E-Synergy

Local collaboration in Agriport

Ewout Smits

1503480

Architectural Engineering

inspired by a technique

Nature = most sophisticated technique

↓

Sustainable energy

Disadvantage of sustainable energy

Power source	Power Denisty [W/m²]
Nuclear	up to 4000
Natural gas	200 - 2000
Coal	100 - 1000
Solar (PV)	4 - 10
Wind	0,5 - 1,5
Biomass	0,5 - 0,6

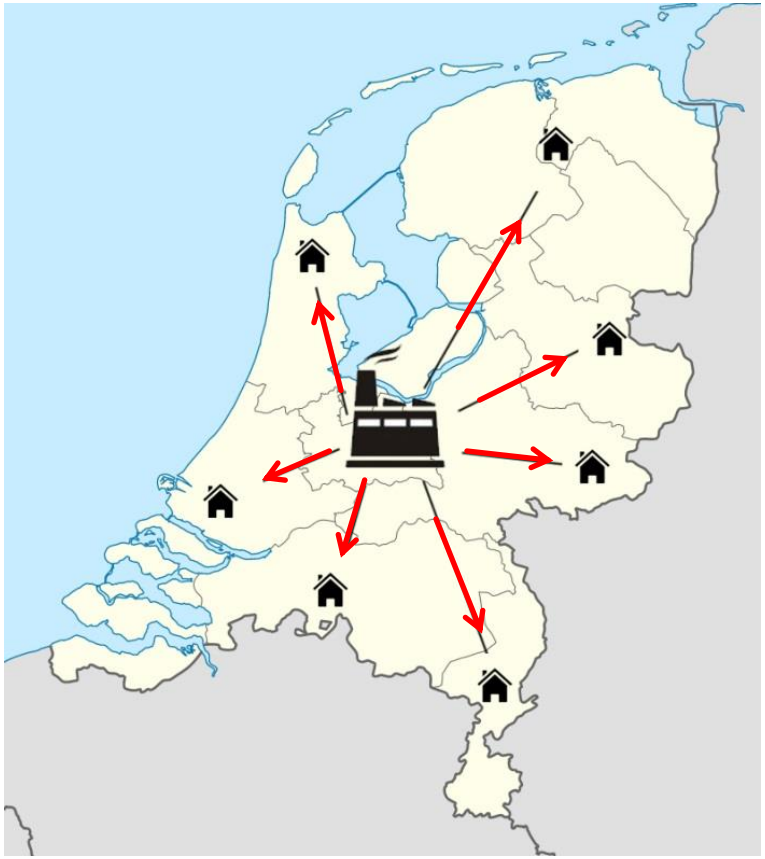
Sustainable energy

closer to its user

"Truly a disadvantage?"

Energy infrastructure

change of scale: macro



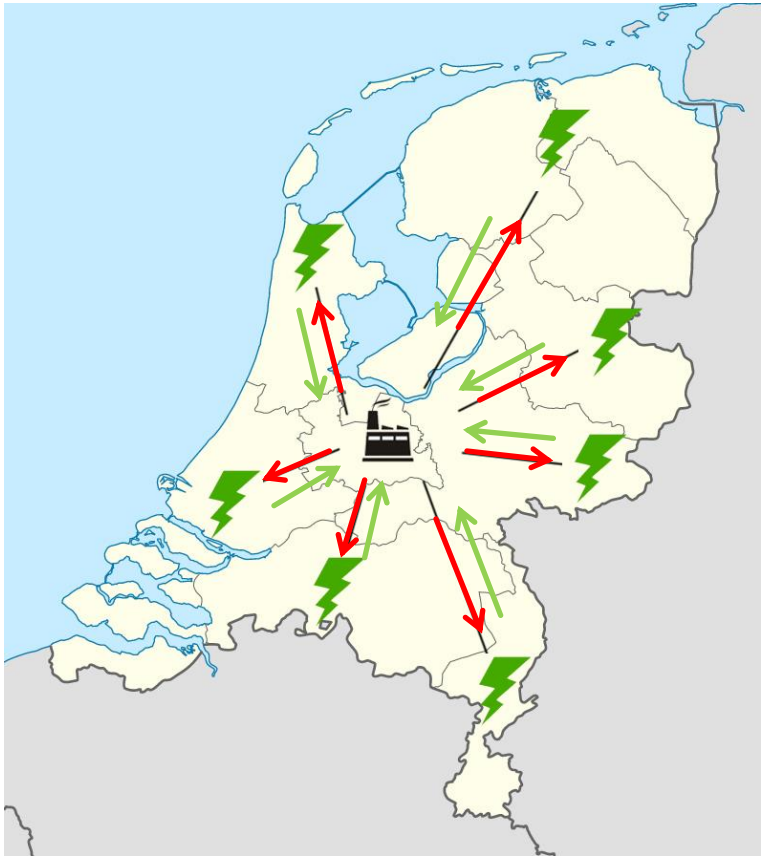
Conventional
energy infrastructure

macro scale

One way distribution

Energy infrastructure

change of scale: to micro



implementations

micro scale

Two way distribution

Less demand from macro system

Energy infrastructure

change of scale: to micro

further implementations

micro scale

Imbalance

Energy infrastructure

change of scale: meso is the answer

Small scale power plants (micro)

Implemented in a system (macro)

= a short term-based transition

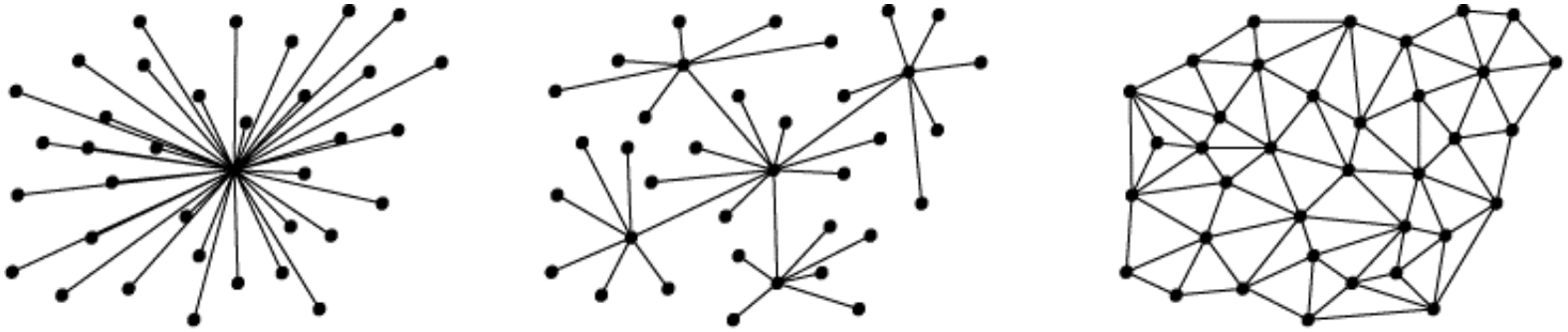
We need to revolutionize the system:

meso scale

And eventually go for a worldwide grid

Energy infrastructure

change of scale: meso is the answer



centralised + decentralised = distributed

macro **micro** **meso**

↓

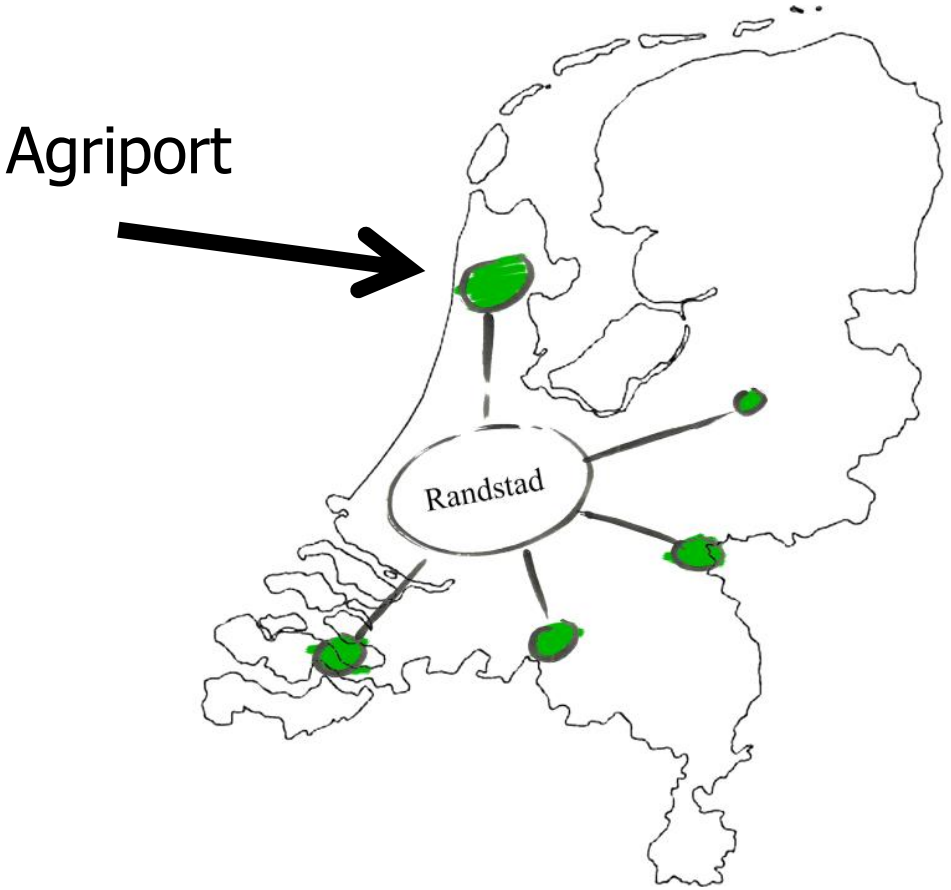
collaboration

Energy infrastructure

new spatial planning concept

Energy infrastructure

new spatial planning concept



Context: Agriport

Agriport

Agricultural cluster

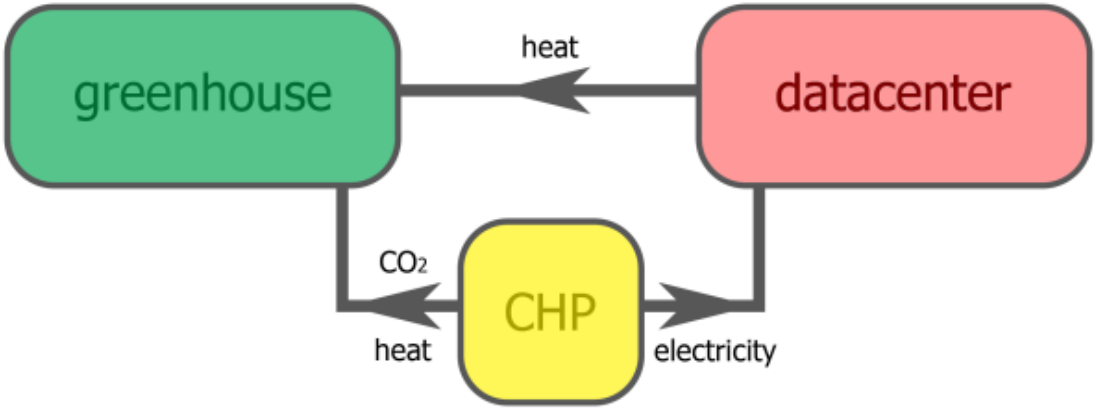
Cluster of large scale food
- *production*
- *processing*
- *logistics*

