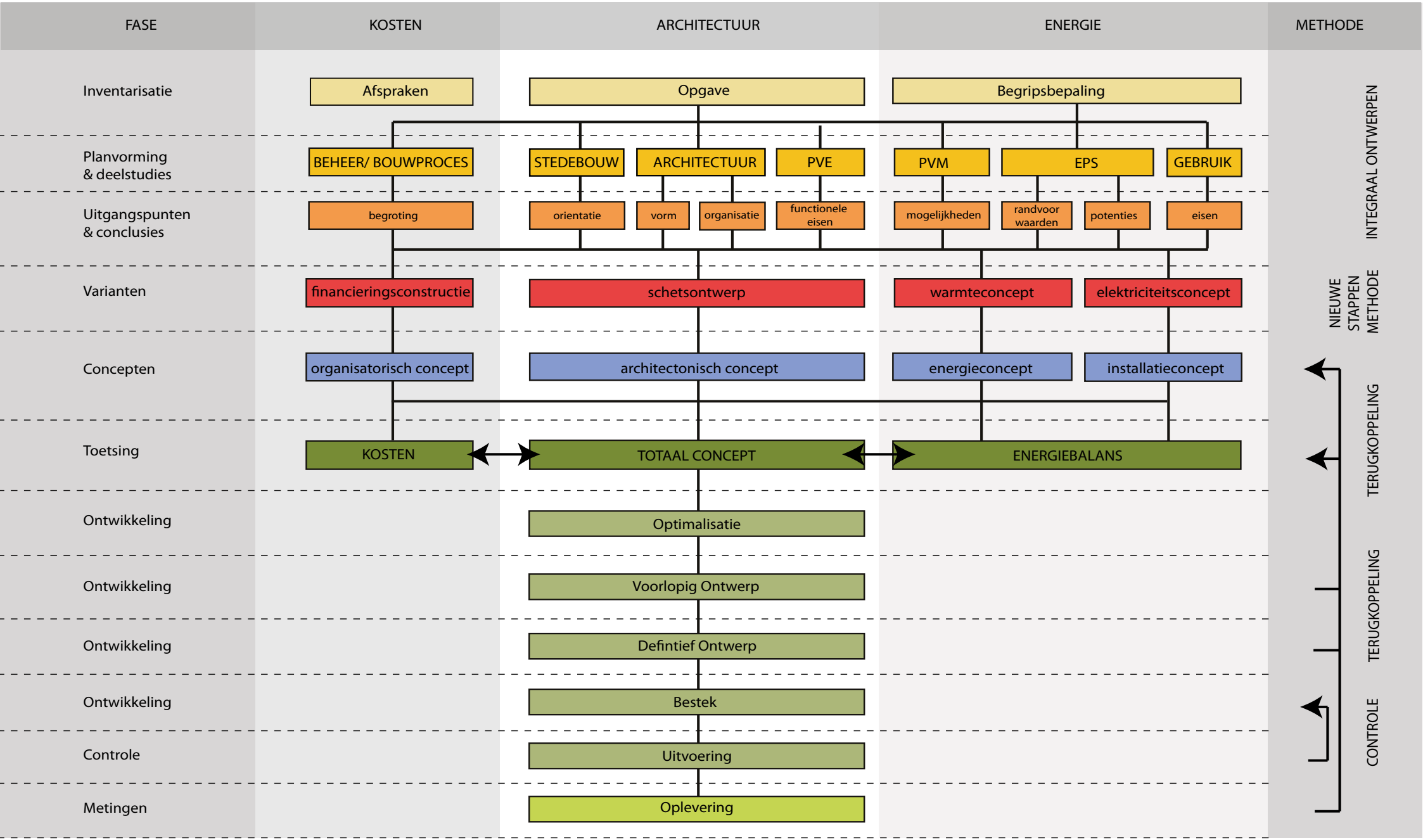

STANDARD SITUATION
ENVIRONMENT
LOSSES
ENERGY DEMAND


ZERO ENERGY
ENVIRONMENT
REUSE
LOSSES
ENERGY REDUCTION


CASE STUDIES
METHODOLOGY
VALIDATING CASE
unec design
optimalisation

METHODOLOGY IN SHORT





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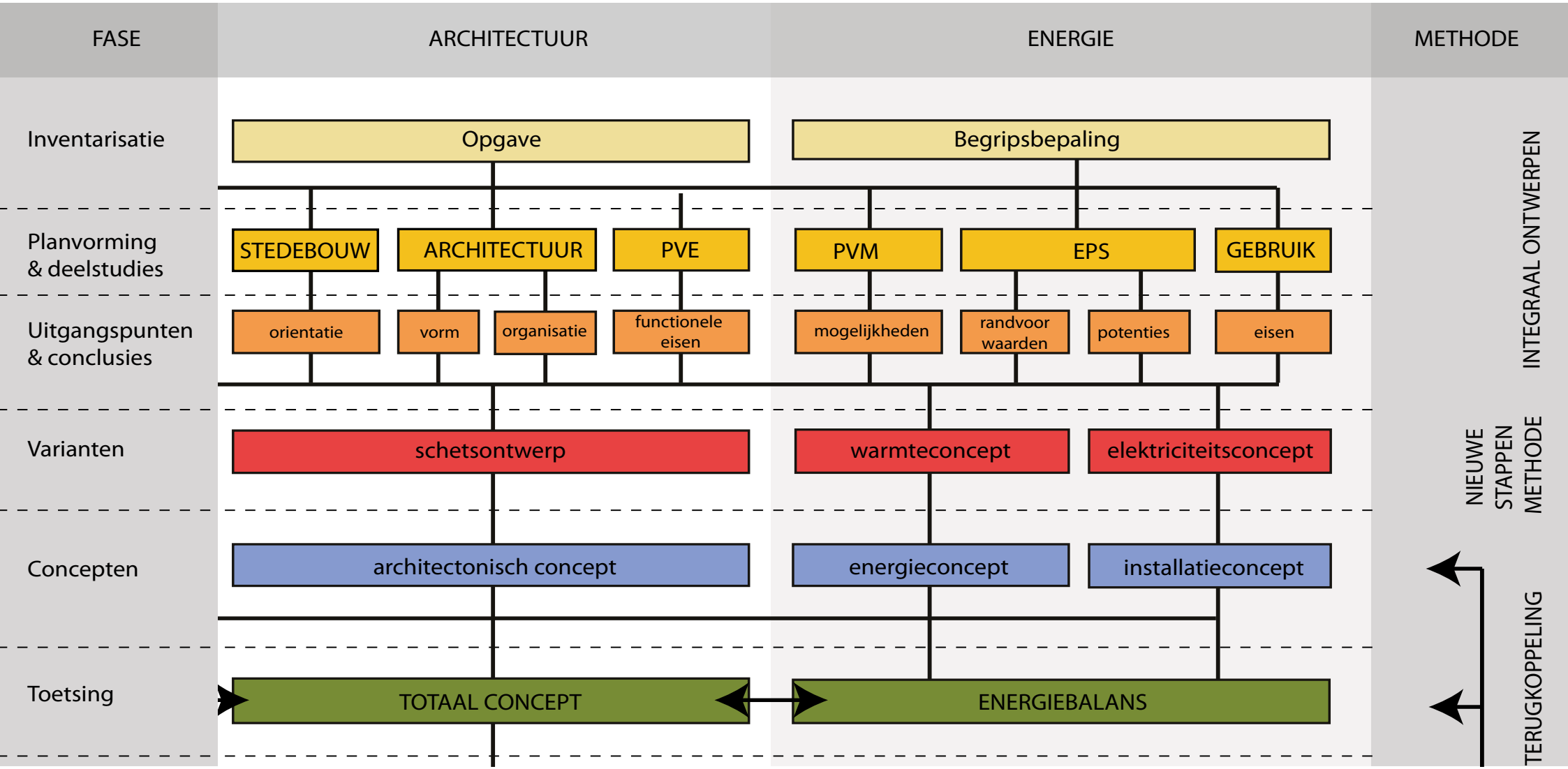
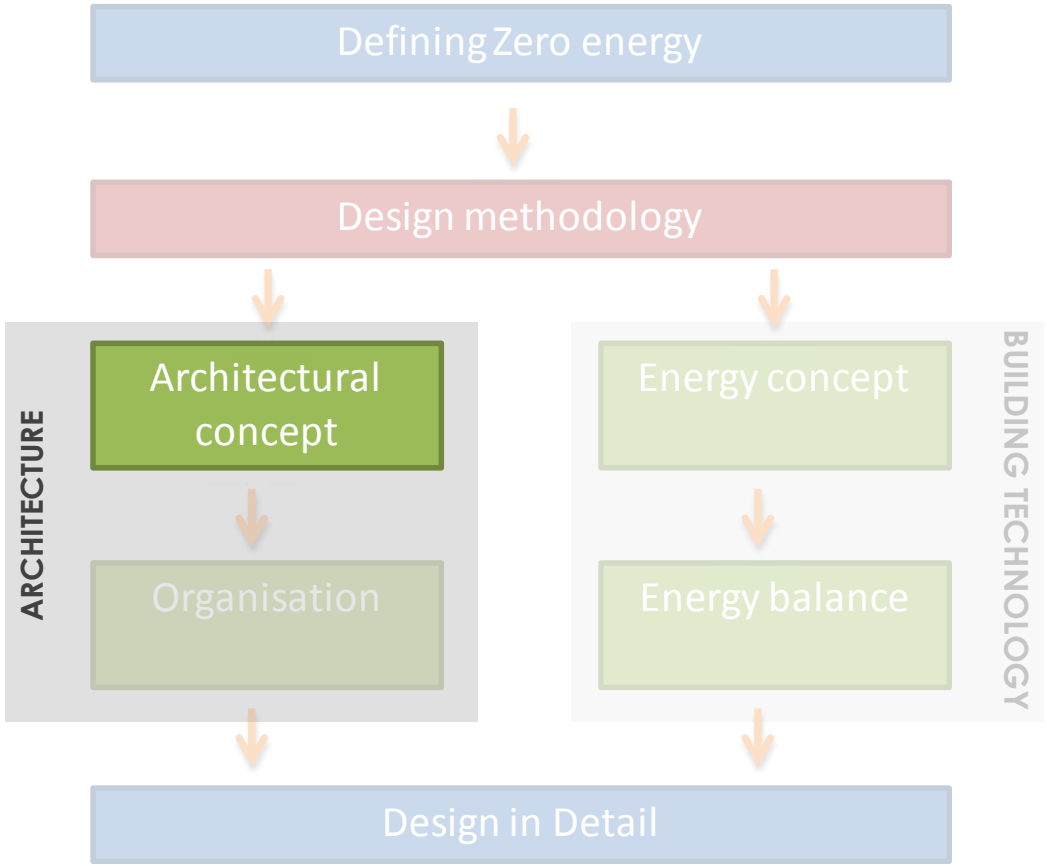
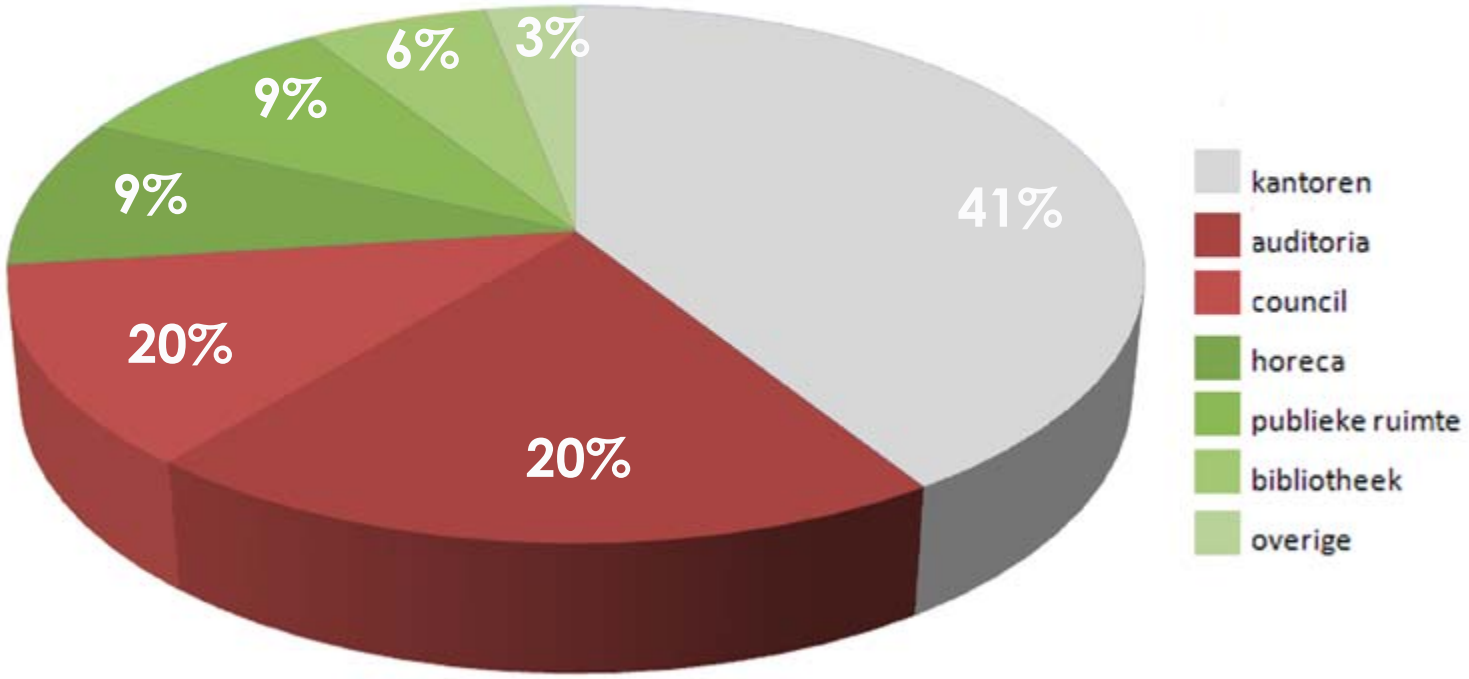

FASE
ARCHITECTUUR
ENERGIE
METHODE
Inventarisatie
Planvorming & deelstudies
Uitgangspunten & conclusies
Varianten
Concepten
Toetsing
Opgave
Begripsbepaling
STEDEBOUW
ARCHITECTUUR
PVE
PVM
EPS
GEBRUIK
orientatie
vorm
organisatie
functionele eisen
mogelijkheden
randvoor waarden
potenties
eisen
schetsontwerp
warmteconcept
elektriciteitsconcept
architectonisch concept
energieconcept
installatieconcept
TOTAAL CONCEPT
ENERGIEBALANS
INTEGRAAL ONTWERPEN
NIEUWE STAPPEN METHODE
TERUGKOPPELING

VAN ONTWERPOPGAVE TOT ARCHITECTONISCH CONEPT



Total Floor Area: 15.000 m2



OFFICES	COUNCIL & AUDITORIUMS	EXPOSITION, HORECA & LIBRARY
private	Safe	public

Employees

Delegates
Businessmen
Employees

Visitors

OFFICES

COUNCIL & AUDITORIUMS

EXPOSITION, HORECA & LIBRARY

private

Safe

public

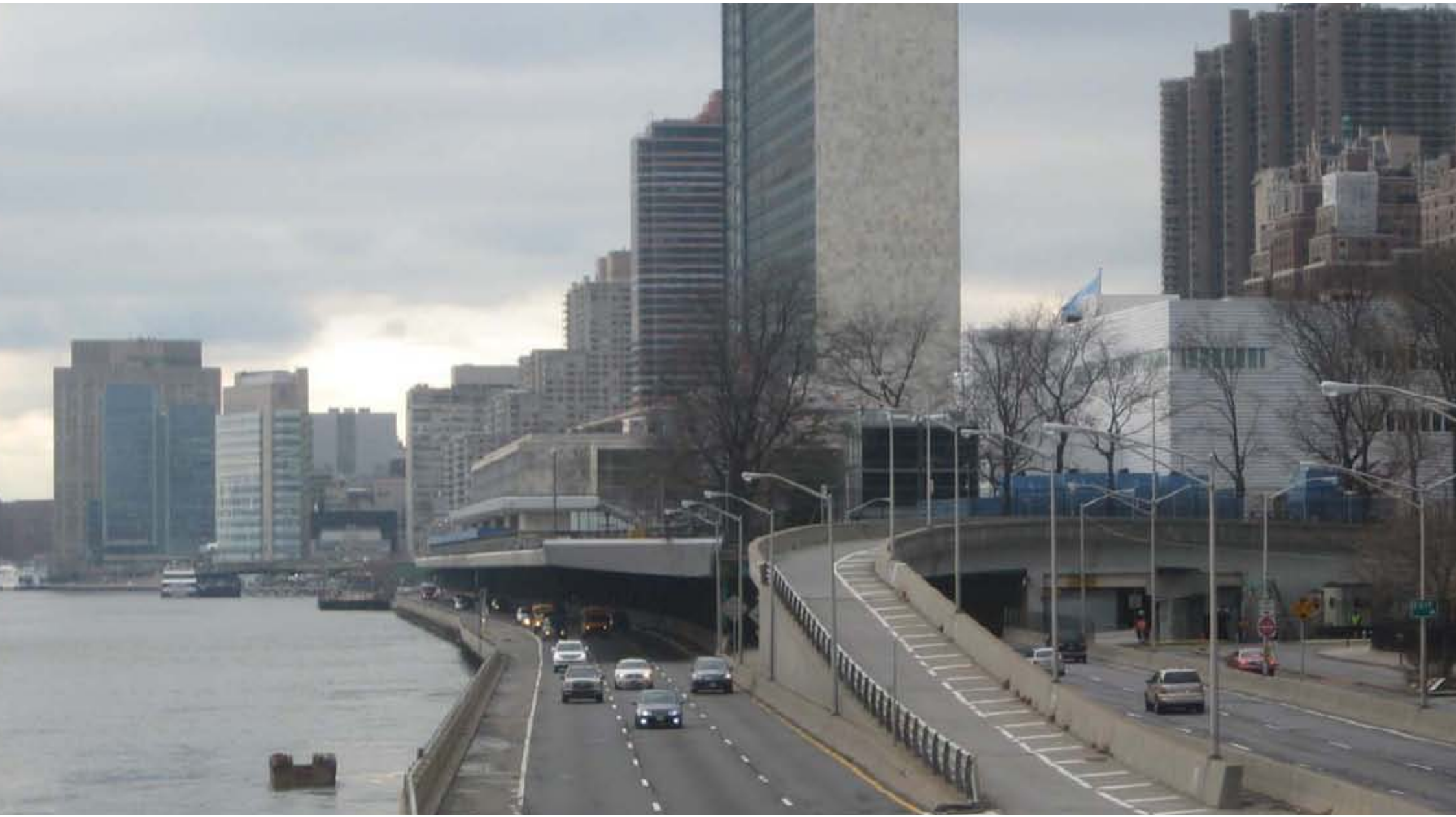
LOCATION IN NEW YORK


East River


Offices
Library
Councils
General
Assembly

Current situation

FDR DRIVE & UN BUILDING



PROBLEMS

CHANCES

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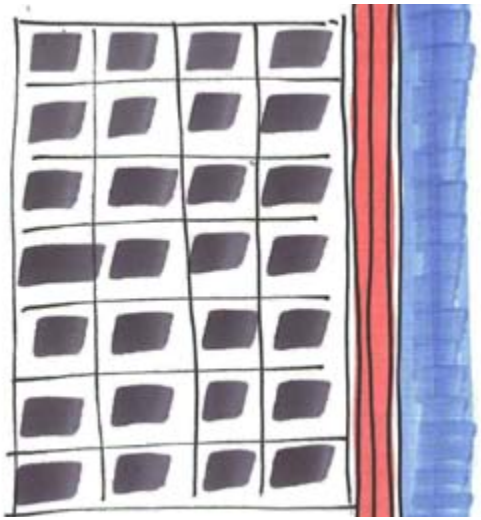
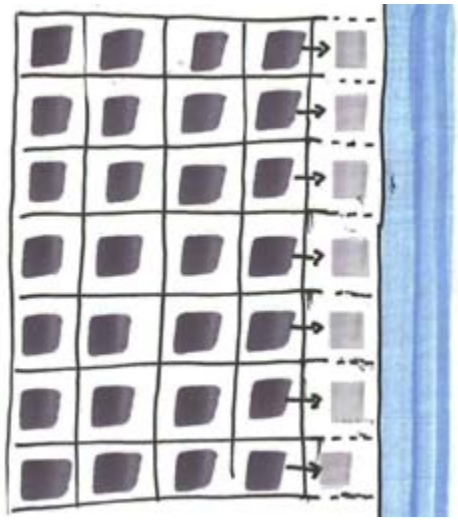
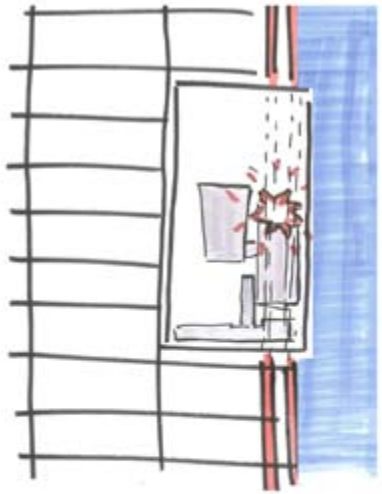
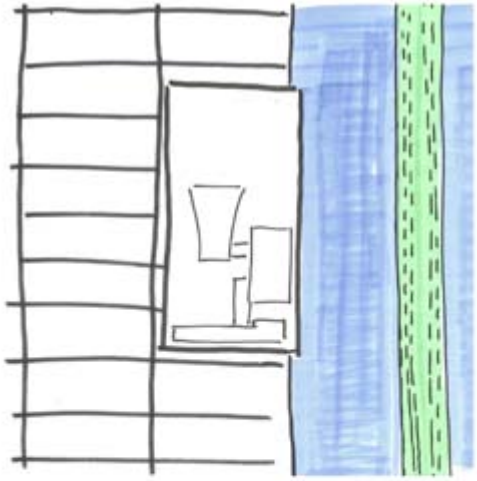
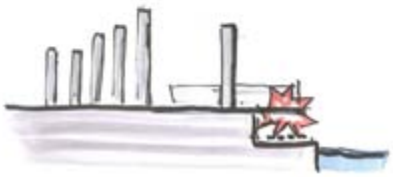


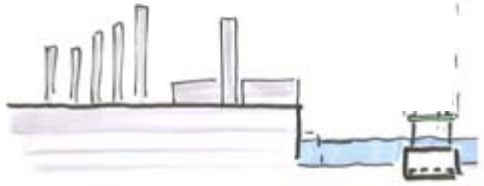


2. FDR drive









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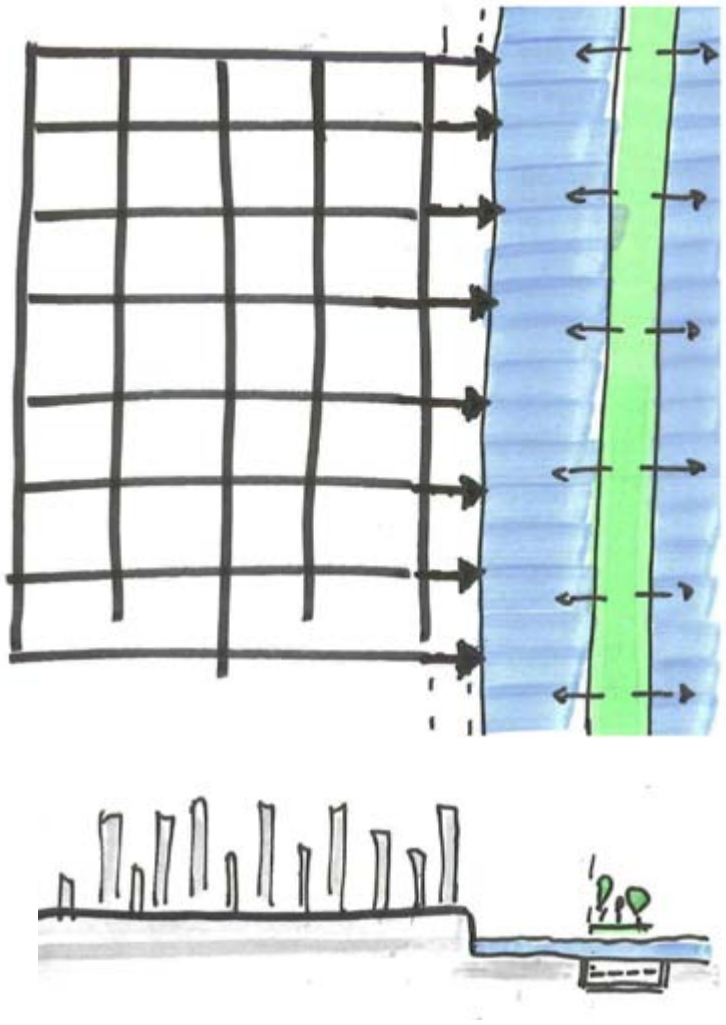
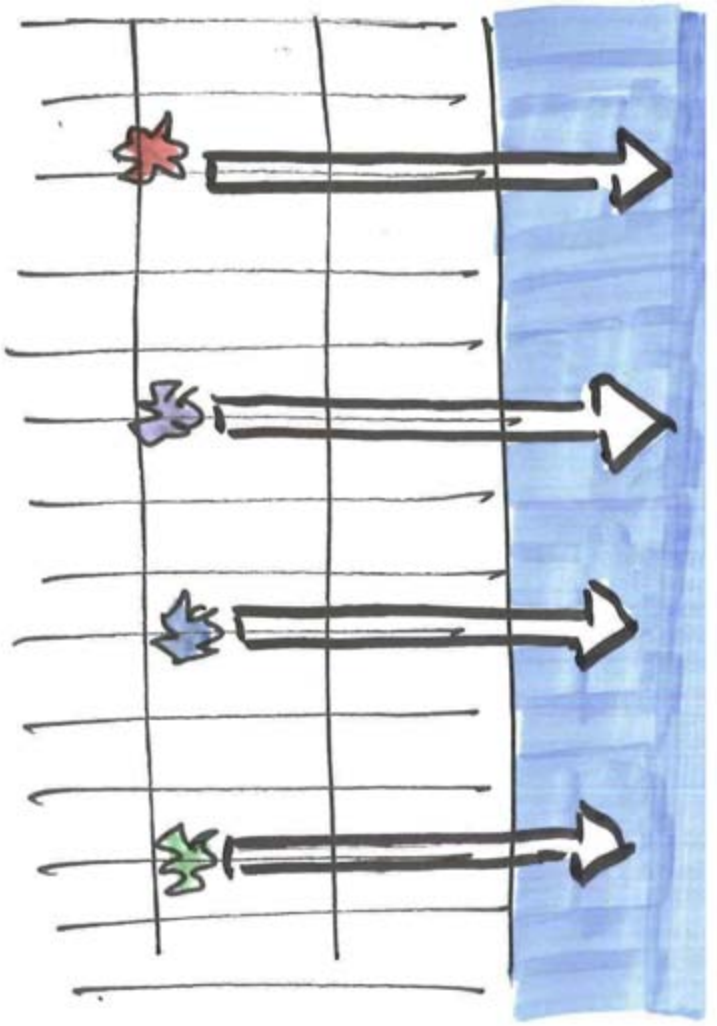
1. Relation Water



2. Connections



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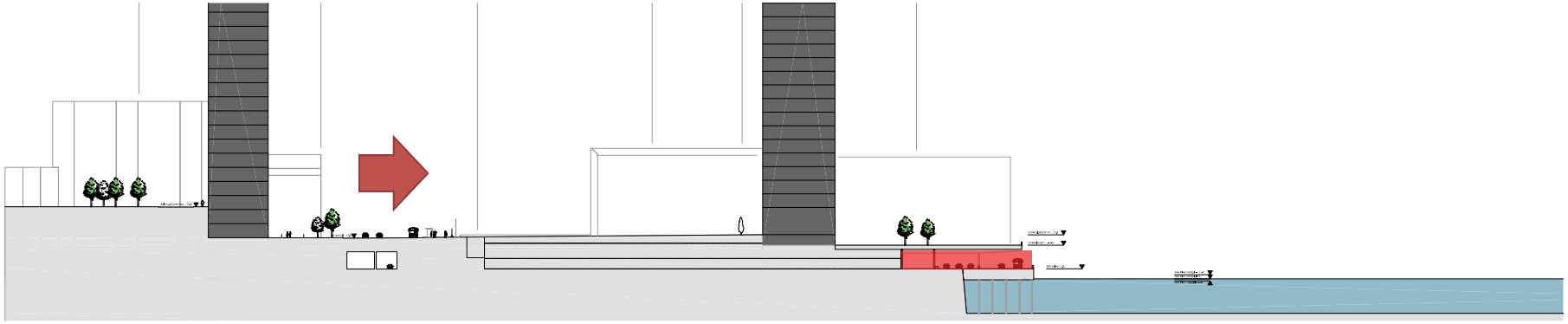
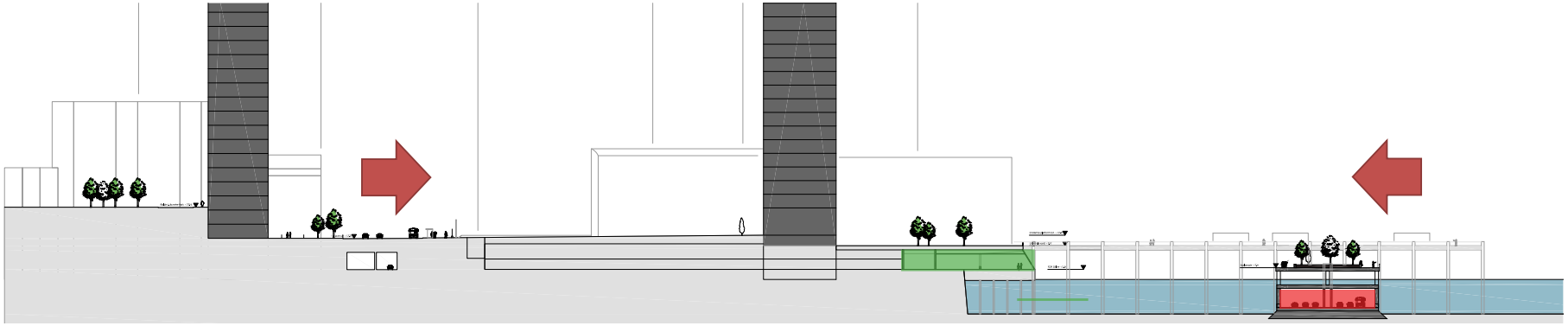
Masterplan
Fun
UN
Leisure
Sports

