energy planning for the unknown

On the potential of adaptive planning to guide the development of a future-proof energy system for the case of Schieoevers Noord, Delft

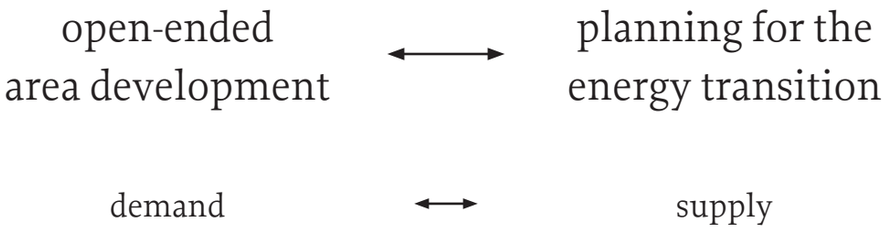
Schieoevers Noord is transforming...

...intended to become a lively mixed-use urban area...

...yet the end-state of the area development is *unknown*

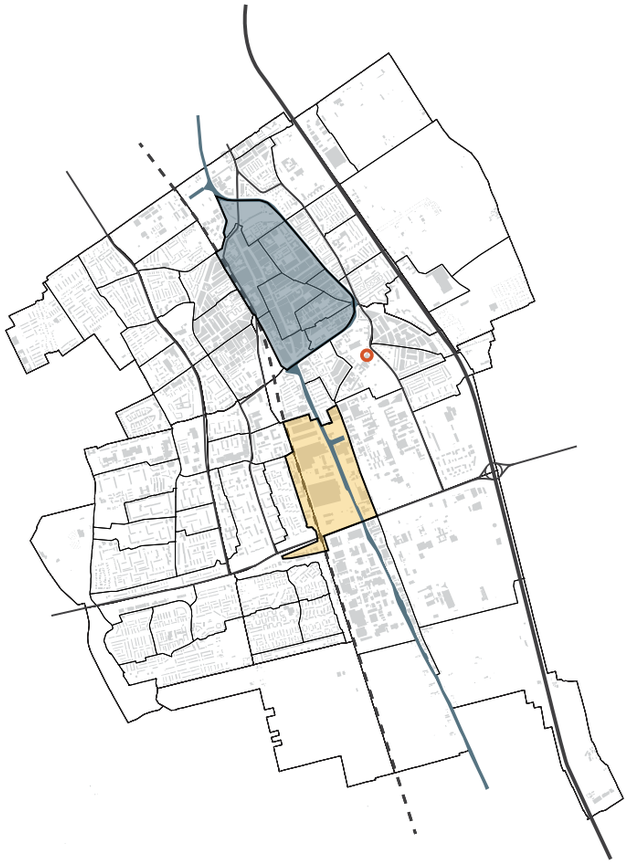
open-ended
area development

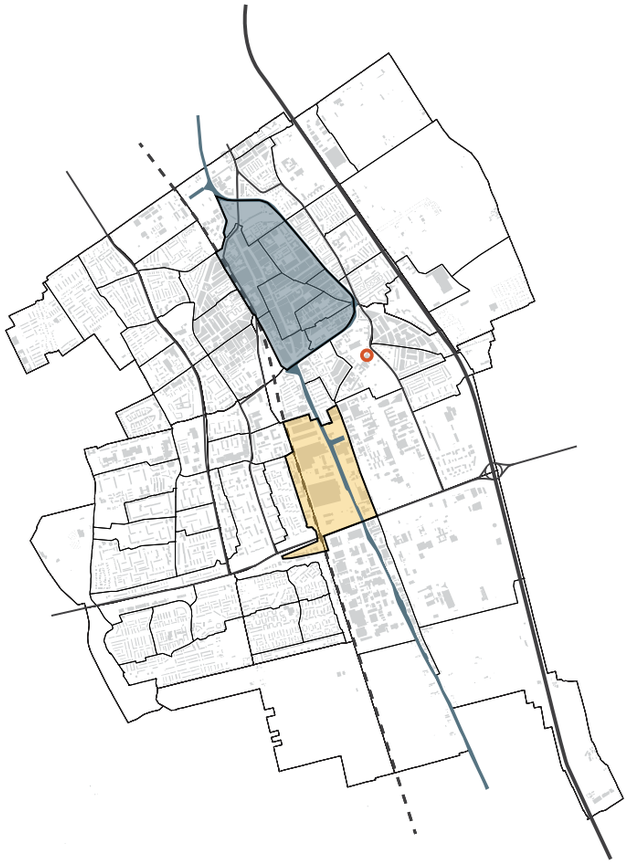
planning for the
energy transition

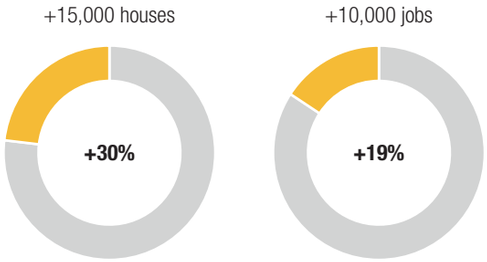

open-ended
area development
planning for the
energy transition
demand
supply

complexity in Schieoevers Noord

housing challenge + sustainability goals + conflict of interests





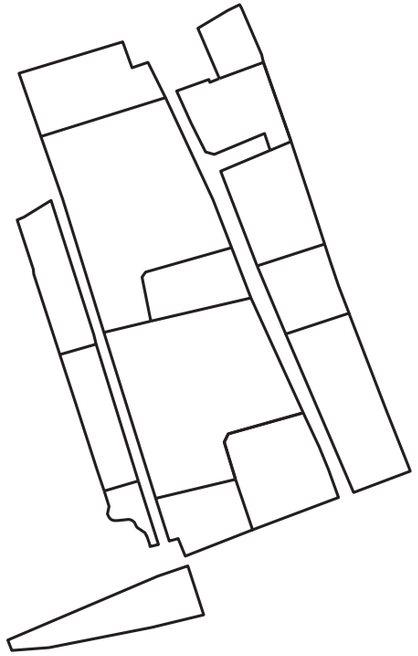

+15,000 houses
+30%

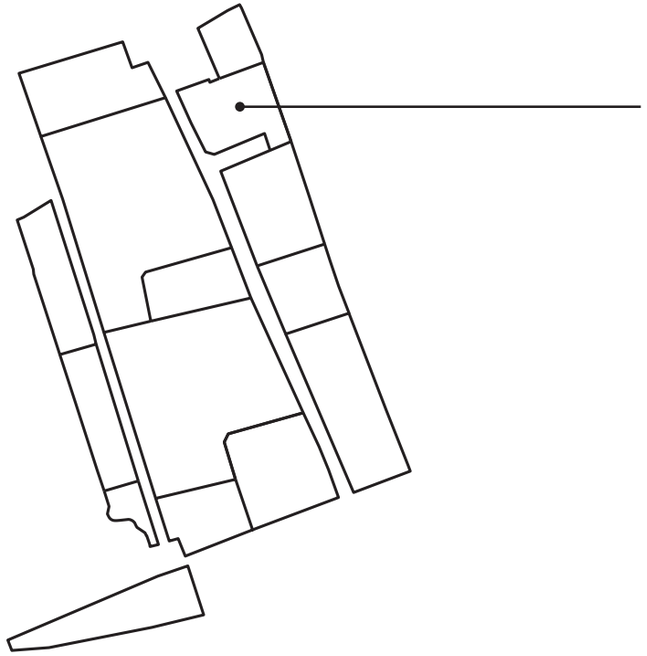
+10,000 jobs
+19%

Delft aims to be an

energy-neutral city

by 2050



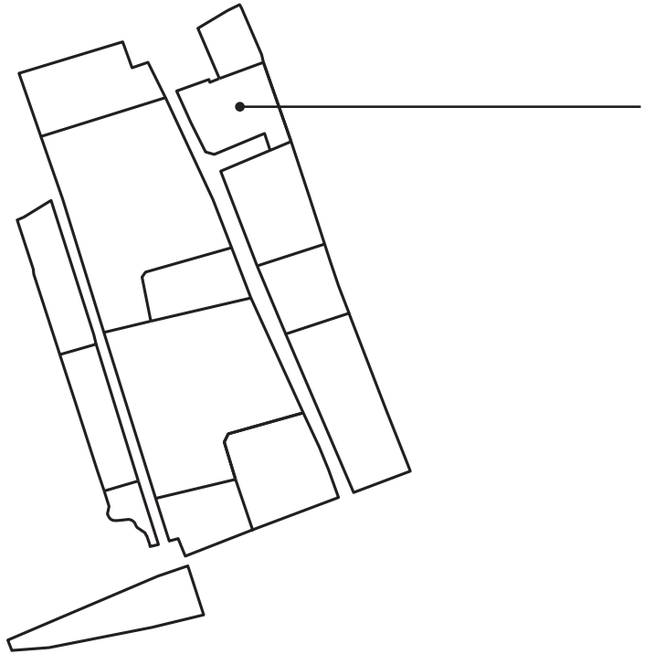


force field

municipality

companies

developers



force field

municipality	*regulations*	*addition of houses and jobs*
companies	*owning land*	*continuation of business*
developers	*money*	*profit by real estate development*

problem statement

high ambitions

- 15,000 houses +10,000 jobs
- energy-neutrality in 2050

high uncertainties

- open-ended development path
- & large interdependencies

lack of an approach to make decisions regarding sustainable energy supply in case of open-ended developments

adaptivity

research aim

the creation of an **approach** for **adaptive energy planning**, enabling **decision-making** regarding sustainable energy supply under **uncertainty**

research question

How can an adaptive approach to energy planning
enable the municipality of Delft to guide the development
of a future-proof energy supply (heat and cold supply)
for Schieoevers Noord?

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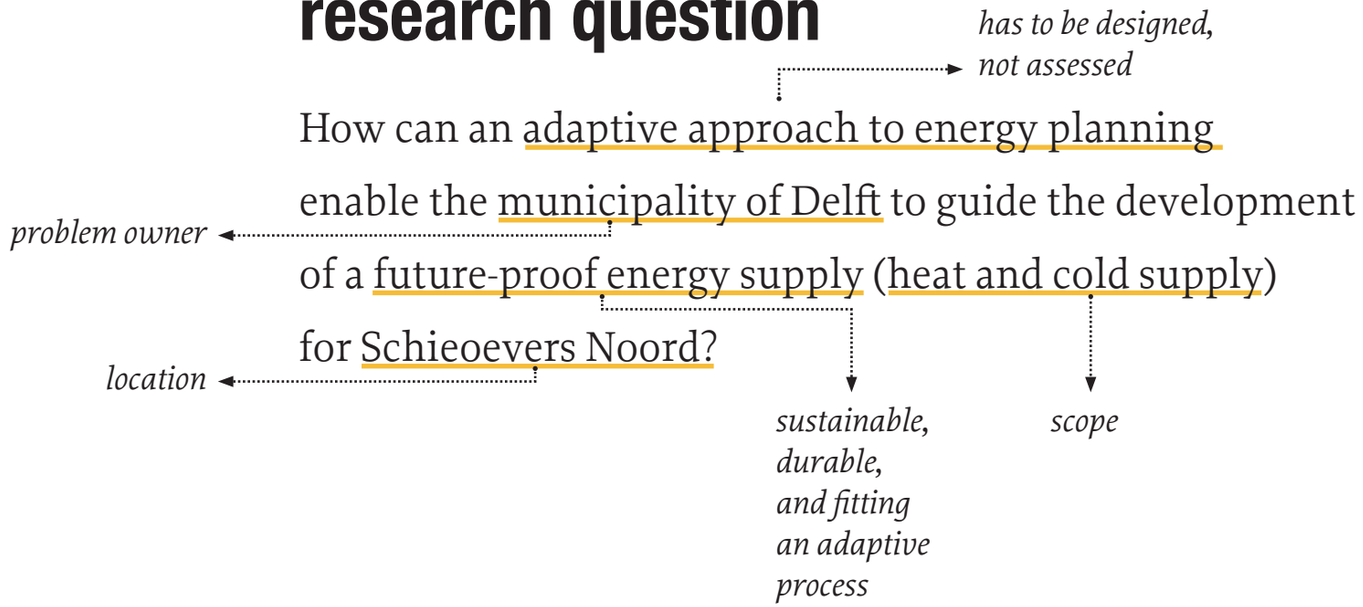
research question

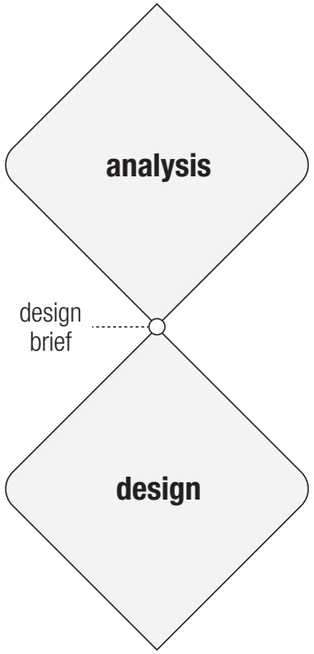


research approach

explorative research

design-based research

case-study



analysis

of the *concept*	**of adaptivity**
of the *current use*	**of adaptivity**
of the *scale*	**of adaptivity**
of the *energy sources*	**for adaptivity**

analysis

of the *concept*	**of adaptivity**
of the *current use*	**of adaptivity**
of the *scale*	**of adaptivity**
of the *energy sources*	**for adaptivity**

the concept of *adaptivity*

adaptivity is the characteristic of a system or pathway to adapt or be adapted by system actors, as a response to changing (unforeseen) future conditions


complexity
causes
uncertainty
copes
with
adaptivity

an adaptive *process*

1. explore and embrace uncertainty;
2. connect long-term visions with short-term actions;
3. treat a process of systemic change as experiment;
4. focus on conditions for development;
5. spread responsibility for decision-making over the system;
6. integrate the diverse knowledge of those involved

approaches for energy planning

- REAP
- Energy Potential Mapping
- Energy Master Planning
- Swarm Planning
- SREX
- STEEP

