

CITY-ZEN ROADSHOW 'SEVILLA'

20th – 24th
NOV
2017



8 Gerencia de
Urbanismo



iuacc
INSTITUTO UNIVERSITARIO
ARQUITECTURA Y CIENCIAS DE LA CONSTRUCCIÓN



Agencia Andaluza de la Energía
CONSEJERÍA DE EMPLEO, EMPRESA Y COMERCIO



Arditec
Arquitectura Diseño Técnica



NO8DO
AYUNTAMIENTO DE SEVILLA



Escuela Técnica Superior de
Ingeniería de Edificación



TECNOLOGÍAS FUTURAS

DAY 1
(MON)

THE LCA OF A CONSTRUCTION PRODUCT



Future technologies

Sustainable technologies and projects in Seville

SUSTAINABLE
CONSTRUCTION
in Andalusia



HUELLA DE CARBONO DE MENORCA

CONTABILIDAD DEL CARBONO

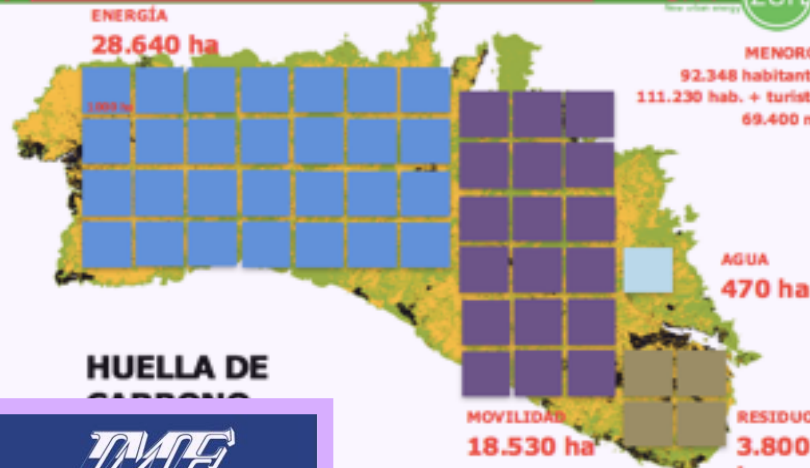


ENERGÍA

28.640 ha

MENORCA

92.348 habitantes
111.230 hab. + turistas
69.400 m2



HUELLA DE CARBONO

IME
Institut Menorquí d'Estudis

CARBONO - RICCARDO M. PULSILLI - UNIVERSIDAD DE SEVILLA

8 Gerencia de Urbanismo

NO8DO
AYUNTAMIENTO
DE SEVILLA



TECNOLOGÍAS FUTURAS

DAY 1
(MON)



8 Gerencia de Urbanismo

NO8DO
AYUNTAMIENTO
DE SEVILLA

IME
Institut Menorquí d'Estudis

PARALLEL TALLERS

DAYS
2 - 4



PARALLEL TALLERS

DAYS
2 - 4



PARALLEL TALLERS

DAYS
2 - 4



JUEGO SERIO 'Go2Zero'

DAY 3
(WED)



JUEGO SERIO 'Go2Zero'

DAY 3
(WED)



SEVILLA: UNA CIUDAD DE BAJAS EMISIONES!

DAY 3
(WED)

HOUSEHOLD ENERGY USE		D	E	F	G	H	I	J
AVG EU		lighting appliances kWh/yr	cooling kWh/yr	heating kWh/yr	cooling kWh/yr	heating kWh/yr	cooling kWh/yr	heating kWh/yr
Madelyn		670	3.177	335	112	4.280	1.284	1.284
Jorge		0,5	0,8					
Covadonga		0,4	0,0			2.876		
Patricia		0,4	0,1			268		
Juan		0,4	0,0			586		
Alejandra		0,5	0,1			268		
Pablo		0,0				623		
Regina		0,3				675		
John		1,0						

WS Instructions
normale Ritorno



WALKING TOUR

DAY 3
(WED)



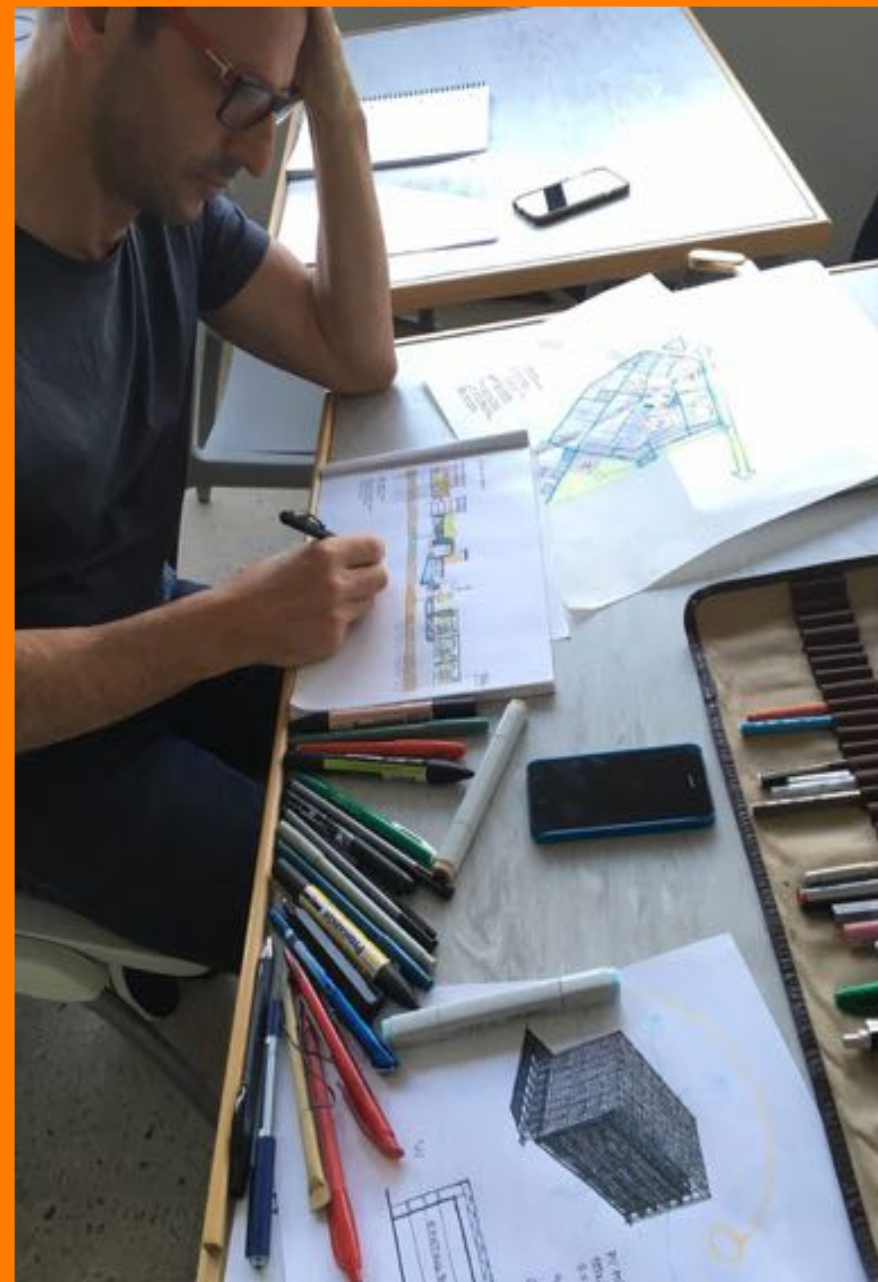
WALKING TOUR

DAY 3
(WED)



PARALLEL TALLERS

DAY 4
(THUR)

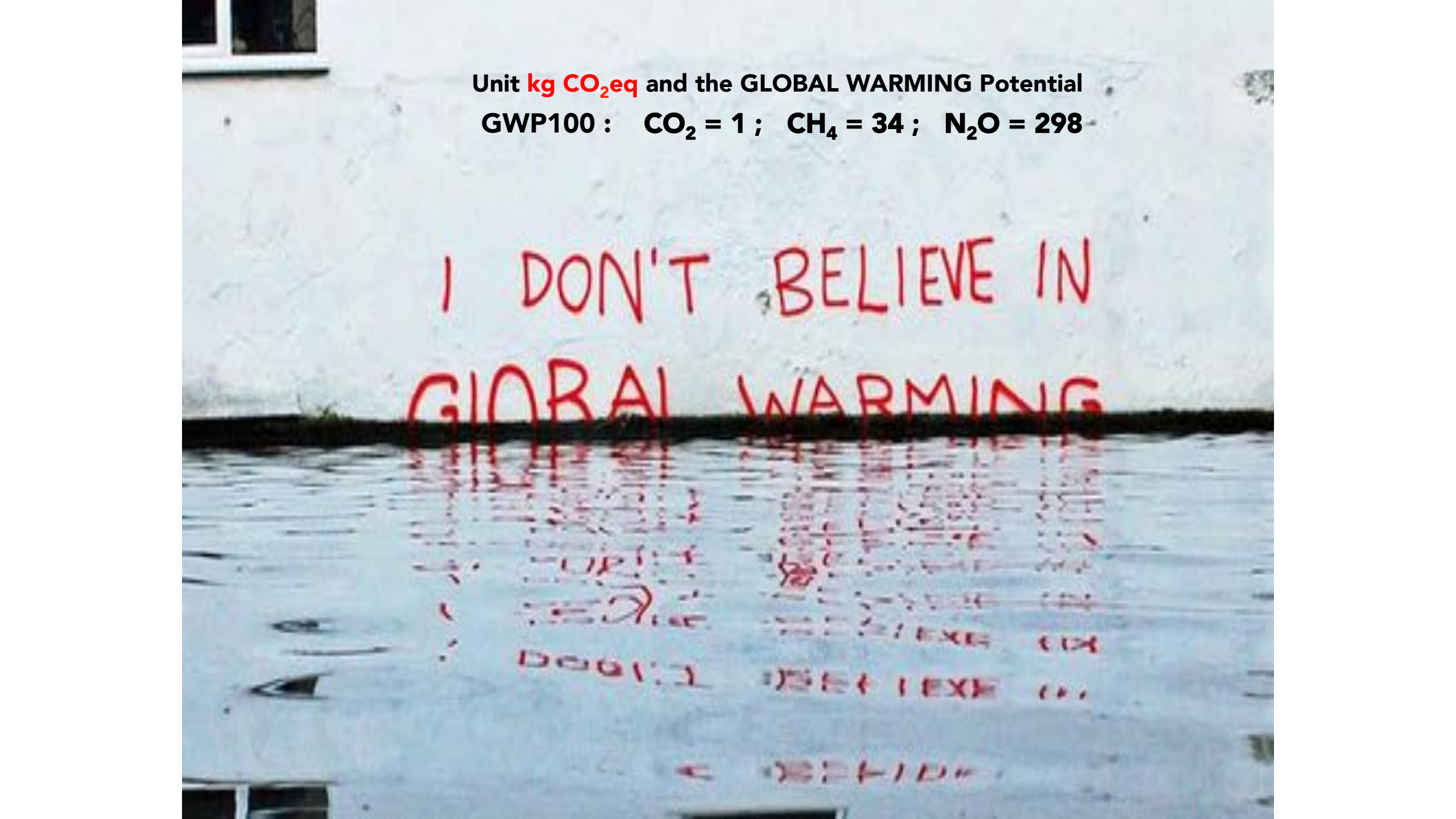


VISIÓN SEVILLA SOSTENIBLE

DAY 5
(FRI)

Unit **kg CO₂eq** and the GLOBAL WARMING Potential

GWP100 : CO₂ = 1 ; CH₄ = 34 ; N₂O = 298



I DON'T BELIEVE IN
GLOBAL WARMING

ANDALUCIA (2015)



Electricity production **83.0 TWh**



THERMO-ELECTRICITY 54.98 TWh (66.2%)

Natural gas **19.0 TWh** (22.9%)

Coal **34.70 TWh** (41.8%)

Oil and others **1.28 TWh** (1.5%)



RENEWABLE 27.98 TWh (30.8%)

Solar thermal **13.70 TWh** (16.5%)

Solar PV **1.60 TWh** (1.9%)

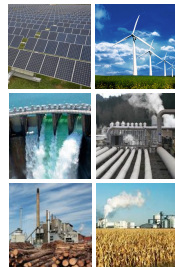
Hydro **0.59 TWh** (0.6%)

Wind **6.39 TWh** (6.2%)

Biomass **5.70 TWh** (5.6%)

Geothermal –

Biofuel & Waste –



**ELECTRICITY EMISSION FACTOR
(LCA based)**

0.534 kg CO₂eq/kWh

Source: Agencia Andaluza de la Energía

RESIDENTIAL ENERGY **1,945,729 t CO₂eq/yr**

	Electricity	3,223.84	GWh/yr
	Natural gas	345.41	GWh/yr
	Diesel	182.59	GWh/yr
	LGP	650.12	GWh/yr
	Biomass + thermosolar	594.29	GWh/yr

SERVICES **1,282,478 t CO₂eq/yr**

	Electricity	2,329.49	GWh/yr
	Natural gas	252.37	GWh/yr
	Diesel	36.05	GWh/yr
	LPG	13.06	GWh/yr
	Biomass+Biogas	124.44	GWh/yr

PRIMARY SECTOR **551,995 t CO₂eq/yr**

	Electricity	282.61	GWh/yr
	Natural gas	143.05	GWh/yr
	Diesel	1,337.45	GWh/yr
	LPG	6.98	GWh/yr
	Biodiesel+Bioethanol	73.27	GWh/yr

Source: Agencia Andaluza de la Energía
Source: Anuario Estadístico de la Ciudad de Sevilla

INDUSTRIAL ENERGY **1,360,389 t CO₂eq/yr**

	Electricity	1,600.29	GWh/yr
	Coal	8.14	GWh/yr
	Natural gas	1,761.95	GWh/yr
	Diesel	24.42	GWh/yr
	LPG	58.15	GWh/yr
	Petroleum	909.47	GWh/yr
	biomas+biogas	377.98	GWh/yr

MOBILITY **2,910,884 t CO₂eq/yr**

	Electricity	79.08	GWh/yr
	Diesel	7,572.29	GWh/yr
	Fuels	3,230.82	GWh/yr

WASTE MANAGEMENT **210,981 t CO₂eq/yr**

	Collected quantity	871,725	t/yr
	Waste to landfill	155,952	t/yr
	Composting	330,514	t/yr

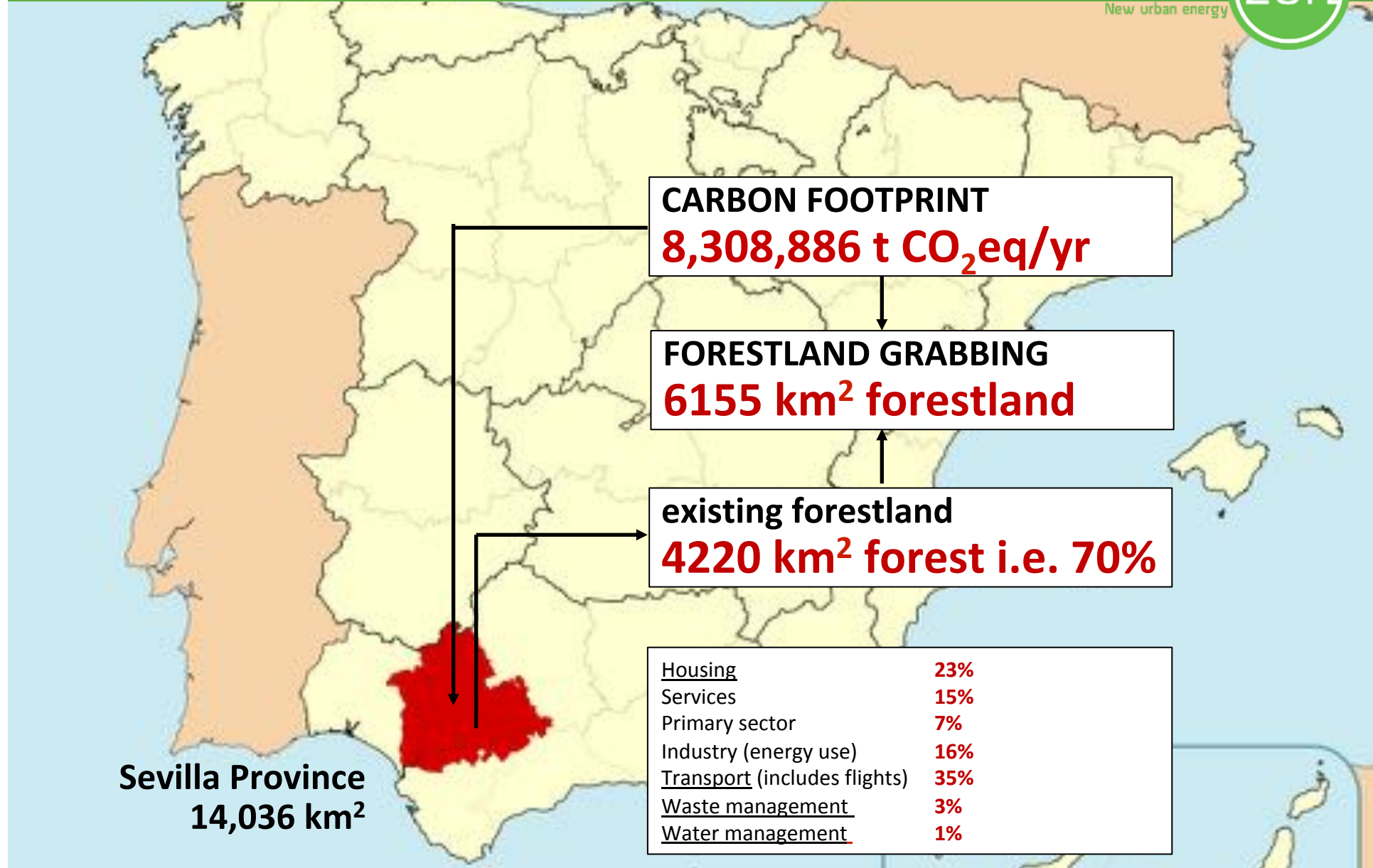
WATER MANAGEMENT **46,430 t CO₂eq/yr**

	Water use	79,367,702	m ³ /yr
---	-----------	------------	--------------------



CARBON ACCOUNTING

CARBON FOOTPRINT ASSESSMENT OF THE PROVINCE OF SEVILLA



CARBON ACCOUNTING HOUSEHOLD PROFILE

SEVILLA HOUSEHOLD (DISTRICT SUR)

Avg inhab. 2.6 n.

Gross floor surface 70 m²



ENERGY DEMAND

2,591 kg CO₂eq 49,4%

E - Cooling 3,177 kWh_e/m²

E - Lighting & appliances 1,116 kWh_e/m²

H - Heating (energy mix) 1,204 kWh_e/m²

H - DHW (energy mix) 1,157 kWh_h/m²

4,293 kWh_e/yr

2,360 kWh_h/yr



MOBILITY

2,307.9 kg CO₂eq 44%

Driven km/house 6,410 Km/yr

i.e. 30 km/car day



WASTE MANAGEMENT

284.5 kg CO₂eq 5.4%

Waste per household 1162.9 kg/yr

i.e. 449 kg/cap

Waste to energy 0.4 %

Waste to landfill 17.9 %

Organic waste 37.9 %

Recycled 44.2 %



WATER MANAGEMENT

61.9 kg CO₂eq 1.2%

Water use per household 106 m³/yr

i.e. 112 L/day cap



5.92 t CO₂eq/yr



5.04 t CO₂eq/yr



5.70 t CO₂eq/yr



9.40 t CO₂eq/yr



8.50 t CO₂eq/yr



5.60 t CO₂eq/yr



CARBON FOOTPRINT

5.25 t CO₂eq/yr



CARBON FOOTPRINT OFFSET

carbon uptake by urban forestry (i.e. 1.35 kg CO₂/m²)

SEVILLA HOUSEHOLD

Ref: 2014-2015

People: 2.6 inhab./house

Avg surface: 70 m²/house

Electricity: 4293 kWh/yr

Heat: 1204 kWh/yr

(mix: 19% CH₄, 10% diesel, 37% LPG, 34% RES)

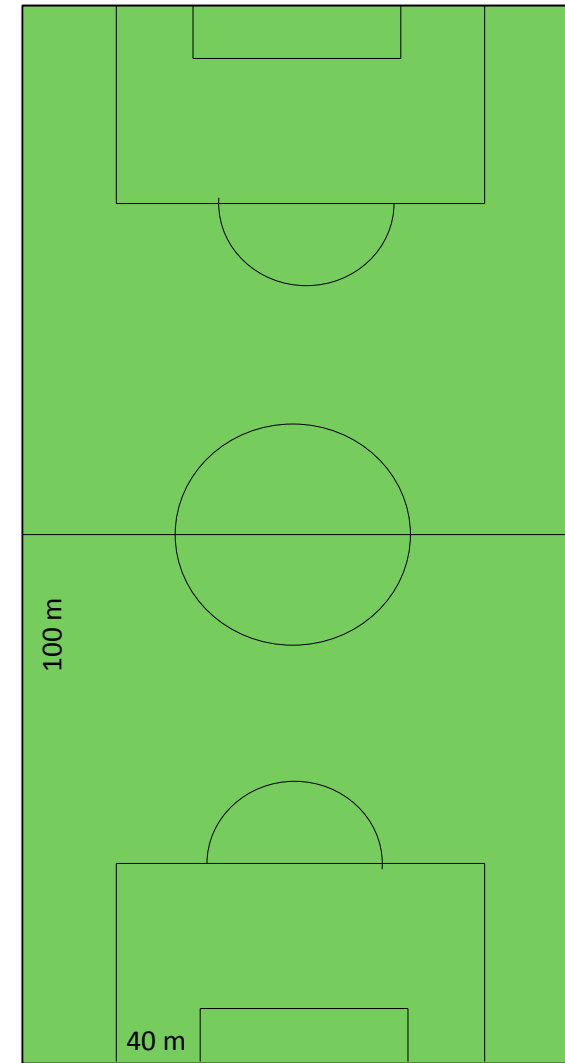
Mobility: 30 km/day x 1.06 car/house

Waste: 1.16 t/house yr

Water: 106 m³/house yr



The carbon footprint offset of one household
is equivalent to **0.39 ha forestland**



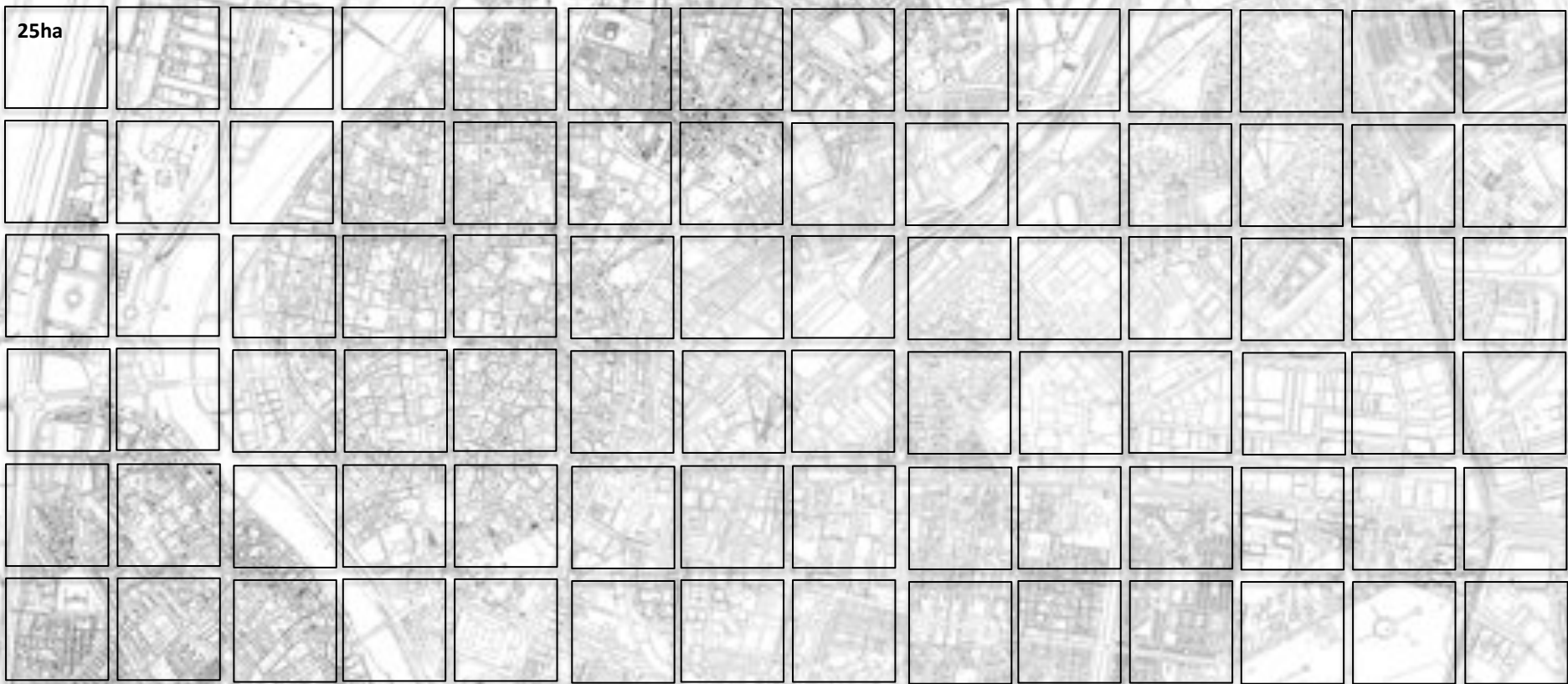
Source: Agencia Andaluza de la Energía; Anuario Estadístico de la Ciudad de Sevilla 2017

CARBON ACCOUNTING NEIGHBOURHOOD

What is the impact of the Barrio Tiro de Linea?

BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

1 km

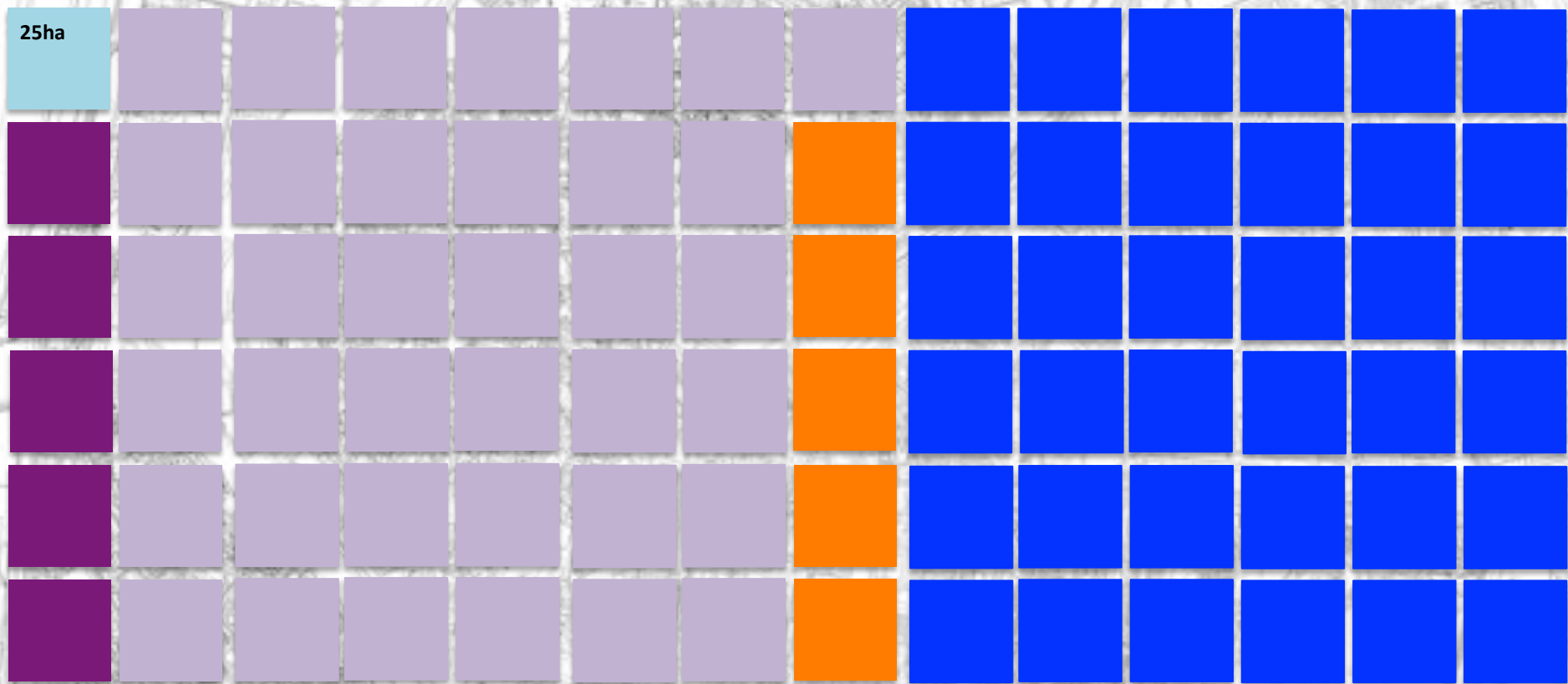


BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

Carbon Footprint: 28,136 t CO₂-eq
Forestland grabbing: 2084 ha



1 km



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

-  **ELECTRICITY** 12700 MWh
-  **HEAT ENERGY** 23000 MWh
-  **MOBILITY** 34400 km/house yr
-  **WASTE** 6240 t (1160 kg/house)
-  **WATER** 568,000 m³ (106 m³/house)

Carbon Footprint: 28,136 t CO₂-eq
Forestland grabbing: 2084 ha

- 12205 t CO₂-eq; 904ha forestland**
- 1694 t CO₂-eq; 125ha forestland**
- 12380 t CO₂-eq; 917ha forestland**
- 1526 t CO₂-eq; 113ha forestland**
- 332 t CO₂-eq; 25ha forestland**

IMAGINE YOUR CITY

Sevilla
100
años

Sevilla

La mirada innovadora

TAPPING INTO THE POTENTIAL

MOVIENDO





Copenhagen expertos en movilidad:
Si dejas el espacio para conducir en coche,
la gente usará el coche
Si dejas el espacio para ir en bicicleta,
la gente usará la bicicleta



peatones, bici



coches buses (travías)





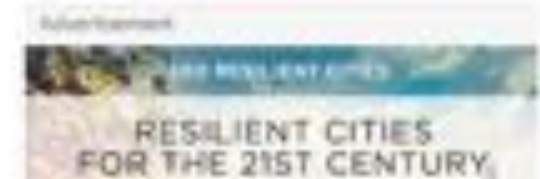
MOVIENDO



Cities

Cycling the city

How Seville transformed itself into the cycling capital of southern Europe



Manuel Calvo @ The Guardian

GREEN HEROS



GREEN HEROS

Huerta del Rey Moro



GREEN HEROS





TIRO DE LÍNEA



TIRO DE LÍNEA



TIRO DE LÍNEA

GREEN HEROS CTUED



NEVERTHELESS



NEVERTHELESS

NEVERTHELESS



DISRUPTIVE CHANGE

Equipa Urbanista

City-zen roadie

- Prof. **Greg Keeffe** (Queens University Belfast)

Interpreter and guest roadie

- **Jesús Cardona** (Nontropía)

Student facilitators

- **Dora Vancsó** (TU Delft)
- **Laura Solarino** (TU Delft)
- **Antigoni Karaiskou** (TU Delft)

Equipa Energetica

City-zen roadies

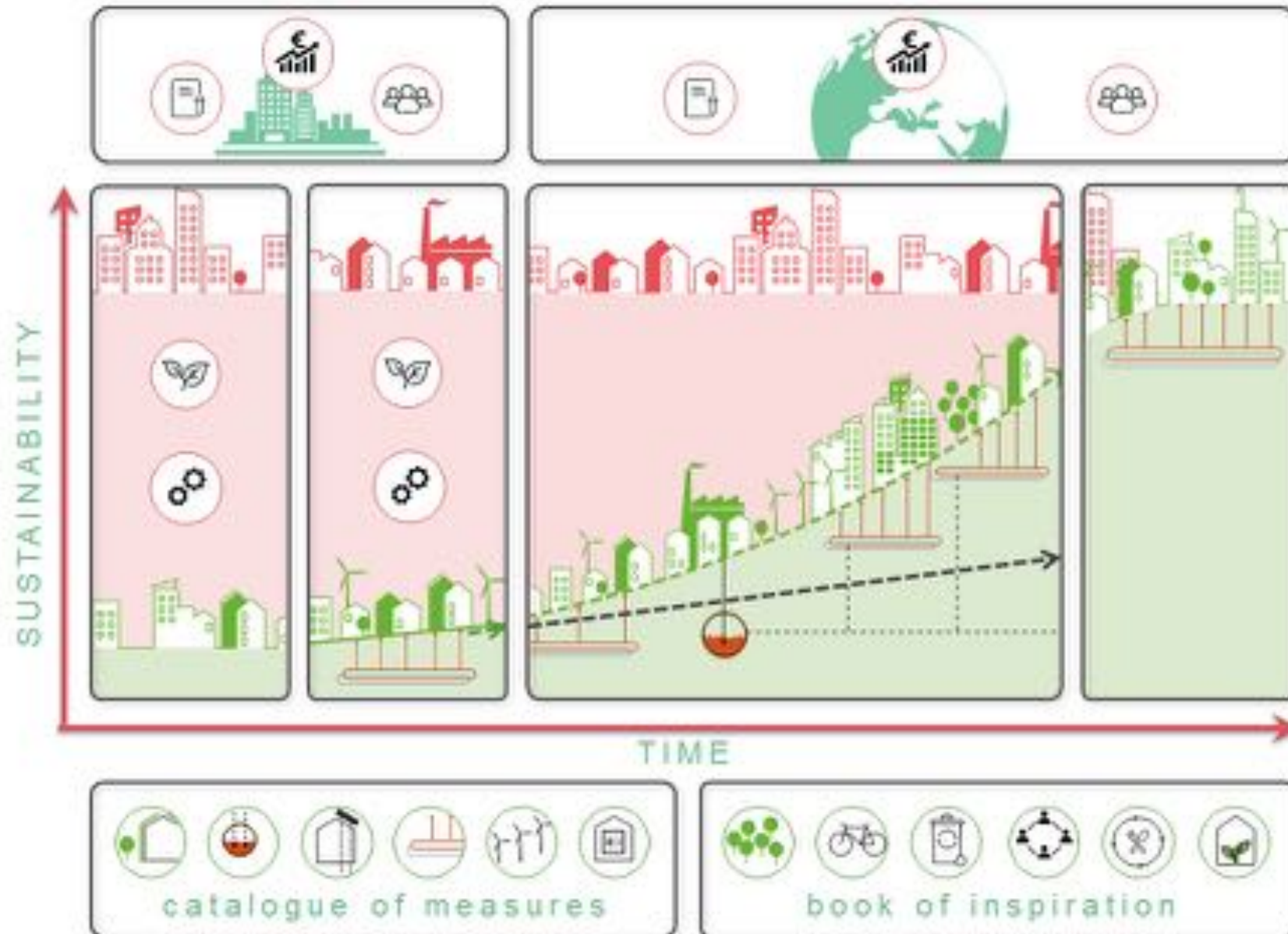
- Prof. **Andy van den Dobbelsteen** (TU Delft)
- Dr. **Riccardo Pulselli** (Università di Siena)
- **Matteo Maccanti** (Università di Siena)
- Dr. **Han Vandevyvere** (EnergyVille)
- Dr. **Leen Peeters** (Think!E)

Student facilitators

- **Eva Farrugia** (TU Delft)
- **Michael Cobb** (TU Delft)
- **Álvaro Rodríguez García** (TU Delft)

CITY-ZEN ROADMAPPING SCHEME

[City-zen WP4T2 team, image by Siebe Broersma and Michiel Fremouw, TU Delft]



What does the sustainable city look like in 2050?



Hammarby Sjöstad, Stockholm

Aims of the Roadshow energy studio

Main aim: to support Sevilla in its energy transition from fossil fuels to renewable sources

Stepped objectives

1. Creating a good overview of energy demand, supply and local potentials

2. Converting energy usage to a carbon footprint

3. Finding solutions to get to net zero-carbon developments

- Reduce the energy demand (urban planning, building design, appliances)
- Reuse waste energy (program, attune, exchange, store)
- Produce renewables (sun, wind, water, soil, air, biomass, humans)

4. Involve solutions for non-building sectors:

- Transportation
- Waste (water) treatment
- Economic developments

5. Calculate the carbon emissions reduced and remaining carbon footprint

Climate data

Conclusion: mean temperature 18°C → soil perfect for cooling/pre-heating

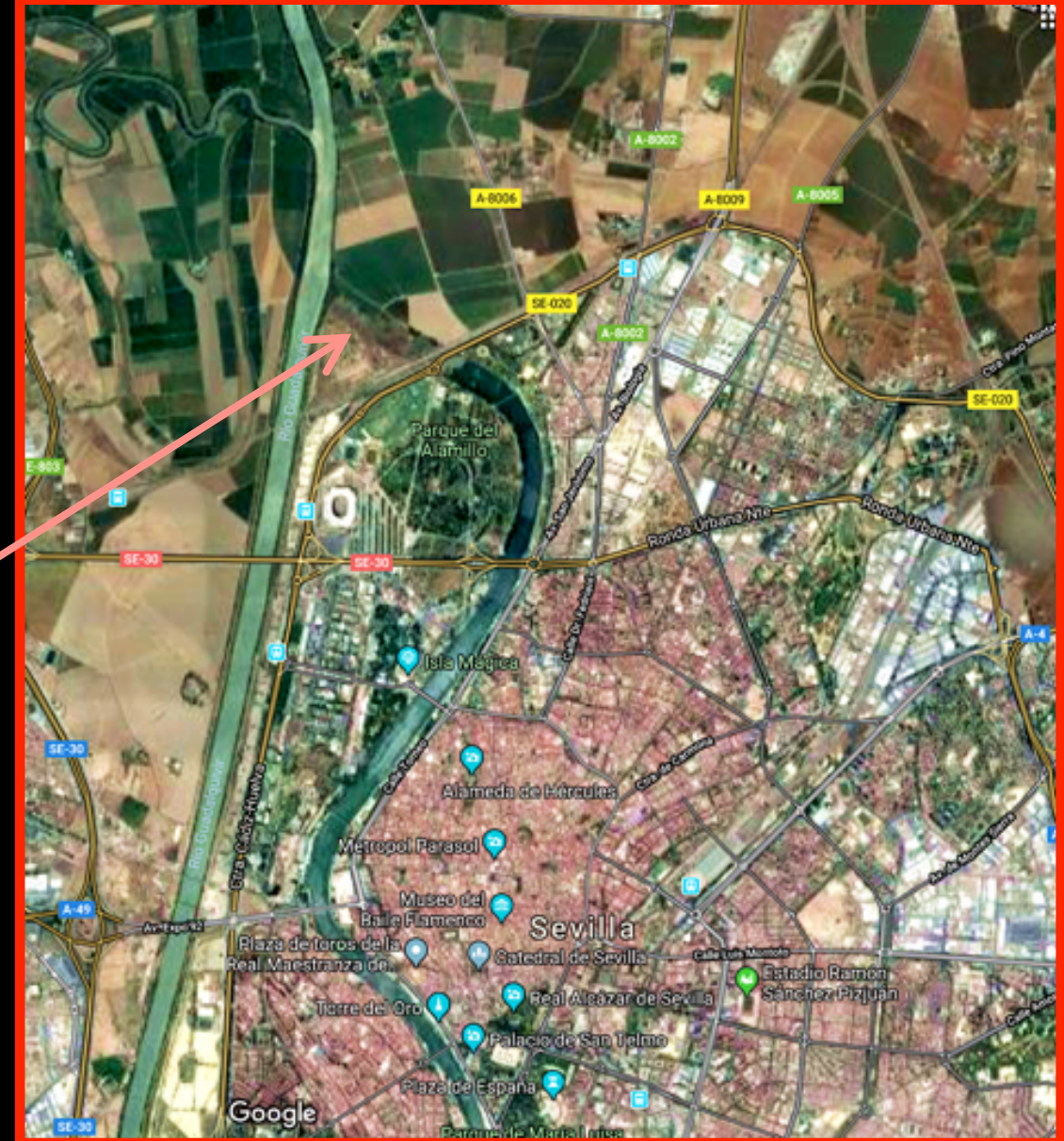


Source: ClimateConsultant / IWECC Data

Water – Guadalquivir & Sevilla



What is happening here?





Escala 1/25000



Mapa geotécnico básico de Sevilla
Profundidad del nivel freático (m)

5

MACRO SCALE **WATER IN THE CITY**

Reconnect the city to the Guadalquivir and
use flowing water to cool and humidify it



MACRO SCALE **WATER IN THE CITY**

Reconnect the city to the Guadalquivir and
use flowing water to cool and humidify it

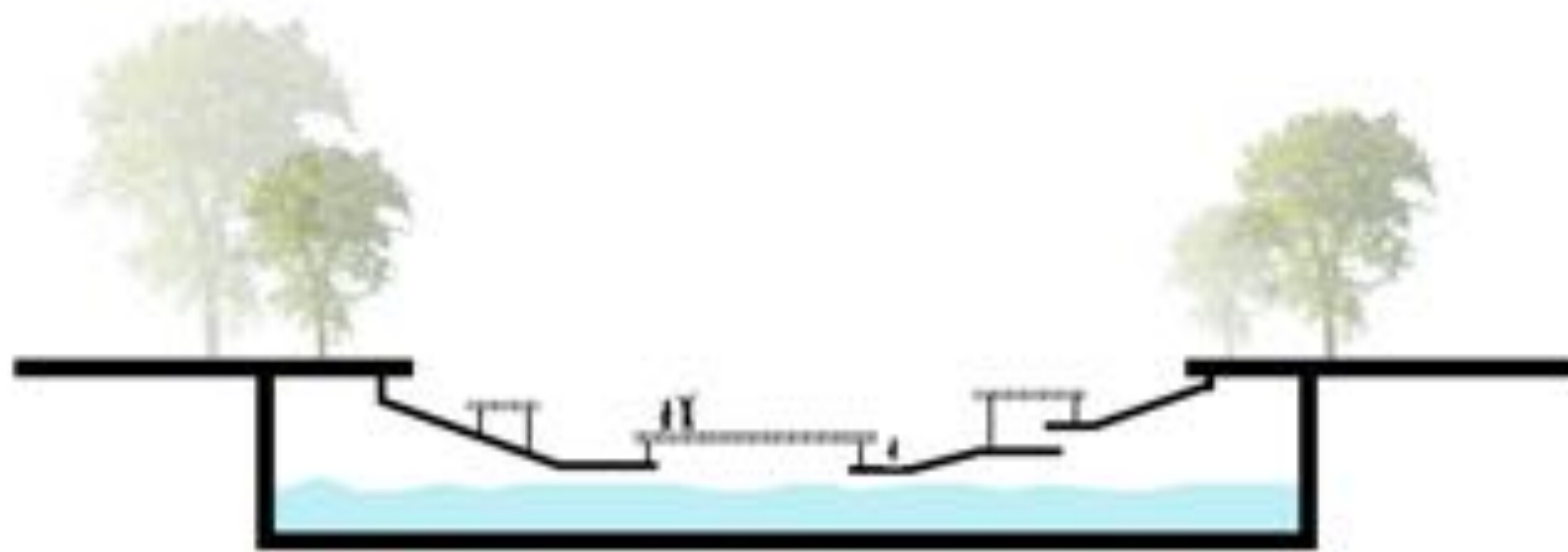




Tiro de Línea

MESO SCALE CAPTURE & STORE

A combination of rainwater collection, filtering, evaporative cooling and a playground.



MICRO SCALE CAPTURE & USE

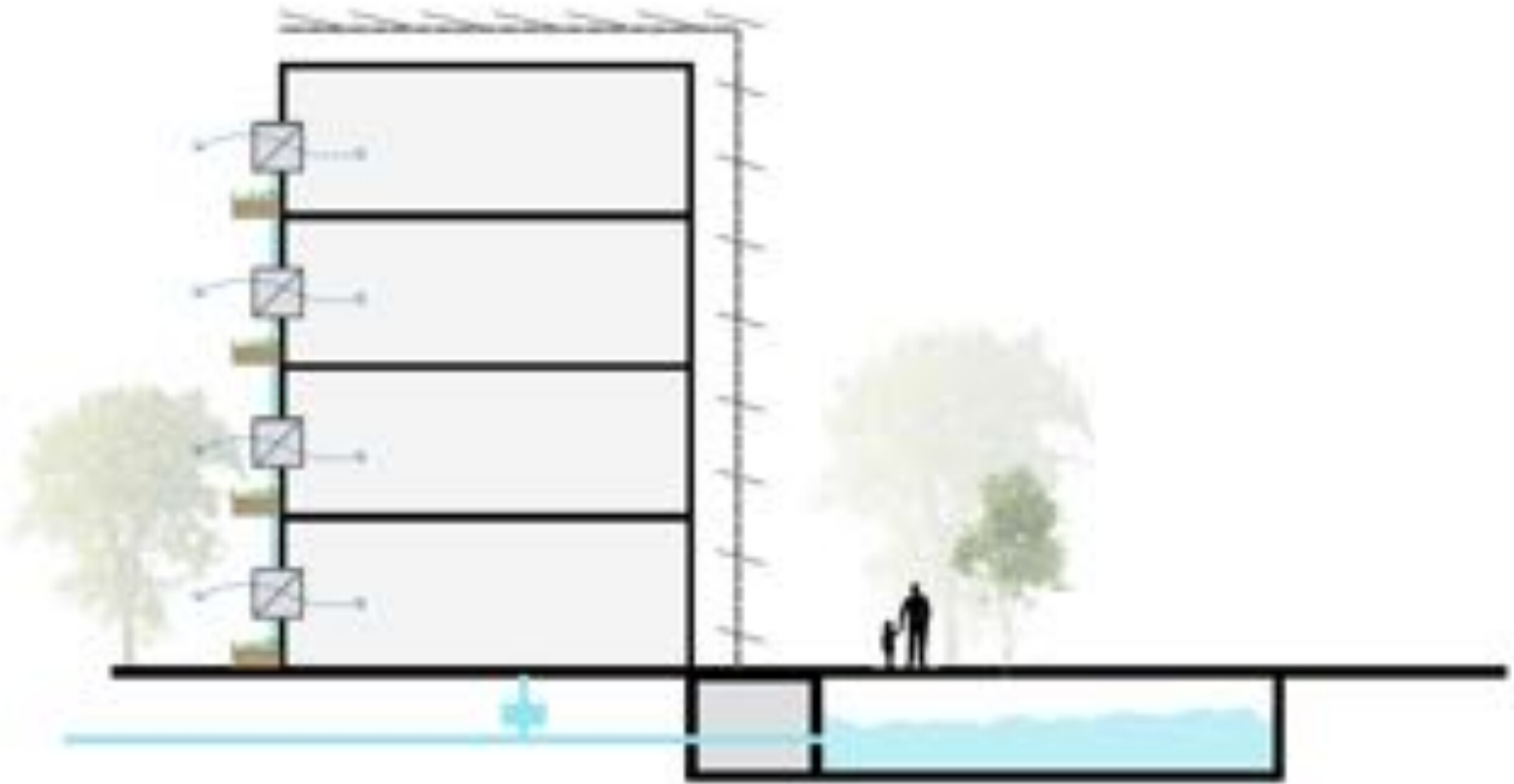
Use of cisterns underneath the streets which link to the water squares.



MICRO SCALE

CAPTURE & REUSE

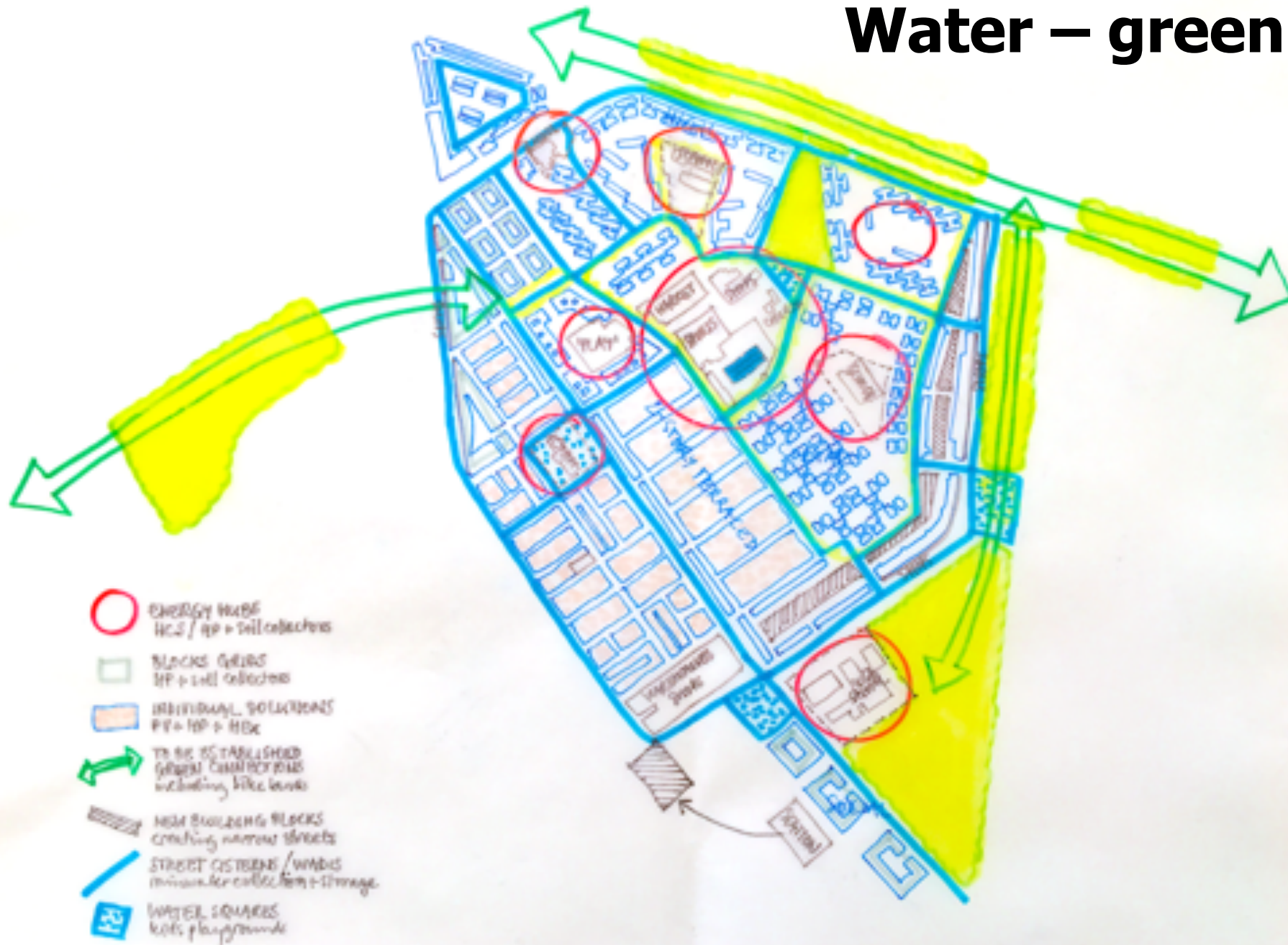
Condensate Irrigation from Heat Exchangers



Tiro de Línea Water infra



Water – green – energy hubs





Kronsberg



Grenoble



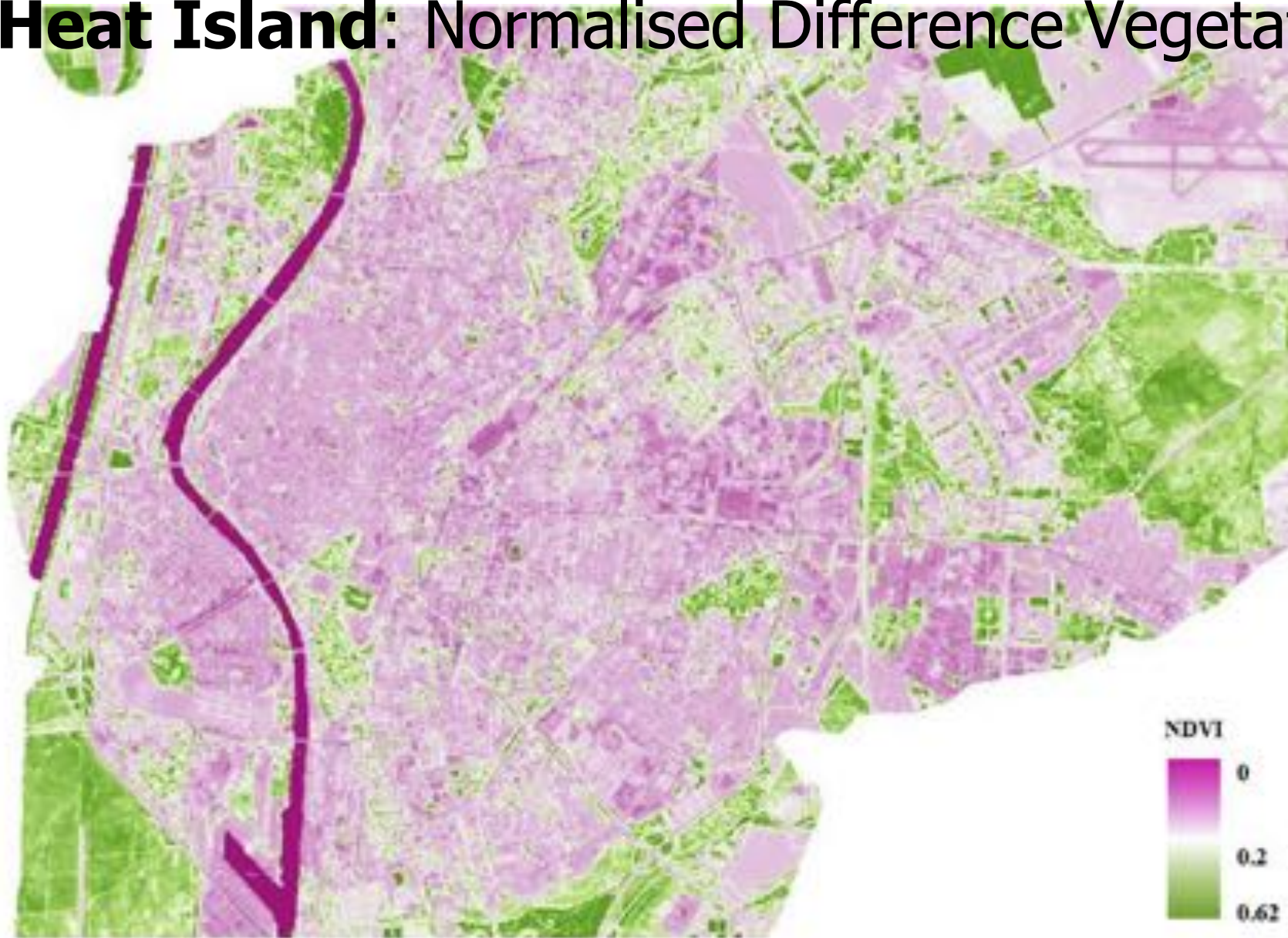
Bad Langensalza



Malmö



Urban Heat Island: Normalised Difference Vegetation Index



Herrera-Gomez S., Quevedo-Nolasco A., Pérez-Urrestarazu L. (2017); The role of green roofs in climate change mitigation - A case study in Seville (Spain); Building and Environment 123, p. 575-584

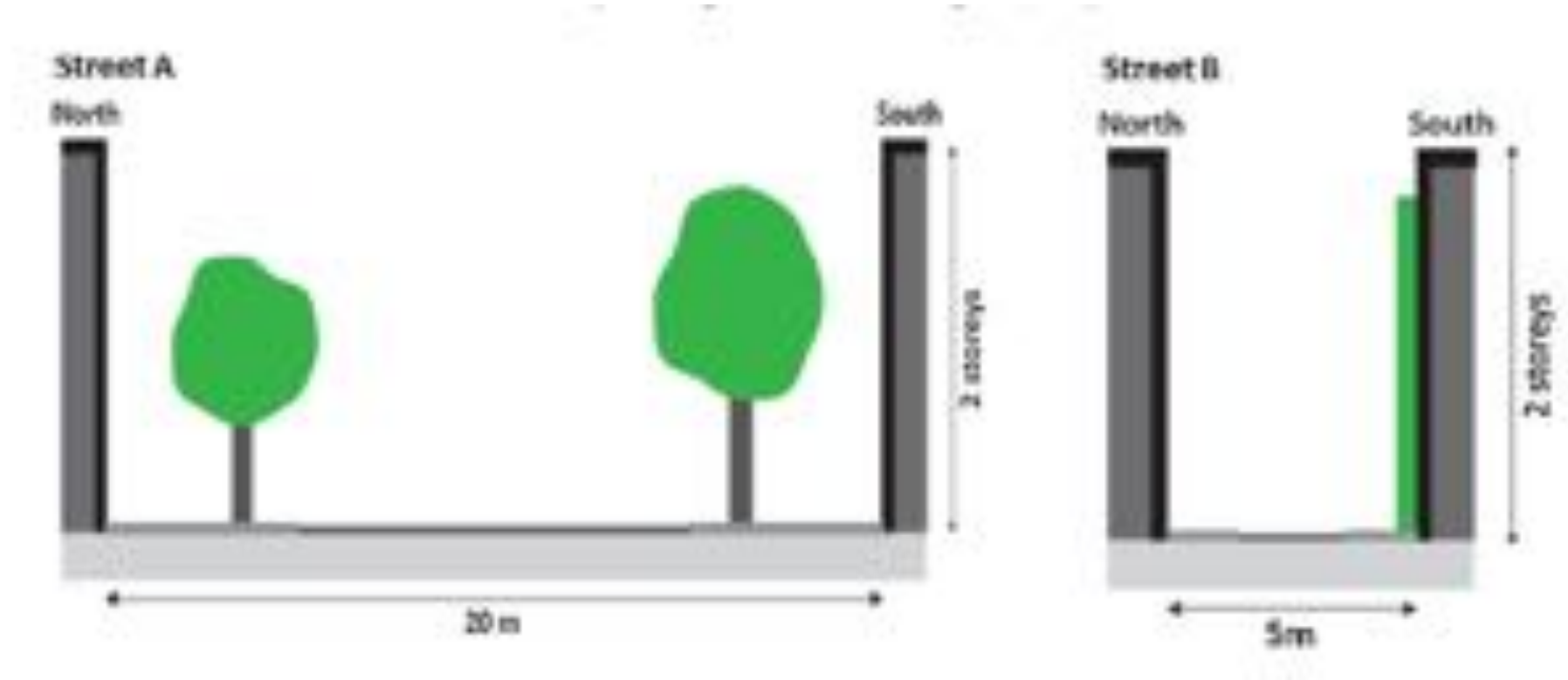
Percentage of green roofs needed due to climate change

Table 2

Estimation of the green roof surface necessary to mitigate ΔT due to climatic change.