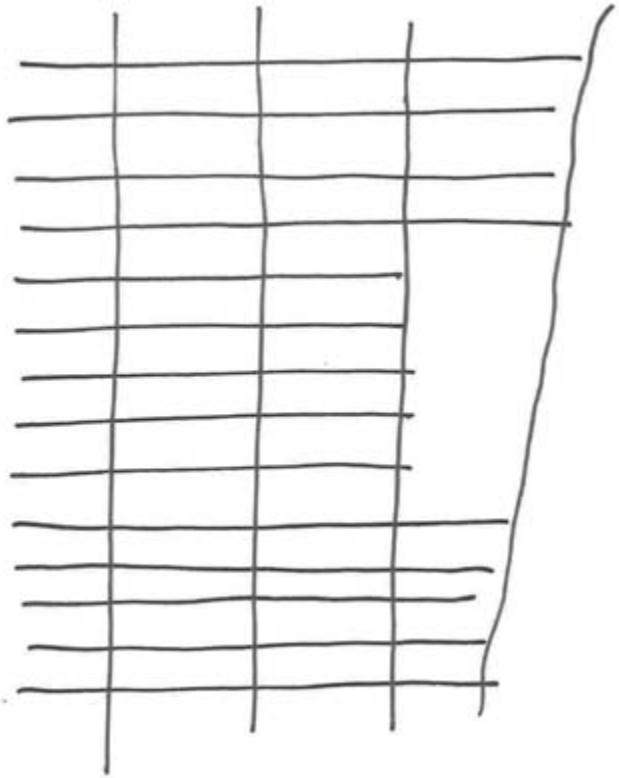
Section Present



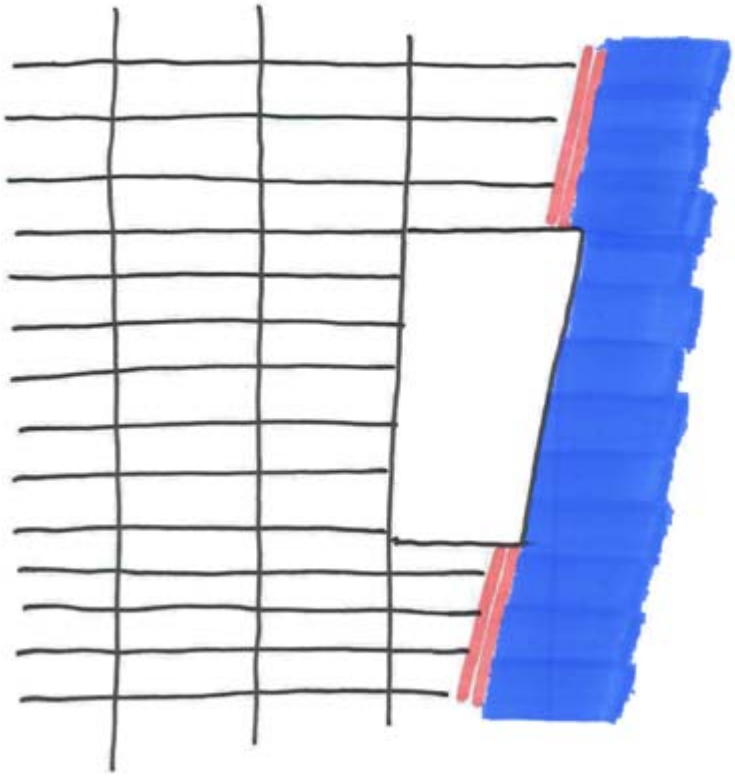
Section Masterplan



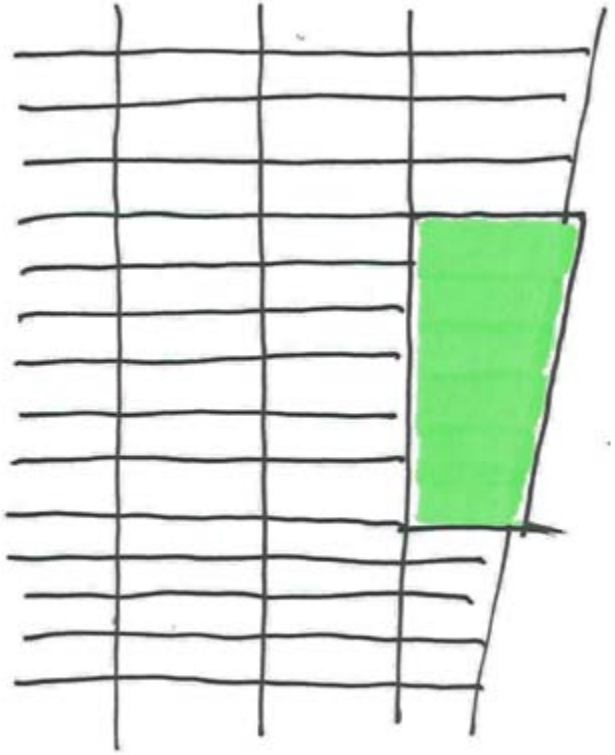
EXCEPTION



RELATION WITH WATER

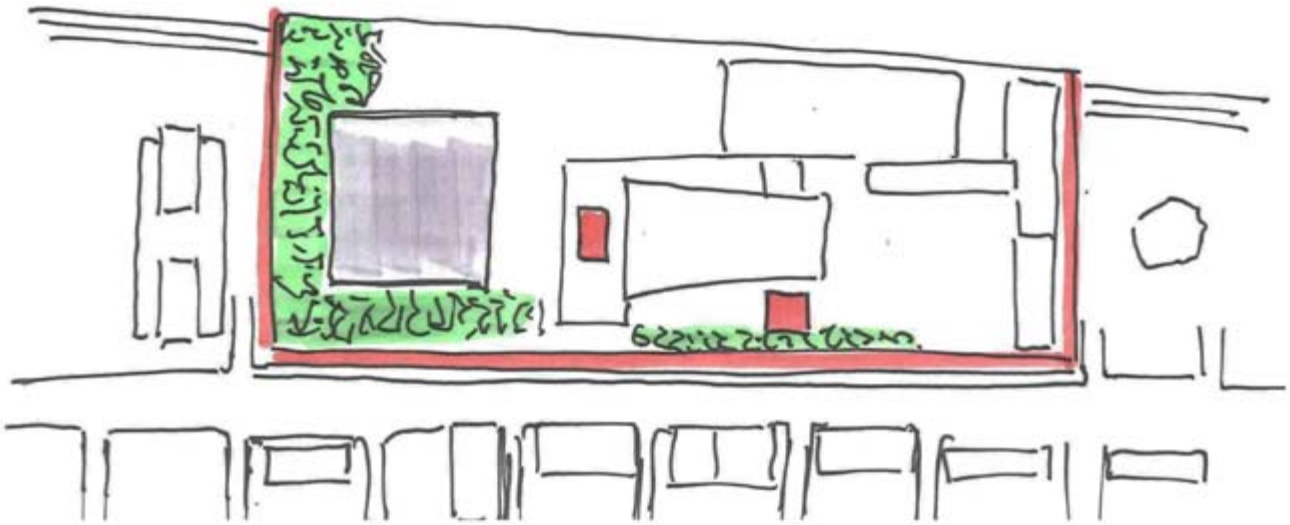


GREEN PLATEAU



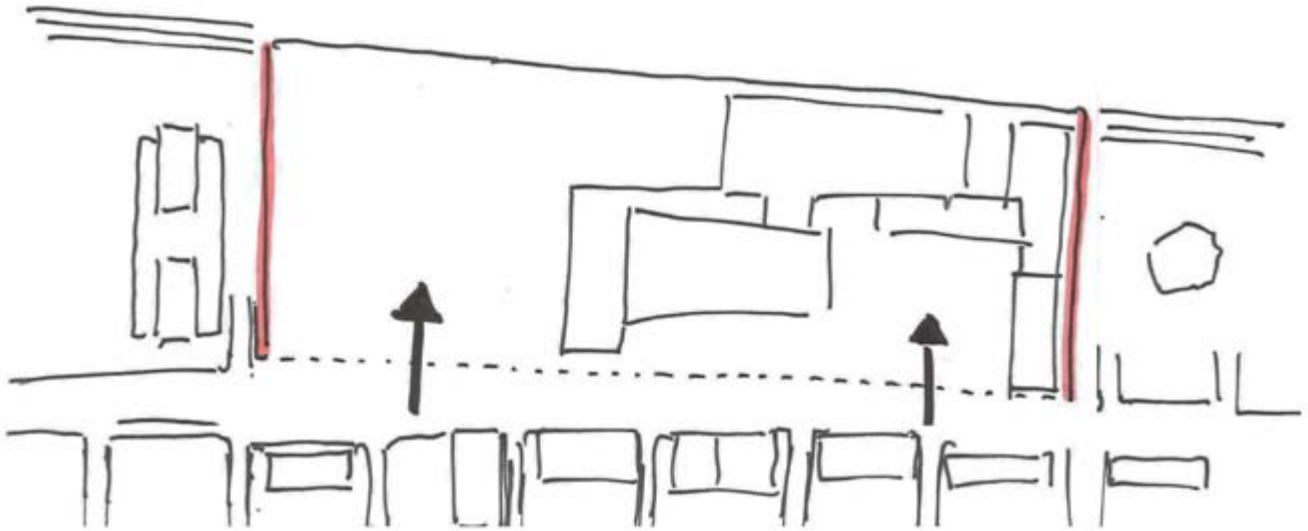
PROBLEMS

- Enclosed
- Visual barier
- Visible Safety
- Temporary UN building

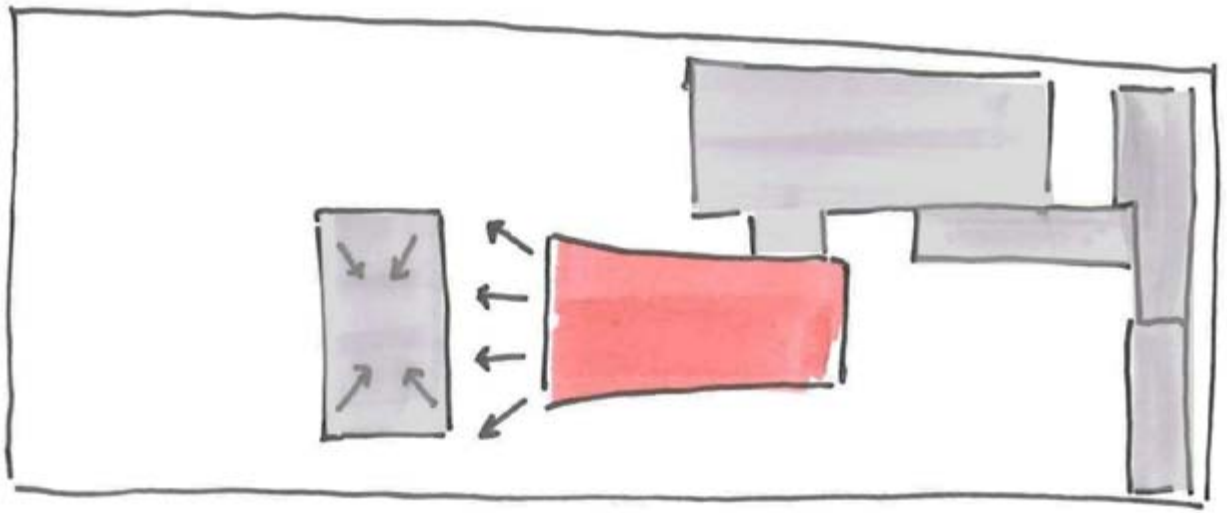


CHANCES

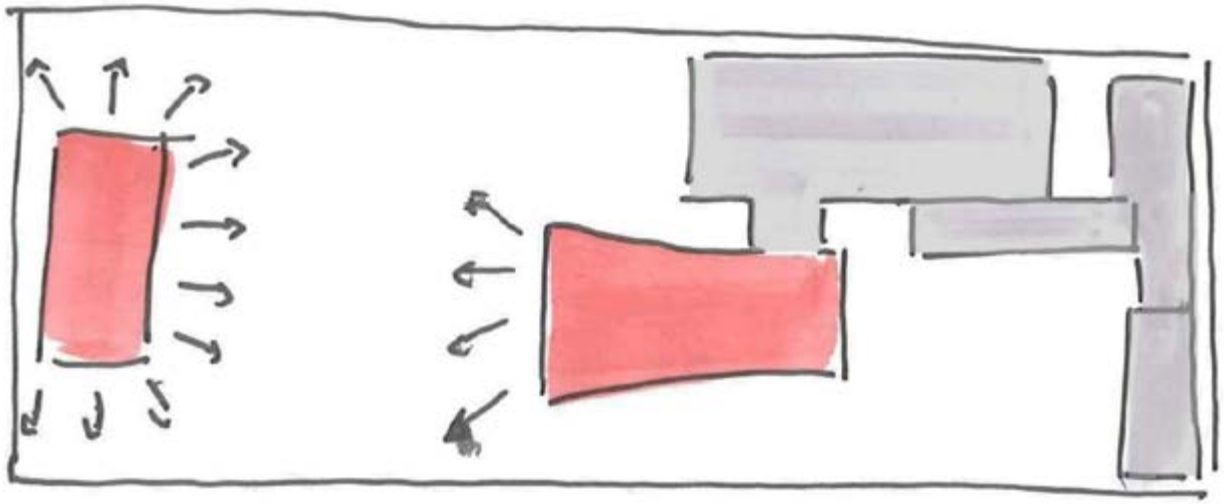
- Open UN plateau
- Visible relation
- Integrated safety