REAP

Energy Potential Mapping

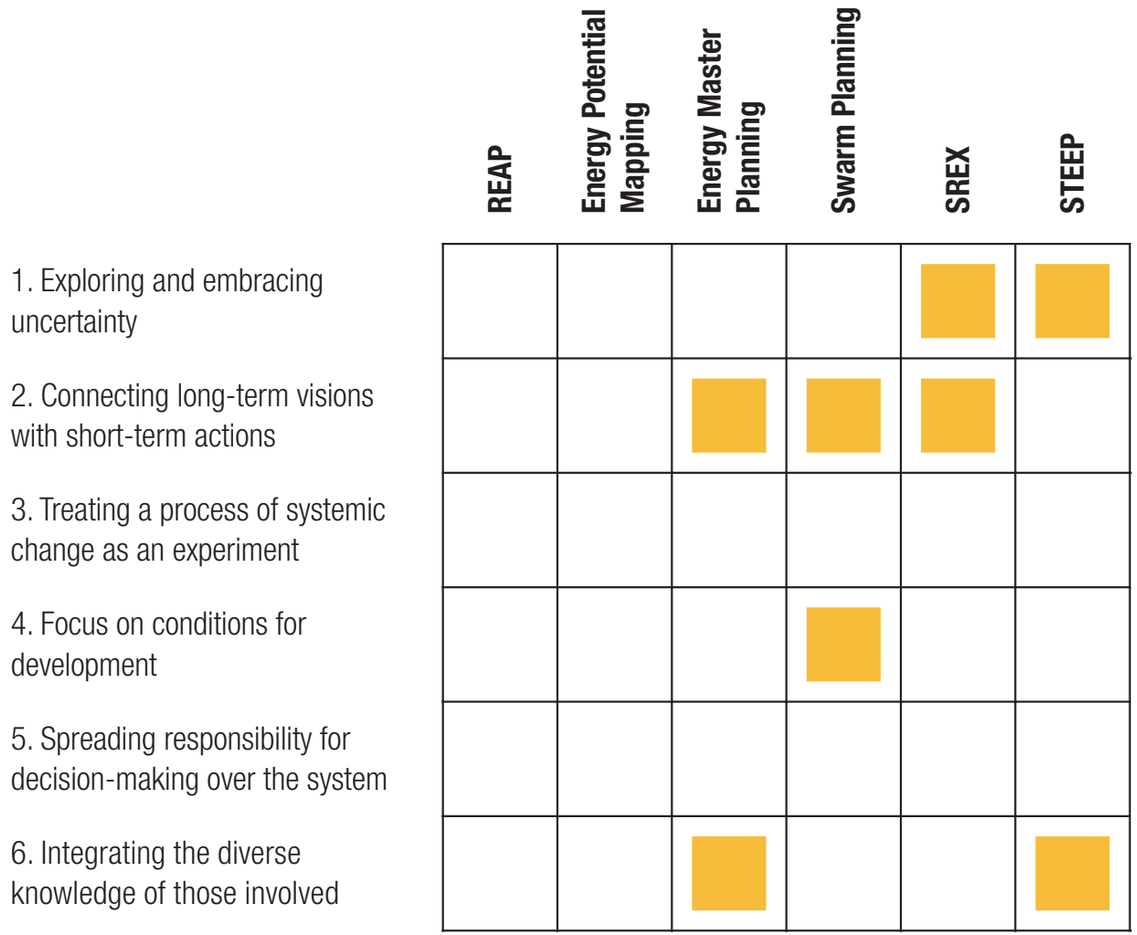
Energy Master Planning

Swarm Planning

SREX

STEEP

	REAP	Energy Potential Mapping	Energy Master Planning	Swarm Planning	SREX	STEEP
1. Exploring and embracing uncertainty						
2. Connecting long-term visions with short-term actions						
3. Treating a process of systemic change as an experiment						
4. Focus on conditions for development						
5. Spreading responsibility for decision-making over the system						
6. Integrating the diverse knowledge of those involved						


REAP
Energy Potential Mapping
Energy Master Planning
Swarm Planning
SREX
STEEP
1. Exploring and embracing uncertainty
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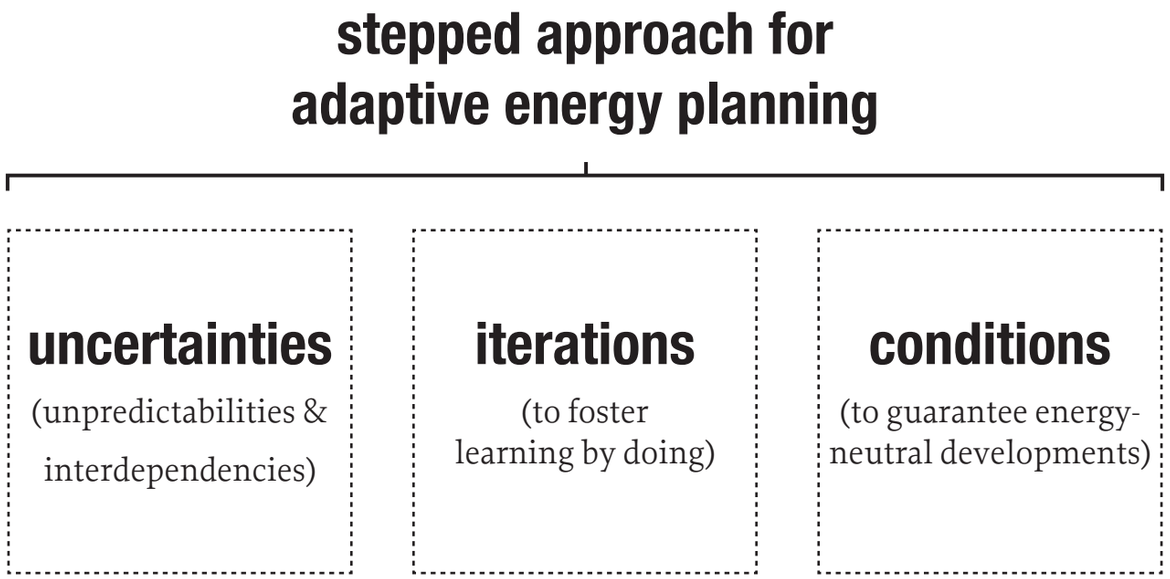
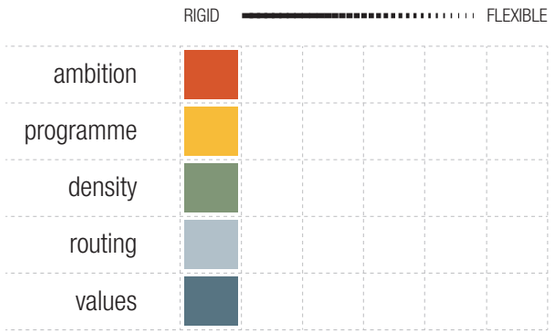

stepped approach for
adaptive energy planning
uncertainties
(unpredictabilities &
interdependencies)
iterations
(to foster
learning by doing)
conditions
(to guarantee energy-
neutral developments)

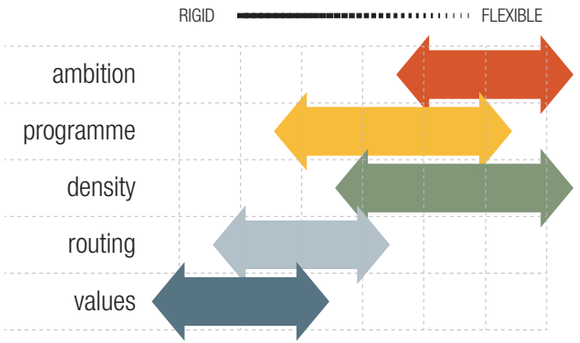
analysis

of the *concept* **of adaptivity**
of the *current use* **of adaptivity**
of the *scale* **of adaptivity**
of the *energy sources* **for adaptivity**

→ an *adaptive* development plan



BLUEPRINT



ADAPTIVE PLAN

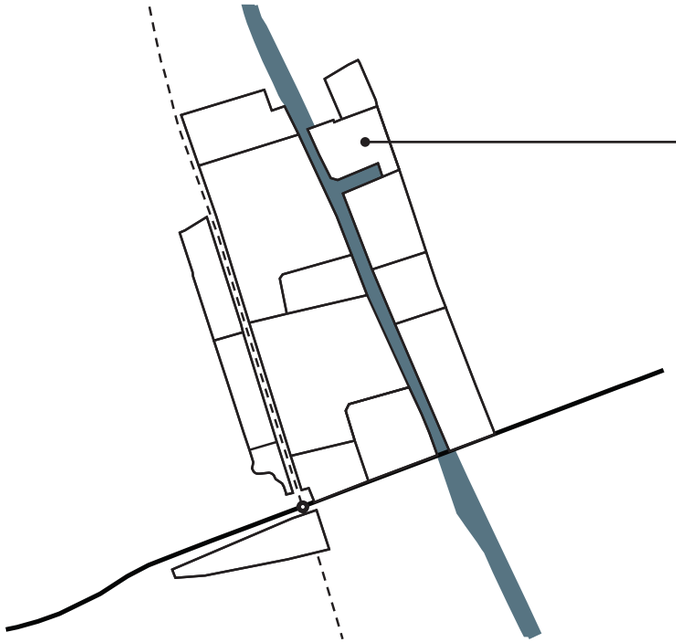
development goals by the municipality

1. space for innovative “making industry”
2. lively mixed-use urban area
3. healthy and sustainable environment
4. good connections and new mobility
5. socially inclusive and culturally diverse