business park

160 MW datacenter

Agriport energy analysis

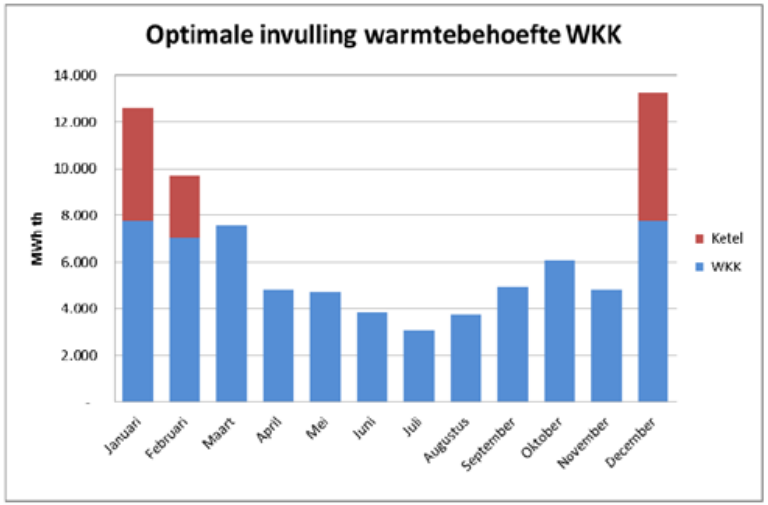
energy exchange & CHP: current

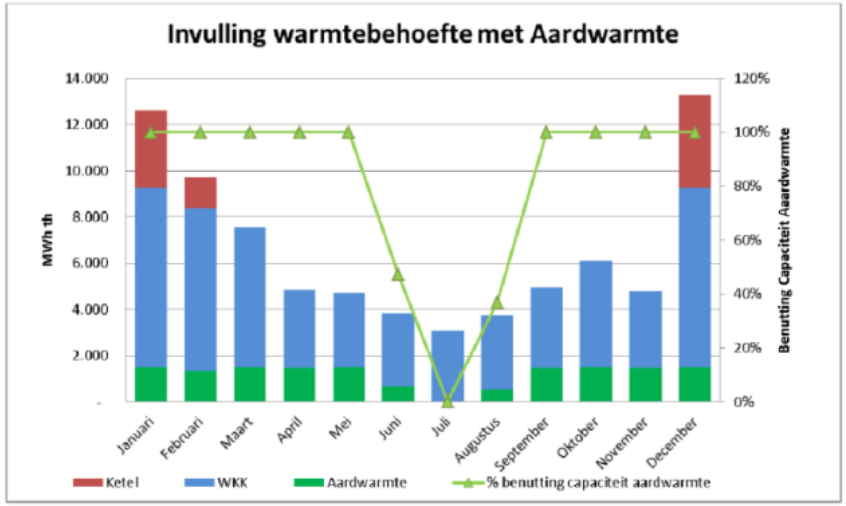


CHP (3 – 4 MW capacity): 49% heat; 43% electricity

Agriport energy analysis

implementation geothermal

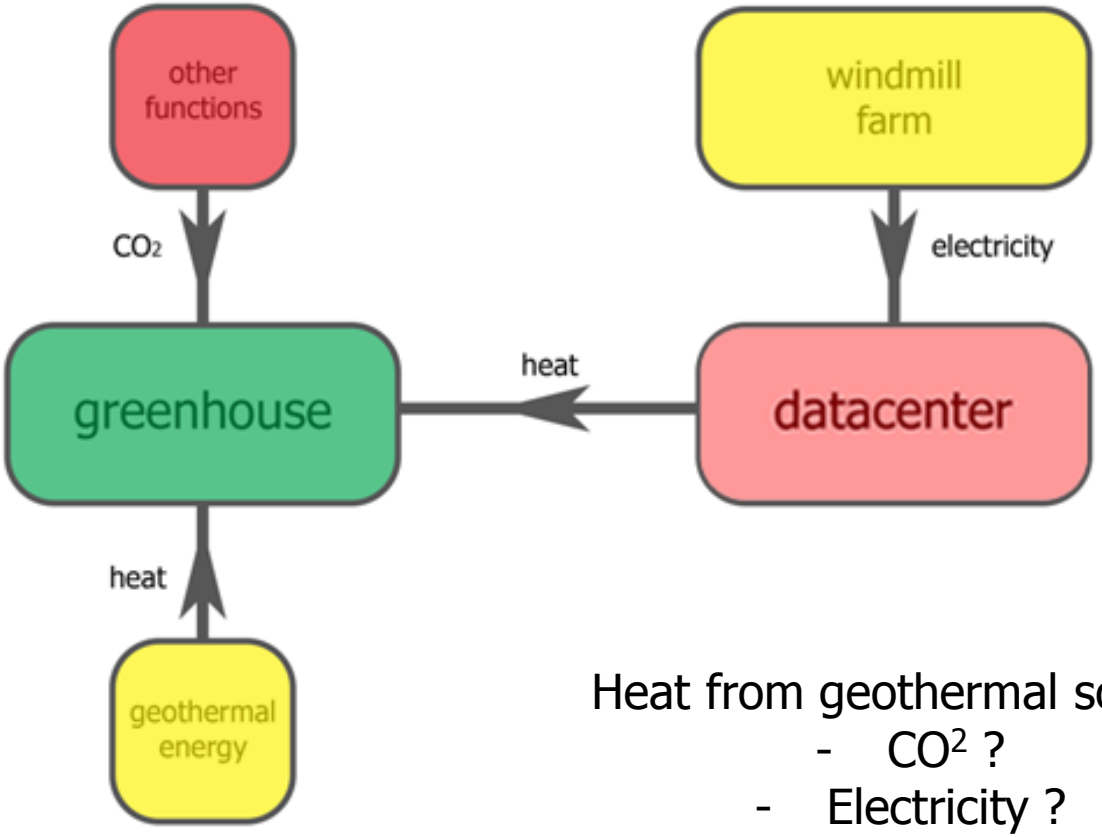




Currently providing 10 – 15 % of heat demand of greenhouses

Agriport energy analysis

implementation geothermal: future

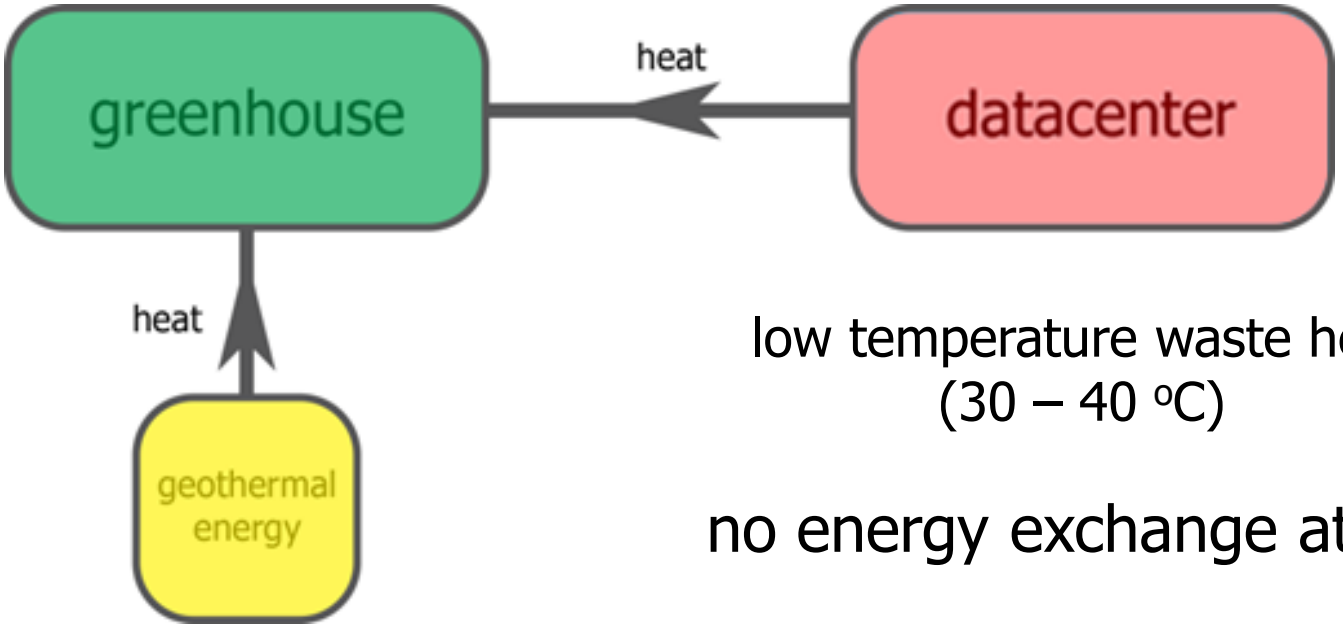


Heat from geothermal source:

- CO^2 ?
- Electricity ?

Agriport energy analysis

actual future situation



low temperature waste heat
(30 – 40 °C)

no energy exchange at all!

