# re-thinking the power of water

## integrating sustainable water management and renewable energy systems in a strategy to design future living quality in the Rijnmond delta

P5 Presentation

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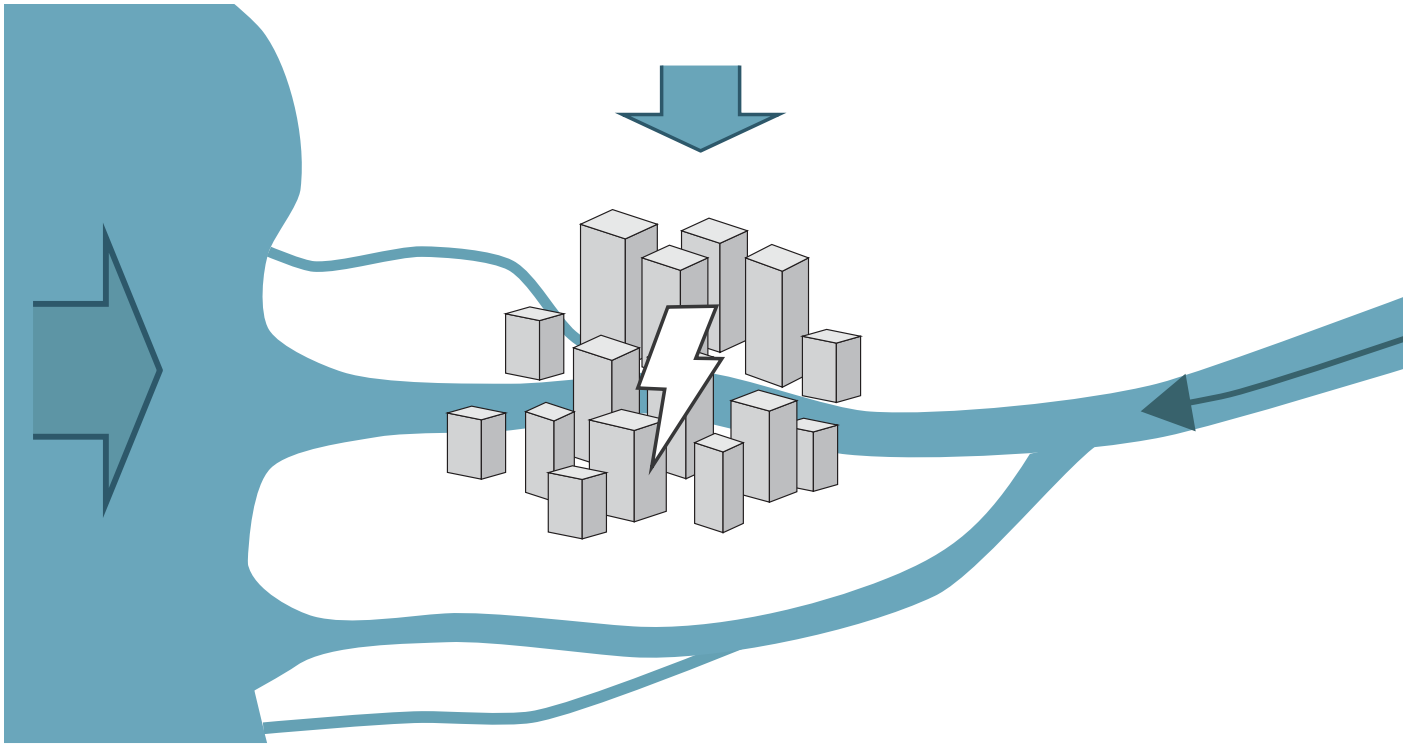
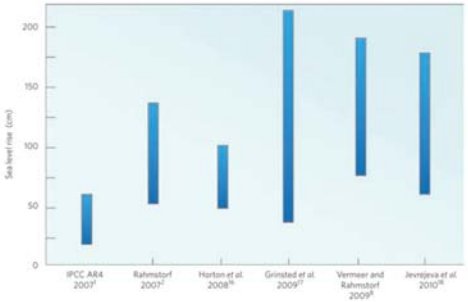
# content

- project set-up
- analysis: theoretical
  technical
  spatial
- design: per scale
  regional -> local
- conclusions

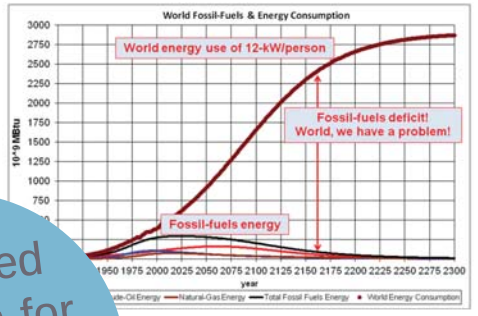
# introducing the problem





water management

energy management




sustainable urban delta

integrated approach for sustainable urban delta

# introducing the problem

Rijnmond region: - delta programme
- economic importance
- sustainability programme

integrated approach for sustainable urban delta

# research question

*How to spatially integrate flood adaptation and renewable energy systems with urban development to design a sustainable urban delta?*

What sustainability approaches can be found in water management, energy management and urban development?

Are there possibilities to combine the disciplines of energy management and water management when implementing spatial development?

Can the possible combination be applied in a vision of the urban delta of the Rijnmond-Drechtsteden region?

What is the potential of implementing this combination in a strategy for the city ports of Rotterdam?

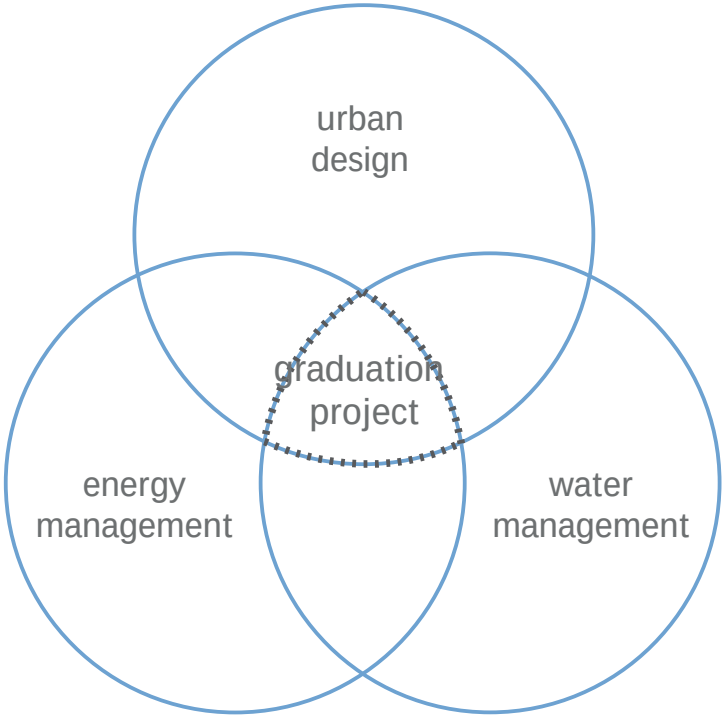
How to translate the results spatially?

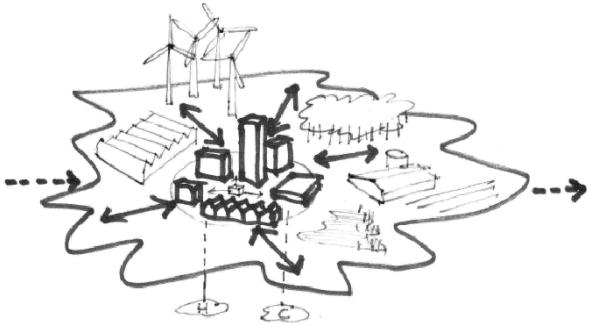
# project aim

develop an integrated approach of 3 disciplines
- water management
- energy management
- urban planning and design

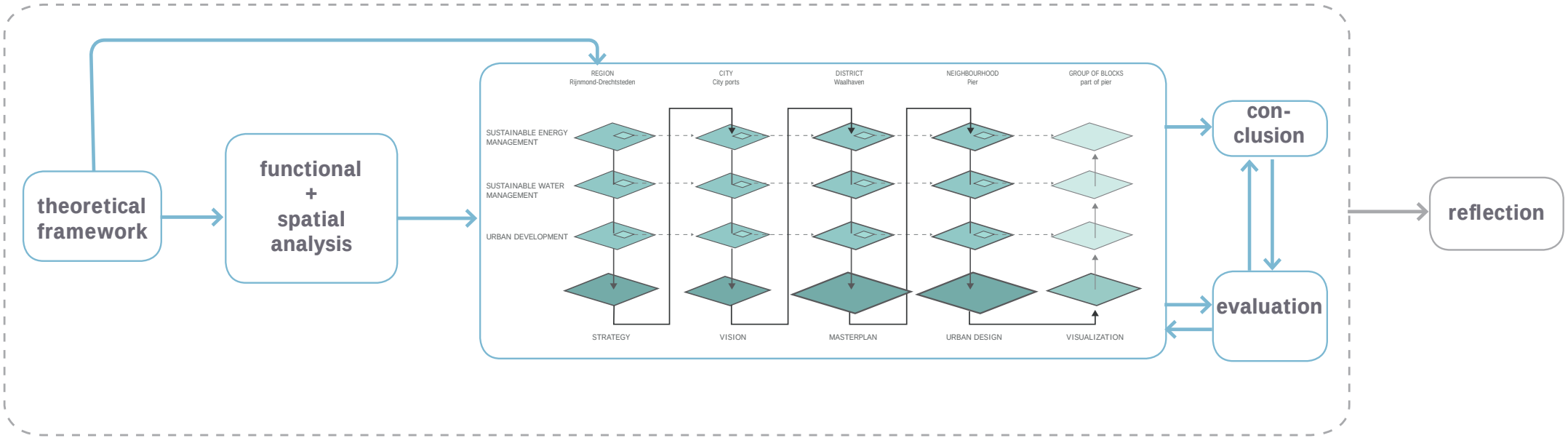
find solutions for the effects of climate change and the energy transition that threaten the Rijnmond region in the twenty-first century

A spatial implementation of environmentally friendly and adaptive solutions
- examplary for what the changes will look like
- test of feasibility of regional strategy



# methodology




## Layer method: result matrix

I - horizontal: products per discipline
II - vertical: integrated design products per level of scale.

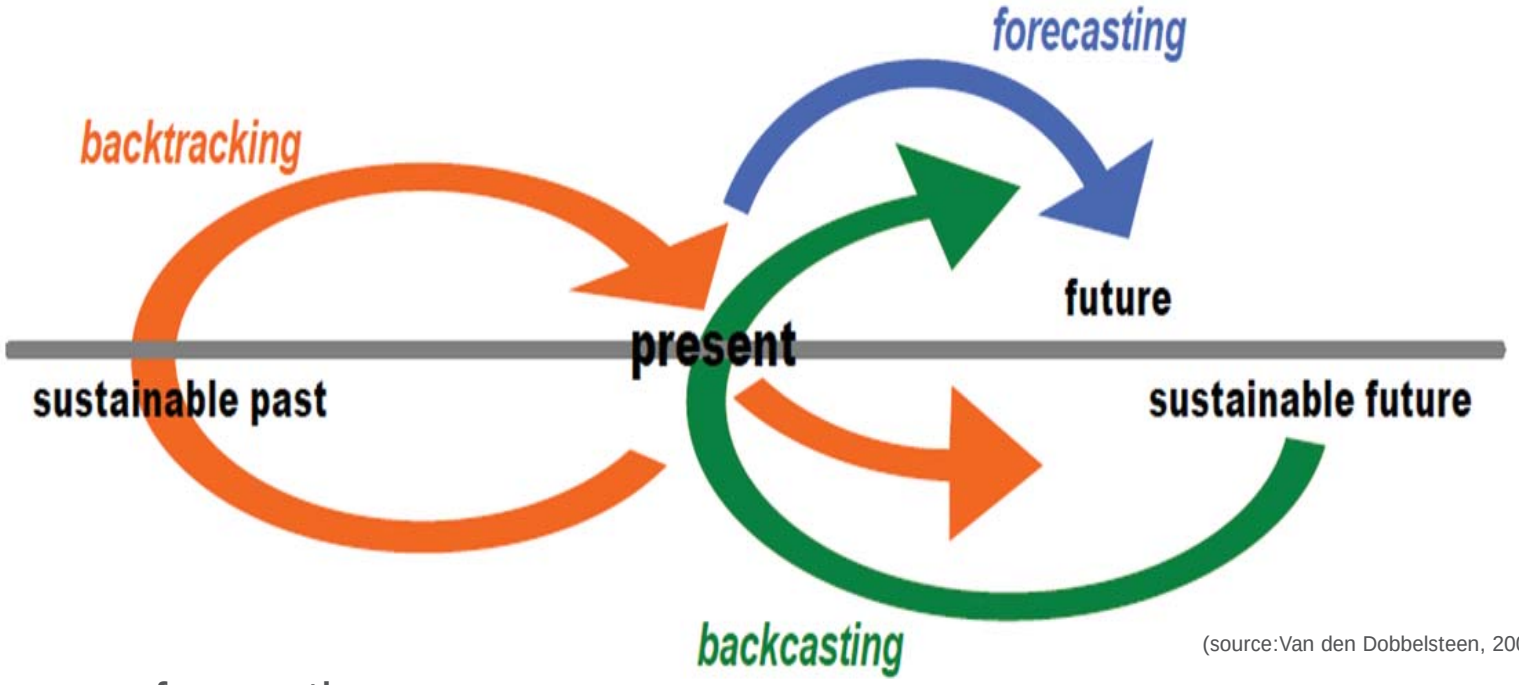
## methods:

- design by research & re-search by design

## techniques:

- literature & reports
- interviews
- drawing

# approach




(source:Van den Dobbelsteen, 2006)

forecasting → future scenarios for project area towards 2100

backtracking → historic development energy-, water management, urban development

backcasting → integrated strategy of energy- and water management into urban design and strategy towards 2100

