CITY-ZEN ROADSHOW ‘SEVILLA’

20th – 24th
NOV
2017

Escuela Técnica Superior de
Ingeniería de Edificación

Gerencia de Urbanismo

INSTITUTO UNIVERSITARIO
ARQUITECTURA Y CIENCIAS DE LA CONSTRUCCIÓN

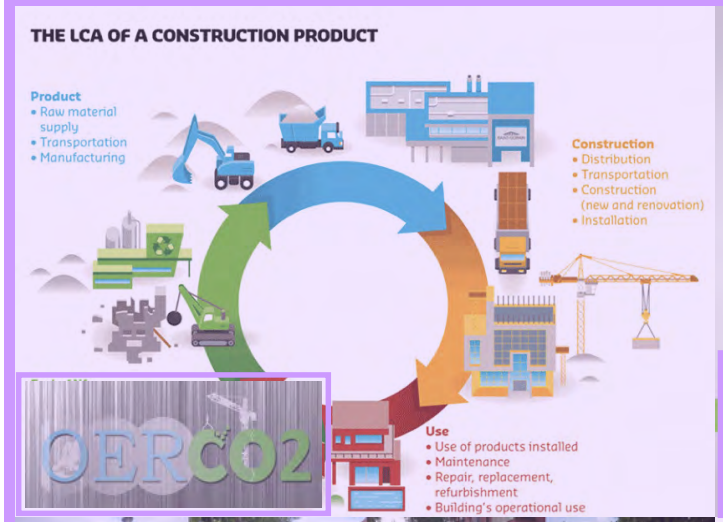
Agencia Andaluza de la Energía
CONSEJERÍA DE EMPLEO, EMPRESA Y COMERCIO

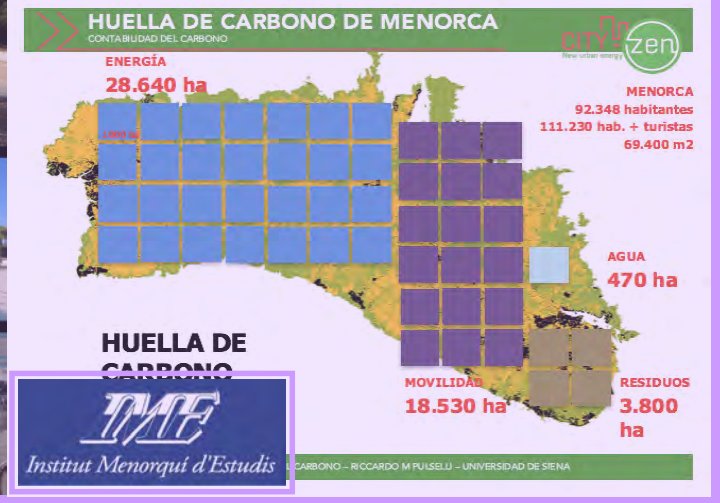
Arditec
Arquitectura Diseño Técnica

NO8DO
AYUNTAMIENTO DE SEVILLA

CITY-zen
New urban energy

TECNOLOGÍAS FUTURAS





DAY 1 (MON)

CITY-zen New urban energy

TECNOLOGÍAS FUTURAS

DAY 1
(MON)

CITY-zen
New urban energy

PARALLEL TALLERS

DAYS
2 - 4

CITY-zen
New urban energy

PARALLEL TALLERS

DAYS
2 - 4

CITY-zen
New urban energy

PARALLEL TALLERS

DAYS
2 - 4

CITY-zen
New urban energy

JUEGO SERIO ‘Go2Zero’

DAY 3
(WED)