Agriport energy analysis

datacenter: waste heat

Agriport energy analysis

greenhouses: electricity

Waste electricity from greenhouse next to datacenter:

3800 MWh

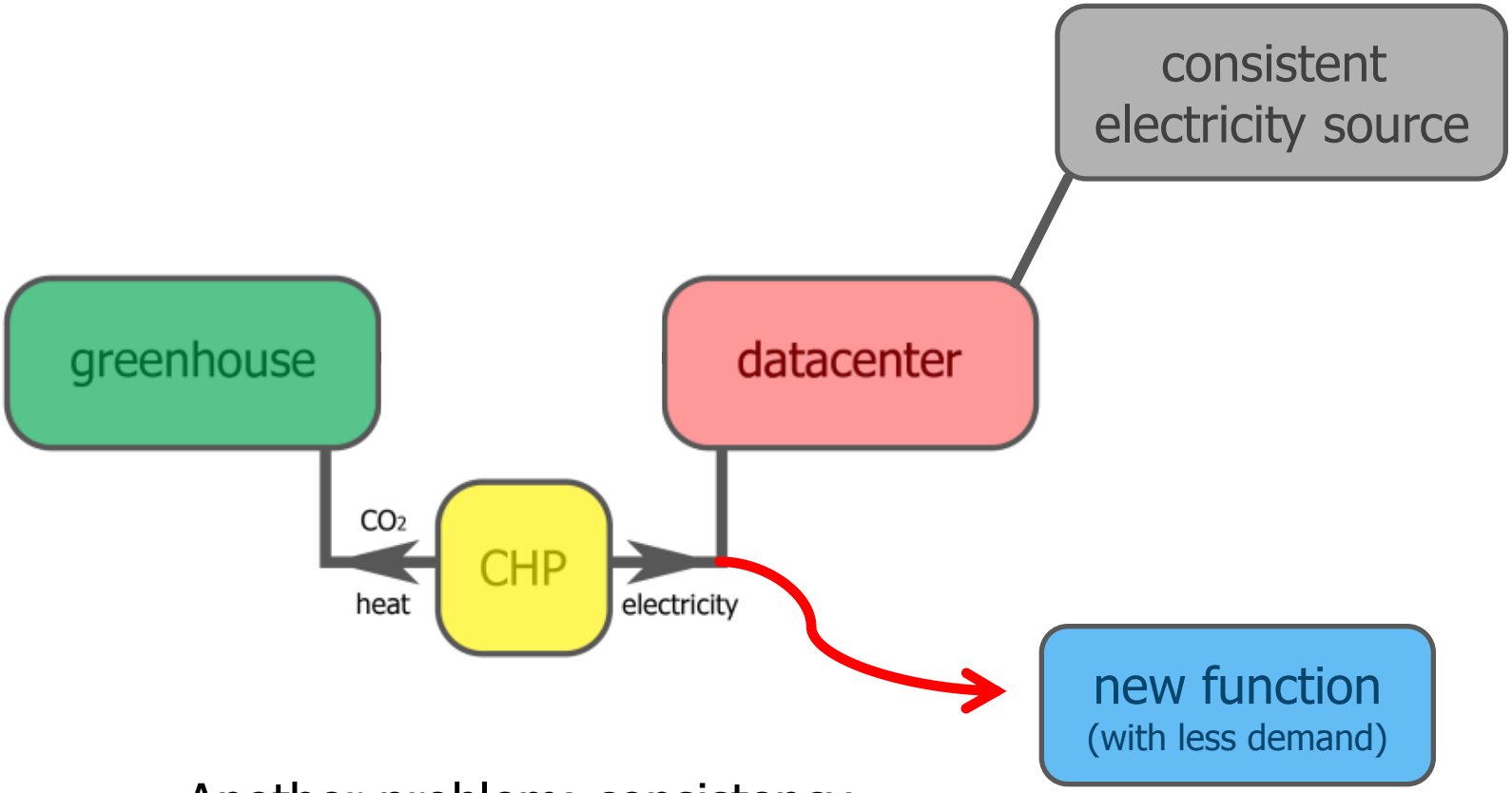
Average electricity use per household in NL: ***3500 kWh***

Waste is enough for 1000 households!

But it´s not consistent

Agriport energy analysis

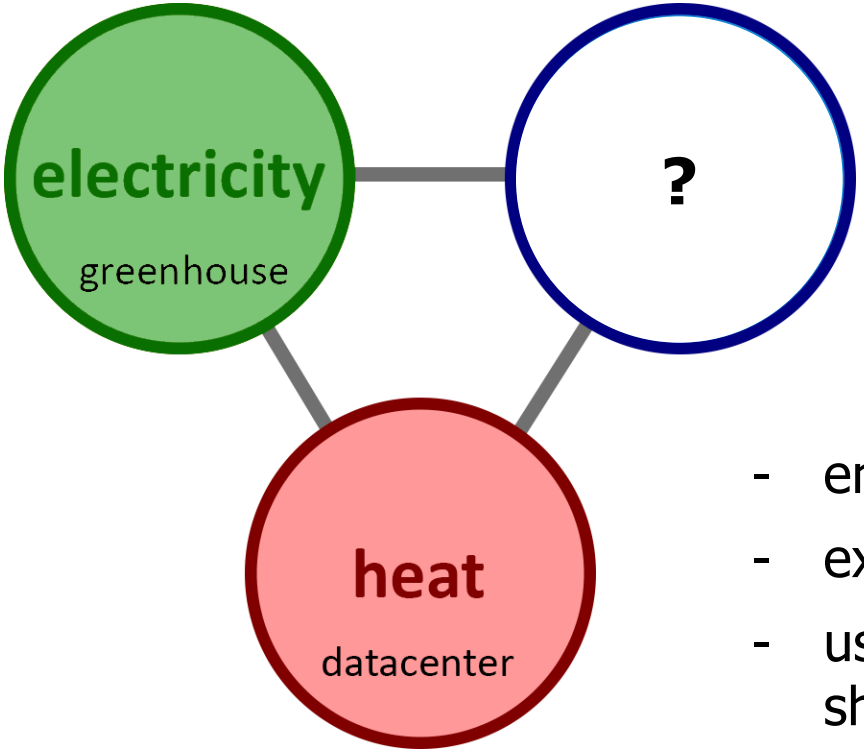
greenhouses: electricity



Another problem: consistency

Agriport energy analysis

meso solution

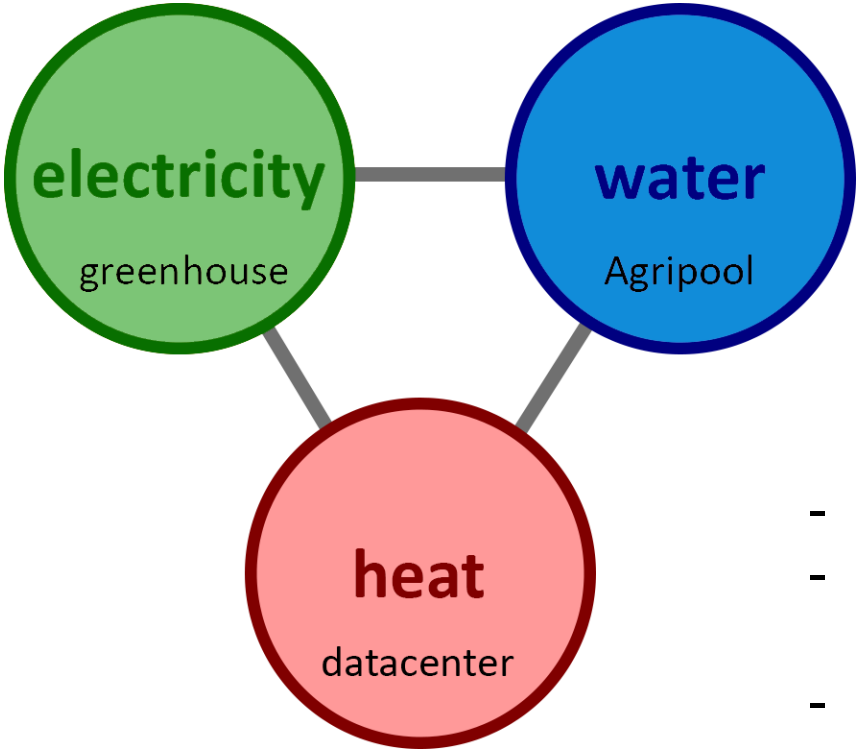


Complement the energy exchange in the cluster
(not only using wastes)

- energy balance in own cluster
- exchange with other clusters
- use national/international energy shortages (wider scale)

Agriport energy analysis

energy & resource exchange



Function:

Swimming pool

(& water treatment plant)

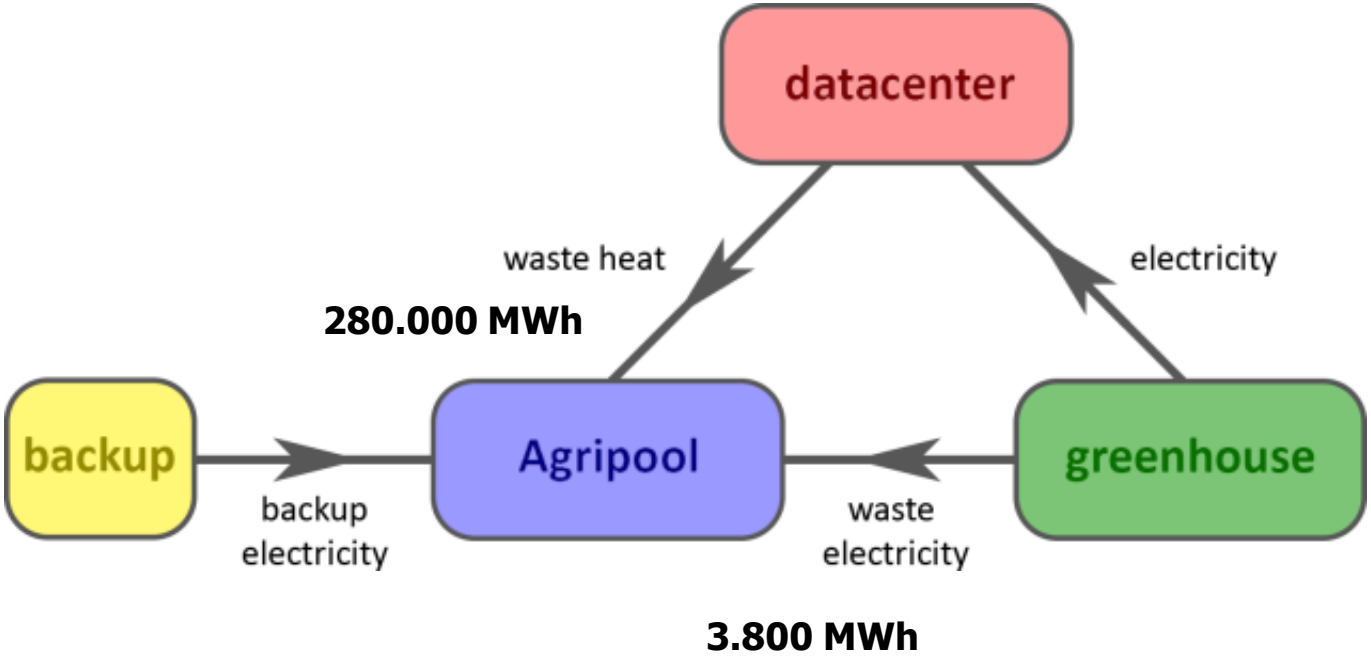
- using mainly waste heat
- using waste electricity