# research & analysis

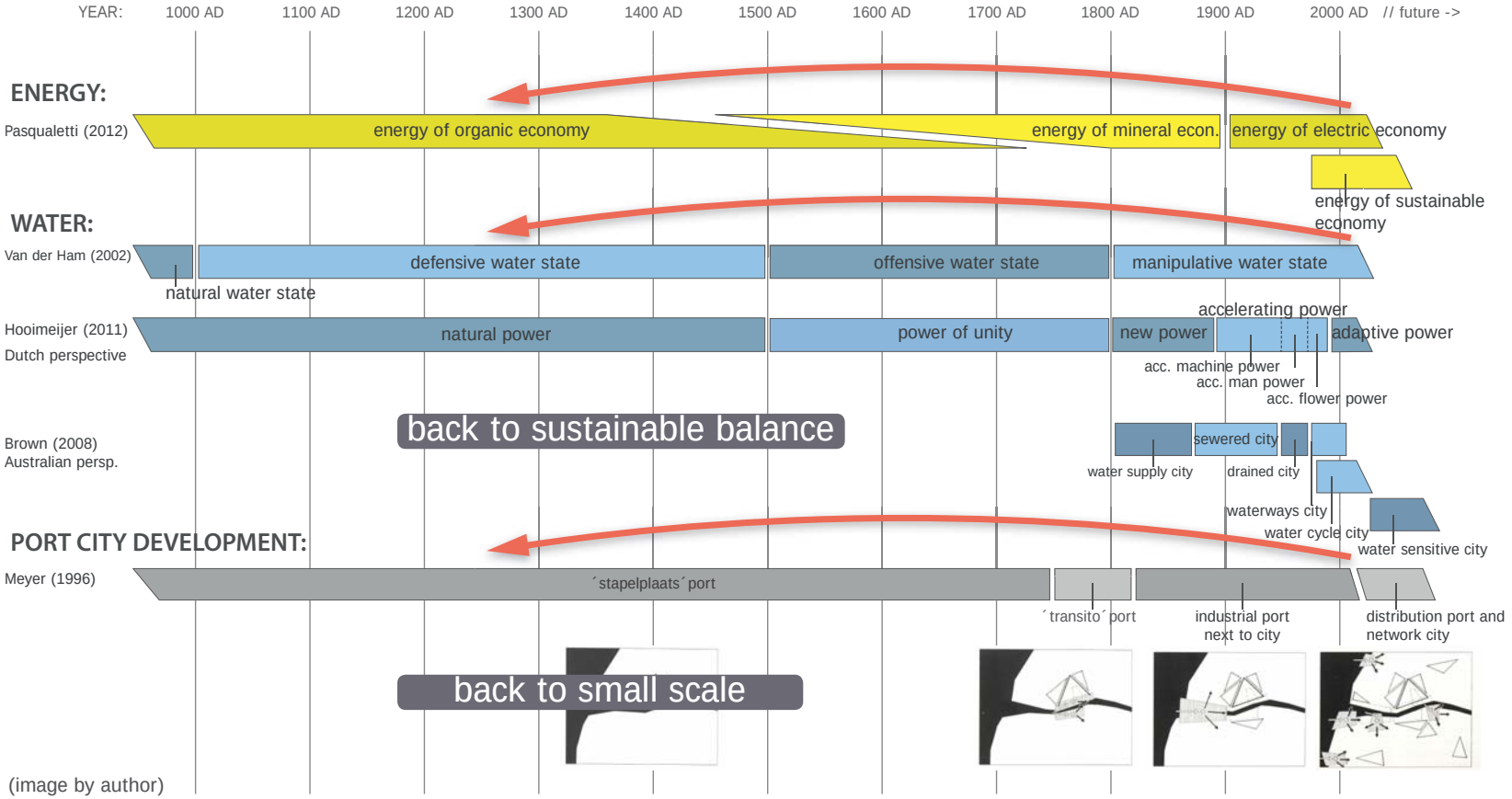
# research

## introduction

- theoretical
- technical/functional analysis
- spatial analysis

# theoretical framework

## backtracking




(image by author)

local resources

plan with water

mosaic of functions

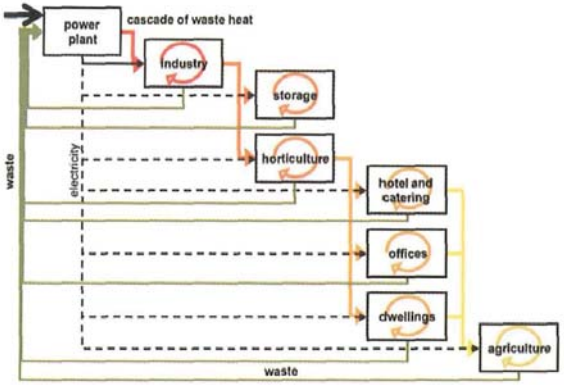
# theoretical framework

## sustainable strategies

E

New Stepped Strategy:
1.Reduce the demand
2. Reuse waste streams
3.A. Use renewable energy sources
B. ‘Ensure that waste can be used as food’

(source: Van den Dobbelsteen and Tillie, 2011, p.6)



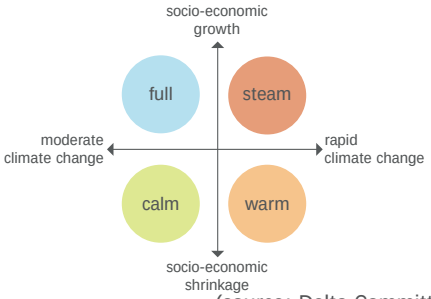

Source: Van den Dobbelsteen, 2010

W

Delta Programme:
4 future scenarios

-> ‘Full’ most likely

(source: Delta Committee, 2008)




(source: Delta Committee, 2012)

U

´City Apps´ (Waterstudio, 2012)
Blue Revolution (Deltasync, 2012)

improve overal fitness (Roggema, 2005)

‘Power to the people’ (Rifkin, 2011)

(source: Waterstudio, 2012)

## assessing energy from water

reports by Deltares and CE Delft show:

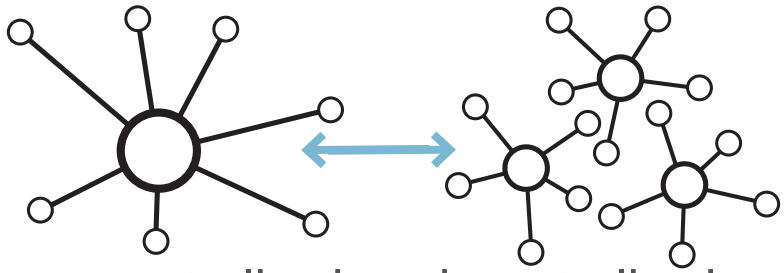
**Implementations considering thermal energy from water are most feasible;**

**FOCUS ON THERMAL ENERGY**

also most interesting for urban design & planning

| PJ / year | fresh/salt gradiënt | river flux | tidal flux or diffe-rence | waves | aquatic biomass | heat/cold storage | geother-mal | difference in tempe-rature | total energy yield |
|---|---|---|---|---|---|---|---|---|---|
| total potential | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| technically collectable | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| societally collectable | ● | ● | ● | ● | ● | ● | ● | ● | ● |

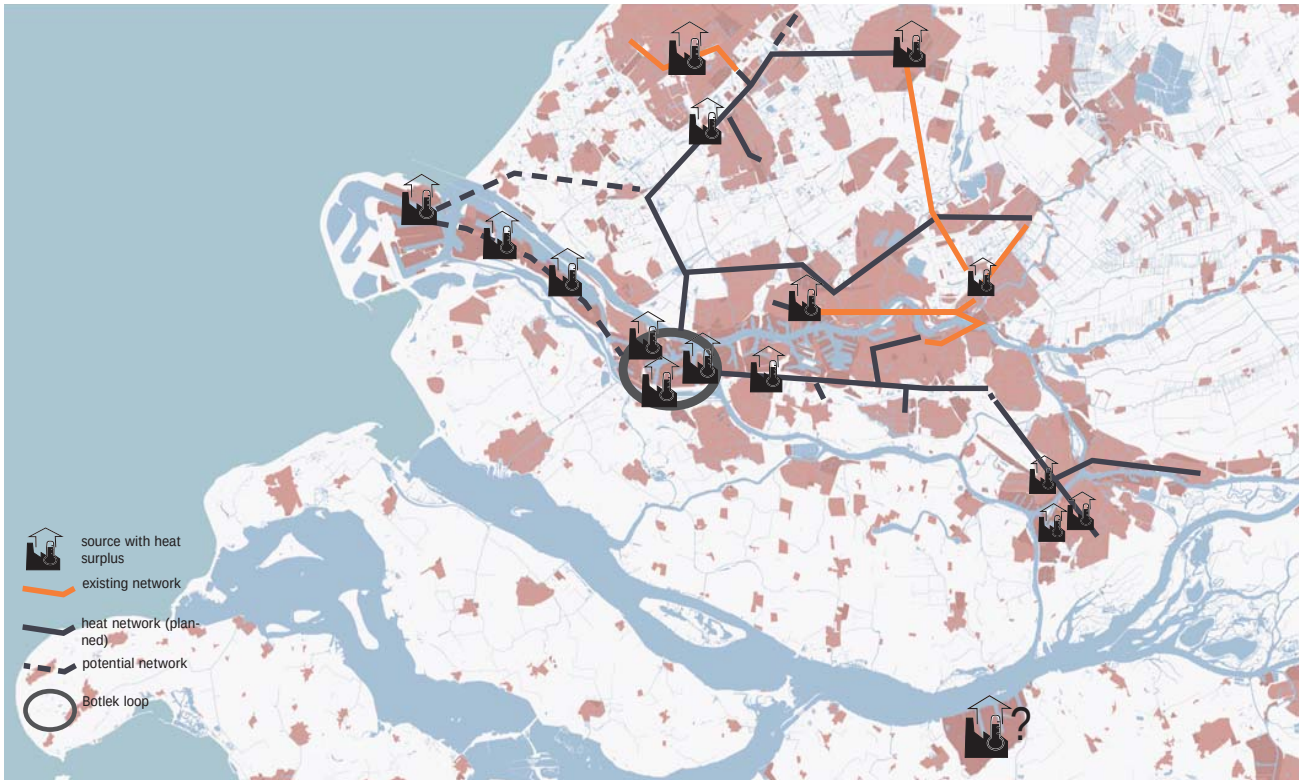
source: Deltares (2008)



centralized vs decentralized

# analysis

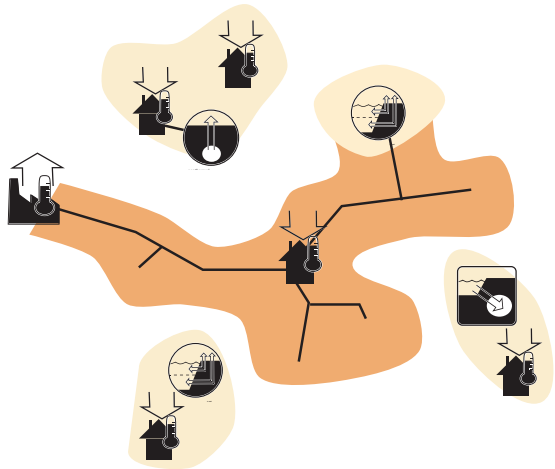
## thermal networks





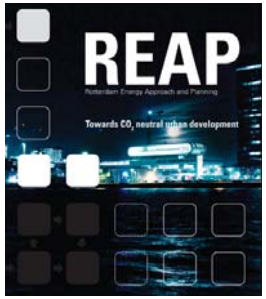
current district heating pipelines


district heating vision of mun. of R'dam



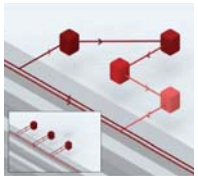
sustainable alternatives heat network

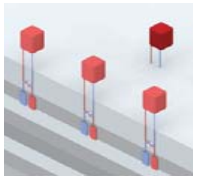
## REAP assessment

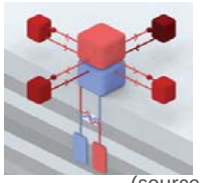



REAP - Rotterdam Energy Approach & Planning:
- reduce demand
- exchange, reuse energy
- use sustainable sources

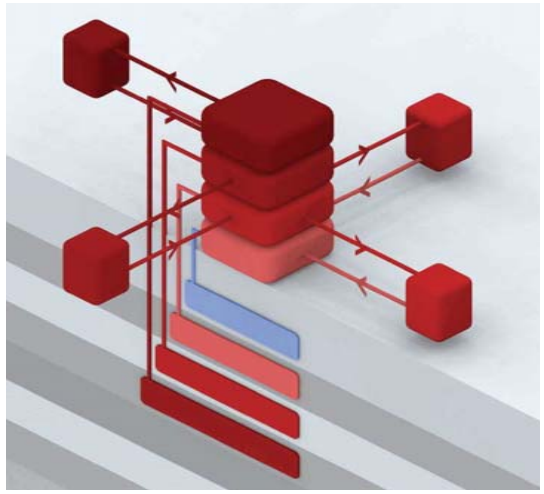
different local energy distribution systems


cascading


individual
self support


exchanging

(source: Tillie et al., 2010)

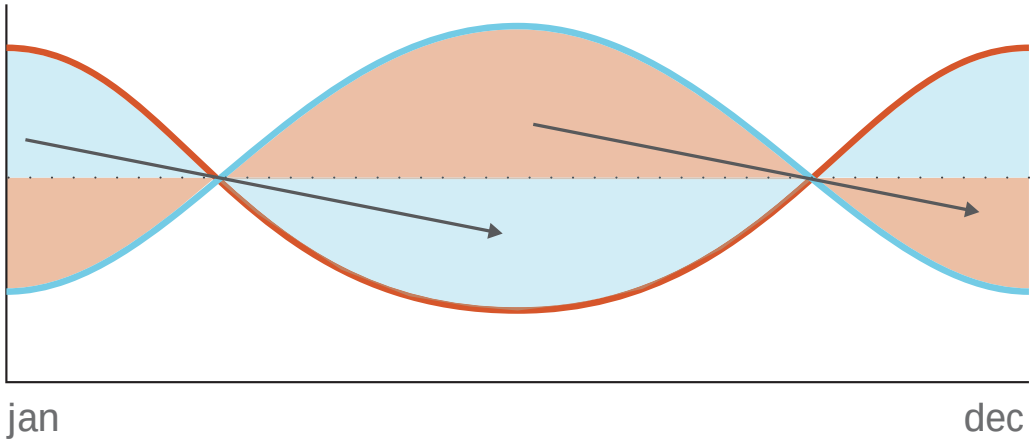


**cascading machine**

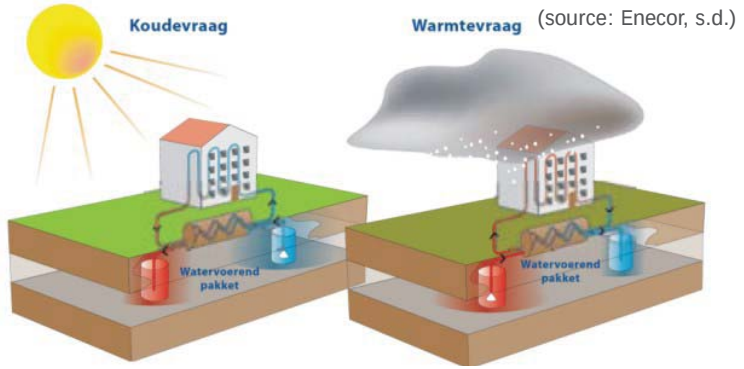
+ individual servicing; adaptive
+ central distribution point
+ optional connection to heat source
+ also distribution of cold

- extensive pipeline network

# thermal energy from surface water: heat difference

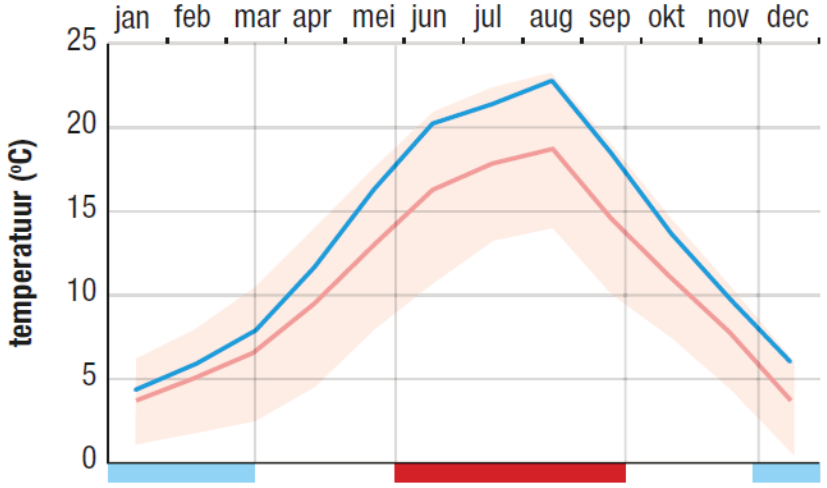


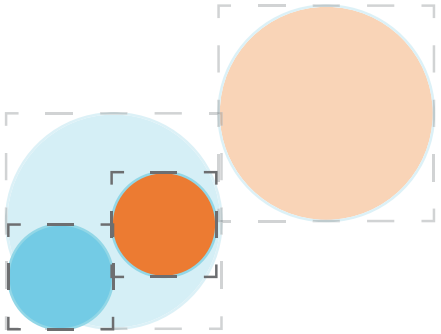

## HEAT/COLD STORAGE IN AQUIFER

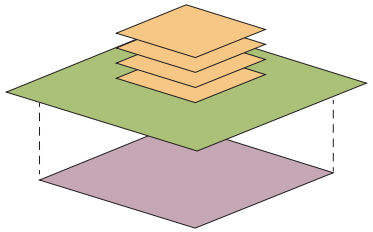



(source: Enecor, s.d.)