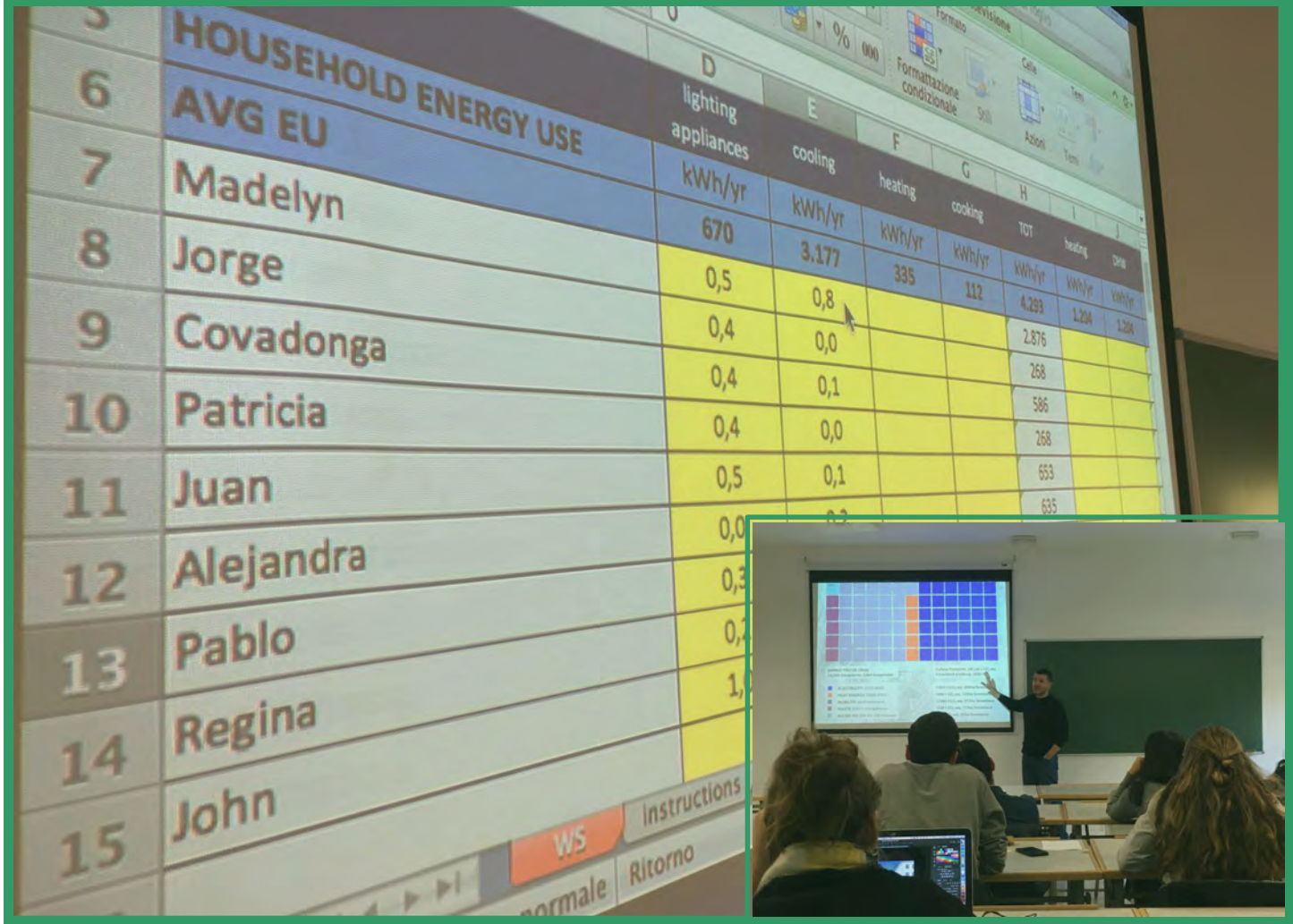
CITY-zen
New urban energy

JUEGO SERIO ‘Go2Zero’

DAY 3
(WED)

CITY-zen
New urban energy

SEVILLA: UNA CIUDAD DE BAJAS EMISIONES!