MODEST

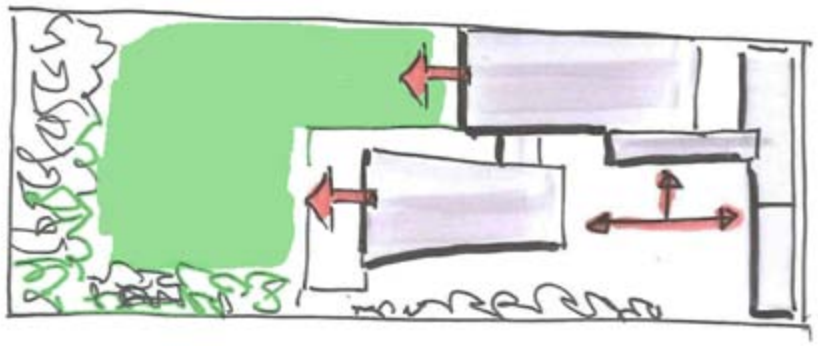


EXPRESSIVE

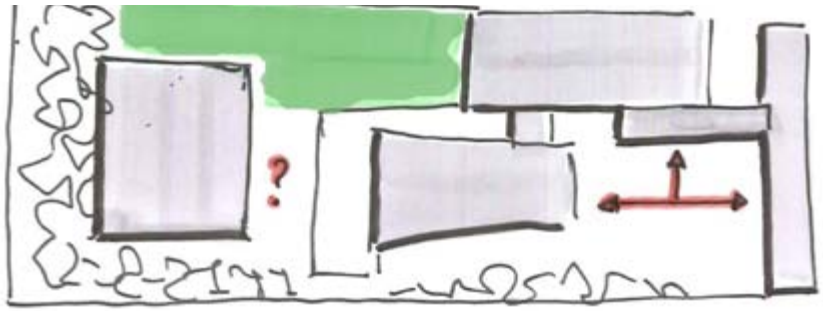


HISTORY VS FUTURE PERSPECTIVE

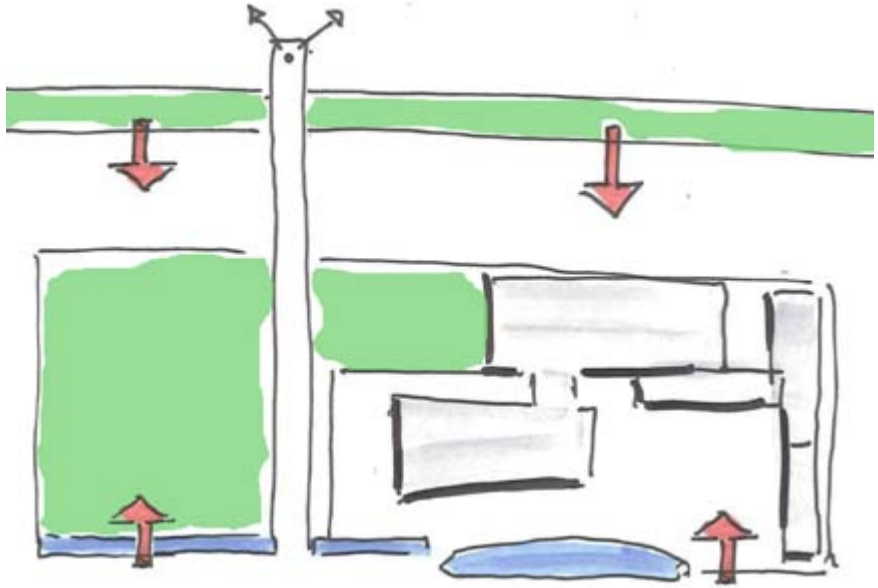
PAST Park for UN



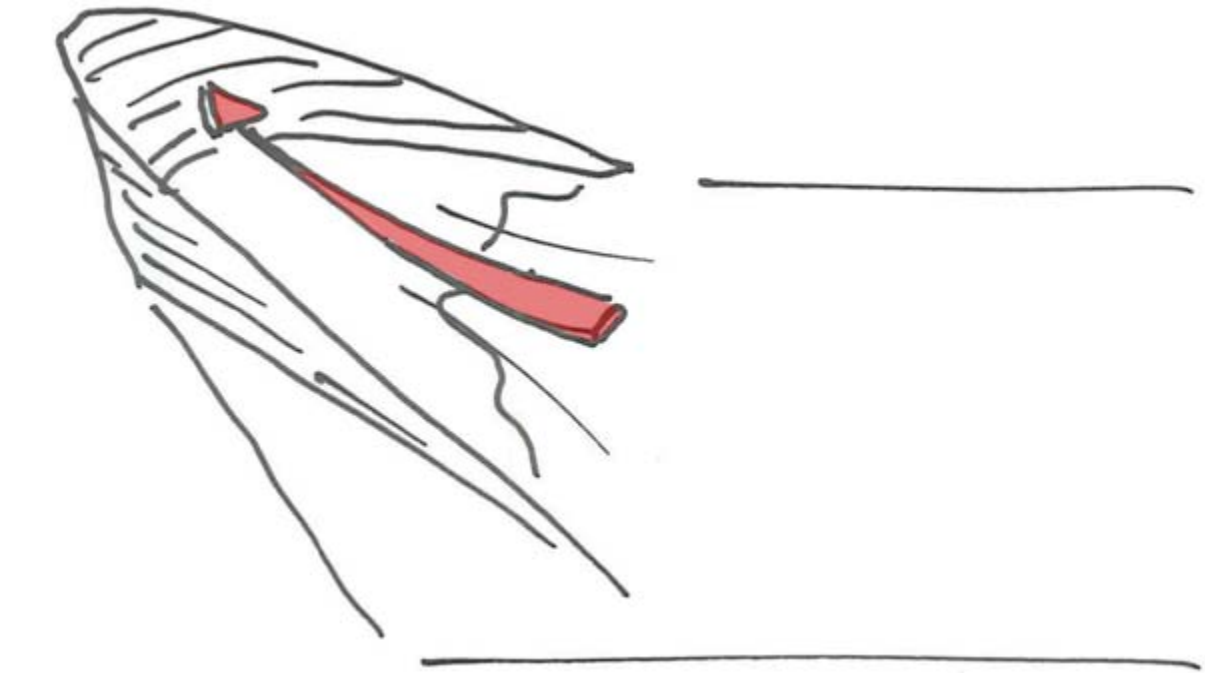
PRESENT NO park

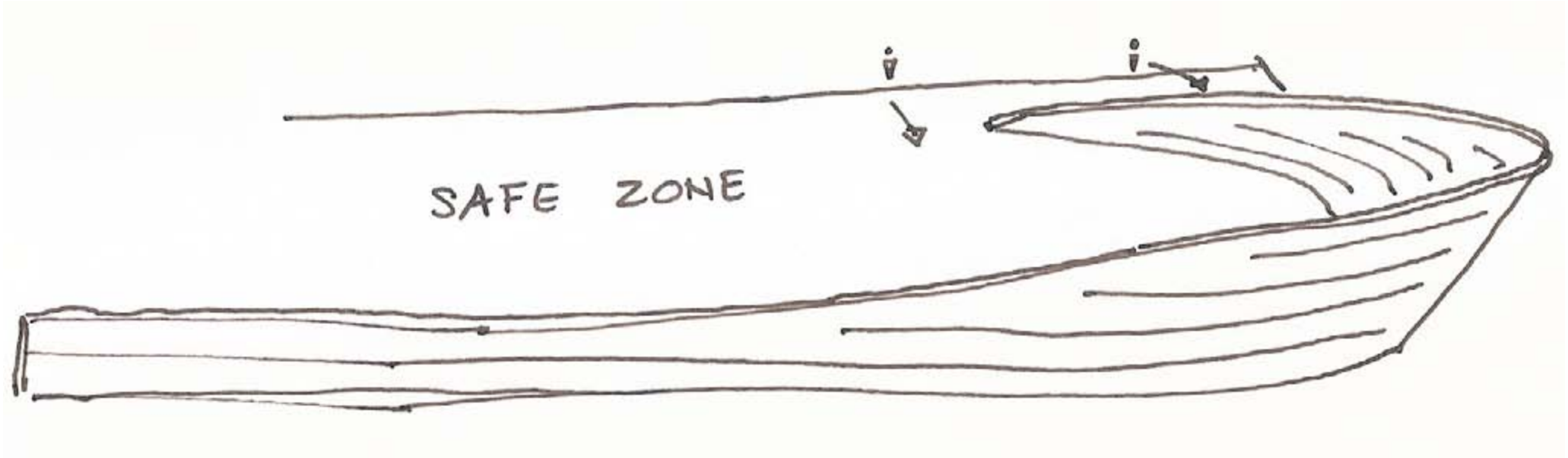


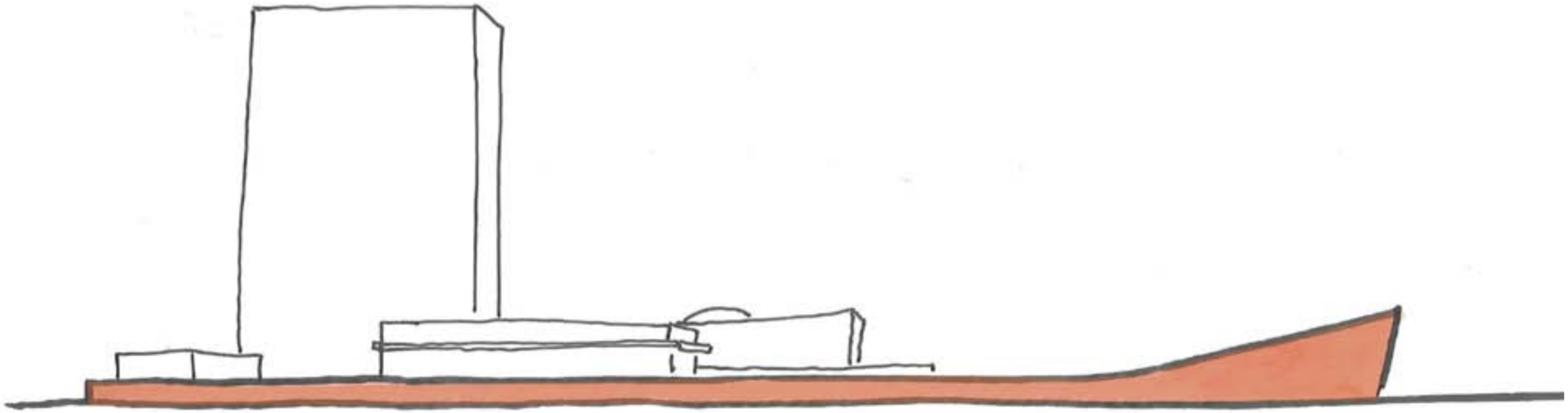
PRESENT park for the world



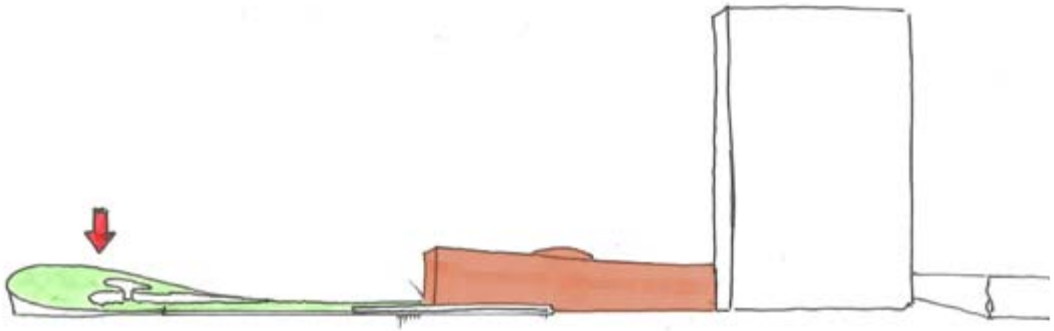
ARCHITECTONIC CONCEPT



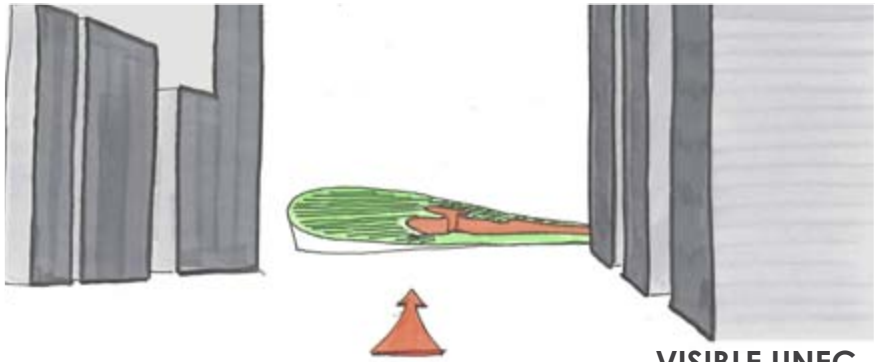




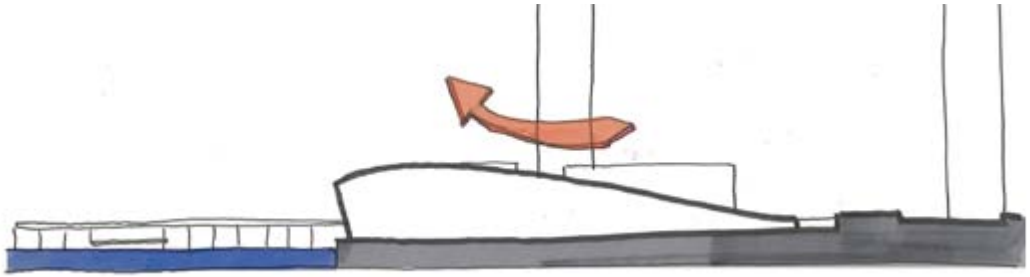
UNEC = fundament for UN



UNEC < UN



VISIBLE UNEC

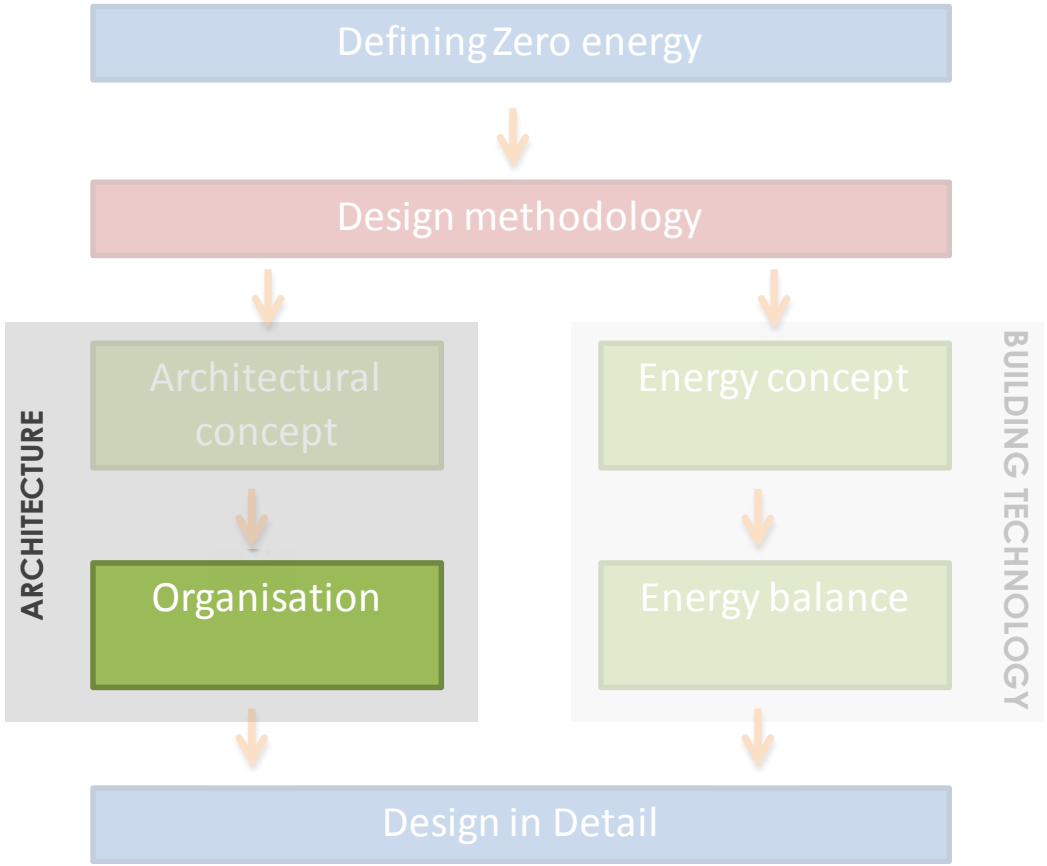


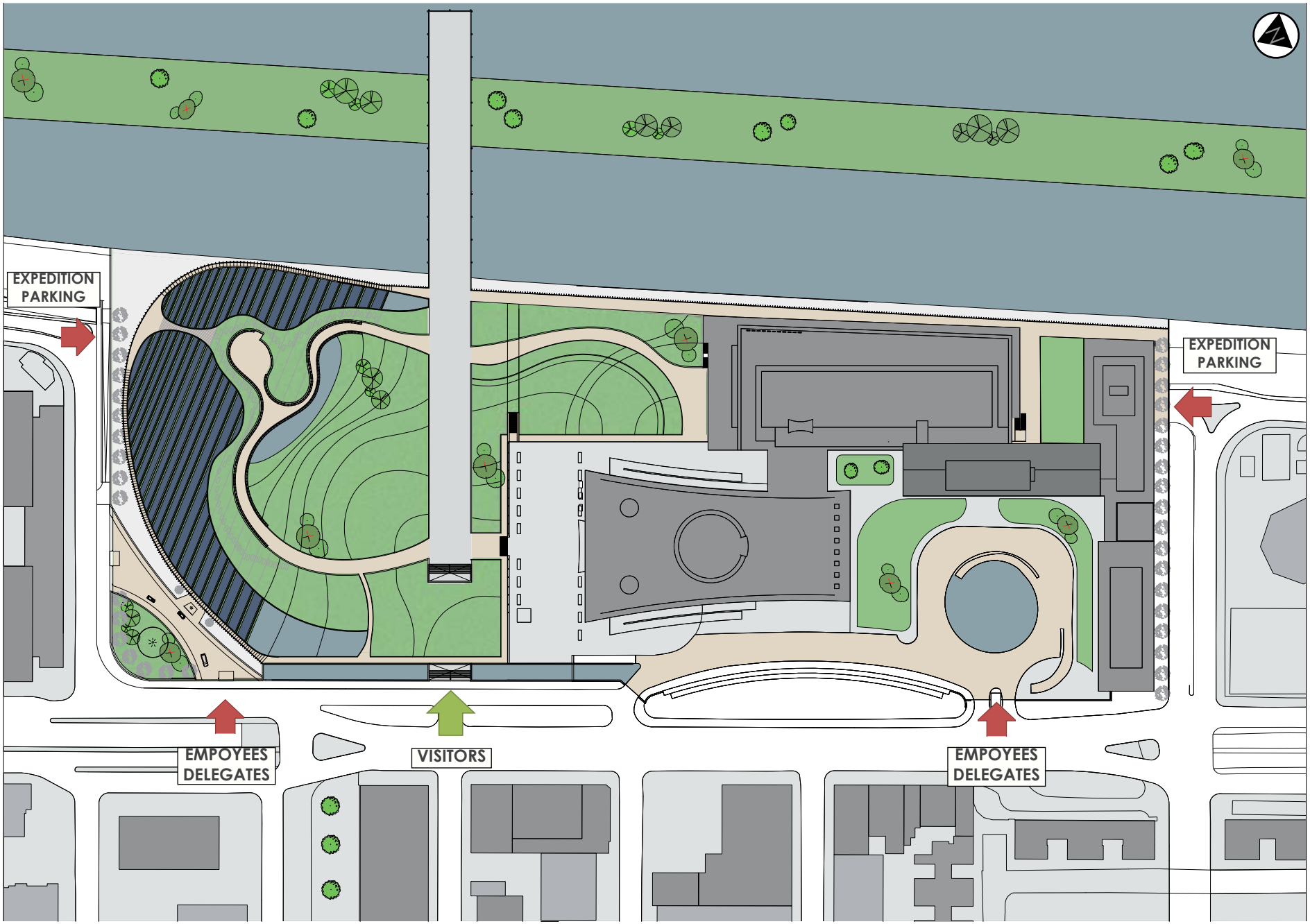
UPWARD MOVEMENT

VISIBLE UN

UNEC IMPRESSION FROM ESPLANADE

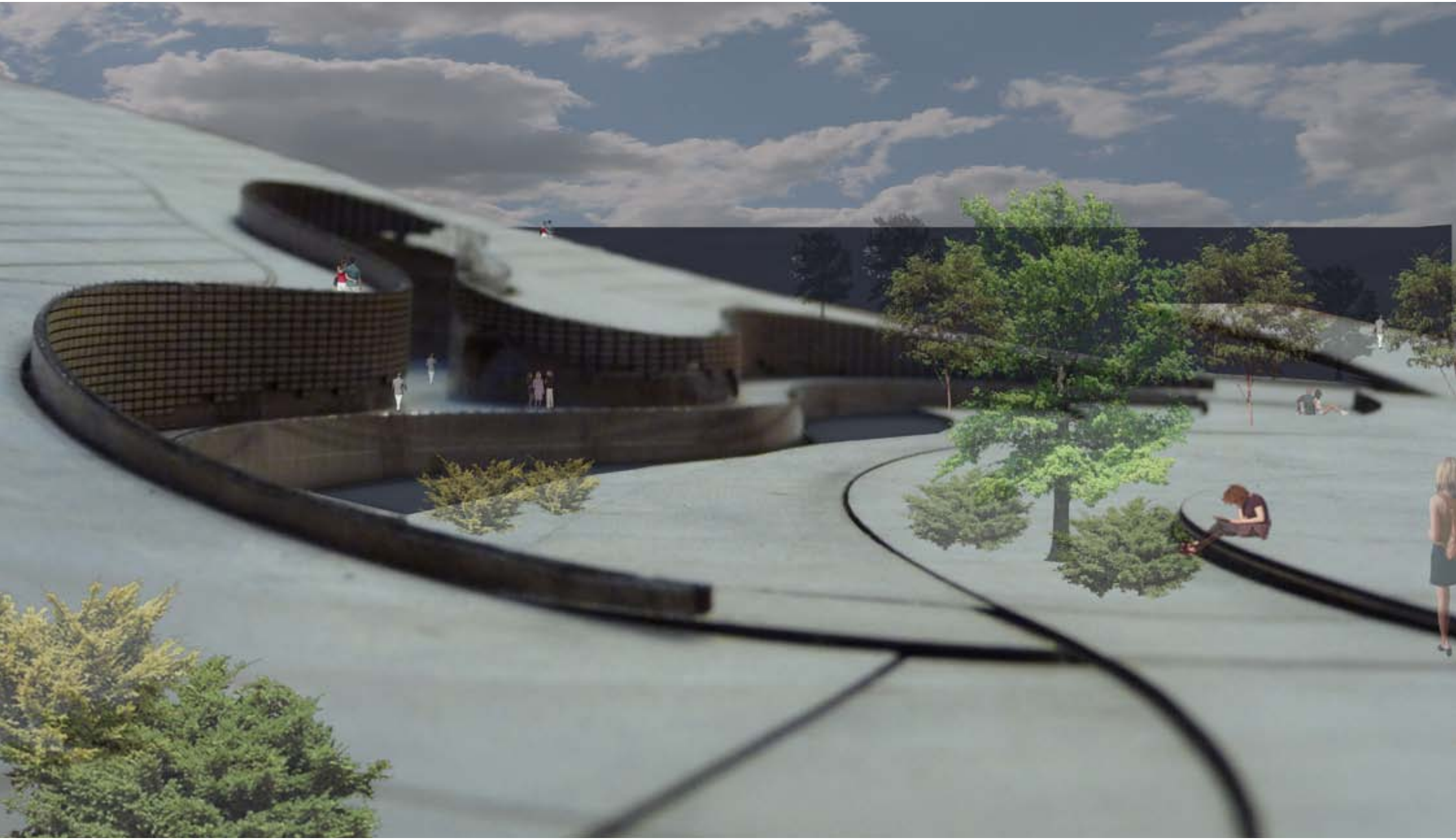
ORGANISATION OF THE BUILDING DESIGN

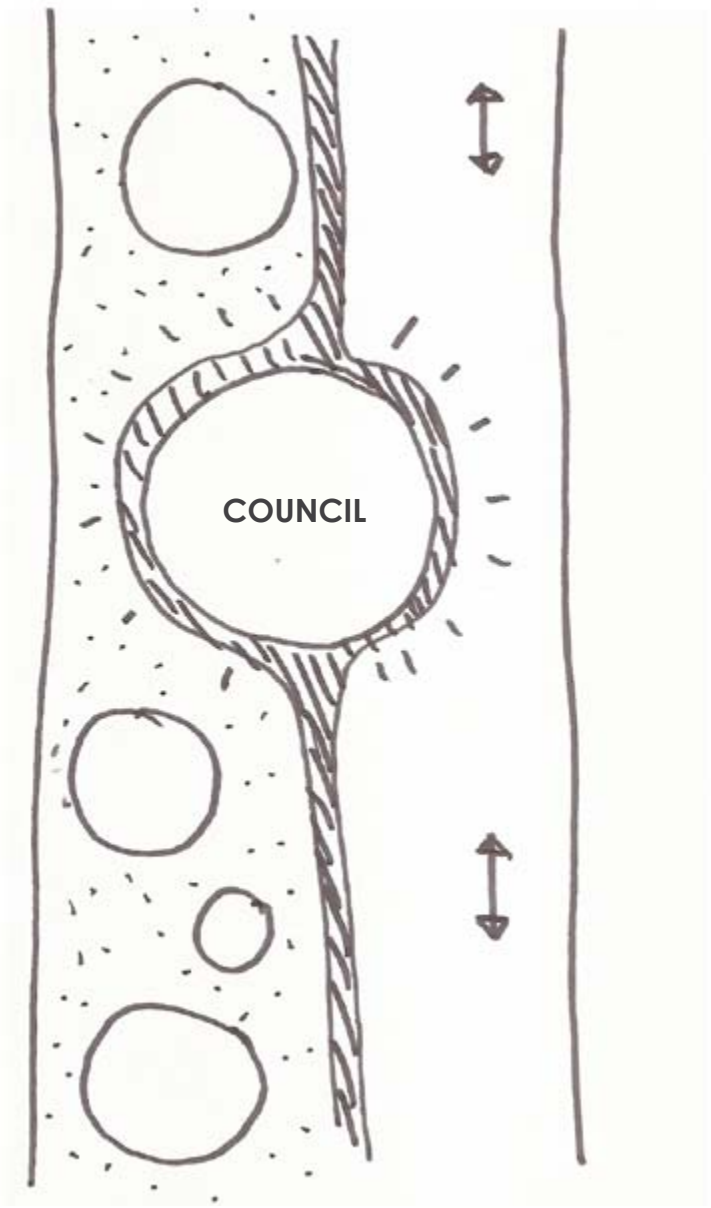


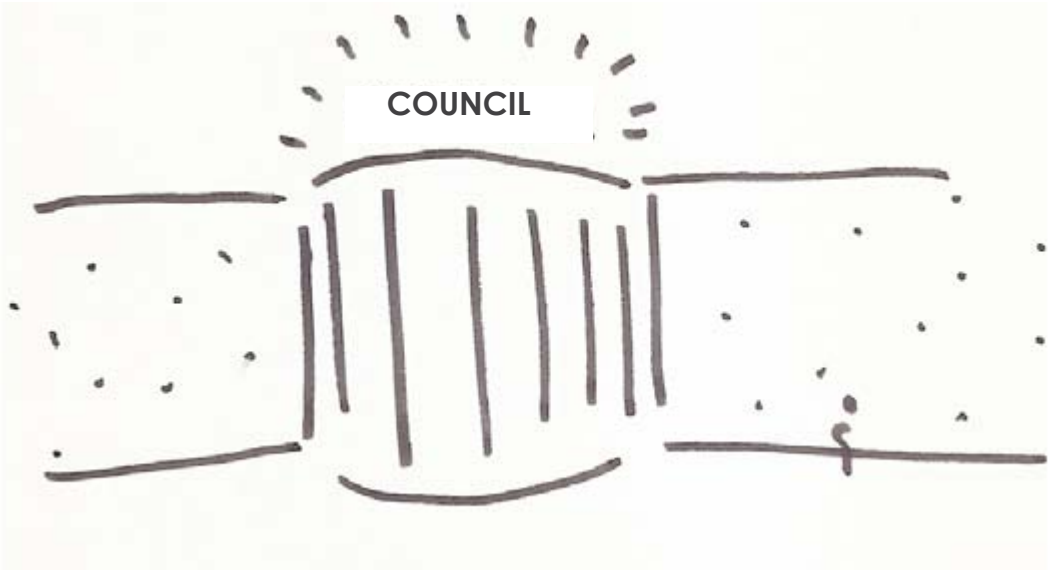

EXPEDITION PARKING
EXPEDITION PARKING
EMPOYEES DELEGATES
VISITORS
EMPOYEES DELEGATES

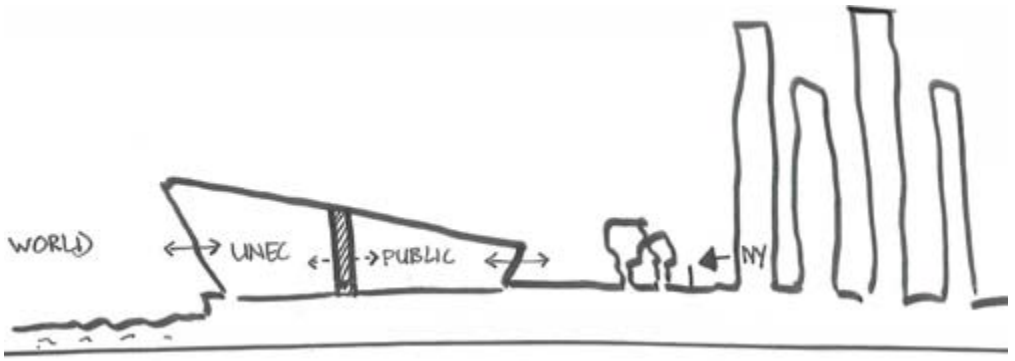
UNEC IMPRESSION FROM 1ST AVENUE

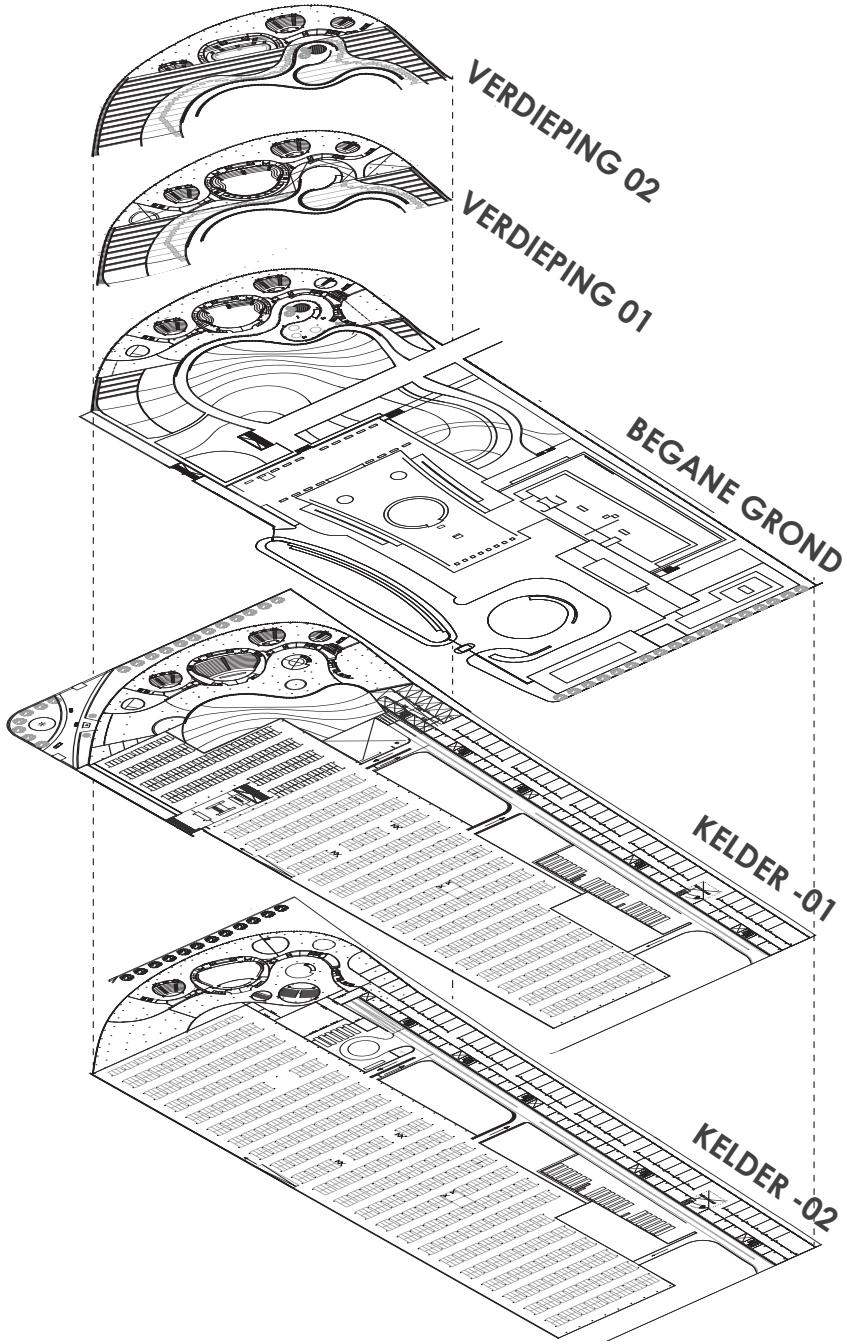
IMPRESSION PUBLIC ENTRANCE



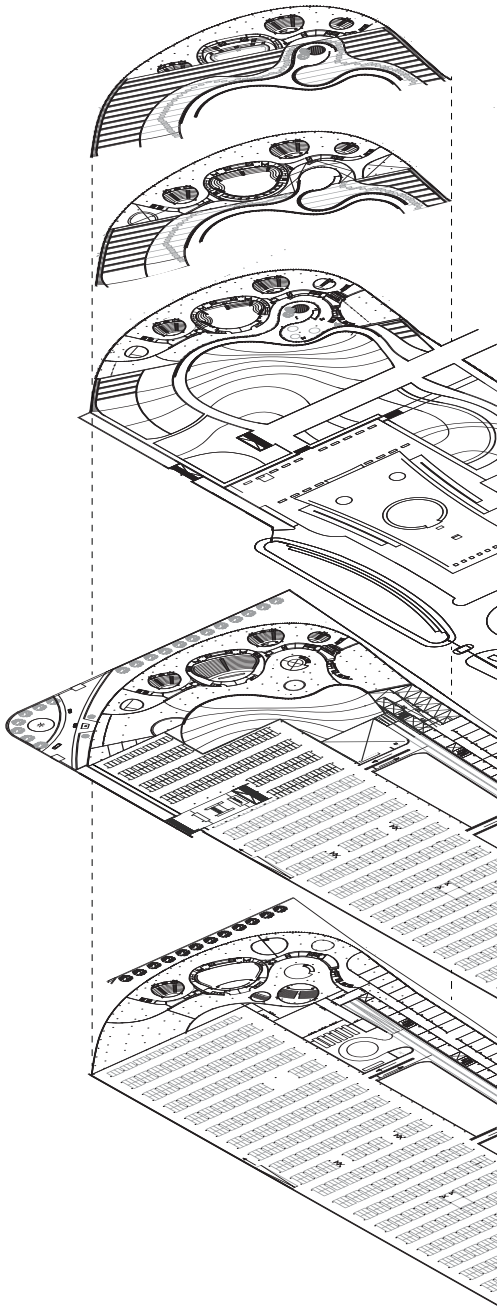

COUNCIL


COUNCIL


WORLD
UNEC
PUBLIC
NY

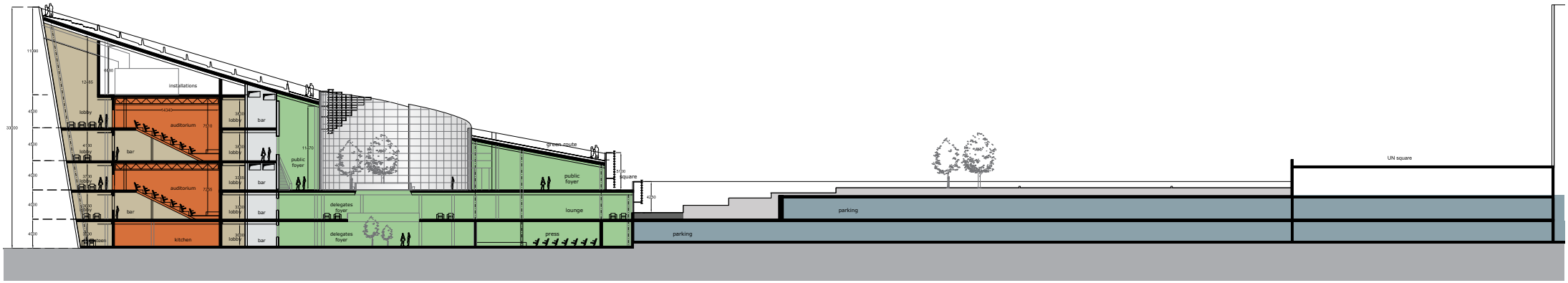

VERDIEPING 02
VERDIEPING 01
BEGANE GROND
KELDER -01
KELDER -02

Lay out Ground Floor (00)

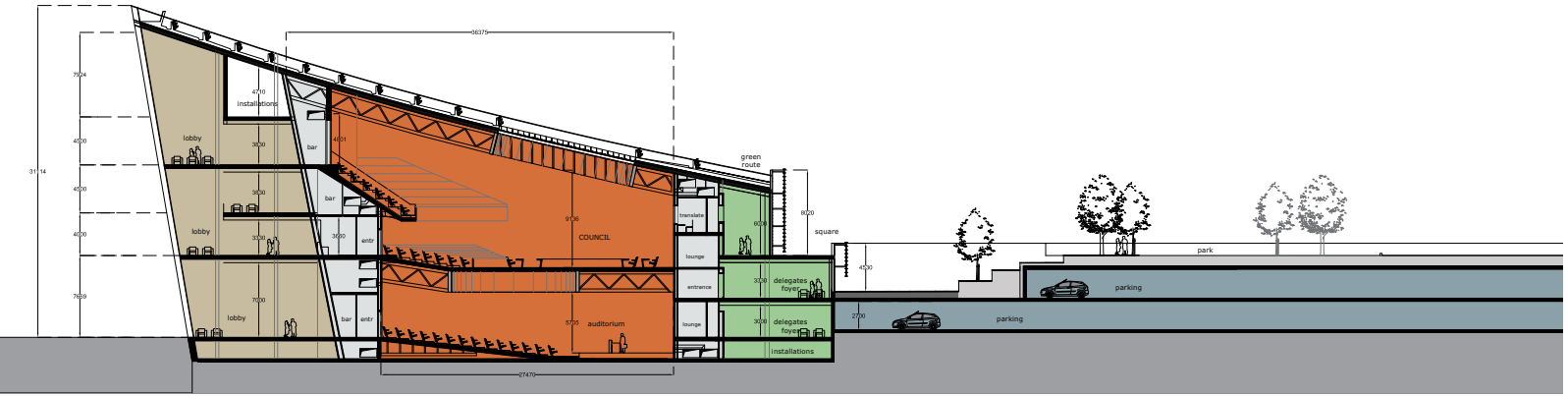


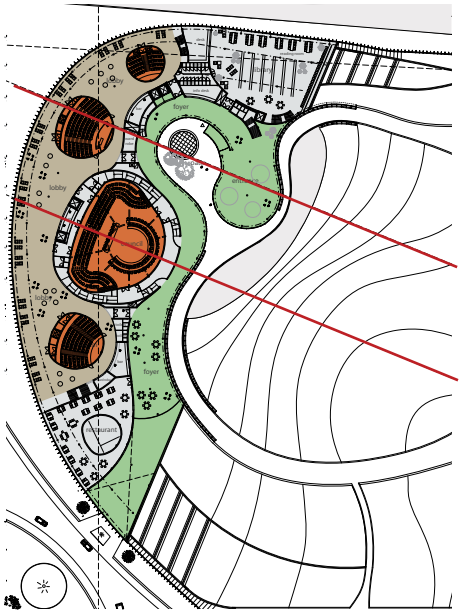
Foyer | Lobby | Lint | Council & Auditoriums | Offices | parking

Cross Section Top



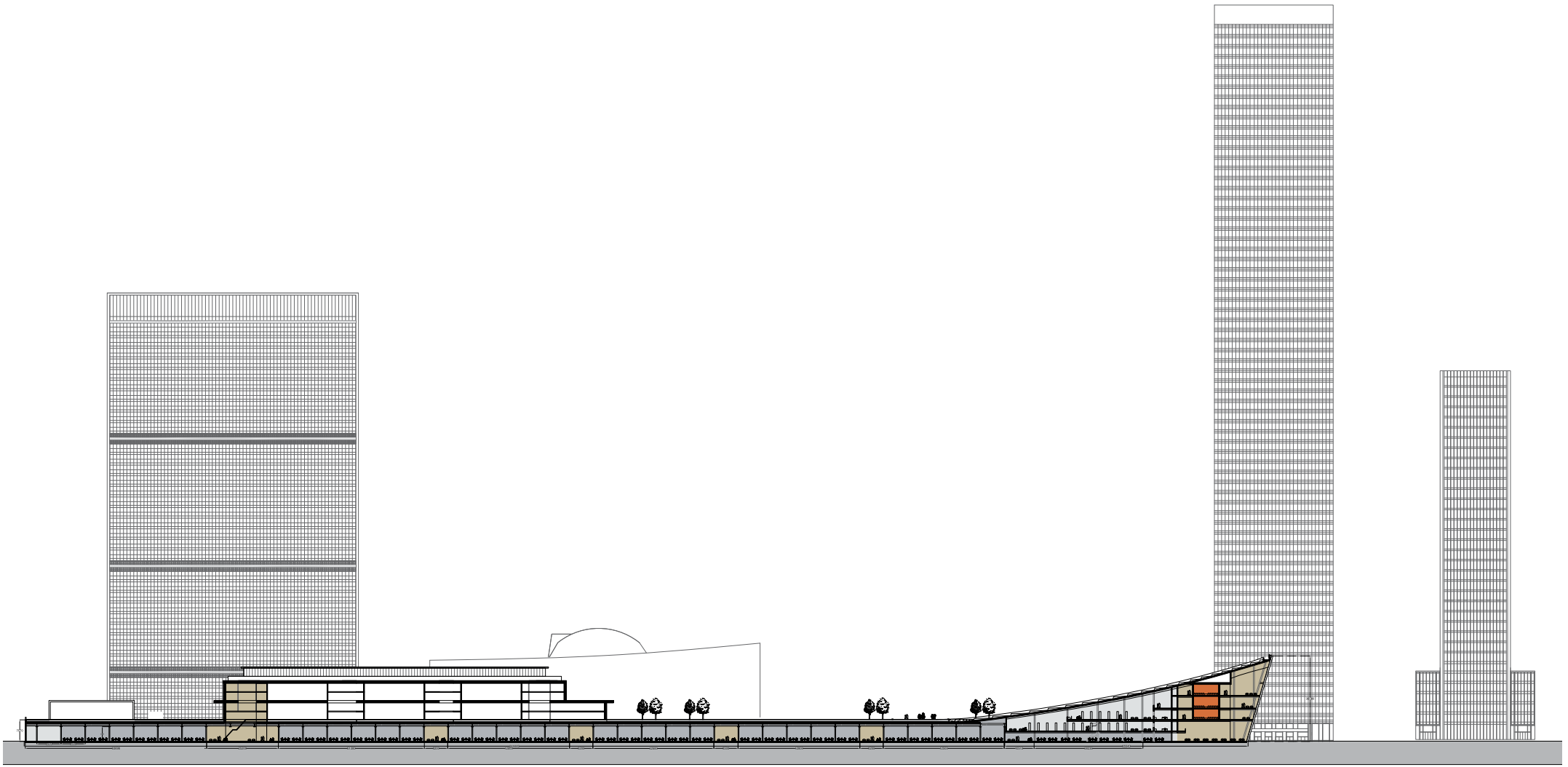
Cross Section Council



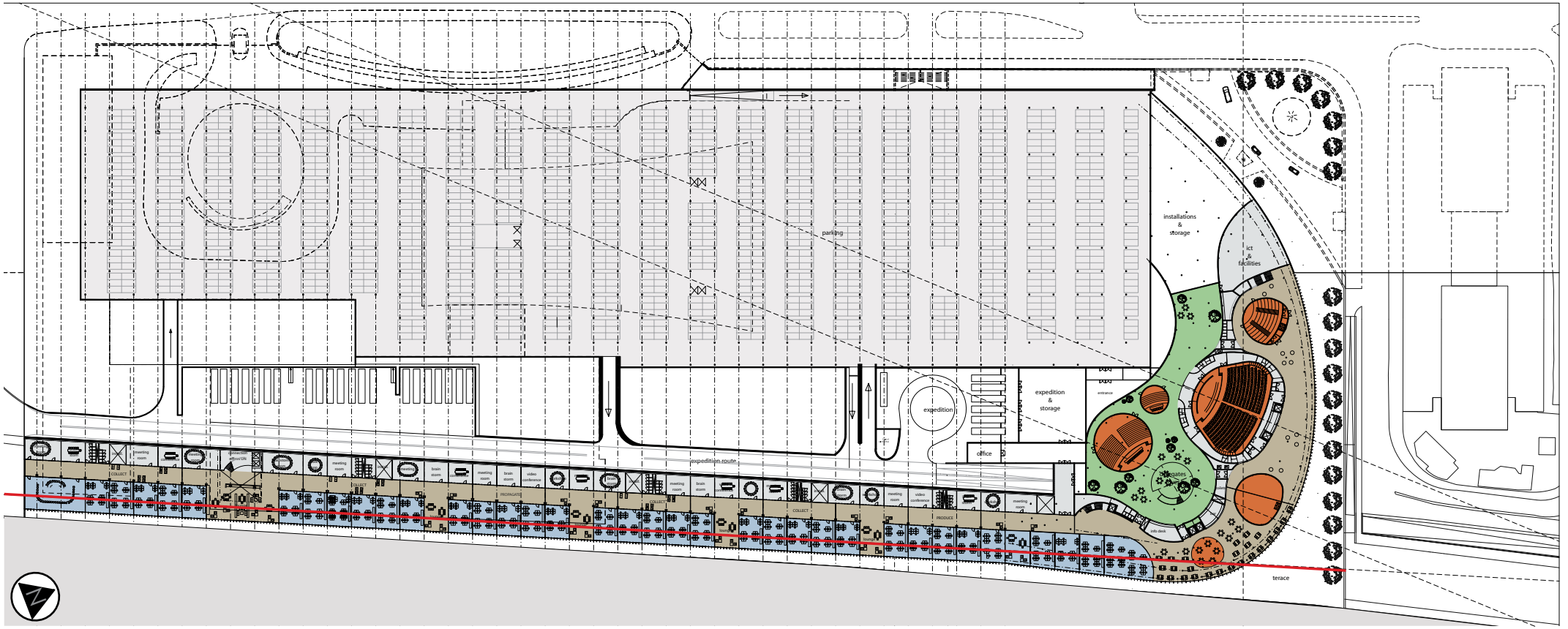


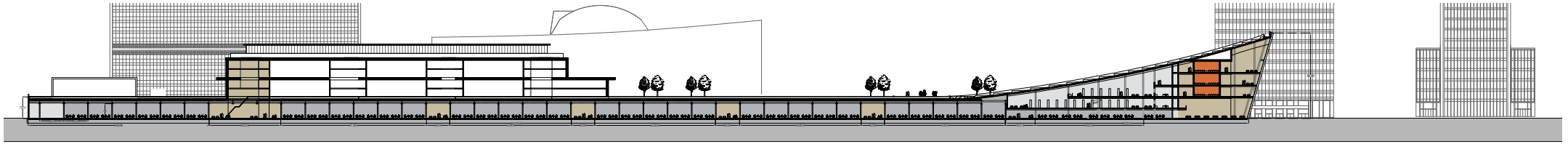
Foyer | Lobby | Lint | Council & Auditoriums | Offices | parking

Longitudinal Crossection Offices

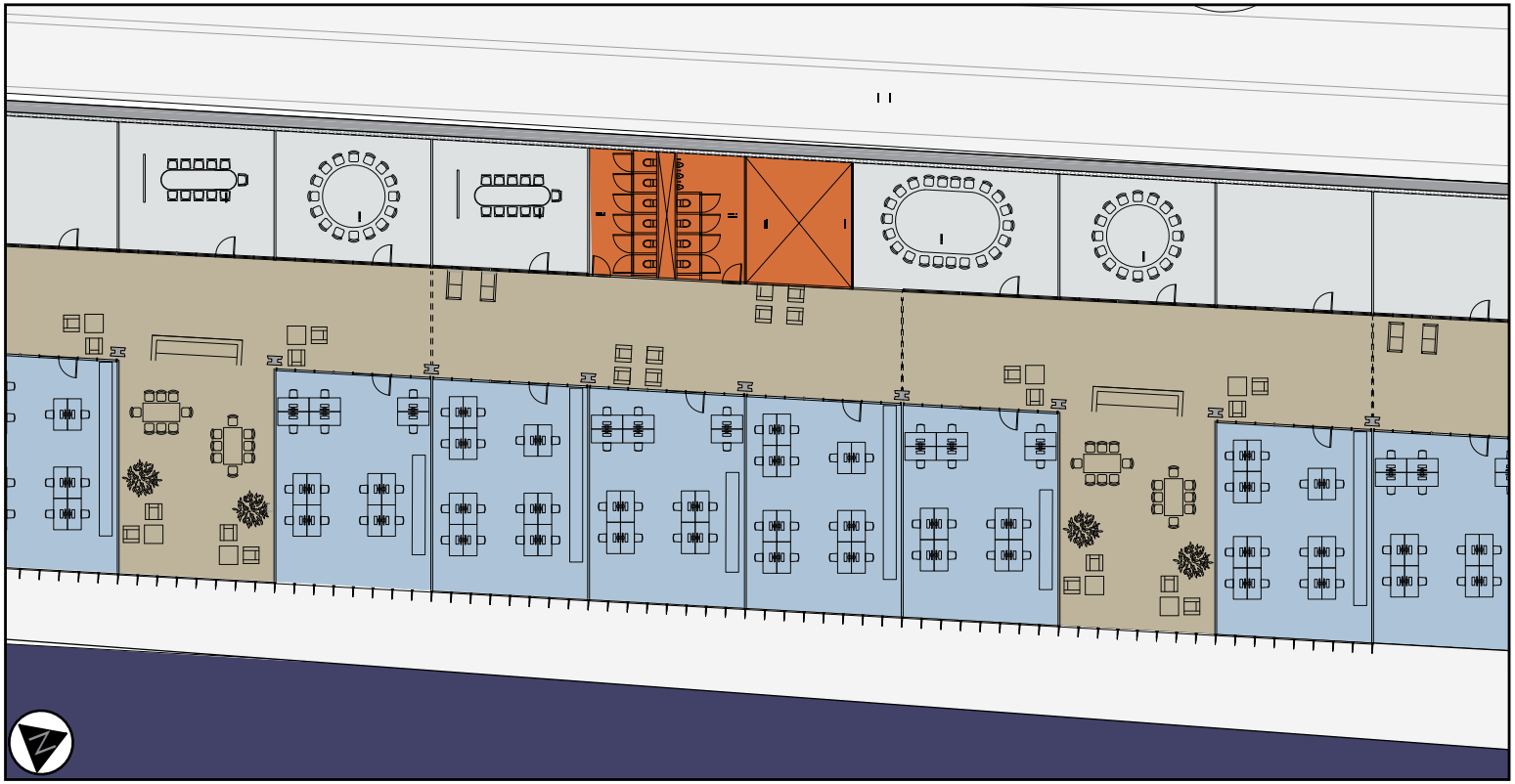


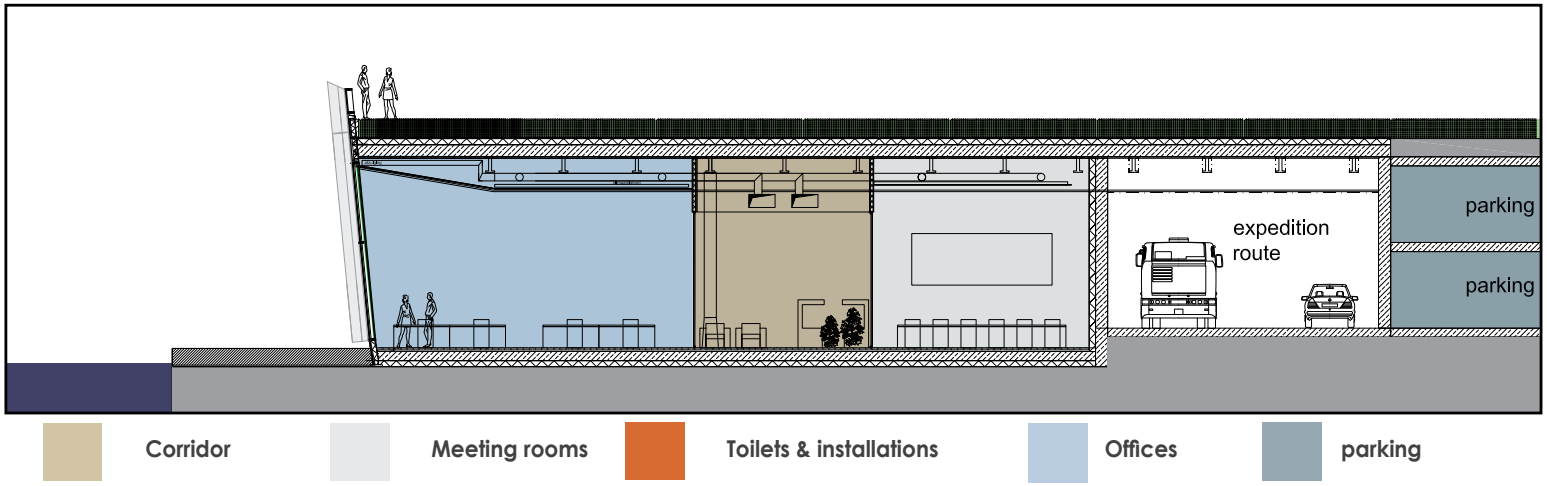
Lay out Basement (-02)





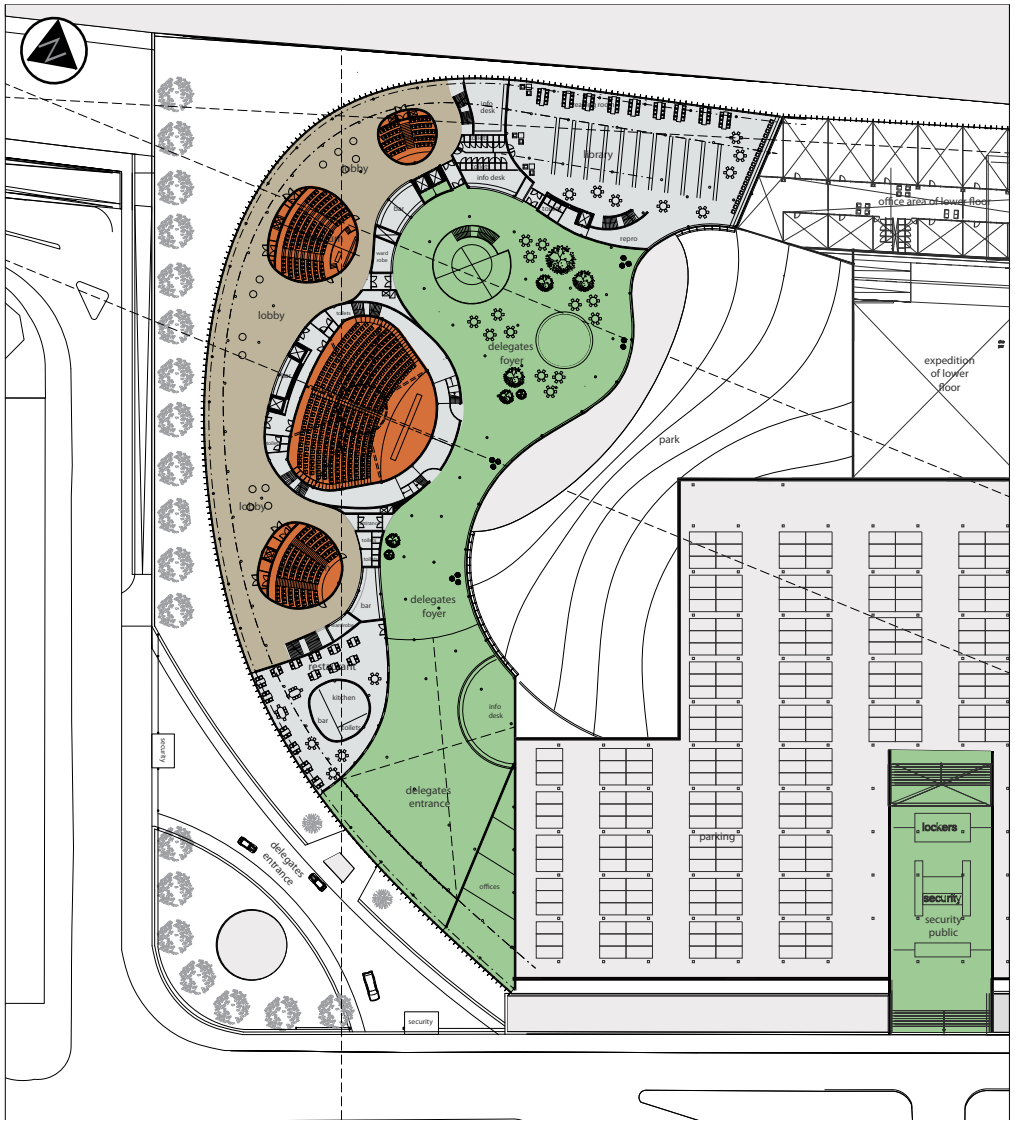
Foyer | Lobby | Lint | Council & Auditoriums | Offices | parking

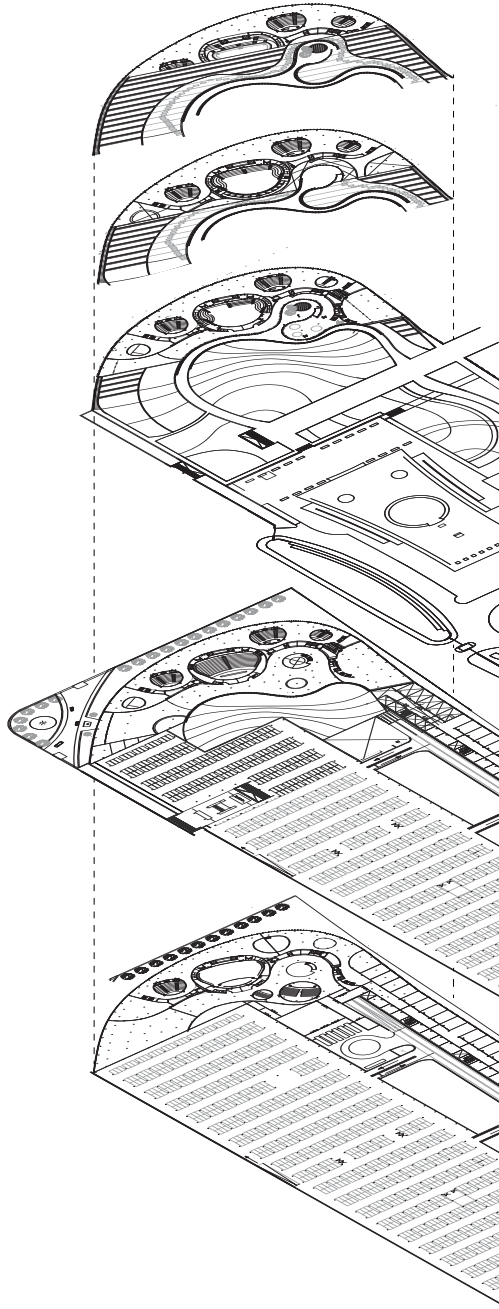




Corridor | Meeting rooms | Toilets & installations | Offices | parking

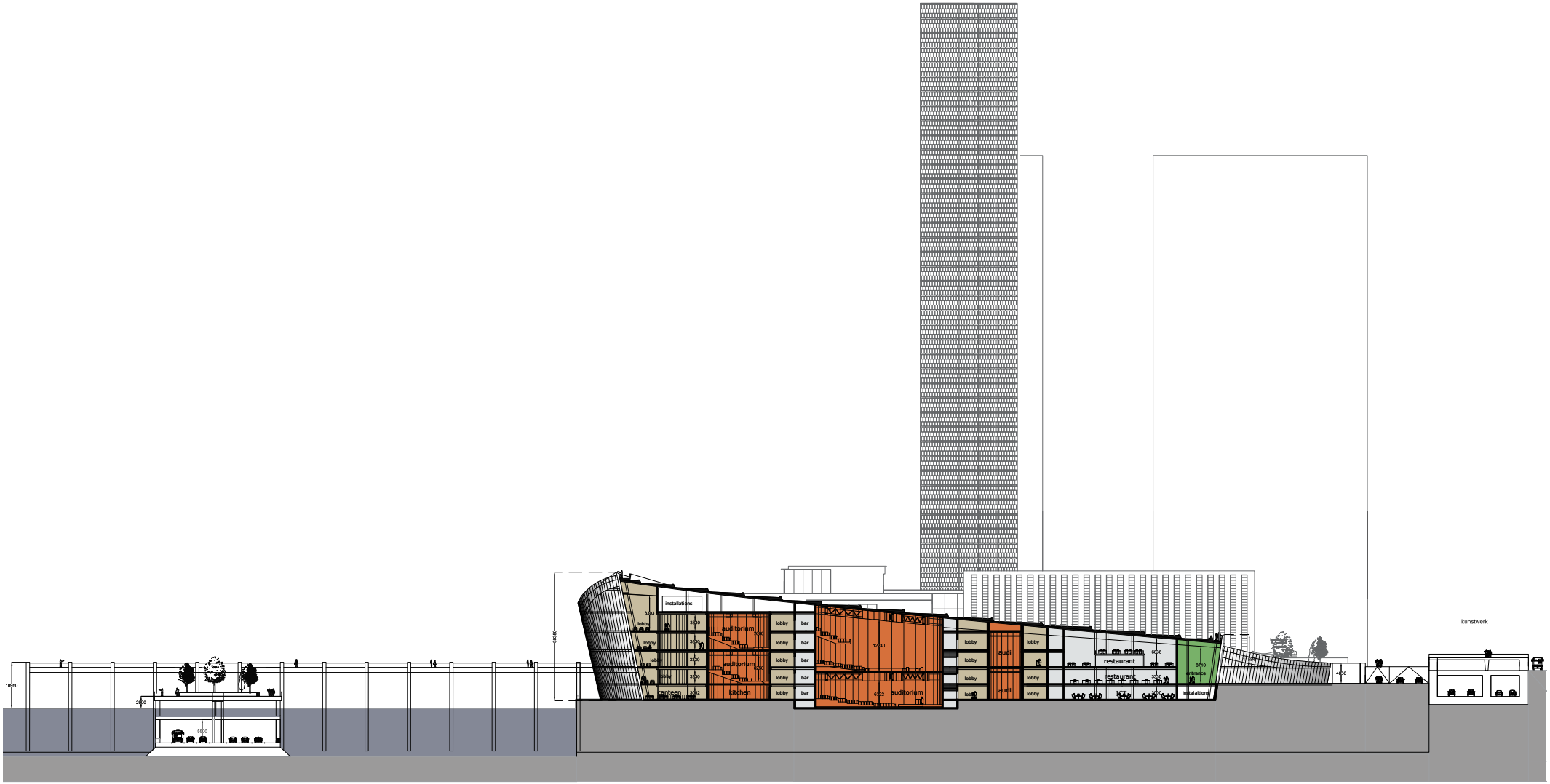
Lay out Basement (-01)