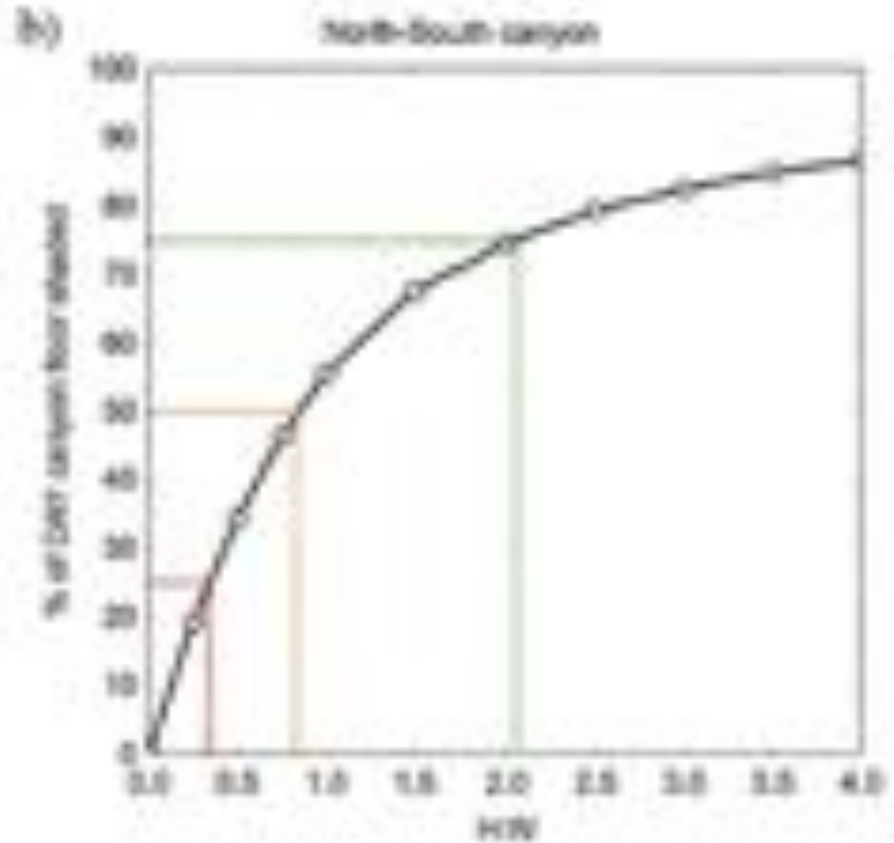
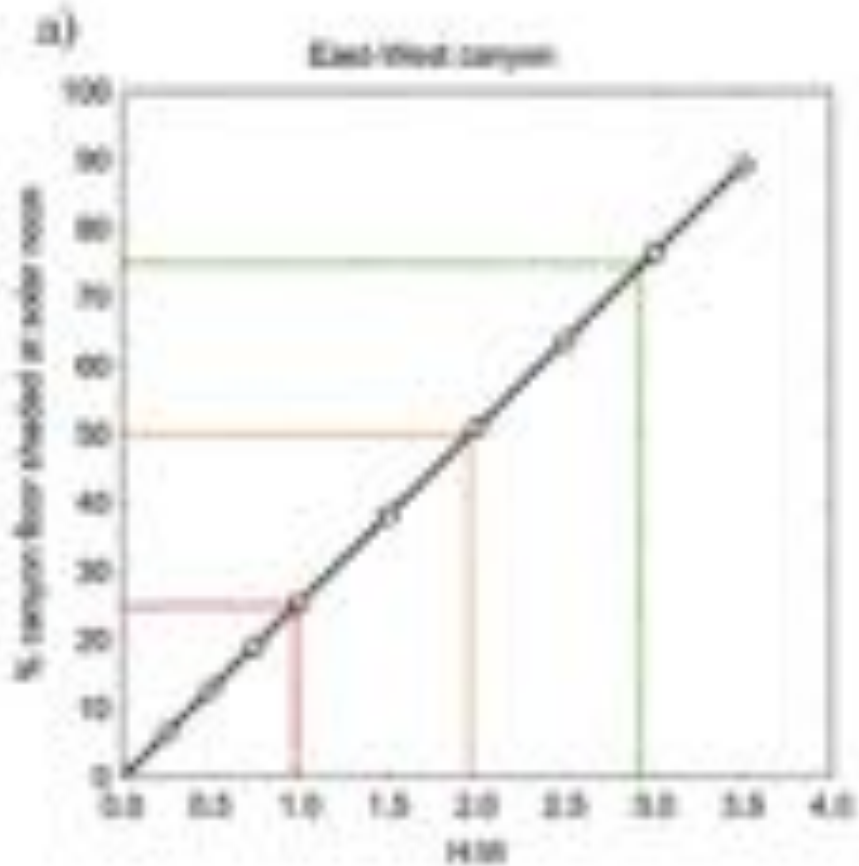
Period	SERES climatic scenario	T_{max}^{CC} ($^{\circ}C$)	ΔT_{max} ($^{\circ}C$)	Landsat 7 ETM+			
				NDVI ^{CC} (dim)	S_{veg}^{CC} (ha)	ΔA_{gr} (ha)	Percentage of roofs to vegetate (%)
2011–2040	A2	^{a/} 35.5	3.5	0.47	1257	367	20.1
2041–2070	A2	^{a/} 34.0	5.0	0.52	1414	524	28.8
2071–2100	A2	^{a/} 33.0	6.0	0.56	1519	629	34.5

Different green solutions for different street sections



Norton A. et al. (2015); Planning for cooler cities: A framework to prioritise green infrastructure to mitigate high temperatures in urban landscapes; Landscape and Urban Planning 134, p. 127–138

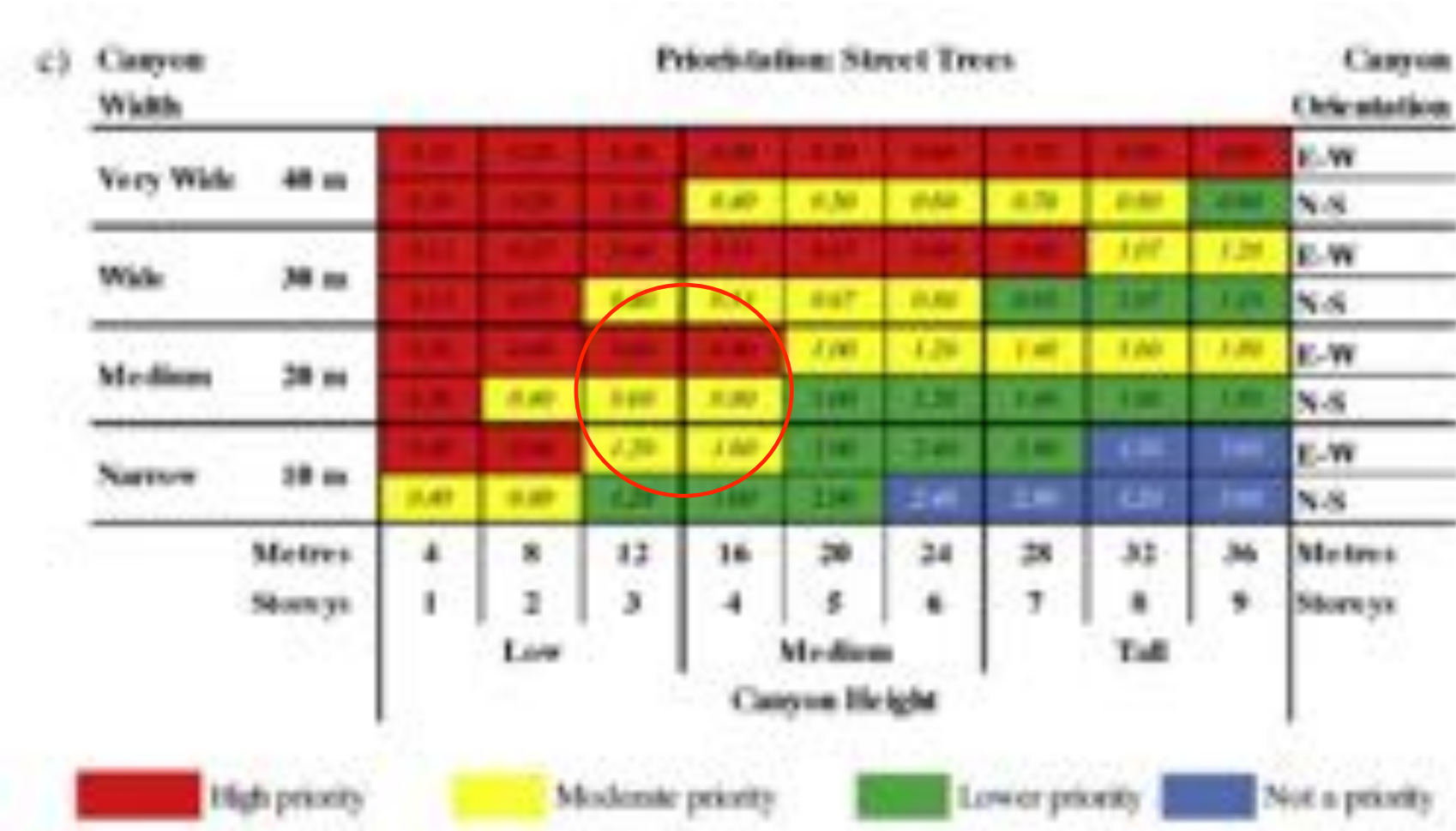
Percentage of street shaded with different height/widths



Norton A. et al. (2015); Planning for cooler cities: A framework to prioritise green infrastructure to mitigate high temperatures in urban landscapes; Landscape and Urban Planning 134, p. 127–138

Streets in danger of overheating

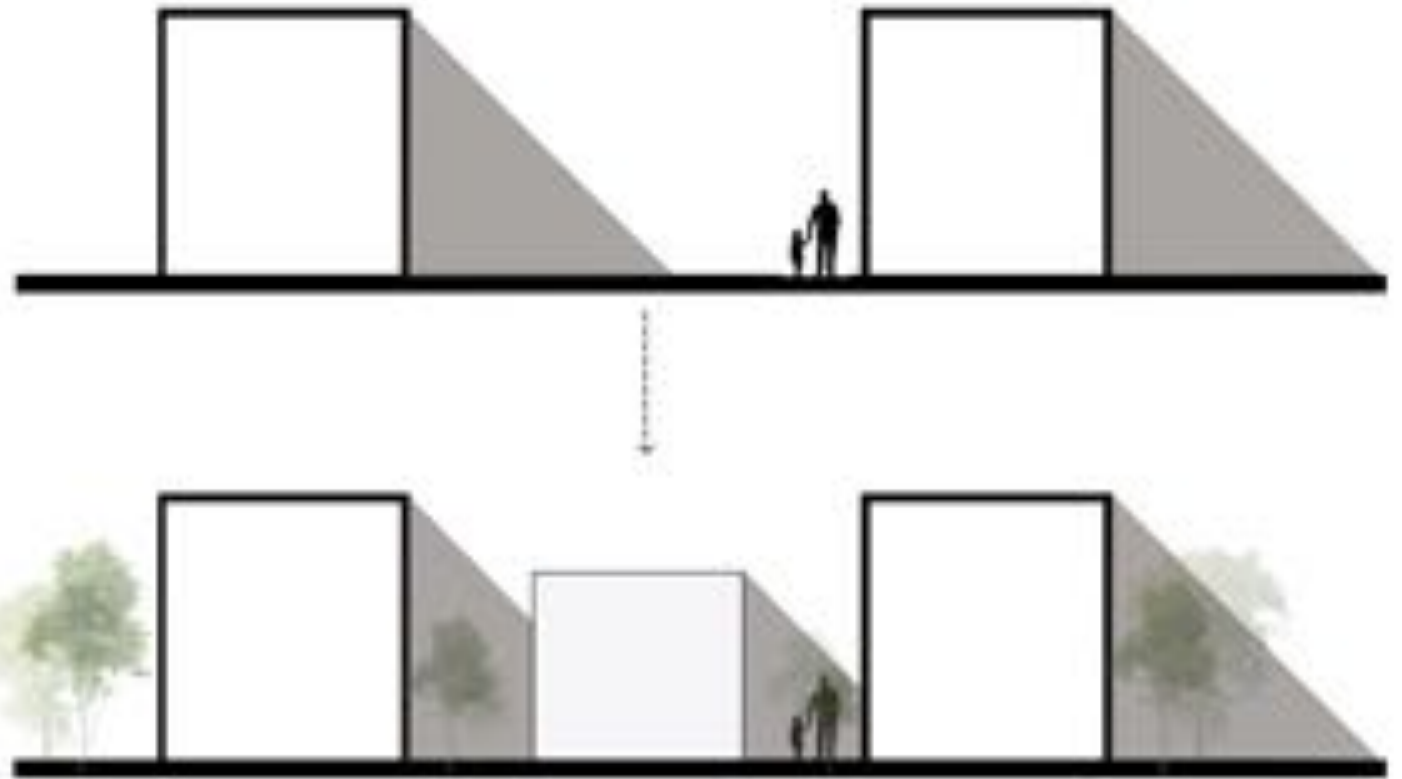
Tiro de Línea



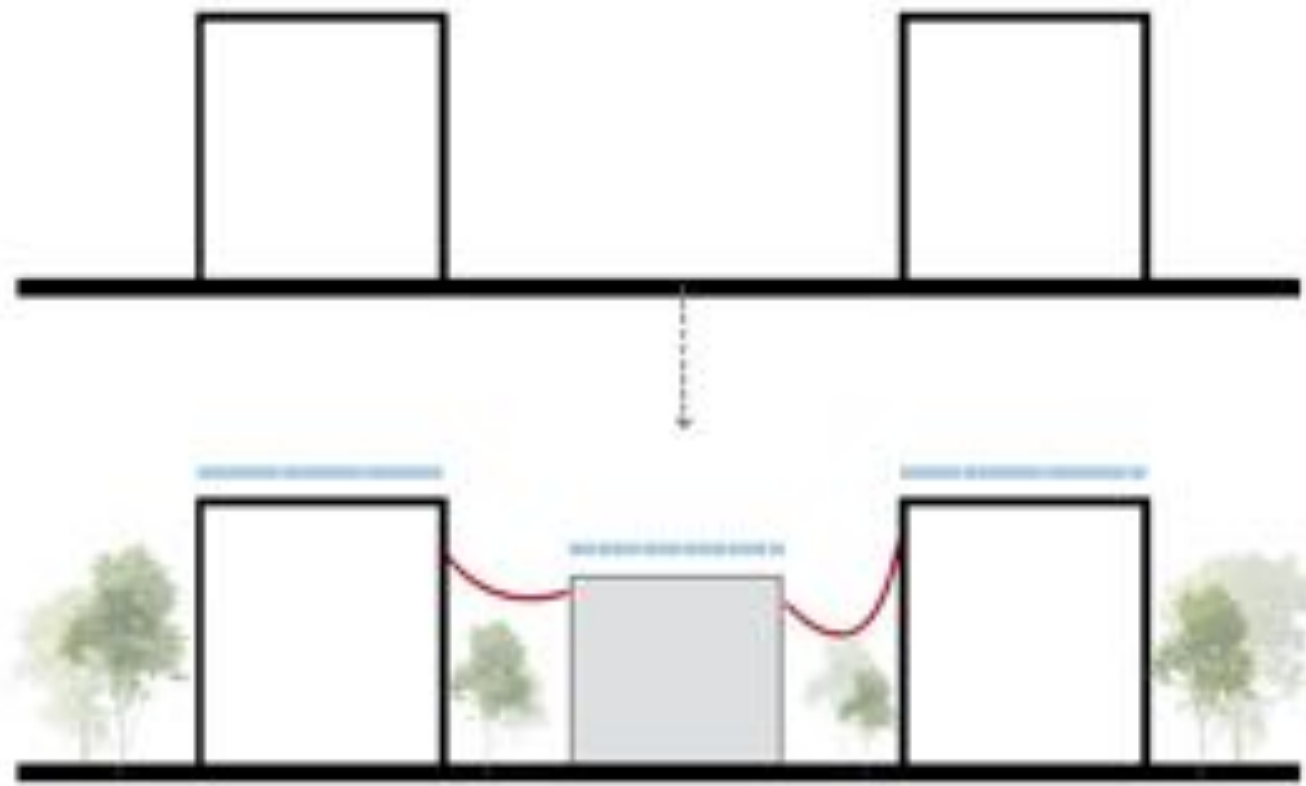
Norton A. et al. (2015); Planning for cooler cities: A framework to prioritise green infrastructure to mitigate high temperatures in urban landscapes; Landscape and Urban Planning 134, p. 127–138

**PASSIVE ENERGY
RENOVATION STRATEGIES**
INNER-CITY DENSITIES - SELF SHADING

INCREASED SHADING MEANS COOLER
PATHS TO WALK ALONG AND COOLER
BUILDINGS



**PASSIVE ENERGY
RENOVATION STRATEGIES
INNER-CITY DENSITIES**



New Stepped Strategy for energy-positive (re) design

1. Reduce the demand

- a) Smart bioclimatic design
- b) Energy-efficient appliances

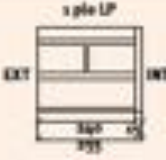
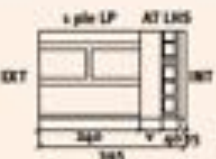
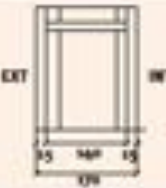
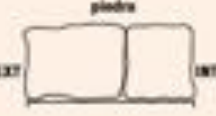
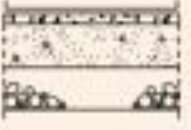
2. Reuse waste energy

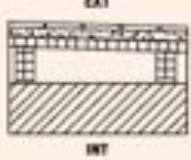
- a) Recover heat/cold from exhaust air and waste water (buildings)
- b) Attune urban functions programmatically (neighbourhoods)
- c) Exchange heat, cold and electricity (neighbourhoods)
- d) Store heat, cold and electricity (neighbourhoods-districts)
- e) Use industrial waste heat (city)

3. Produce renewable energy

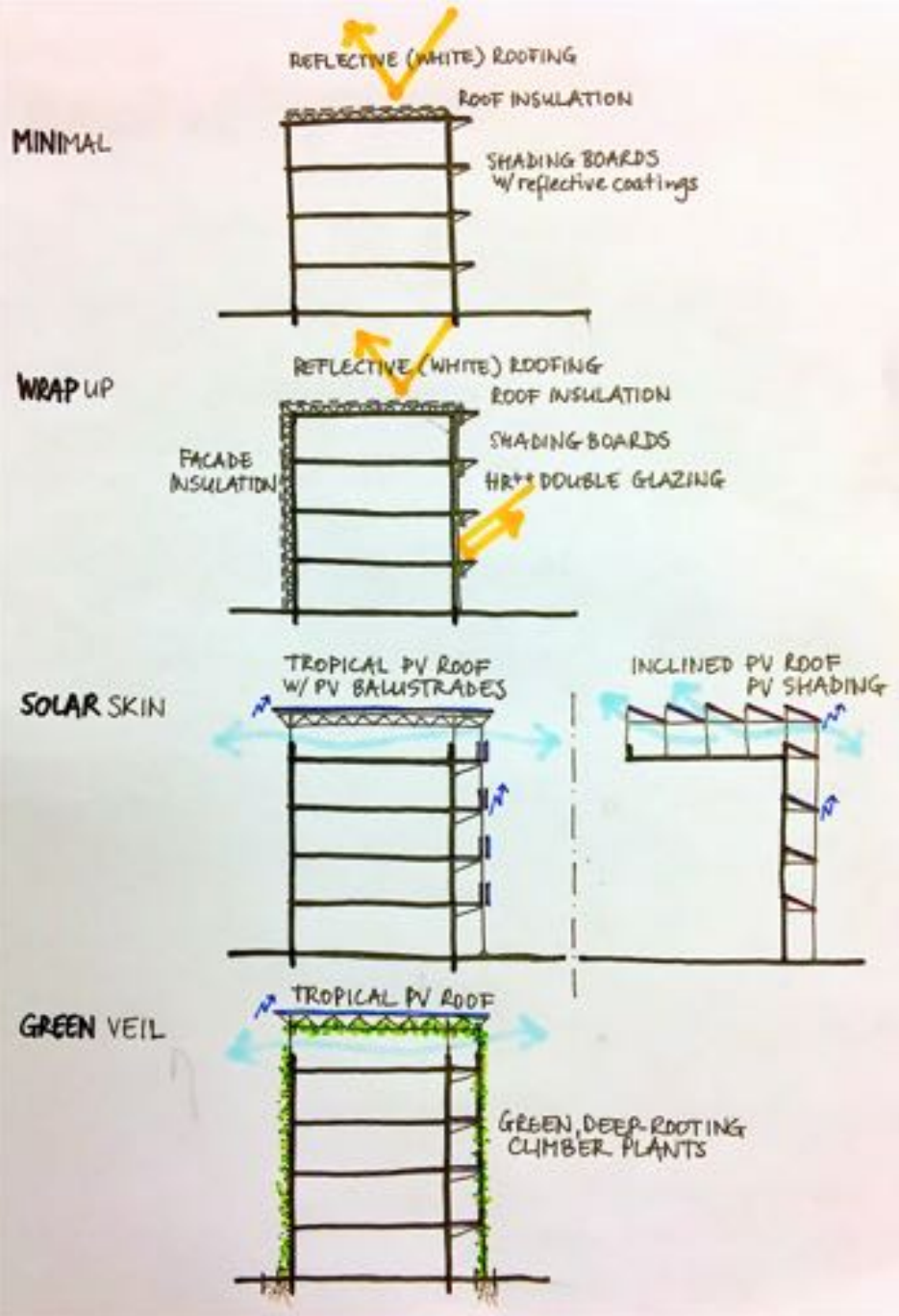
- a) Solar
- b) Wind
- c) Water
- d) Air
- e) Geothermal
- f) Biomass
- g) Human

Typical facades and roofs

Nombre	Transmitancia	Capas materiales	Secciones
Fachada 1	$U = 2.65 \text{ W/m}^2 \text{ K}$	"1 pie LP métrico o catalán 40 mm < G < 60 mm" + "Enlucido de yeso 1000 < d < 1300"	
Fachada 2	$U = 1.57 \text{ W/m}^2 \text{ K}$	"1 pie LP métrico o catalán 40 mm < G < 60 mm" + cámara no ventilada vertical de 3 cm + "Tabique de LH sencillo [40 mm < Espesor < 60 mm]" + "Enlucido de yeso 1000 < d < 1300"	
Fachada 3	$U = 2.46 \text{ W/m}^2 \text{ K}$	"Enlucido de yeso 1000 < d < 1300" + bloque de hormigón de áridos densos de espesor 140 + "Enlucido de yeso 1000 < d < 1300"	
Fachada 4	$U = 2.15 \text{ W/m}^2 \text{ K}$	"Piedra caliza dura [2000 < d < 2190]"	
Suelo 1	$U = 3.06 \text{ W/m}^2 \text{ K}$	"Mortero de cemento o cal para albañilería y para revoco/enlucido d > 2000" + hormigón con áridos ligeros con densidad entre 1800 y 2000	
Suelo 2	$U = 2.32 \text{ W/m}^2 \text{ K}$	"Mortero de cemento o cal para albañilería y para revoco/enlucido d > 2000" + "FU Entrevigado cerámico-Canto 250 mm" + "Enlucido de yeso 1000 < d < 1300"	

Nombre	Transmitancia	Capas materiales	Secciones
Cubierta1	$U = 1.65 \text{ W/m}^2 \text{ K}$	"Plaqueta o baldosa cerámica" + "Tablero de partículas con cemento d < 1200" + cámara horizontal ligeramente ventilada + "FU Entrevigado cerámico- Canto 250 mm" + "Enlucido de yeso 1000 < d < 1300"	
Cubierta2	$U = 0.71 \text{ W/m}^2 \text{ K}$	"Teja de arcilla cocida" + "Tablero contrachapado 700 < d < 900" + "EPS Poliestireno Expandido [0.037 W/(mK)]" + "FU Entrevigado cerámico-Canto 250 mm" + "Enlucido de yeso 1000 < d < 1300"	
Cubierta3	$U = 1.62 \text{ W/m}^2 \text{ K}$	"Teja de arcilla cocida" + "Tablero contrachapado 700 < d < 900" + "FU Entrevigado cerámico- Canto 250 mm" + "Enlucido de yeso 1000 < d < 1300"	

[Gobierno de España/IDAE; Escala de calificación energética – Edificios existentes; Madrid, 2011]

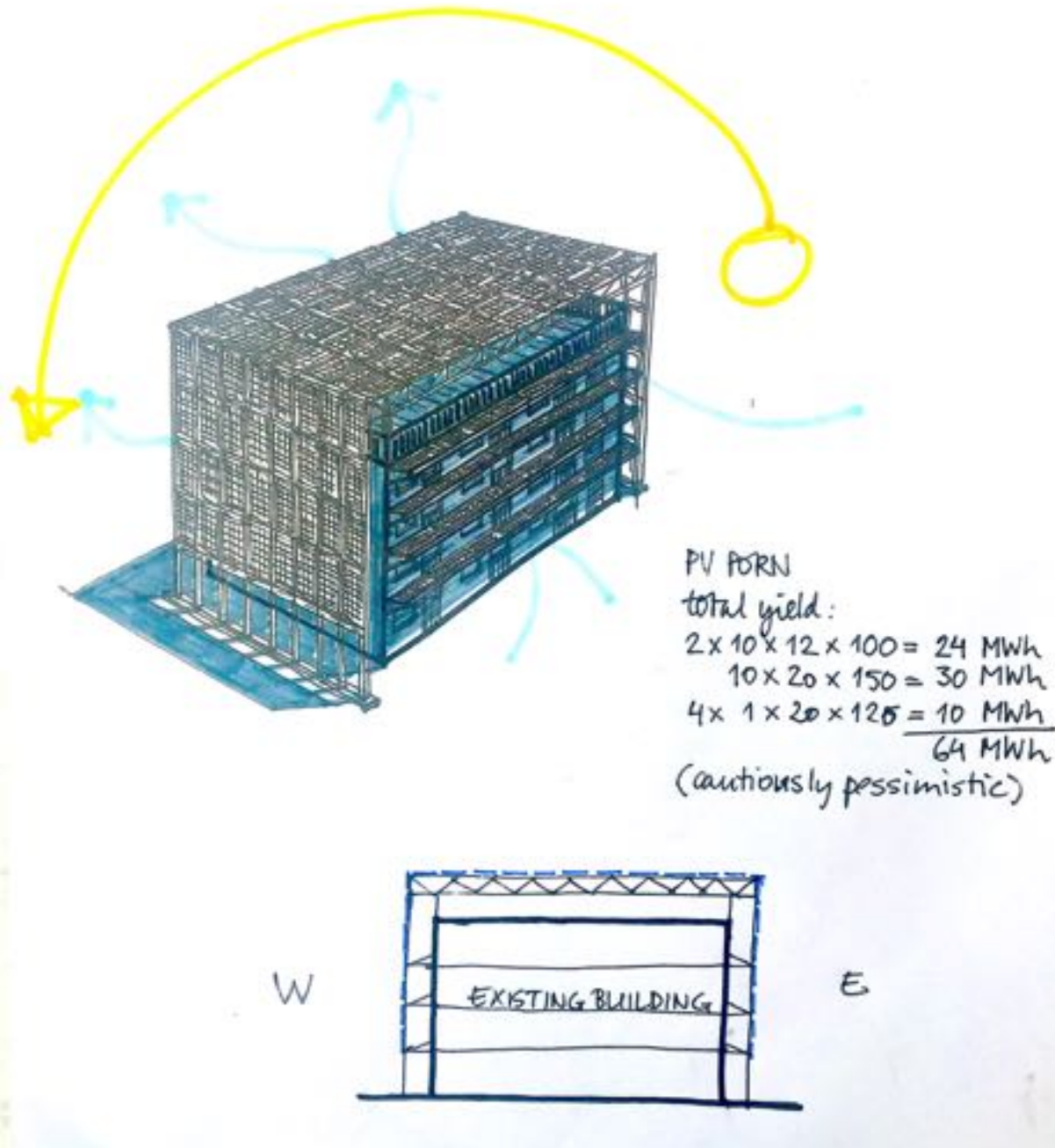


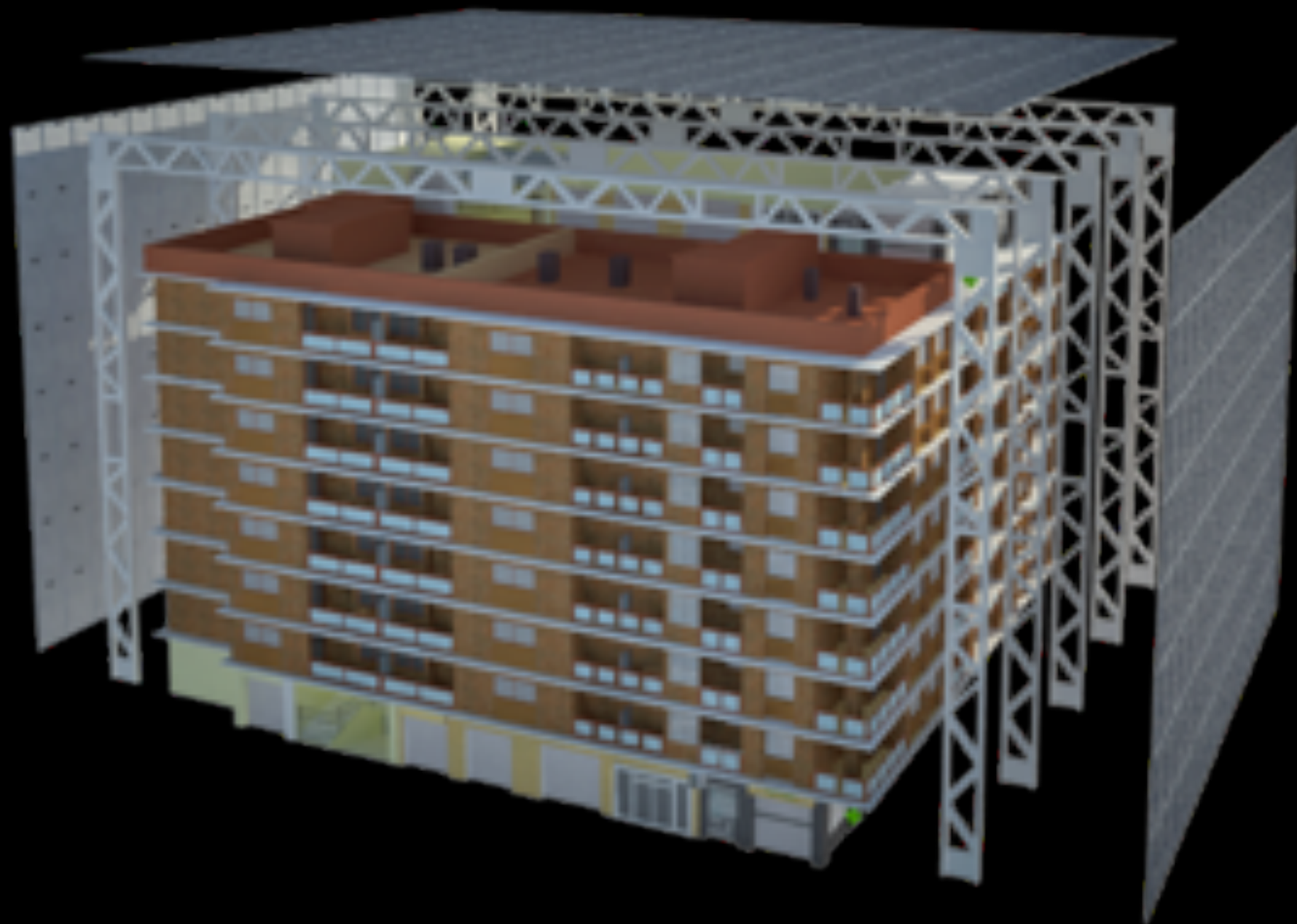
Energy renovation options

- **Minimal**
 - Simple & cheap
 - Saves most cooling needs
- **Wrap up**
 - More extensive & expensive
 - Saves a lot of cooling and heating needs
- **Solar skin**
 - Technical solution
 - Reduces most cooling needs
 - Produces a lot of electricity
- **Green veil**
 - Green solution
 - Reduces most cooling needs and saves heating
 - Combined with PV roof: produces electricity
- **Combination of all 4 possible**