DAY 3
(WED)

CITY-zen
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WALKING TOUR

DAY 3
(WED)

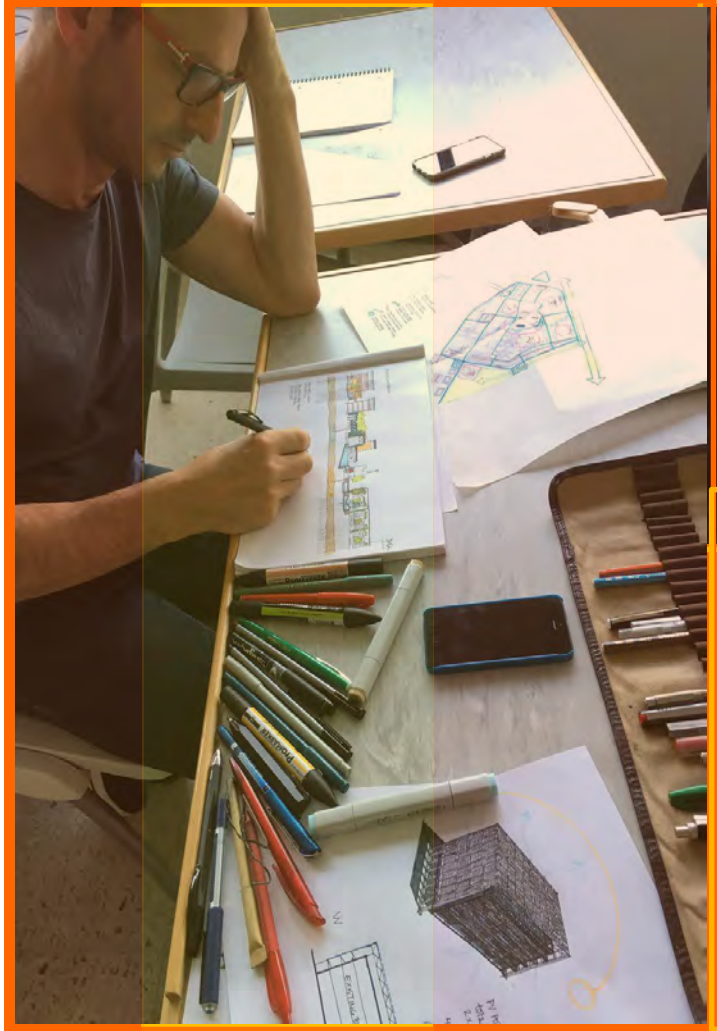
CITY-zen
New urban energy

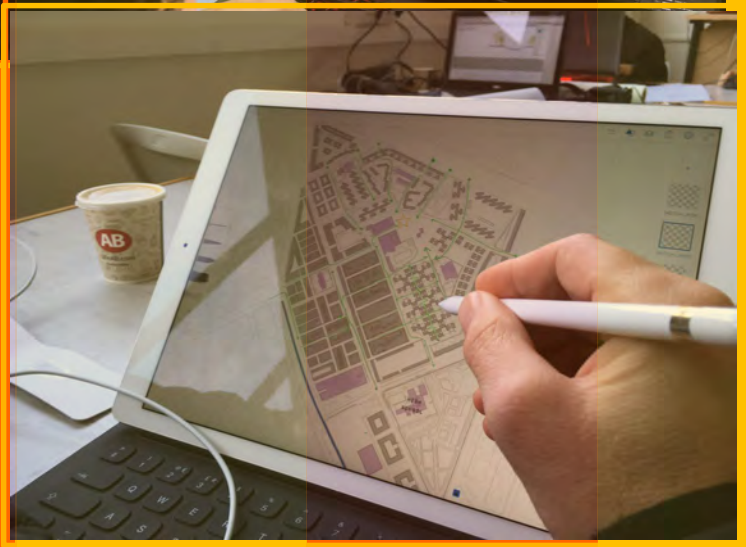
WALKING TOUR

DAY 3
(WED)

CITY-zen
New urban energy

PARALLEL TALLERS





DAY 4 (THUR)

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VISIÓN SEVILLA SOSTENIBLE

DAY 5
(FRI)