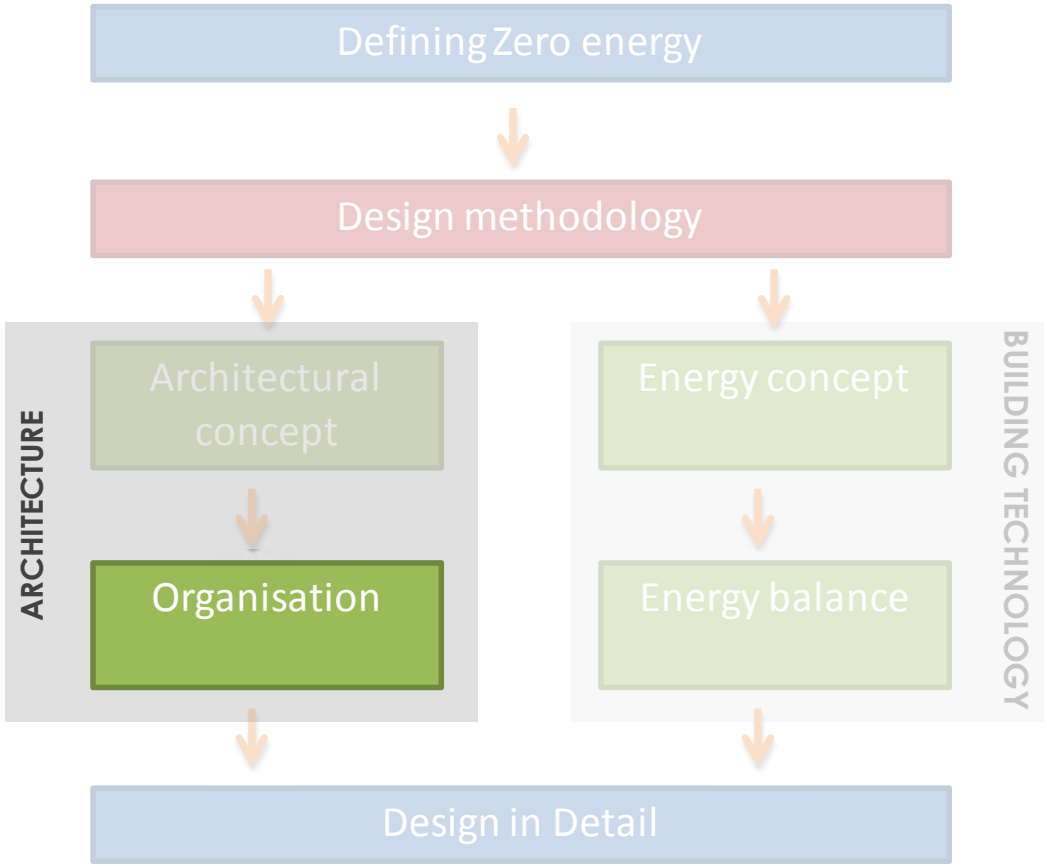
Foyer | Lobby | Lint | Council & Auditoriums | Offices | parking

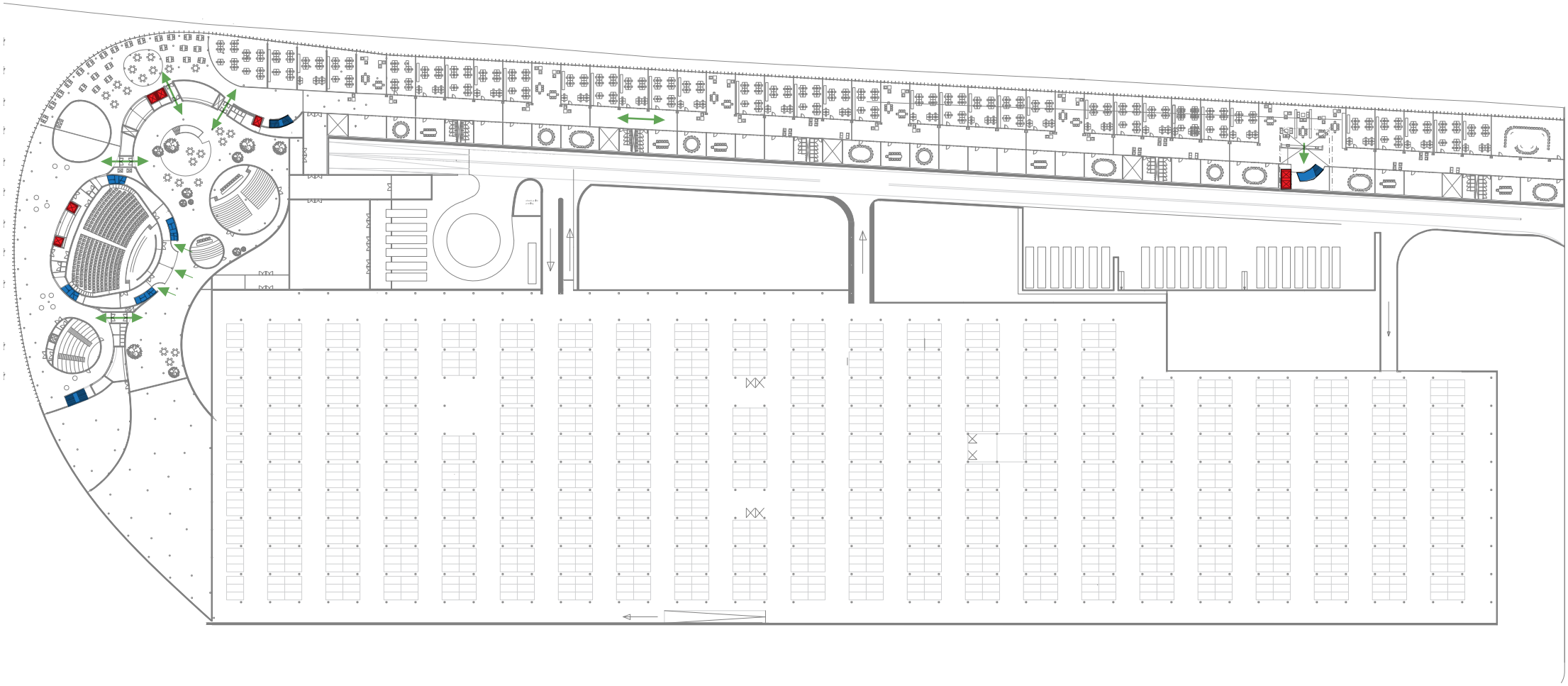
Longitudinal section auditoriums

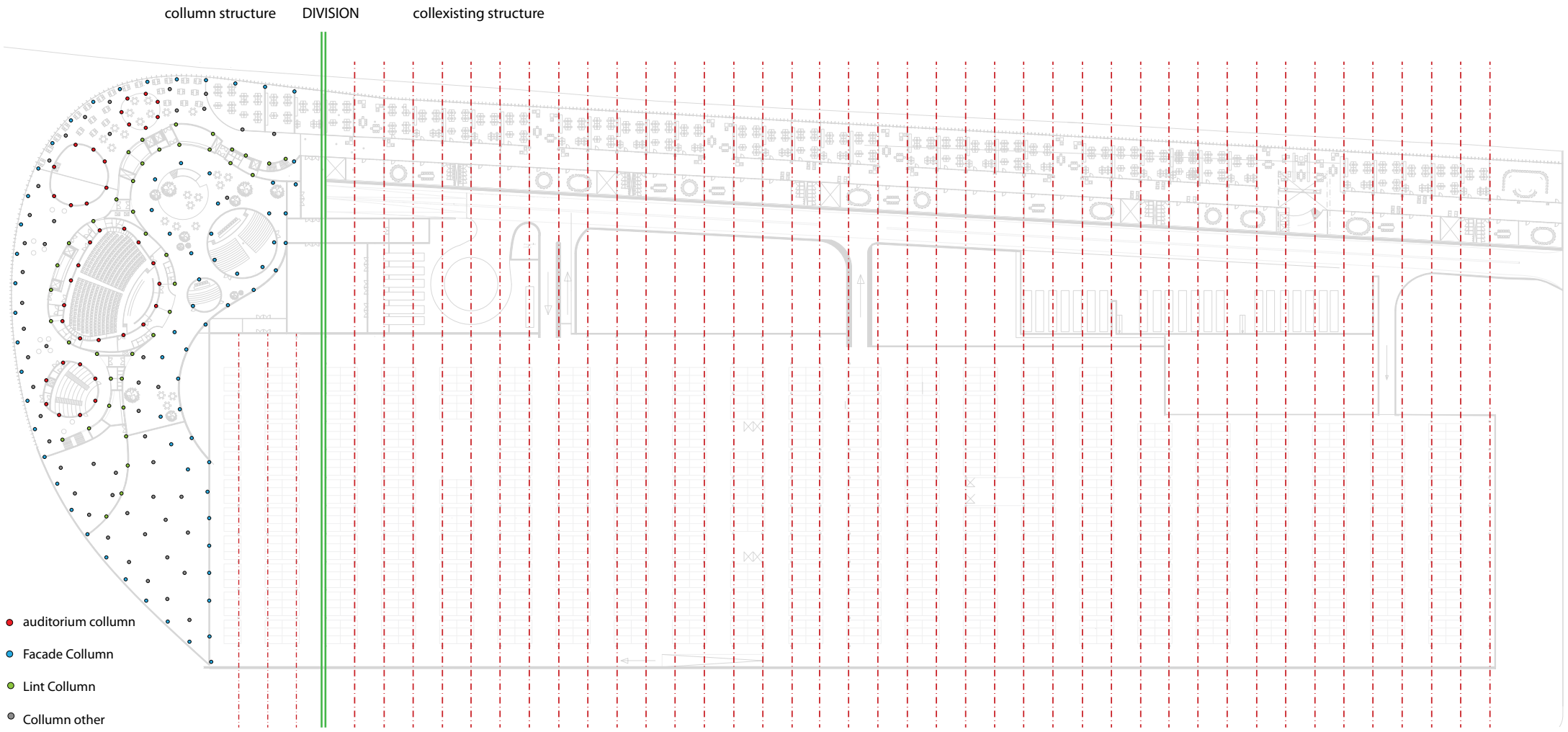


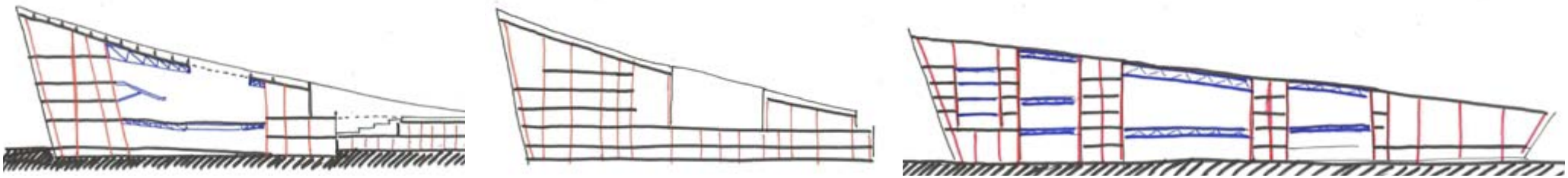
Foyer | Lobby | Lint | Council & Auditoriums | Offices | parking

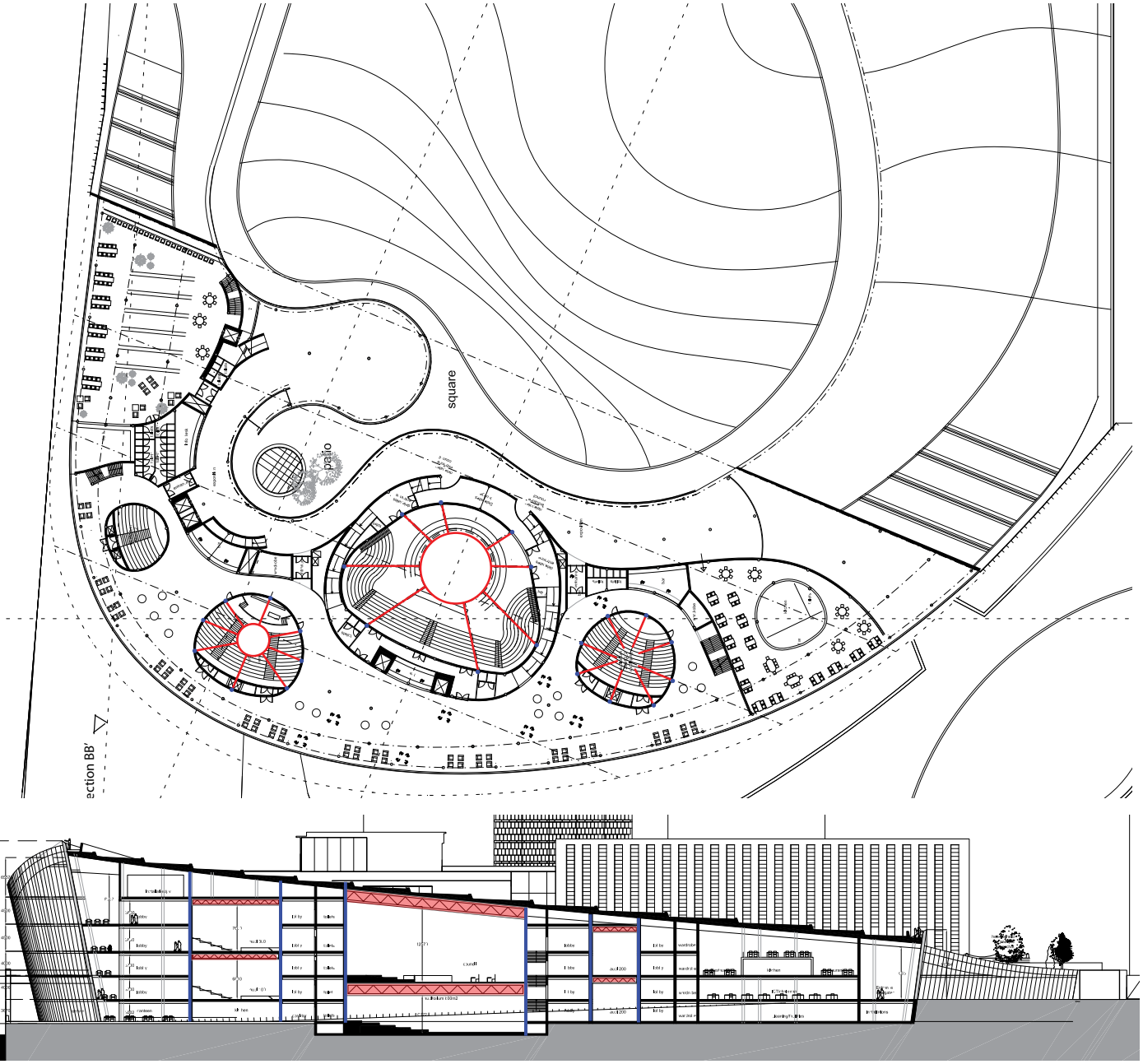
ROUTING
CONSTRUCTION
STABILITY
CLIMATE

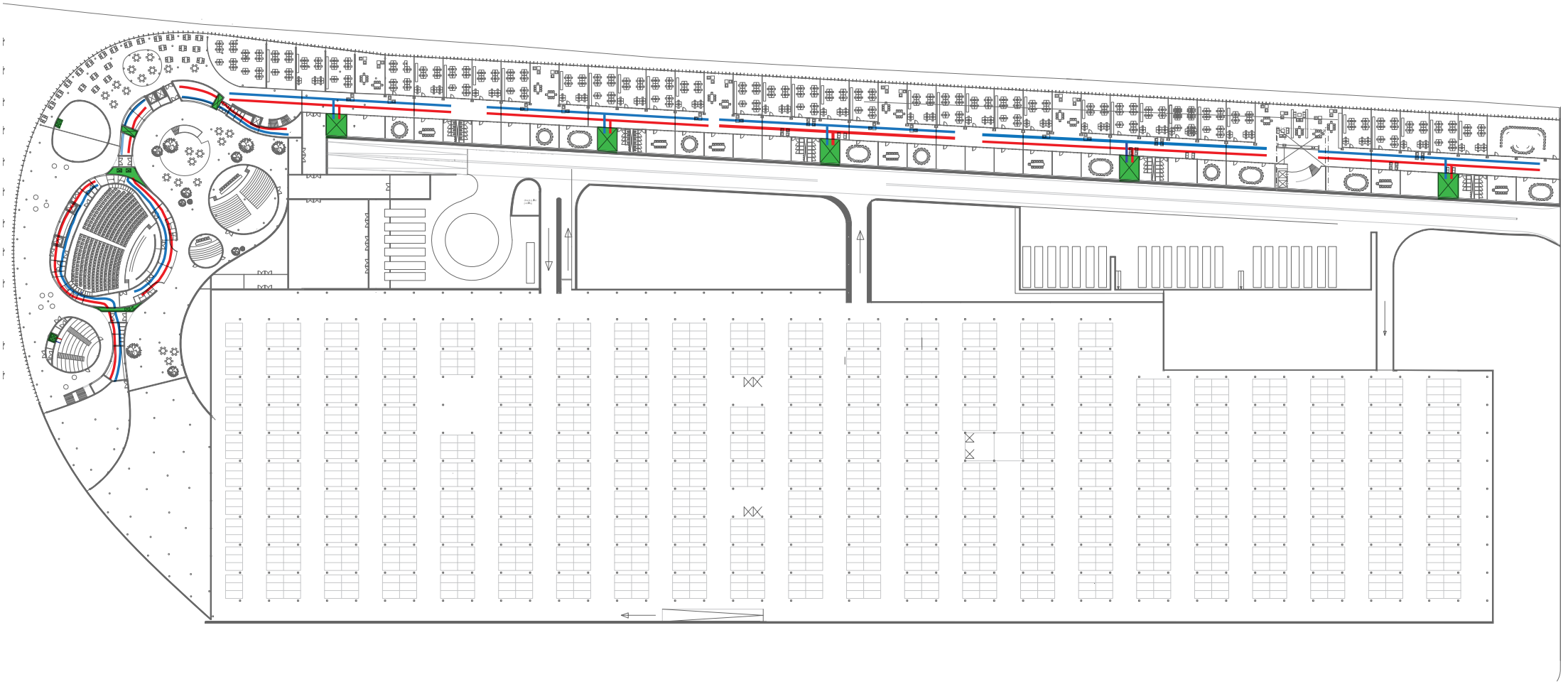


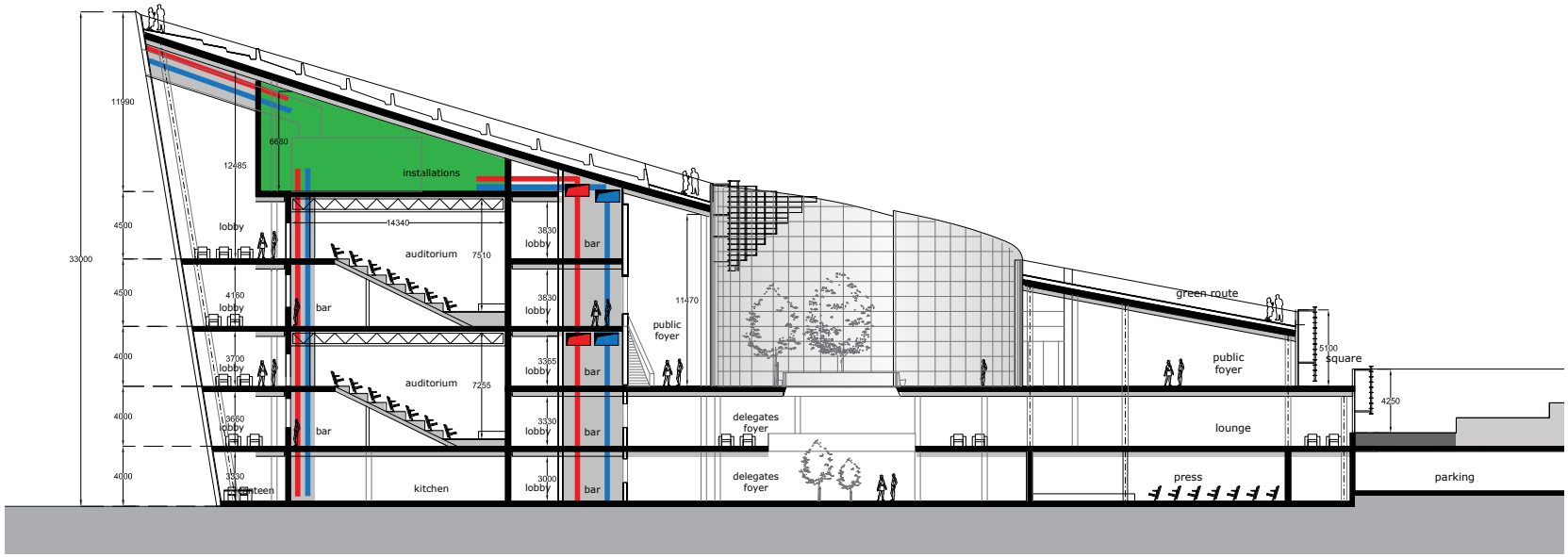


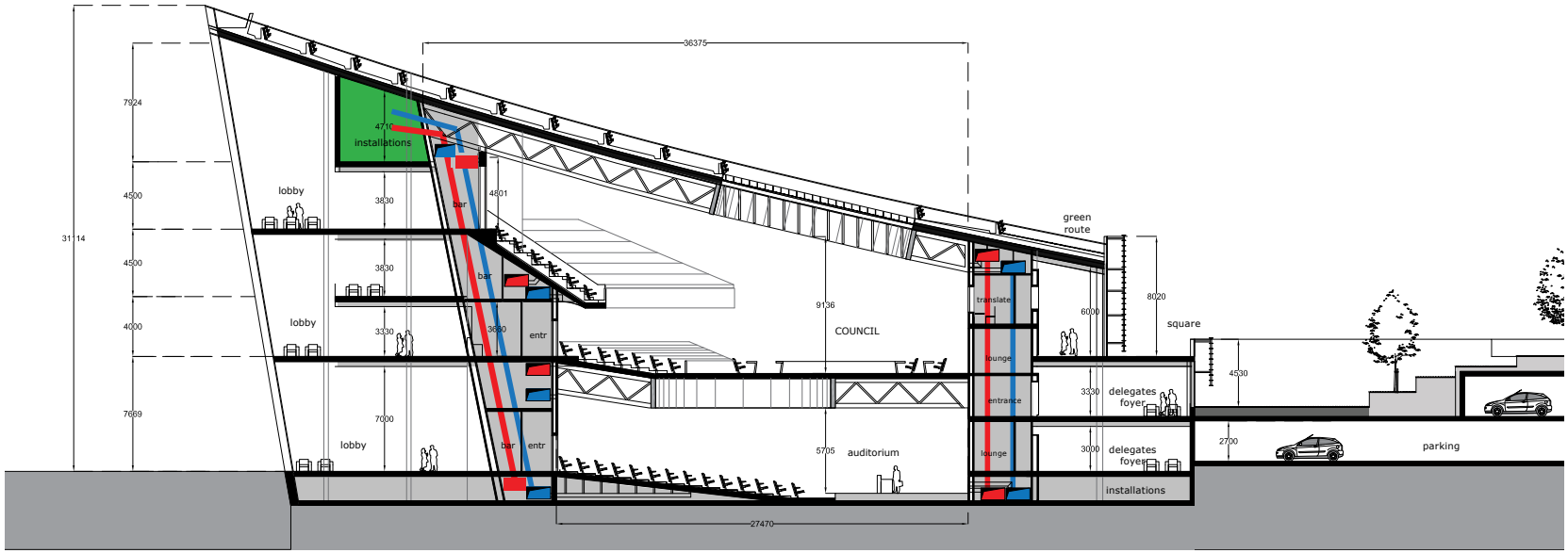

collumn structure
DIVISION
collexisting structure
auditorium collumn
Facade Collumn
Lint Collumn
Collumn other

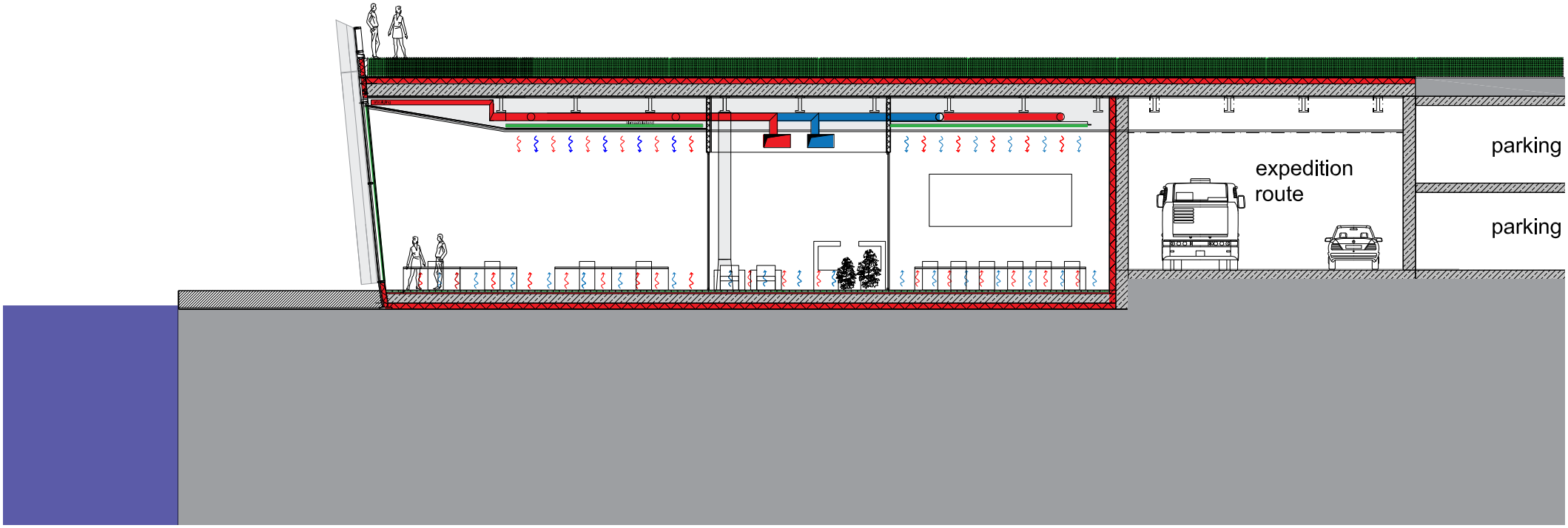



square
patio
ection BB'

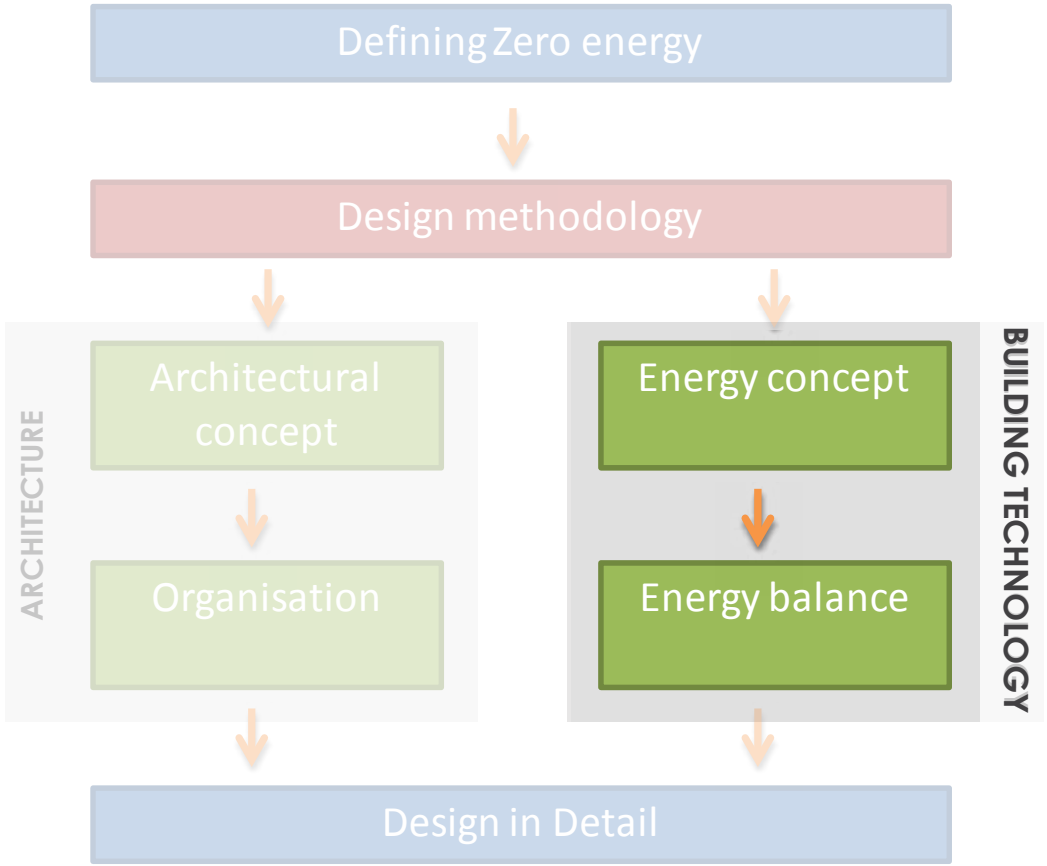



11990
6680
12485
installations
4500
lobby
14340
auditorium
7510
3830
lobby
bar
33000
4500
4180
lobby
bar
11470
public
foyer
4000
3700
lobby
auditorium
7255
3365
lobby
bar
green route
public
foyer
5100
square
4000
13680
lobby
bar
3330
lobby
bar
delegates
foyer
lounge
4250
4000
3330
canteen
kitchen
3000
lobby
bar
delegates
foyer
press
parking

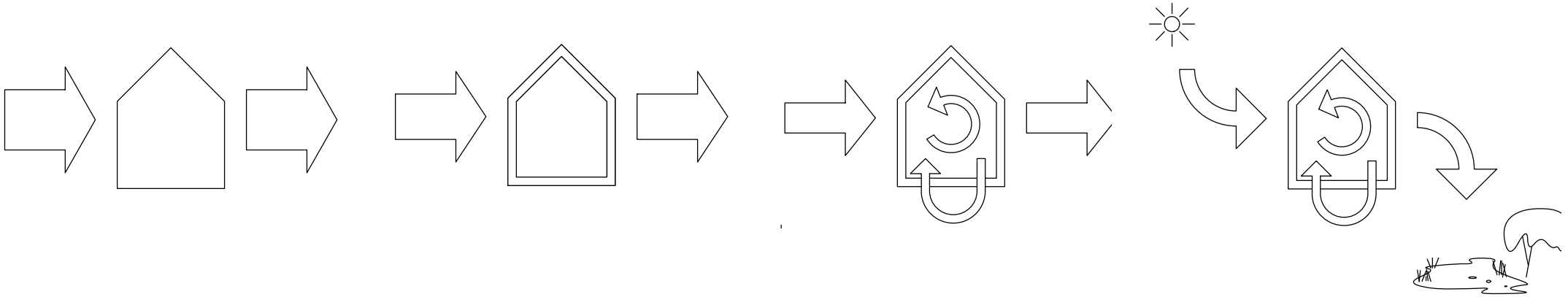

36375
7924
4710
installations
lobby
4500
3830
4601
bar
31714
4500
3830
bar
green
route
9136
translate
6000
8020
lobby
4000
3330
3830
entr
COUNCIL
square
lounge
4530
7699
7000
entrance
3330
delegates
foyer
lobby
bar
entr
5705
auditorium
lounge
3000
delegates
foyer
2700
parking
installations
27470


parking
expedition
route
parking

VAN ENERGIENEUTRAAL TOT ENERGIECONCEPT



NIEUWE STAPPEN STRATEGIE

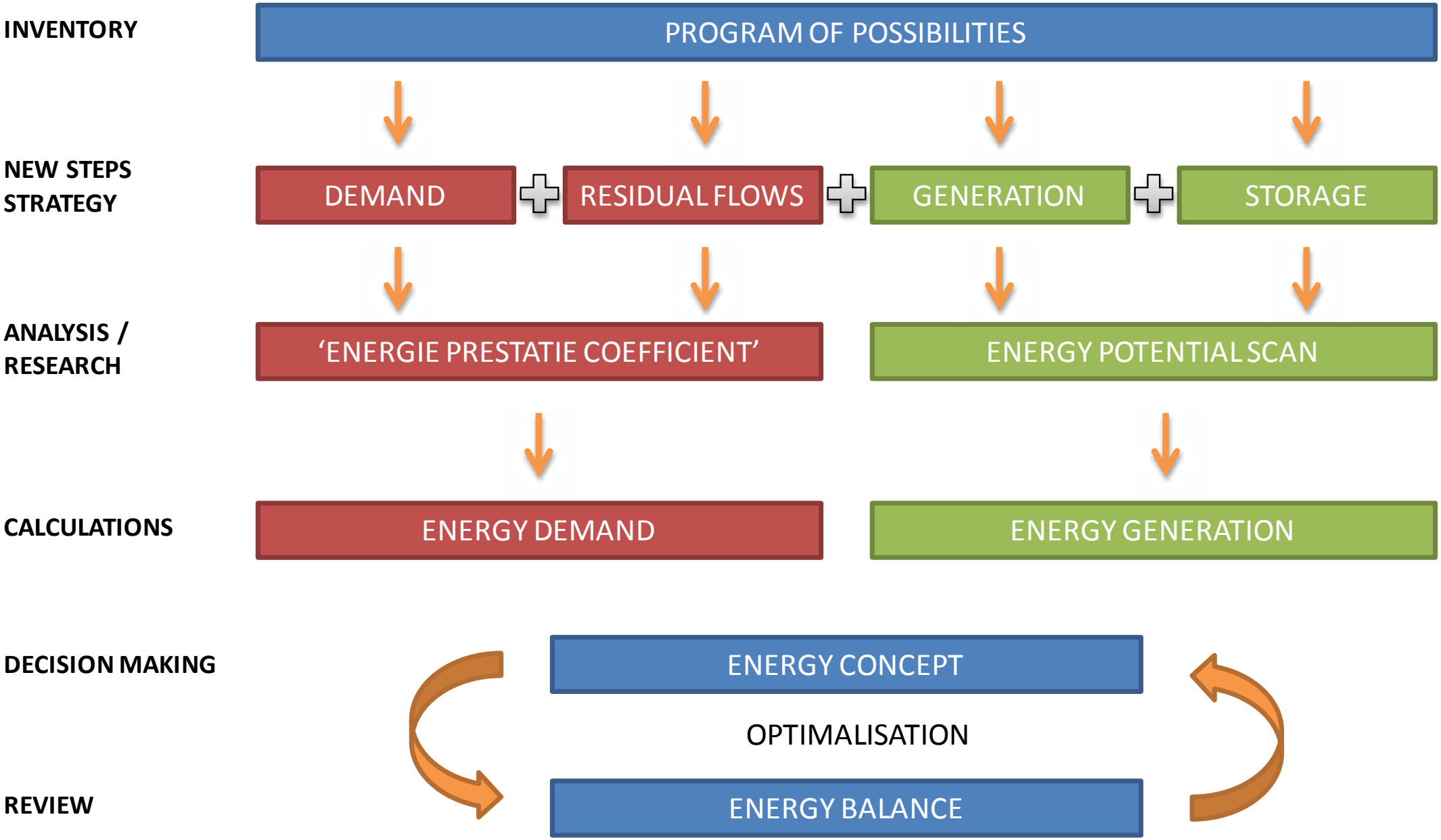


00 Standard

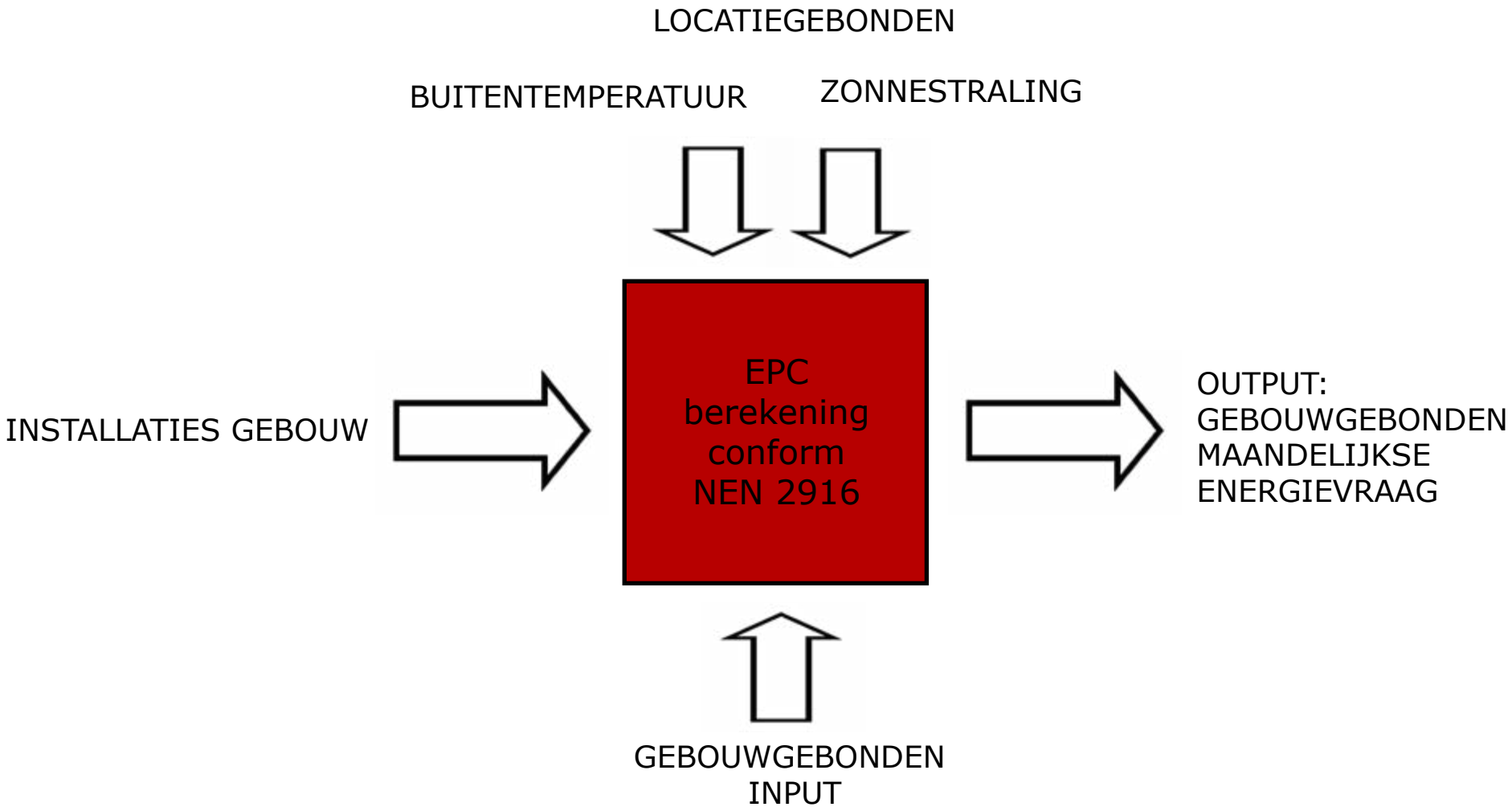
01 reduce energy demand

02 reuse residuals

03 sustainable energy
04 storage


INVENTORY
PROGRAM OF POSSIBILITIES
NEW STEPS STRATEGY
DEMAND
RESIDUAL FLOWS
GENERATION
STORAGE
ANALYSIS / RESEARCH
'ENERGIE PRESTATIE COEFFICIENT'
ENERGY POTENTIAL SCAN
CALCULATIONS
ENERGY DEMAND
ENERGY GENERATION
DECISION MAKING
ENERGY CONCEPT
OPTIMALISATION
REVIEW
ENERGY BALANCE