- provides clean surface water

Program: Natural swimming pool

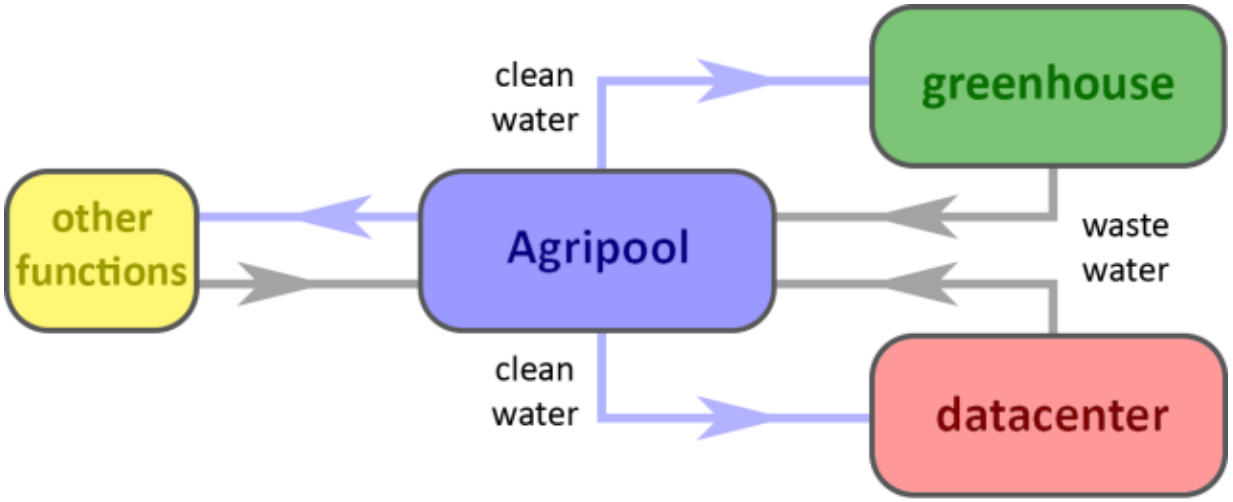
Agripool

energy & resource exchange: ***incoming***



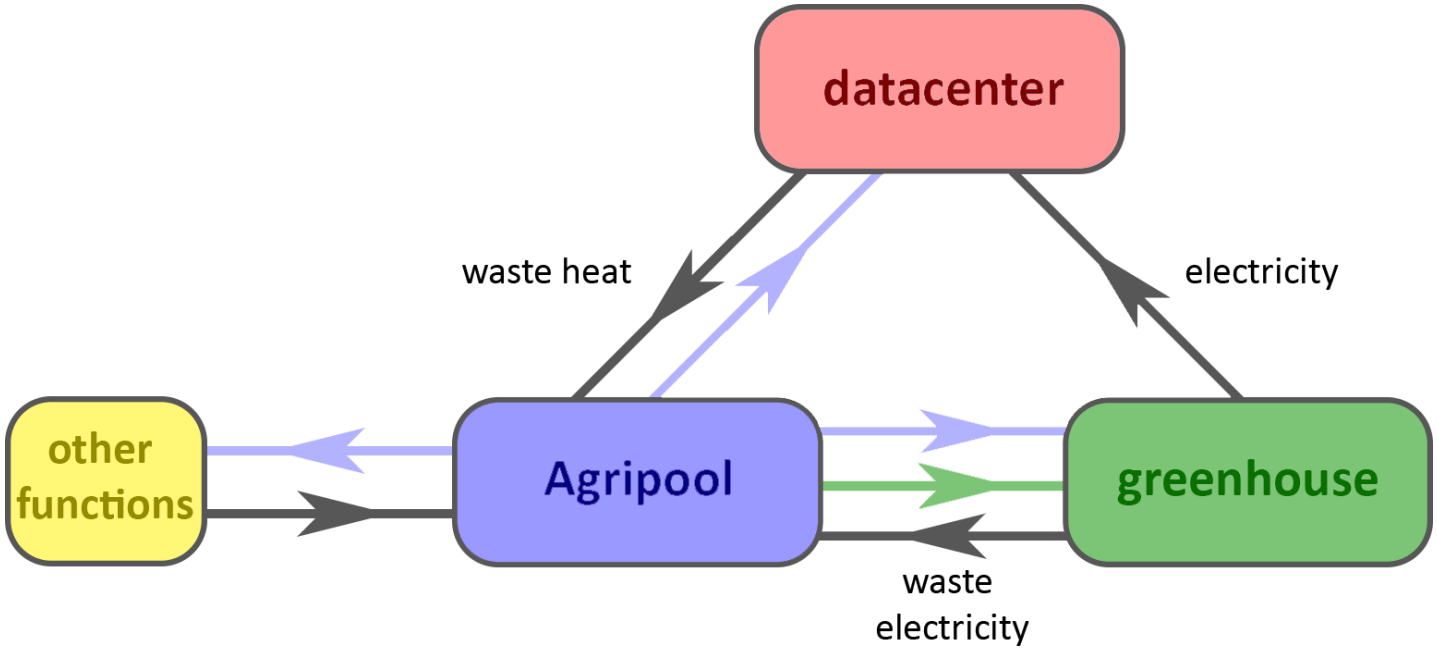
Agripool

energy & resource exchange: ***outgoing***



Agripool

energy & resource exchange



Region scan

is there a need for a swimming pool?

absence of swimming association Medemblik:
regional collaboration
(april, 2014)