CITY-zen
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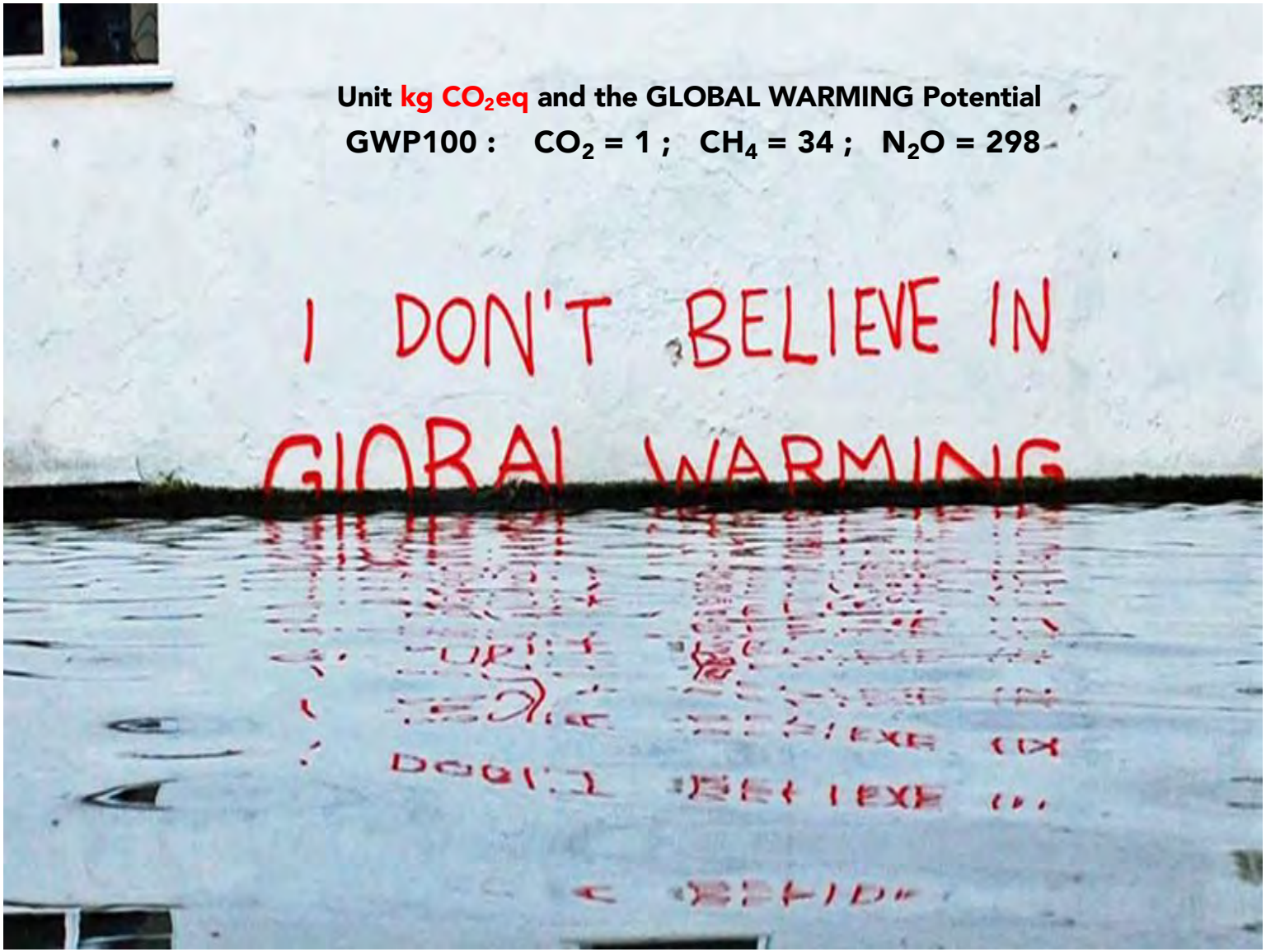

Unit kg CO_2eq and the GLOBAL WARMING Potential
GWP100 : CO_2 = 1 ; CH_4 = 34 ; N_2O = 298
I DON'T BELIEVE IN
GLOBAL WARMING

CARBON ACCOUNTING

ELECTRICITY EMISSION FACTOR

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%)

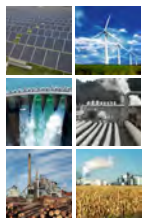
Oil and others 1.28 TWh (1.5%)