## near surface water: reduce storage volume



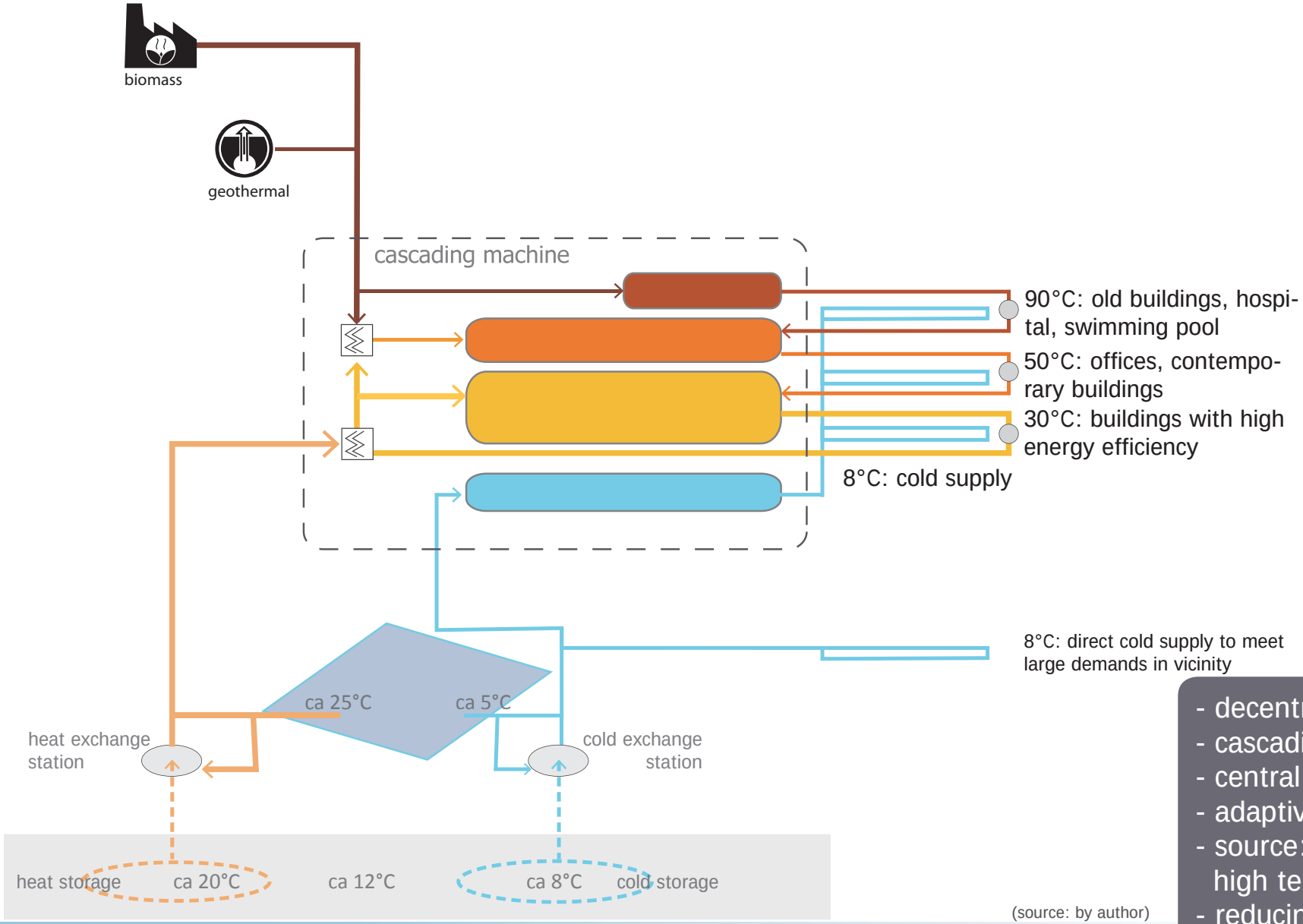





FSI < storage footprint

# analysis

## thermal distribution system

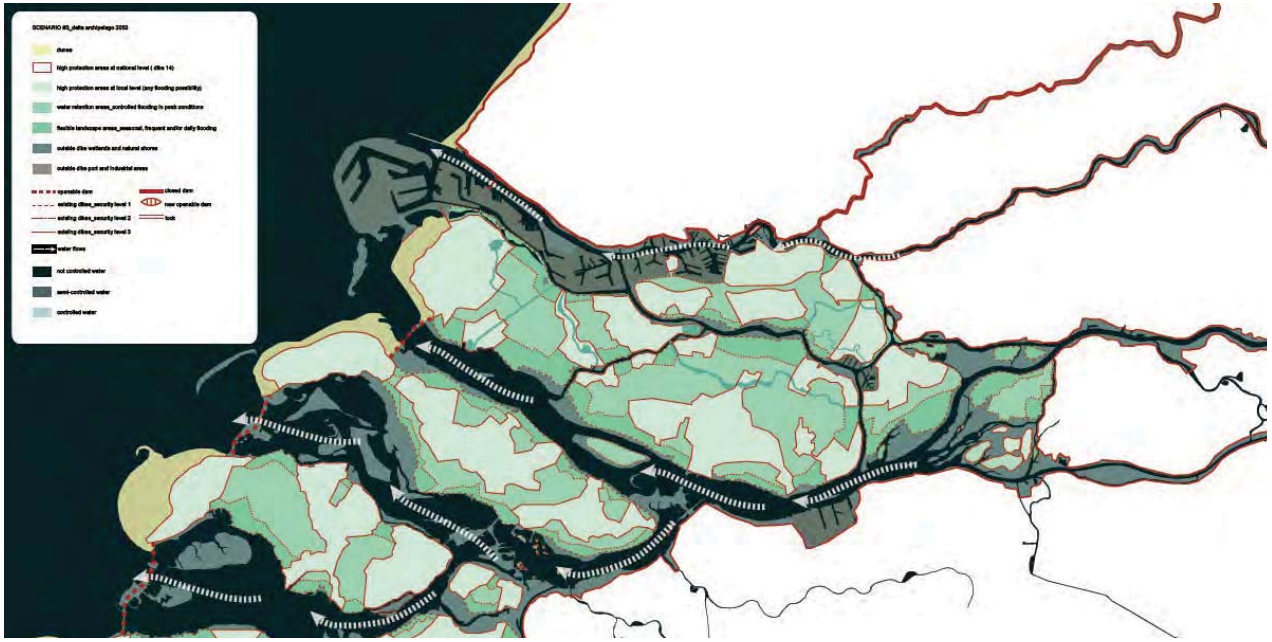



(source: by author)

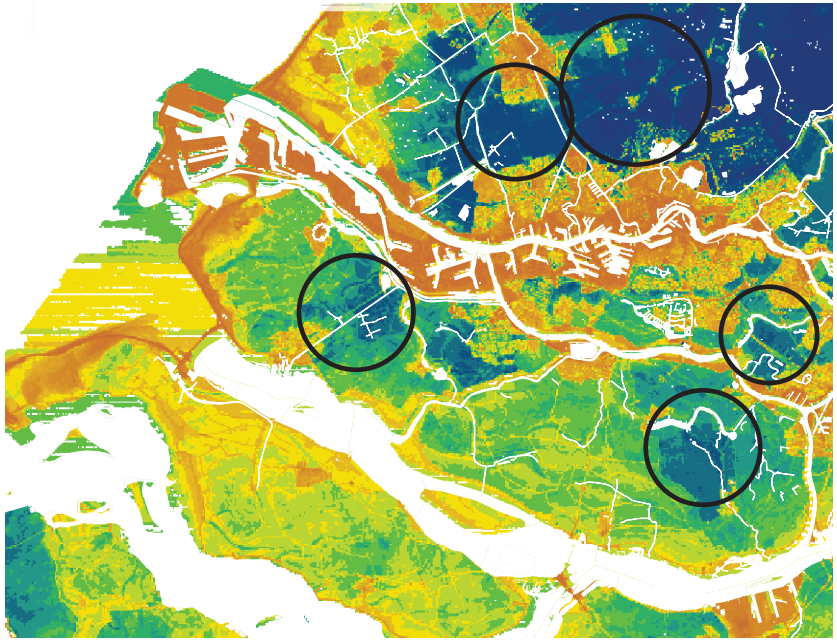
- decentralized local network
- cascading energy
- central distribution
- adaptive distribution system
- source: surface water & external high temperature supply
- reducing storage space

# analysis

## regional water strategies



(source: Meyer, 2010)

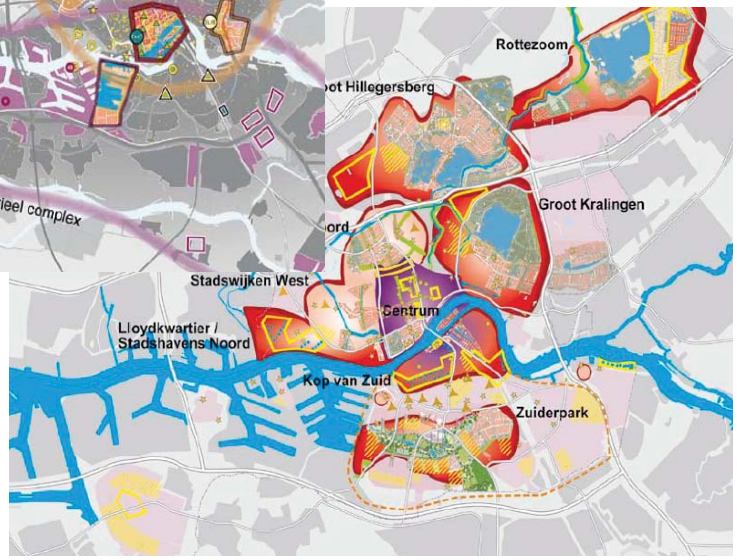


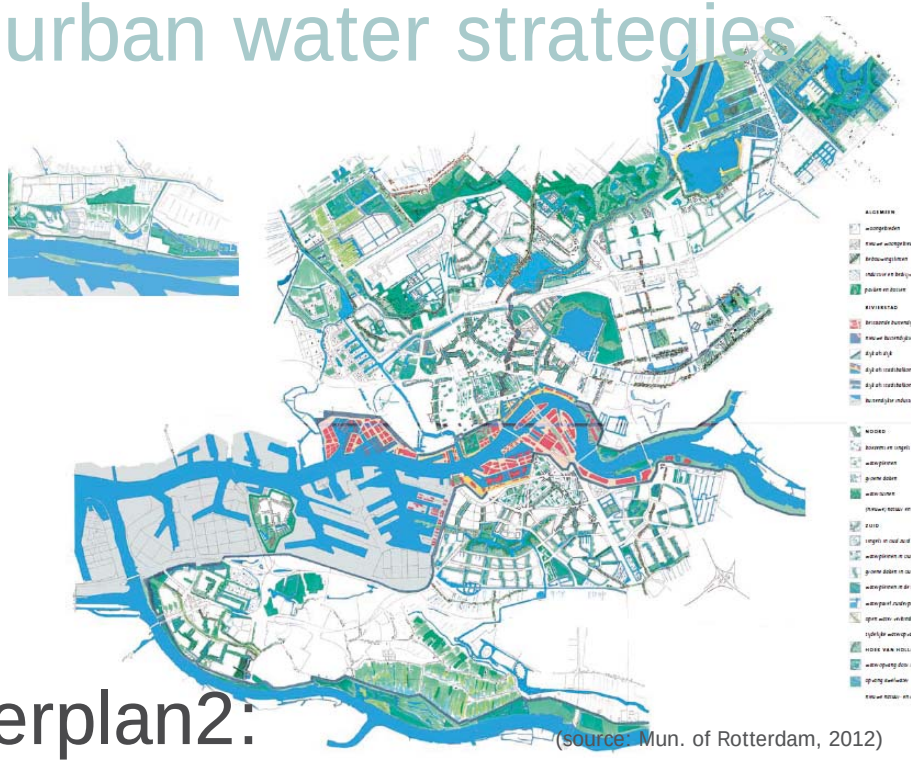
(source: AHN, s.d.)