A7 highway

Agripool

water treatment

Water treatment
for the cluster Agriport

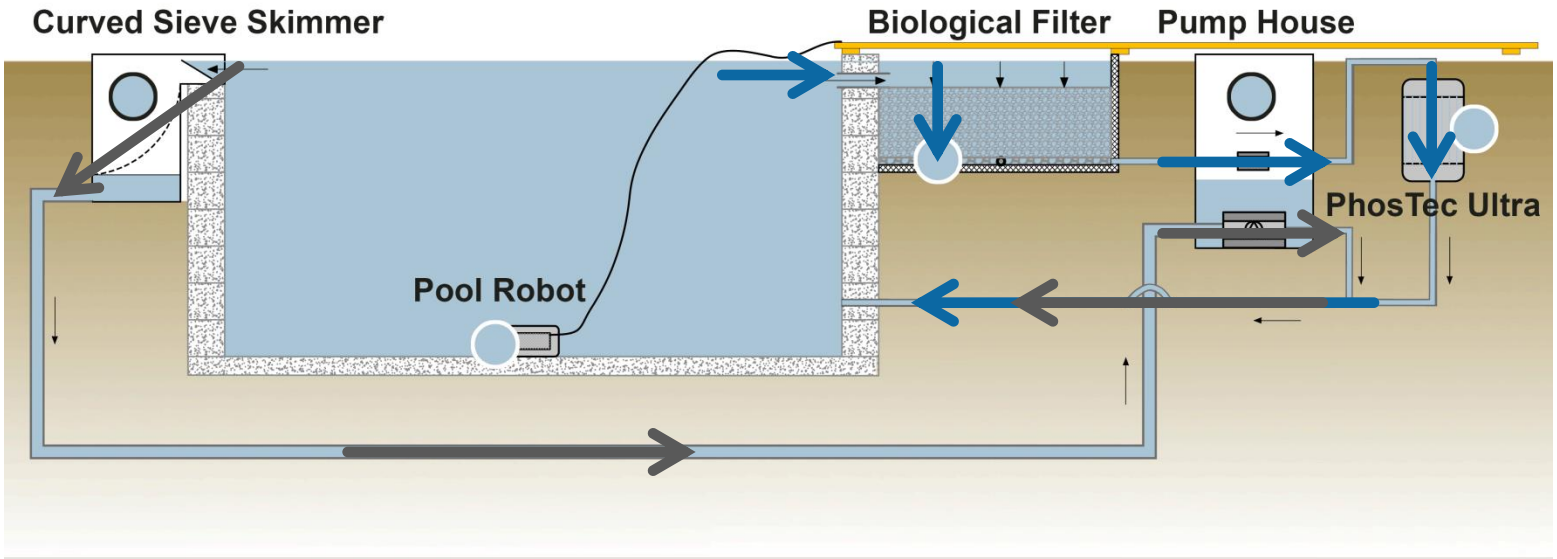
Technique = nature

Agripool

natural water treatment: sewage water

Agripool

natural water treatment: pool water



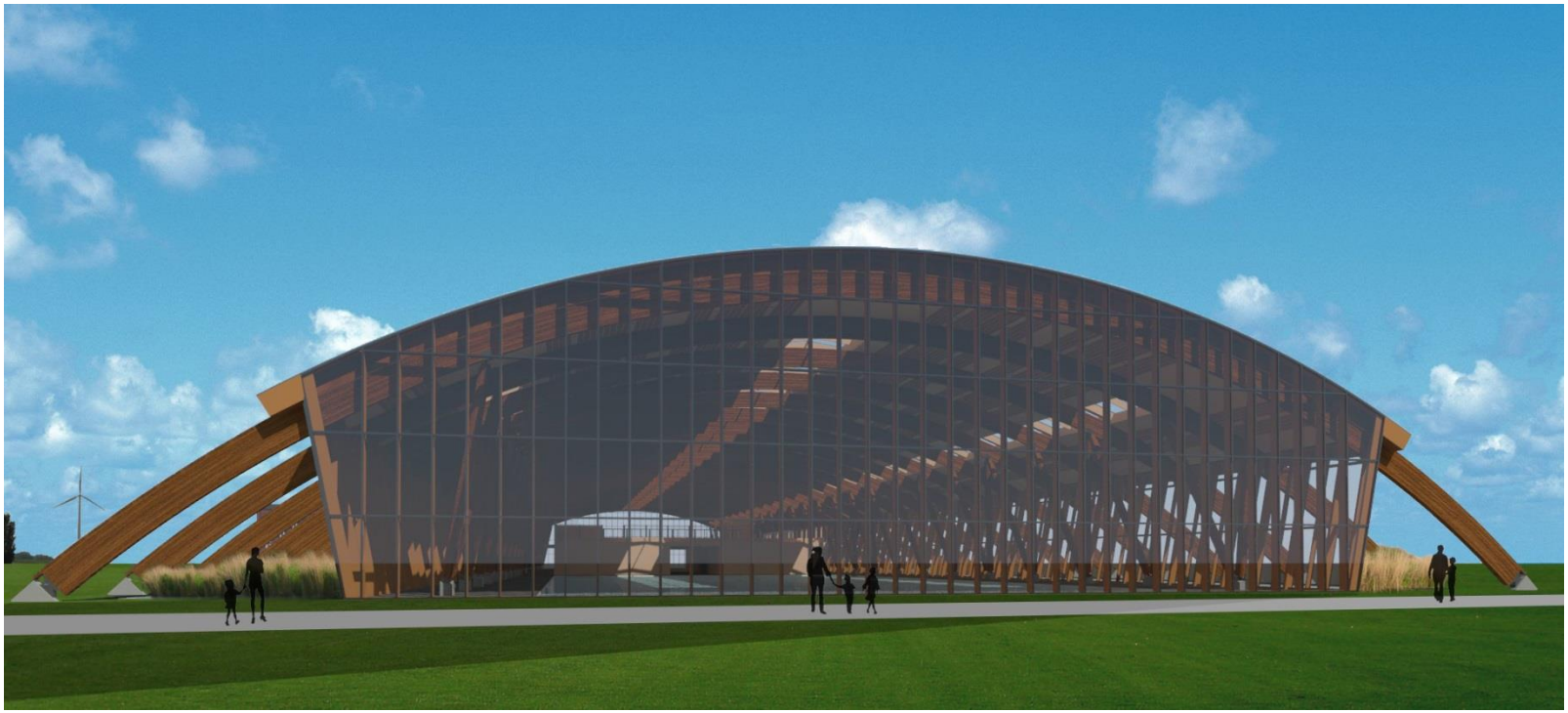
goal: chlorine free swimming pool

Agripool

legislation vs. creativity

Design: Agripool

Impression

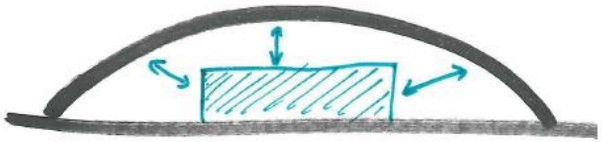


Design principles

*the different **scales** implemented*

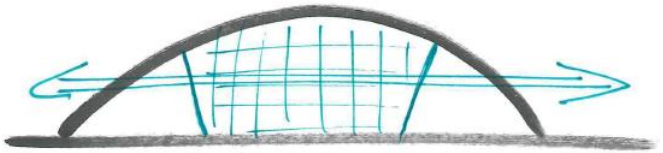
Coöperation

Micro scale : aim on **self-sufficiency**
(self supporting roof)



Macro scale: **colossal** macro infrastructure
(exaggerated presence of construction)

Meso scale : **contribution** to the cluster
(transparency of facades)



Design principles

***context** implemented*

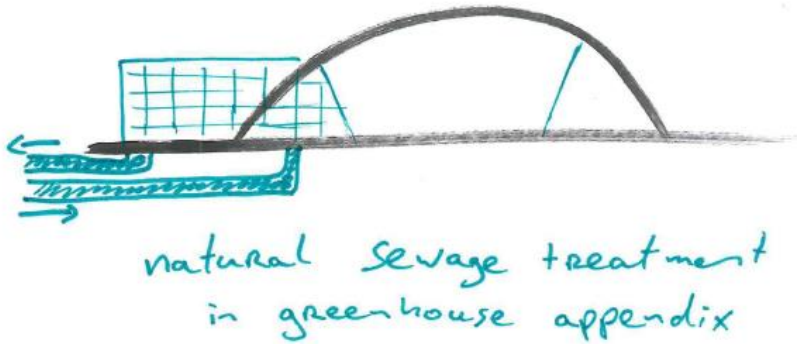
Materialization:
glass facade (greenhouses)

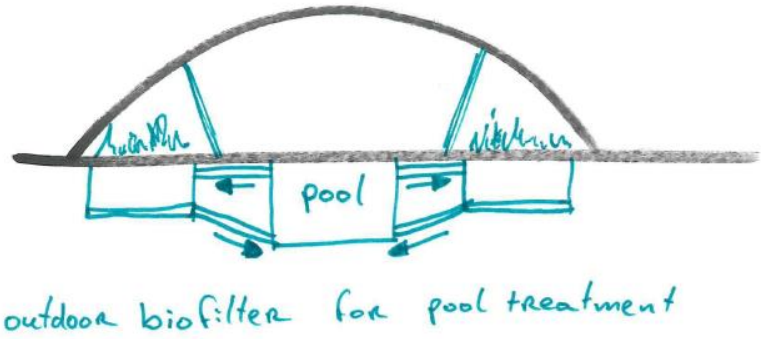
Shape:
rational & functional
(factories)