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 CO_2eq/kWh

Source: Agencia Andaluza de la Energìa

CARBON ACCOUNTING

CARBON FOOTPRINT ASSESSMENT OF THE PROVINCE OF SEVILLA

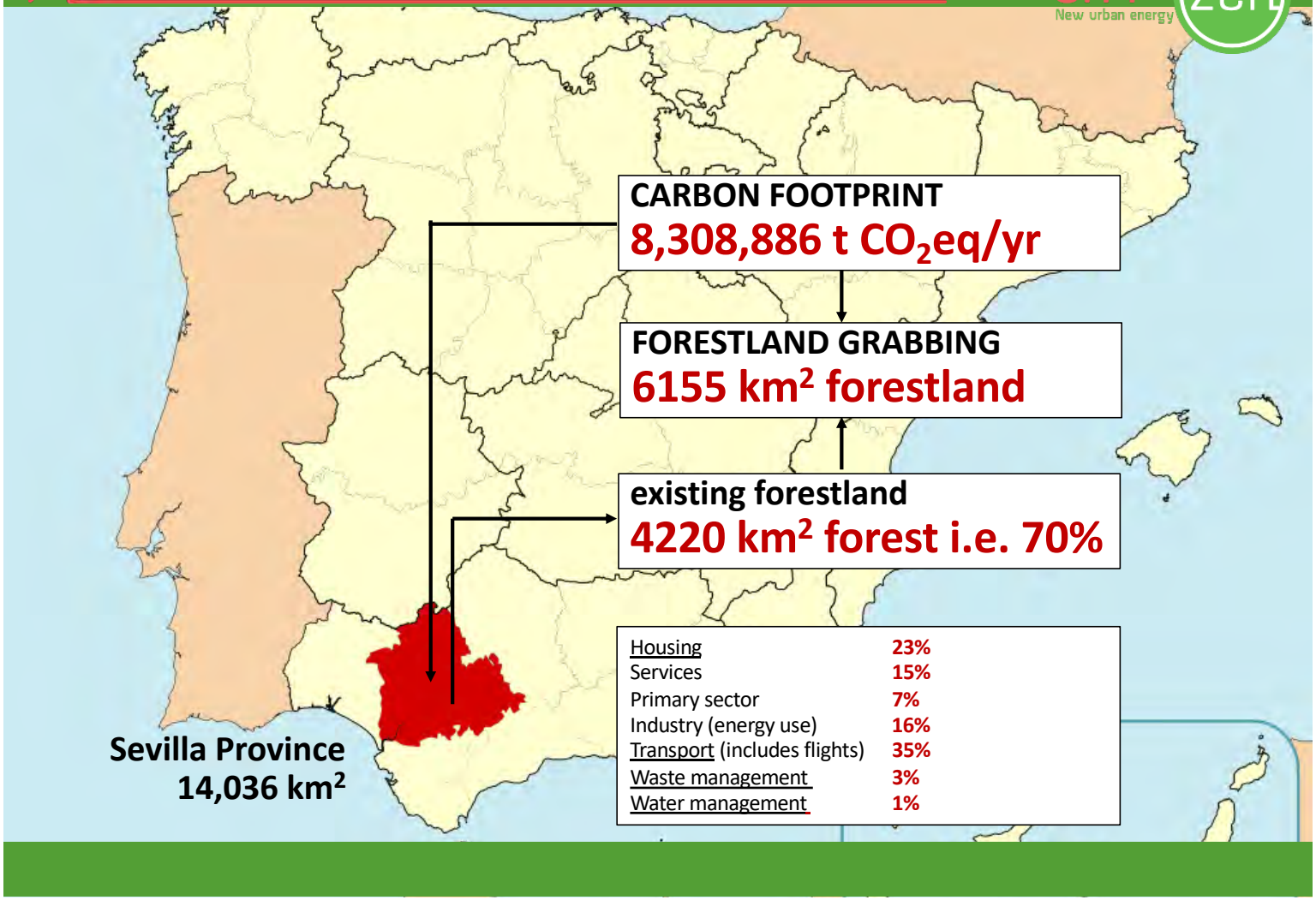
RESIDENTIAL ENERGY	**1,945,729**	**t CO_2eq/yr**	
Electricity	3,223.84	GWh/yr	
Natural gas	345.41	GWh/yr	
Diesel	182.59	GWh/yr	
LGP	650.12	GWh/yr	
Biomass + thermosolar	594.29	GWh/yr	
SERVICES	**1,282,478**	**t CO_2eq/yr**	
Electricity	2,329.49	GWh/yr	
Natural gas	252.37	GWh/yr	
Diesel	36.05	GWh/yr	
LPG	13.06	GWh/yr	
Biomas+Biogas	124.44	GWh/yr	
PRIMARY SECTOR	**551,995**	**t CO_2eq/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 Energìa
Source: Anuario Estatistico de la Ciudad de Sevilla