steering mechanisms

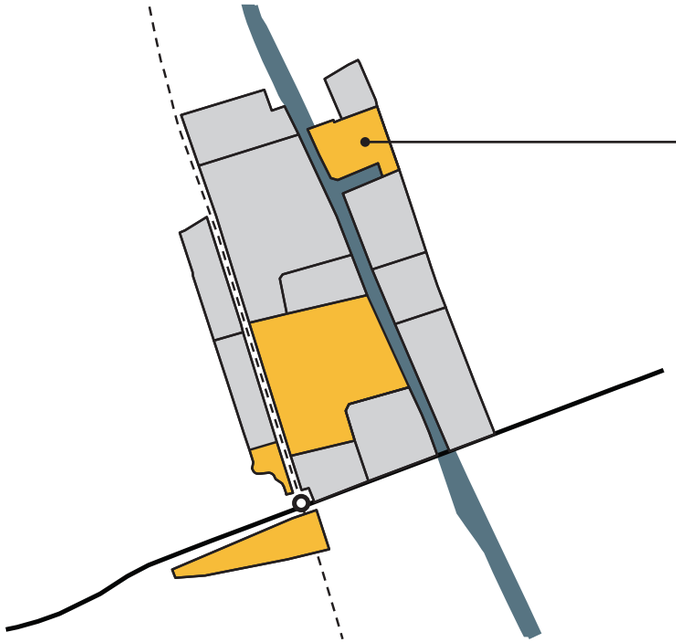
framework map for public space

design guidelines for building blocks



15 plots

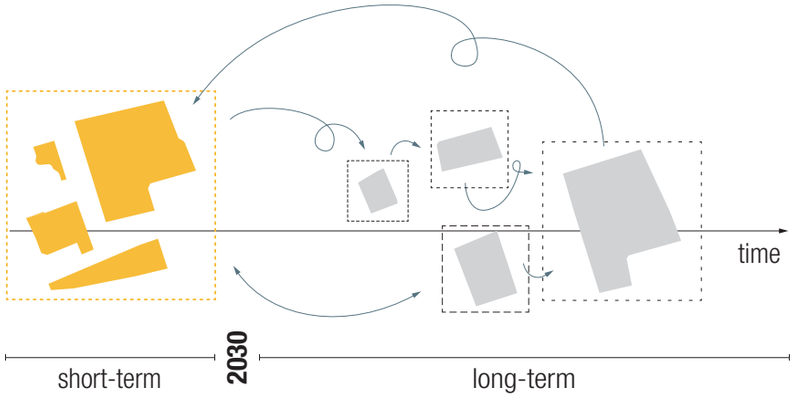
15 different force fields



4 plots

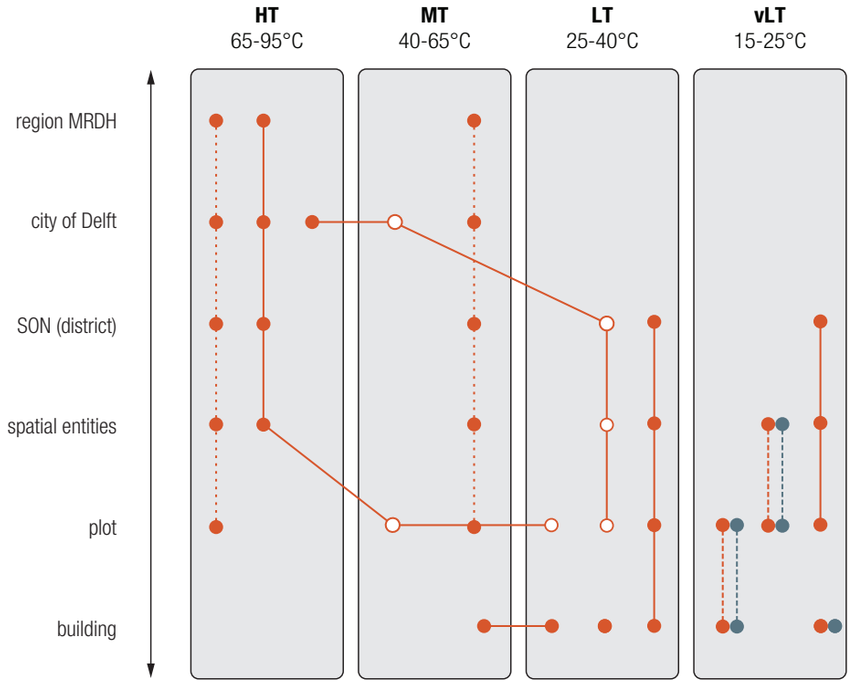
to be developed

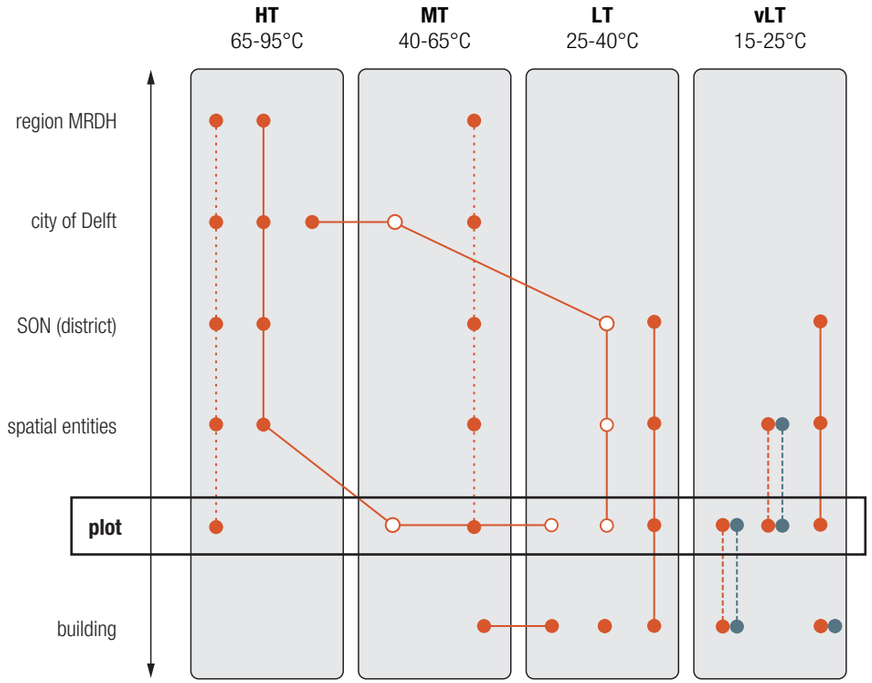
until 2030



level of the plot = **level of adaptivity**

sustainable energy
for the plot


HT
65-95°C
MT
40-65°C
LT
25-40°C
vLT
15-25°C
region MRDH
city of Delft
SON (district)
spatial entities
plot
building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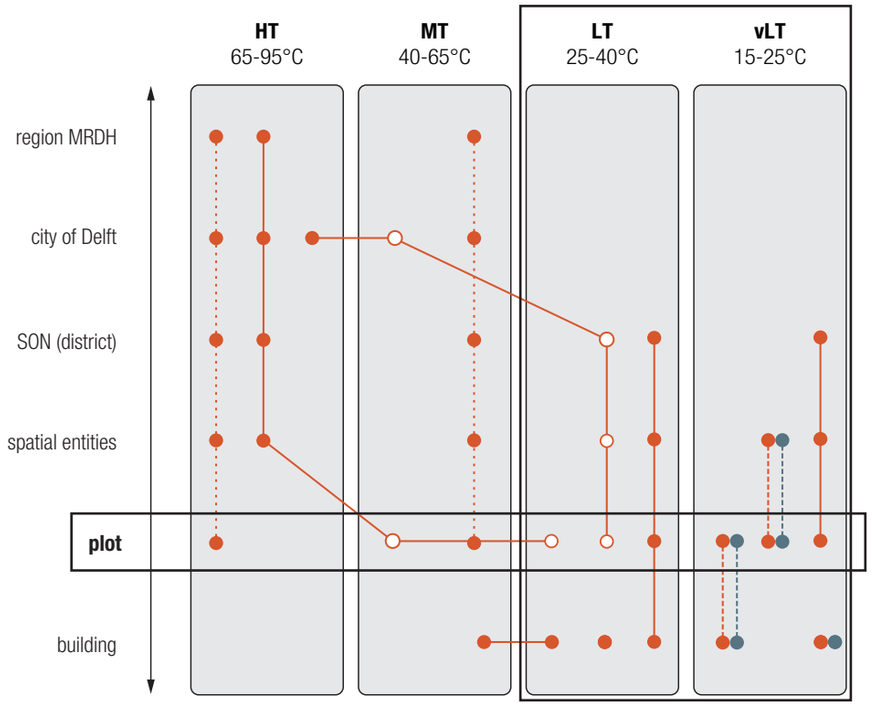
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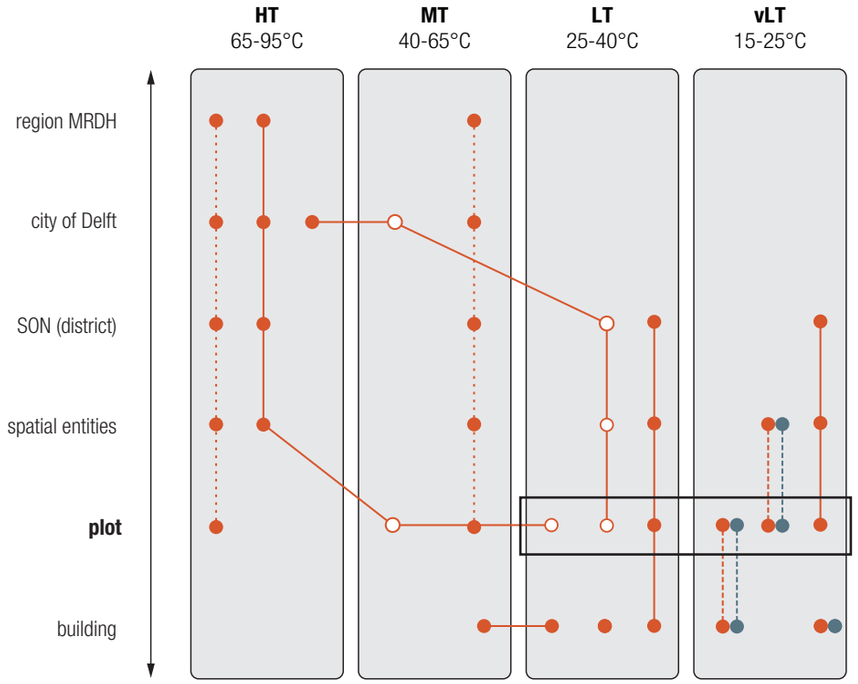
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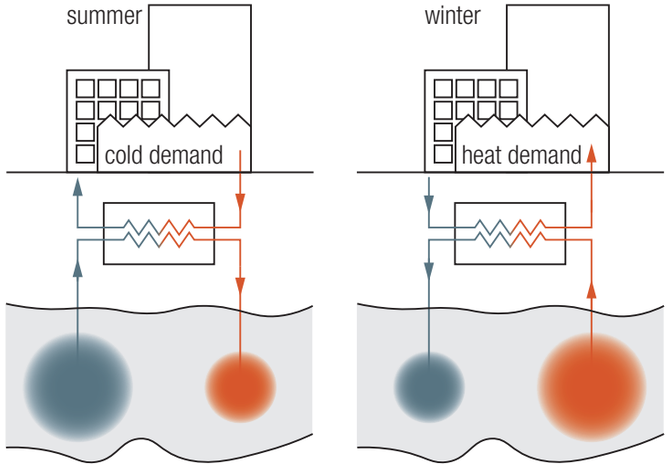
LT
25-40°C
vLT
15-25°C
region MRDH
city of Delft
SON (district)
spatial entities
plot
building

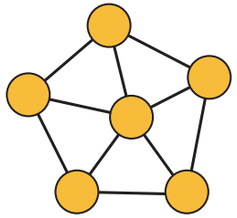
Aquifer Thermal Energy Storage (ATES)

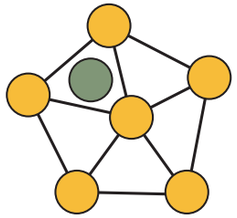


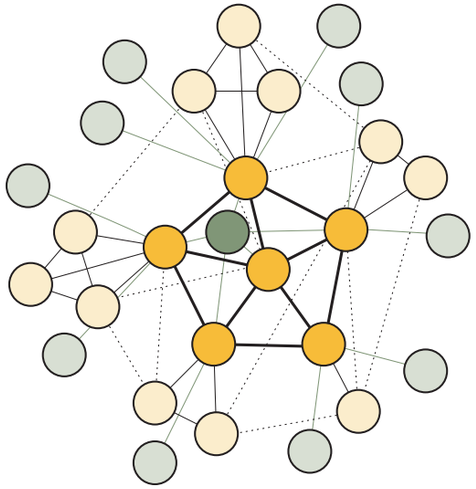
heat in
(summer)
=
heat out
(winter)

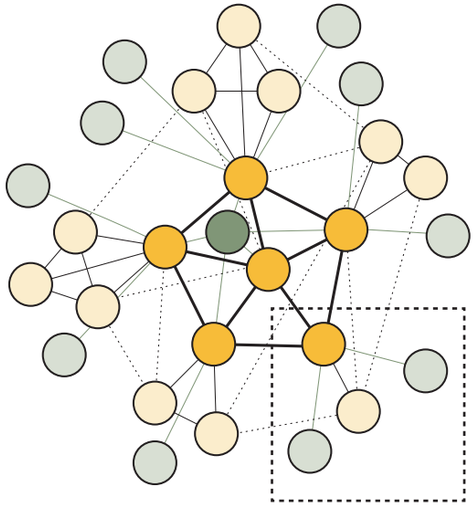
energy planning is a verb

who is the planning *actor*?



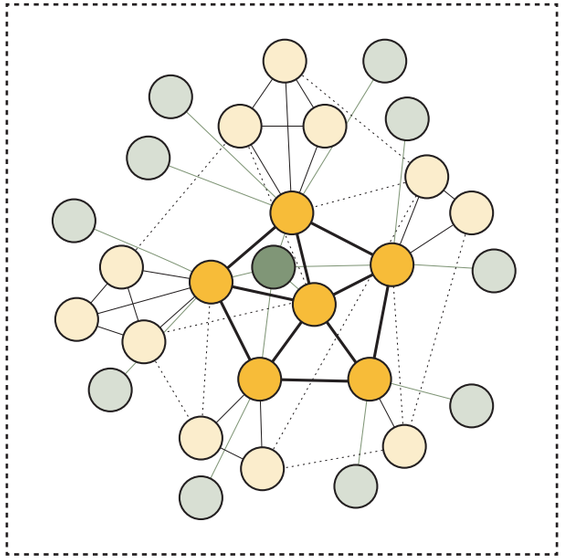




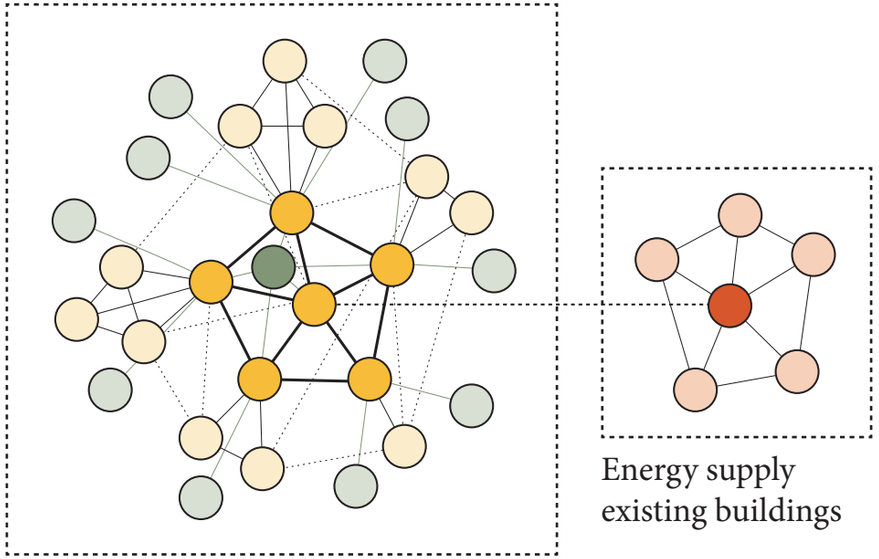


Energy supply within project
Schieoevers Noord (direct)

Energy supply within project
Schieoevers Noord (indirect)



Energy supply within project
Schieoevers Noord (indirect)