Design principles

technique *implemented*

Sewage treatment:
in greenhouse appendix



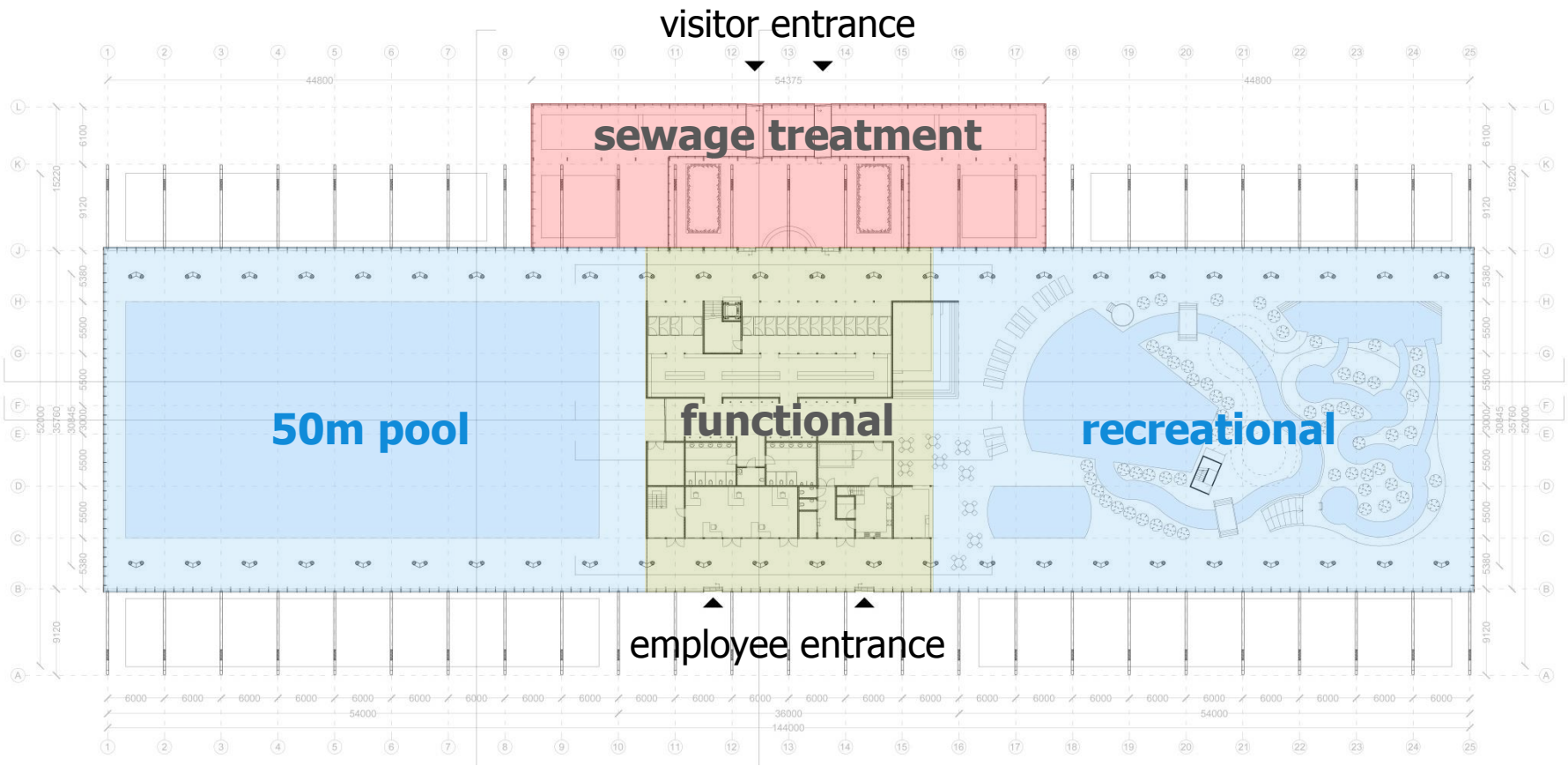


Pool water treatment:
outside but under construction

Agripool

Agripool

organization

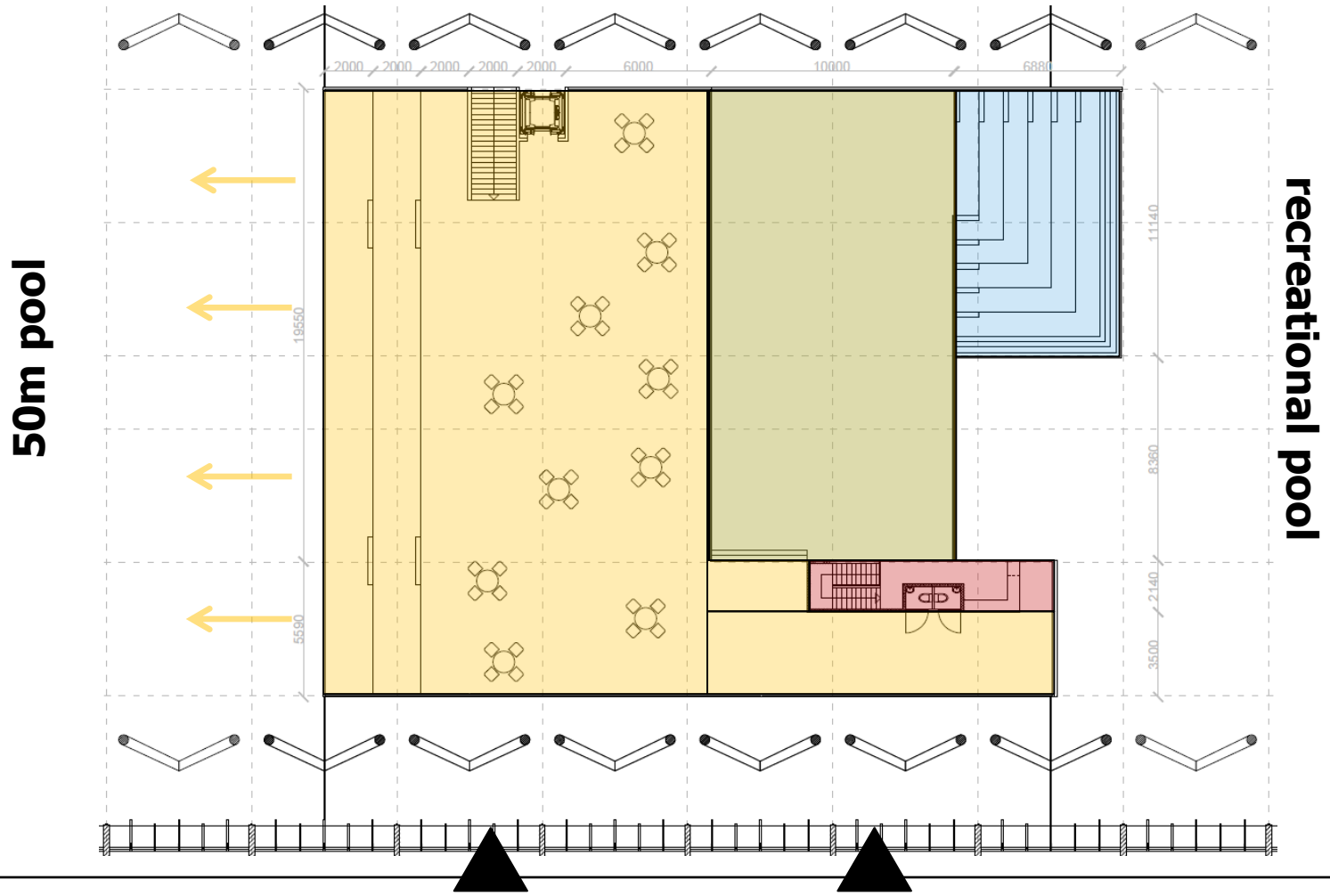


Agripool

organization: middle part (ground floor)

Agripool

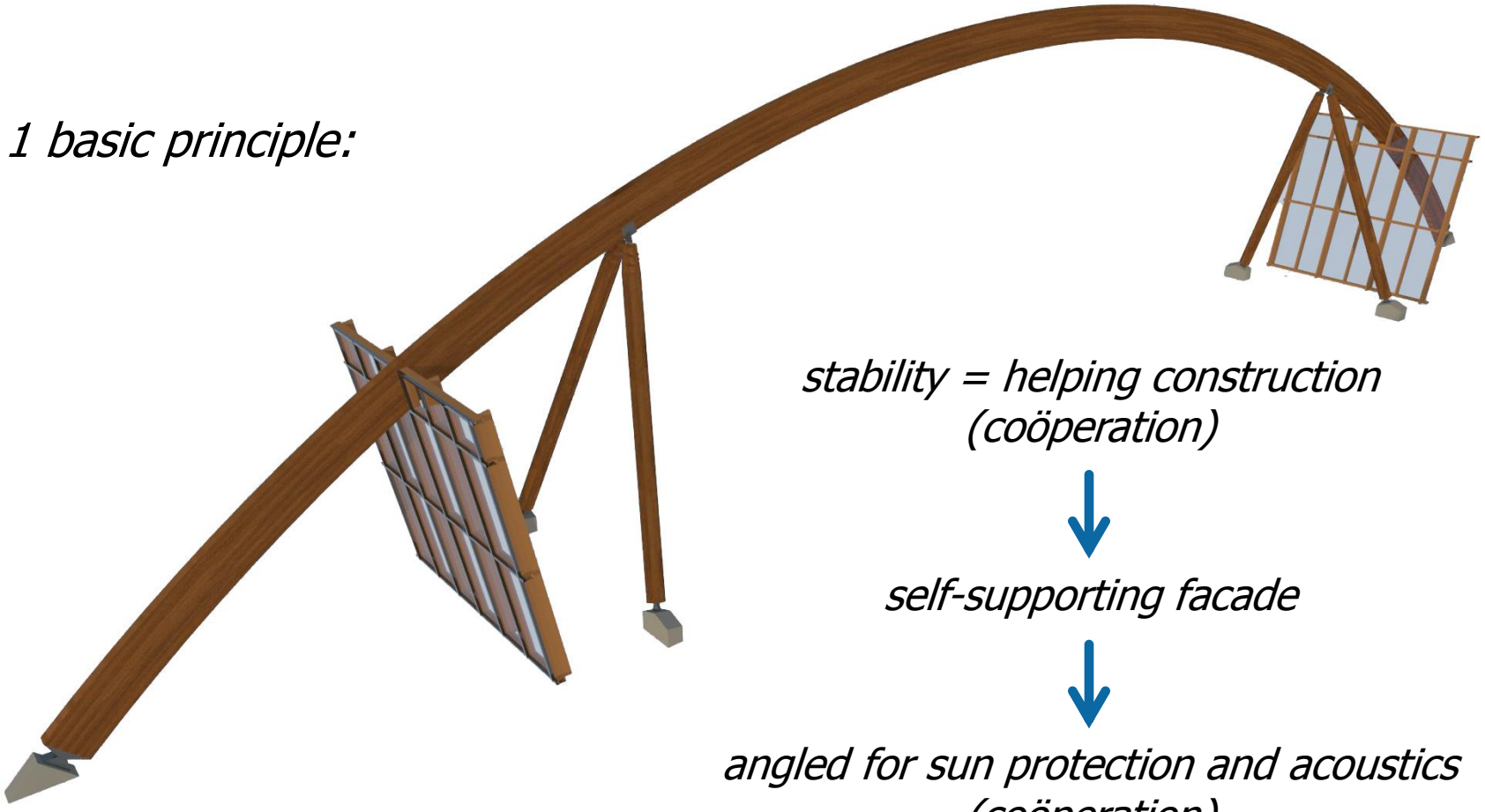
organization: middle part (1st floor)



Technical design

construction

1 basic principle:



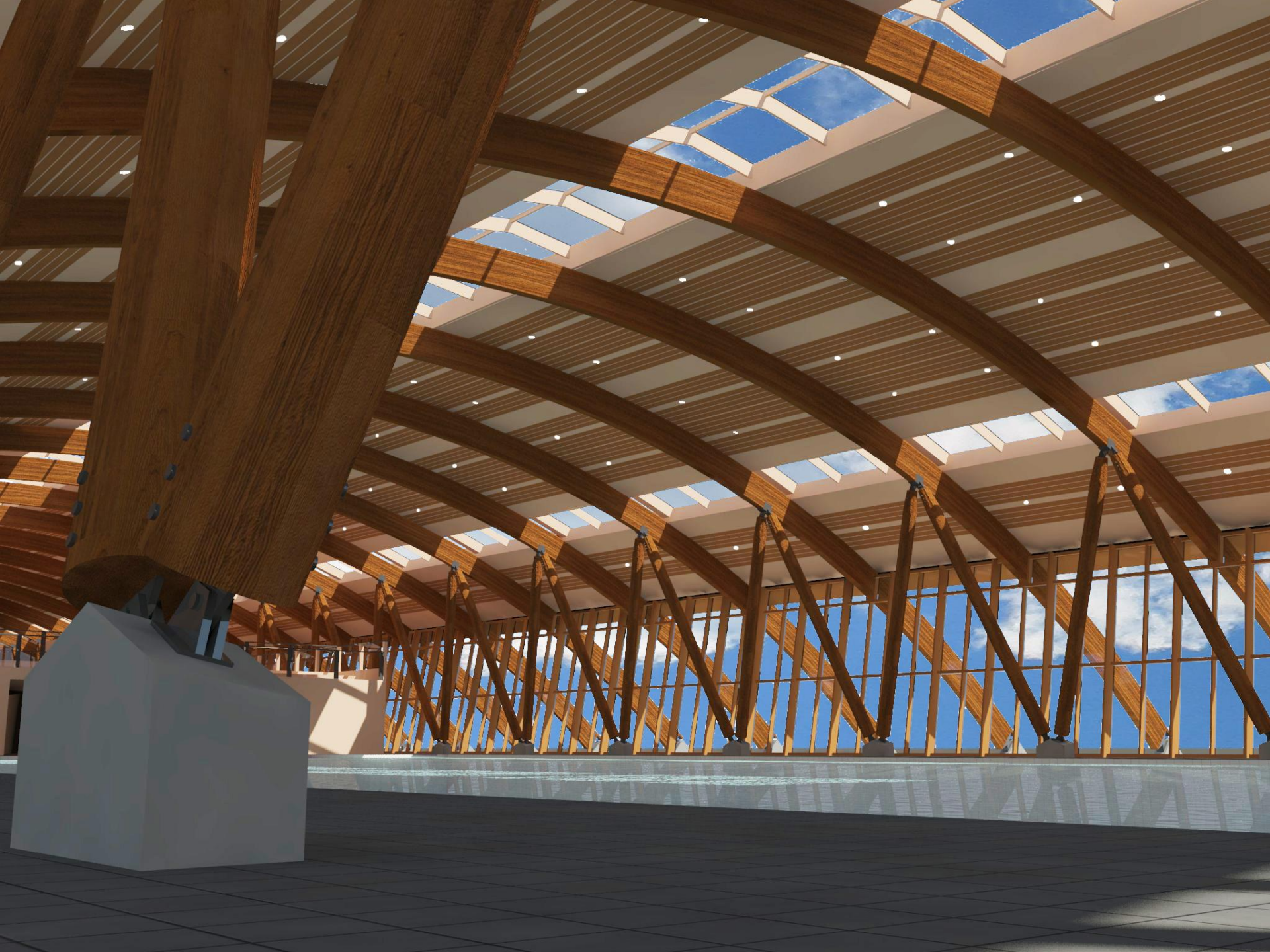
stability = helping construction (coöperation)