DEFINING ENERGY DEMAND



HEATING

COOLING

VENTILATION

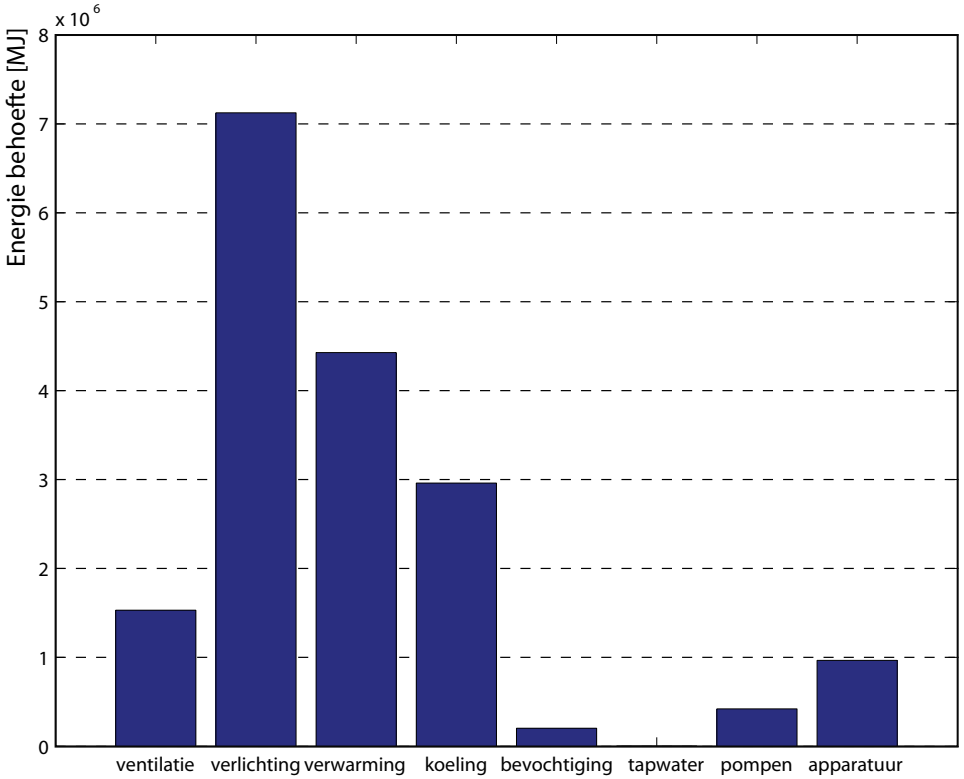
LIGHTING

MOISTENING

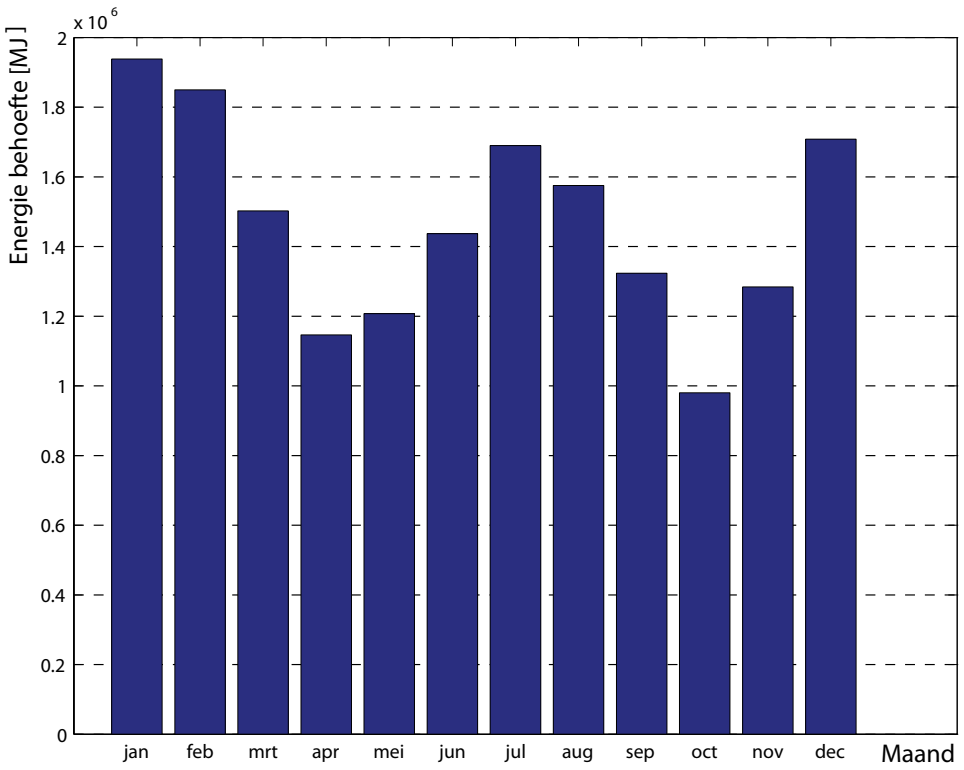
PUMPING

EQUIPMENT

Total energy demand per energy theme a year

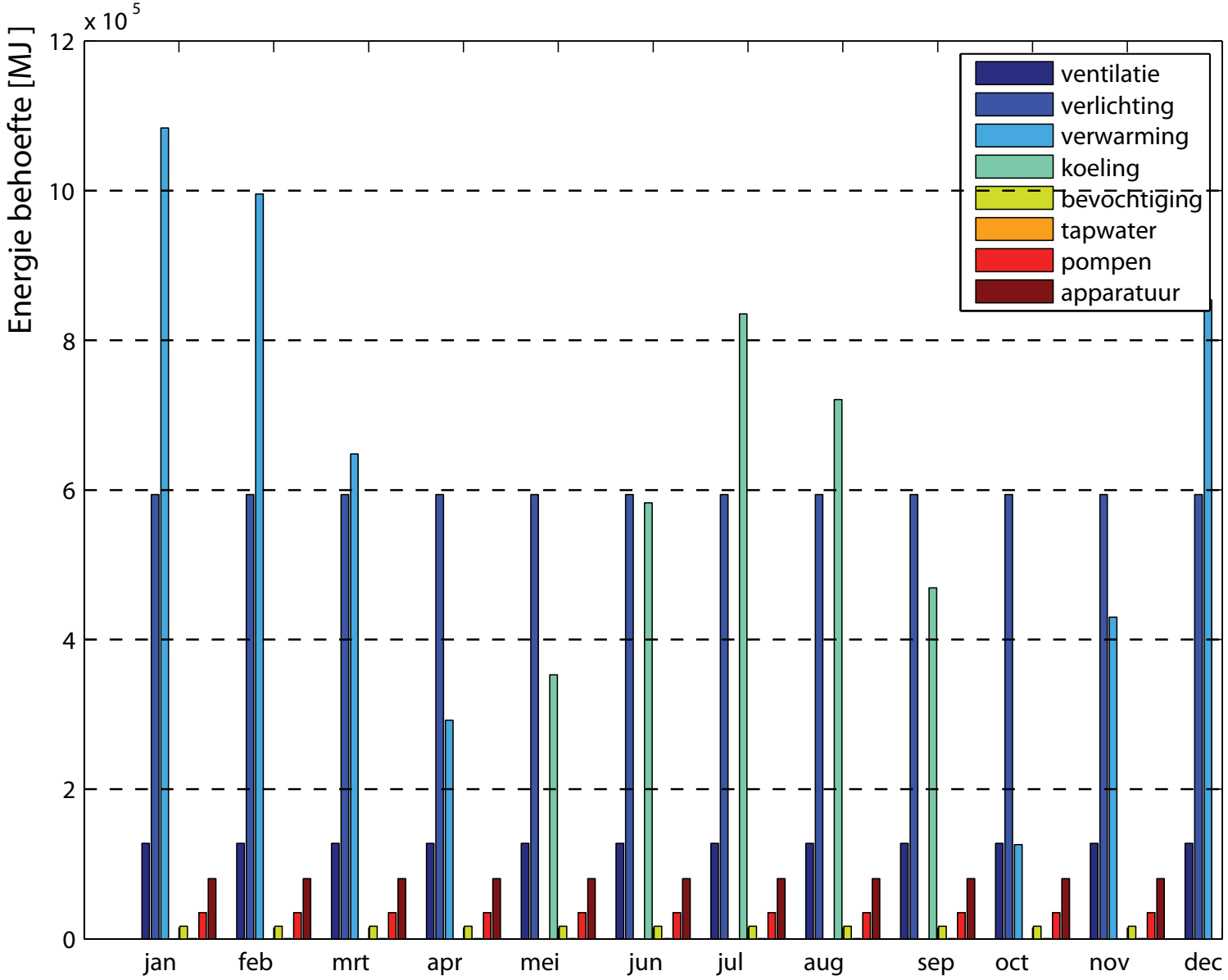


Energy demand pattern



Totale energievraag: 17.640.659 MJ
Specifieke energievraag: 335 MJ/m2

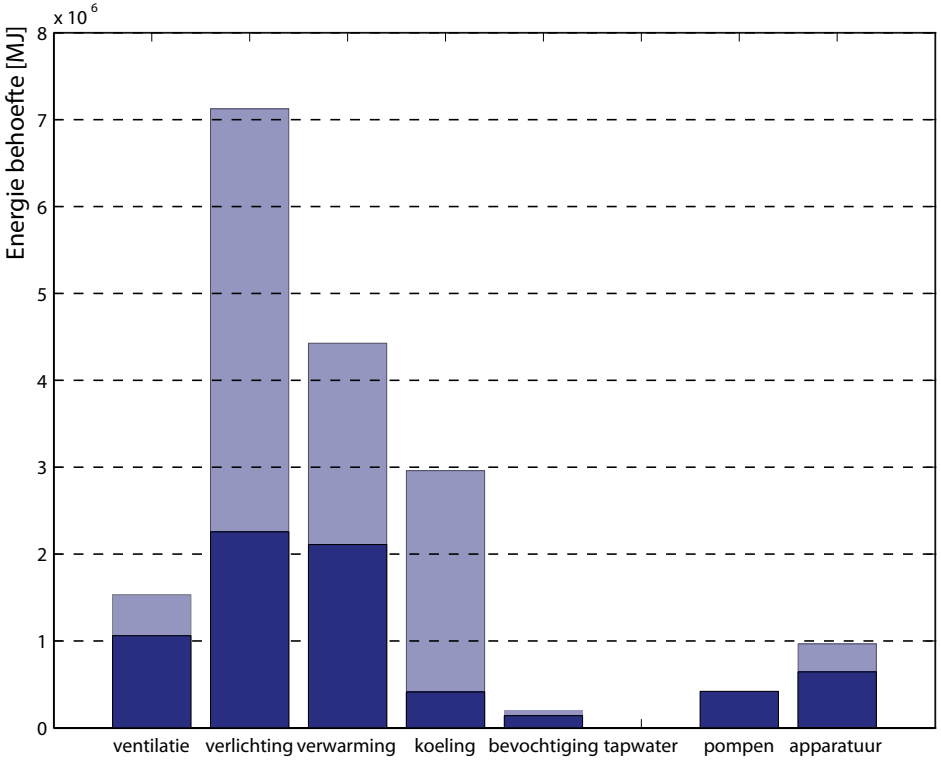
Energy demand pattern per energy theme



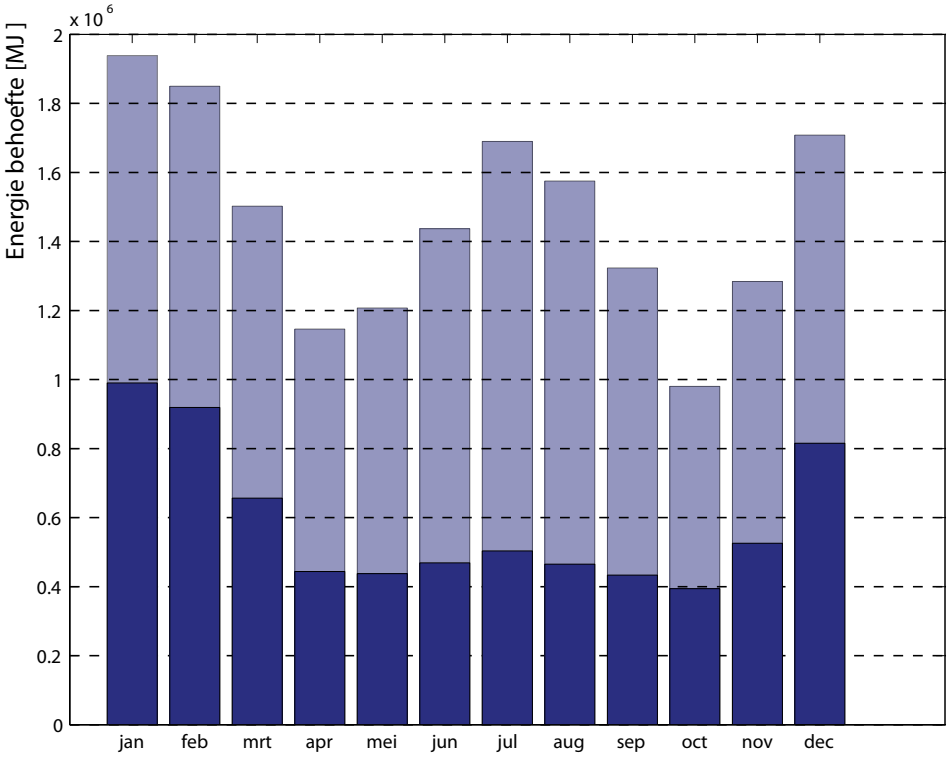
Influence of interventions on energy demand

Ingrepen	Energiereductie
Binnentemperatuur 19-24 graden	8,4%
Rc-waarde = 4	10,4%
Driedubbel glas	4,6%
Transparantie gevel: 10% meer glas	- 1,5%
Buitenzonwering	0,3%
Thermische massa (gemiddel –hoog)	3,1%
Natuurlijk ventileren	21,1%
Mechanische afvoer	5,1%
warmteterugwinning	11,9%
Verlichting	17,4%

Total energy demand per energy theme

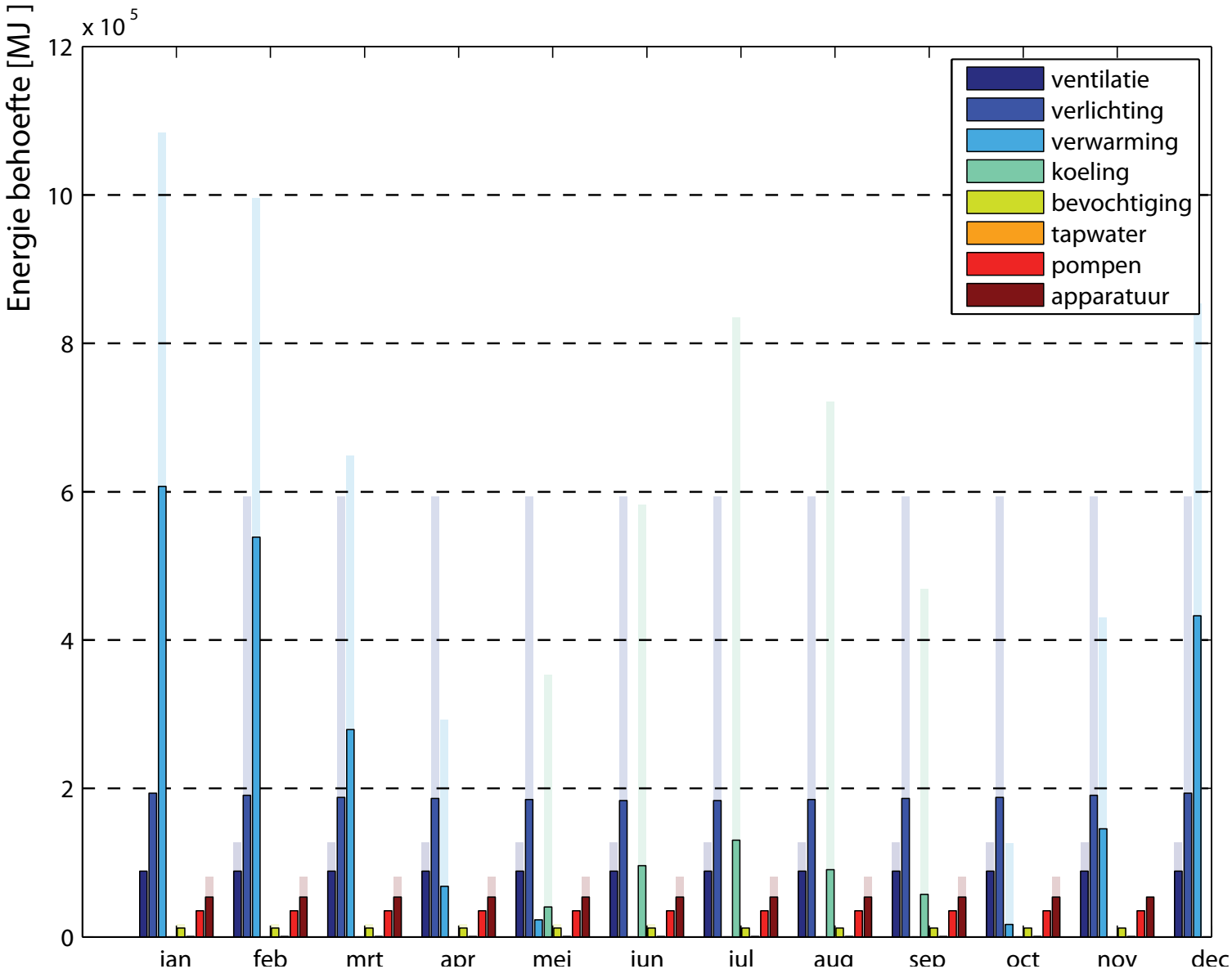


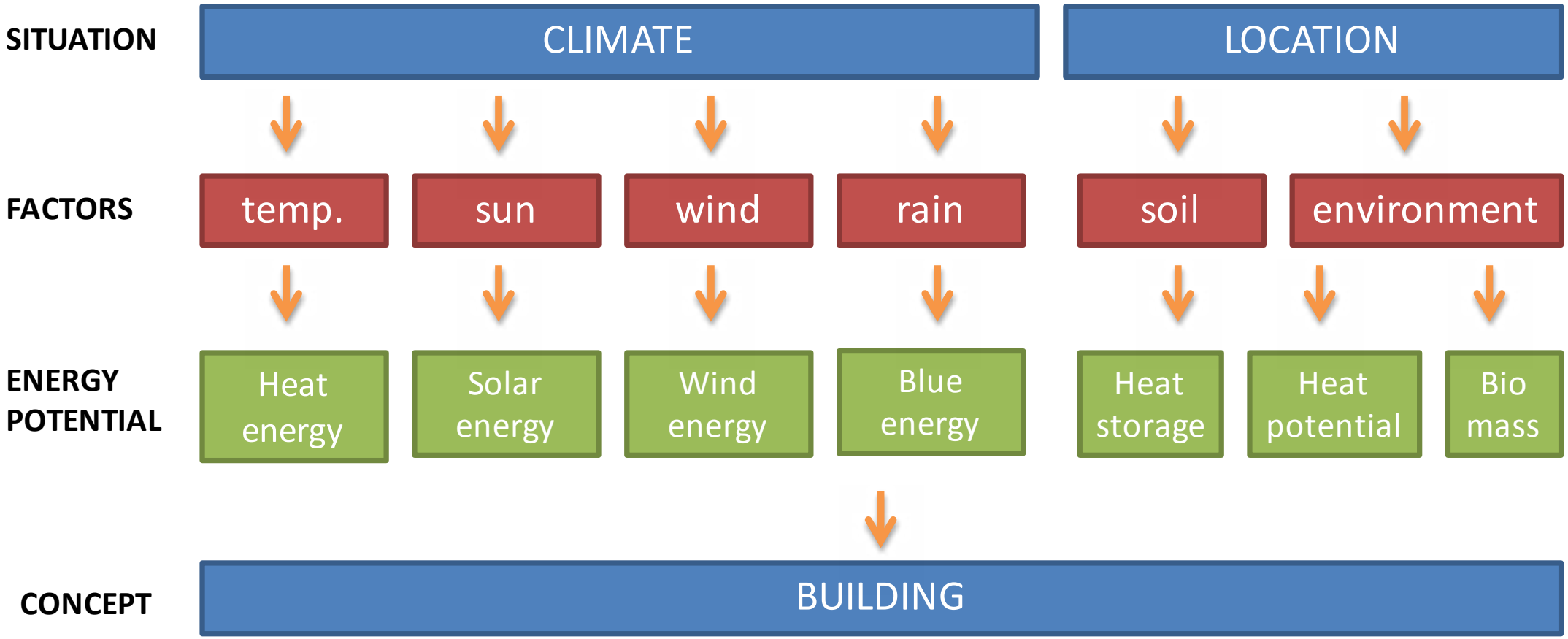
Energy demand pattern



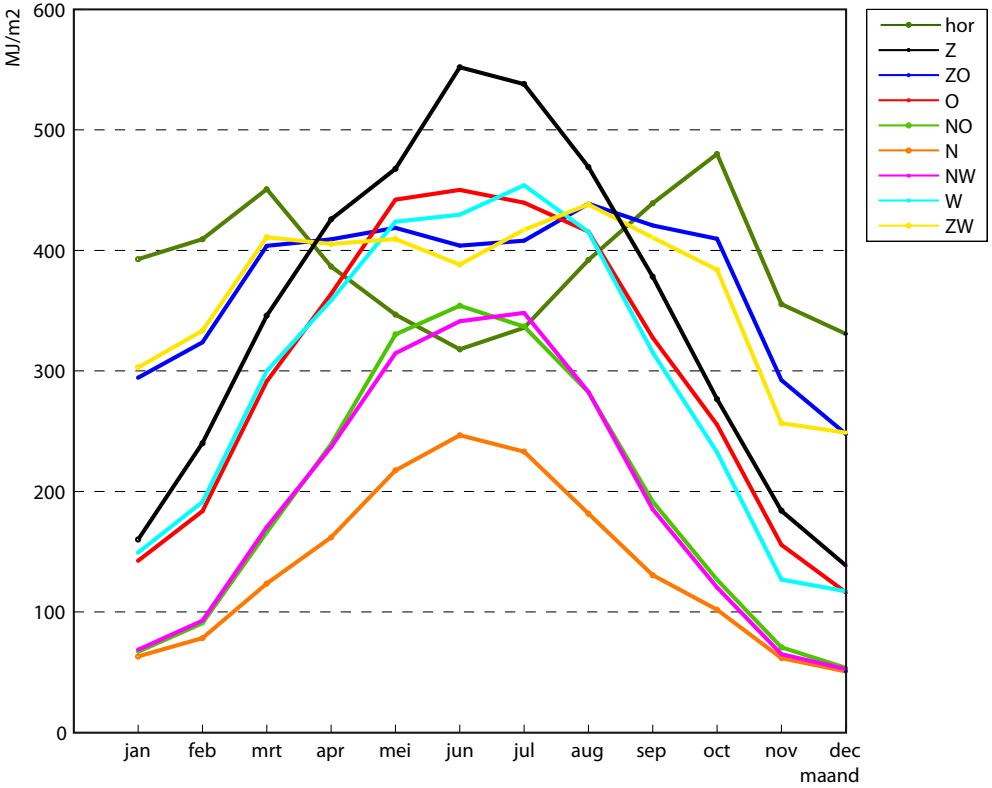
Totale energievraag:	7182598 MJ
Specifieke energievraag:	136 MJ/m2
Energiereductie:	60%

Energy demand pattern per energy theme

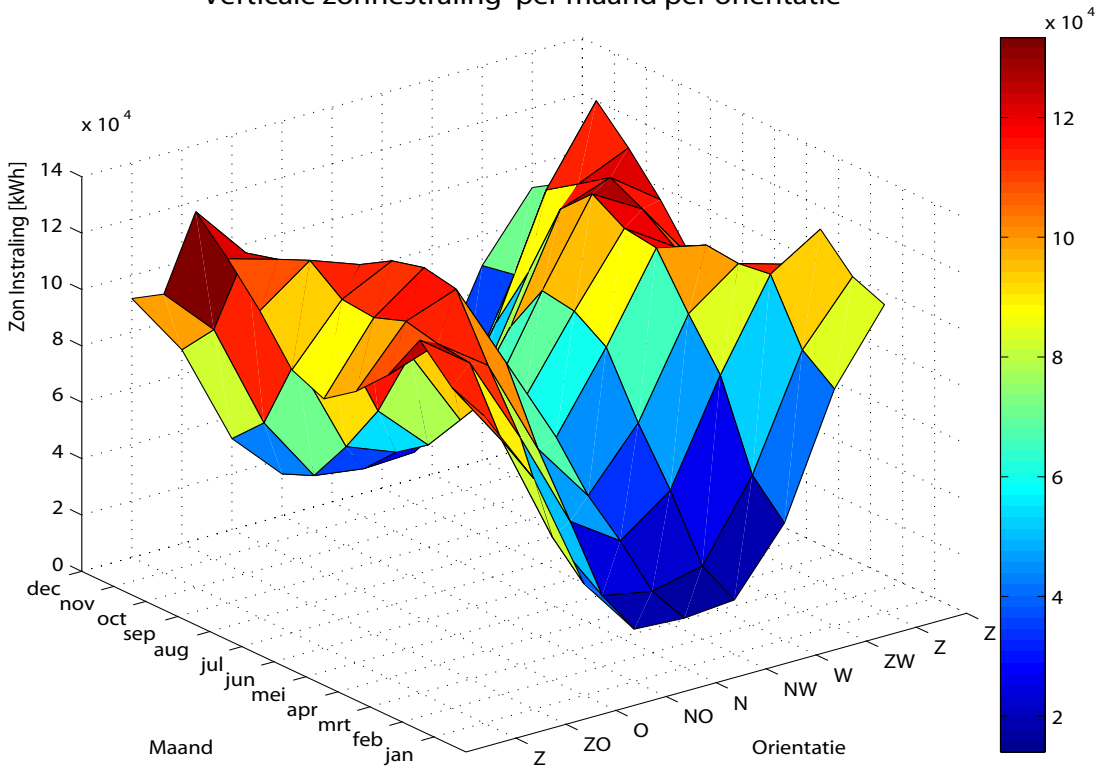



SITUATION
CLIMATE
LOCATION
FACTORS
temp.
sun
wind
rain
soil
environment
ENERGY POTENTIAL
Heat energy
Solar energy
Wind energy
Blue energy
Heat storage
Heat potential
Bio mass
CONCEPT
BUILDING