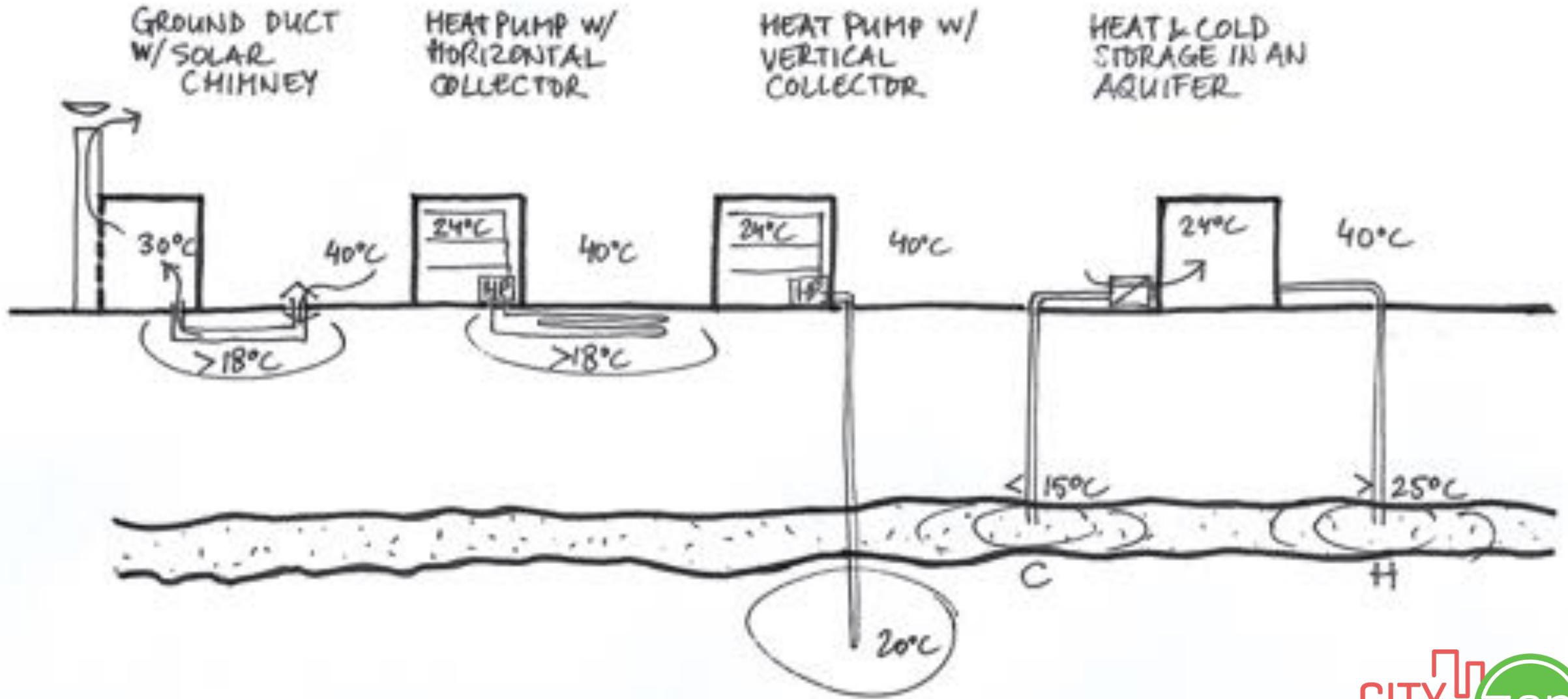
PV porn

- **PV shell over the building, East to West**
 - Catches sun in the morning, afternoon, evening
 - Continuous production during the day
 - Estimated yield with a 20x10x12 m block: 64 MWh
- **Main issue: electricity storage**
 - Daytime domestic activities
 - Central battery storage
 - Electric vehicles
 - Heat pump charging the heat/cold storage



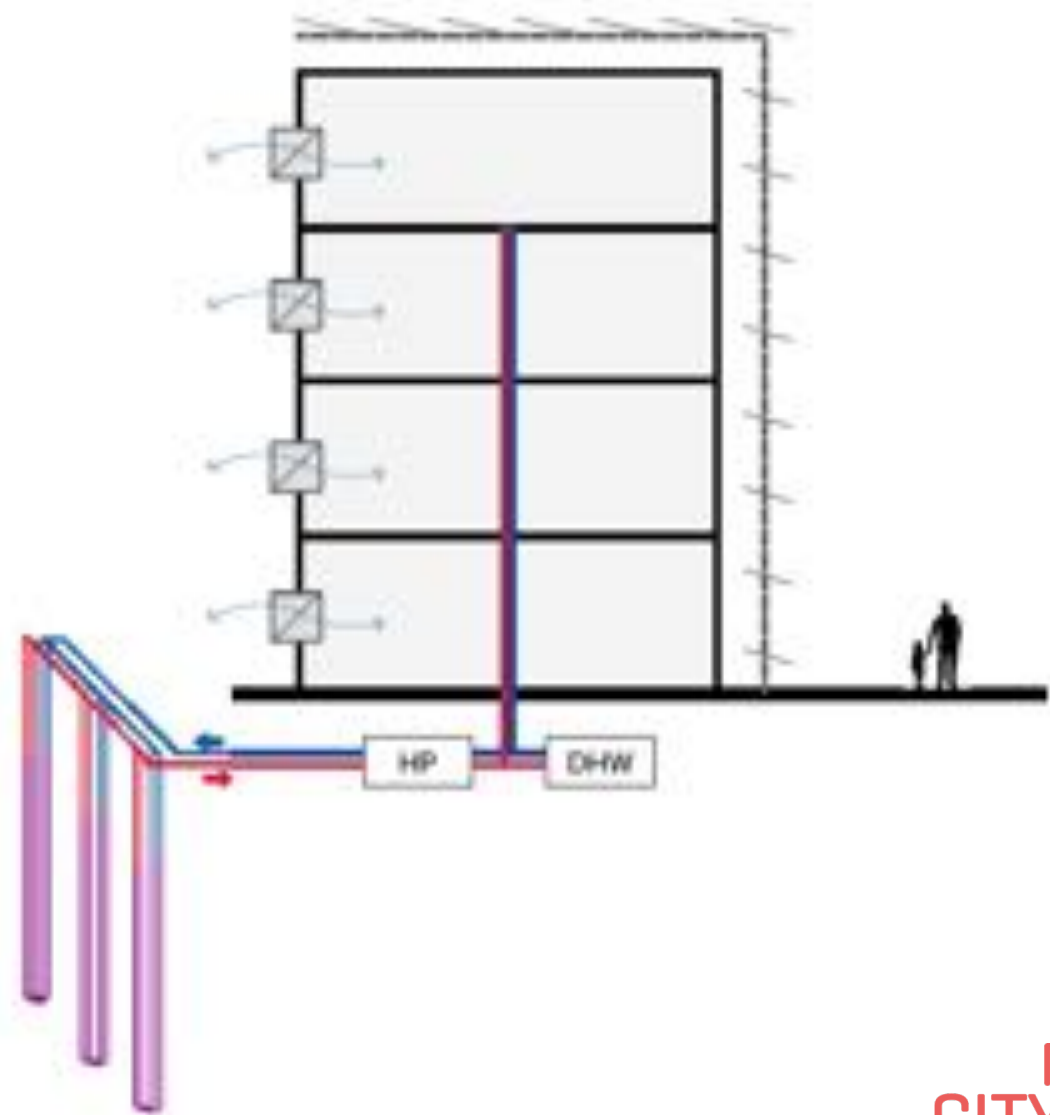


Soil energy options – from passive to active



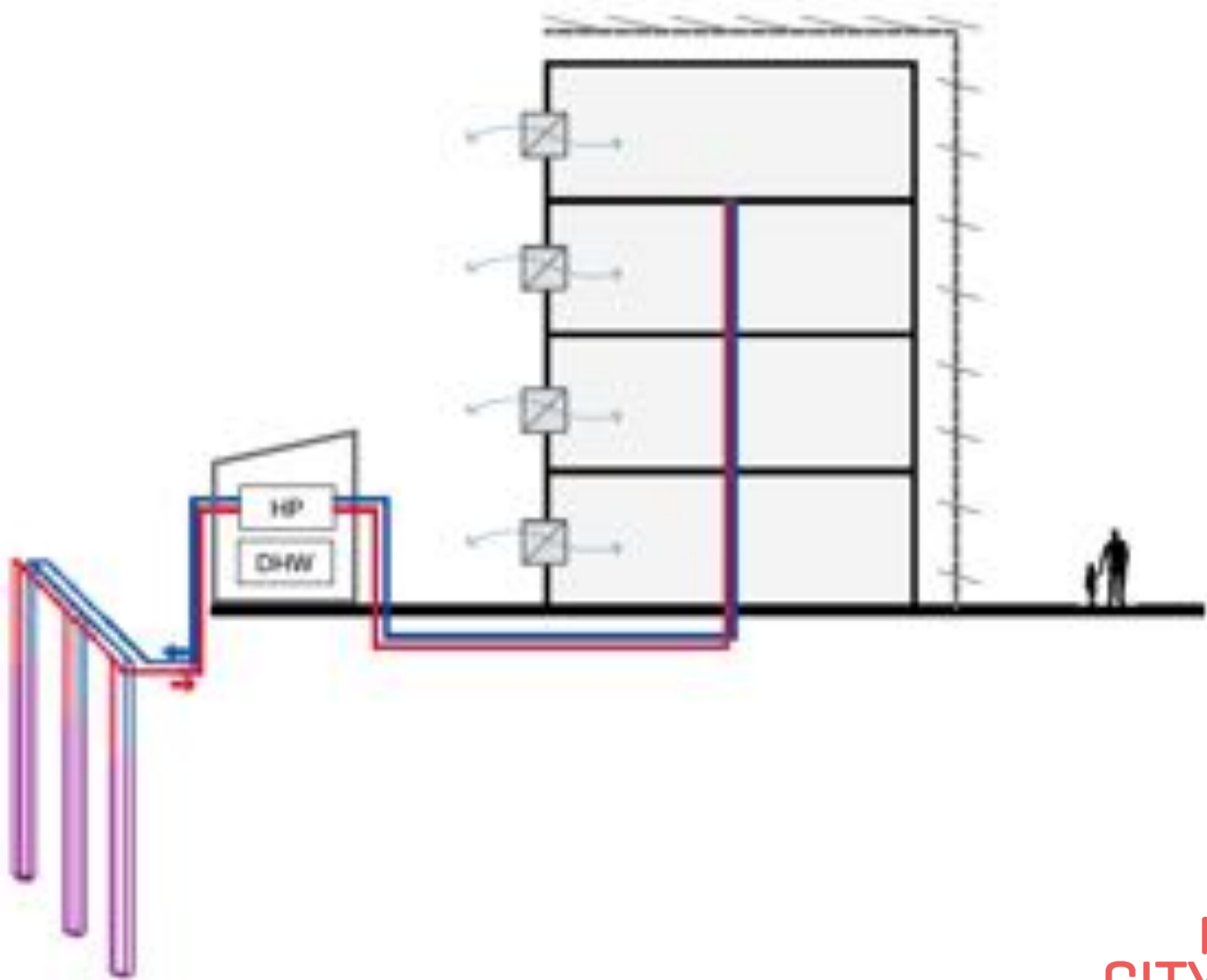
ACTIVE ENERGY RENOVATION STRATEGIES INDIVIDUAL

Vertical soil collectors, individual heat
pumps, PV panels and heat exchangers.



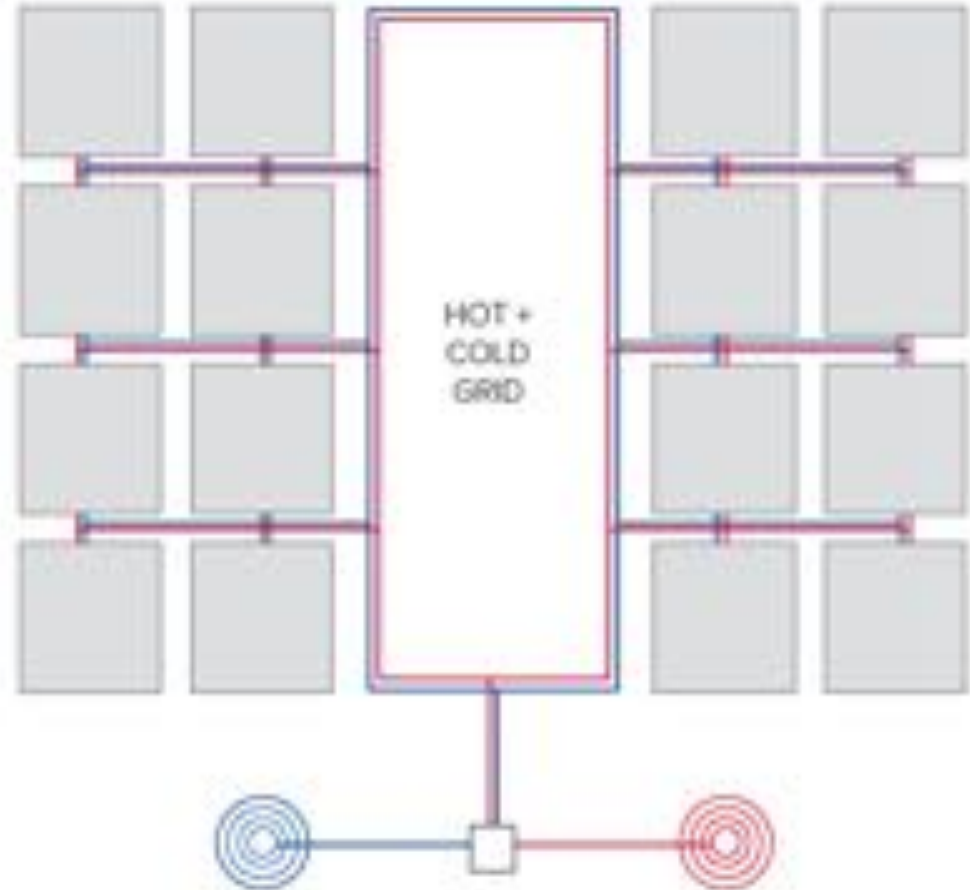
ACTIVE ENERGY RENOVATION STRATEGIES COLLECTIVE

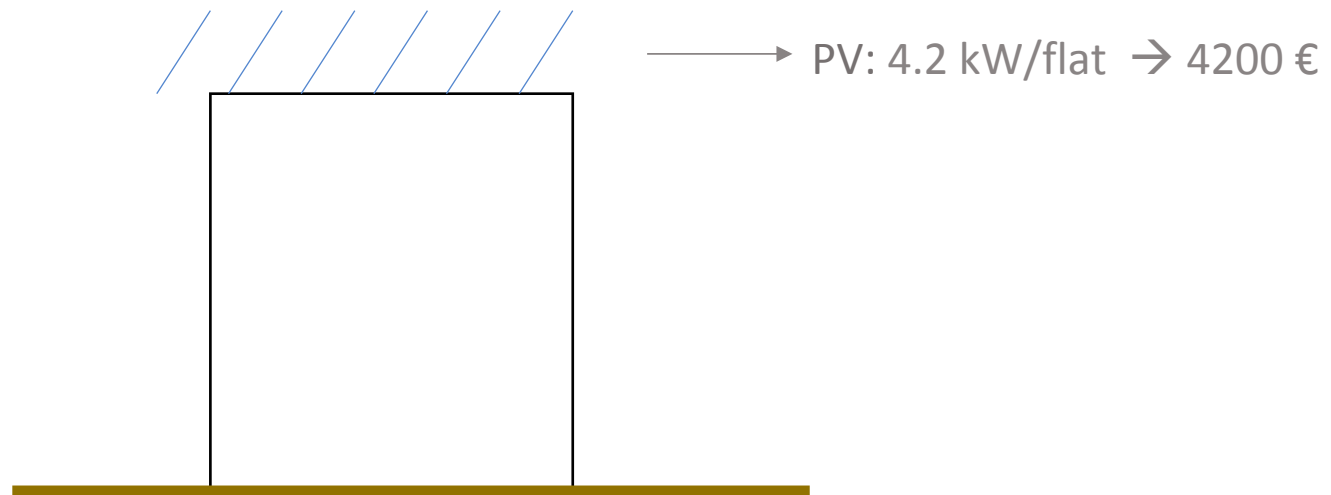
Collective system with a cool/warm air supply and a professionally- managed system.

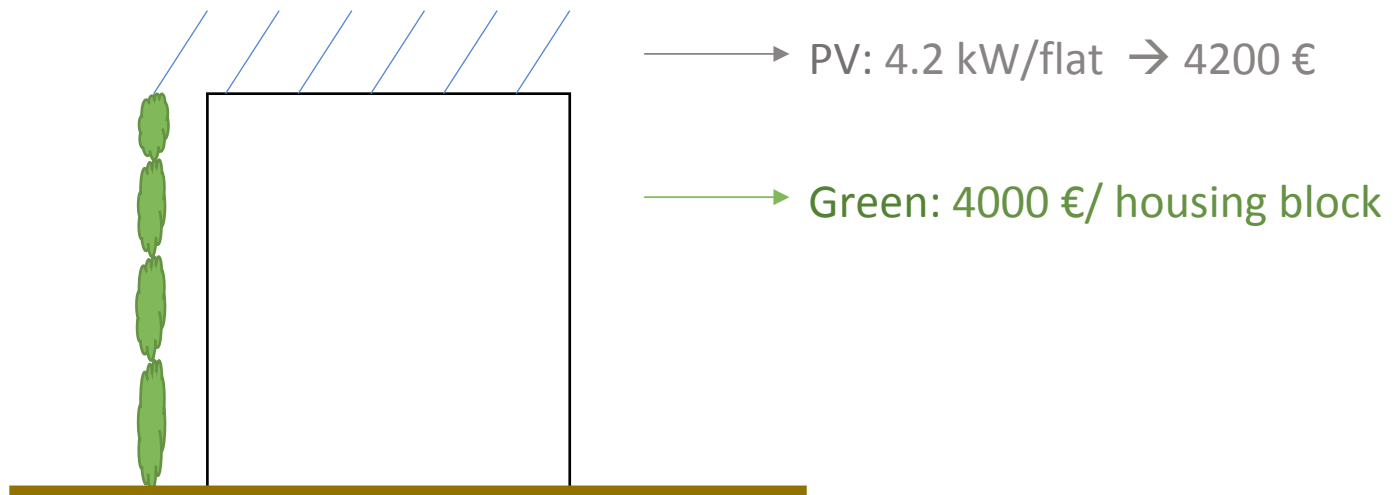


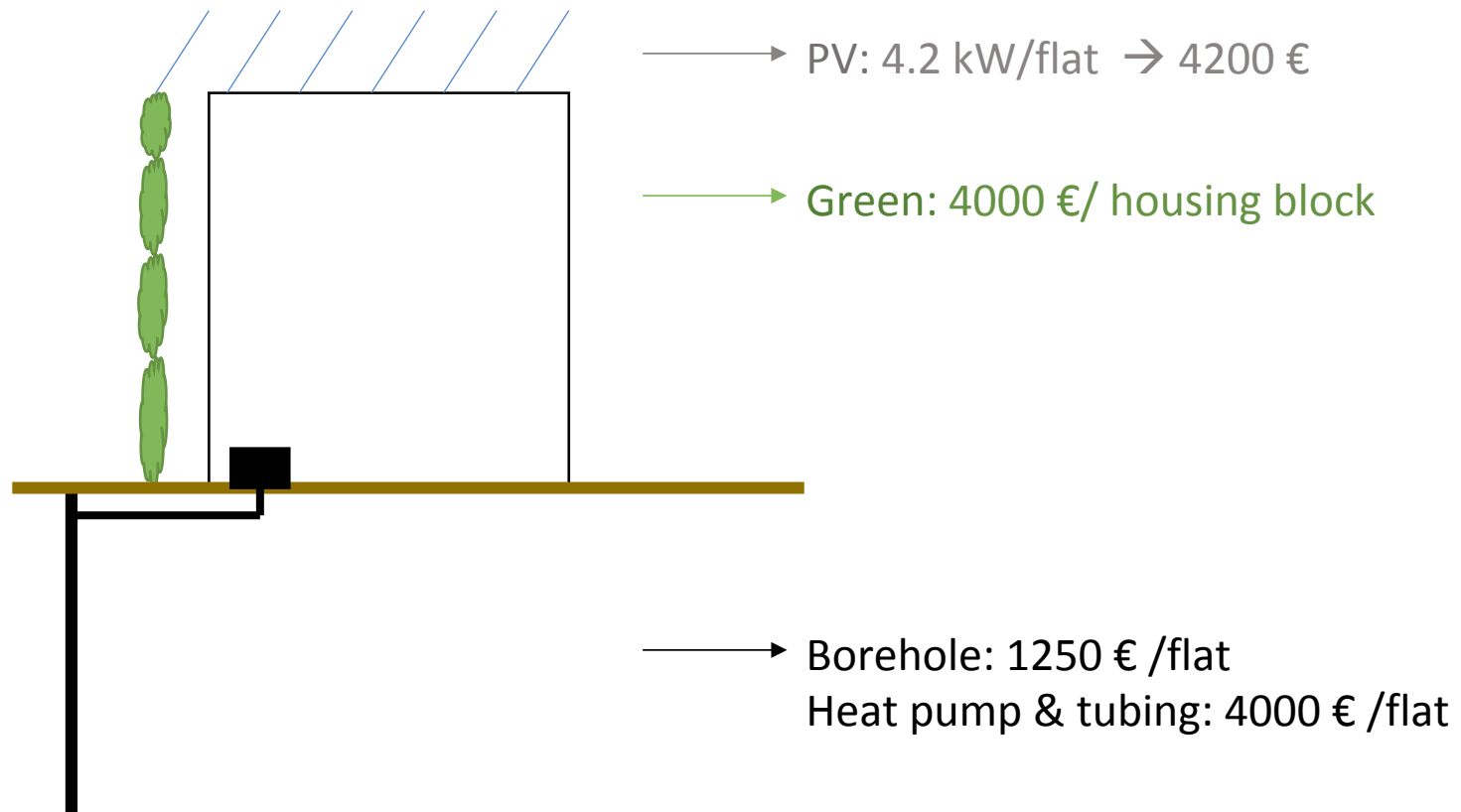
ACTIVE ENERGY RENOVATION STRATEGIES COMMUNAL

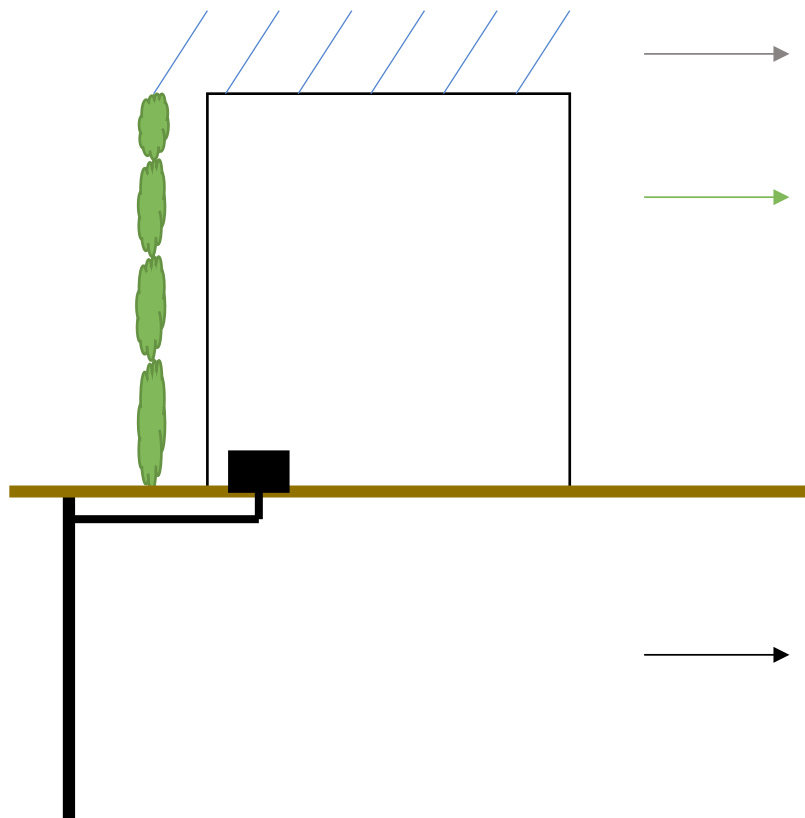
A hot and cold grid will supply energy to the neighbourhood on a communal scale.