↓

self-supporting facade

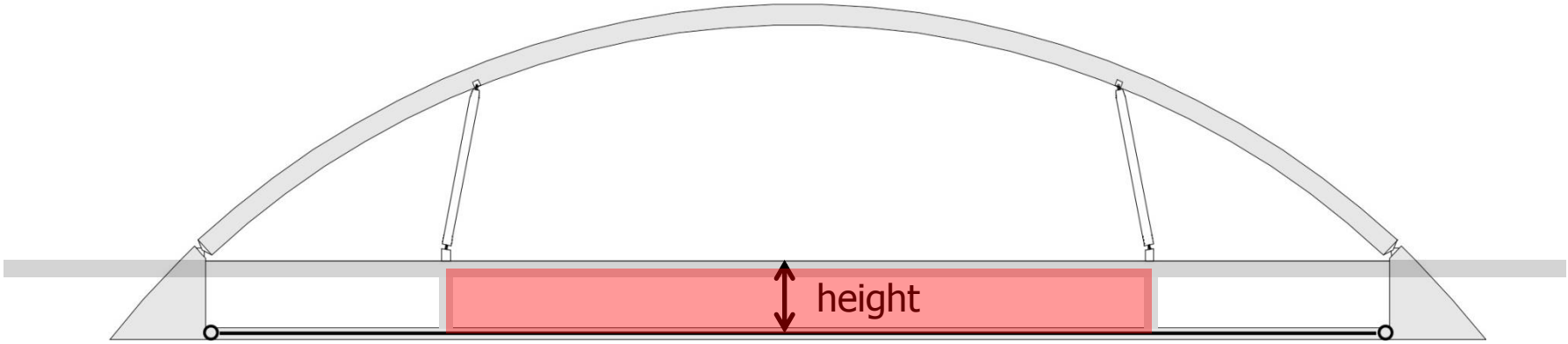
↓

angled for sun protection and acoustics (coöperation)



Technical design

construction

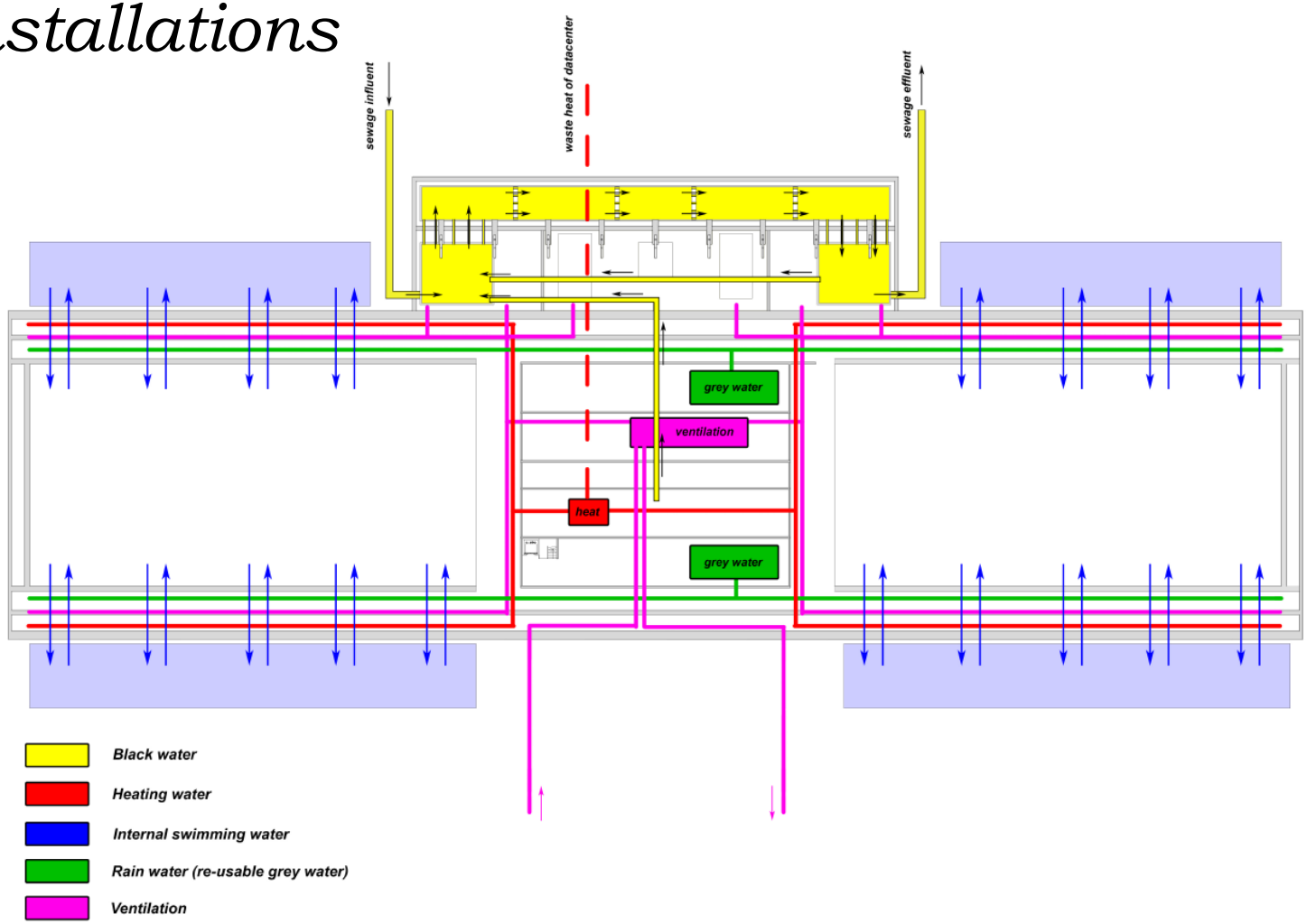


basement needed for tension of construction (under pools)

→ room for installations

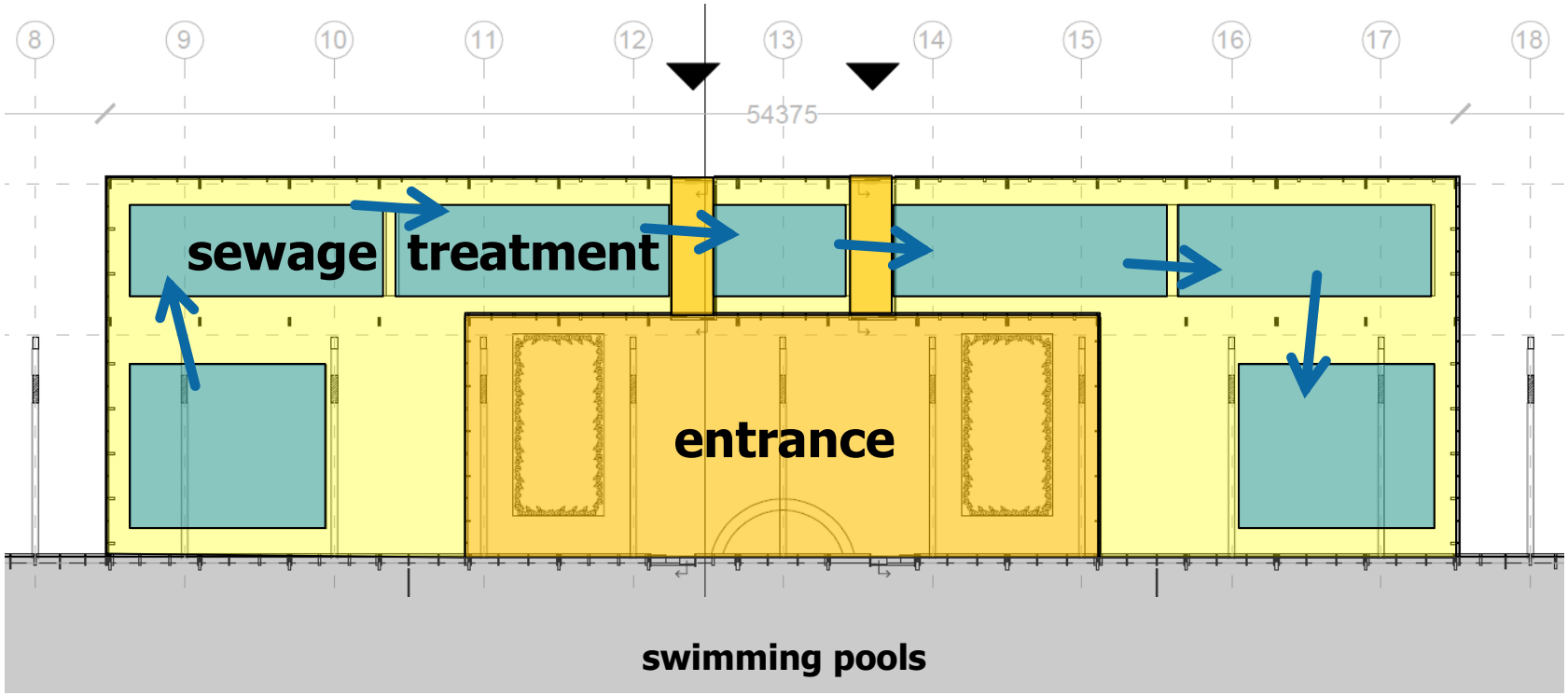
Technical design

installations



Technical design

installations: black water



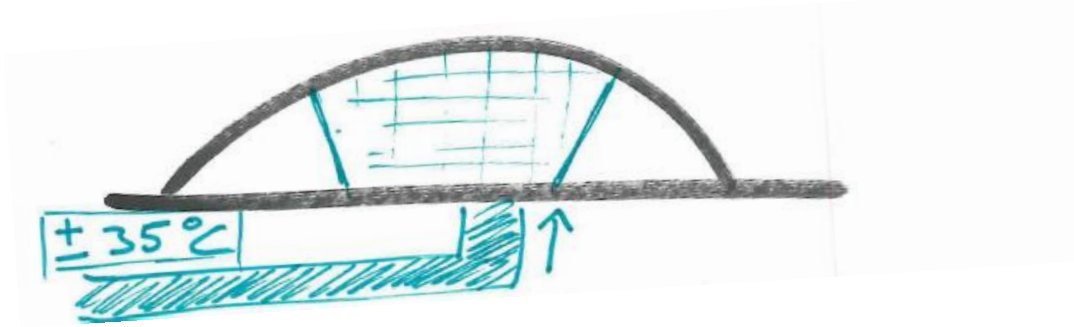
Technical design

installations: heating water

waste heat datacenter (30 – 40 °C)