Horizontale globale straling en verticale straling



Verticale zonnestraling per maand per orientatie



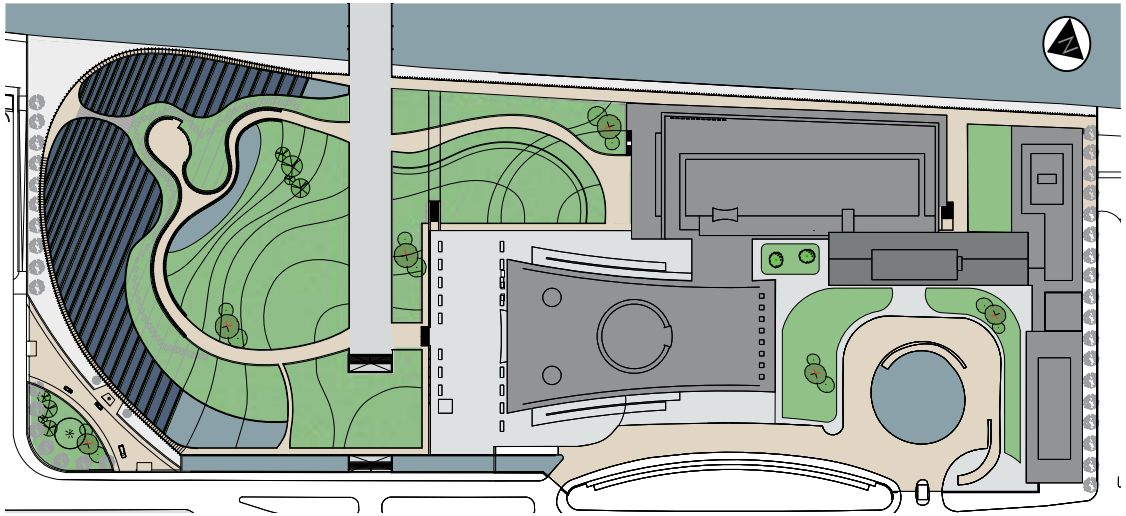
Zonnestudie samenvatting

Sunstudy

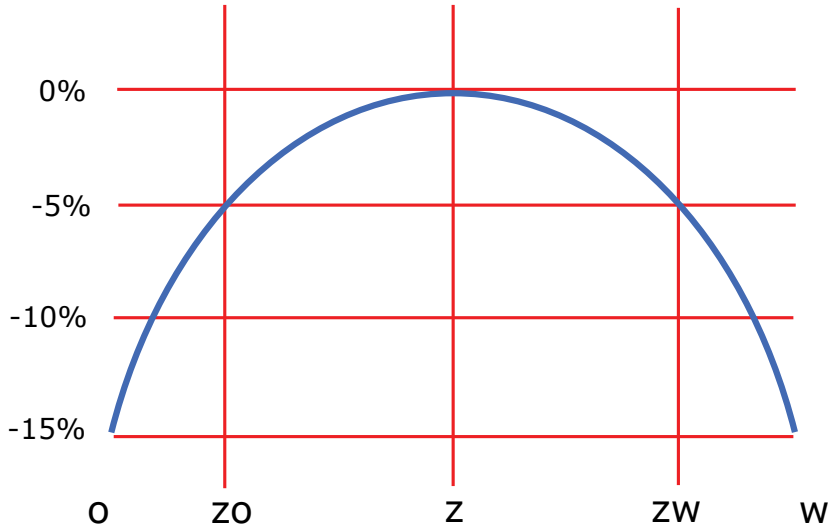
Gedeelte van locatie met meeste zon

DESIGN: orientation

orientation = SW--> 95% production

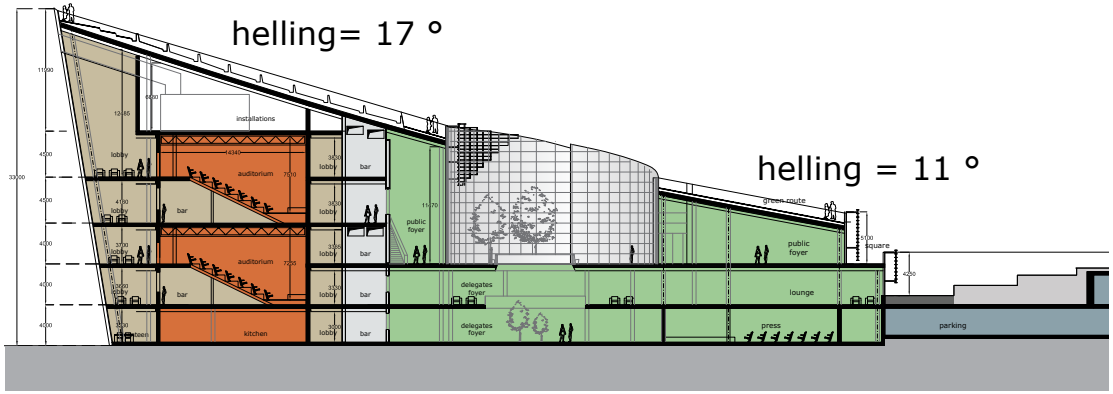


ORIENTATION AND PRODUCTION

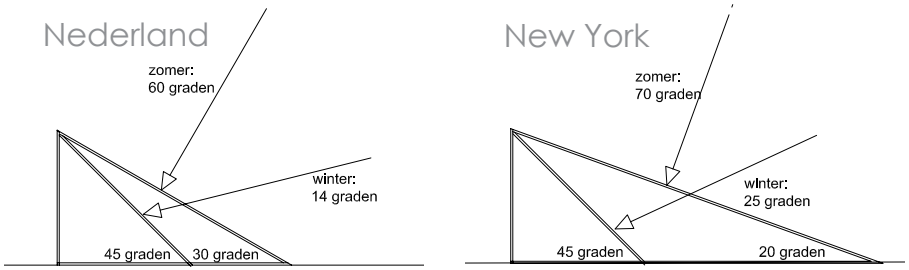


DESIGN: angle roof

--> 95-97% opwekking



SUN ANGLE

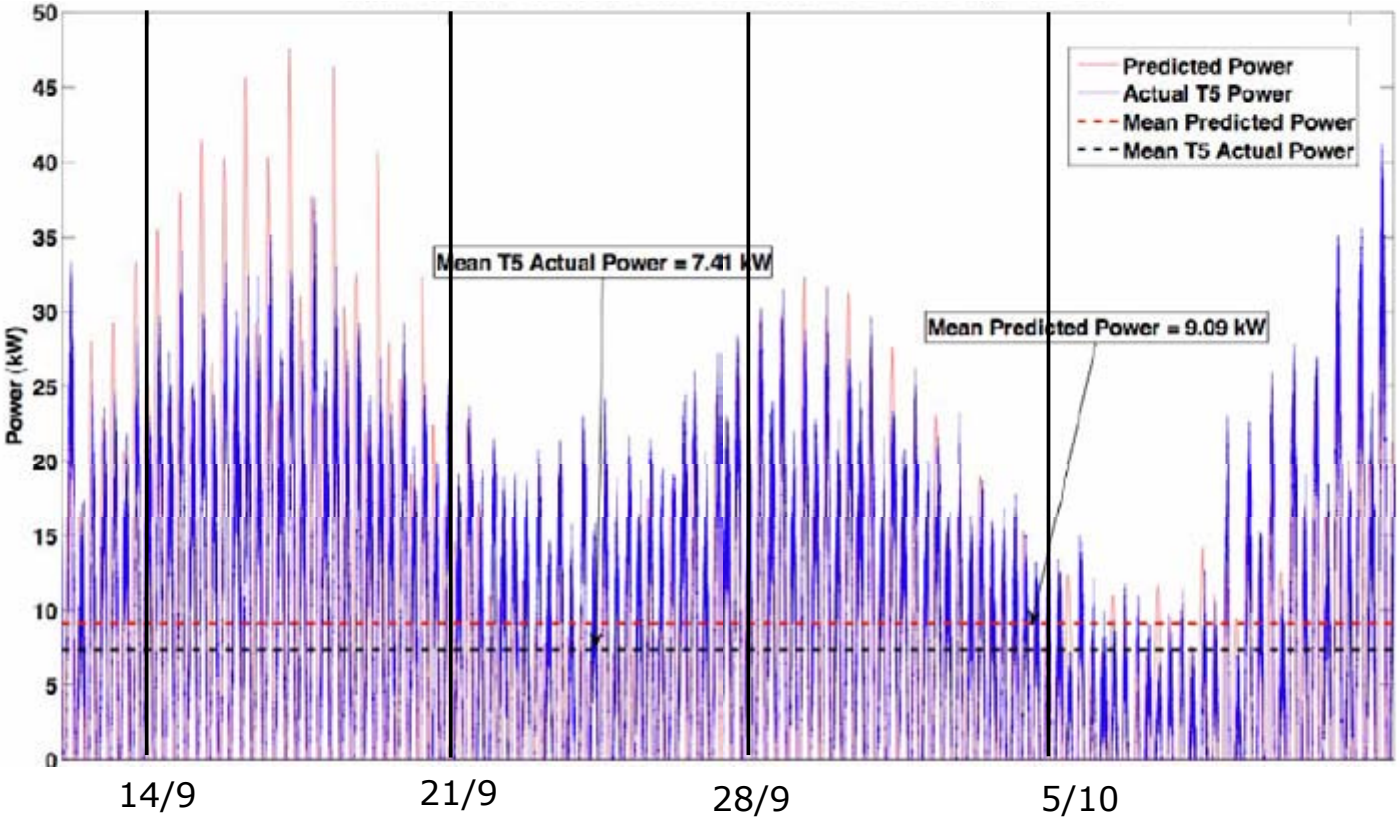


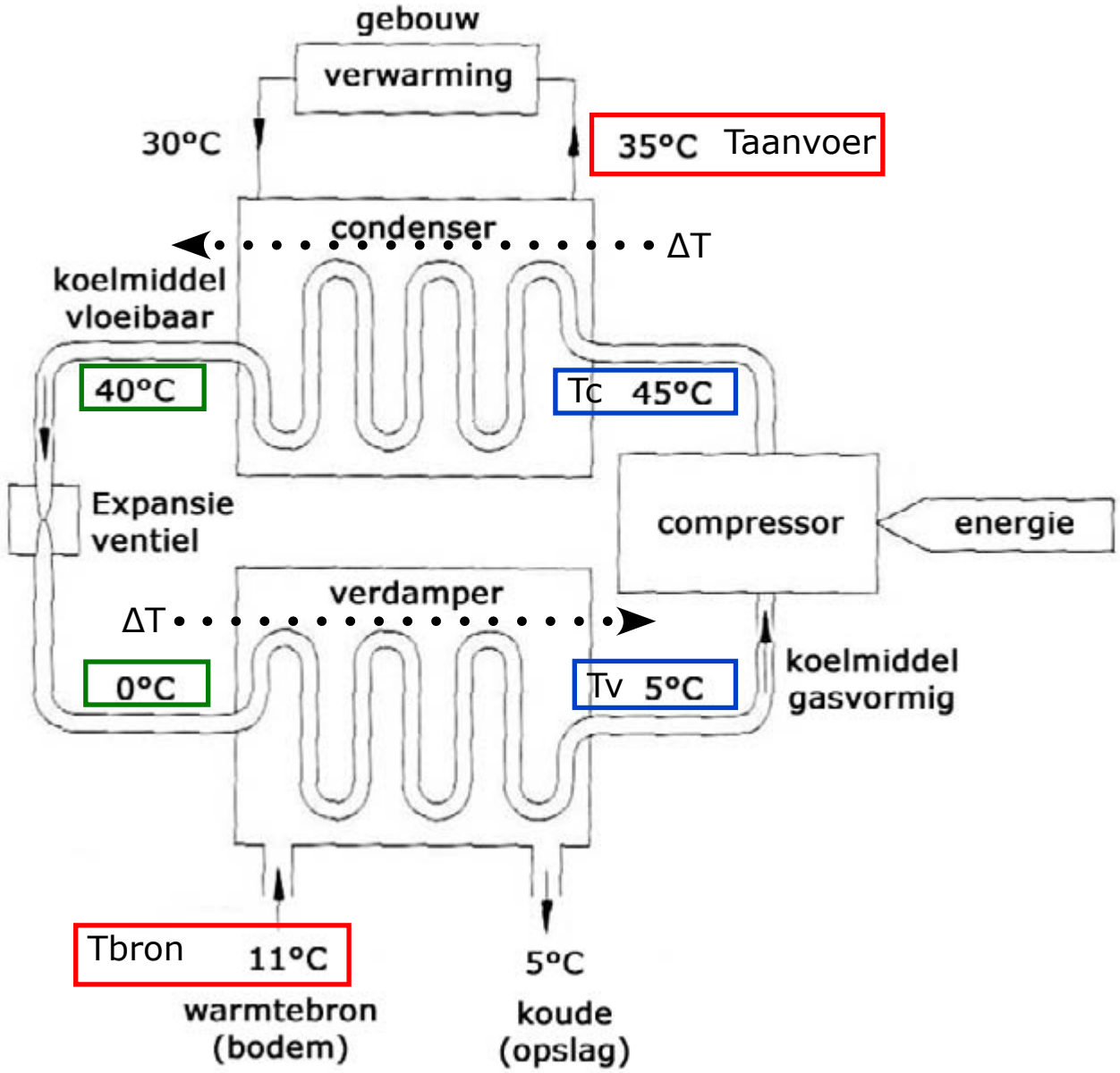
Angle vs efficienty

hellingshoek op het zuiden	o°	15°	20°	45°	60°	75°	90°	
opbrengst t.o.v. optimum	90	97	100	100	97	92	80	%

East river in Manhattan

Getijdepatroon



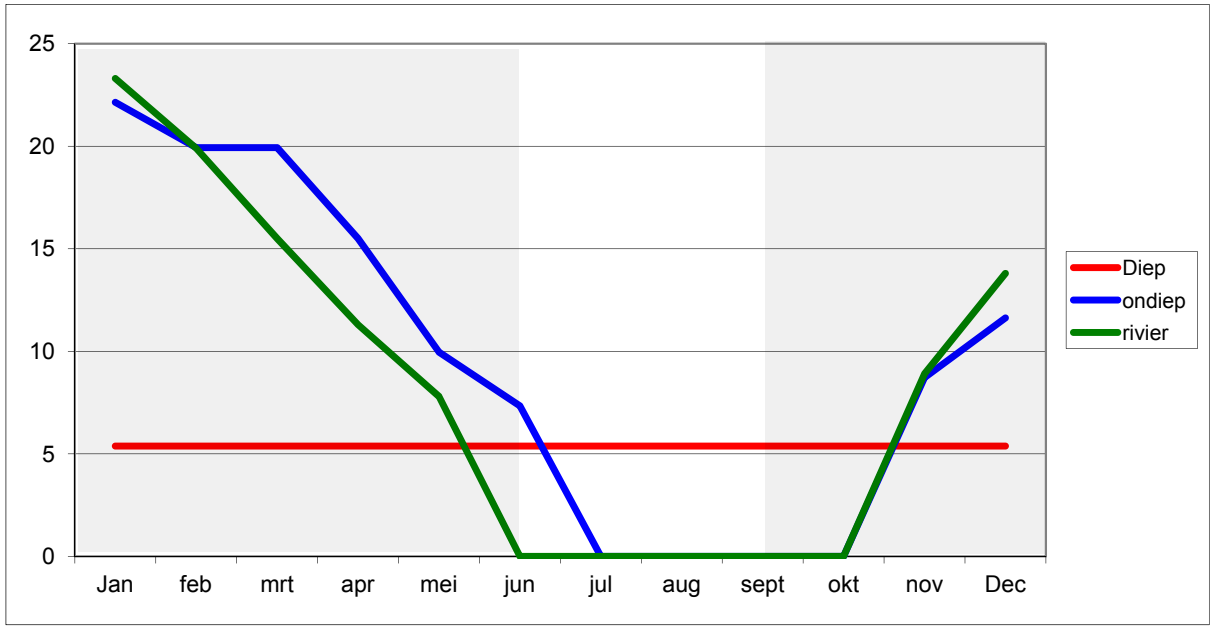


EFFICIENCY:

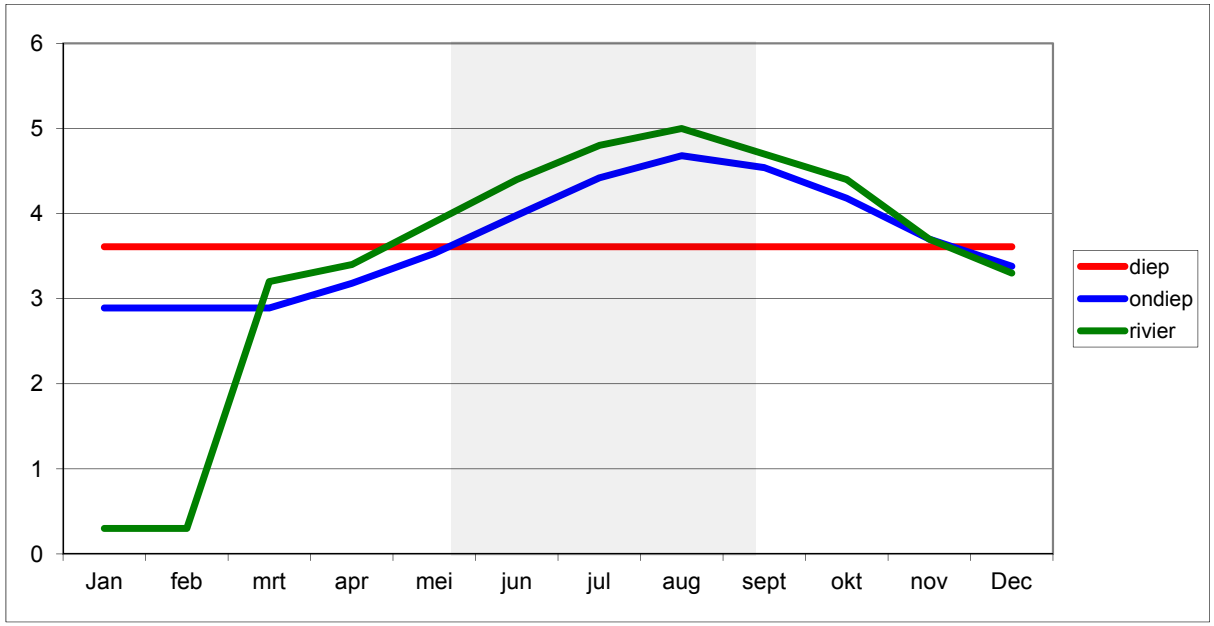
- temperature heat source
- COP heat pump

$$COP = \eta \times \frac{Tc}{Tc-Tv}$$

COP COOLING



COP HEATING



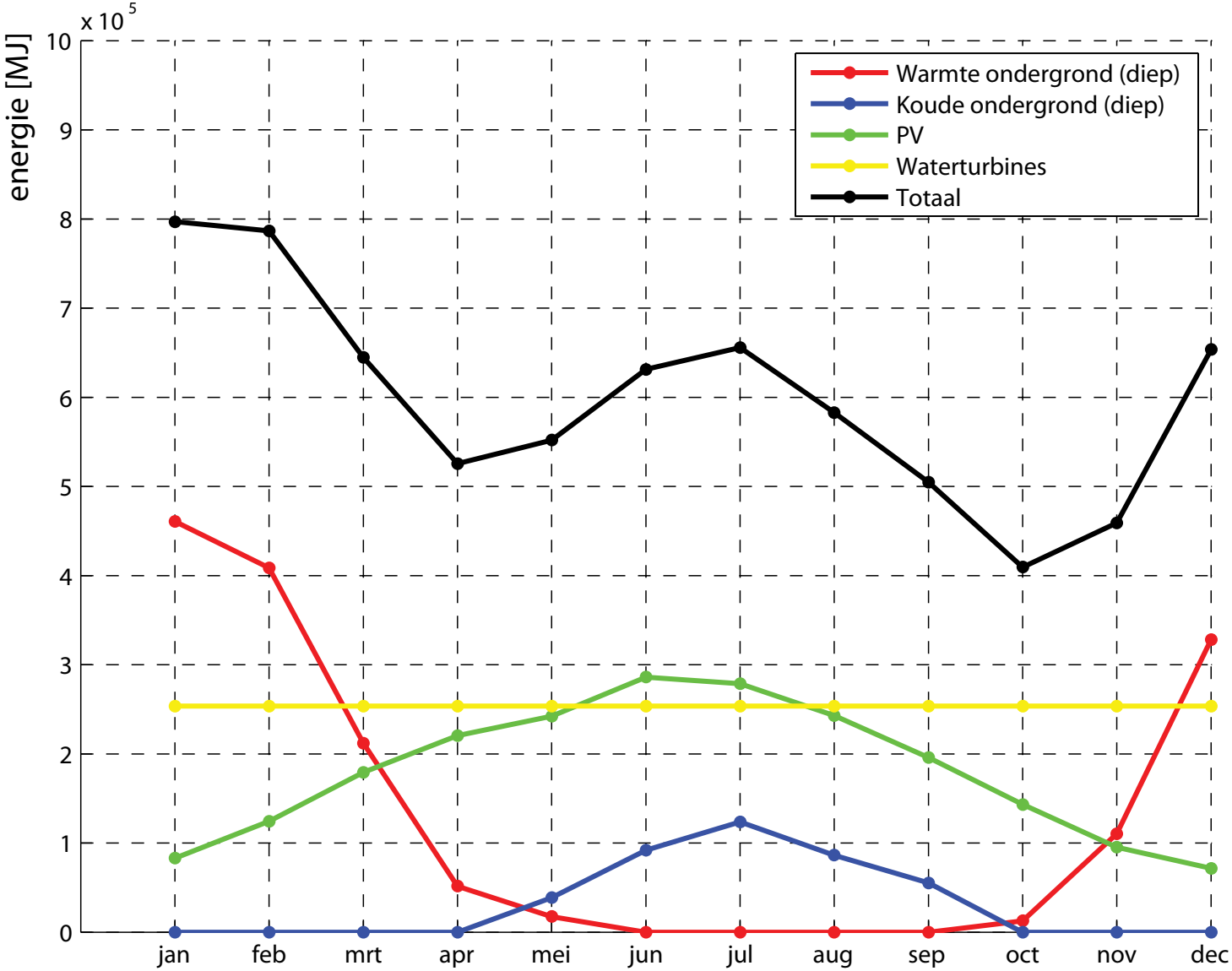
ELECTRICITY PRODUCTION

Energiebron	Energieopbrengst per jaar
Zon	408 MJ/m2
Wind	720 MJ/m2
Water	2340 MJ/m2
Biomassa	8.9 MJ/m2

HEAT PRODUCTION

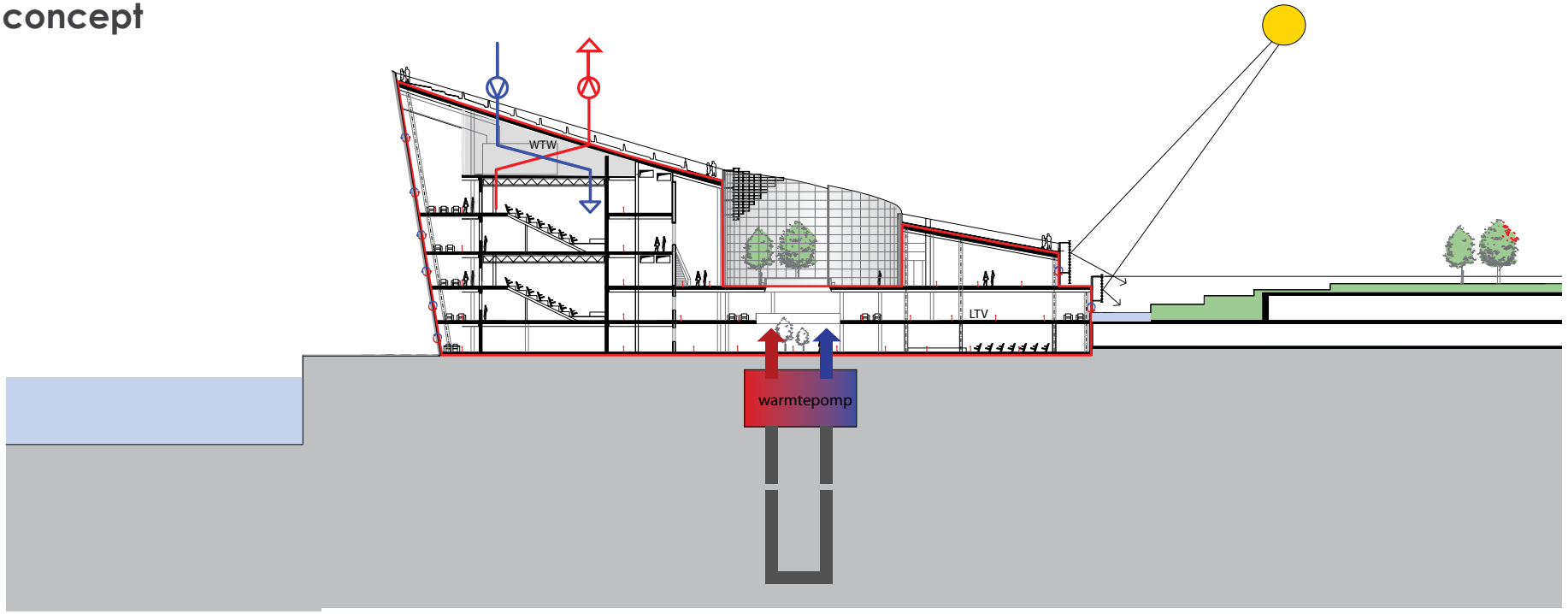
Energiebron	Energieobrengst per jaar
Zon	1404 MJ/m2
Water (rivier)	154 MJ/m2
Ondiepe ondergrond	173 MJ/m2
Diepe ondergrond	1863 MJ/m2

Total energy production per energy source

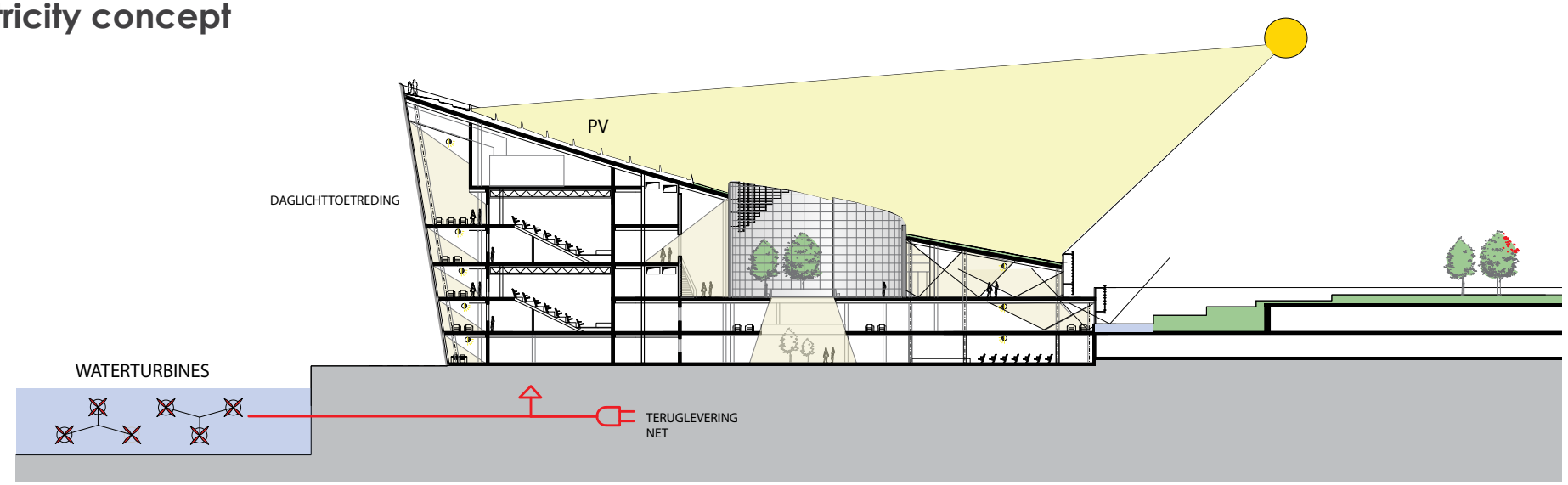


1. 4400 m2 PV
2. 13 turbines
3. Boorputten diepe ondergrond

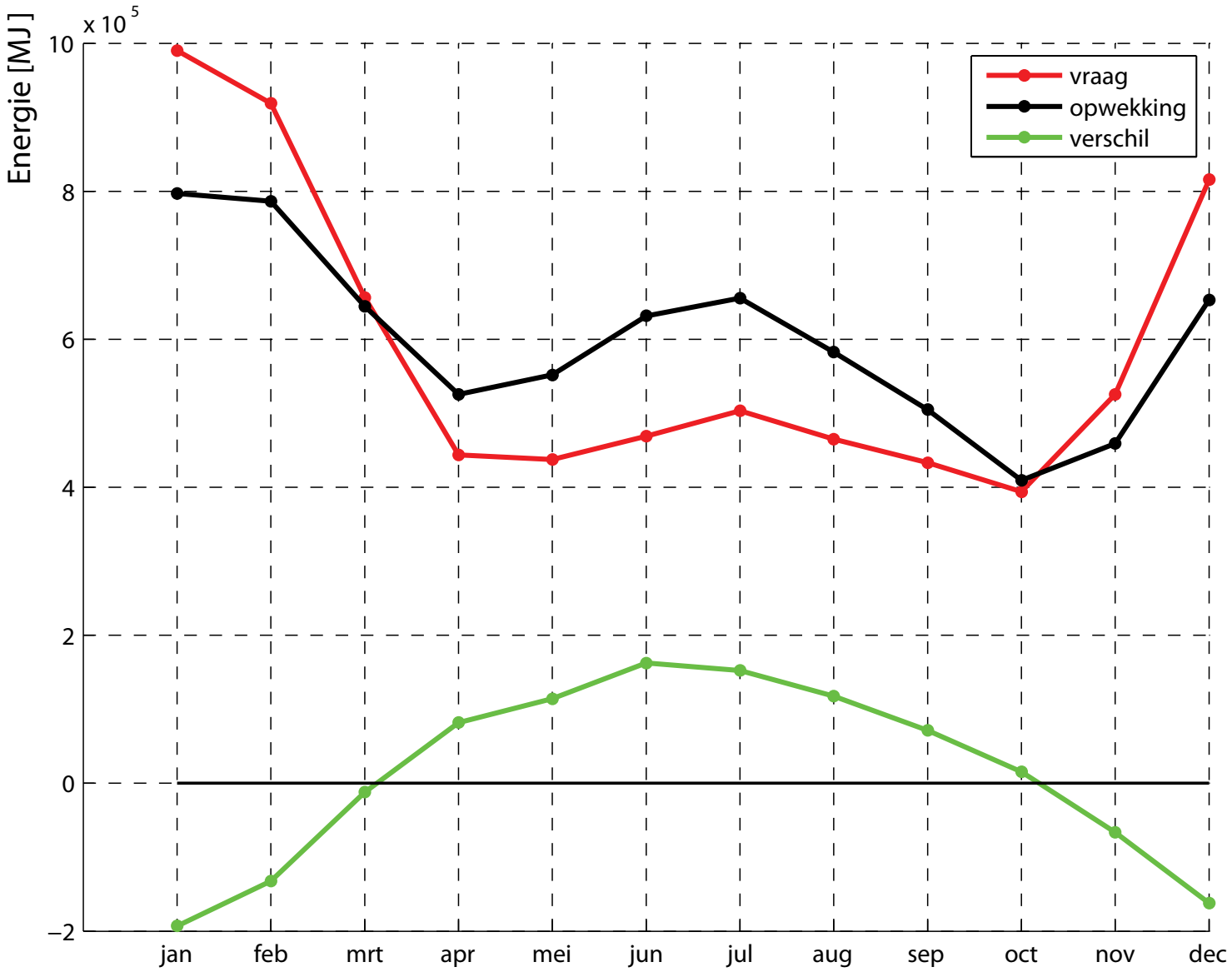
Heat concept



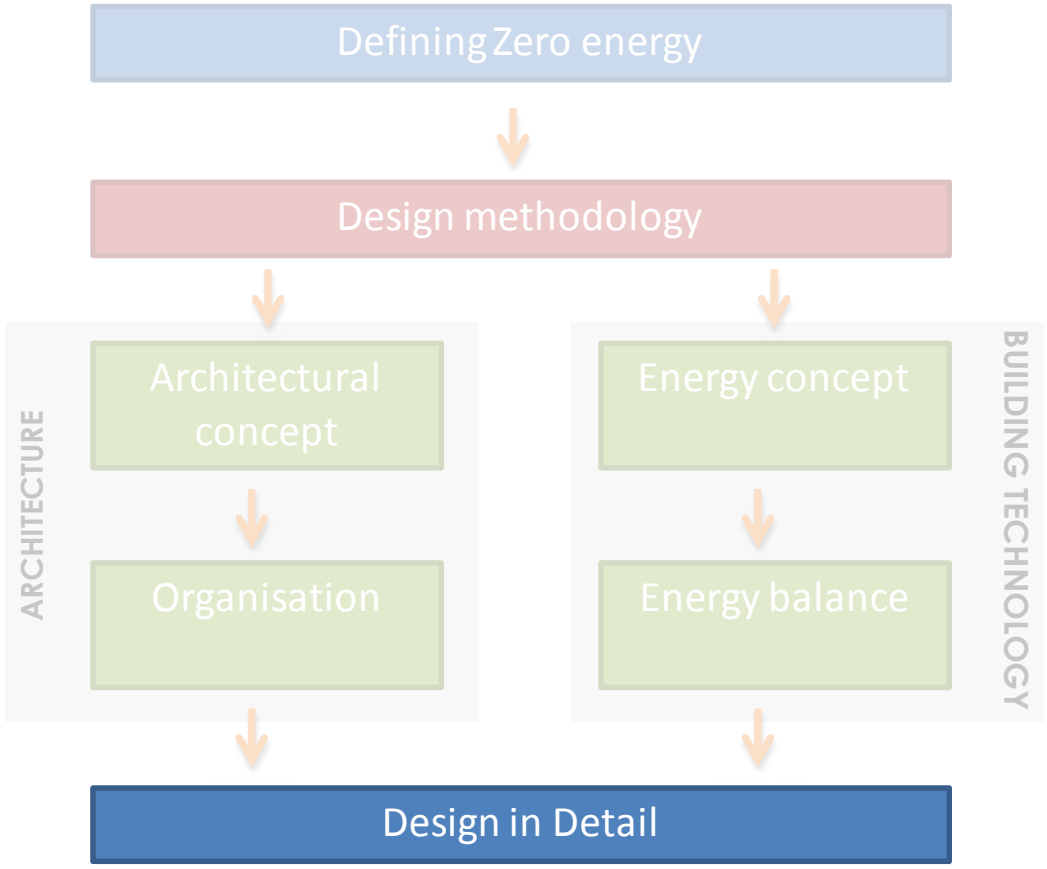
Elektricity concept

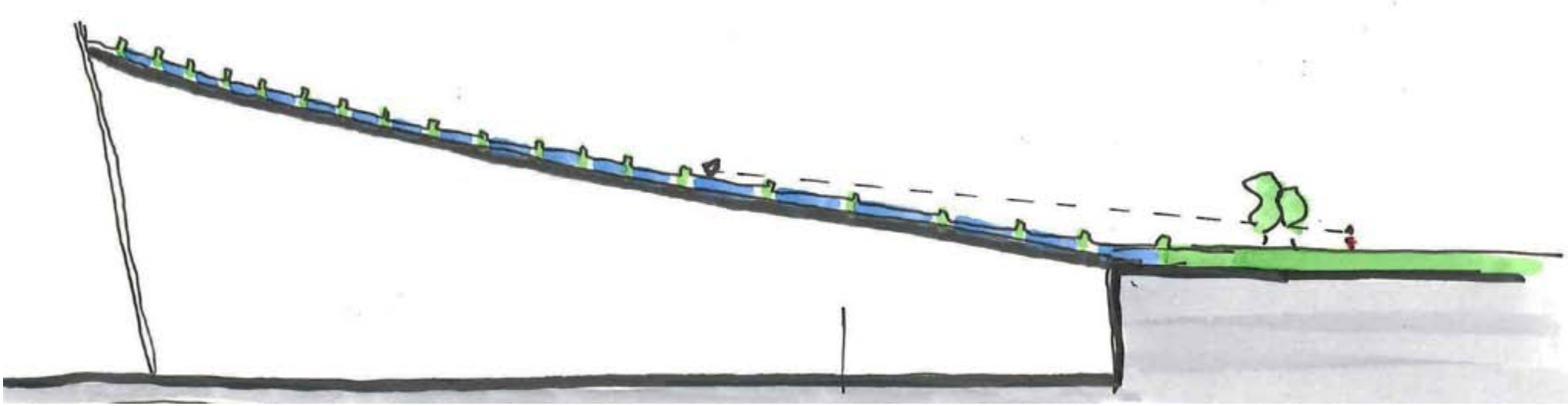


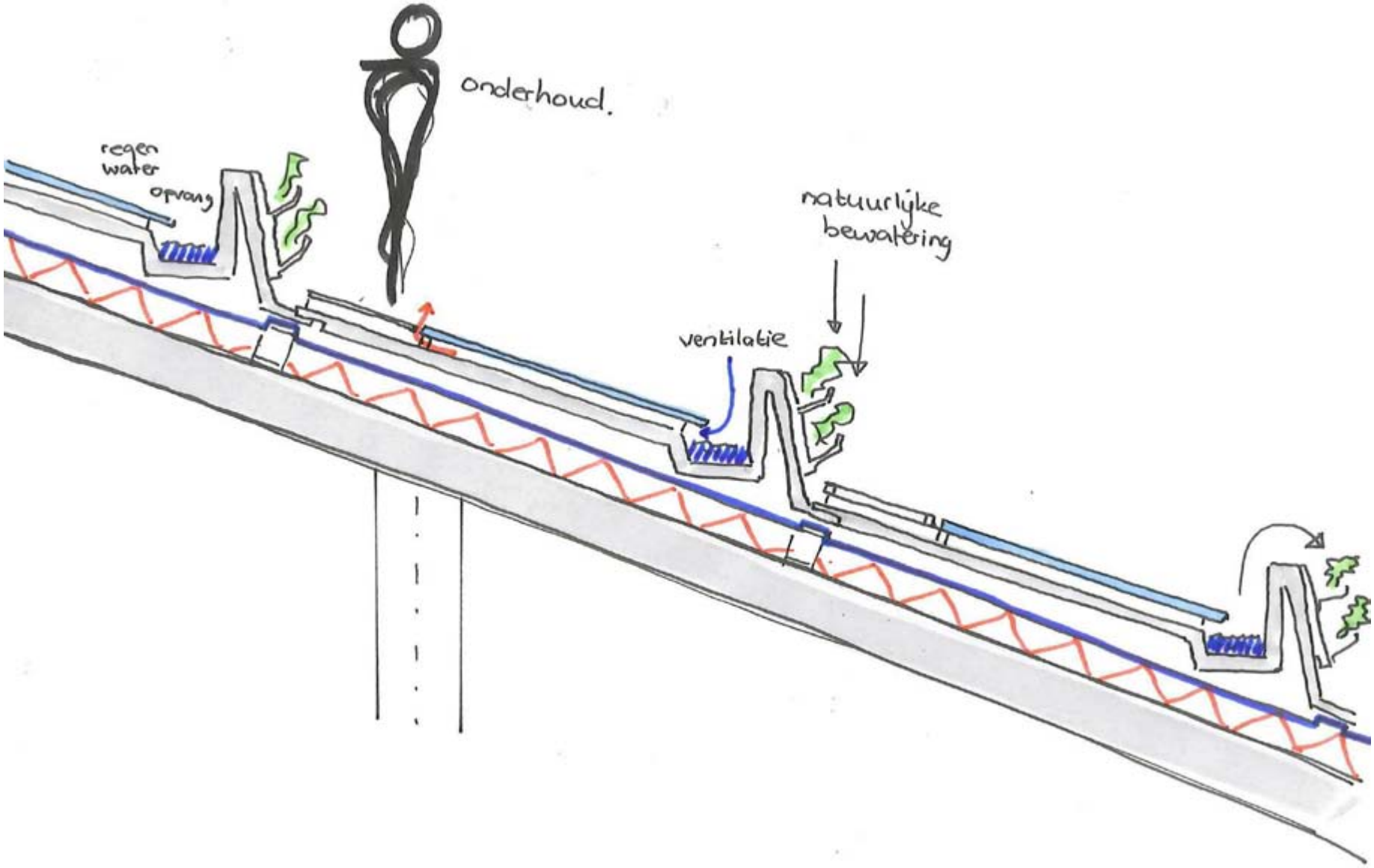
Total energy demand and production per month