INDUSTRIAL ENERGY	**1,360,389**	**t CO_2eq/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 CO_2eq/yr**	
Electricity	79.08	GWh/yr	
Diesel	7,572.29	GWh/yr	
Fuels	3,230.82	GWh/yr	
WASTE MANAGEMENT	**210,981**	**t CO_2eq/yr**	
Collected quantity	871,725	t/yr	
Waste to landfill	155,952	t/yr	
Composting	330,514	t/yr	
WATER MANAGEMENT	**46,430**	**t CO_2eq/yr**	
Water use	79,367,702	m^3/yr	

CARBON ACCOUNTING

CARBON FOOTPRINT ASSESSMENT OF THE PROVINCE OF SEVILLA



CARBON ACCOUNTING
HOUSEHOLD PROFILE

CARBON ACCOUNTING

CARBON FOOTPRINT ASSESSMENT OF THE AVG. HOUSEHOLD IN SEVILLA (DISTRICT SUR)

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SEVILLA HOUSEHOLD (DISTRICT SUR)

Avg inhab.	**2.6**	n.	
Gross floor surface	**70**	m2	
ENERGY DEMAND	**2,591**	**kg CO_2eq**	**49,4%**
E - Cooling	3,177	kWh_e/m2	**4,293 kWh_e/yr**
E - Lighting & appliances	1,116	kWh_e/m2	
H – Heating (energy mix)	1,204	kWh_e/m2	**2,360 kWh_h/yr**
H – DHW (energy mix)	1,157	kWh_h/m2	
MOBILITY	**2,307.9**	**kg CO_2eq**	**44%**
Driven km/house	6,410	Km/yr	i.e. 30 km/car day
WASTE MANAGEMENT	**284.5**	**kg CO_2eq**	**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	%	
Recicled	44.2	%	
WATER MANAGEMENT	**61.9**	**kg CO_2eq**	**1.2%**
Water use per household	106	m3/yr	i.e. 112 L/day cap


5.92 t CO_2eq/yr


5.04 t CO_2eq/yr


5.70 t CO_2eq/yr


9.40 t CO_2eq/yr


8.50 t CO_2eq/yr


5.60 t CO_2eq/yr

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CARBON FOOTPRINT

5.25 t CO_2eq/yr

CARBON FOOTPRINT OFFSET

carbon uptake by urban forestry (i.e. 1.35 kg CO_2/m^2)

SEVILLA HOUSEHOLD

Ref: 2014-2015

People: 2.6 inhab./house

Avg surface: 70 m2/house

Electricity: 4293 kWh/yr

Heat: 1204 kWh/yr

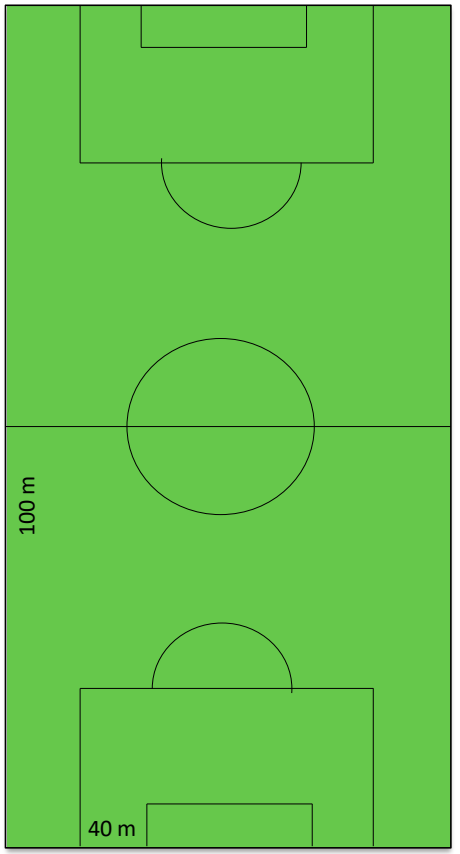
(mix: 19% CH_4, 10% diesel, 37% LPG, 34% RES)