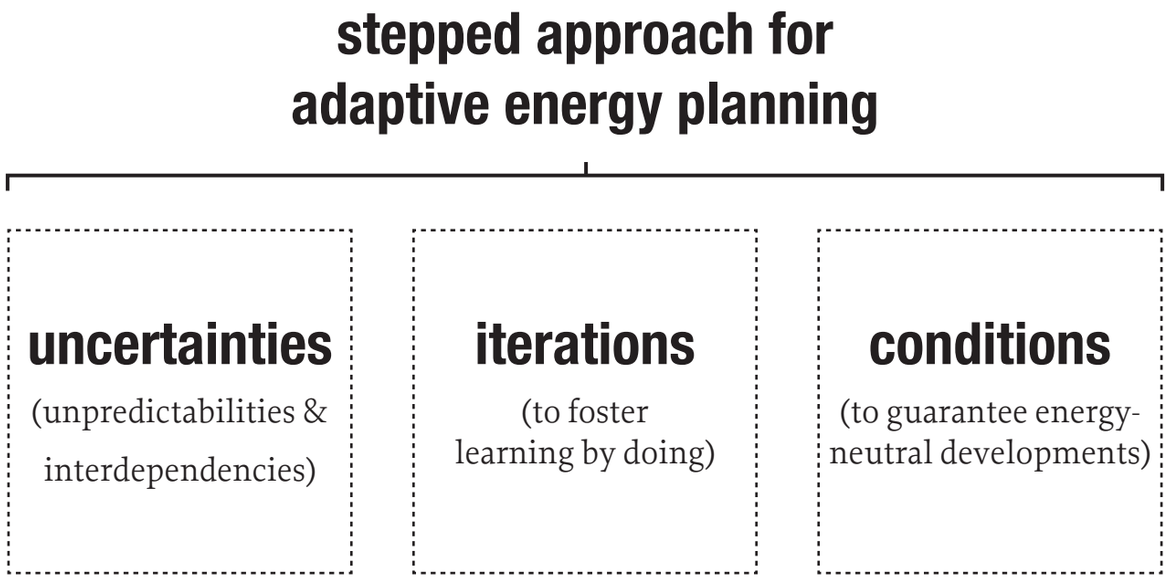


Energy supply
existing buildings

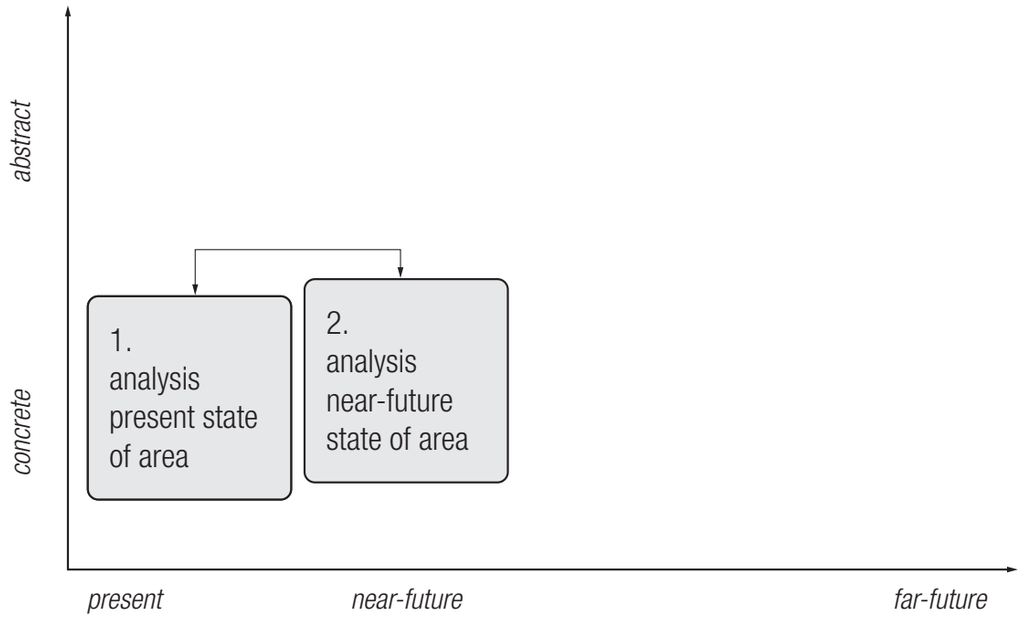
finding solutions

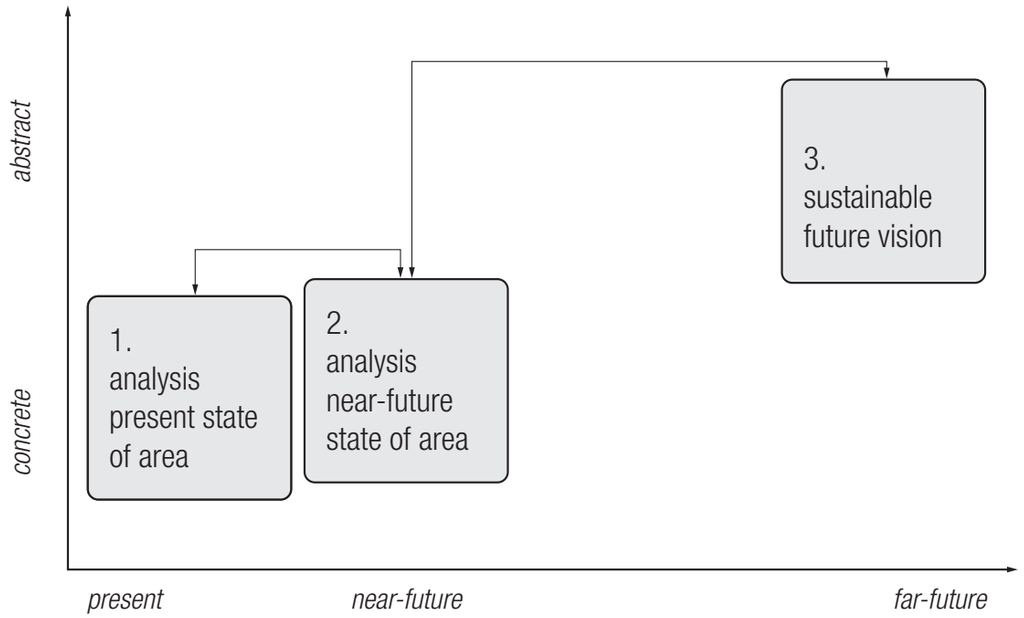
for the *implementation* of adaptivity
in sustainable energy planning

design brief


stepped approach for
adaptive energy planning
uncertainties
(unpredictabilities &
interdependencies)
iterations
(to foster
learning by doing)
conditions
(to guarantee energy-
neutral developments)

Schieoevers Noord approach for adaptive energy planning


abstract
concrete
1.
analysis
present state
of area
2.
analysis
near-future
state of area
present
near-future
far-future


abstract
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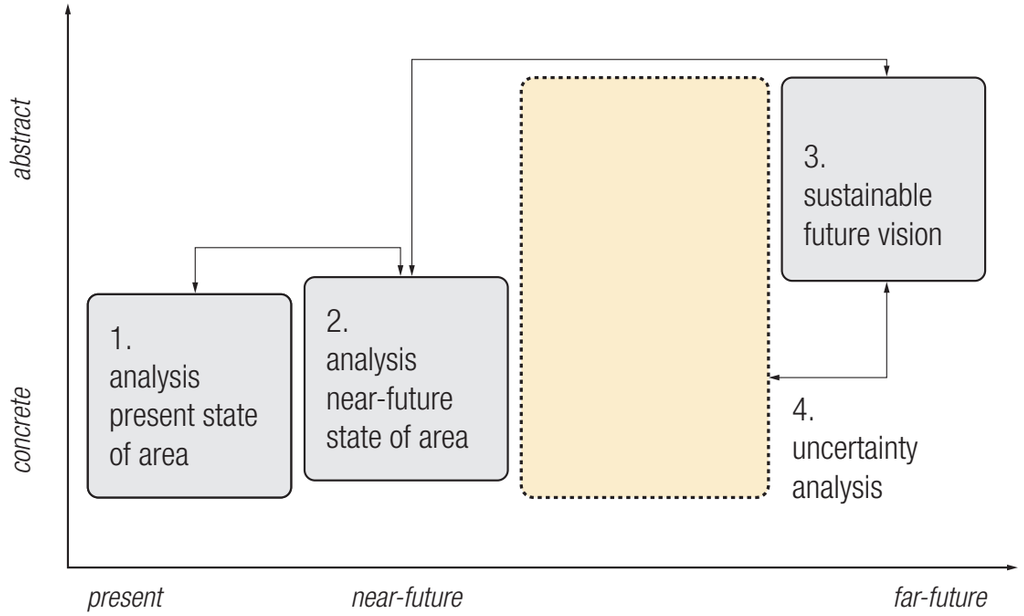
sustainable
future vision
present
near-future
far-future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analysis
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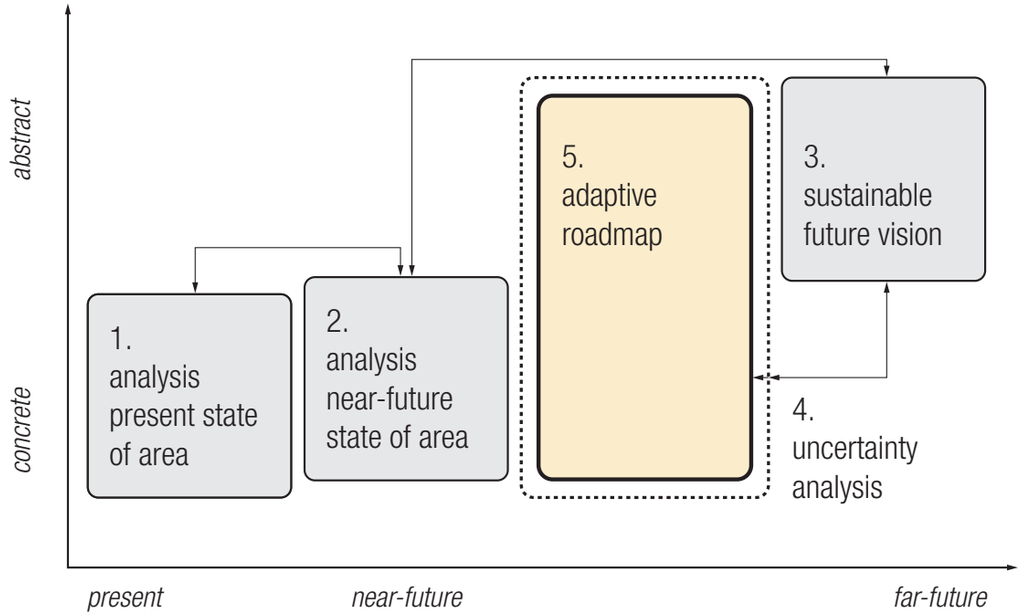
far-future


abstract
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present state
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near-future
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5.
adaptive
roadmap
3.
sustainable
future vision
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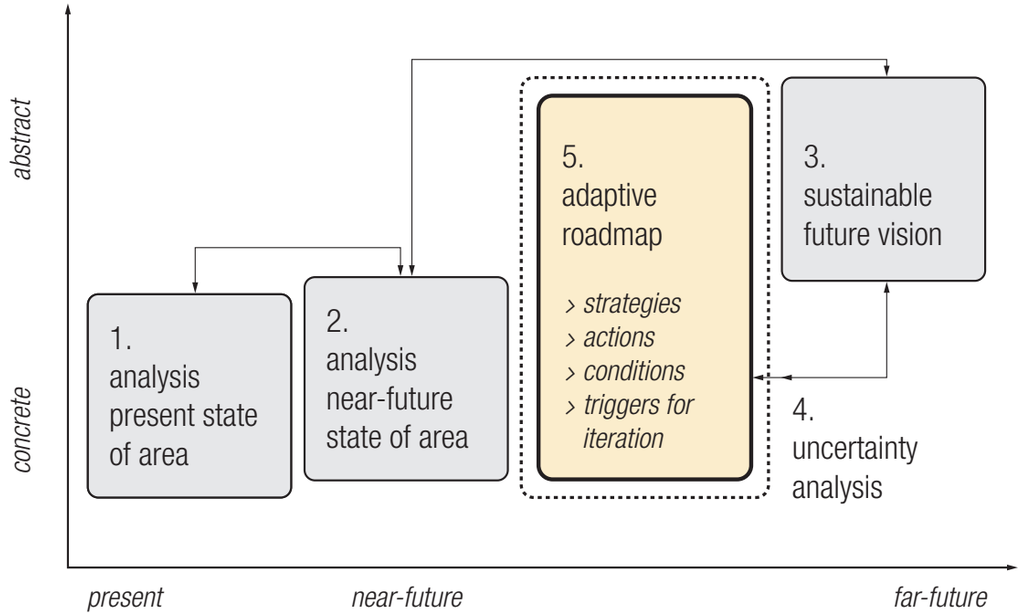
far-future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adaptive
roadmap
› strategies
› actions
› conditions
› triggers for
iteration
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sustainable
future vision
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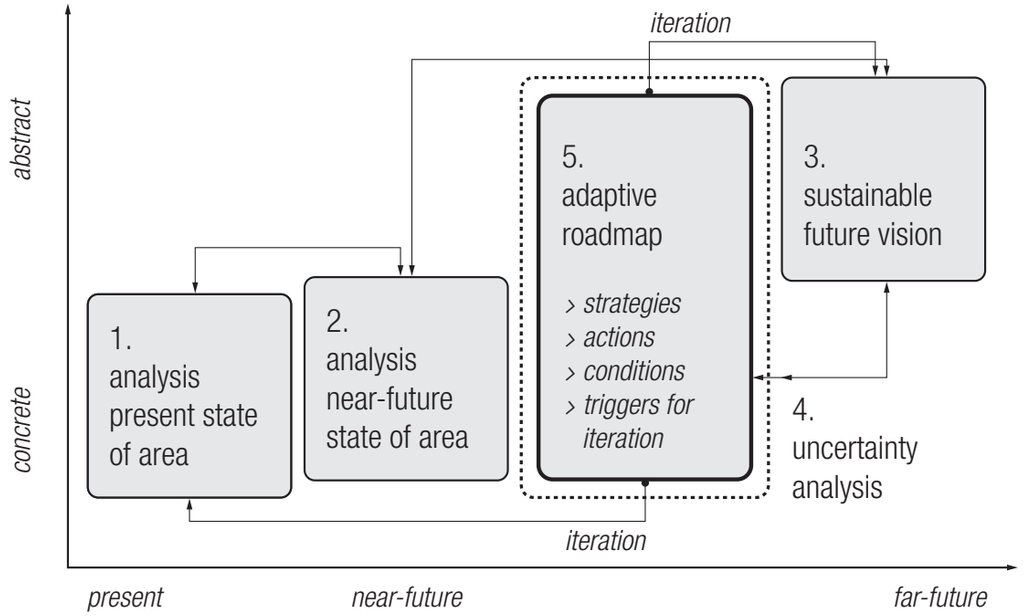
iteration
abstract
concrete
1.
analysis
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› triggers for
iteration
3.
sustainable
future vision
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uncertainty
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iteration
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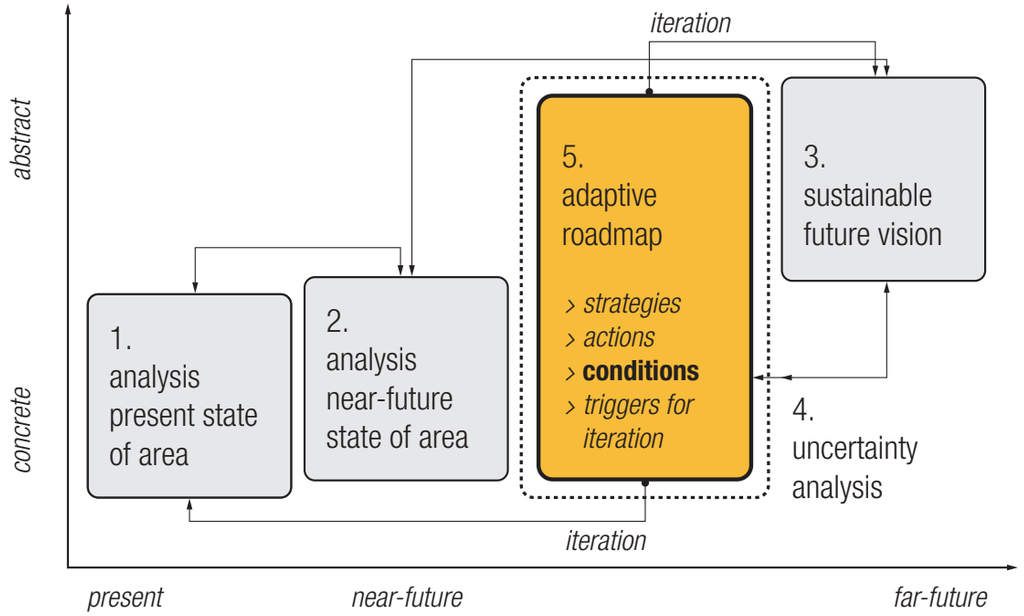
creating favourable *conditions* for development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analysis
iteration
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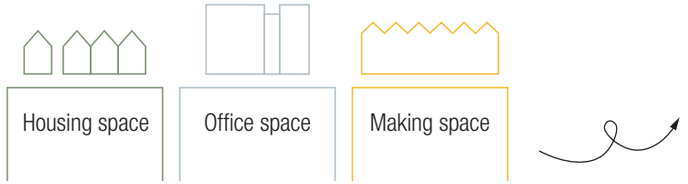
near-future
far-future