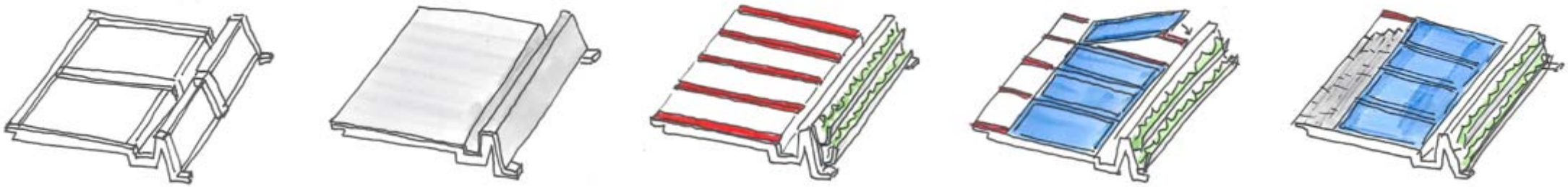


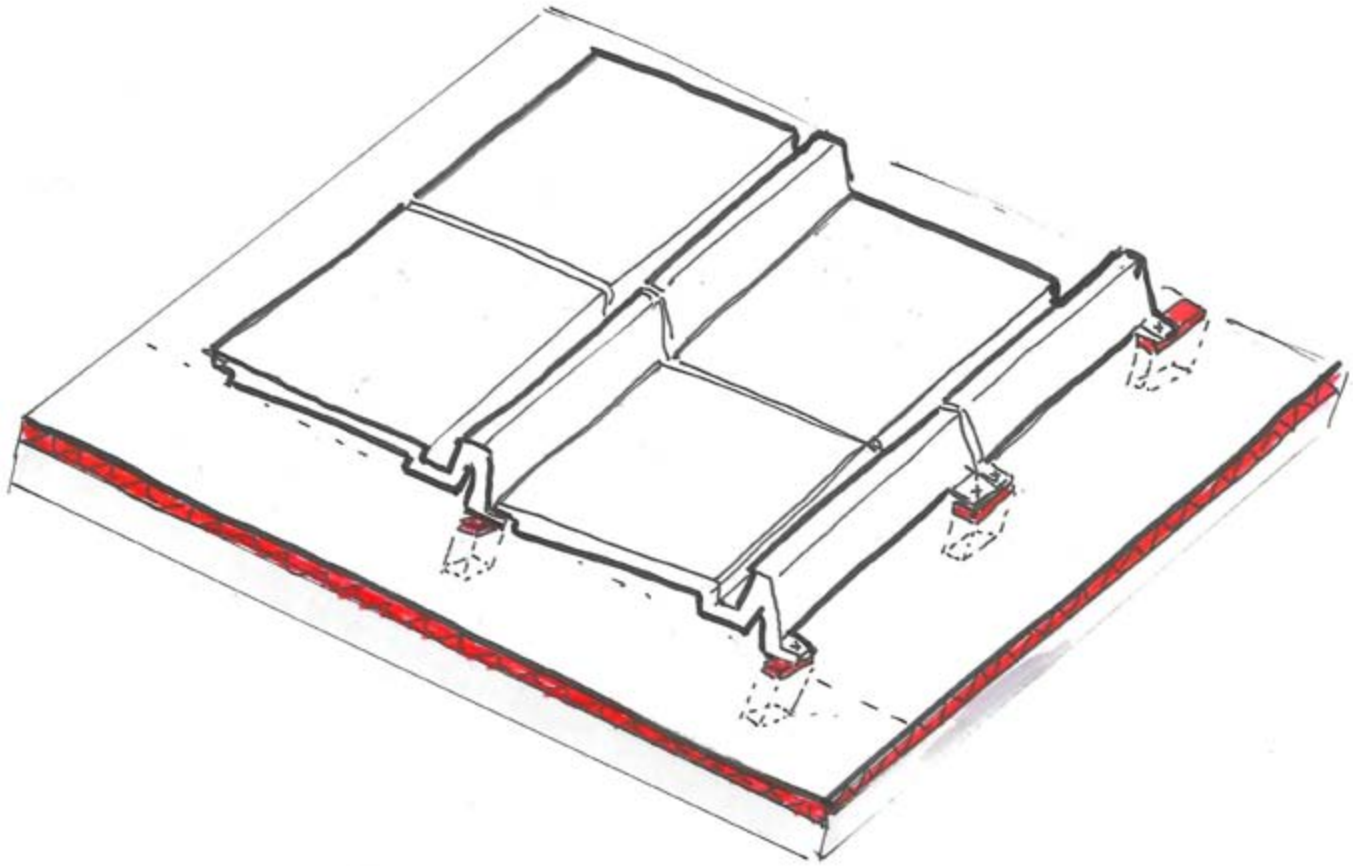
VAN
CONCEPT ONTWERP
TOT
DEFINITIEF ONTWERP



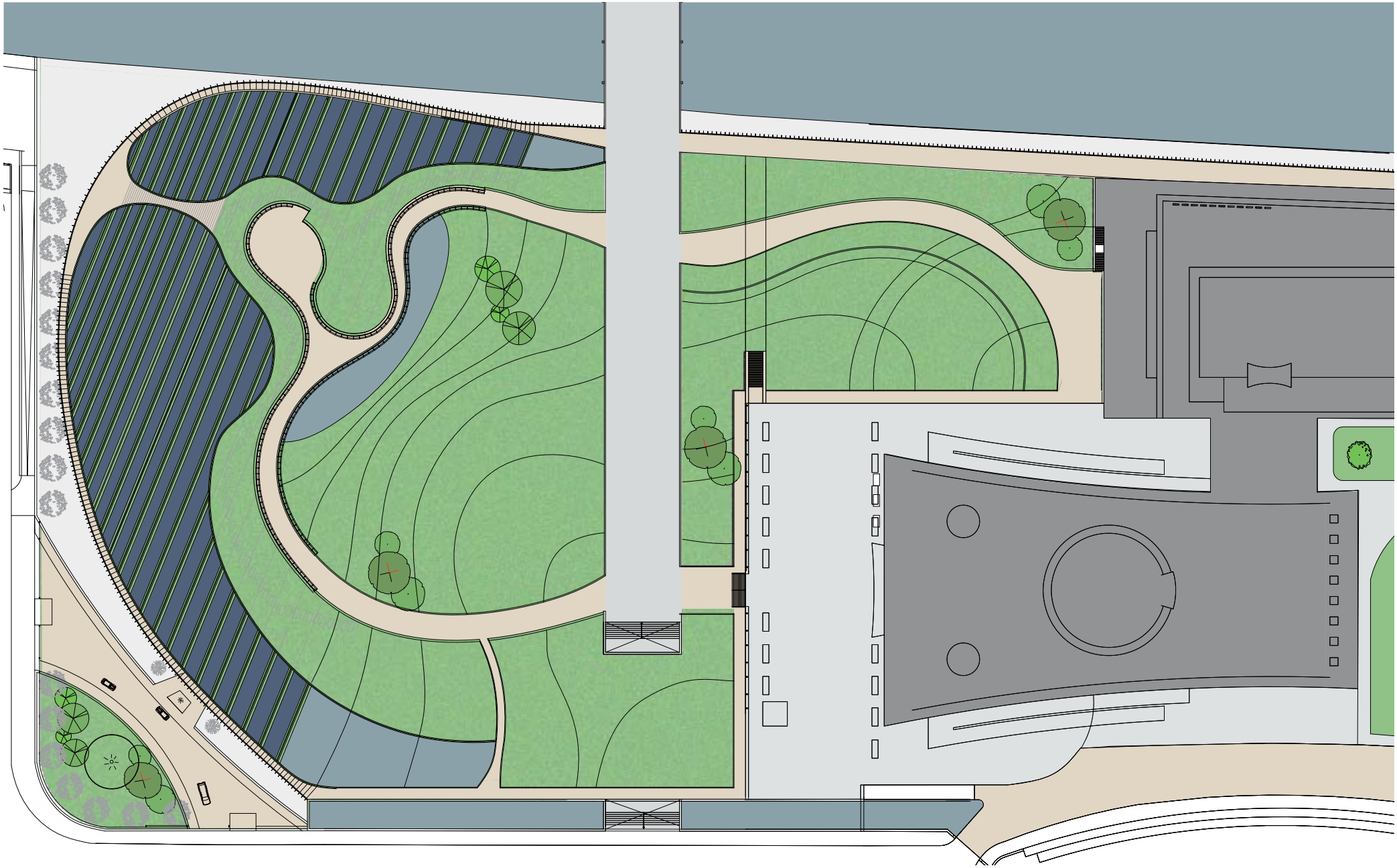


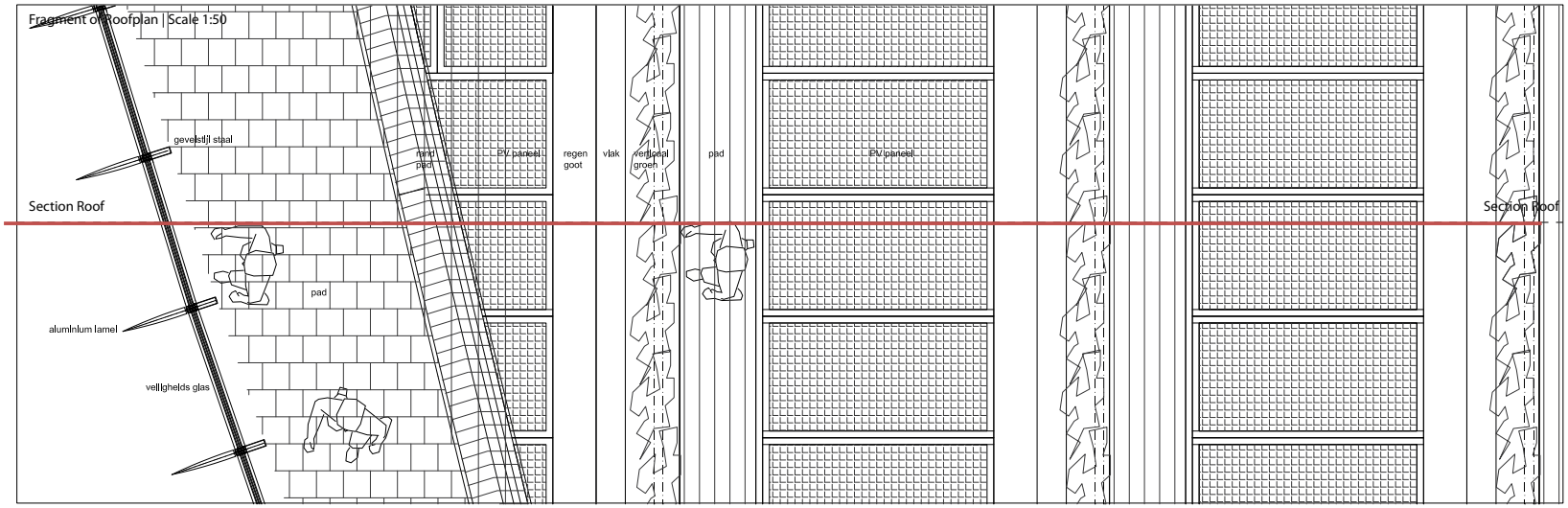

onderhoud.
regen water
opvang
natuurlijke bewatering
ventilatie

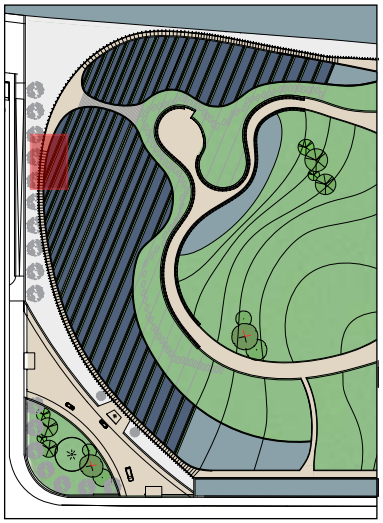


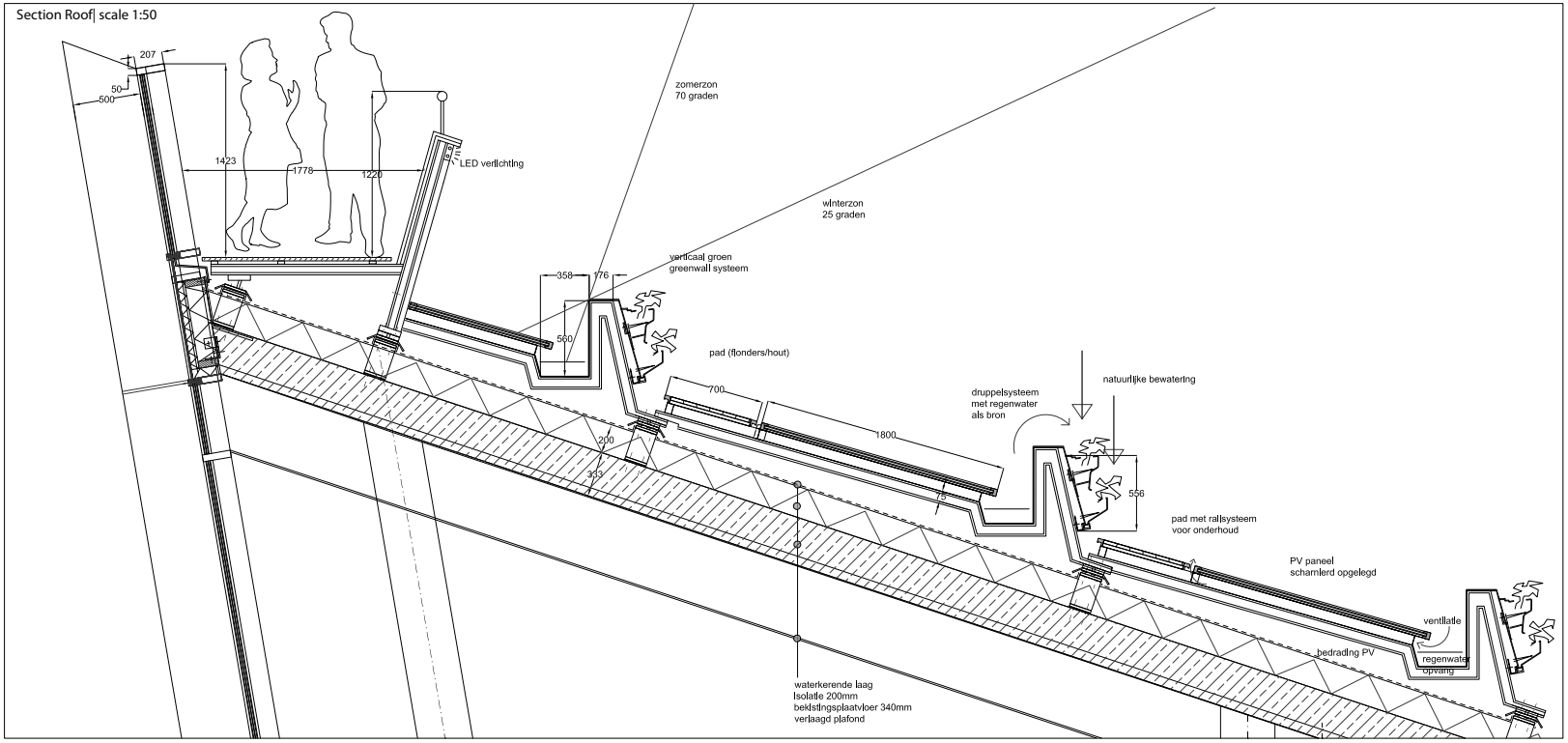


ROOF FRAGMENTS

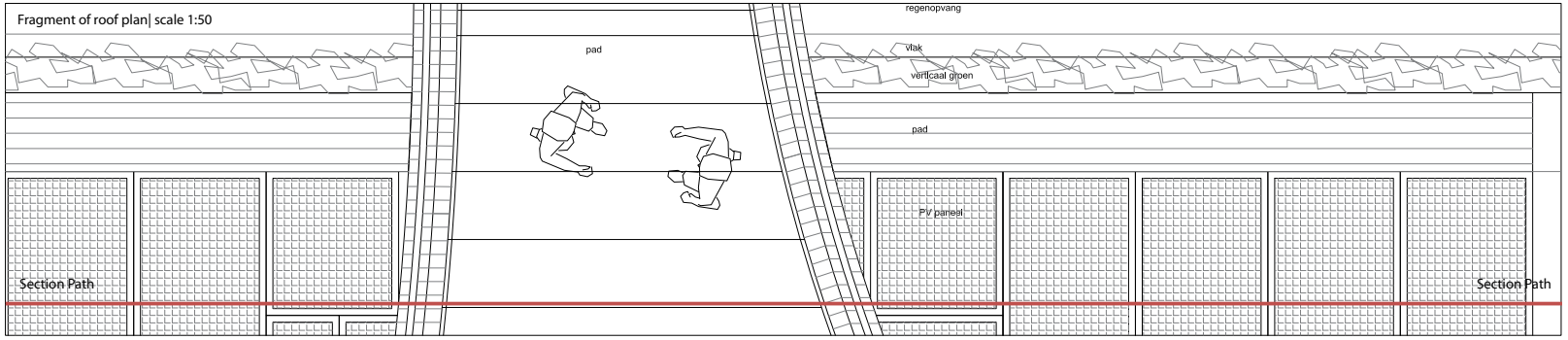


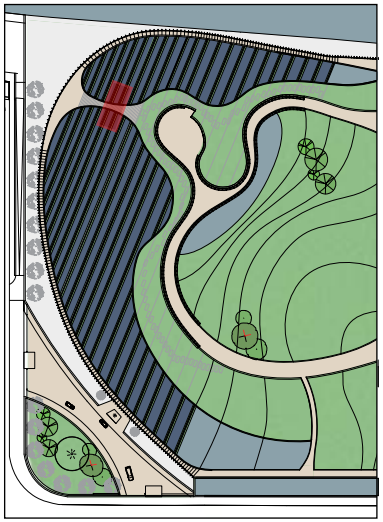

Fragment of Roofplan | Scale 1:50
gevelstijl staal
rand pad
PV paneel
regen goot
vlak
verticaal groen
pad
PV paneel
Section Roof
Section Roof
pad
aluminium lamel
veiligheids glas



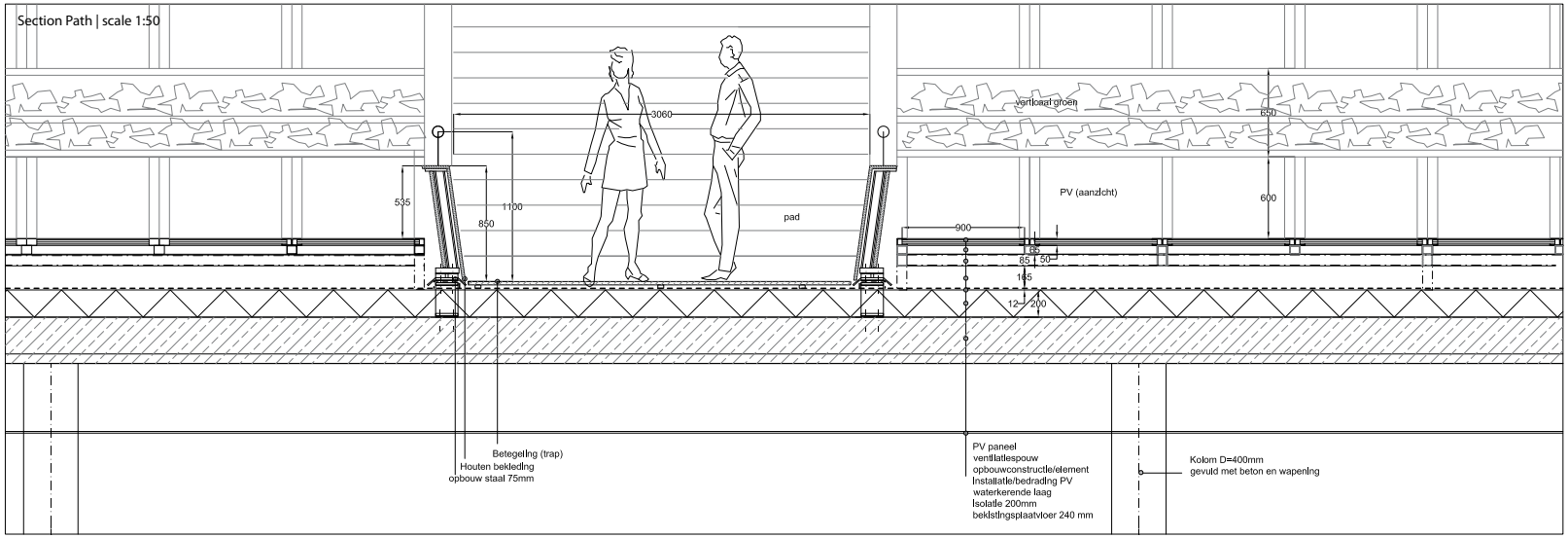

Section Roof| scale 1:50
207
50
500
1423
1778
1220
LED verlichting
zomerzon
70 graden
winterzon
25 graden
verticaal groen
greenwall systeem
358
176
560
pad (flonders/hout)
700
1800
druppelsysteem
met regenwater
als bron
natuurlijke bewatering
200
333
556
pad met railsysteem
voor onderhoud
PV paneel
schamierd opgelegd
ventilatie
bedrading PV
regenwater
opvang
waterkerende laag
Isolatie 200mm
bekistingsplaatvloer 340mm
verlaagd plafond