Mobility: 30 km/day x 1.06 car/house

Waste: 1.16 t/house yr

Water: 106 m^3/house yr

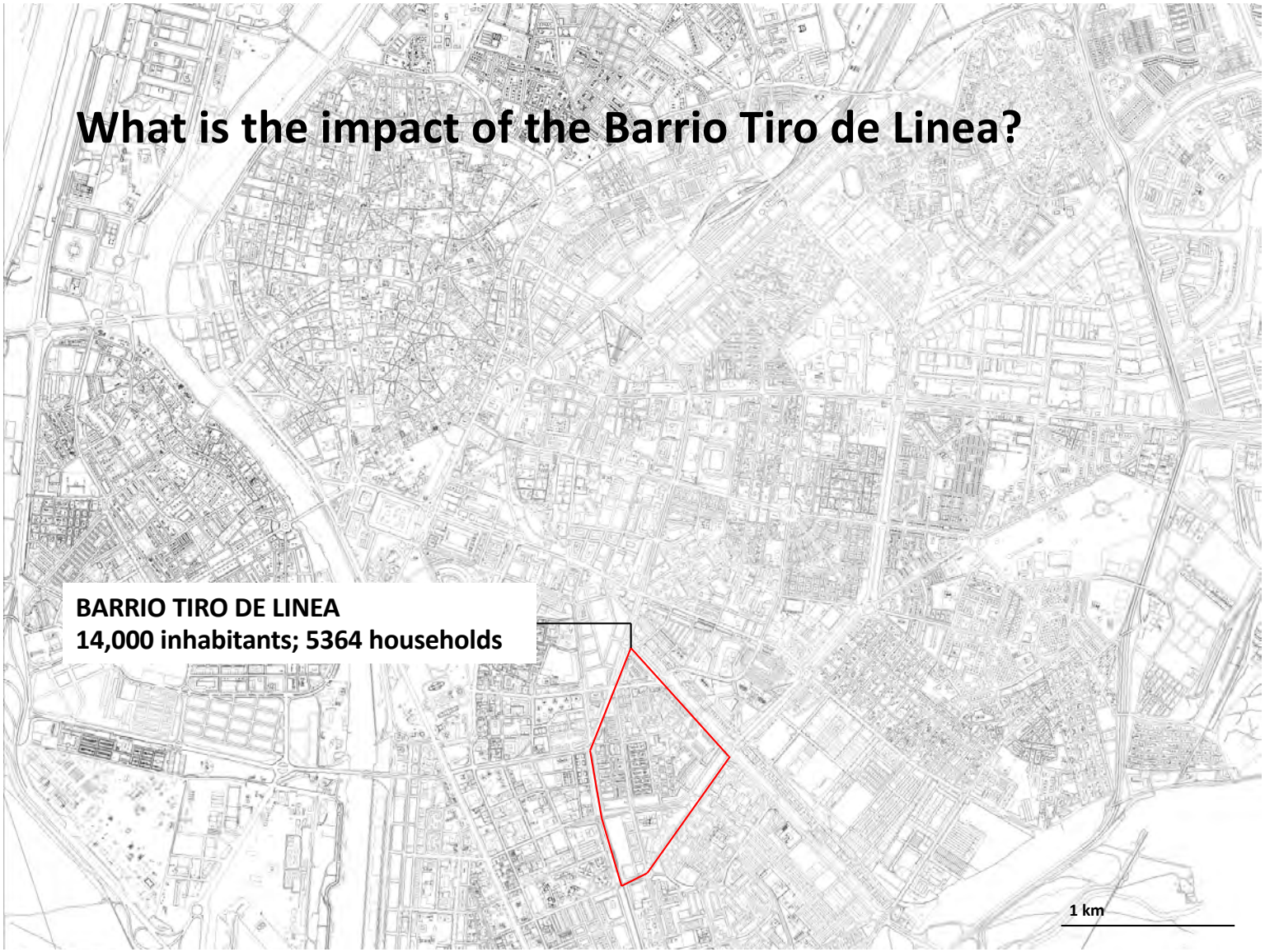
The carbon footprint offset of one household is equivalent to 0.39 ha forestland