→ PV: 4.2 kW/flat → 4200 €

→ Green: 4000 €/ housing block

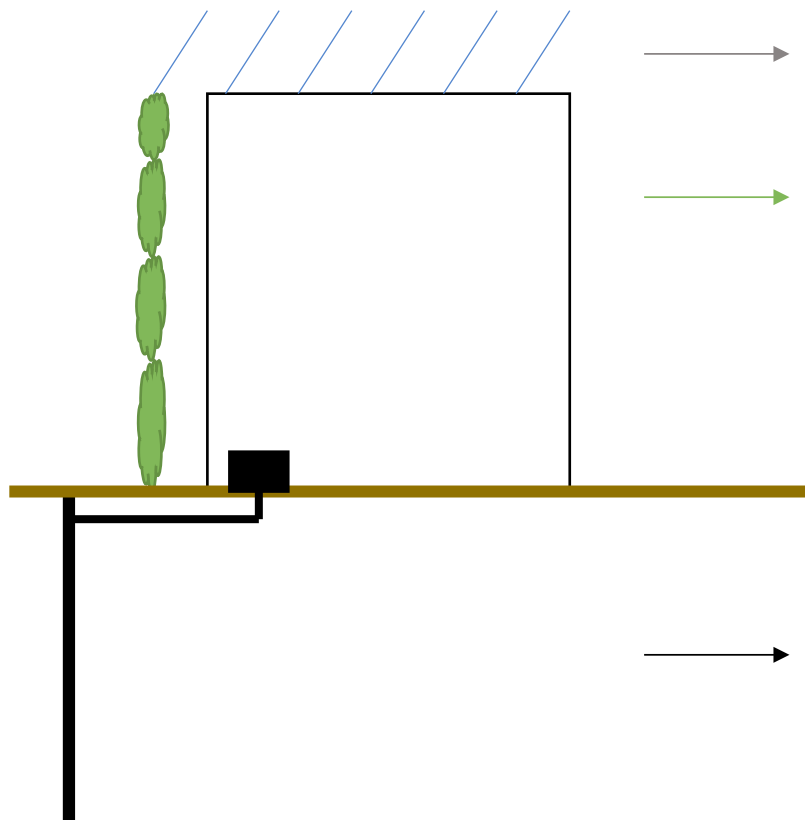
→ Borehole: 1250 €/flat
Heat pump & tubing: 4000 €/flat

→ Investment $4200 \text{ €} + (4000 \text{ €})/3 + 1250 \text{ €} + 4000 \text{ €} = 10\,783 \text{ €}$

→ Annual energy cost 630 €

→ Annual maintenance 100 €

→ 10 year balance: 18 083 €



→ PV: 4.2 kW/flat → 4200 €

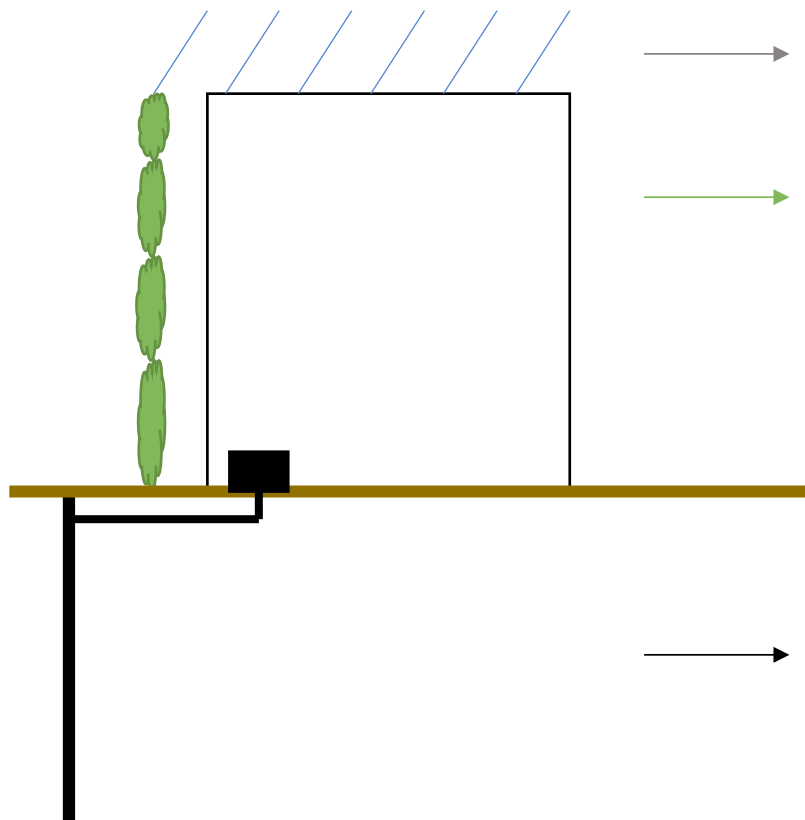
→ Green: 4000 €/ housing block

→ Borehole: 1250 €/flat
Heat pump & tubing: 4000 €/flat

→ ENERGY COOPERATIVE

→ Sells heat, cold and electricity @ 0.15 €/kWh

→ 10 year balance: 18 083 € → 120 553 kWh



→ PV: 4.2 kW/flat → 4200 €

→ Green: 4000 €/ housing block

→ Borehole: 1250 €/flat
Heat pump & tubing: 4000 €/flat

→ ENERGY COOPERATIVE

→ Sells heat, cold and electricity @ 0.15 €/kWh

→ 10 year balance: 18 083 € → 120 553 kWh > 20 years energy use

> life-time of equipment

Trash on the streets



Mierda...

An energy cooperative could involve waste processing



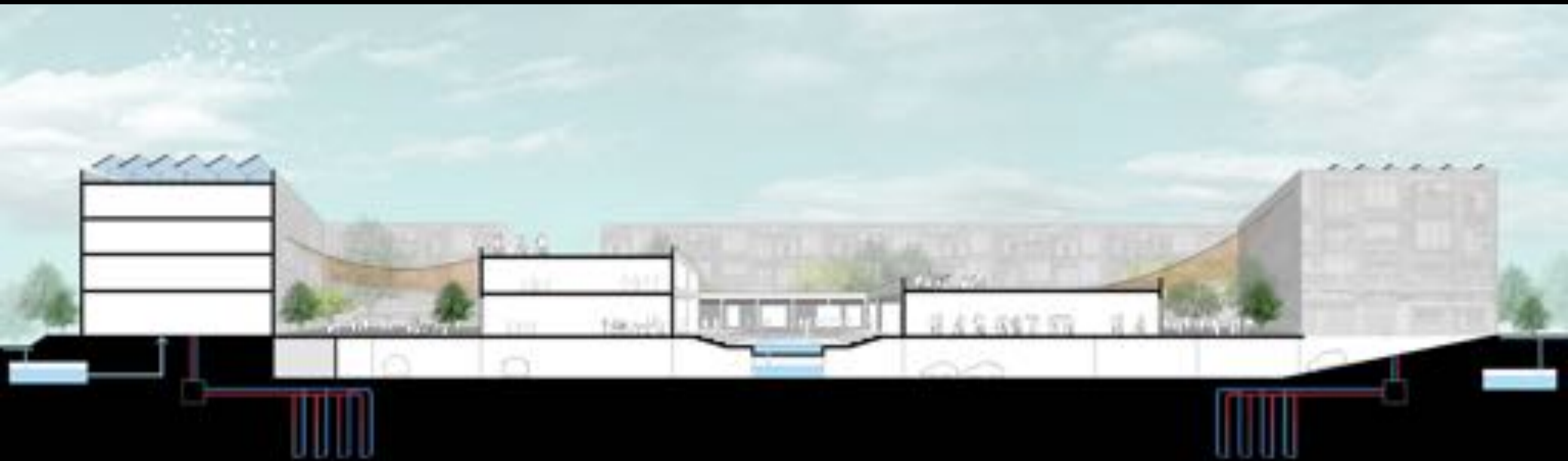
- **Collection of waste**
- **Repair and reuse**
- **Recycling**
- **Digestion of organic waste**
- **Production of biogas for restaurants**



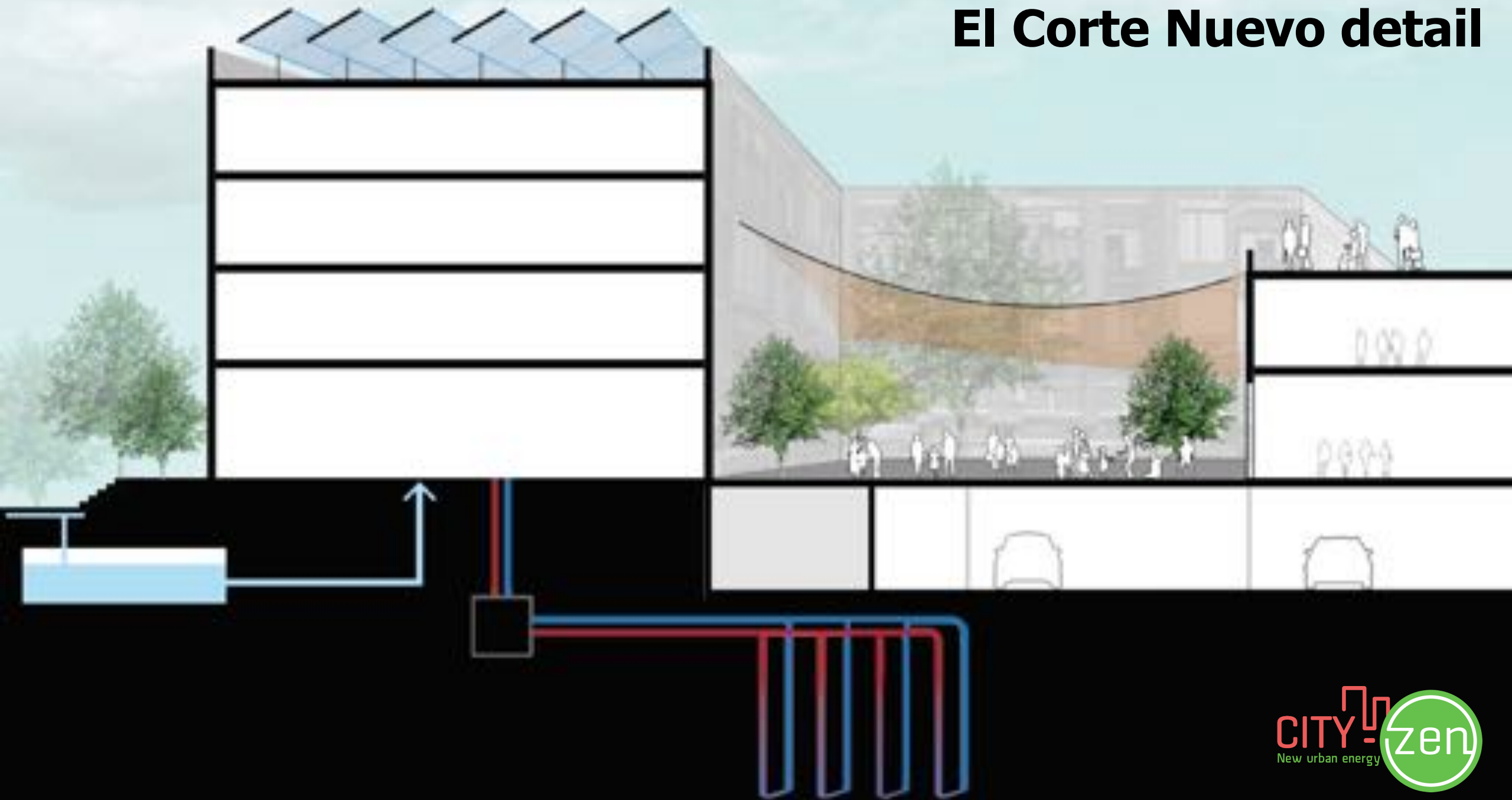
Tiro de Línea sostenible

- **Rainwater collection and usage**
- **Green infrastructure**
- **Energy renovation of buildings**
- **Energy cooperations that serve energy hubs**
- **Clean waste management**
- **Sustainable mobility: bikes and electric cars**

El Corte Nuevo



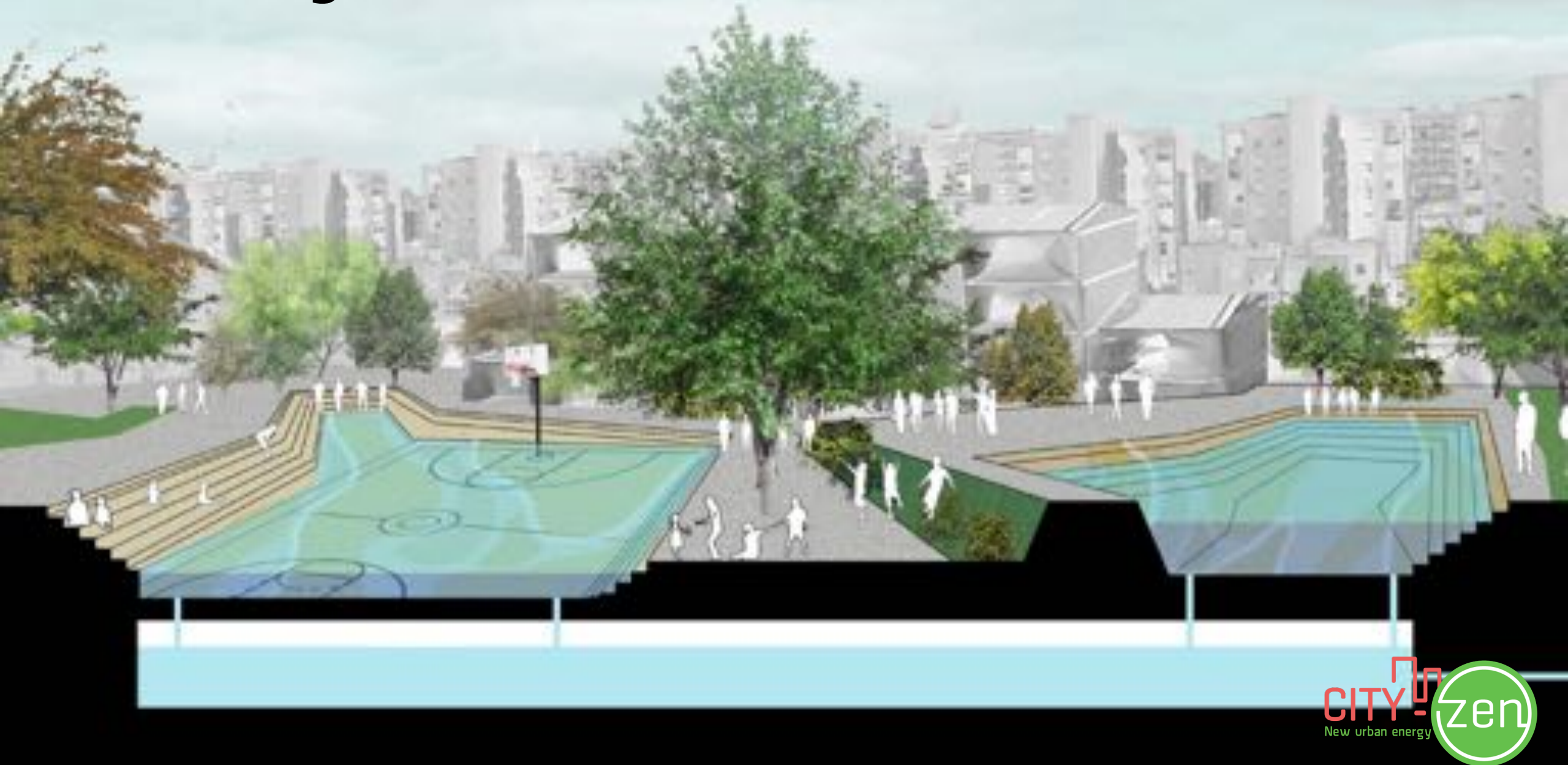
El Corte Nuevo detail



Plaza de Aguas



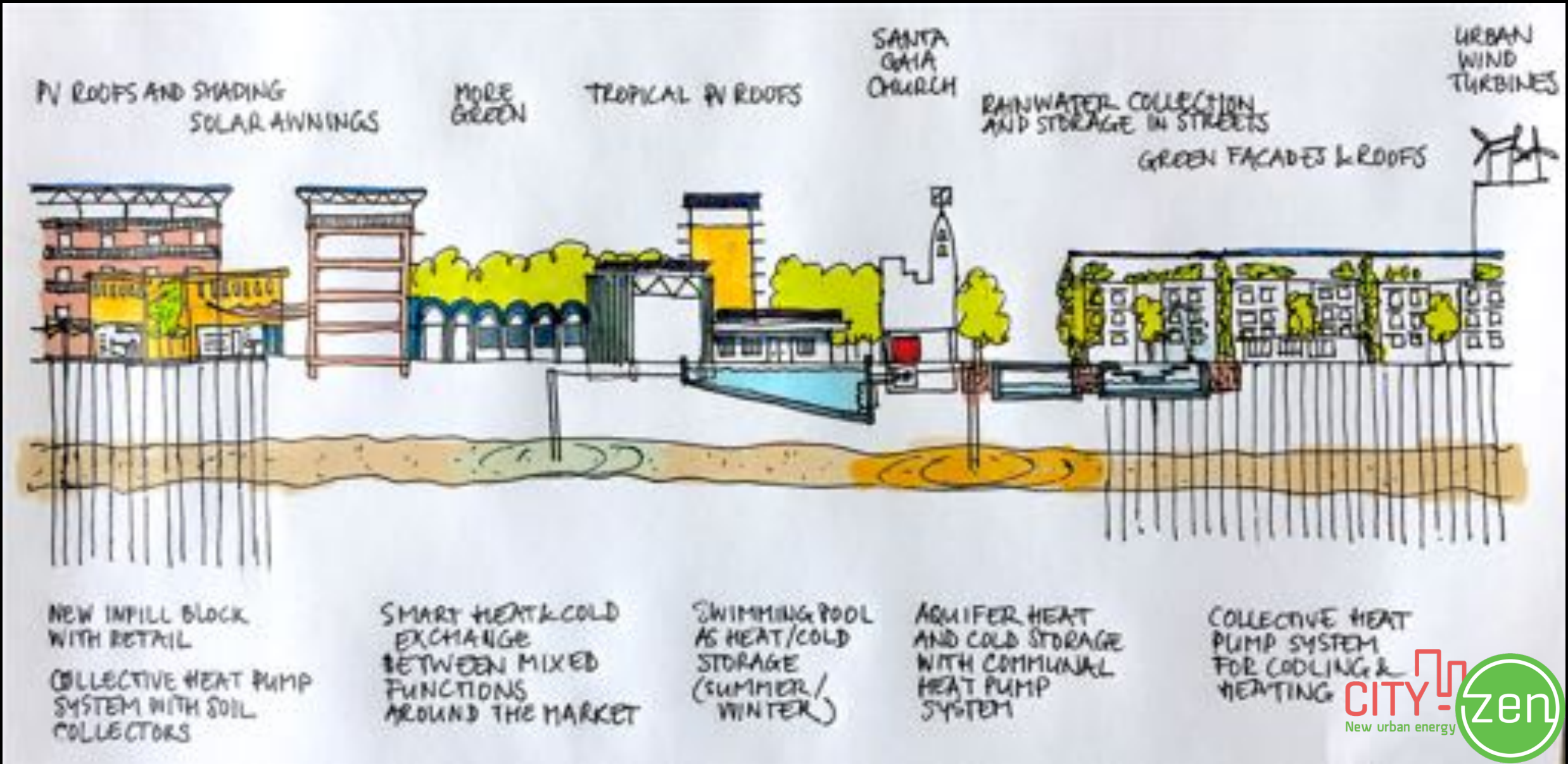
Plaza de Aguas detail

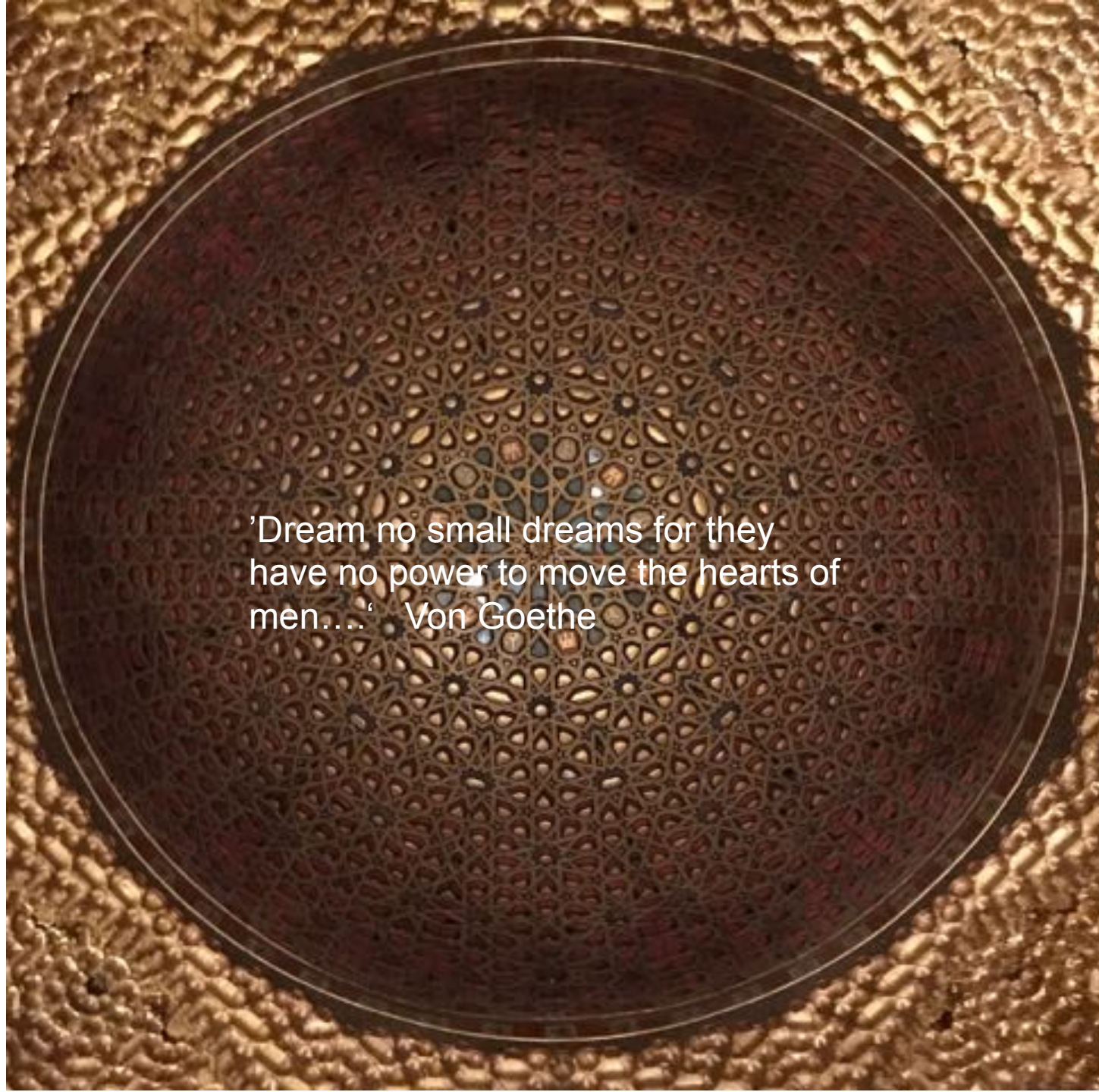


Rambla verde



Tiro de Línea sostenible





'Dream no small dreams for they
have no power to move the hearts of
men....' Von Goethe

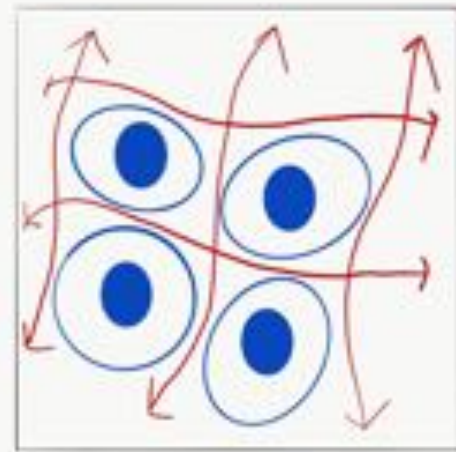
Professor Greg
Keeffe

Head of School
Natural and Built
Environment

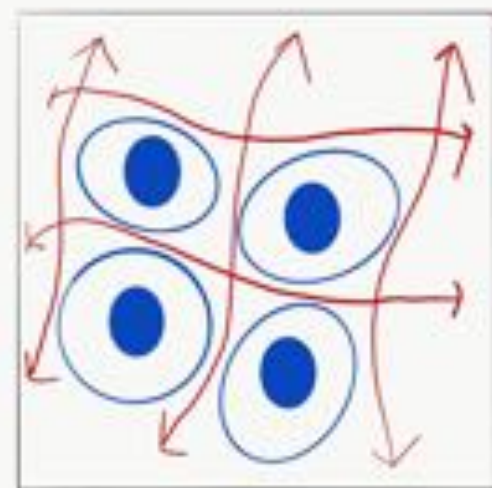
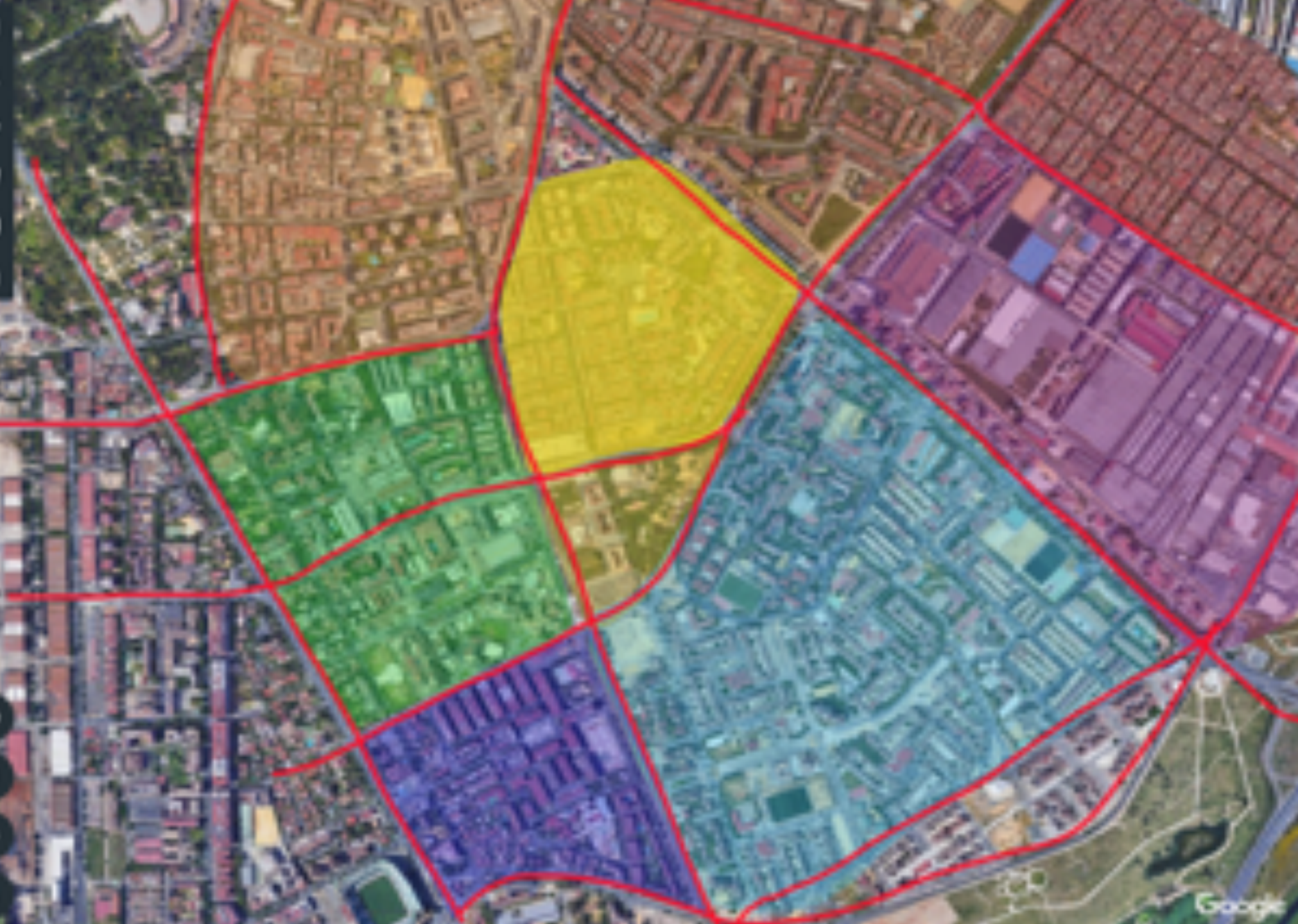
Queens University
Belfast.

Dora Vancso
Laura Solarino
Antigoni Karaiskou
TU Delft

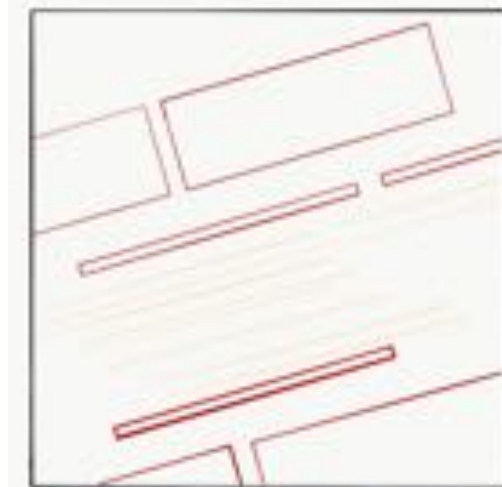




Barrios
urbanism

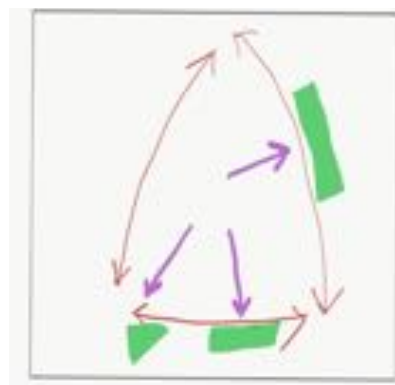


Barrios
urbanism

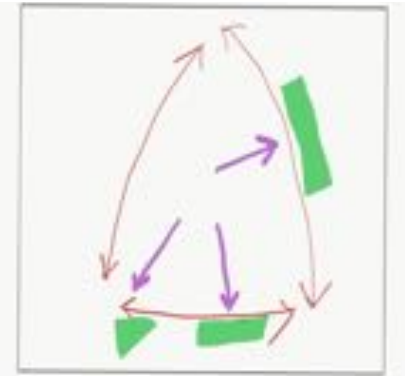


Over-roaded
Urbanism



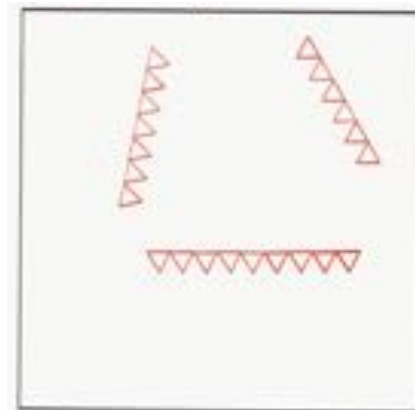


How big is big enough!