# analysis

## urban water strategies


source: dS+V Rotterdam, 2011)



(source: Mun. of Rotterdam, 2012)

## city vision 2030:

- build in existing urban area
- public space and water assignment as accelerator of spatial developments
- combine the approach of environment and spatial development in a creative way
- put cultural heritage and architecture forward as a force of development

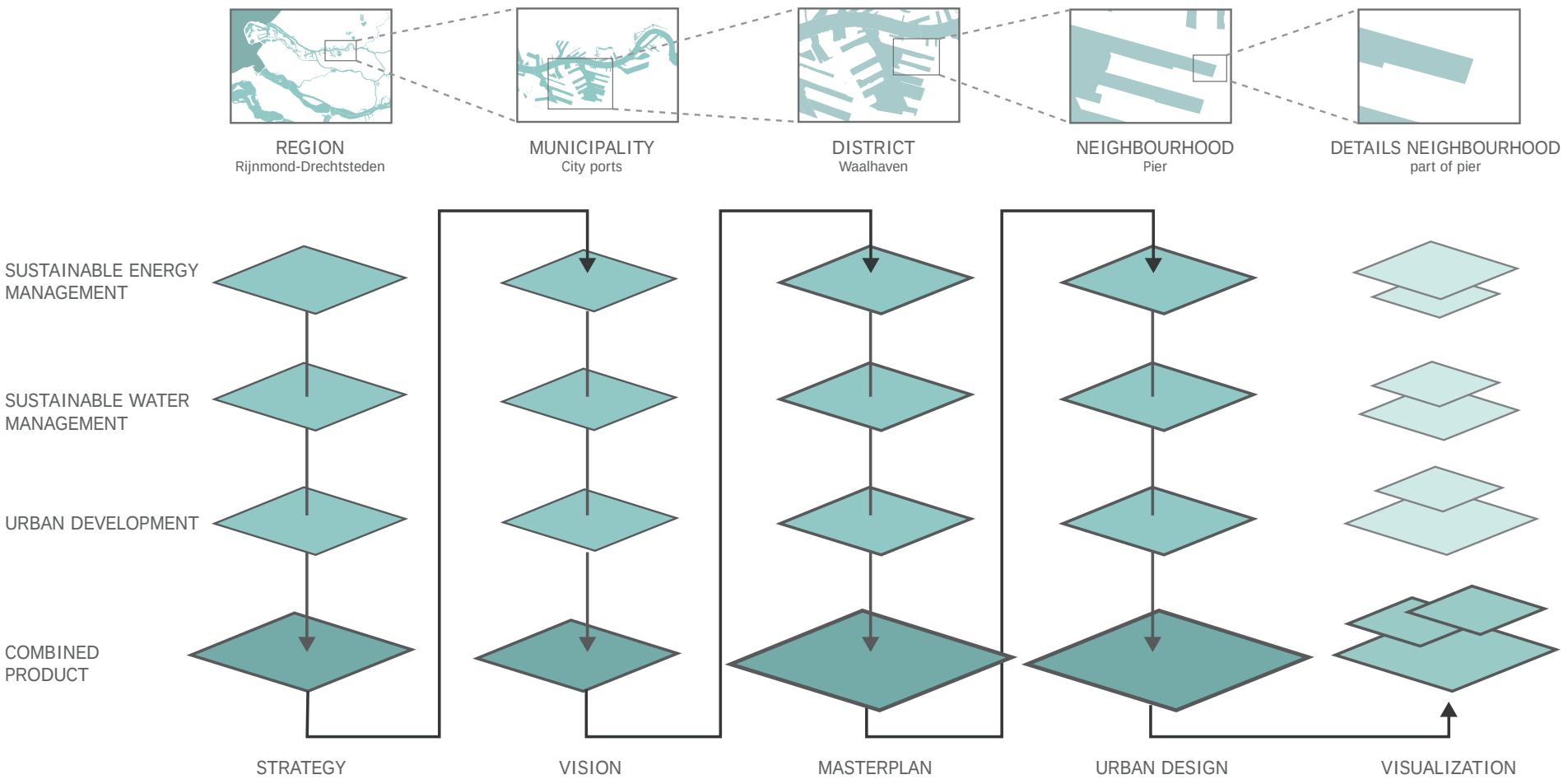
## Waterplan2:

- attractive city, watercity
- higher water levels: strengthen defenses
- traditional solutions insufficient to make attractive city and solve waterproblems
- South of R'dam: more radical approach needed
- collaboration municipality, waterboard, water specialists, **urbanists**

# design products

# design products

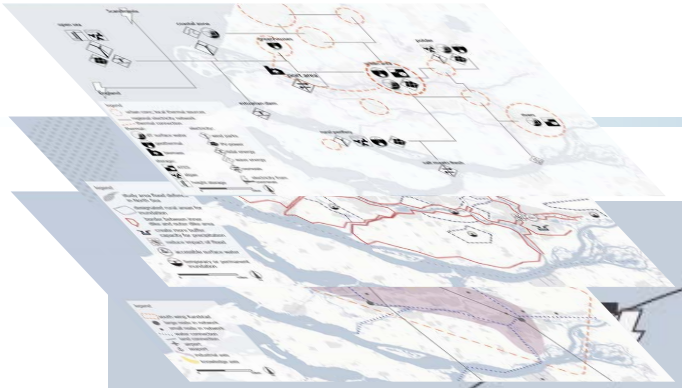
## overview

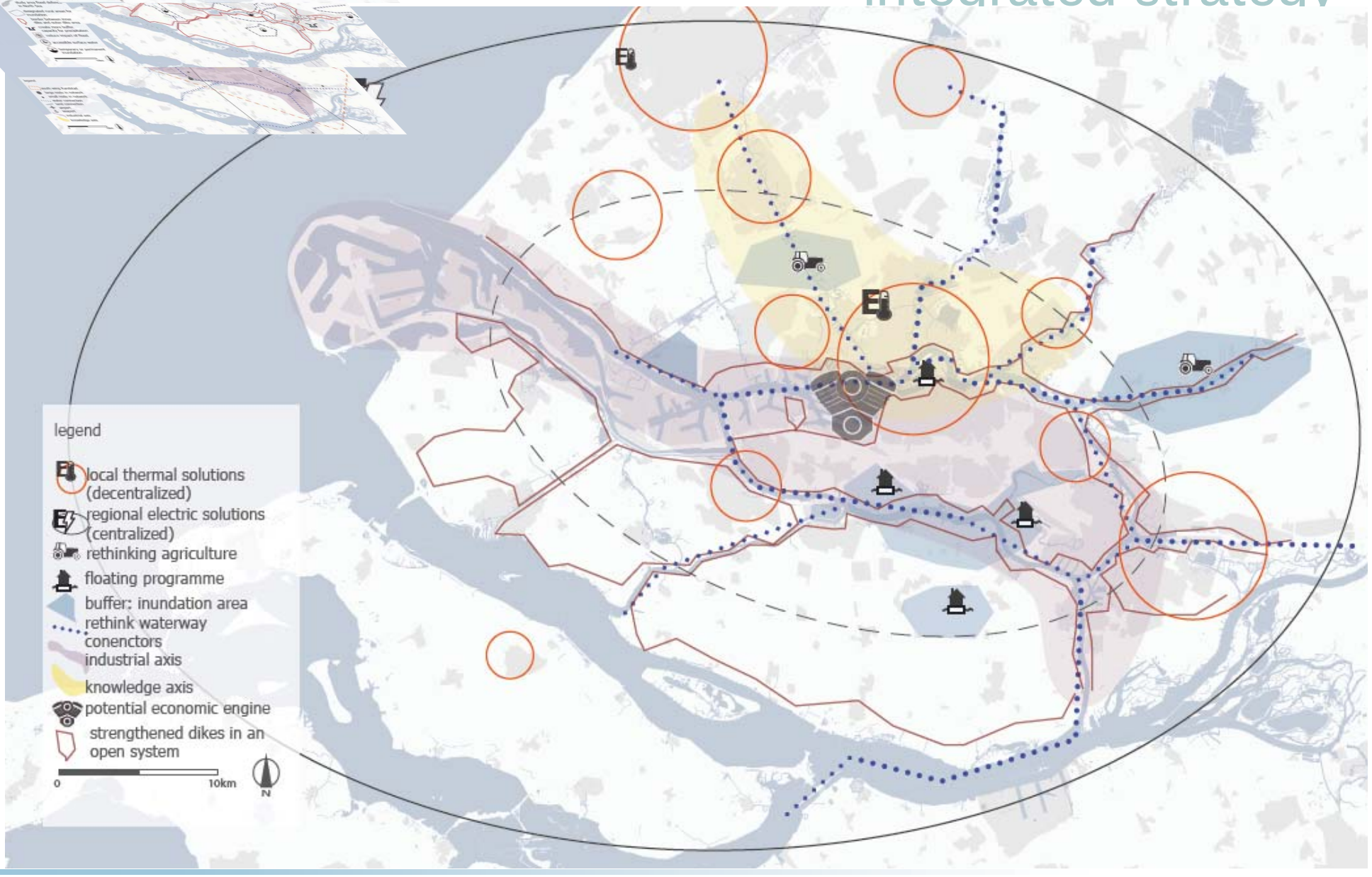



- results of the research translated to a regional vision and strategy
- combining the plans for energy, water and development into integrated spatial solutions