The development of a plot should be

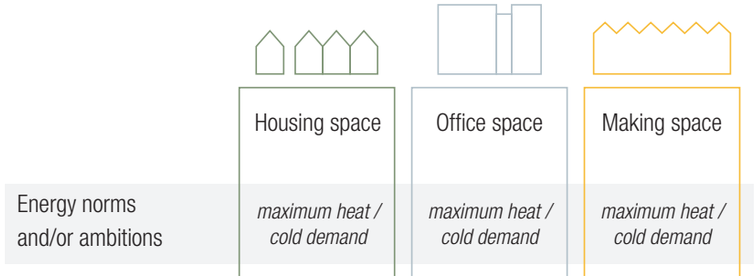
- Energy-neutral *(for at least heat & cold)*
- Not hindering following developments concerning their local energy potentials

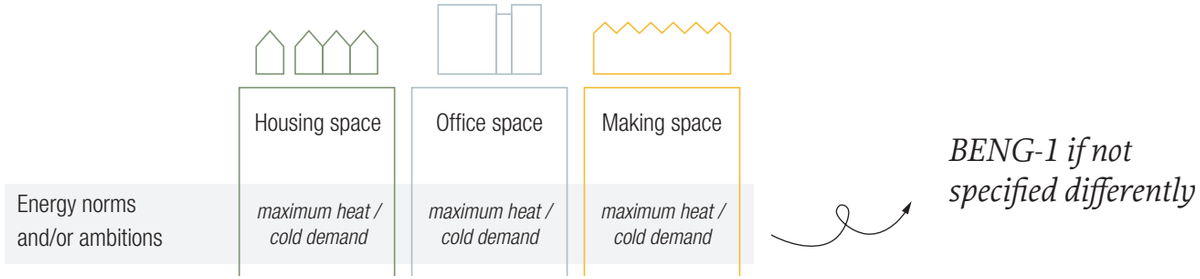
The heat and cold balance of a plot

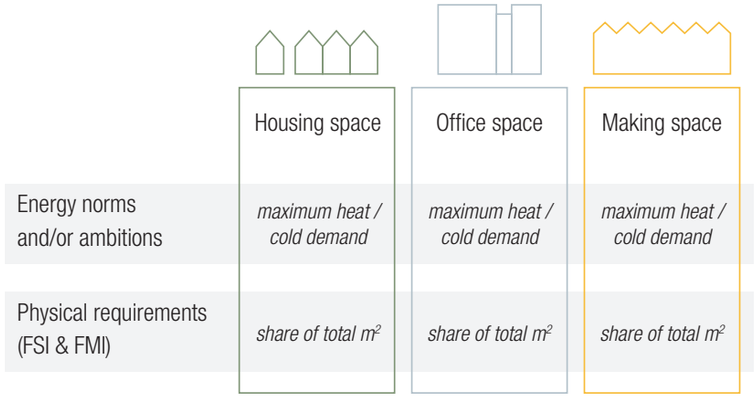
supply = demand



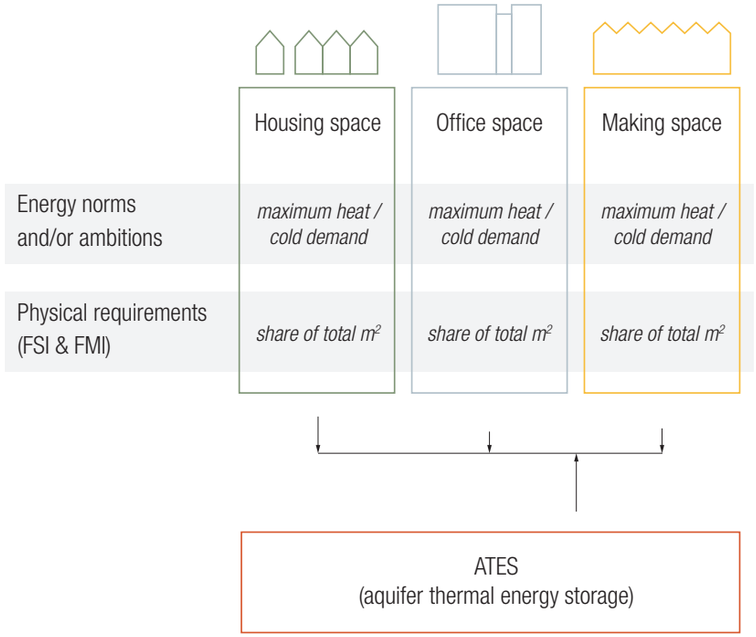
planned programme
for Schieoevers Noord


Housing space
Office space
Making space
Energy norms and/or ambitions
maximum heat / cold demand
maximum heat / cold demand
maximum heat / cold demand


Housing space
Office space
Making space
Energy norms
and/or ambitions
maximum heat /
cold demand
maximum heat /
cold demand
maximum heat /
cold demand
BENG-1 if not
specified differently


Housing space
Office space
Making space
Energy norms and/or ambitions
maximum heat / cold demand
maximum heat / cold demand
maximum heat / cold demand
Physical requirements (FSI & FMI)
share of total m²
share of total m²
share of total m²


Housing space
Office space
Making space
Energy norms and/or ambitions
maximum heat / cold demand
maximum heat / cold demand
maximum heat / cold demand
Physical requirements (FSI & FMI)
share of total m²
share of total m²
share of total m²
ATES
(aquifer thermal energy storage)


Housing space
Office space
Making space
Energy norms
and/or ambitions
maximum heat /
cold demand
maximum heat /
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Physical requirements
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share of total m²
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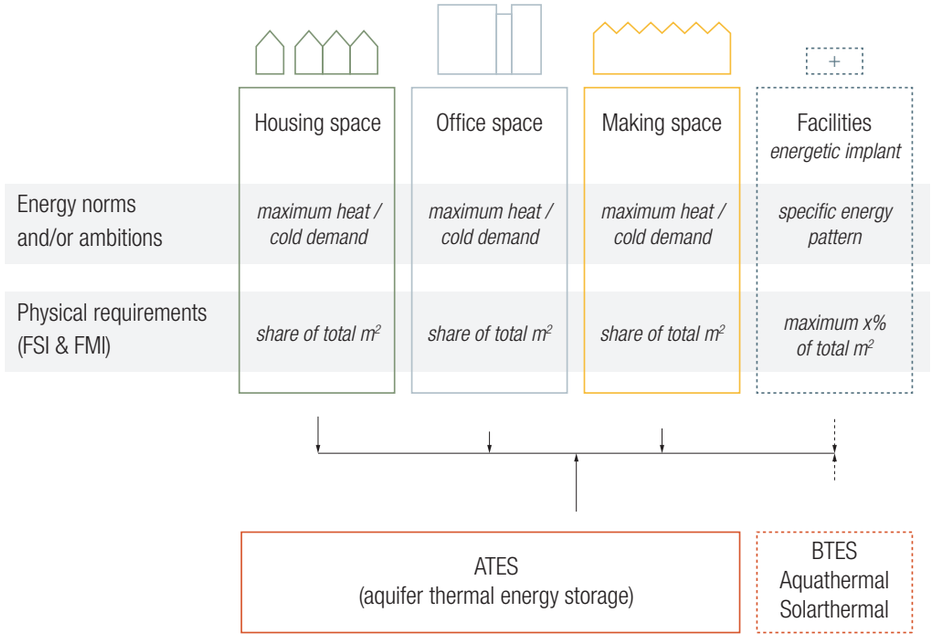
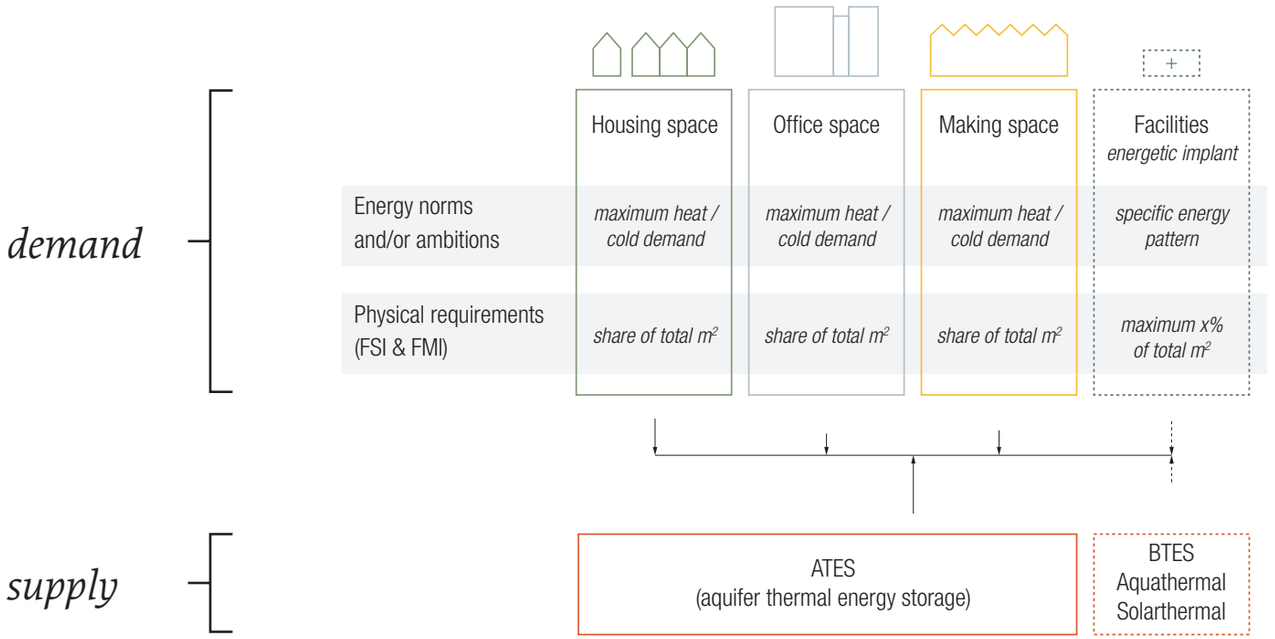
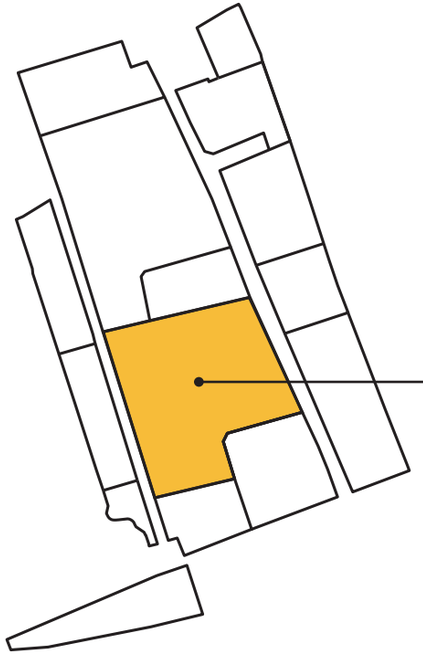
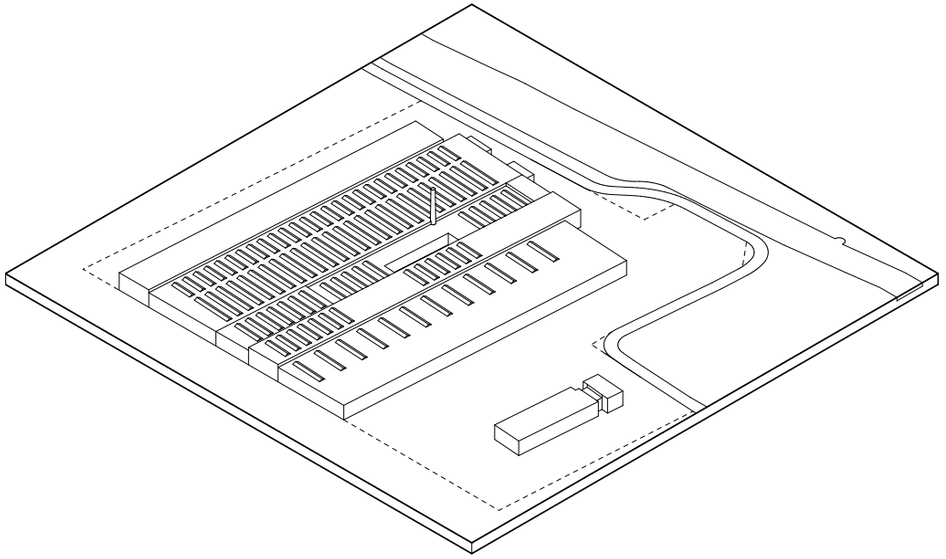
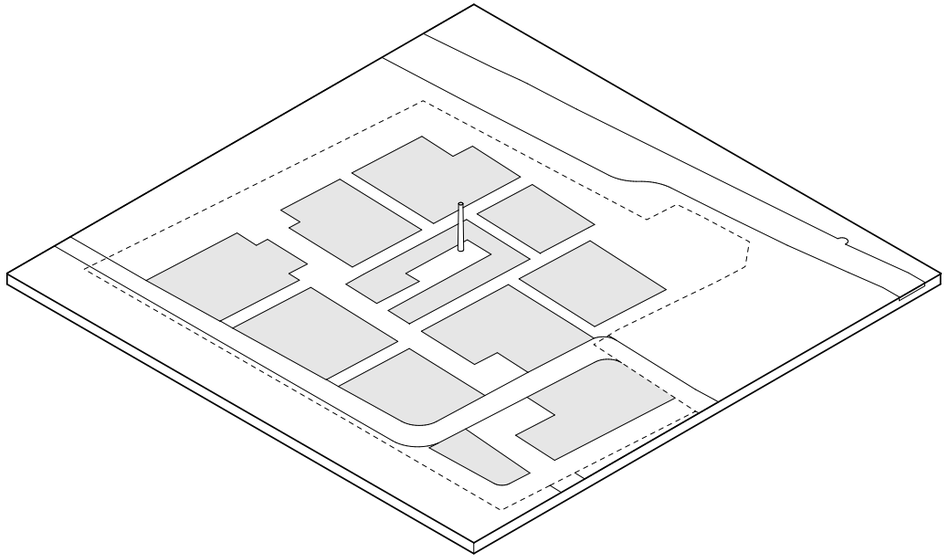