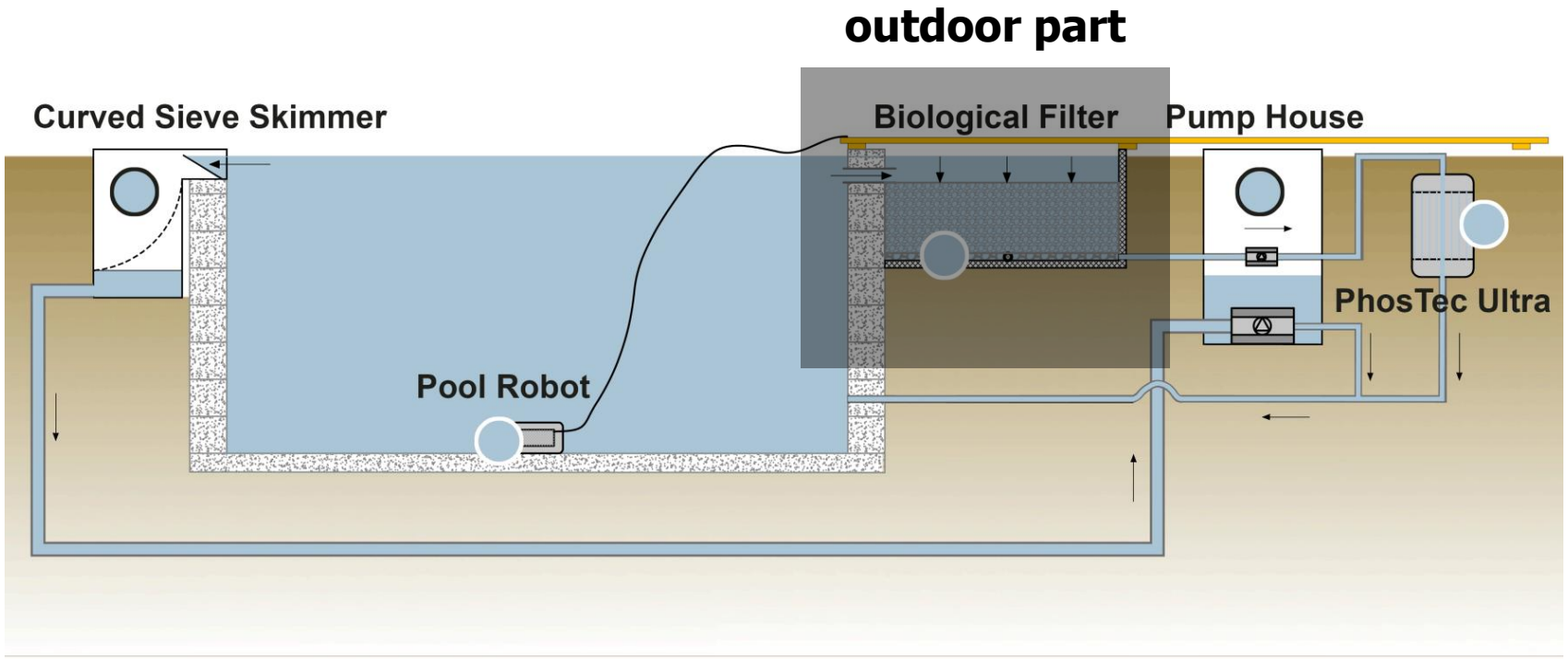
used for:

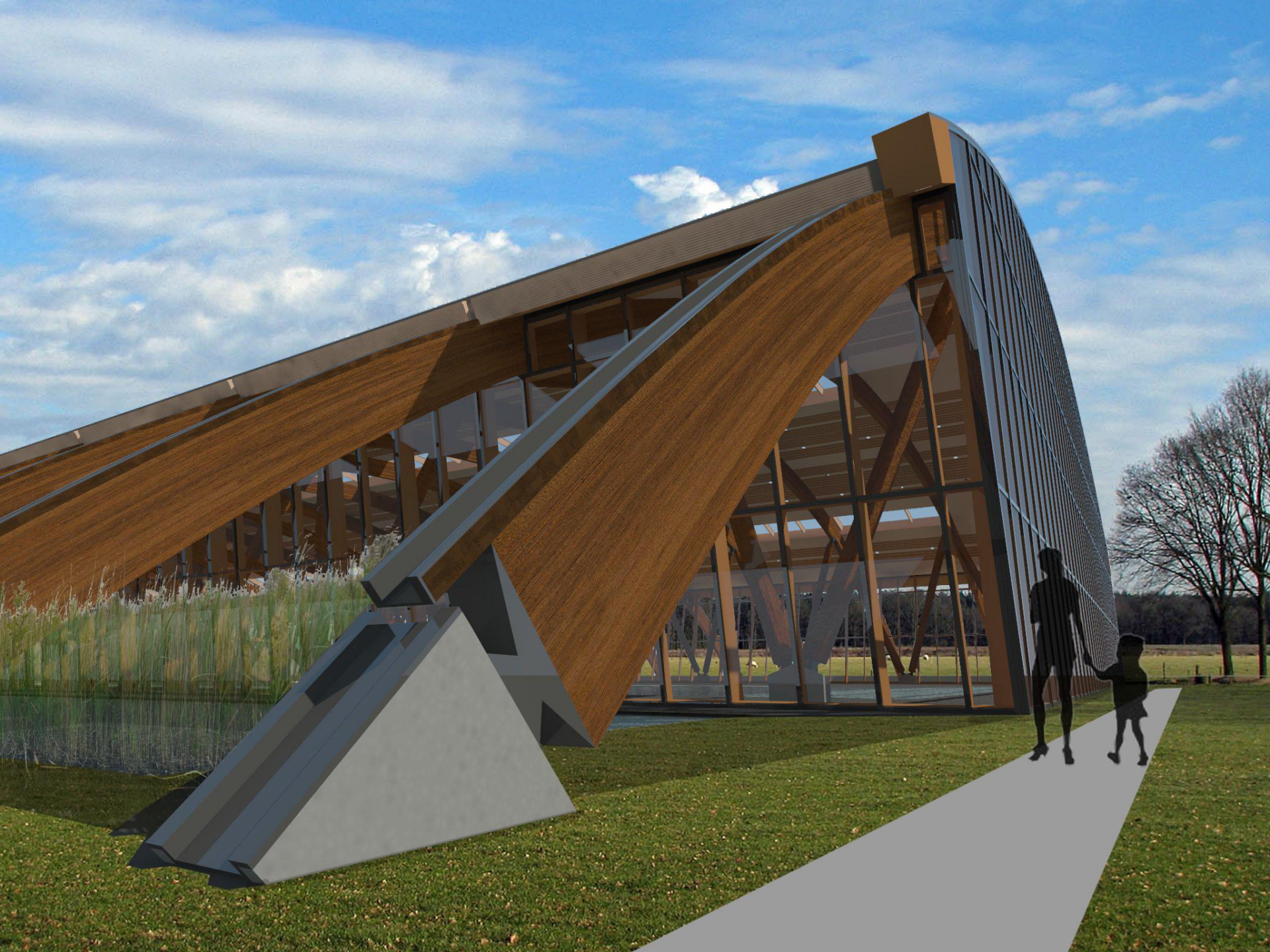
- *swimming water*
- *underfloor heating*
- *ventilation*



Technical design

installations: swimming water

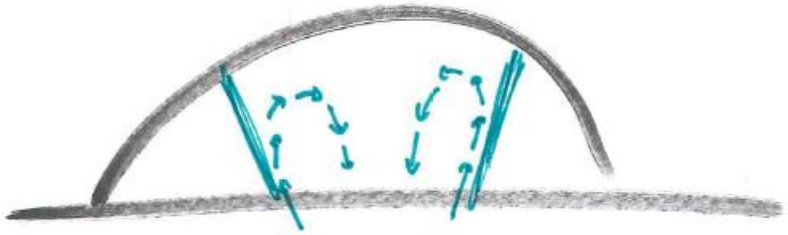




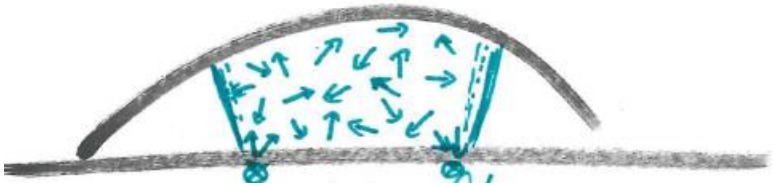
Technical design

installations: ventilation (BaOpt)

conventional ventilation



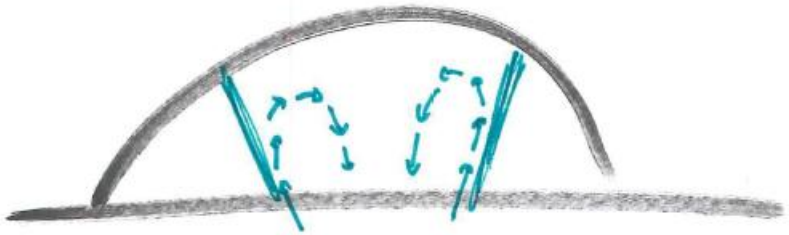
BaOpt ventilation



Technical design

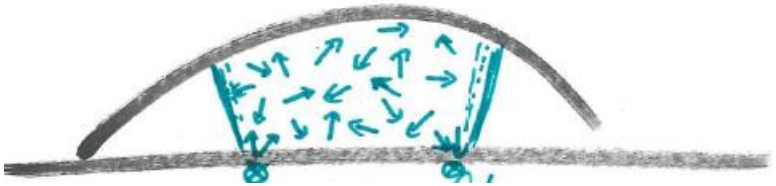
BaOpt ventilation

conventional solution:



inspired by a technique called ´nature´

BaOpt solution:



Technical design

installations overview