# Rijnmond region

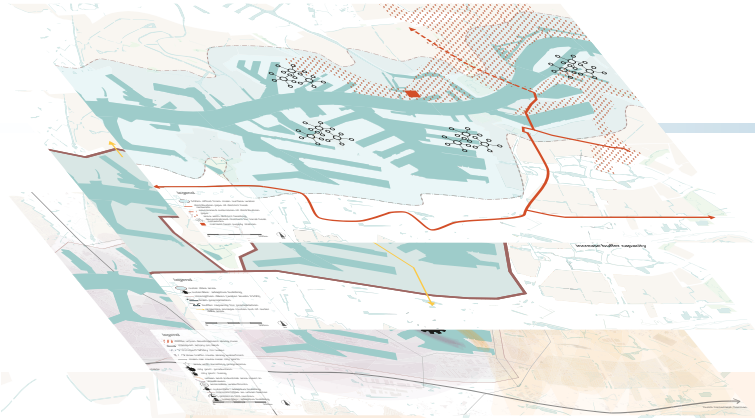
## integrated strategy

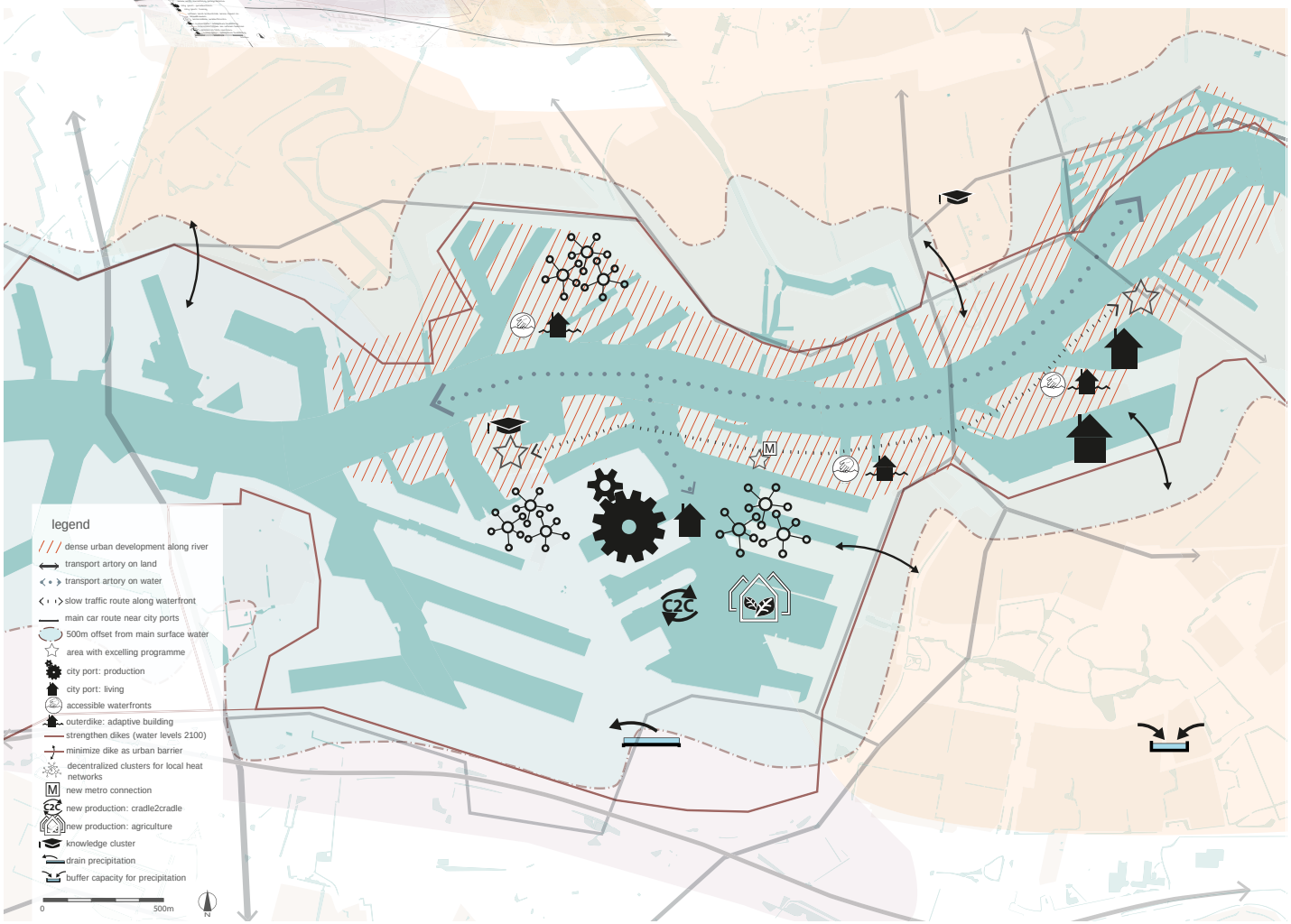


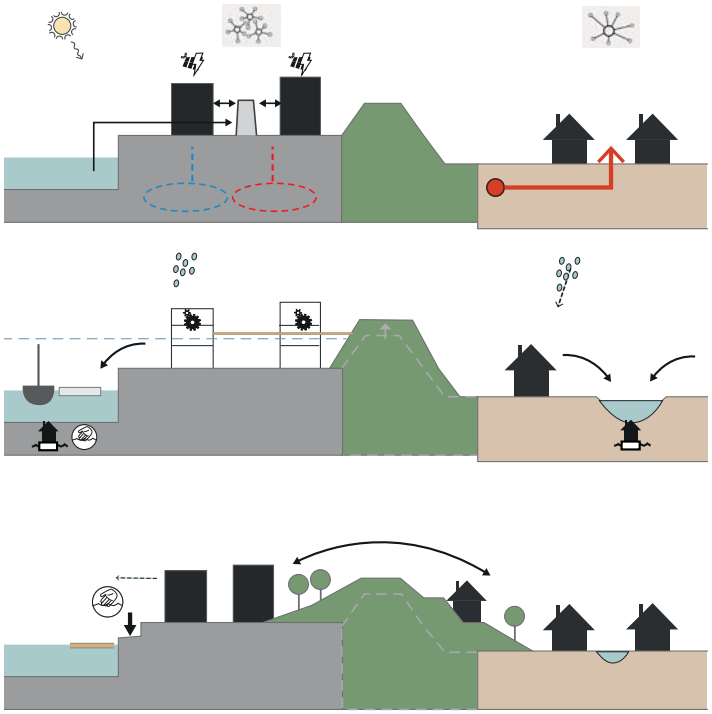


# vision

## city ports

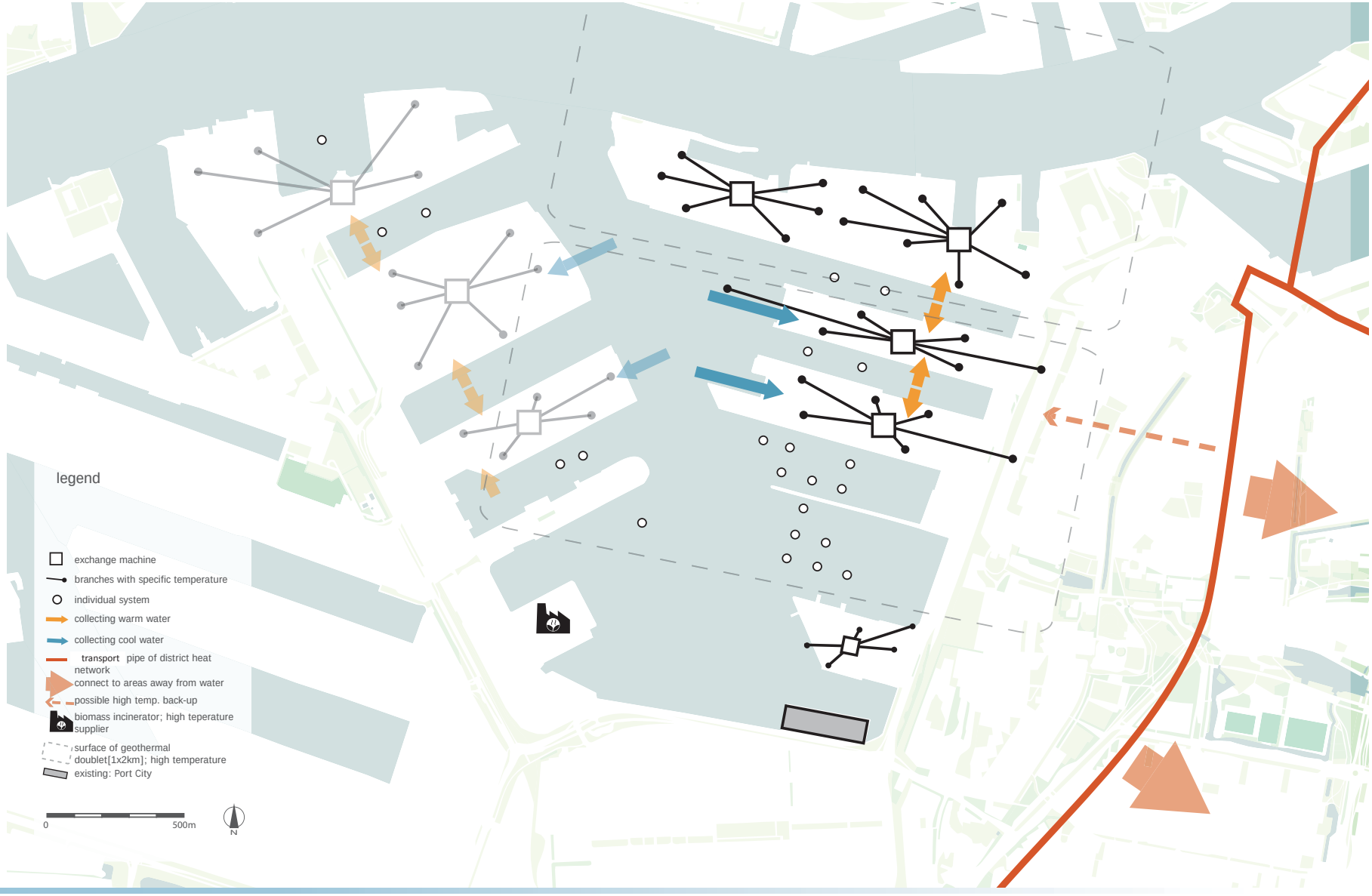




# Waalhaven

## energy

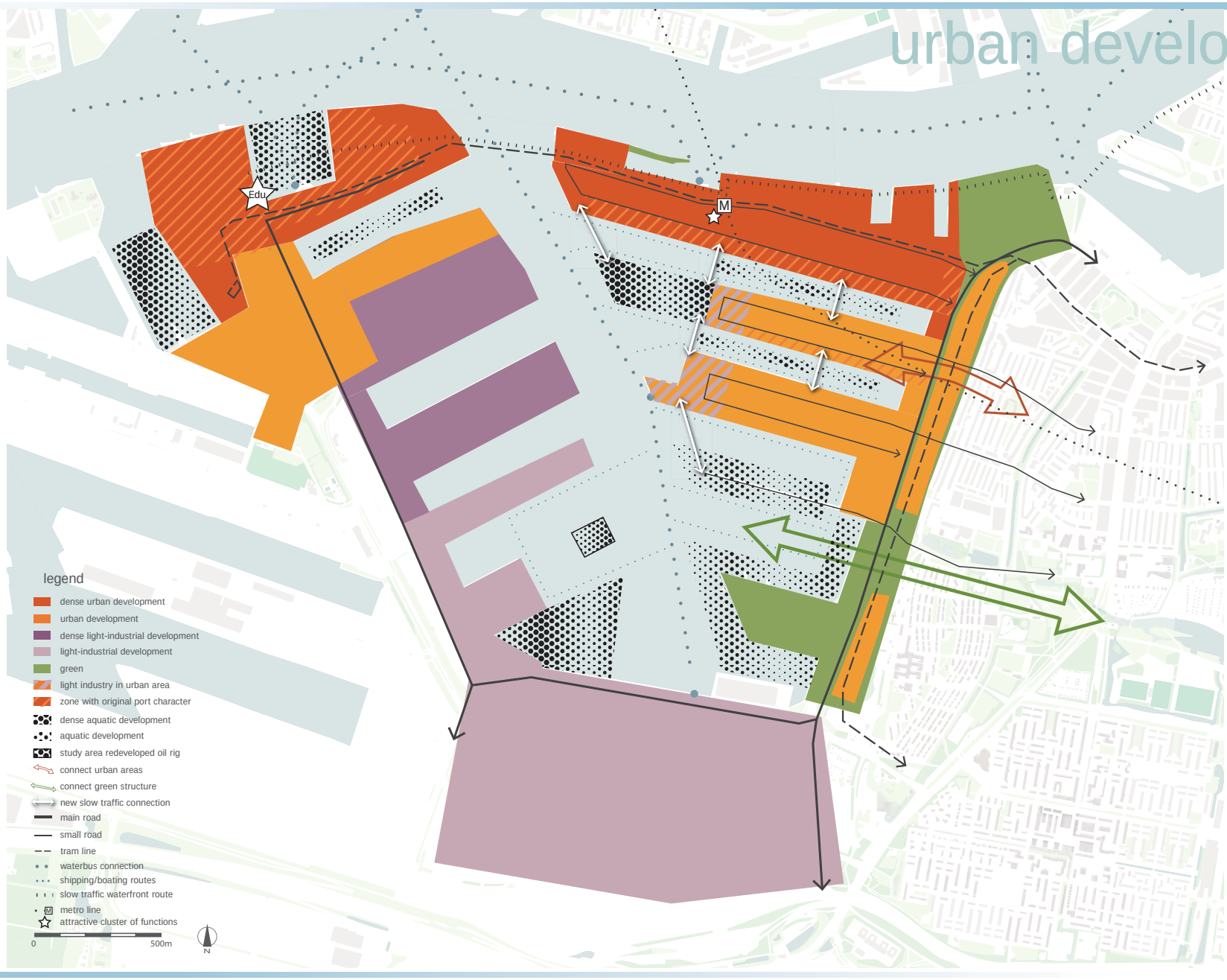


# Waalhaven

## water

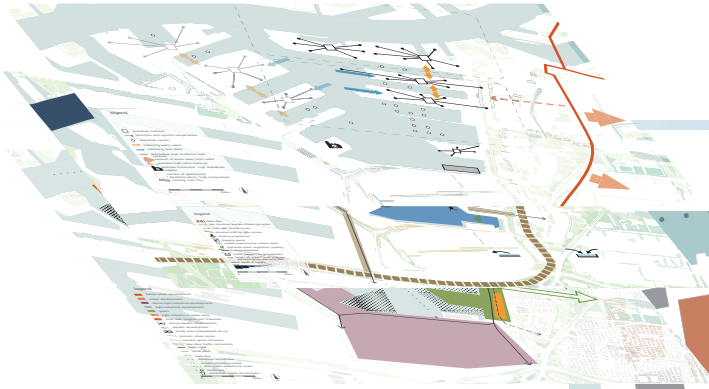
# Waalhaven

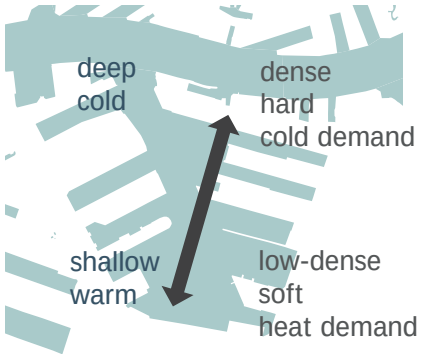
## urban development

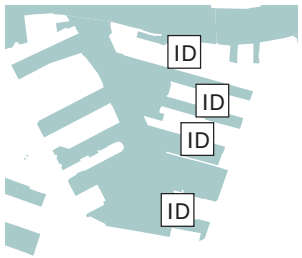


# masterplan

## Waalhaven

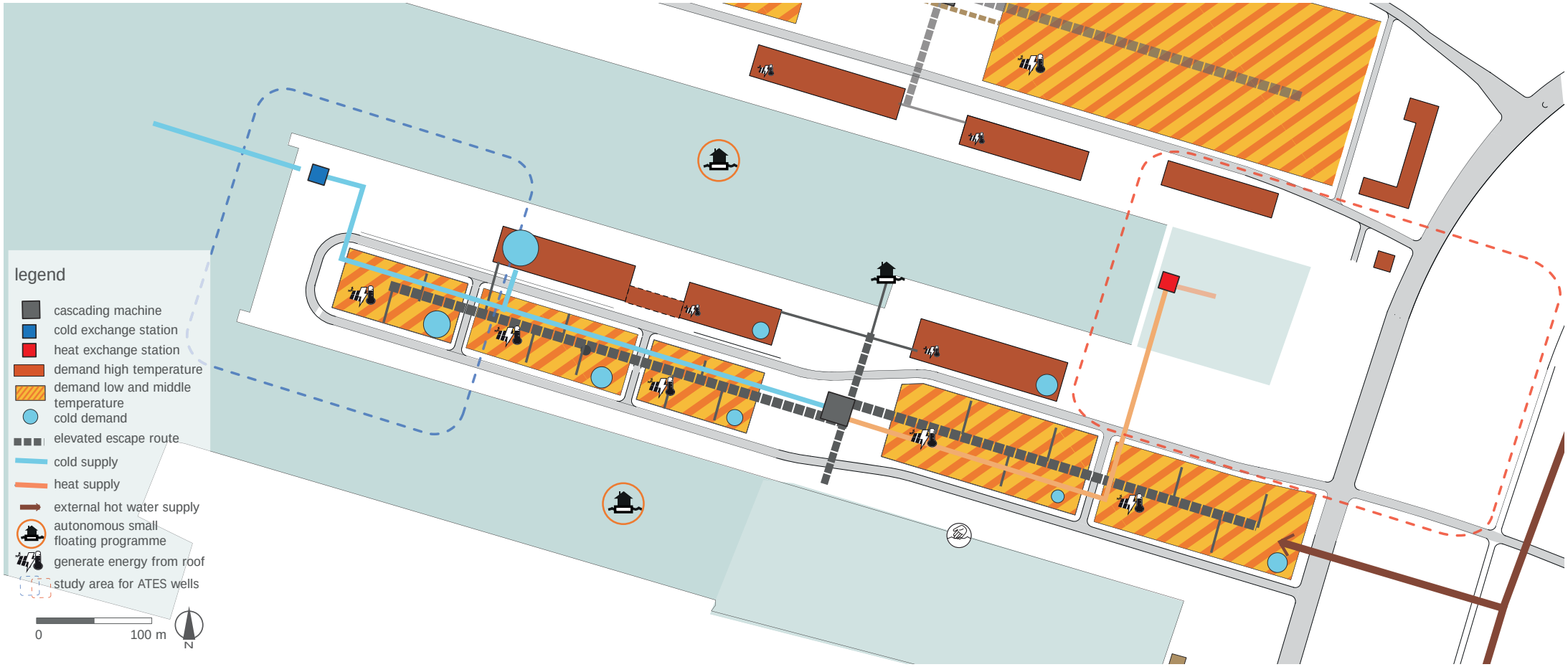




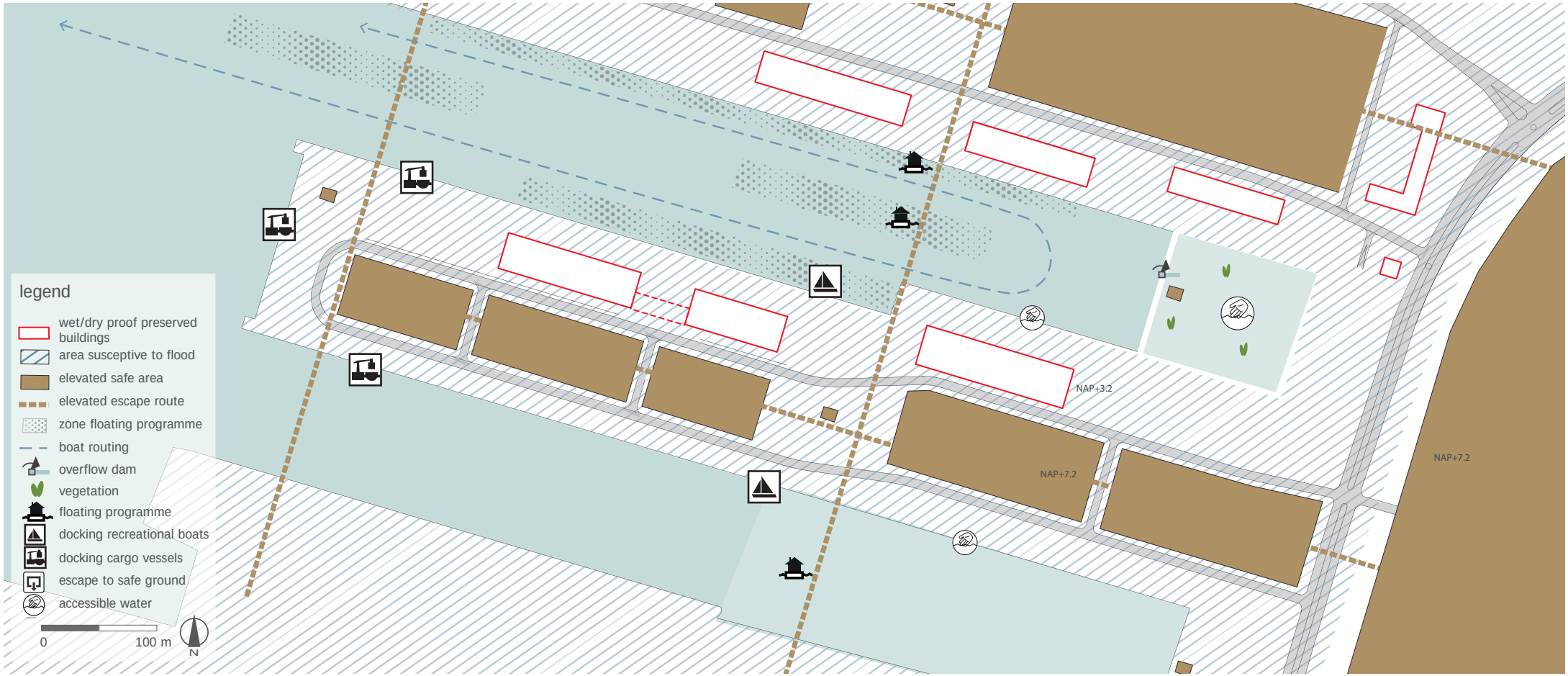

# Pier 1

## energy



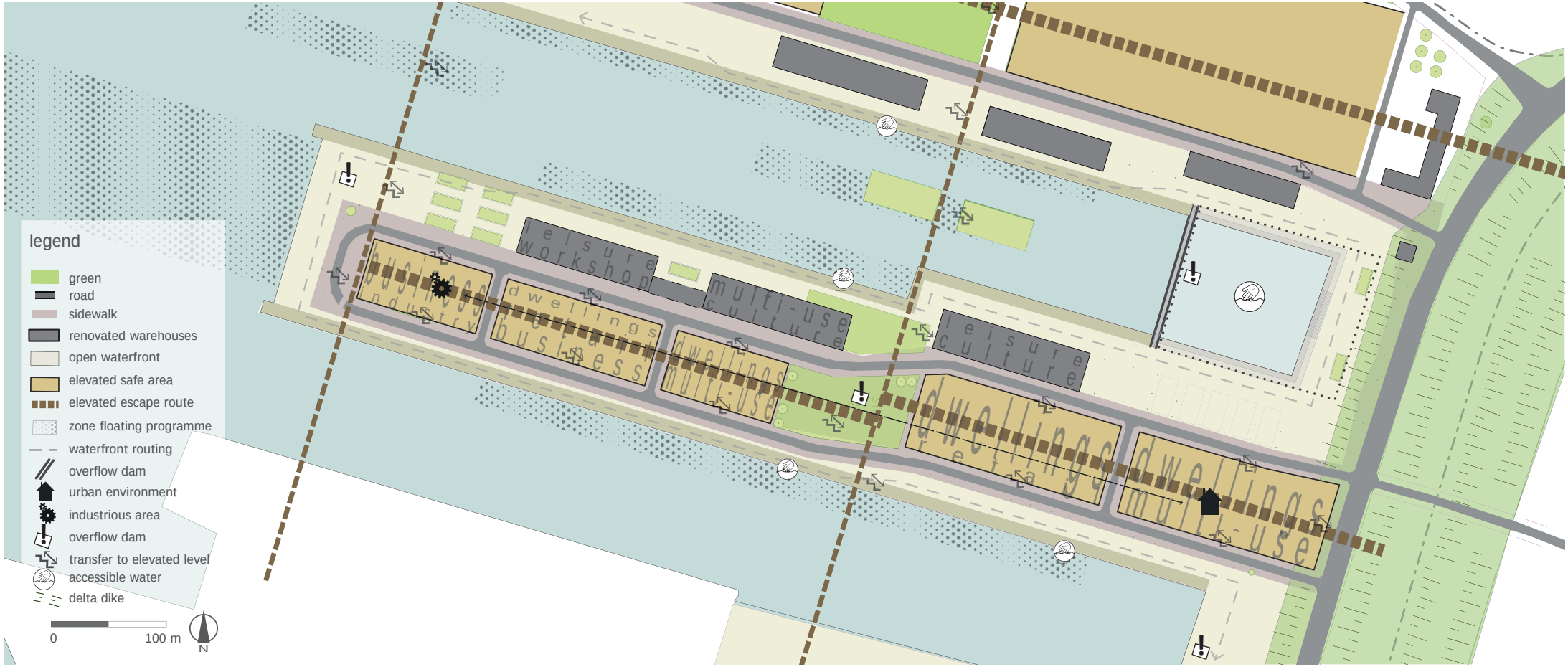
# Pier 1

## water


legend
wet/dry proof preserved buildings
area susceptive to flood
elevated safe area
elevated escape route