Housing space
Office space
Making space
Facilities
energetic implant
Energy norms
and/or ambitions
maximum heat / cold demand
maximum heat / cold demand
maximum heat / cold demand
specific energy pattern
Physical requirements
(FSI & FMI)
share of total m²
share of total m²
share of total m²
maximum x% of total m²
ATES
(aquifer thermal energy storage)
BTES
Aquathermal
Solarthermal

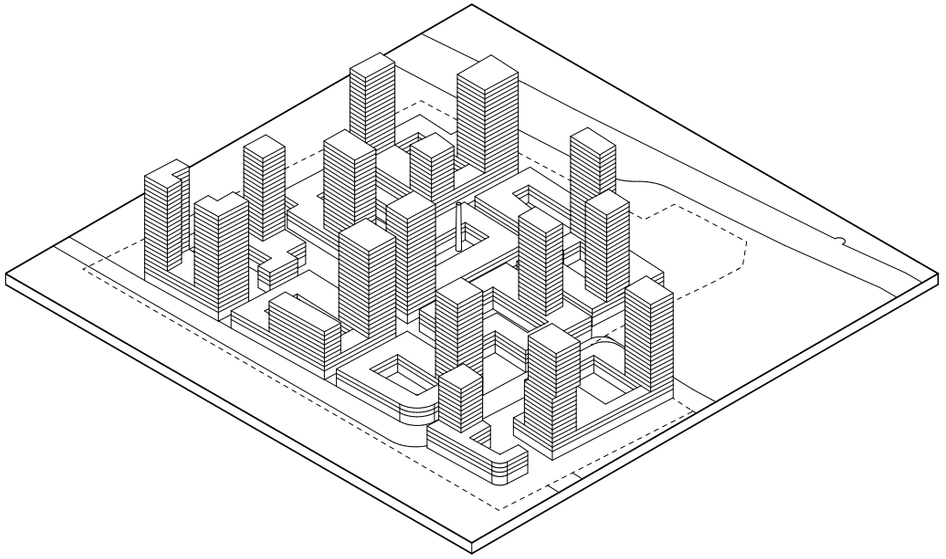

demand
supply
Housing space
Office space
Making space
Facilities
energetic implant
Energy norms
and/or ambitions
maximum heat /
cold demand
maximum heat /
cold demand
maximum heat /
cold demand
specific energy
pattern
Physical requirements
(FSI & FMI)
share of total m²
share of total m²
share of total m²
maximum x%
of total m²
ATES
(aquifer thermal energy storage)
BTES
Aquathermal
Solarthermal



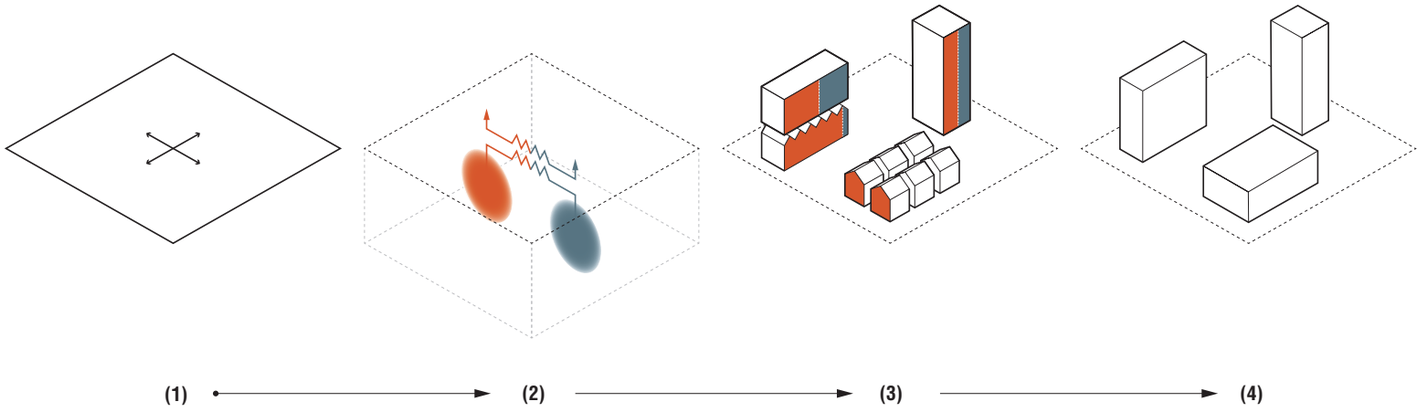
The “Kabeldistrict”
to be developed before
2030 into a high-density,
mixed-use district

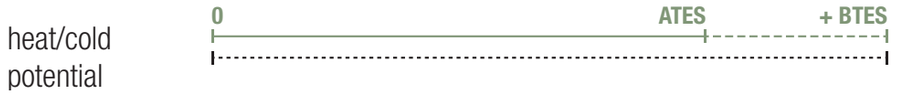


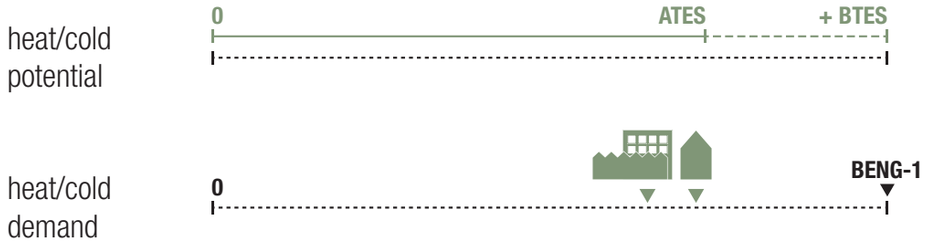


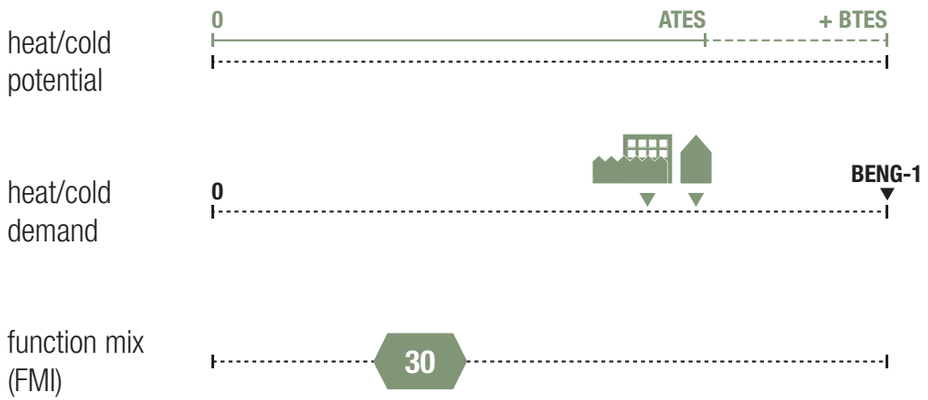


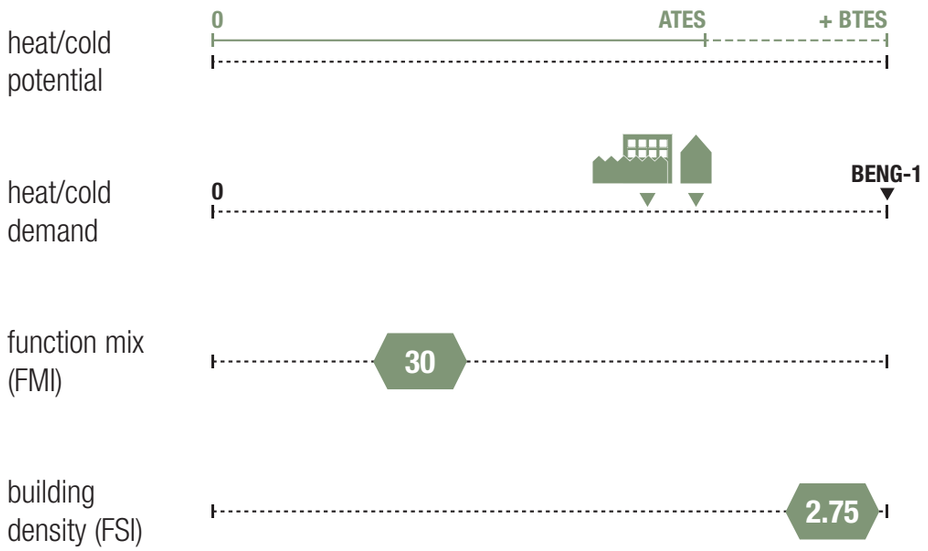
how to supply this
vision-district
with energy?

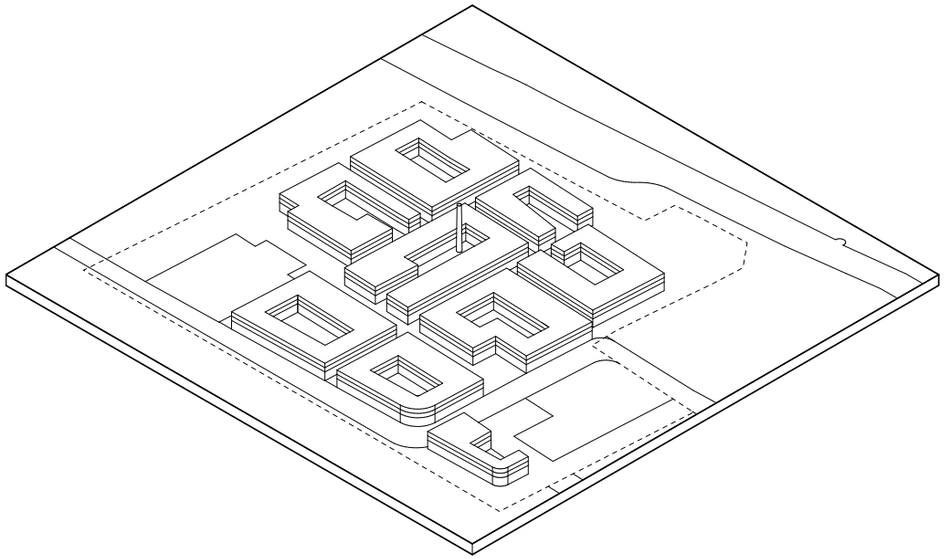

(1)
(2)
(3)
(4)


heat/cold
potential
0
ATES
+ BTES

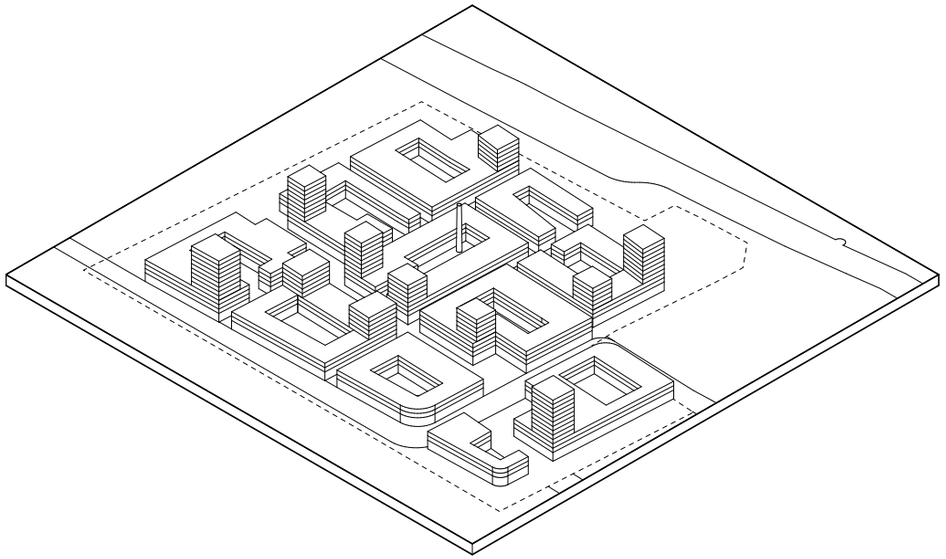

heat/cold
potential
0
ATES
+ BTES
heat/cold
demand
0
BENG-1

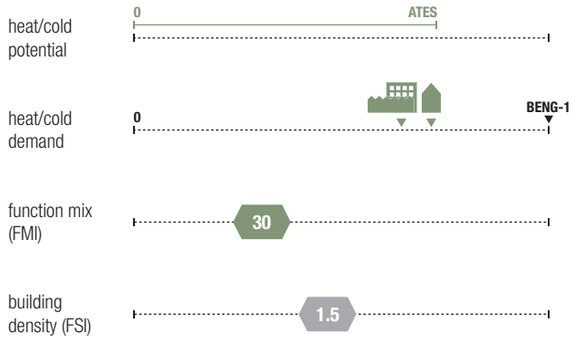

heat/cold
potential
0
ATES
+ BTES
heat/cold
demand
0
BENG-1
function mix
(FMI)
30