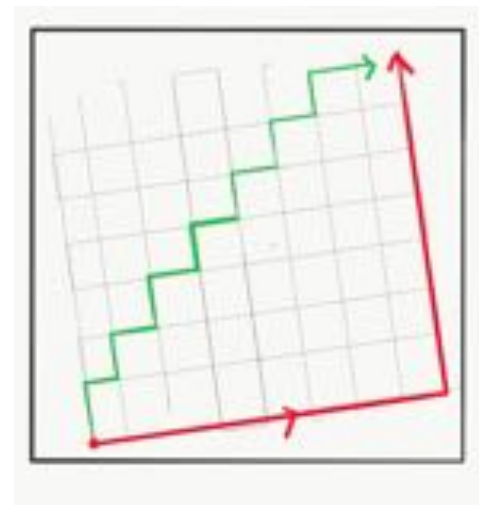
Unpacked
Green





Hard edge



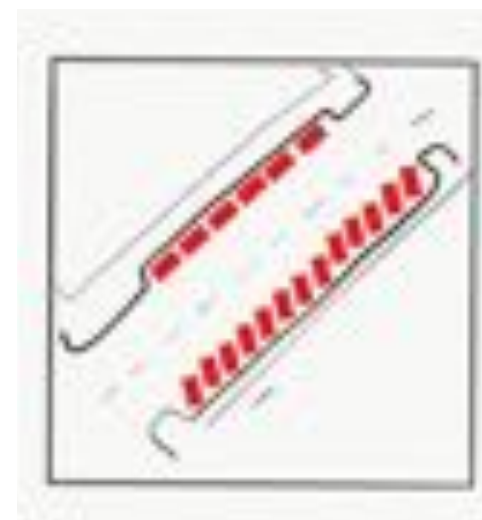


City desire line





Permeable/non-permeable space



Cars cars and
more cars





Surveyed and non-surveyed space





Over-
centralised
space





Over-scaled
external space



Correctly
proportioned
space

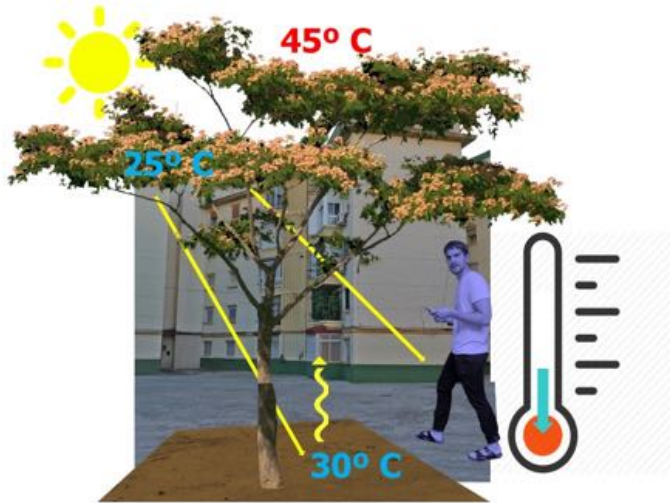
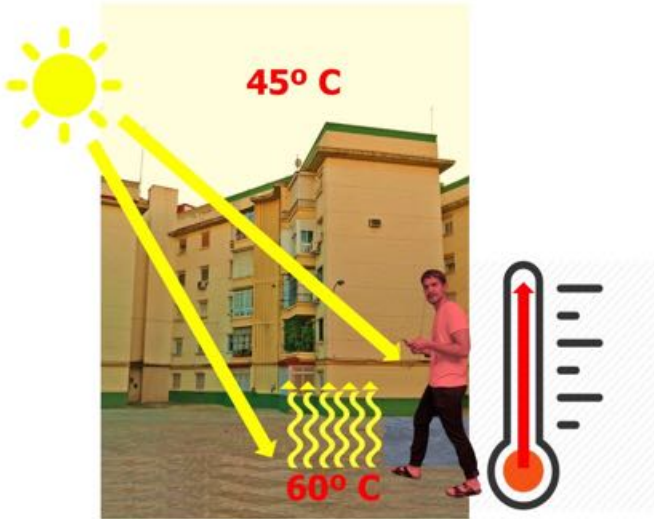


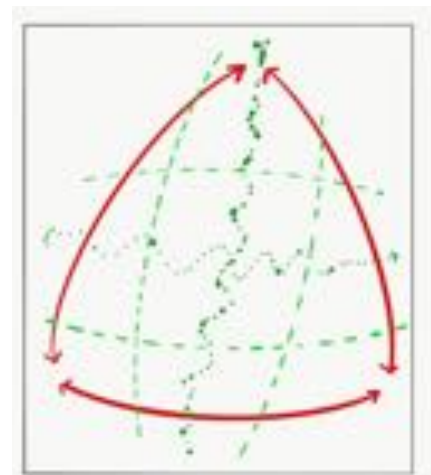
Seville Climate Projections. UK Met Office

Year	Average Temp	Average High	Maximum Temp
2017	19.4	35	45
2070	24	45	55
Climate similar to Dubai by 2070			

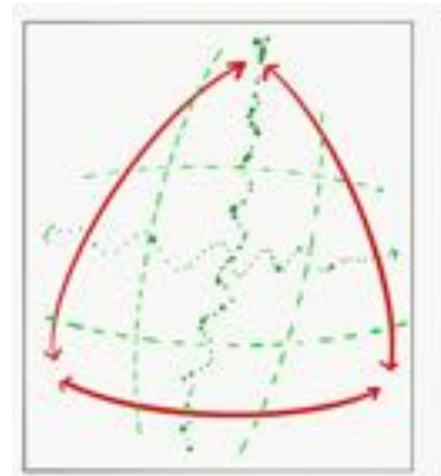


Correctly proportioned space

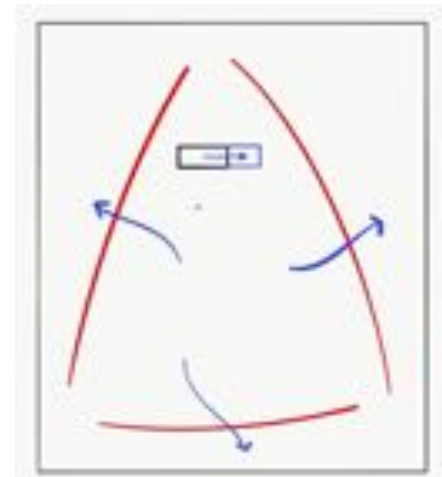
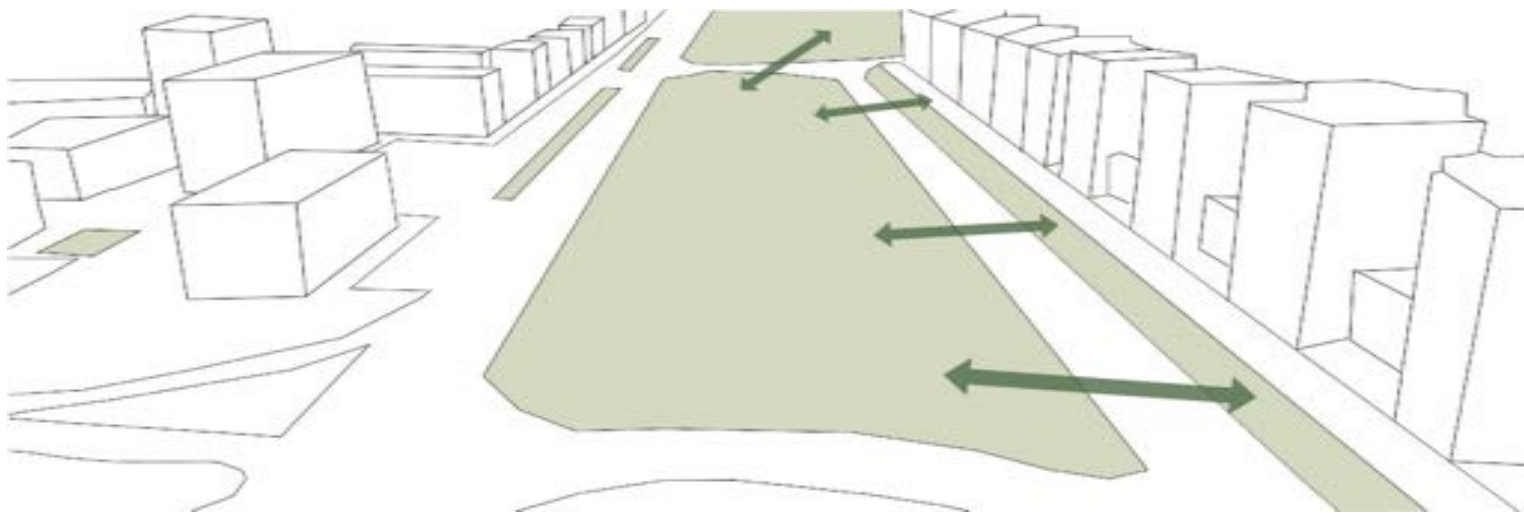




Perforated
urbanism



Perforated
urbanism

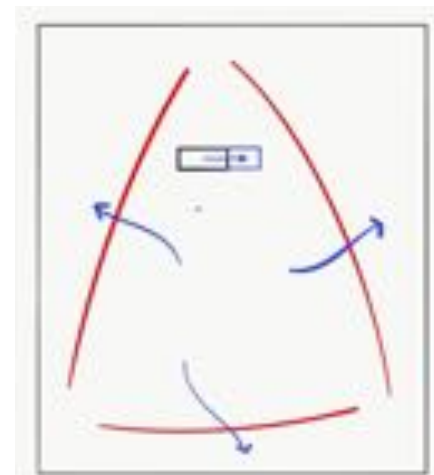
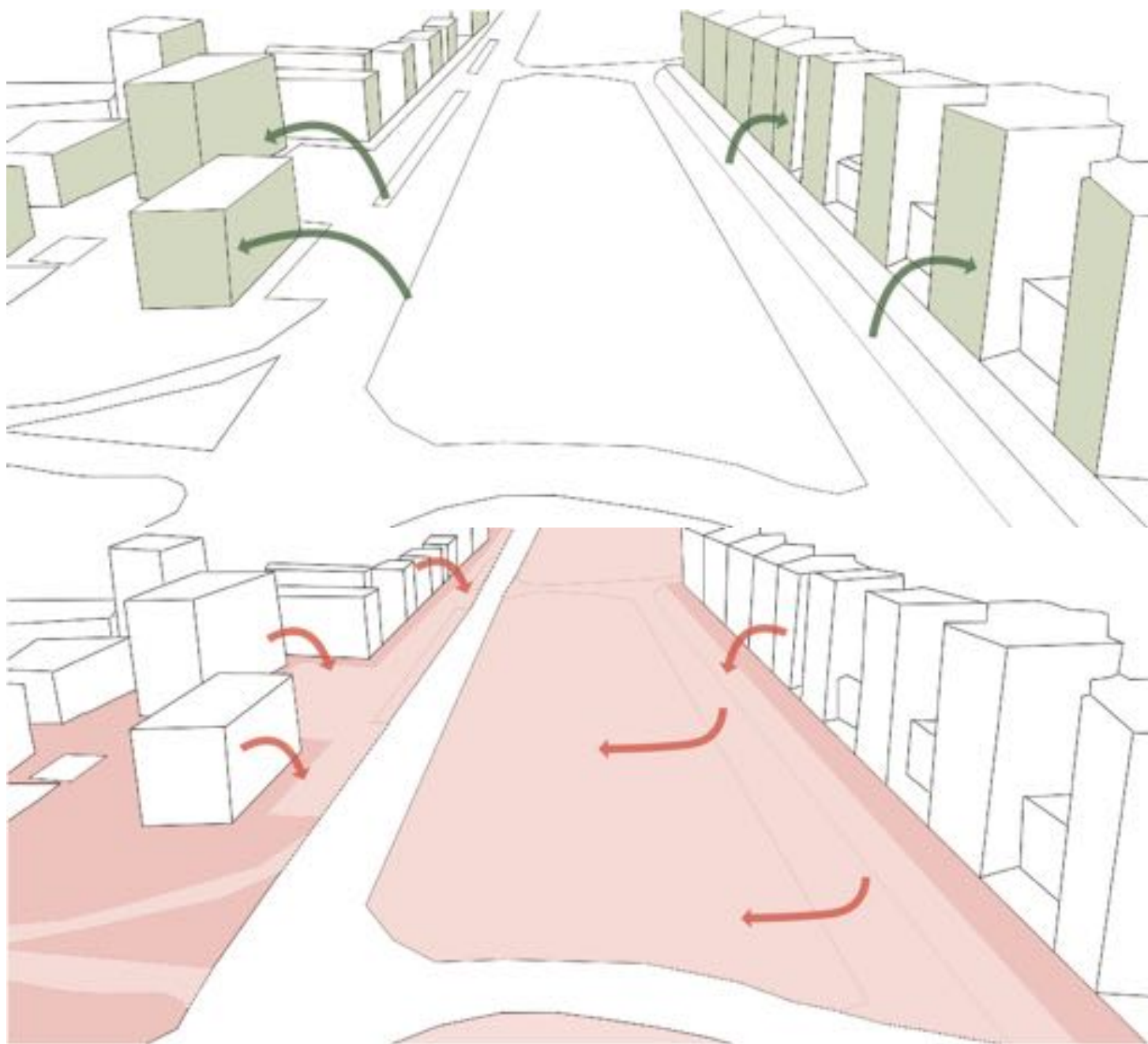


Unpack the
neighbourhood

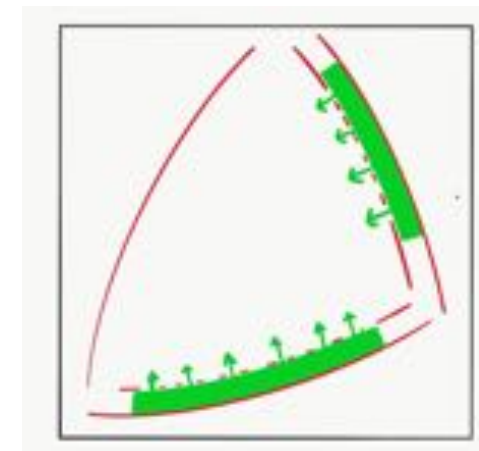
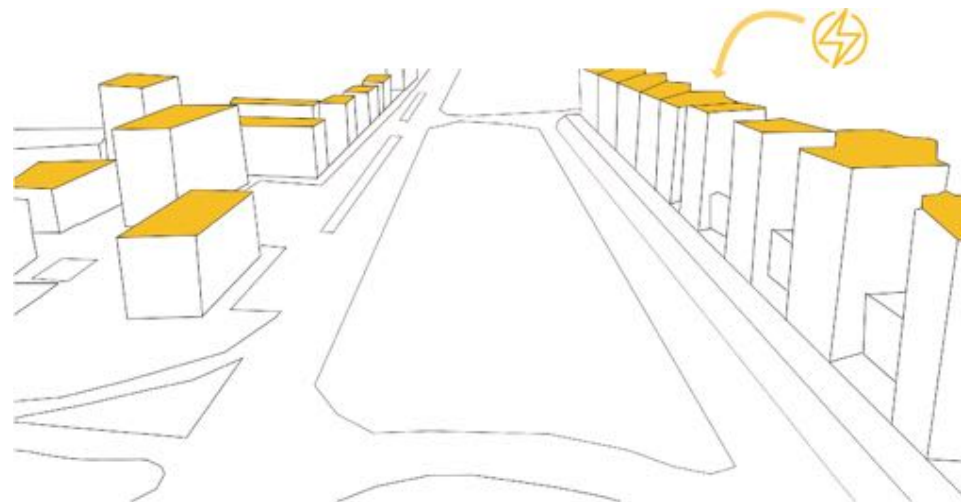
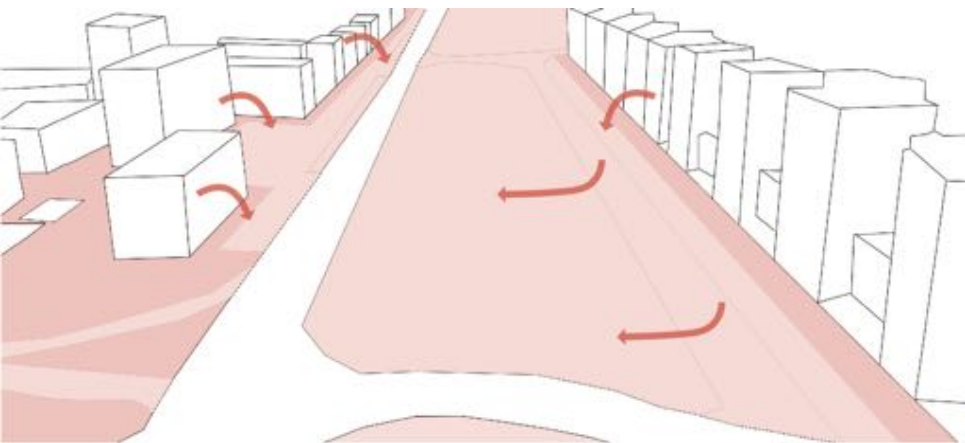


AVENIDA BENÍTEZ CARRASCO - BEFORE

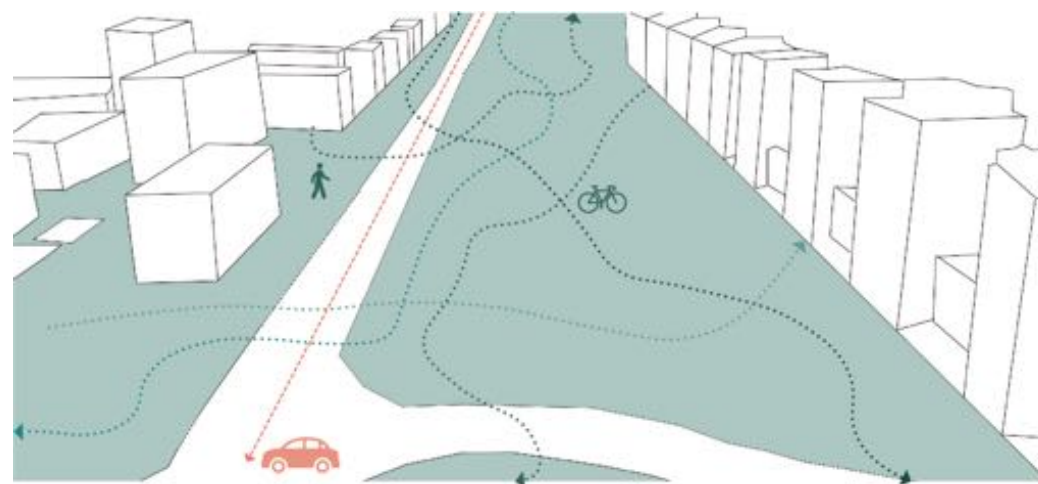
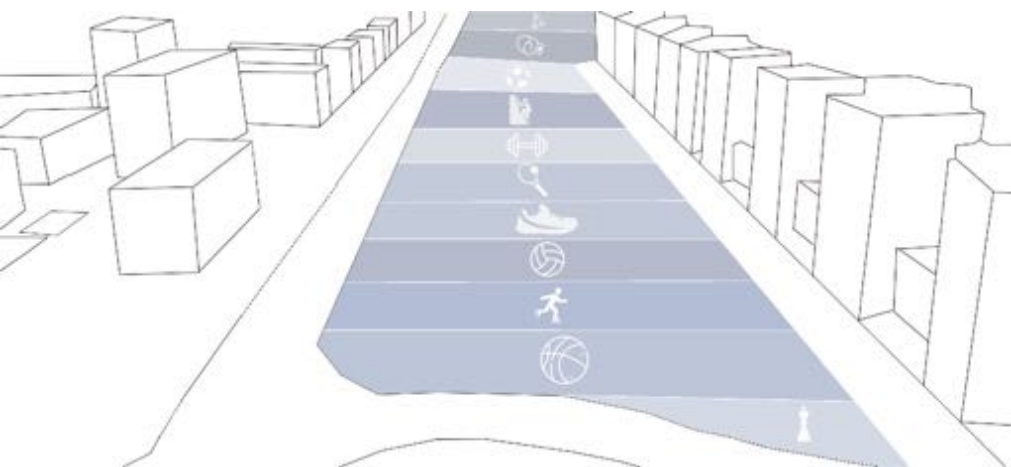


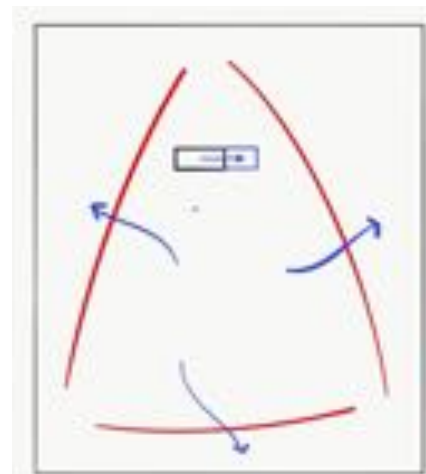


Unpack the
neighbourhood



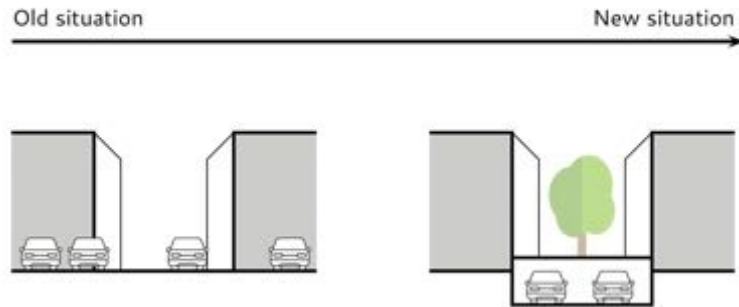
Unpack the
neighbourhood





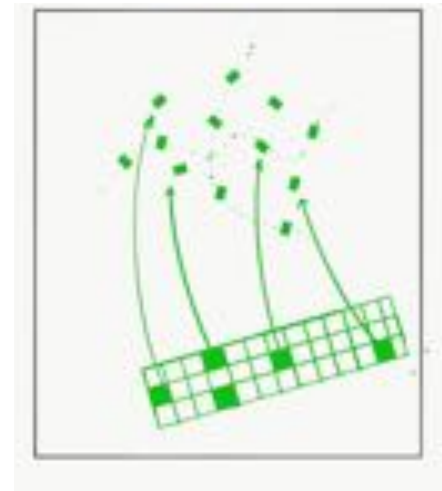
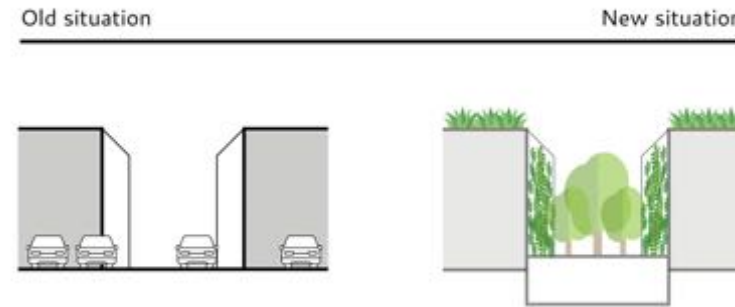
Unpack the
neighbourhood

UNDERGROUND PARKING



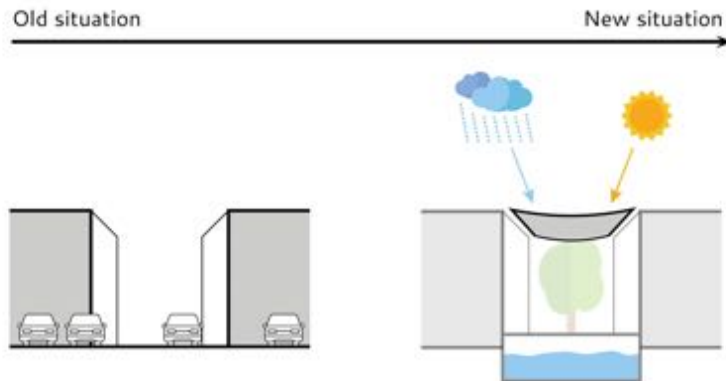
URBAN OASIS

Shading (trees)
Vertical farming/gardens
Rooftop gardens

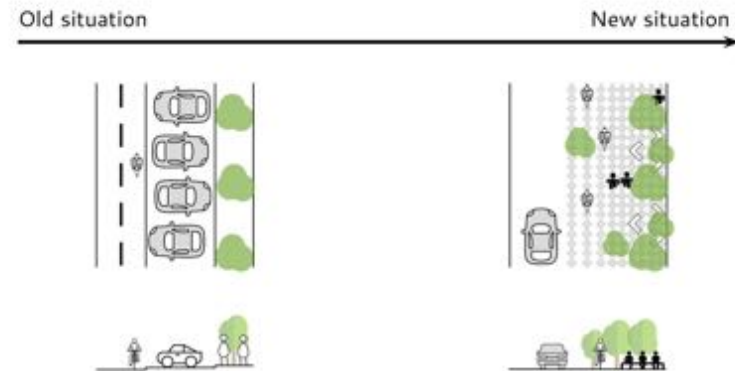


Unpack green
space – make
oases

SHADING (WATER STORAGE+PV)



FROM STREET TO SHARED PAVEMENT

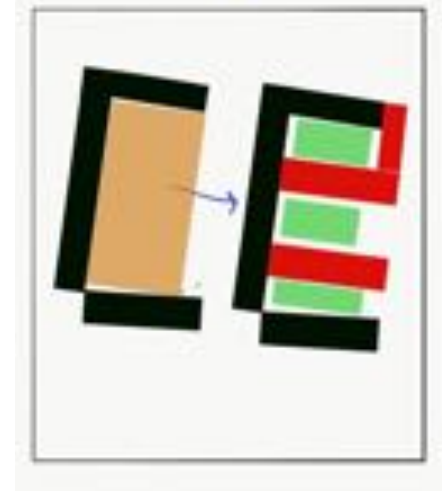
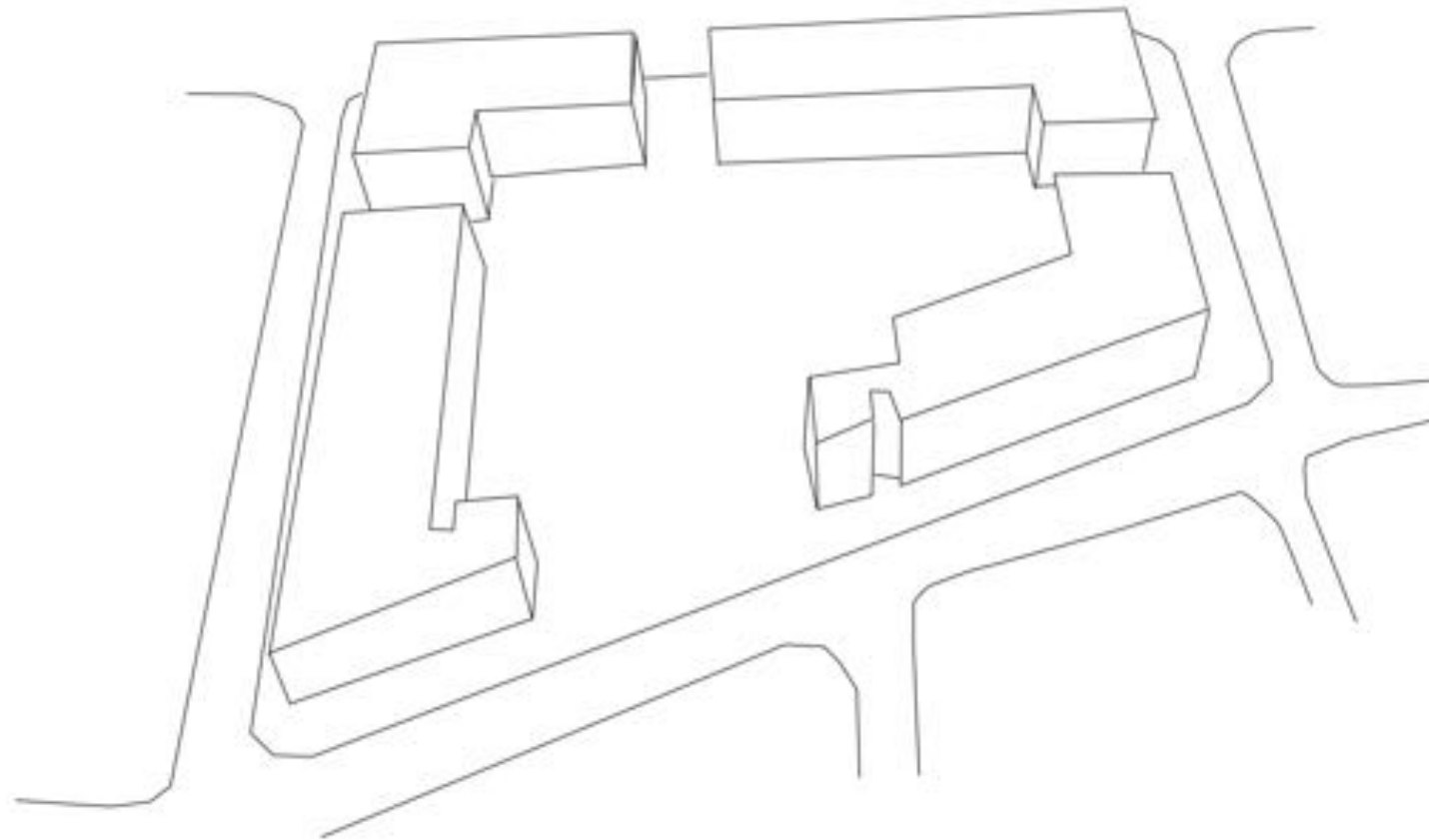