zone floating programme
boat routing
overflow dam
vegetation
floating programme
docking recreational boats
docking cargo vessels
escape to safe ground
accessible water
0
100 m
N
NAP+3.2
NAP+7.2
NAP+7.2

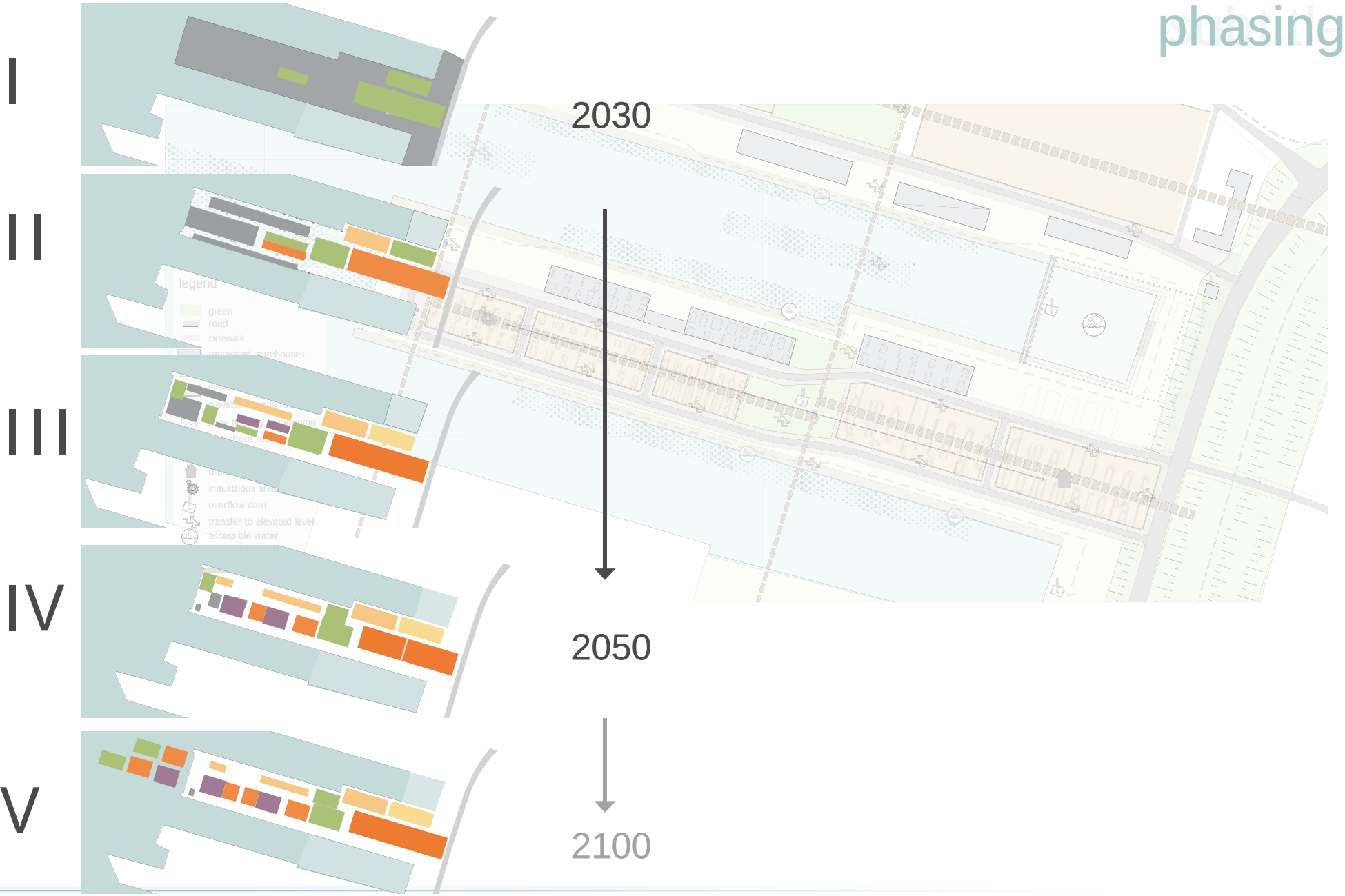
# Pier 1

## urban development



# Pier 1

## phasing



# Pier 1

## phasing

I

II

III

IV

V

2030

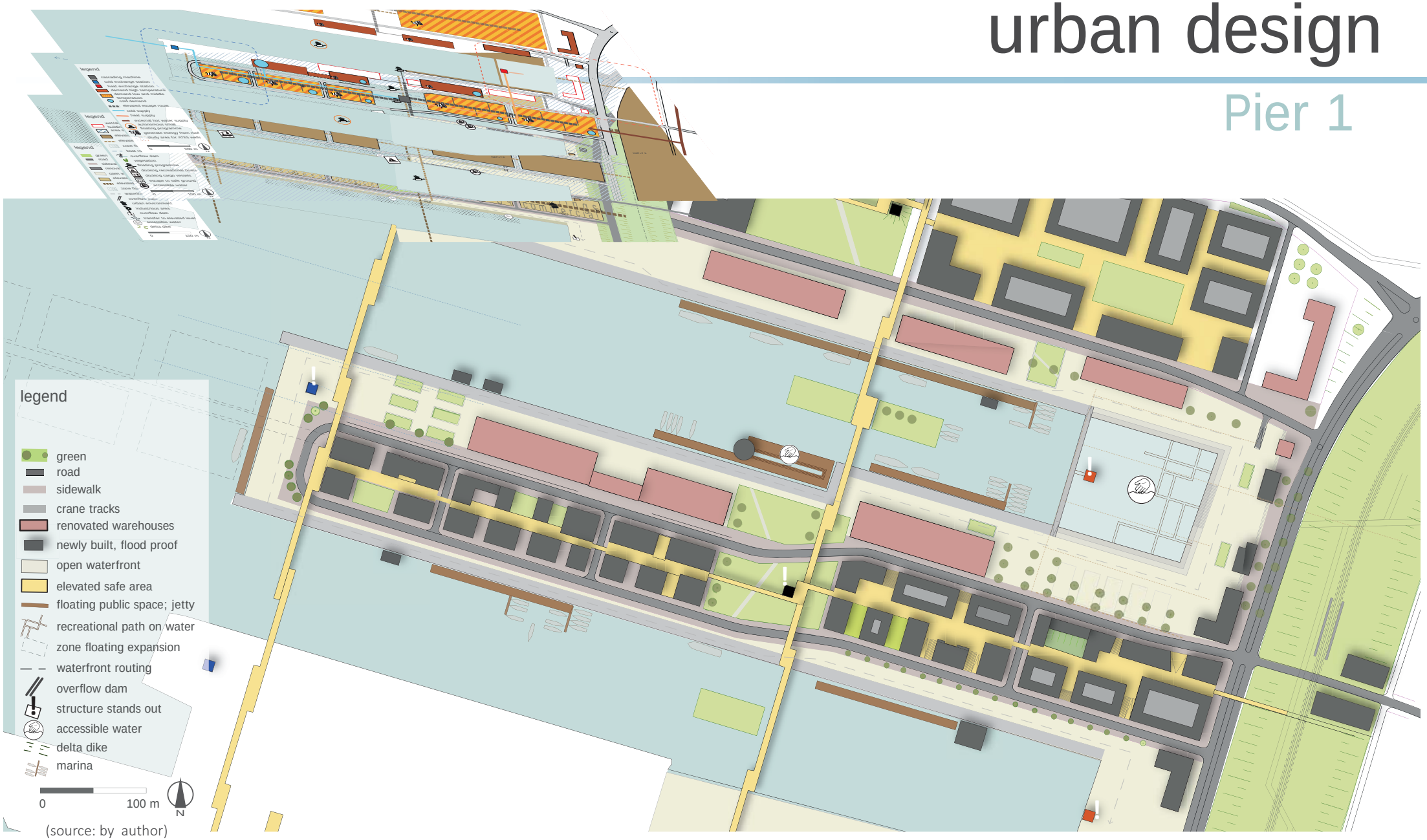
2050

2100




# urban design

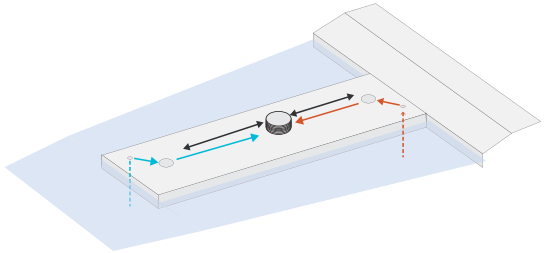
## Pier 1



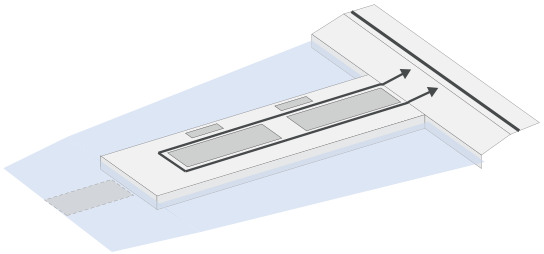

(source: by author)

# Pier 1

## design principles



E



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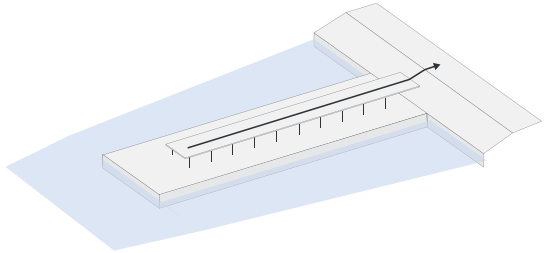
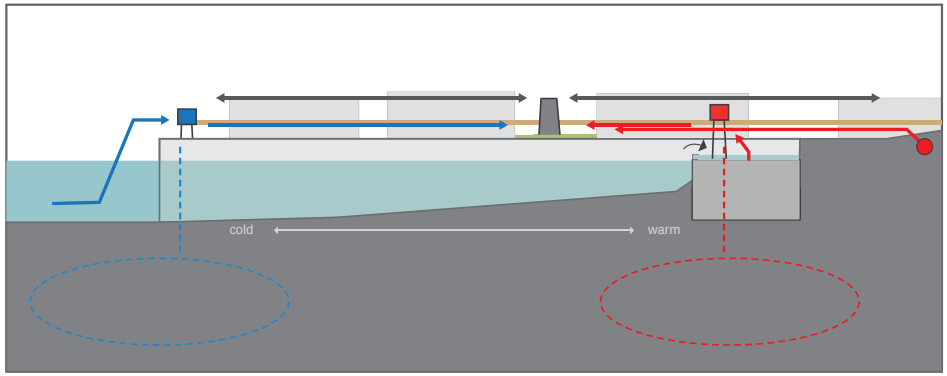
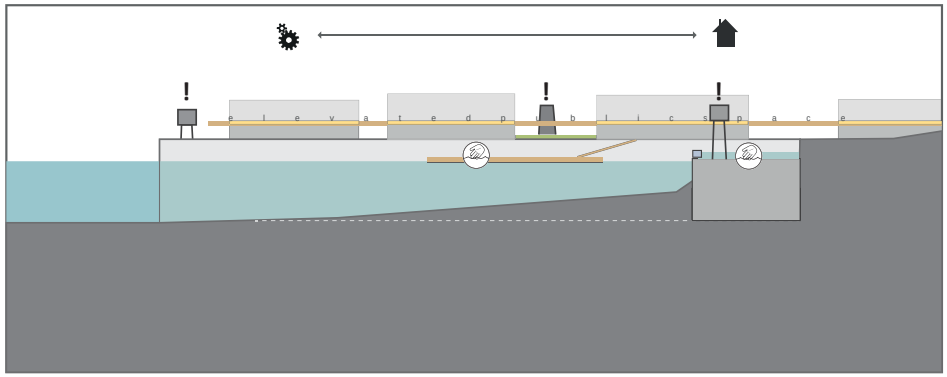
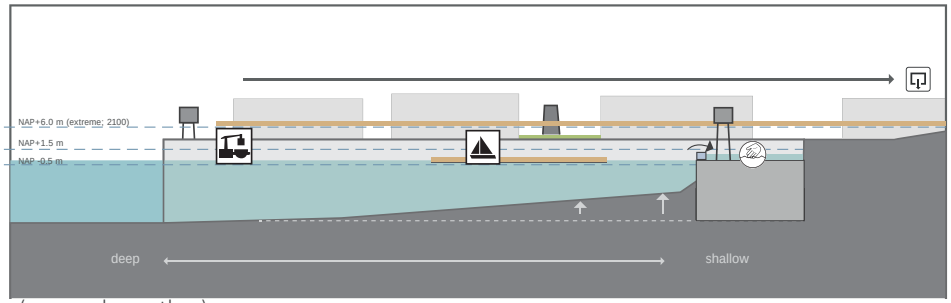