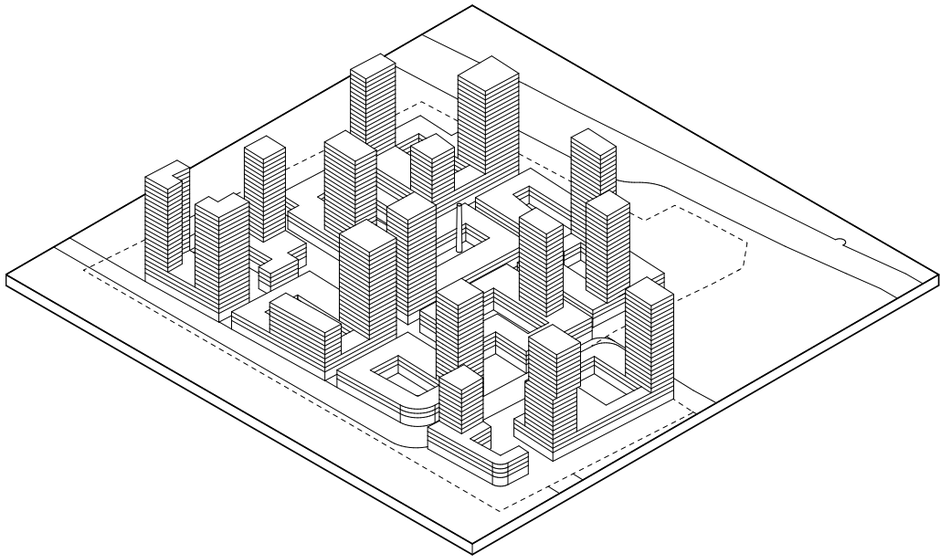

heat/cold potential
0
ATES
+ BTES
heat/cold demand
0
BENG-1
function mix (FMI)
30
building density (FSI)
2.75

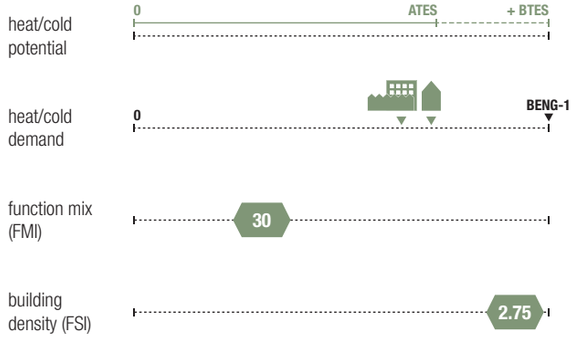


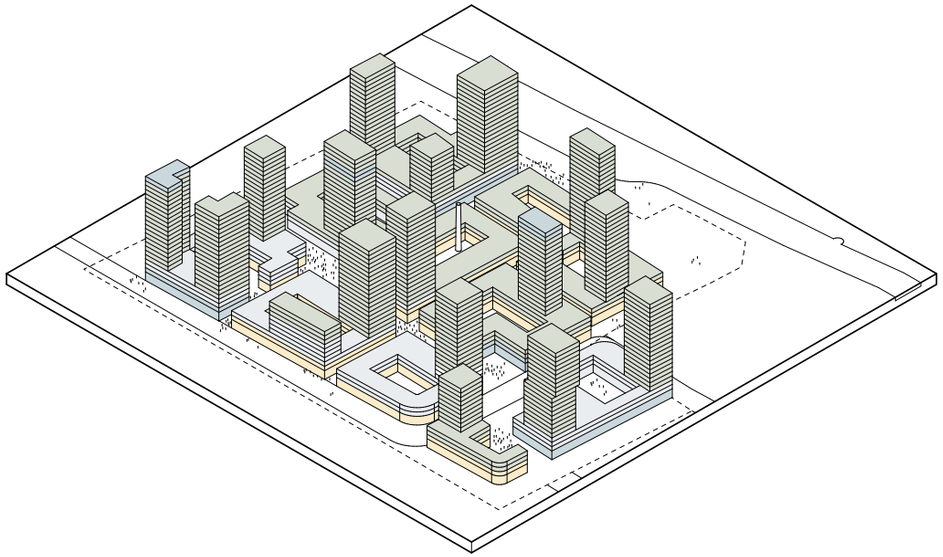

heat/cold potential
0
ATES
heat/cold demand
0
BENG-1
function mix (FMI)
30
building density (FSI)
0.9

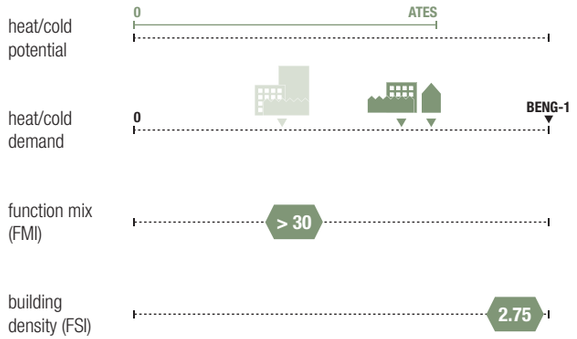


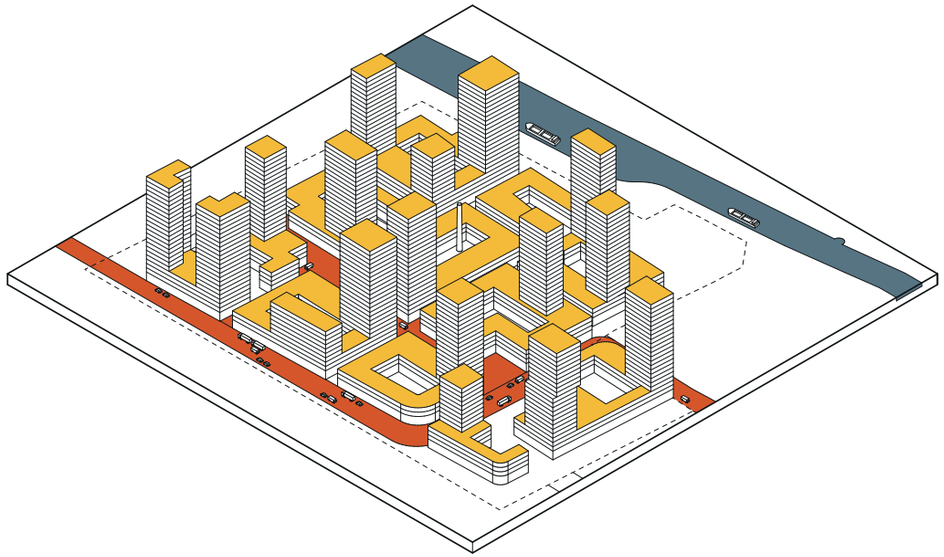

heat/cold potential
0
ATES
heat/cold demand
0
BENG-1
function mix (FMI)
30
building density (FSI)
1.5

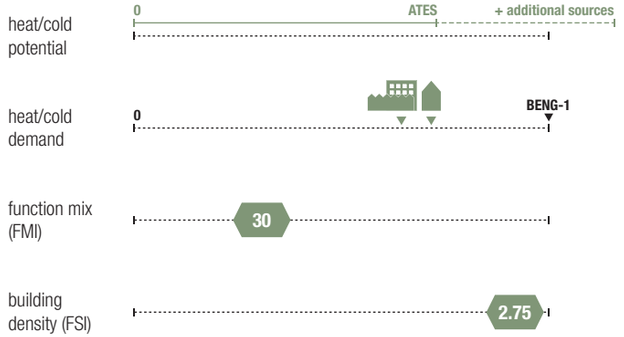



heat/cold potential
0
ATES
+ BTES
heat/cold demand
0
BENG-1
function mix (FMI)
30
building density (FSI)
2.75




heat/cold potential
0
ATES
heat/cold demand
0
BENG-1
function mix (FMI)
> 30
building density (FSI)
2.75




heat/cold potential
0
ATES
+ additional sources
heat/cold demand
0
BENG-1
function mix (FMI)
30
building density (FSI)
2.75

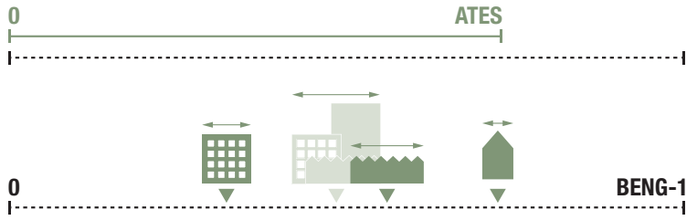
The development of a plot should be

- Energy-neutral *(for at least heat & cold)*
- Not hindering following developments concerning their local energy potentials

Energy-neutrality needs guidance

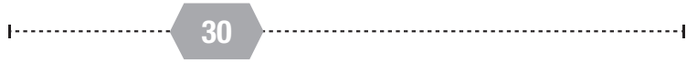
in case of high density developments
BENG does not ensure
energy-neutrality at the own plot