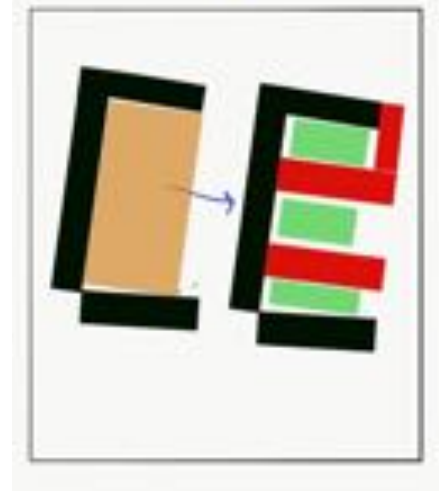
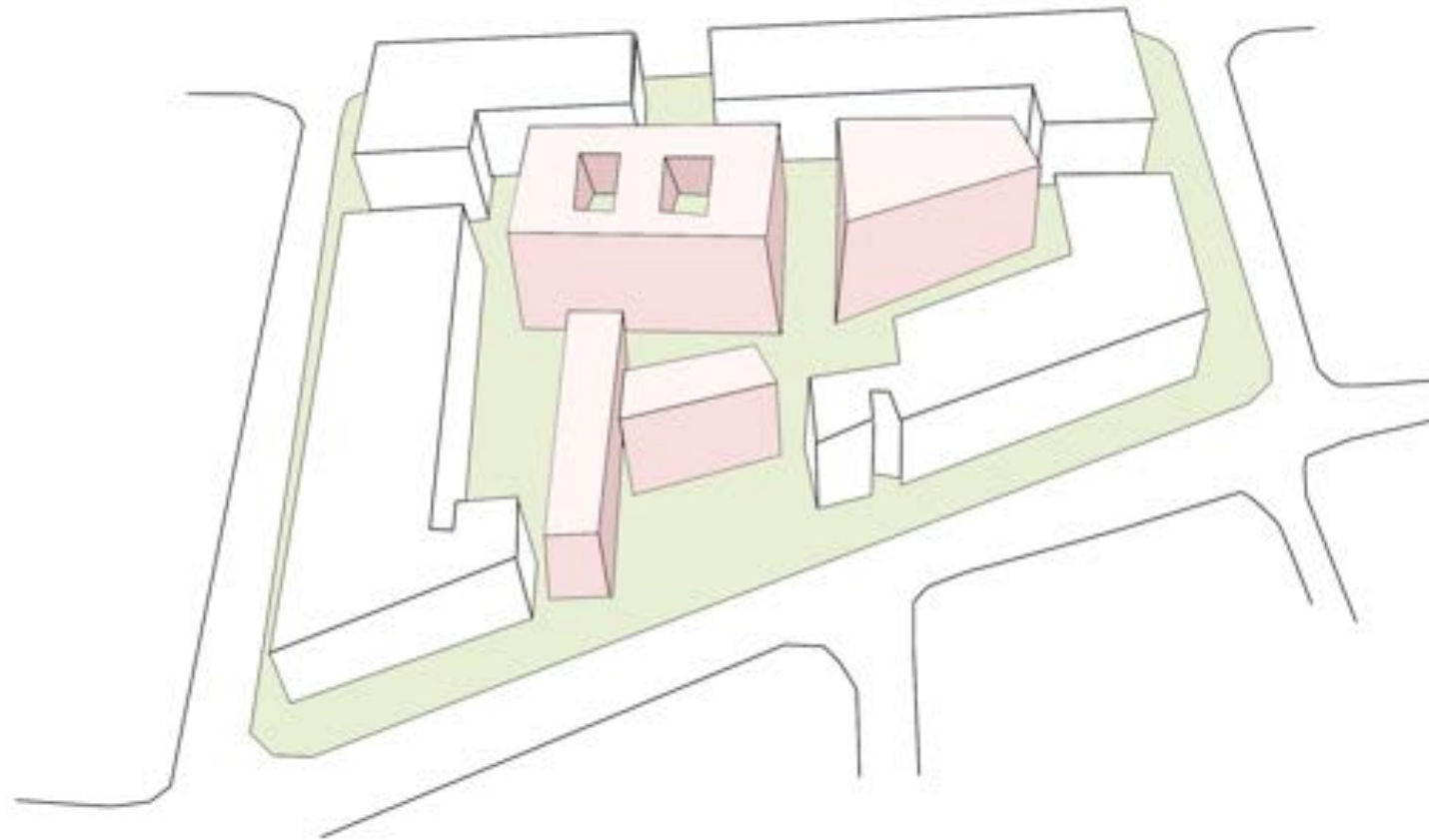
Unpack green
space – make
oases



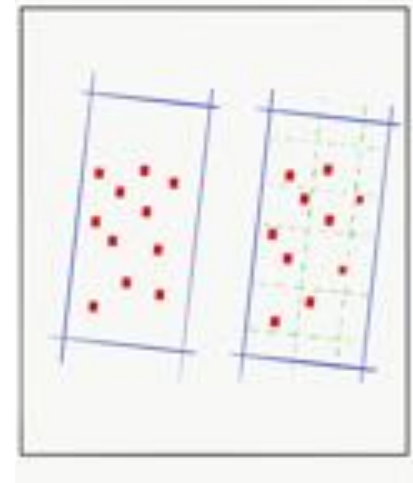
Unpack green
space – make
oases



Densify urban
space – create
shade



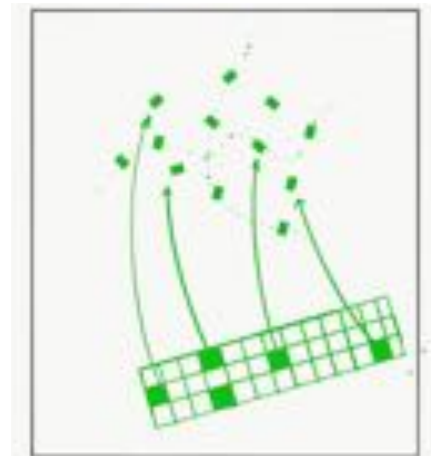
Densify urban
space – create
shade



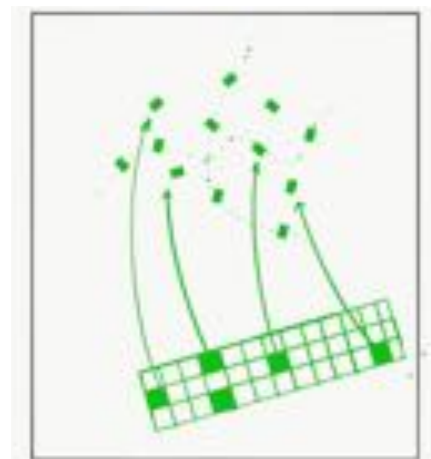
Make small
green routes



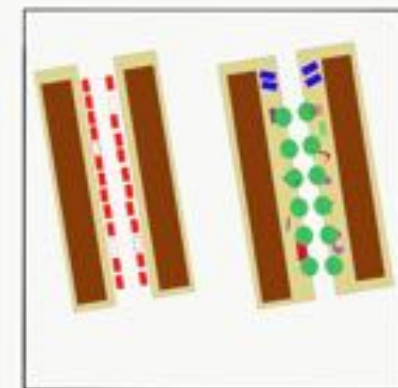
Make small
green routes



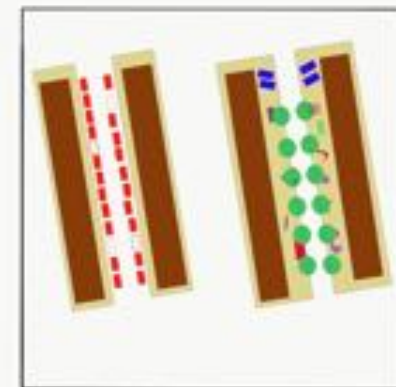
Unpack green
space – make
oases



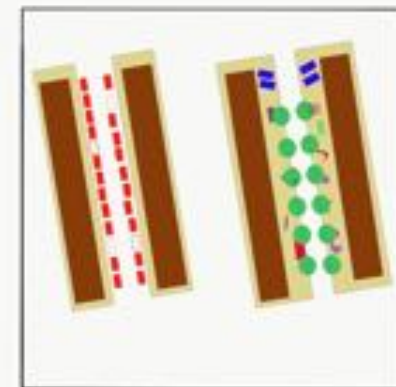
Unpack green
space – make
oases



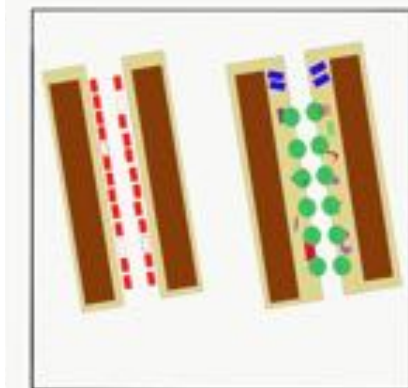
Reclaim the
street – with
car-share!



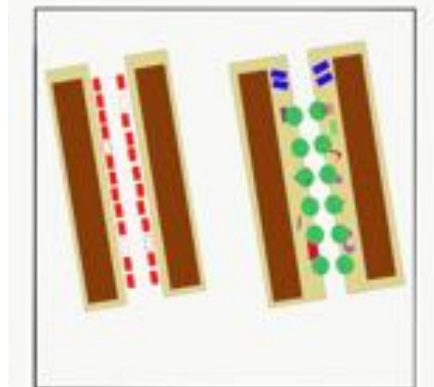
Reclaim the
street – with
car-share!



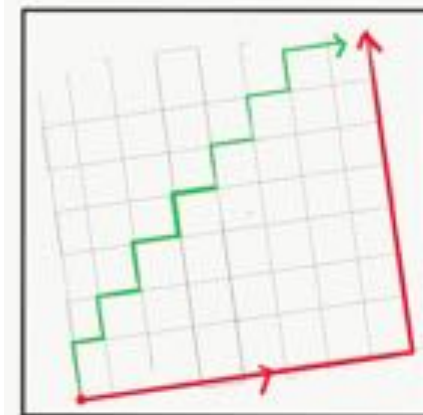
Reclaim the
street – with
car-share!



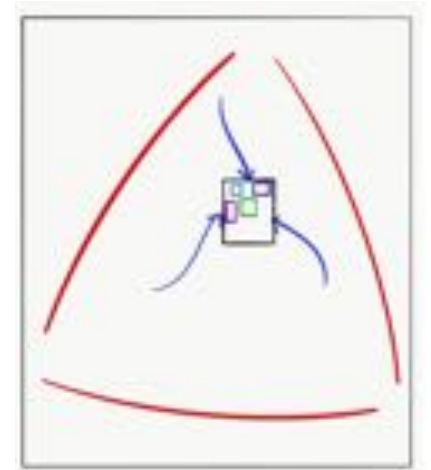
Reclaim the
street – with
car-share!



Reclaim the
street – with
car-share!

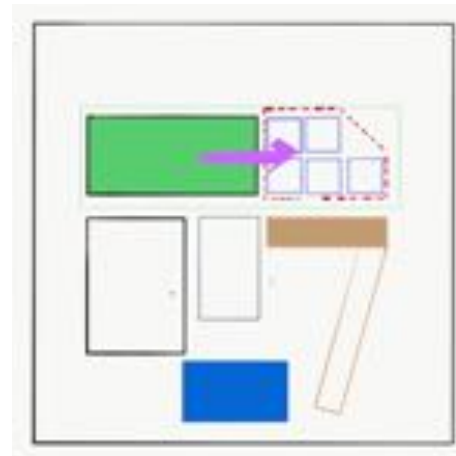


Bike-friendly
routes go
through the
neighbourhood

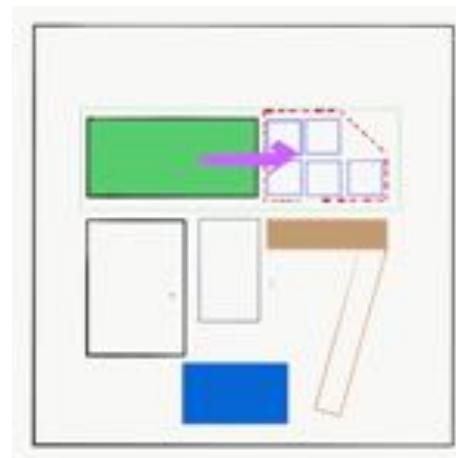


Repack the
neighbourhood

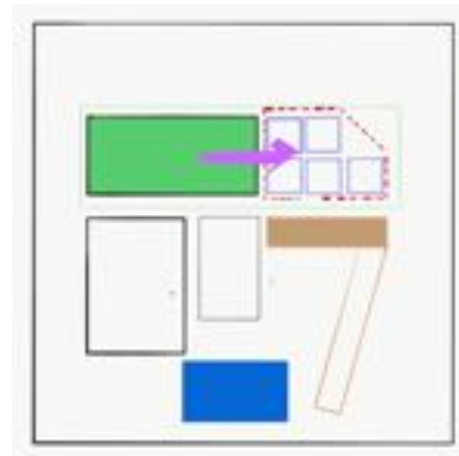




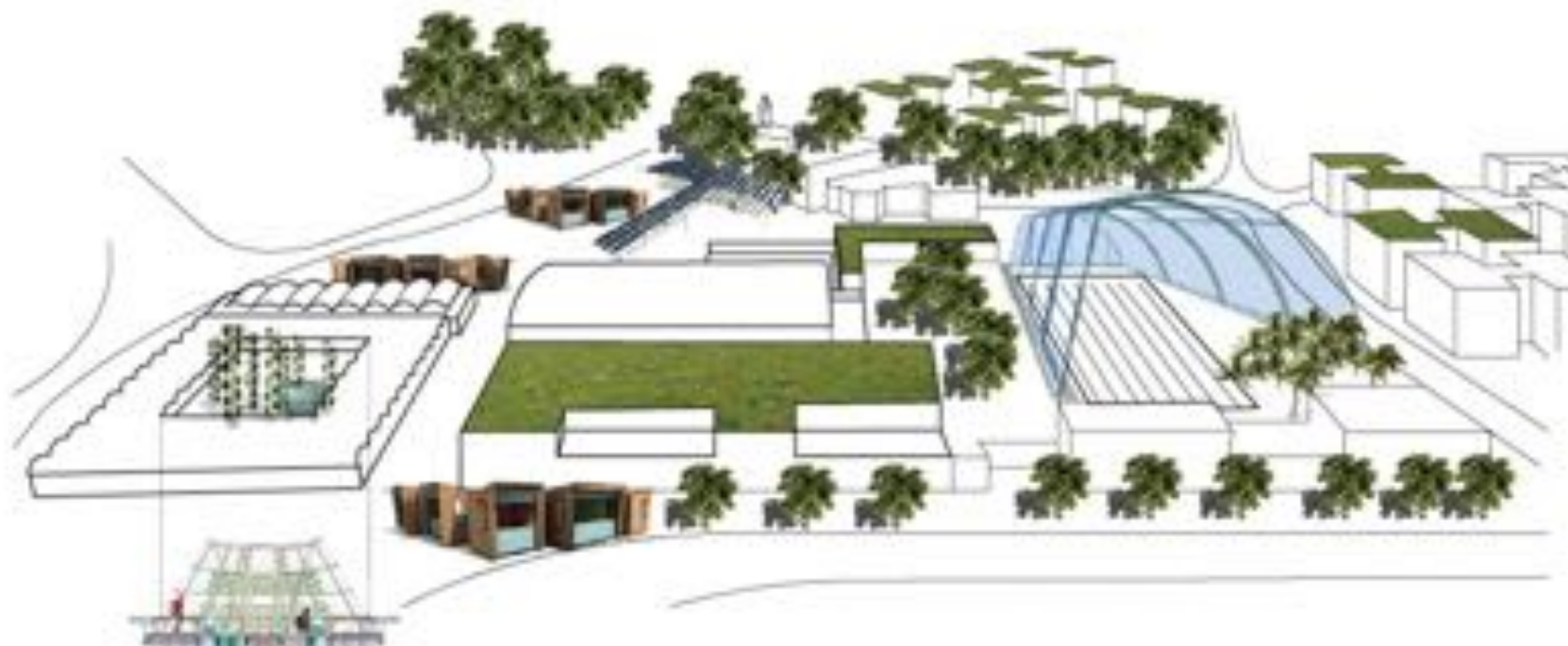
Unpacking the
market makes
new exciting
public space

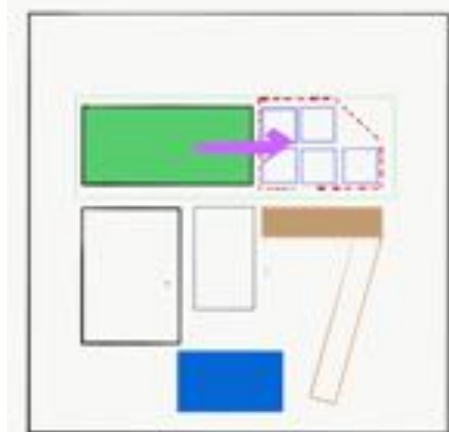


Unpacking the market makes new exciting public space



Unpacking the
market makes
new exciting
public space





Unpacking the market makes new exciting public space

10% GREEN



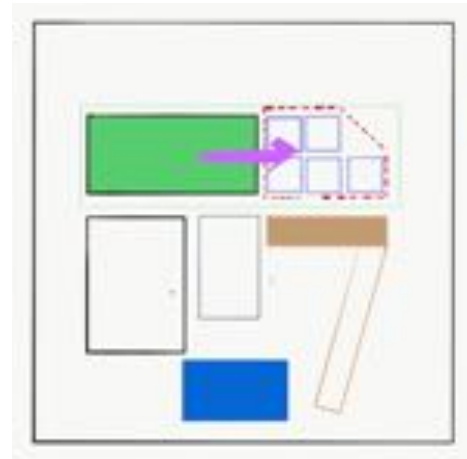
50% GREEN



30% GREEN



80% GREEN



Unpacking the market makes new exciting public space

NOW



To conclude



STEP 1: 25% GREEN

DIFFERENT GREENS



MICRO | TINY COURTYARD | RULES
Ability to sit
One tree/plant/pot

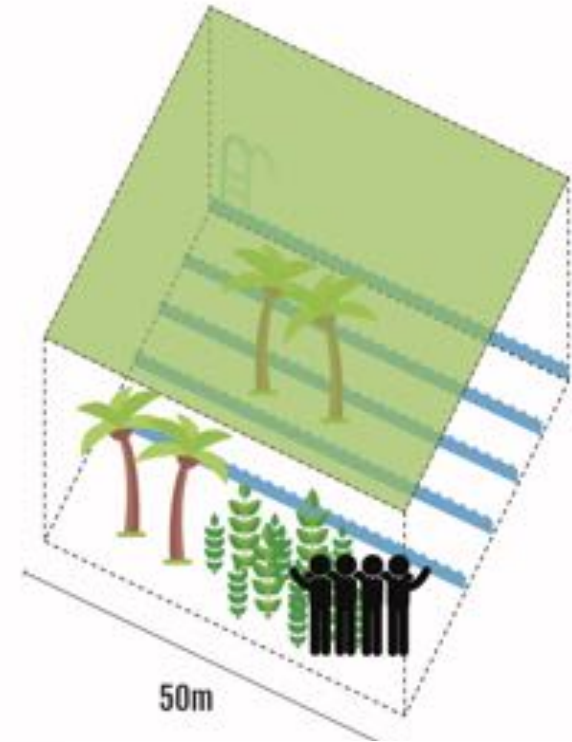


STEP 2: 50% GREEN



MESO | ROOFTOP GARDEN, LARGER COURTYARD | RULES
Ability to sit comfortably and meet friends
More greenery
Shaded

STEP 3: 75% GREEN

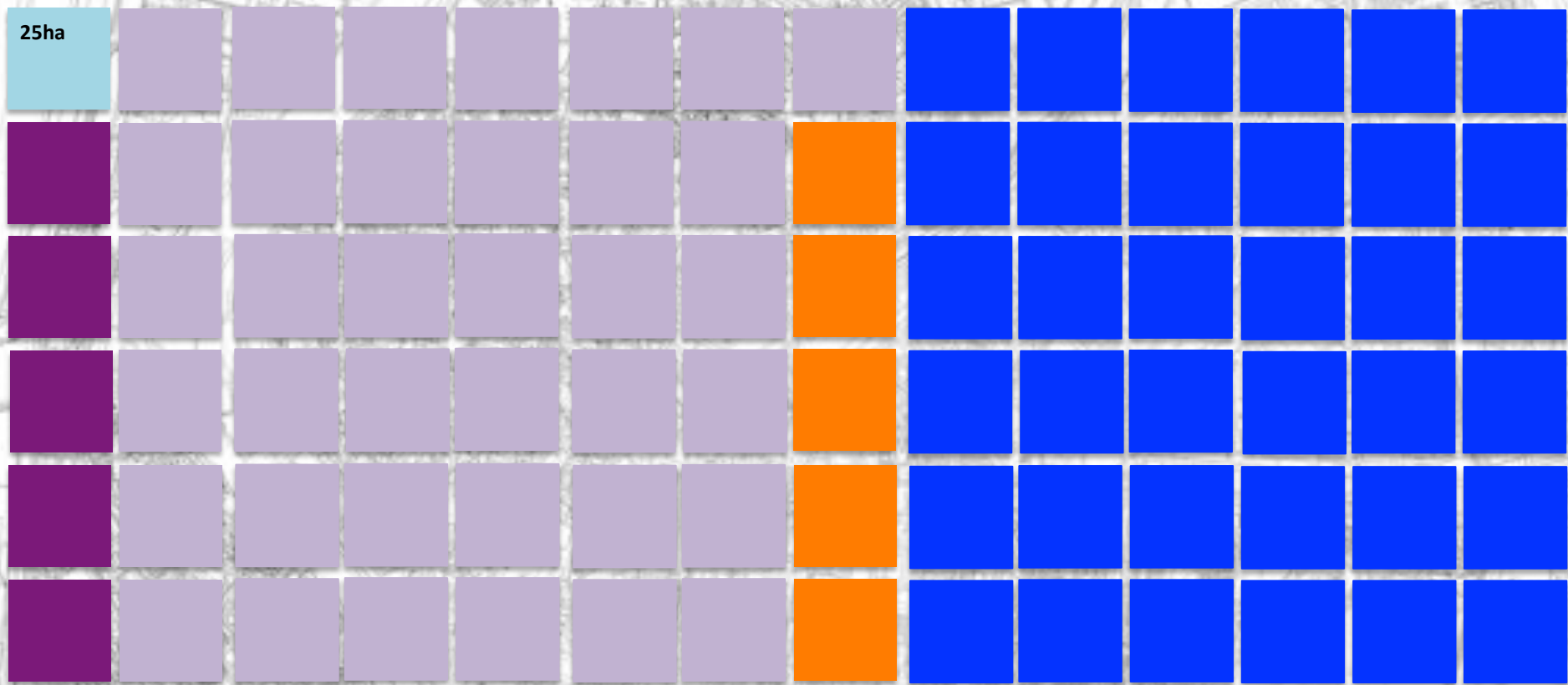


MACRO | STREET, CENTRE (POOL) | RULES
Activities present
Fully green
Shaded
Water

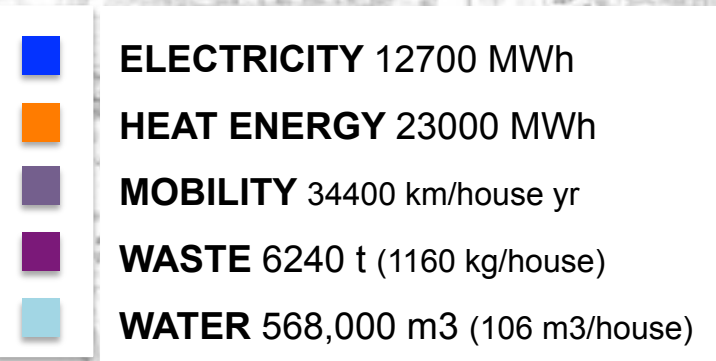
STEP 4: 100% GREEN



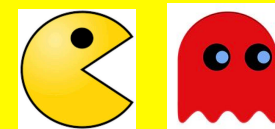
CARBON FOOTPRINT MITIGATION MEASURES

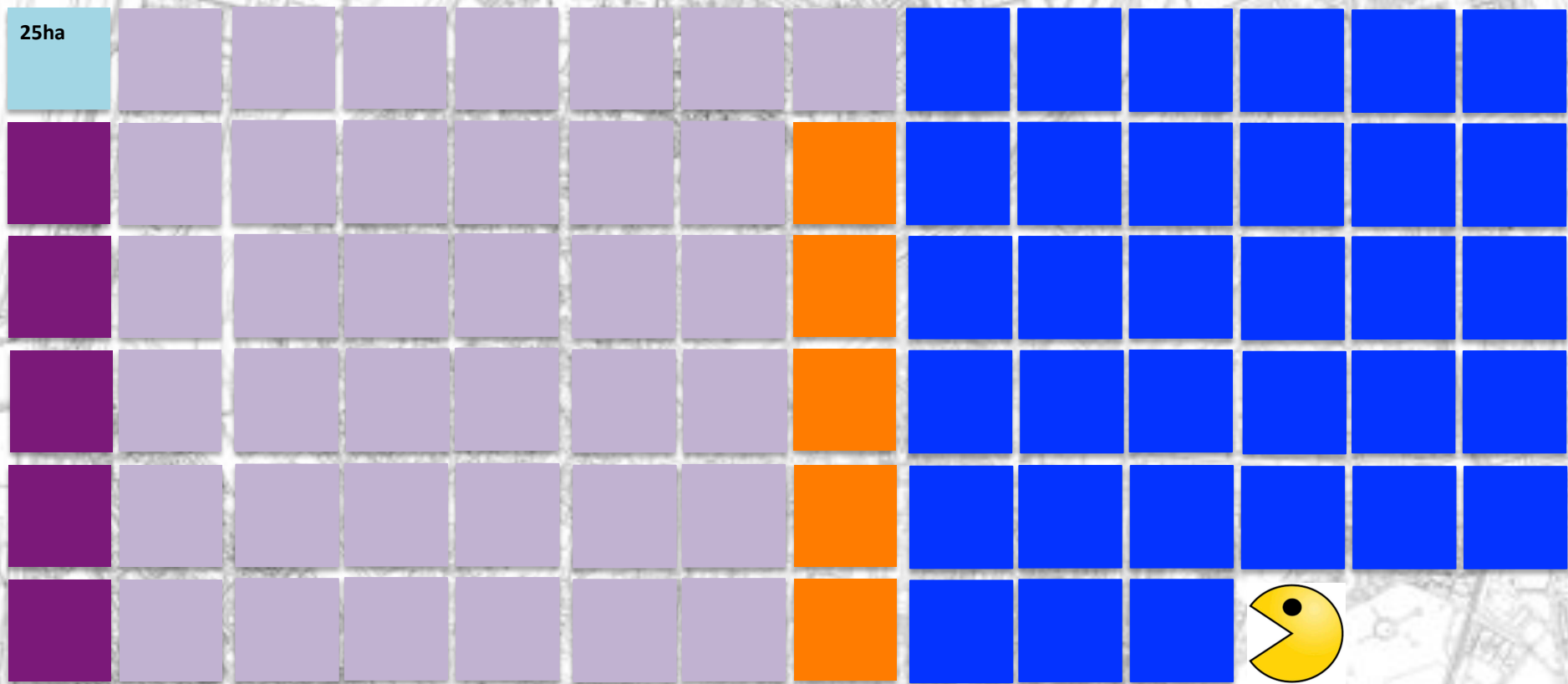


BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households



Pacman
is coming...