W

striking installations
urban character
industrial character
water levels
overflow dam
elevated escape route
cascading machine
thermal exchange station
cold transport
heat transport
external heat supply
ATES
suitable for small boats
suitable for larger vessels
escape to safe ground
accessible water



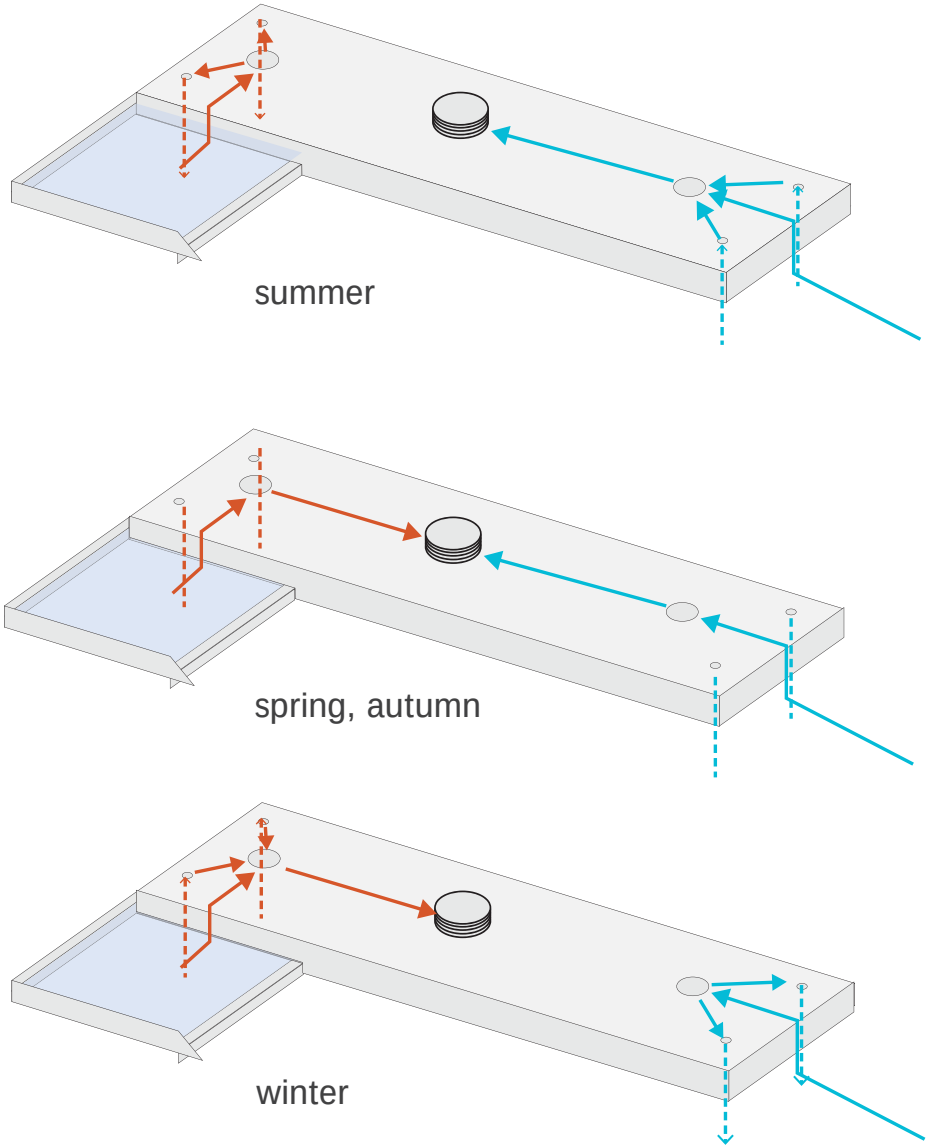



(source: by author)

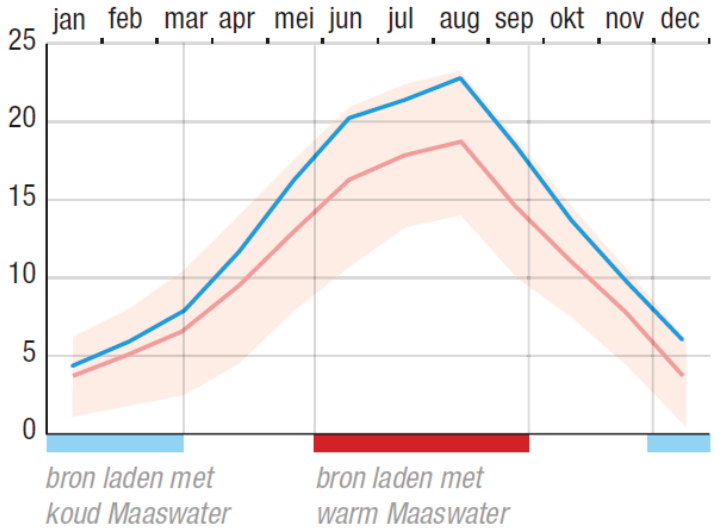
(source: by author)

# Pier 1

## energy system during seasons



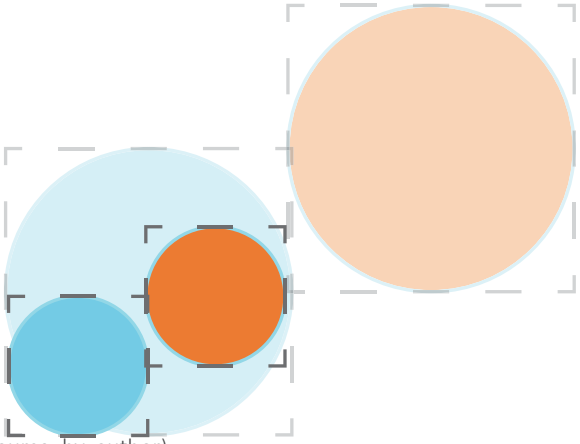

(source: by author)



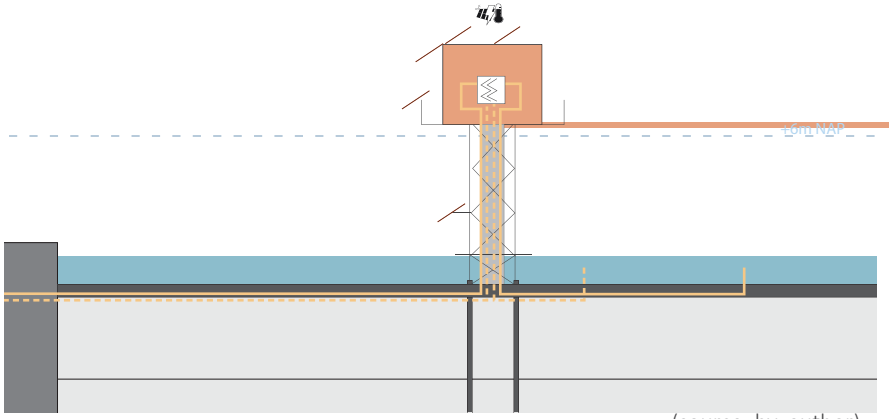

(source: de Ingenieur, 2007))

# Pier 1

## calculations spatial impact heat demand



(source: by author)



(source: by author)

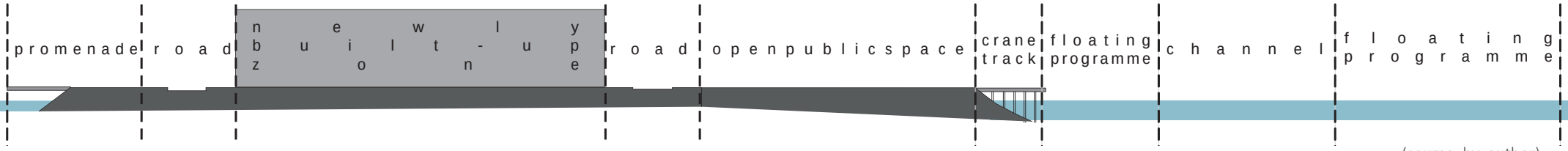
total programme: 151385 m2
total area: 184500 m2
FSI = 0.81

heat demand: 20,2 GWh/yr
cold demand: 13.9 GWh/yr

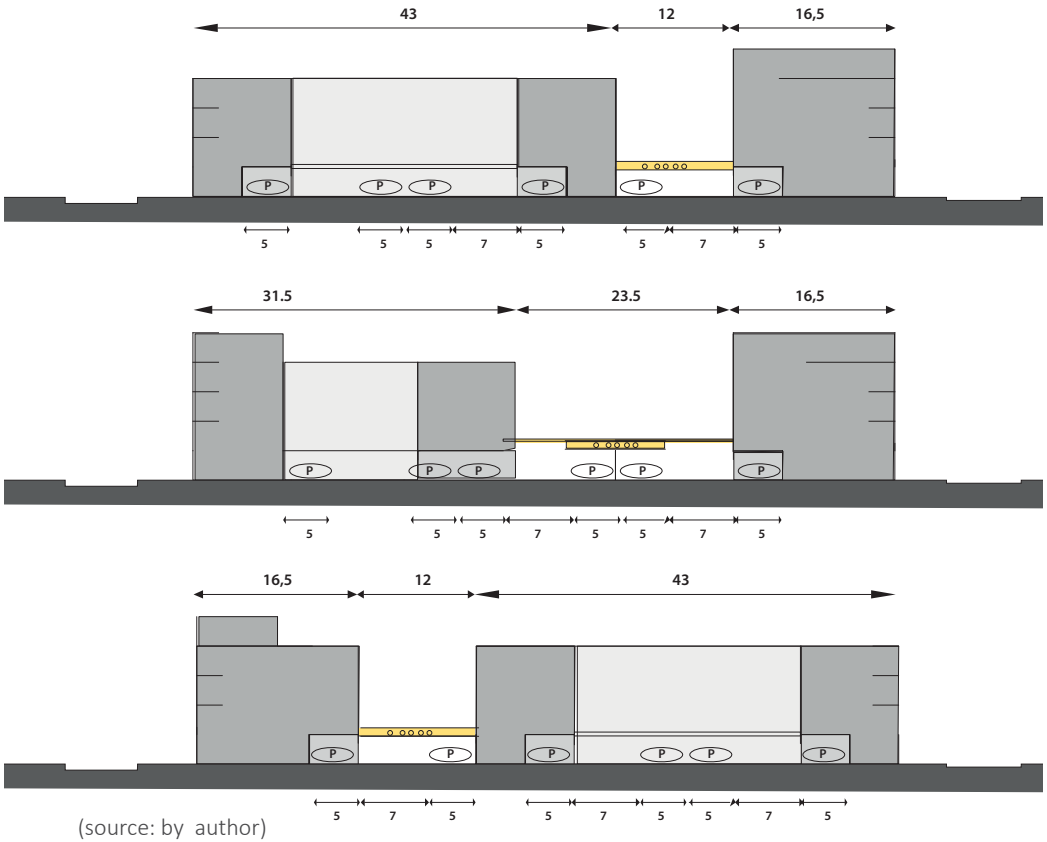
with reduction calculations, programme requires an area of **177 x 177 m**
to store the heat demand

# Pier 1

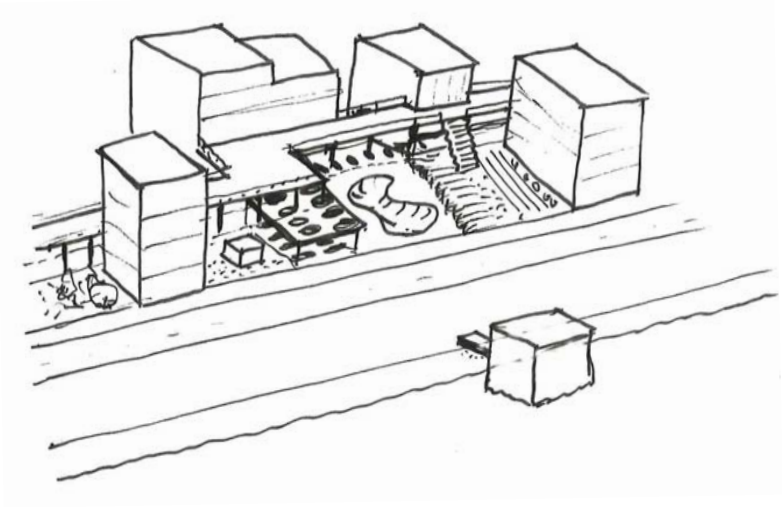
## zoning




(source: by author)




(source: by author)