Fragment Roof Plan

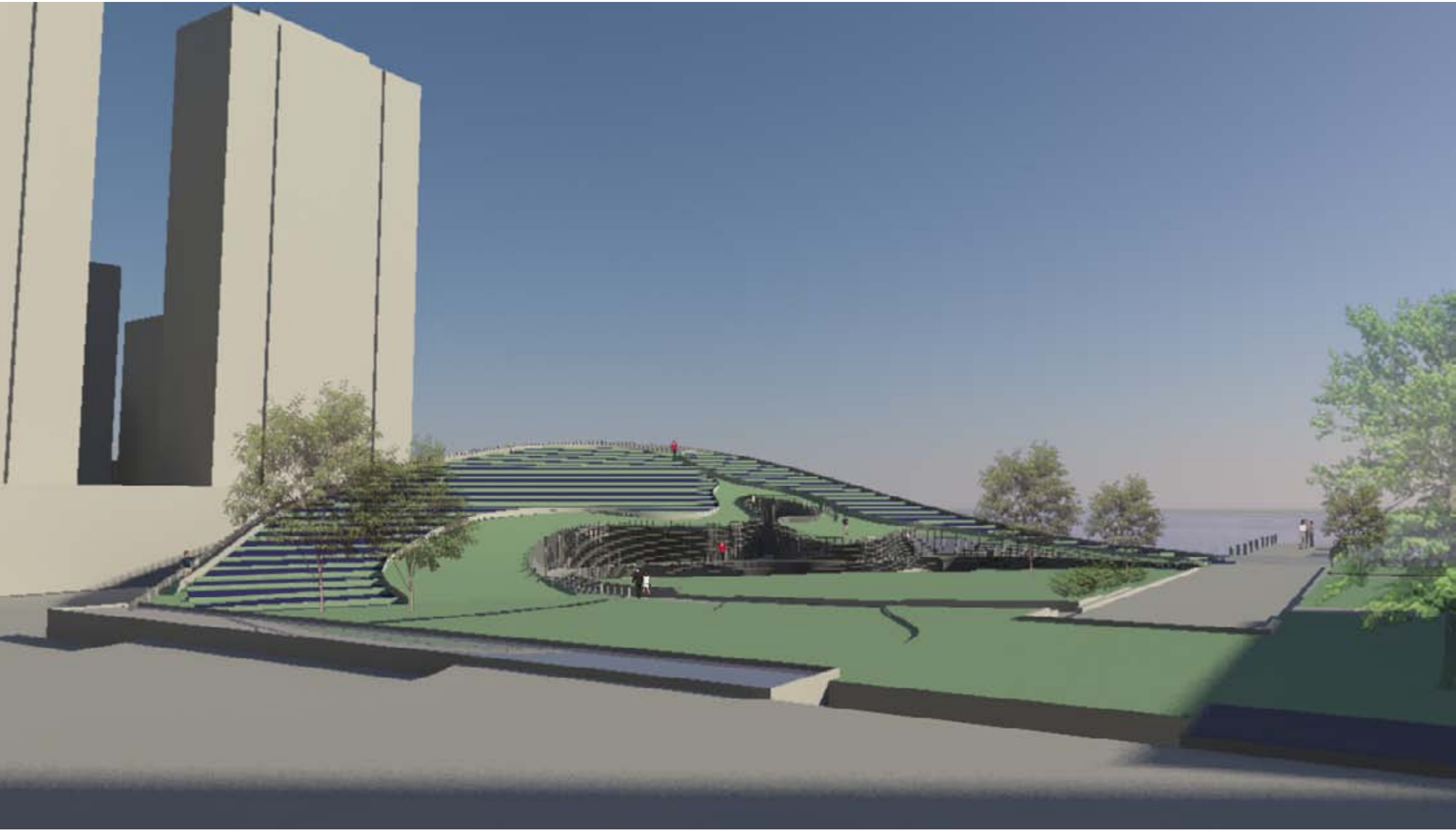




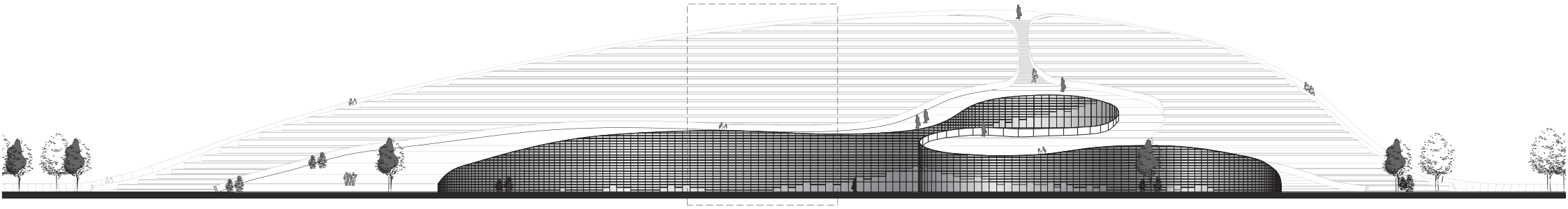
Fragment Roof Section



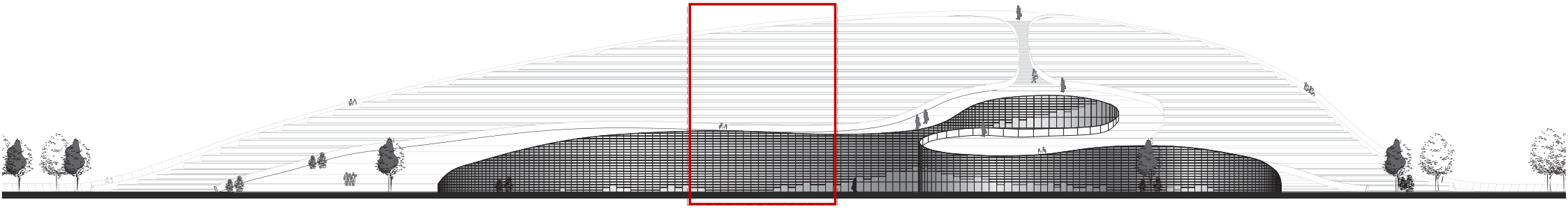
IMPRESSION ROOF



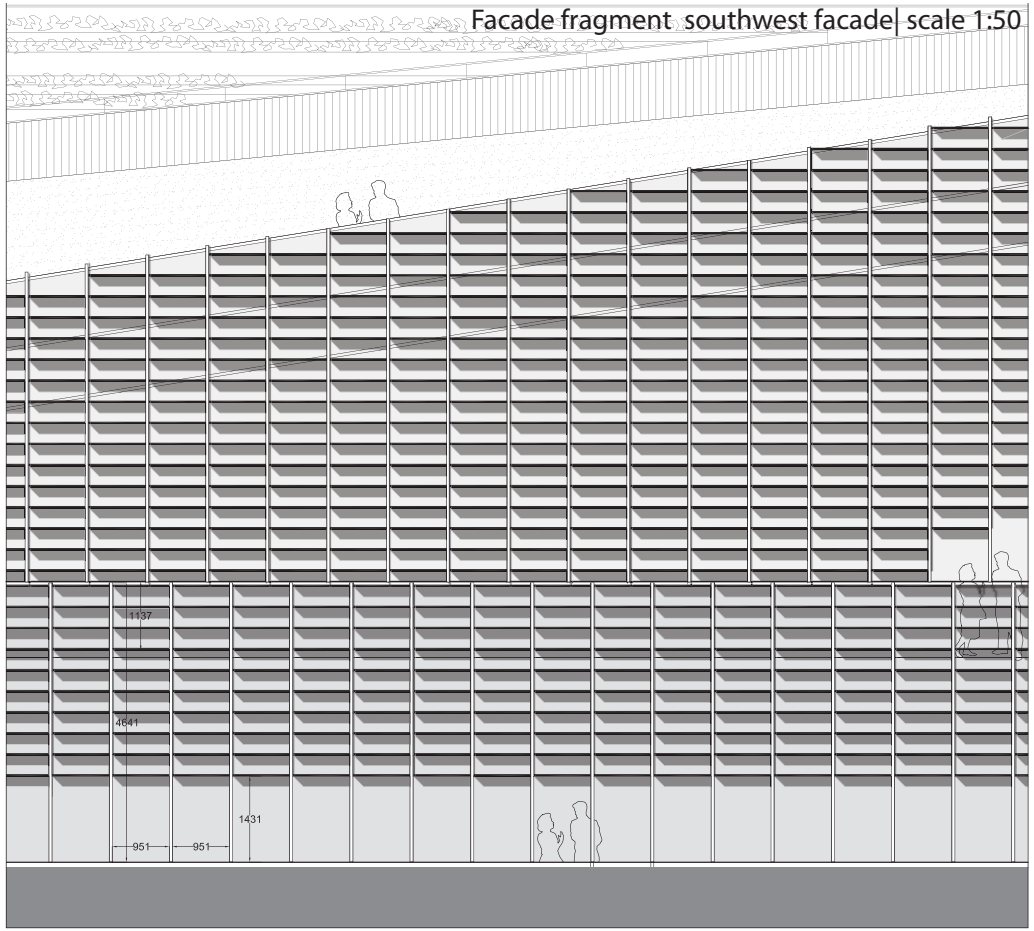
UNEC SOUTH FACADE



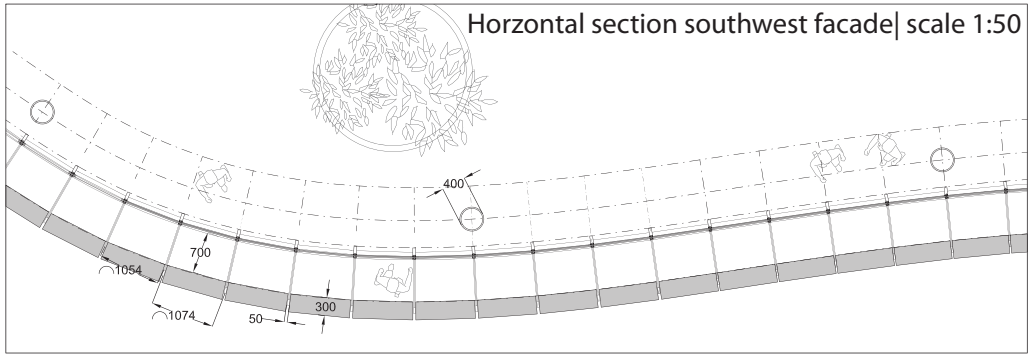
UNEC SOUTH FACADE



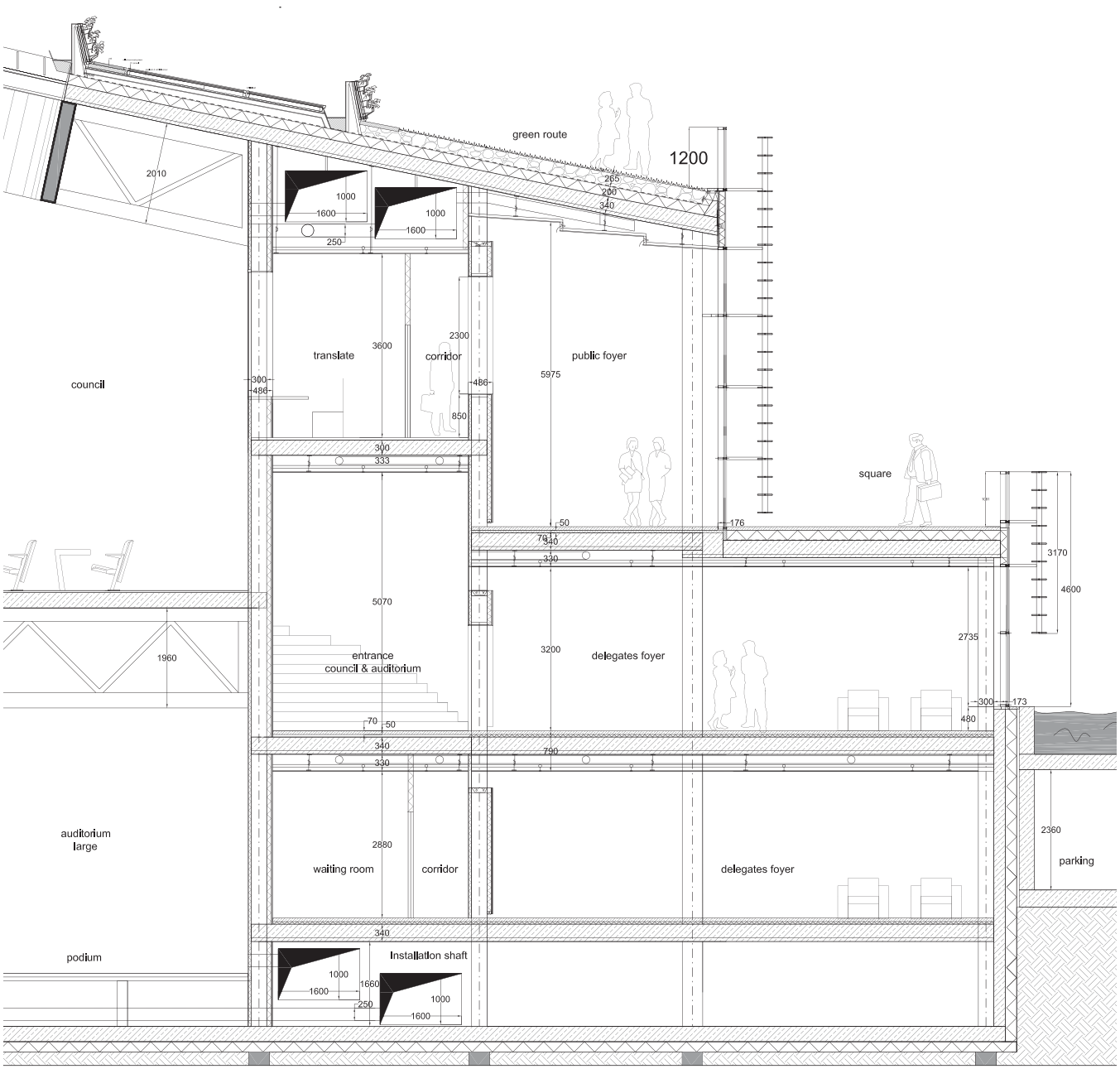
Fragment South Facade



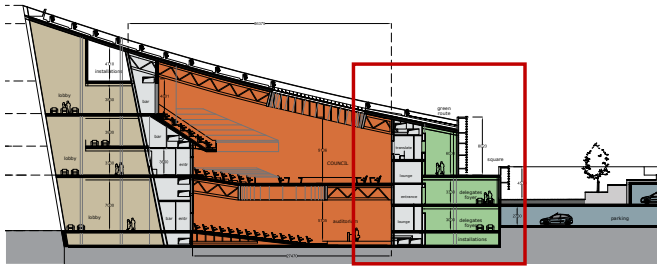
Fragment Floor plan

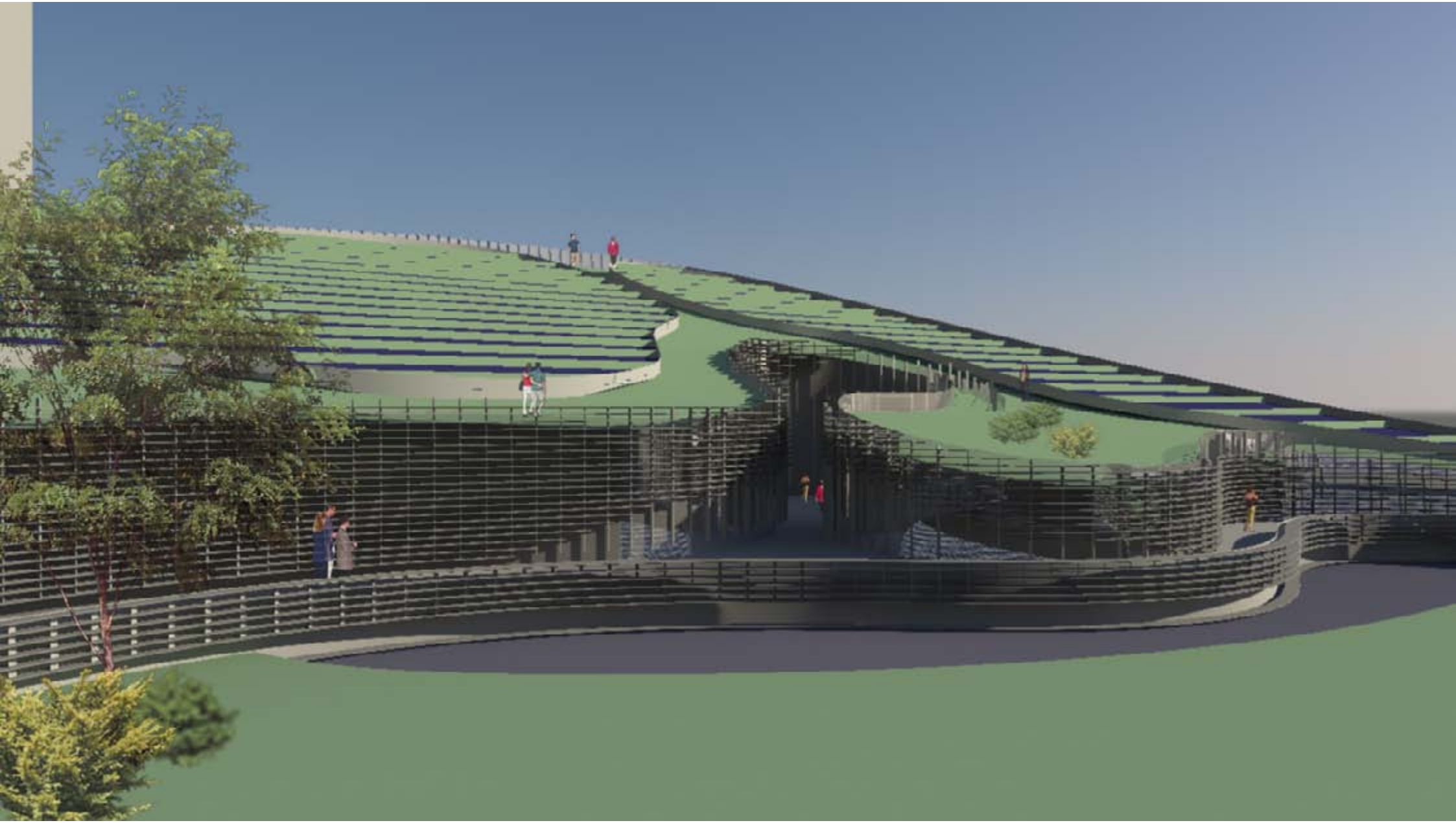


FRAGMENT SOUTH FACADE

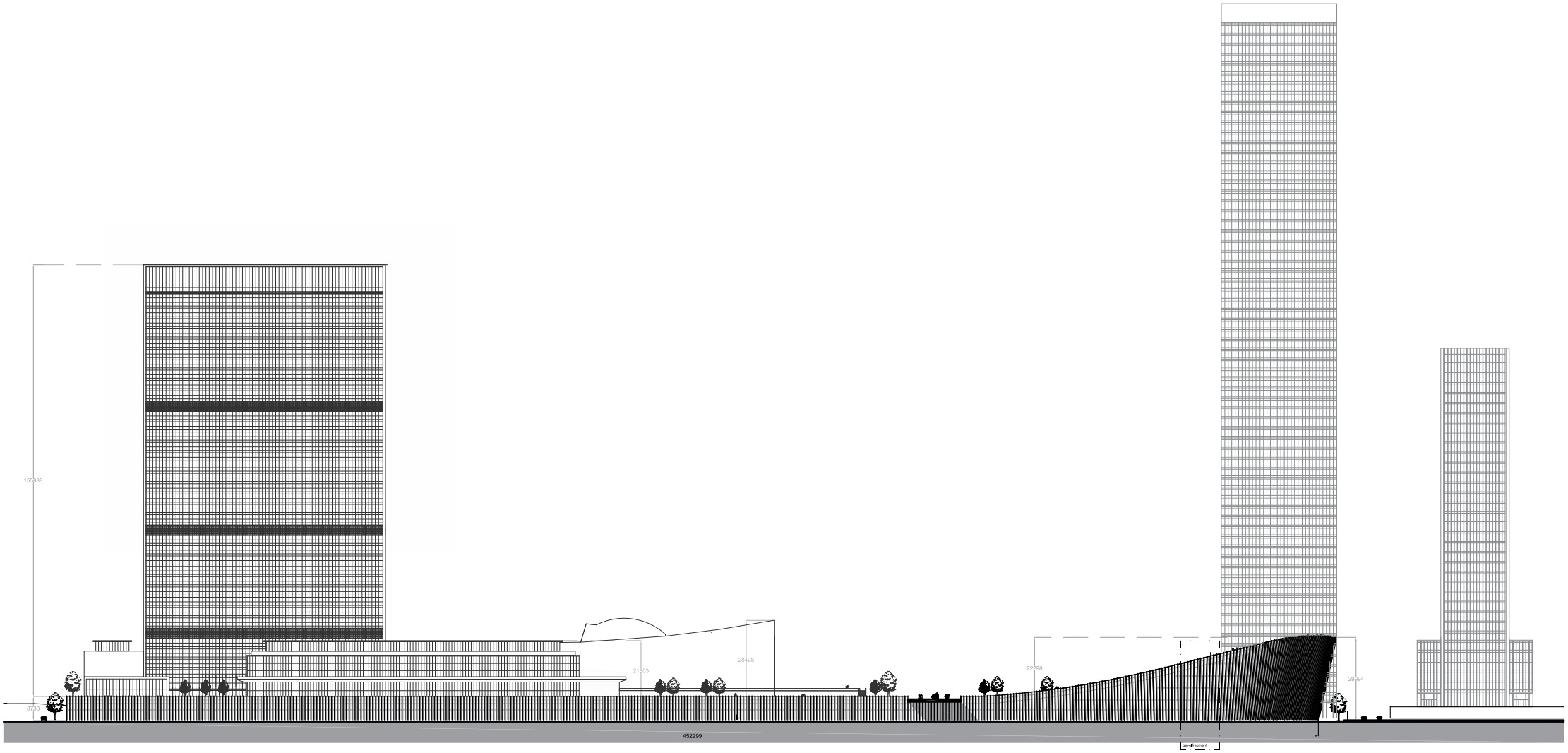


Fragment Cross Section



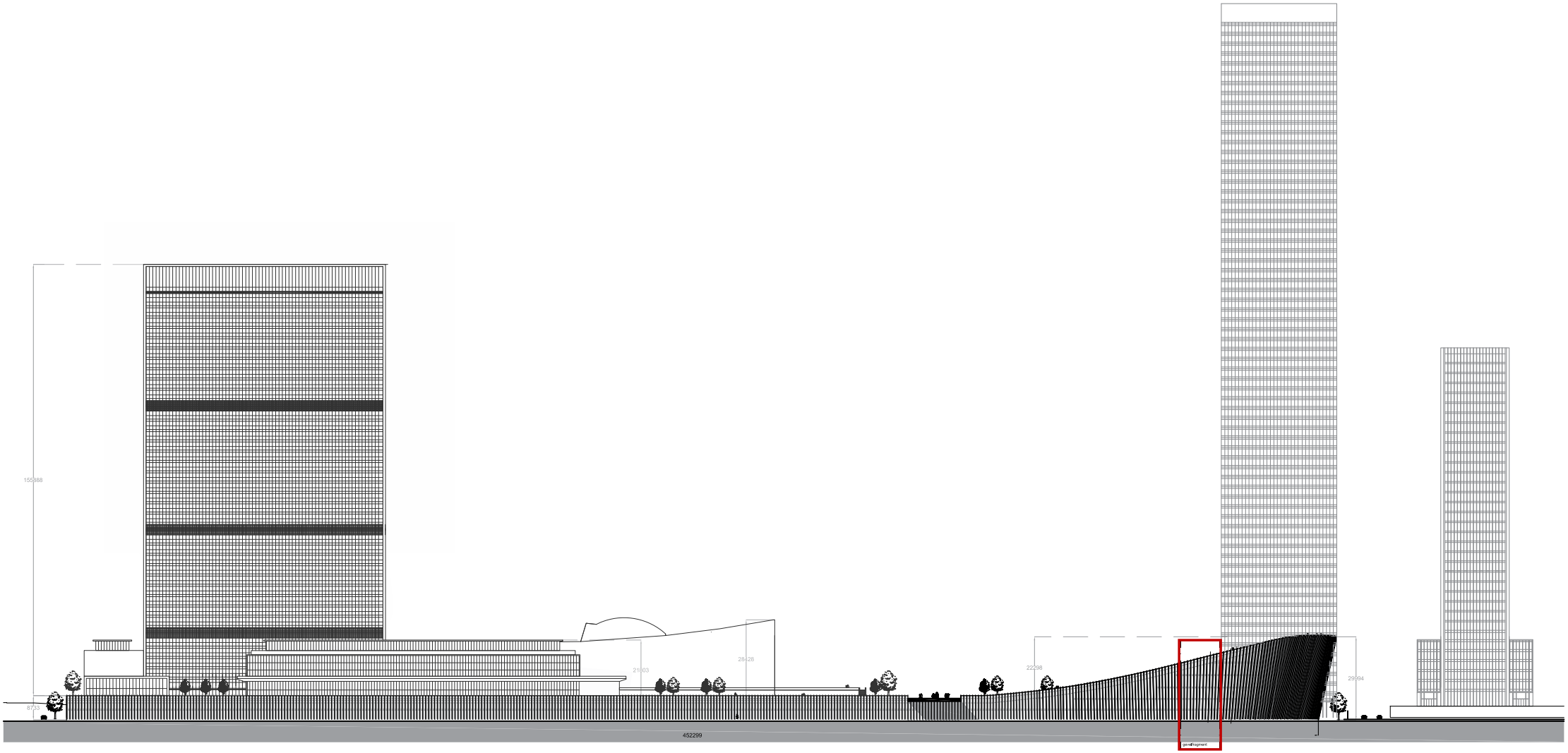


UNEC EAST FACADE



F.J. Corporaal | P5 | 31-01-2012 | SADD | Zero energy architecture & United Nations Environmental Council | Tutors: H. van Bennekom, B.Gremmen, S. Broersma, A. van Timmeren, F. Schnater

UNEC EAST FACADE



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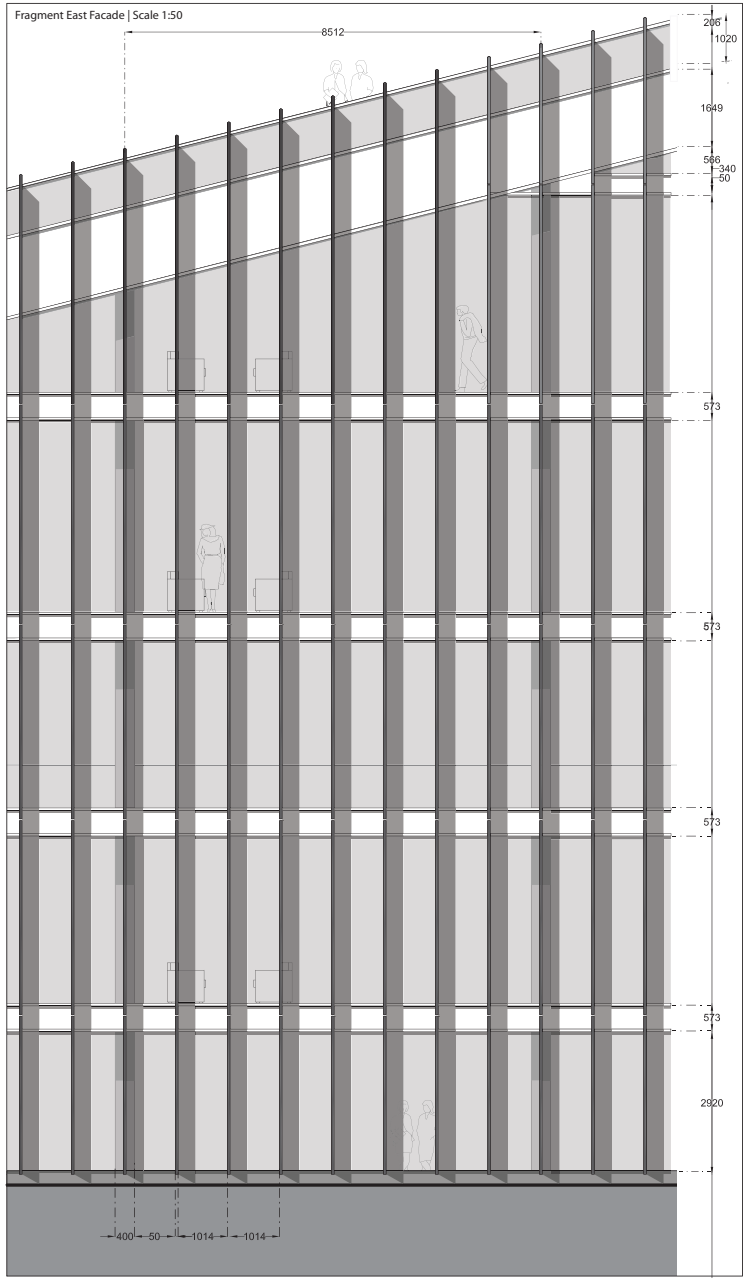
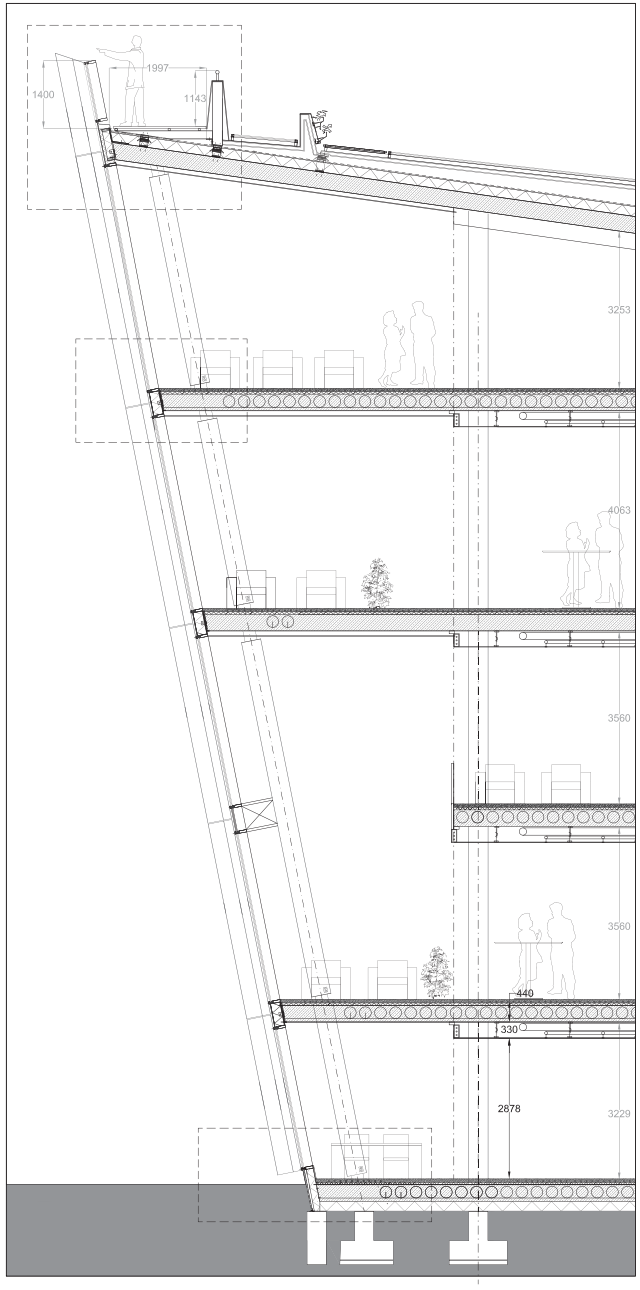
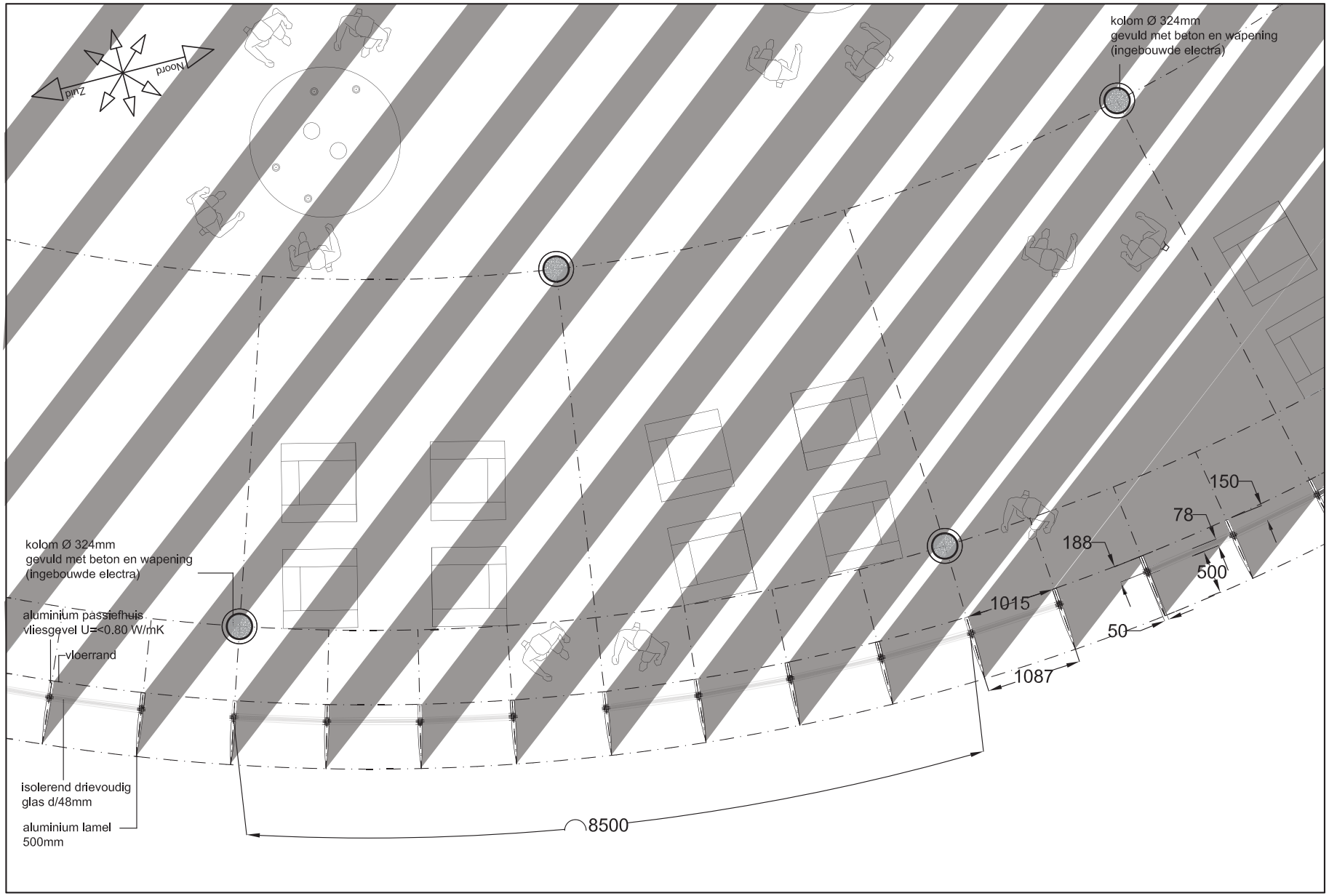
Fragment East Facade



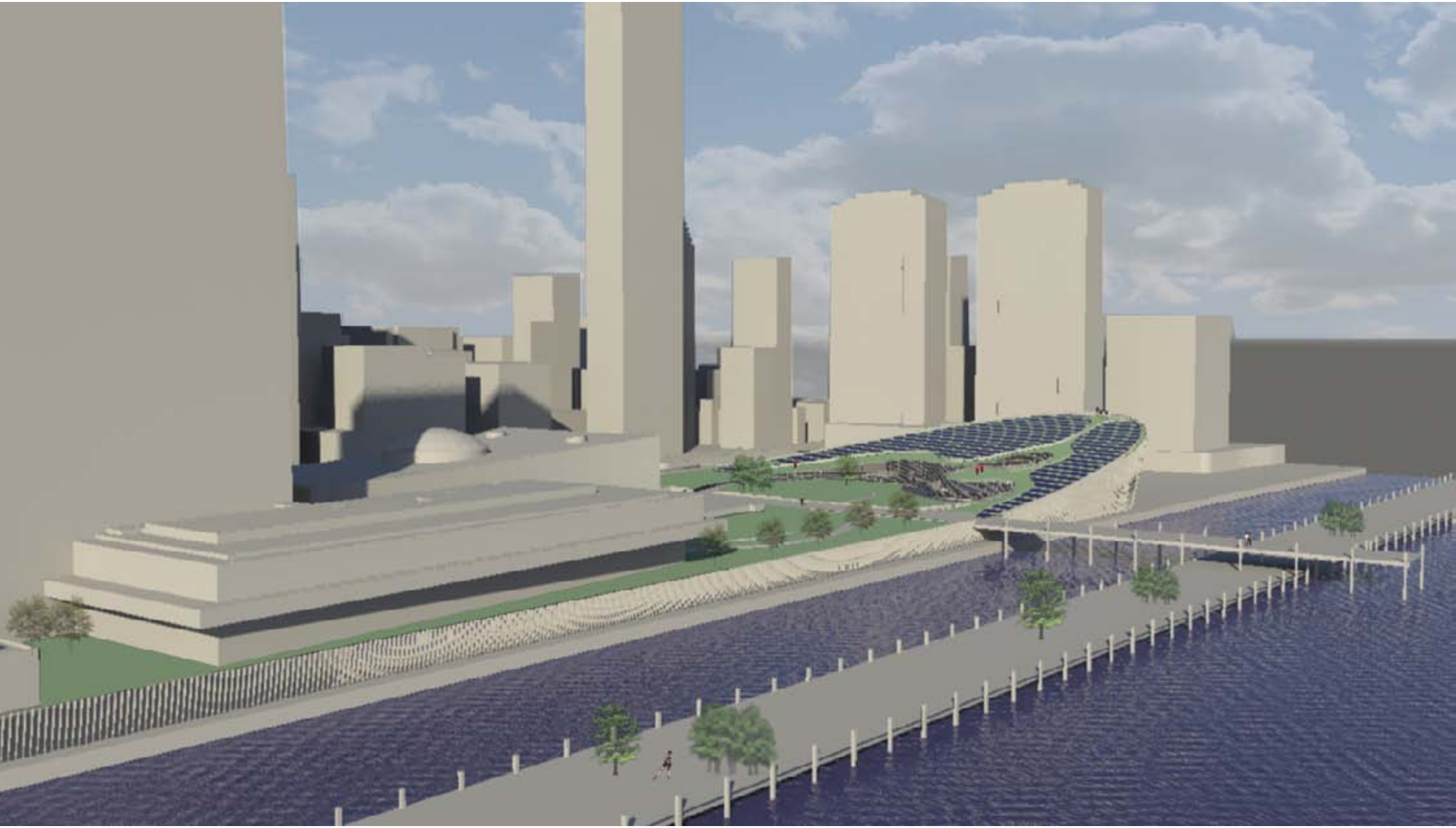
Fragment Section

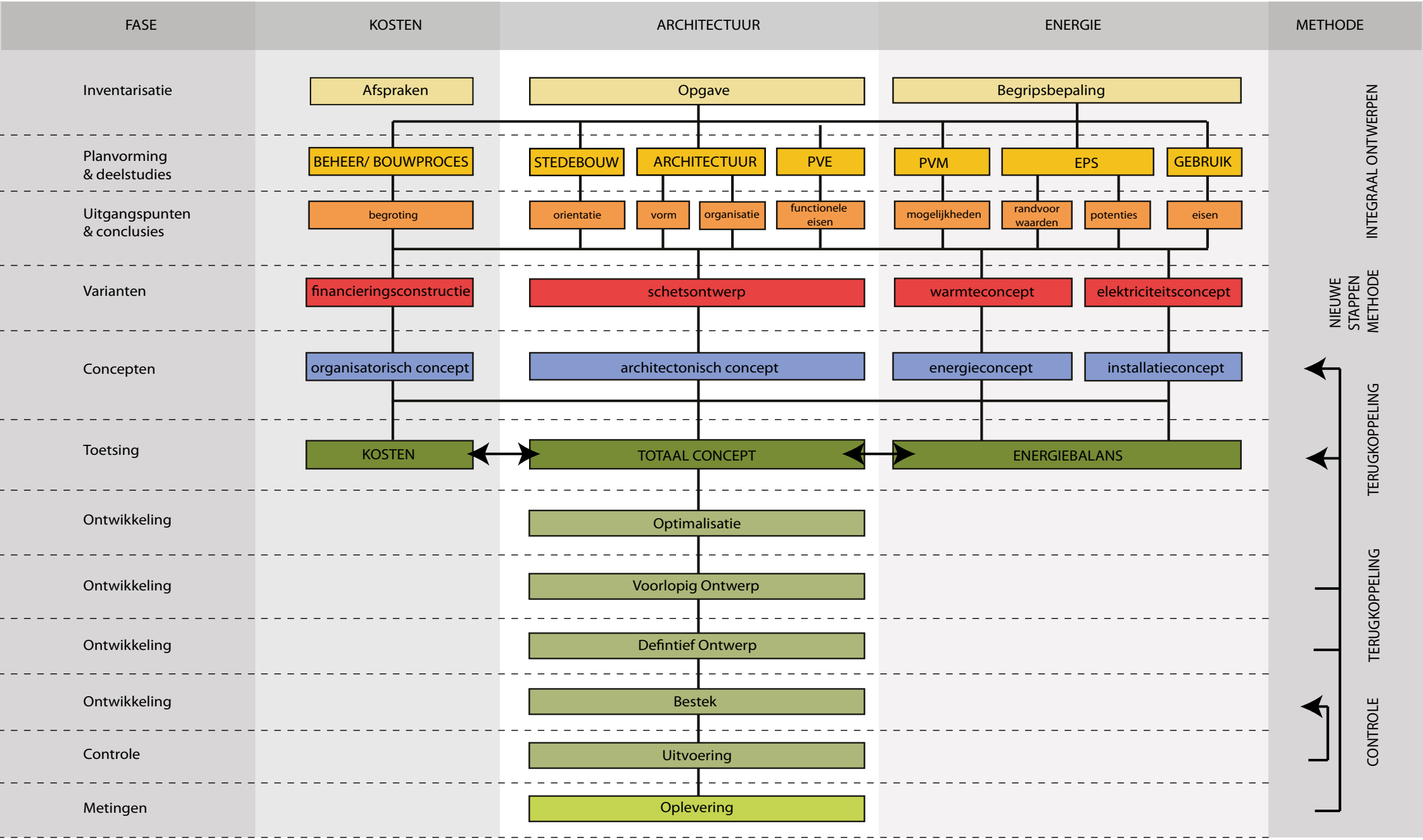


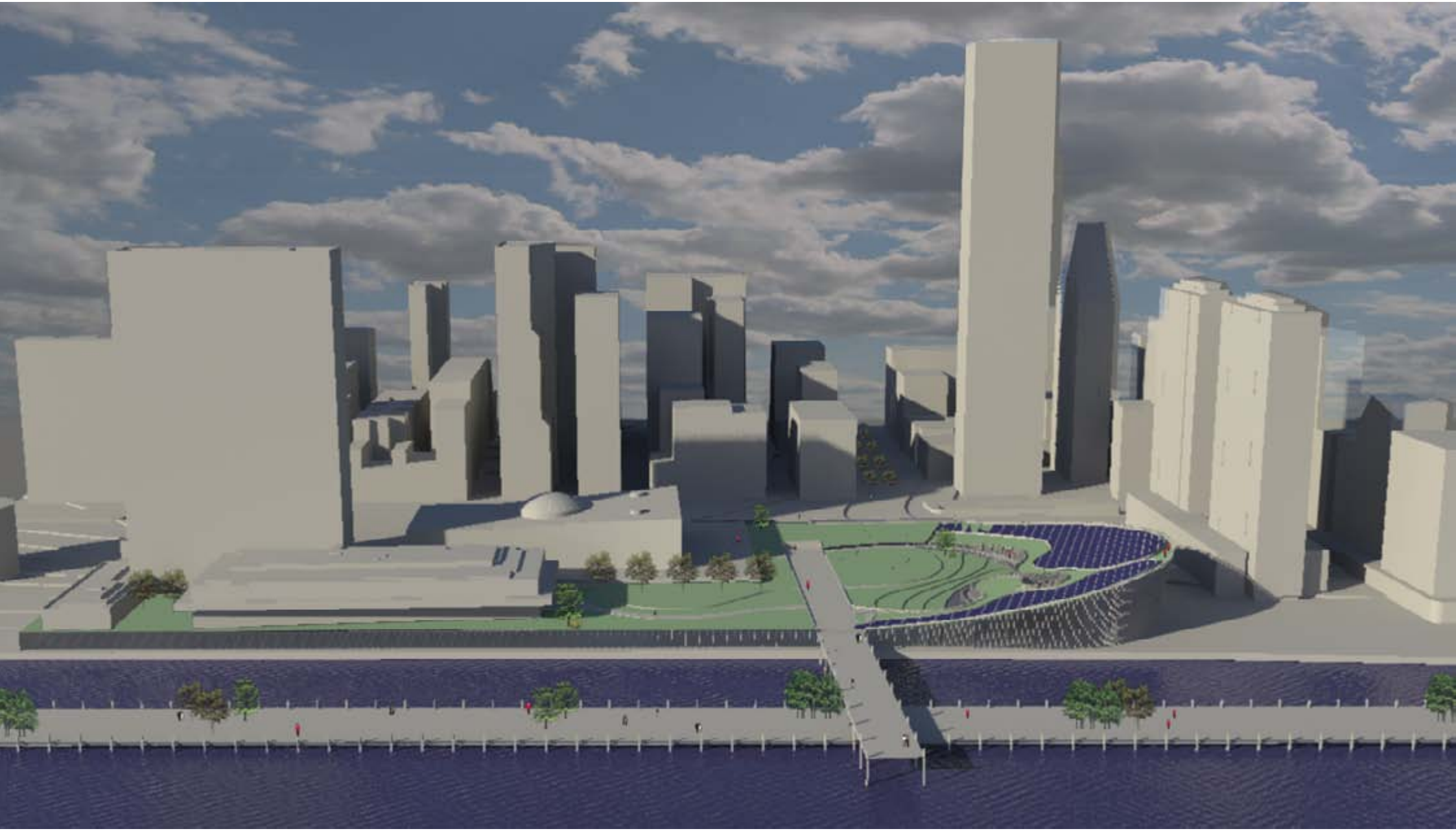


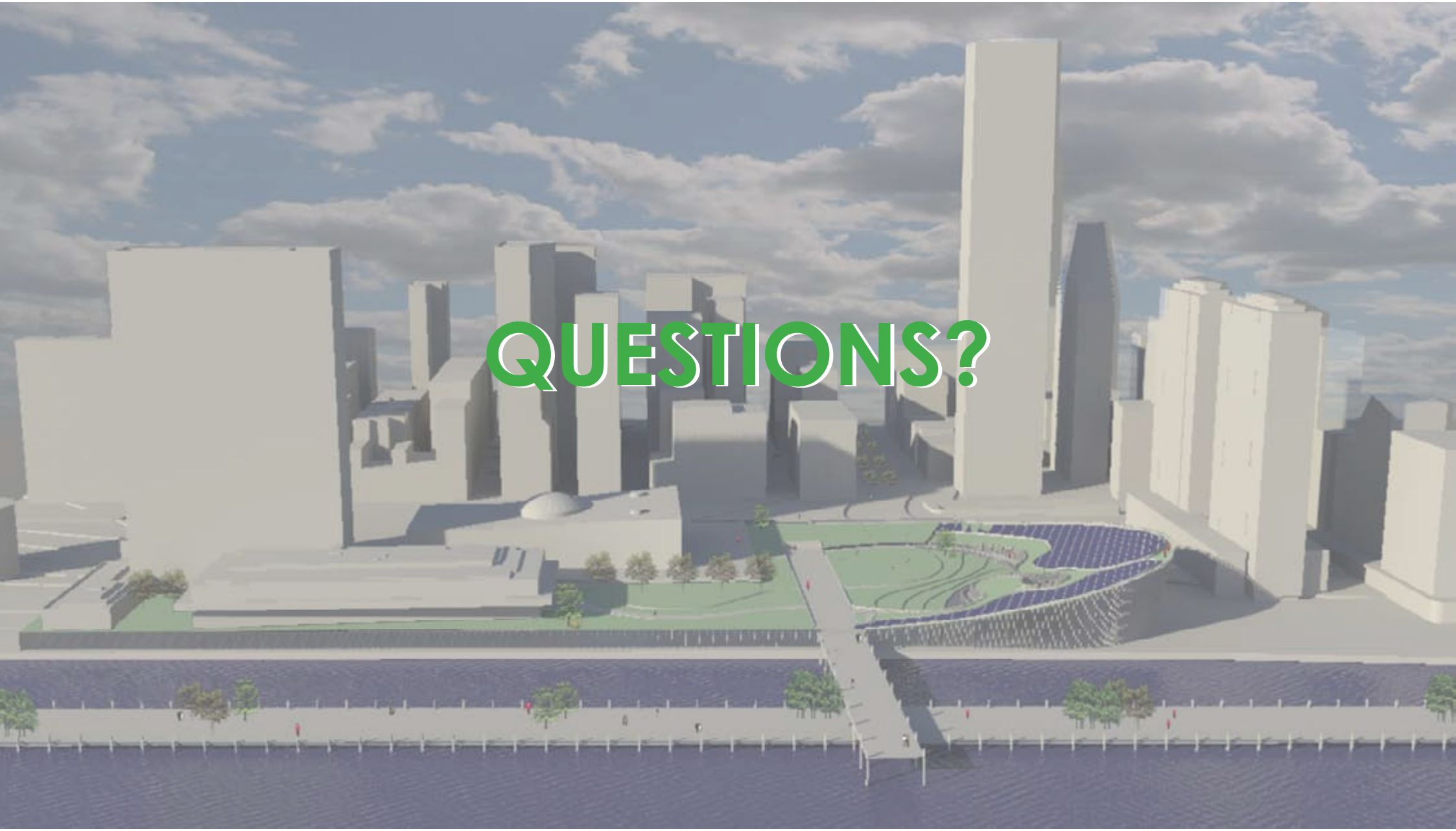
Fragment Floor plan

UNEC IMPRESSION EAST FACADE




FASE
KOSTEN
ARCHITECTUUR
ENERGIE
METHODE
Inventarisatie
Planvorming & deelstudies
Uitgangspunten & conclusies
Varianten
Concepten
Toetsing
Ontwikkeling
Ontwikkeling
Ontwikkeling
Ontwikkeling
Controle
Metingen
Afspraken
Opgave
Begripsbepaling
BEHEER/ BOUWPROCES
STEDEBOUW
ARCHITECTUUR
PVE
PVM
EPS
GEBRUIK
begroting
orientatie
vorm
organisatie
functionele eisen
mogelijkheden
randvoor waarden
potenties
eisen
financieringsconstructie
schetsontwerp
warmteconcept
elektriciteitsconcept
organisatorisch concept
architectonisch concept
energieconcept
installatieconcept
KOSTEN
TOTAAL CONCEPT
ENERGIEBALANS
Optimalisatie
Voorlopig Ontwerp
Defintief Ontwerp
Bestek
Uitvoering
Oplevering
INTEGRAAL ONTWERPEN
NIEUWE STAPPEN METHODE
TERUGKOPPELING
TERUGKOPPELING
CONTROLE




QUESTIONS?