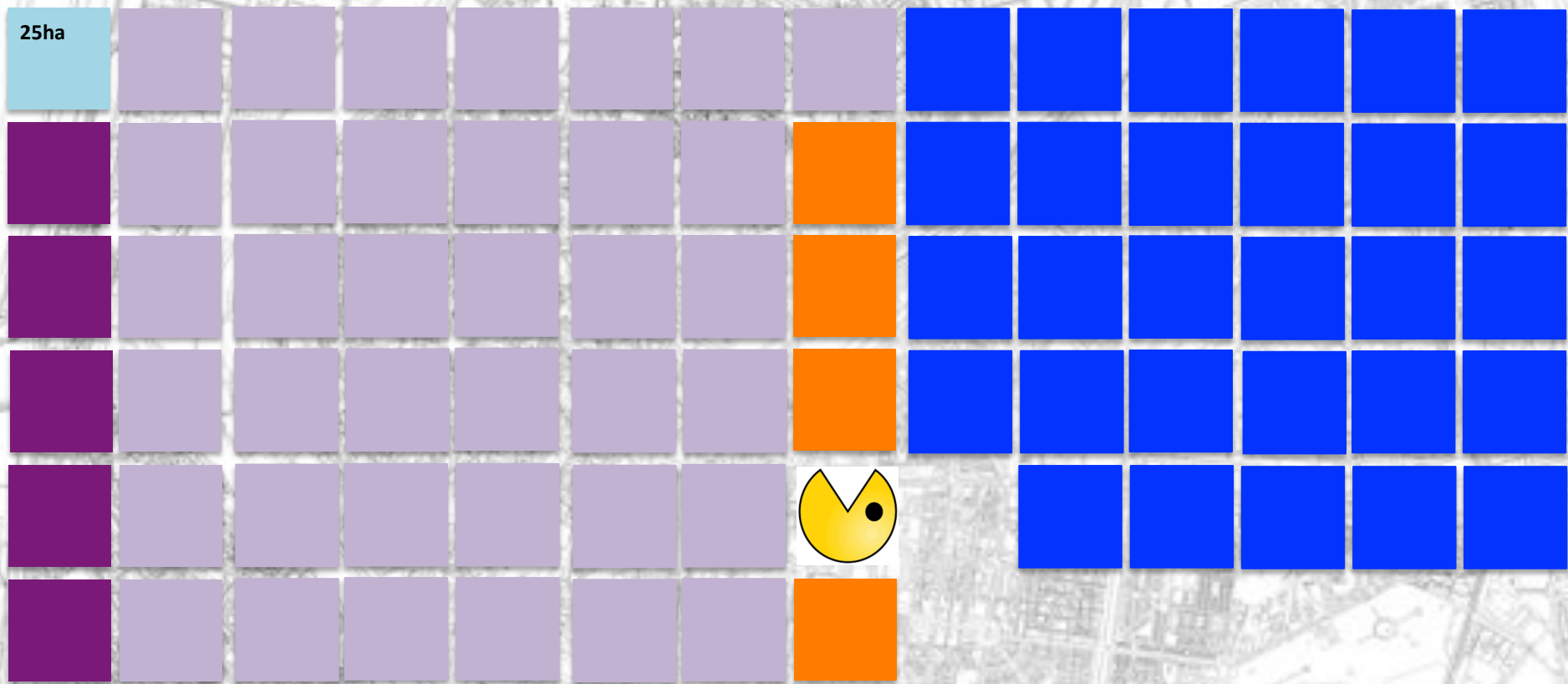




BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

	ELECTRICITY 12700 MWh
	HEAT ENERGY 23000 MWh
	MOBILITY 34400 km/house yr
	WASTE 6240 t (1160 kg/house)
	WATER 568,000 m3 (106 m3/house)

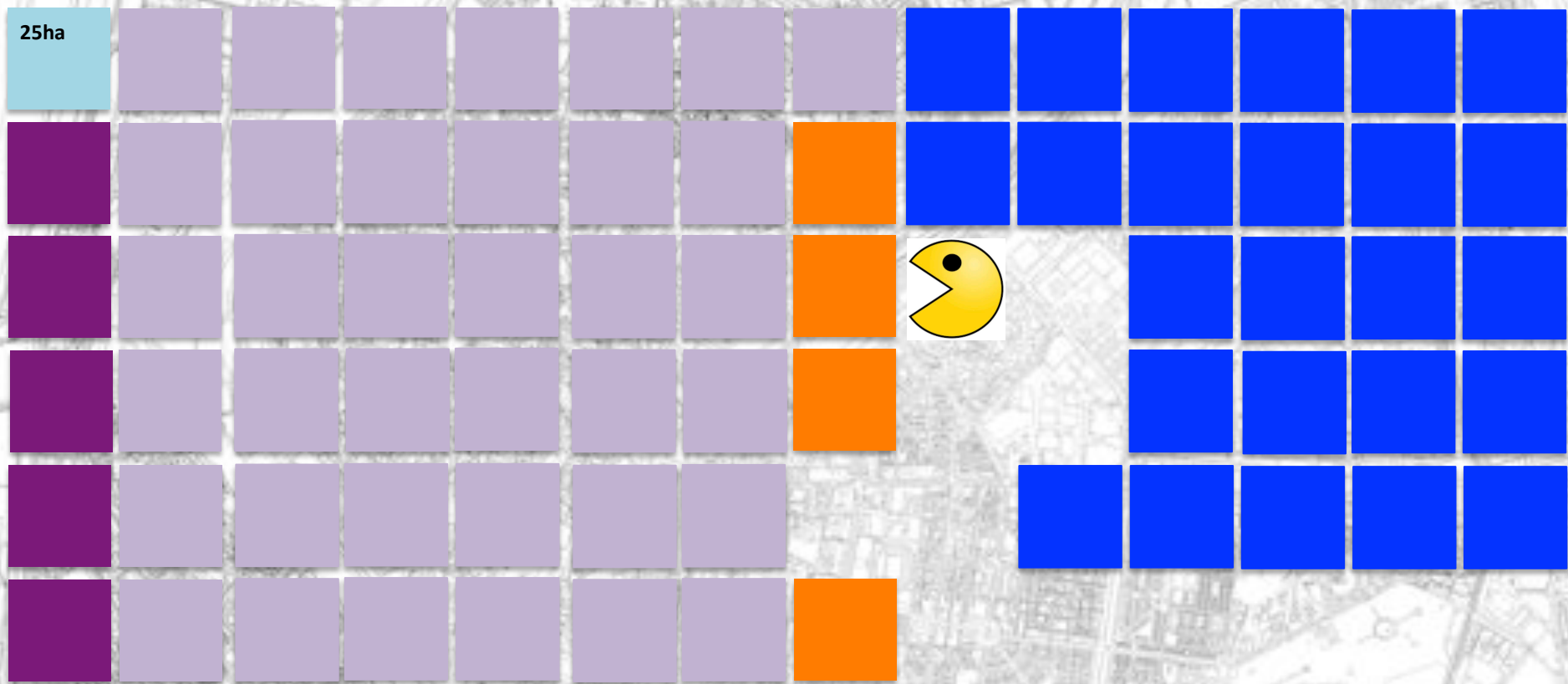
PASSIVE SYSTEMS
greening, shading, low
emission paint
(20% houses)
-50% cooling (-1700MWh)



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

■	ELECTRICITY 12700 MWh
■	HEAT ENERGY 23000 MWh
■	MOBILITY 34400 km/house yr
■	WASTE 6240 t (1160 kg/house)
■	WATER 568,000 m3 (106 m3/house)

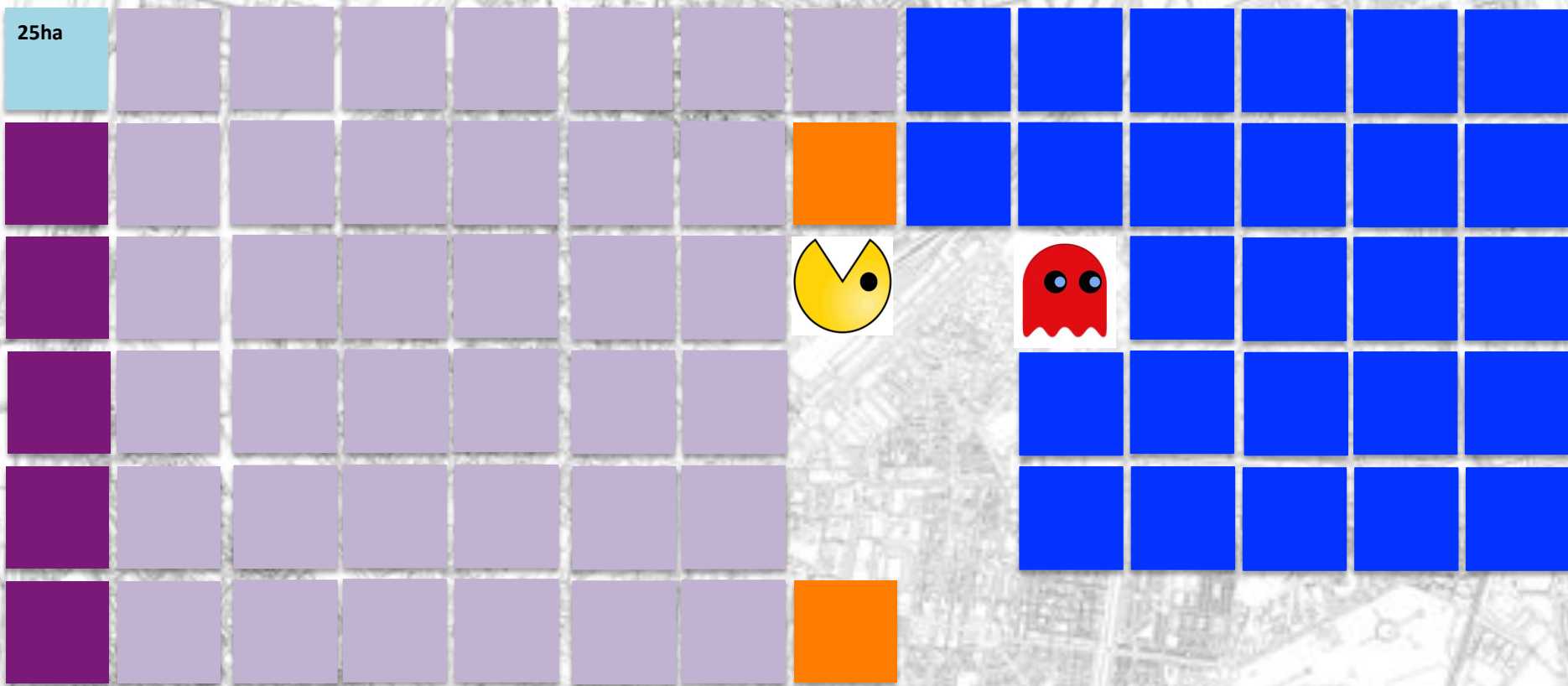
THERMAL INSULATION
roof/facade retrofitting
(30% houses)
-50% cooling (-2500 MWh)
-75% heating (-1450 MWh)



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

	ELECTRICITY 12700 MWh
	HEAT ENERGY 23000 MWh
	MOBILITY 34400 km/house yr
	WASTE 6240 t (1160 kg/house)
	WATER 568,000 m3 (106 m3/house)

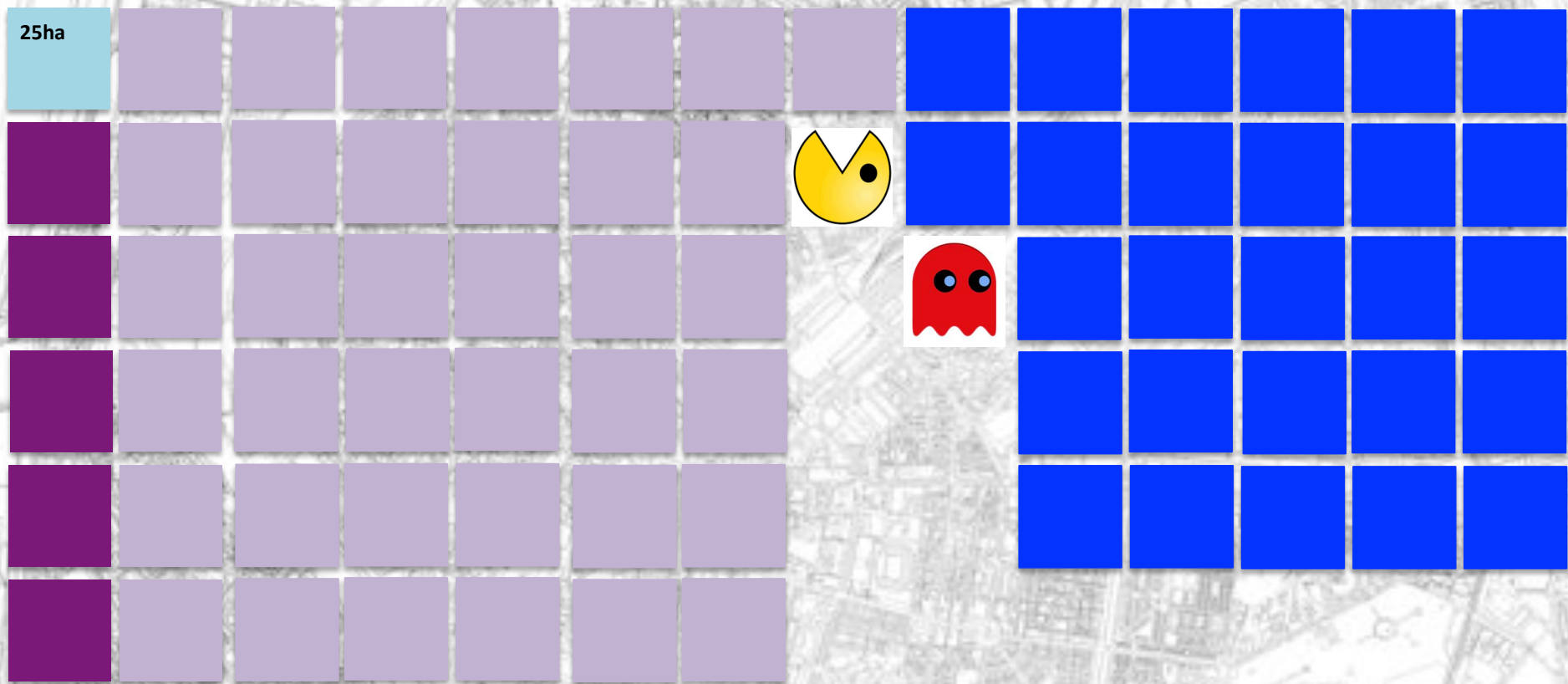
Behavioural changes
LED lights, air conditioning
(80% houses)
-50% electric lighting
(-2400 MWh)



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

	ELECTRICITY 12700 MWh
	HEAT ENERGY 23000 MWh
	MOBILITY 34400 km/house yr
	WASTE 6240 t (1160 kg/house)
	WATER 568,000 m3 (106 m3/house)

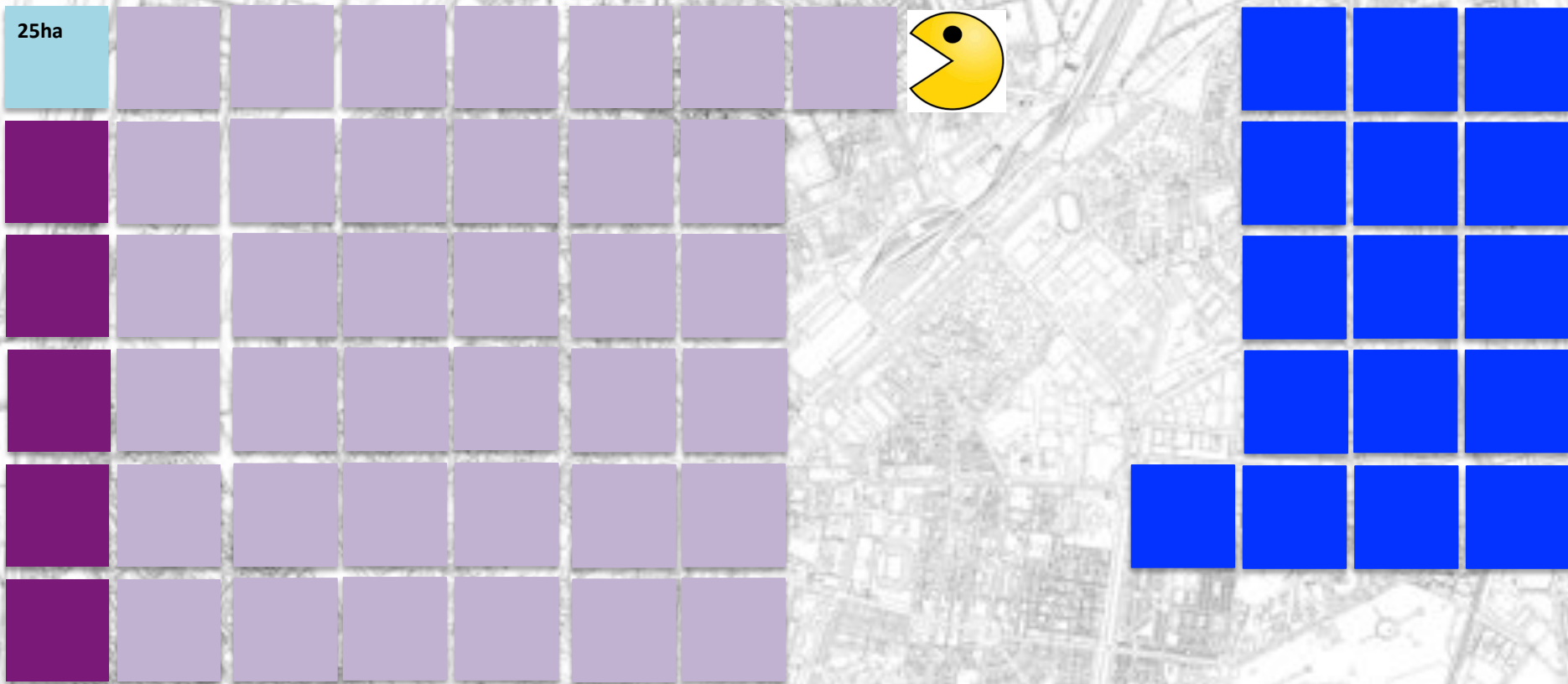
HEAT PUMP
(household scale)
(30% houses)
-75% heating (-1500 MWh)
-75% DHW (-1400 MWh)
+20% electricity (+360 MWh)



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

	ELECTRICITY 12700 MWh
	HEAT ENERGY 23000 MWh
	MOBILITY 34400 km/house yr
	WASTE 6240 t (1160 kg/house)
	WATER 568,000 m3 (106 m3/house)

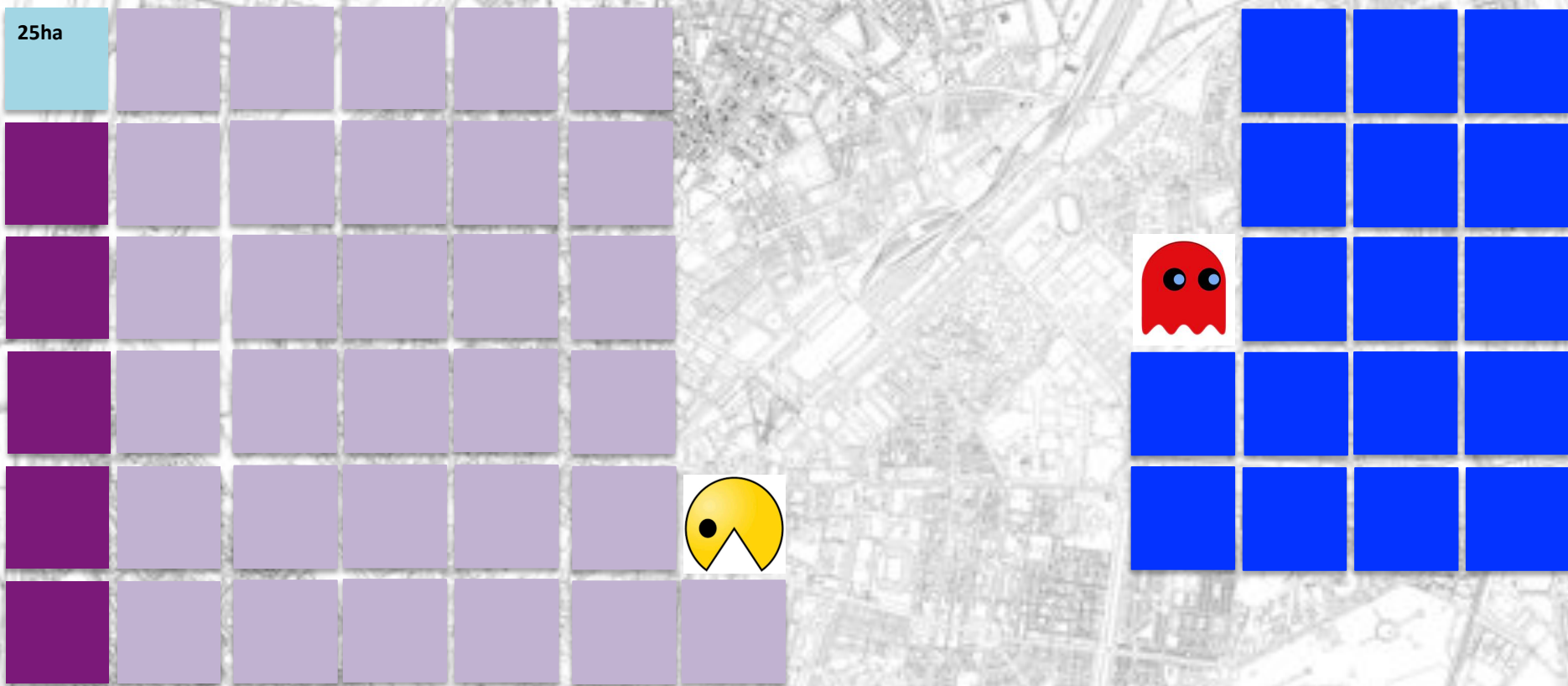
HEAT PUMP
(neighbourhood scale)
(60% houses)
-75% heating (-3000 MWh)
-75% DHW (-2800 MWh)
+20% electricity (+720 MWh)



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

-  **ELECTRICITY** 12700 MWh
-  **HEAT ENERGY** 23000 MWh
-  **MOBILITY** 34400 km/house yr
-  **WASTE** 6240 t (1160 kg/house)
-  **WATER** 568,000 m3 (106 m3/house)

PV panels
(building block scale)
(30% houses)
-100% electricity (-7000 MWh)

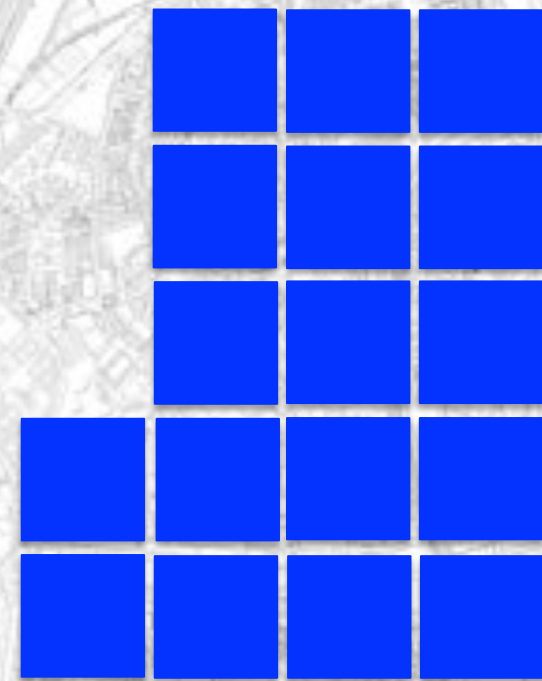
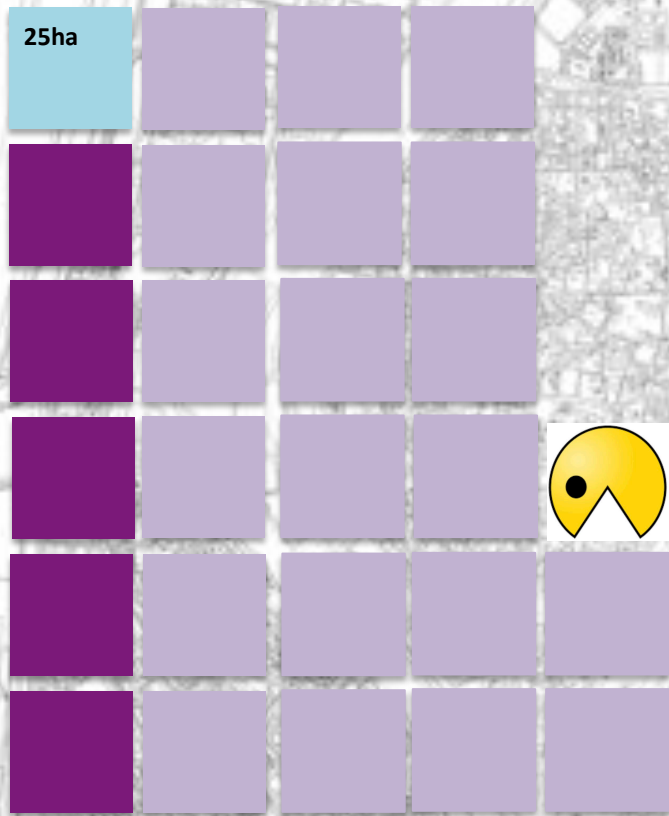


BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

	ELECTRICITY 12700 MWh
	HEAT ENERGY 23000 MWh
	MOBILITY 34400 km/house yr
	WASTE 6240 t (1160 kg/house)
	WATER 568,000 m3 (106 m3/house)

Electric bike sharing
(-15% private car use)
-100% fuel
+20% electricity for appliances

25ha

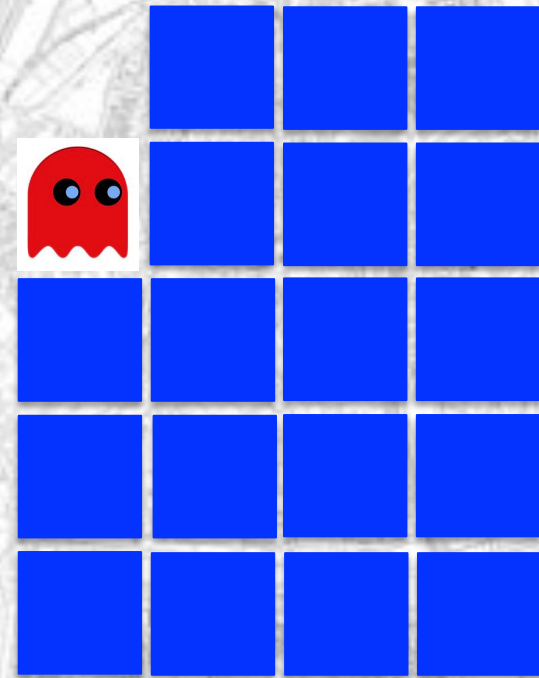
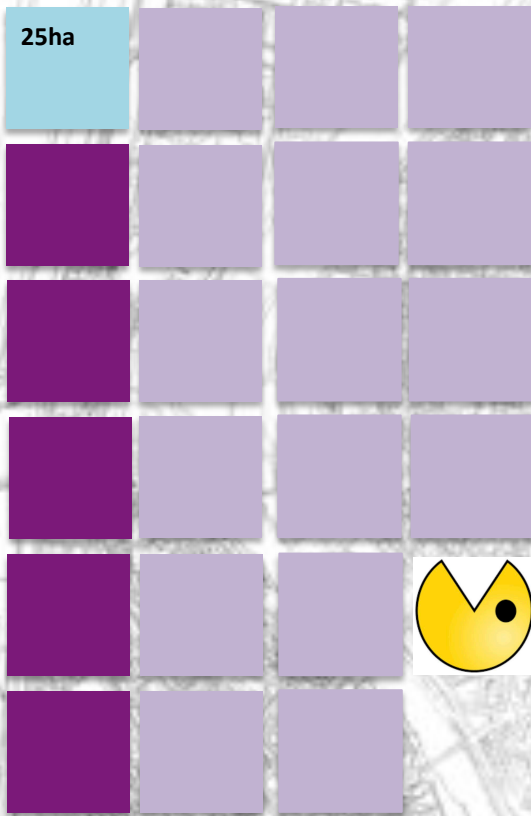


BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

	ELECTRICITY 12700 MWh
	HEAT ENERGY 23000 MWh
	MOBILITY 34400 km/house yr
	WASTE 6240 t (1160 kg/house)
	WATER 568,000 m3 (106 m3/house)

Bike to school/work
(-30% private car use)
-100% fuel

25ha



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households

	ELECTRICITY 12700 MWh
	HEAT ENERGY 23000 MWh
	MOBILITY 34400 km/house yr
	WASTE 6240 t (1160 kg/house)
	WATER 568,000 m3 (106 m3/house)

Electric car recharger station
(10% electric cars)
-100% fuel
+40% electricity for appliances

25ha



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households



ELECTRICITY 12700 MWh



HEAT ENERGY 23000 MWh



MOBILITY 34400 km/house yr



WASTE 6240 t (1160 kg/house)



WATER 568,000 m³ (106 m³/house)

PV panels sharing
(neighbourhood scale)
(40% houses)
-100% electricity (-10000 MWh)

25ha



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households



ELECTRICITY 12700 MWh



HEAT ENERGY 23000 MWh



MOBILITY 34400 km/house yr



WASTE 6240 t (1160 kg/house)



WATER 568,000 m³ (106 m³/house)

Tram line
(district Sur scale)
(-40% private car use)
-100% fuels

25ha



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households



ELECTRICITY 12700 MWh



HEAT ENERGY 23000 MWh



MOBILITY 34400 km/house yr



WASTE 6240 t (1160 kg/house)



WATER 568,000 m³ (106 m³/house)

Differentiated waste

(100% house)

-70% waste-to-landfill

25ha



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households



ELECTRICITY 12700 MWh



HEAT ENERGY 23000 MWh



MOBILITY 34400 km/house yr



WASTE 6240 t (1160 kg/house)



WATER 568,000 m³ (106 m³/house)

Differentiated waste
(avoided landfill)
(100% house)
-100% waste-to-landfill

25ha



BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households



ELECTRICITY 12700 MWh



HEAT ENERGY 23000 MWh



MOBILITY 34400 km/house yr



WASTE 6240 t (1160 kg/house)



WATER 568,000 m³ (106 m³/house)

Existing parks
New green assets
RE surplus
(neighbourhood scale)

25ha



TENED CONFIANZA... GO TO ZERO!!!

BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households



ELECTRICITY 12700 MWh



HEAT ENERGY 23000 MWh



MOBILITY 34400 km/house yr



WASTE 6240 t (1160 kg/house)



WATER 568,000 m³ (106 m³/house)

creativity...



**Muchas
gracias.**

Roadshow

Sevilla – Taller energía



Co-funded by the European Union's Seventh Programme for research, technological development and demonstration