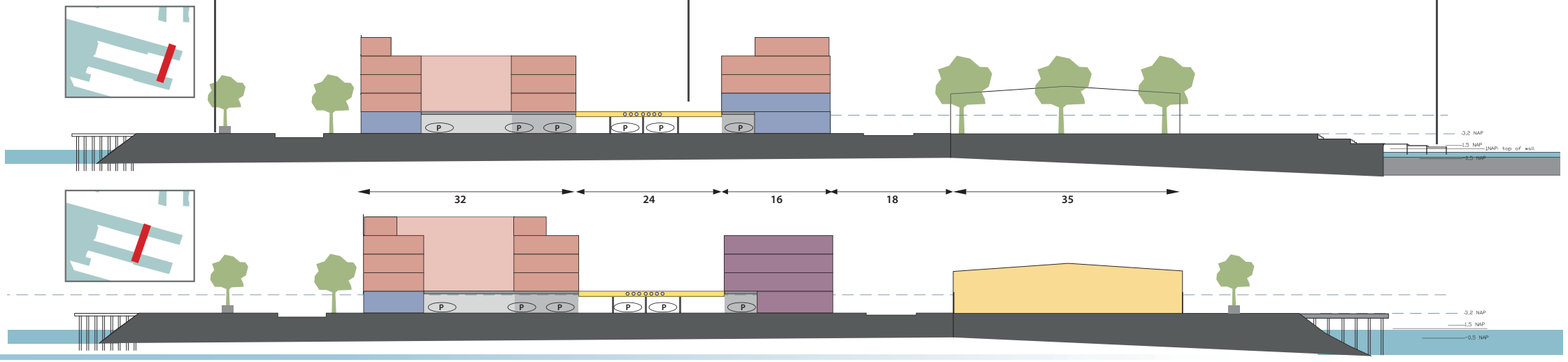


built up zone:
- systematic
- variable
- match level 1 with ground level

# Visualization

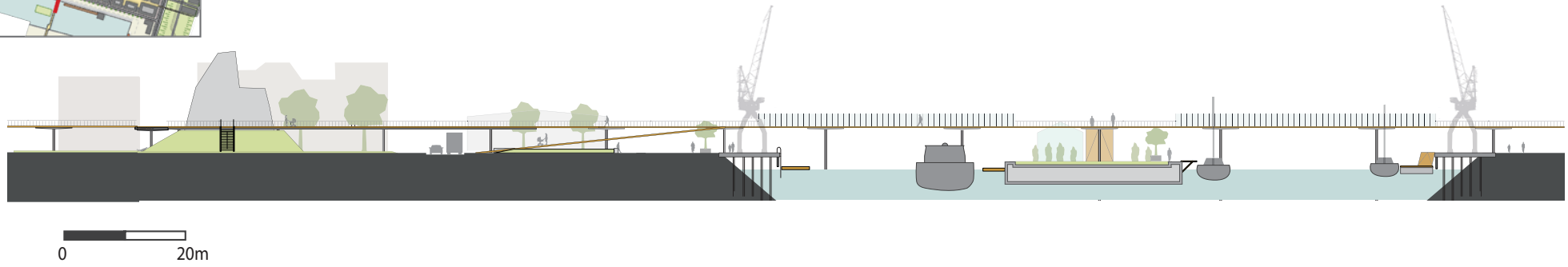
## section

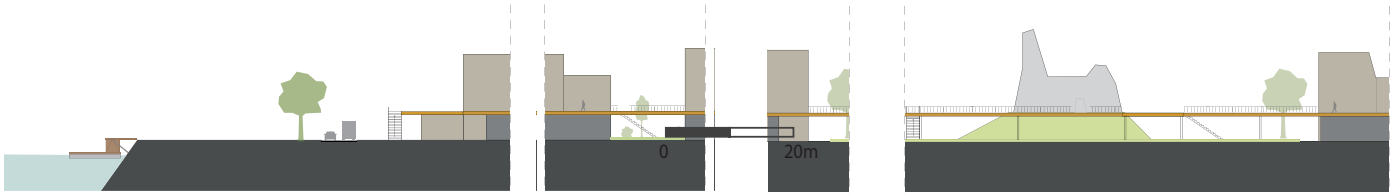
[Figure VS10]: irecreation at Islands Brugge, Copenhagen (source: Eva Fabricius)

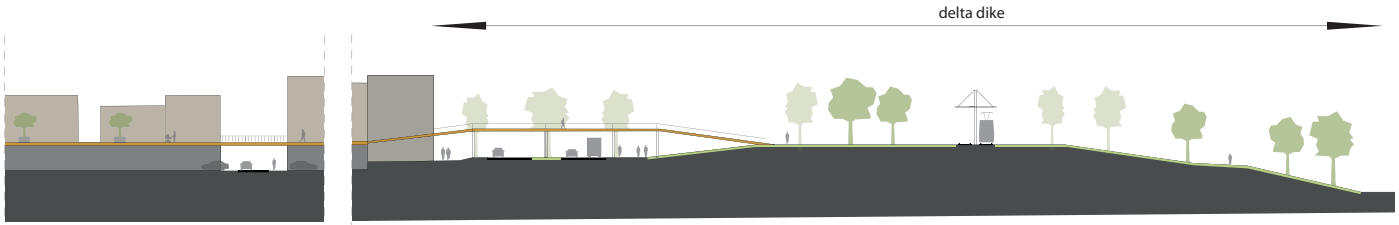


# Visualization

## sections



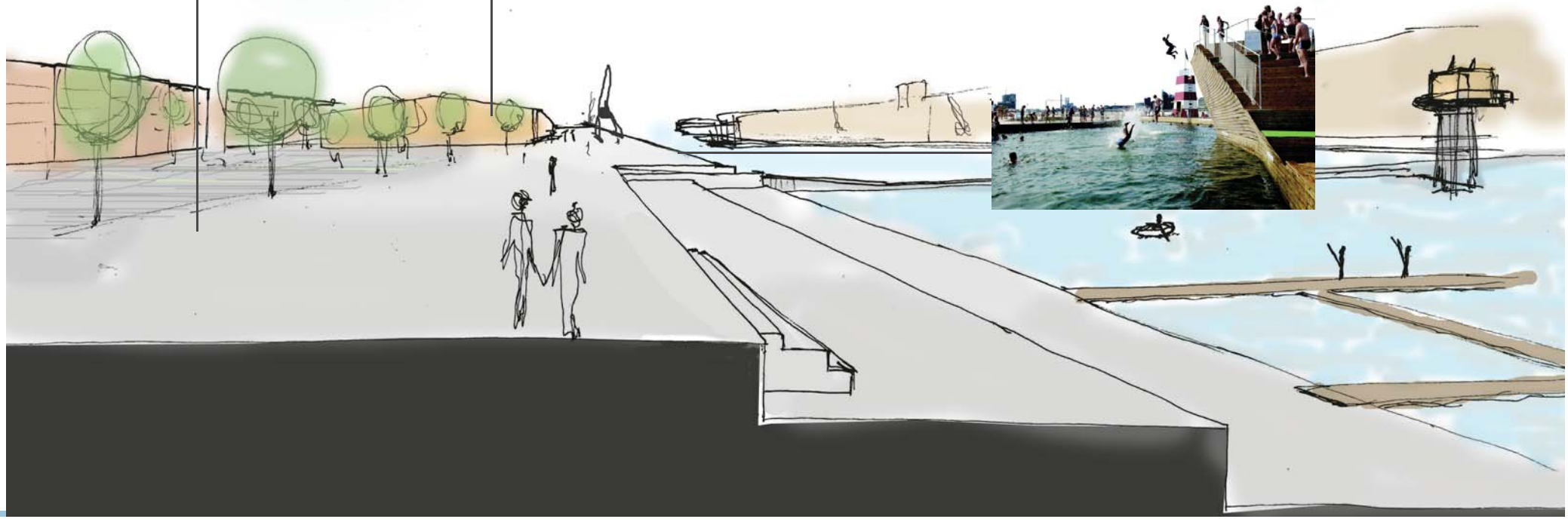
# Visualization

## head of basin


markets/events

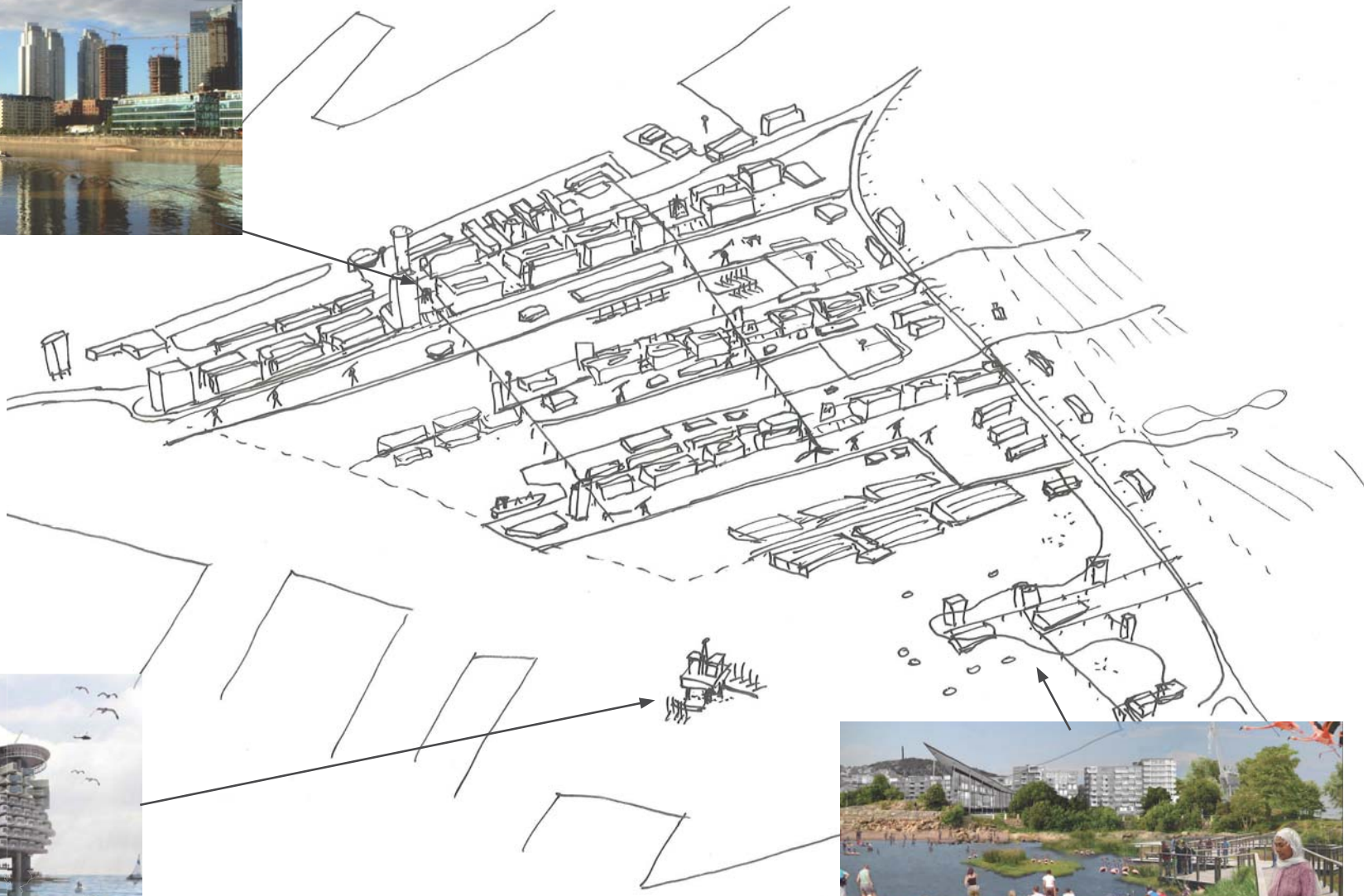
renovated waterfront in Rouen, FRA (image by author)

[Figure]:Quay in Hafencity, Hamburg (Hafencity.com)



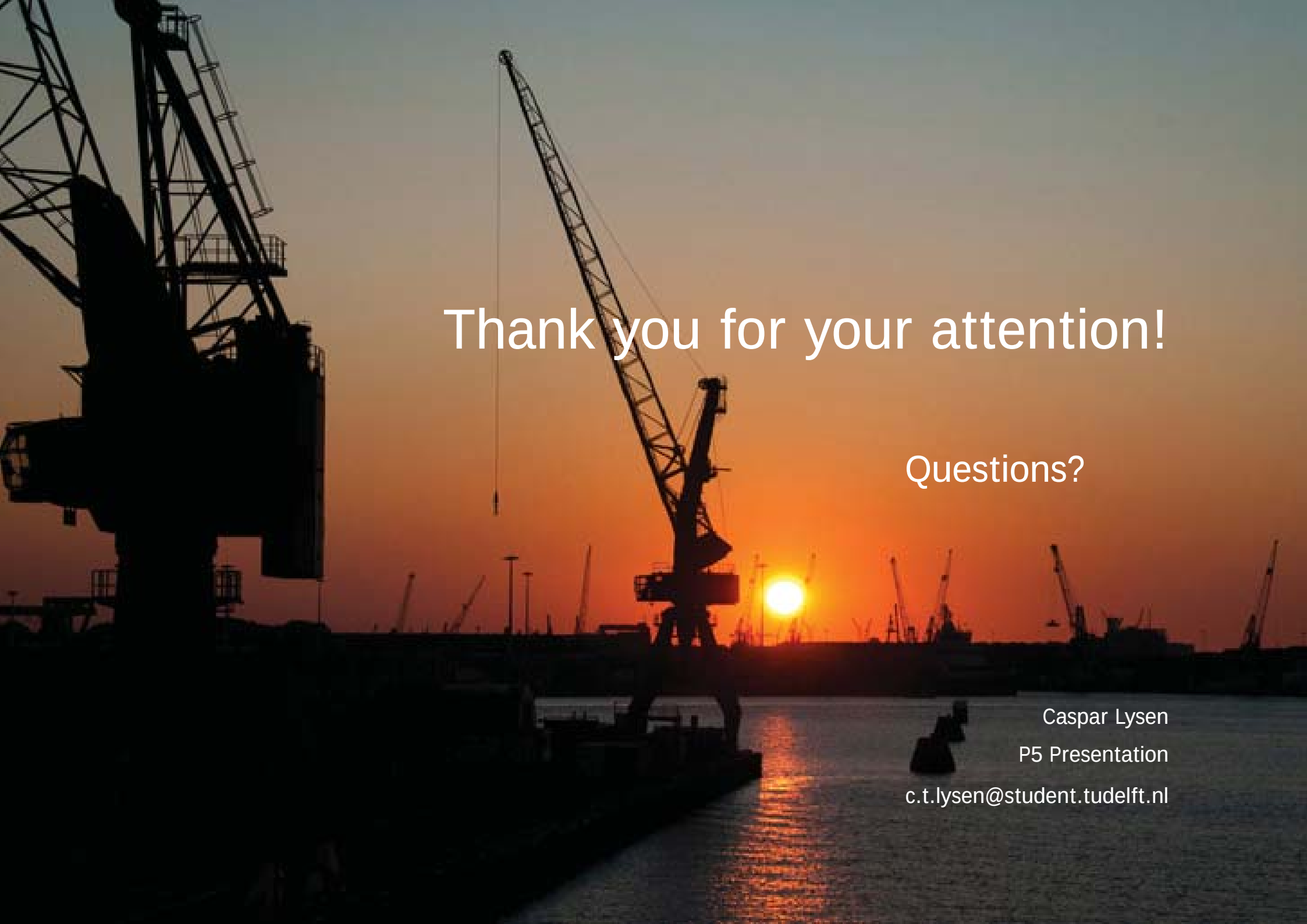
# Visualization

## towards 2100



# conclusions

- sustainable solutions can be found in backtracking to equilibriums in the past and interprete them in a modern age
- Thermal energy is suitable source to explore in urban delta redevelopment, especially when implementing more local networks and bottom-up strategies
- City port structure is very suitable for integrating three disciplines spatially
  - pier structure
  - industrial outer dike area
  - vicinity of accessible waters with thermal quality
- An elevated backbone forms the umbilical cord for sustainable development. It also benefits a gradual transition
- The design can be thermally supplied with surface water and ATES, calculations difficult; focus spatial solutions
- The integration of these three disciplines backtracks to sustainable history; design and strategy show a new way of adaptive green development



# Thank you for your attention!

Questions?

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P5 Presentation

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