heat/cold potential
design guideline

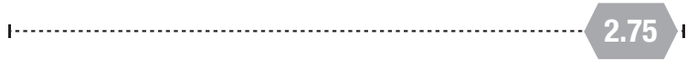


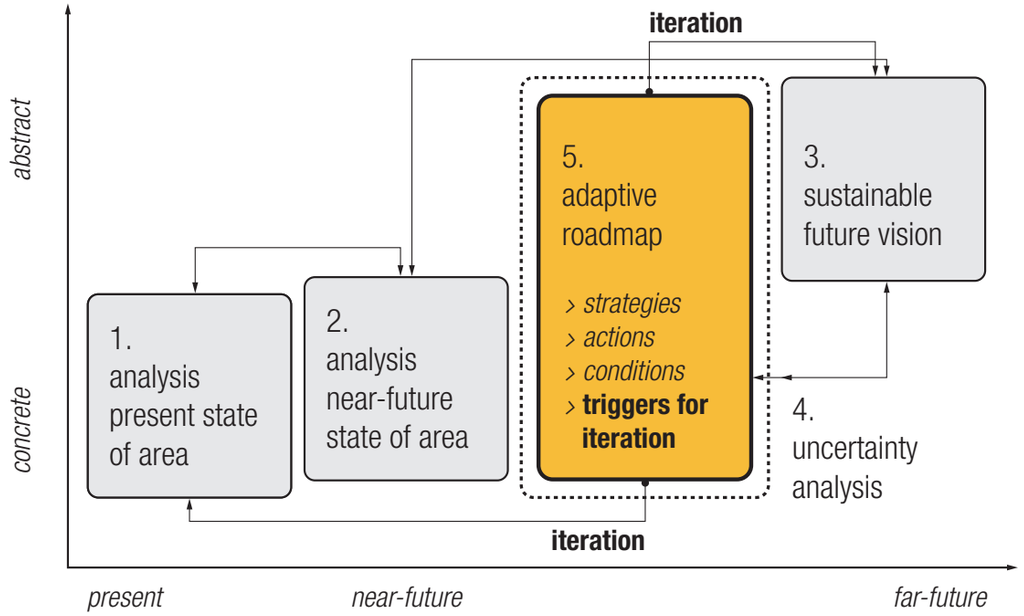
heat/cold demand
design freedom

FMI
primary goal



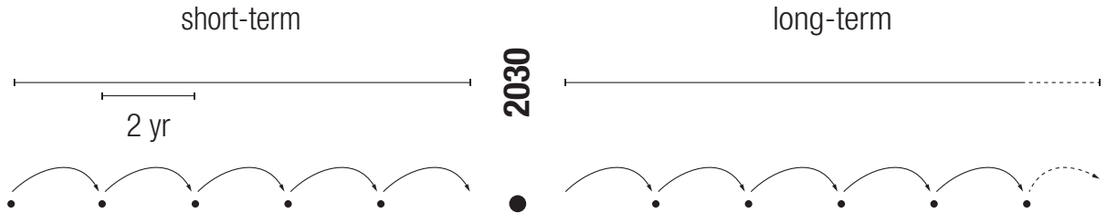
FSI
primary goal

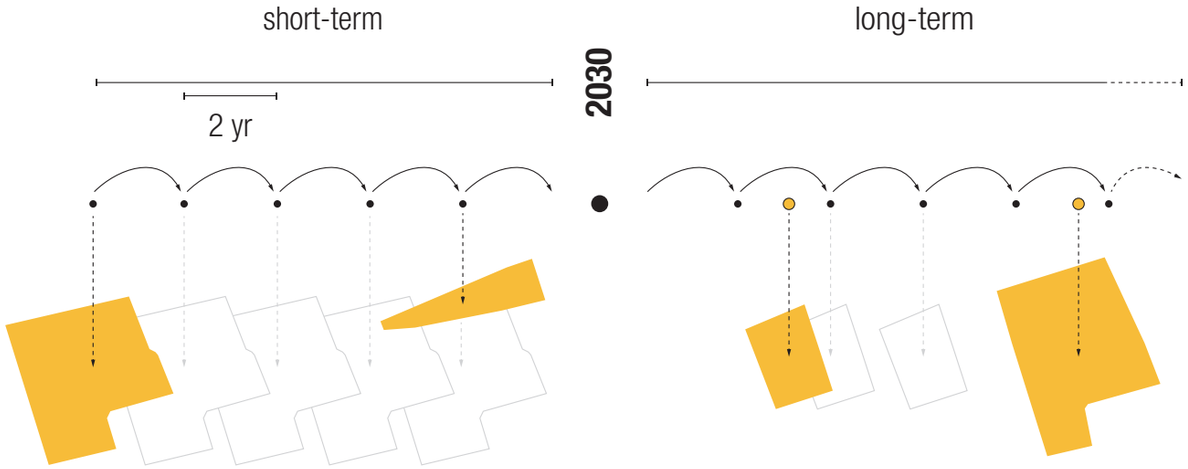


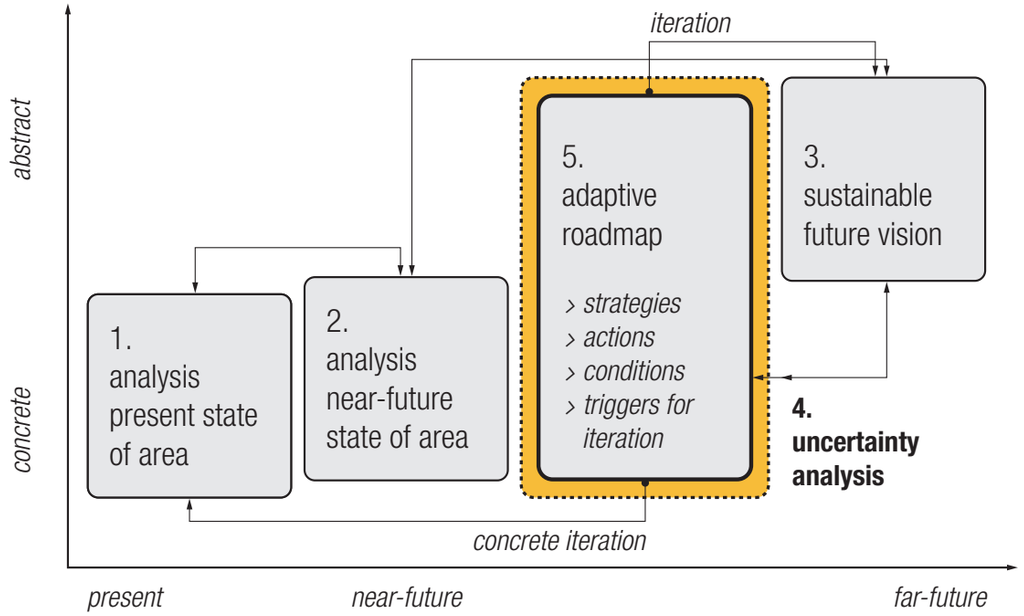

iteration
abstract
concrete
1.
analysis
present state
of area
2.
analysis
near-future
state of area
5.
adaptive
roadmap
› strategies
› actions
› conditions
› triggers for
iteration
3.
sustainable
future vision
4.
uncertainty
analysis
iteration
present
near-future
far-future

iteration

the process of
monitoring - evaluating - adapting


short-term
long-term
2030
2 yr


short-term
2030
long-term
2 yr


iteration
abstract
concrete
1.
analysis
present state
of area
2.
analysis
near-future
state of area
5.
adaptive
roadmap
› strategies
› actions
› conditions
› triggers for
iteration
3.
sustainable
future vision
4.
uncertainty
analysis
concrete iteration
present
near-future
far-future

Which
uncertainty
hinders
the creation
of a blueprint?

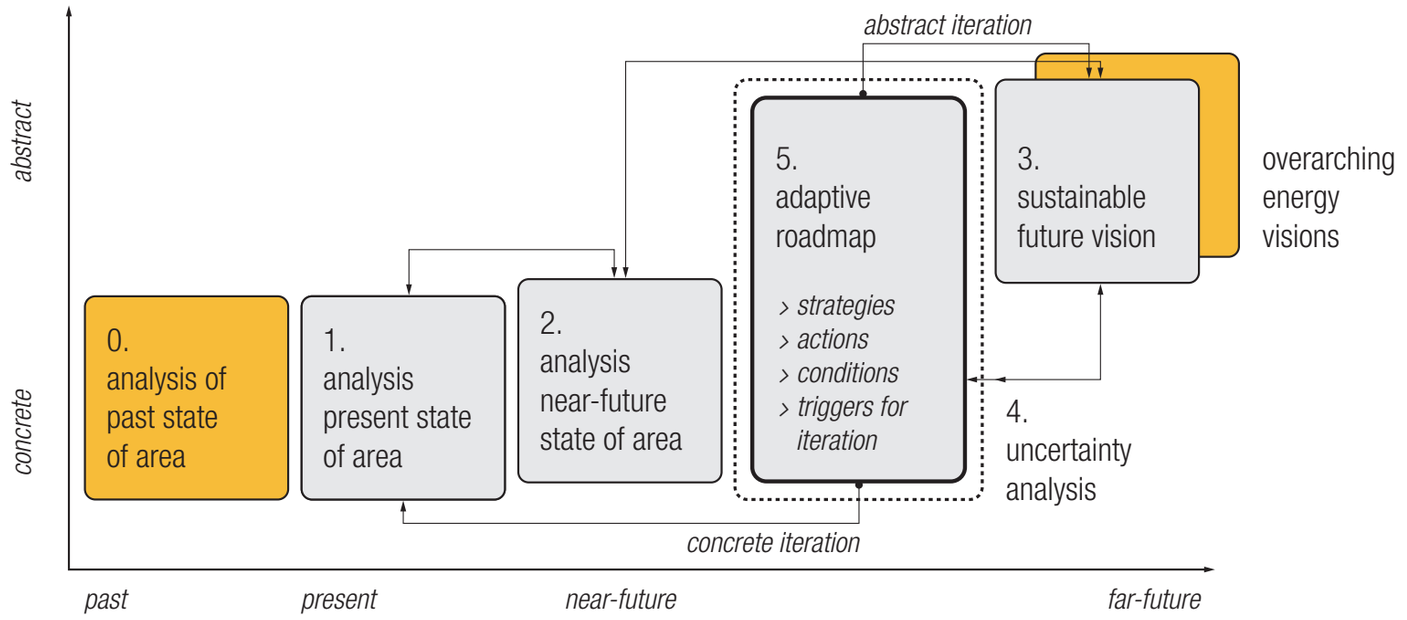
explication

1. Is the uncertainty created at the scale of Schieoevers Noord, or at a larger (or smaller) scale?
2. Is the uncertainty caused by interdependency of other stakeholders or an unknown (far-)future scenario?
3. Is the uncertainty temporary or permanent?

implications

4. Which actions or decisions are hindered by the uncertainty?
5. How can the barrier for taking action or for making a decision be removed?

a reflection
with practice


abstract iteration
abstract
concrete
0.
analysis of
past state
of area
1.
analysis
present state
of area
2.
analysis
near-future
state of area
5.
adaptive
roadmap
› strategies
› actions
› conditions
› triggers for
iteration
3.
sustainable
future vision
overarching
energy
visions
4.
uncertainty
analysis
concrete iteration
past
present
near-future
far-future

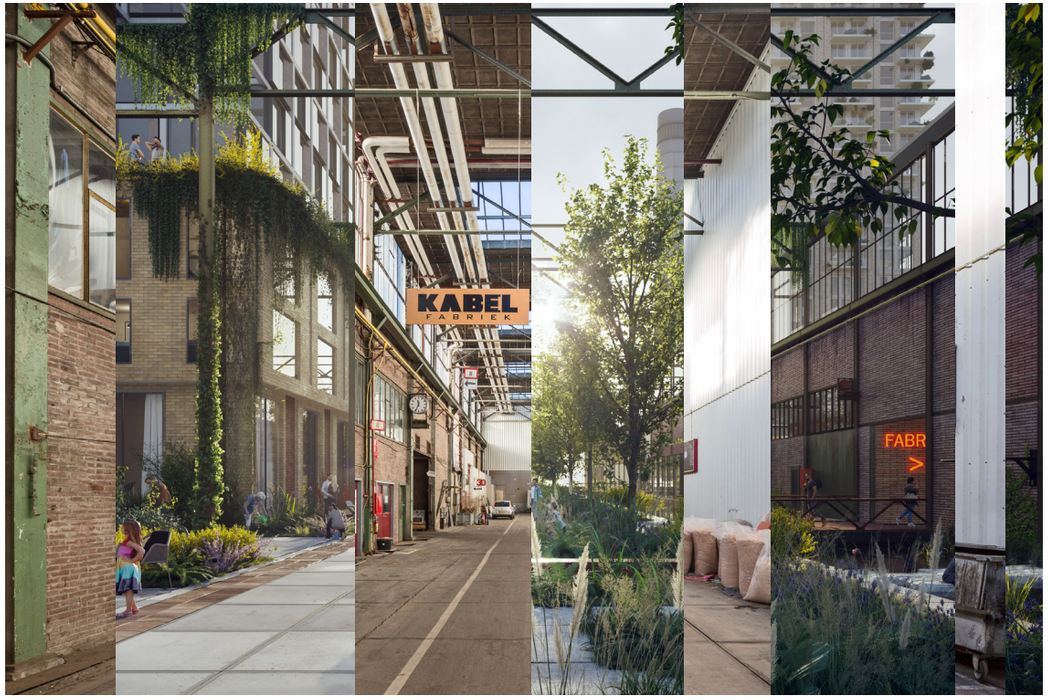
concluding

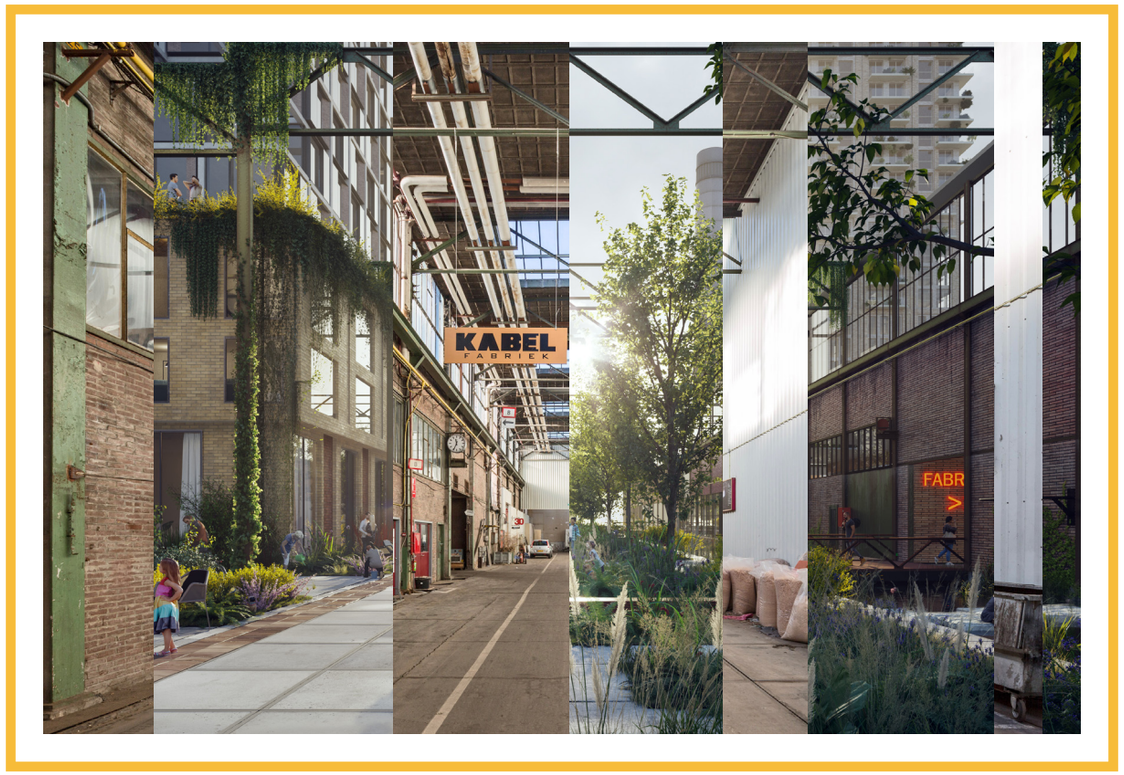
on the *potential* of adaptivity
in energy planning

research question

How can an adaptive approach to energy planning
enable the municipality of Delft to guide the development
of a future-proof energy supply (heat and cold supply)
for Schieoevers Noord?


KABEL
FABRIEK


KABEL
FABRIEK
FABR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FABRIEK
FABR

thank you