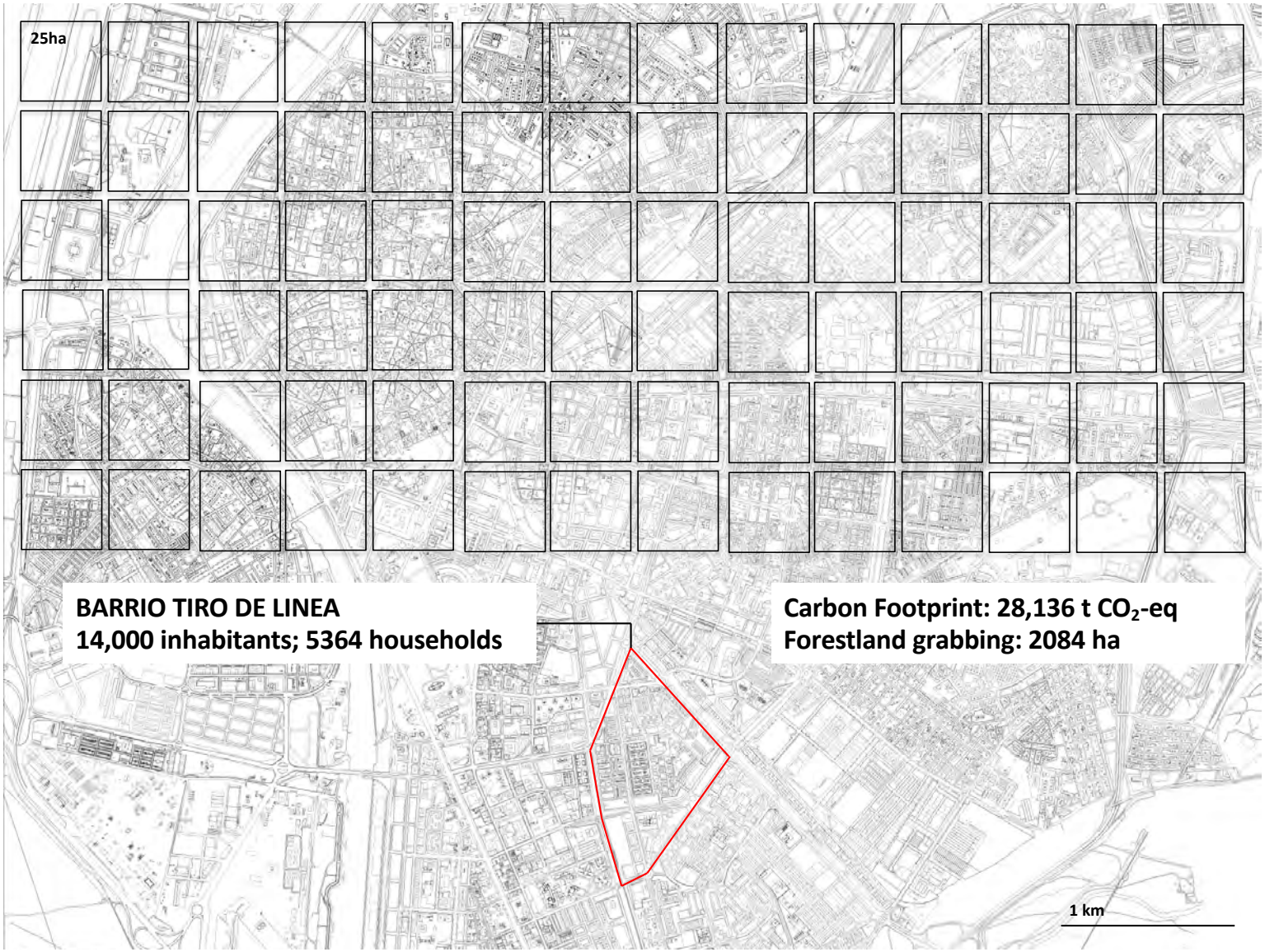


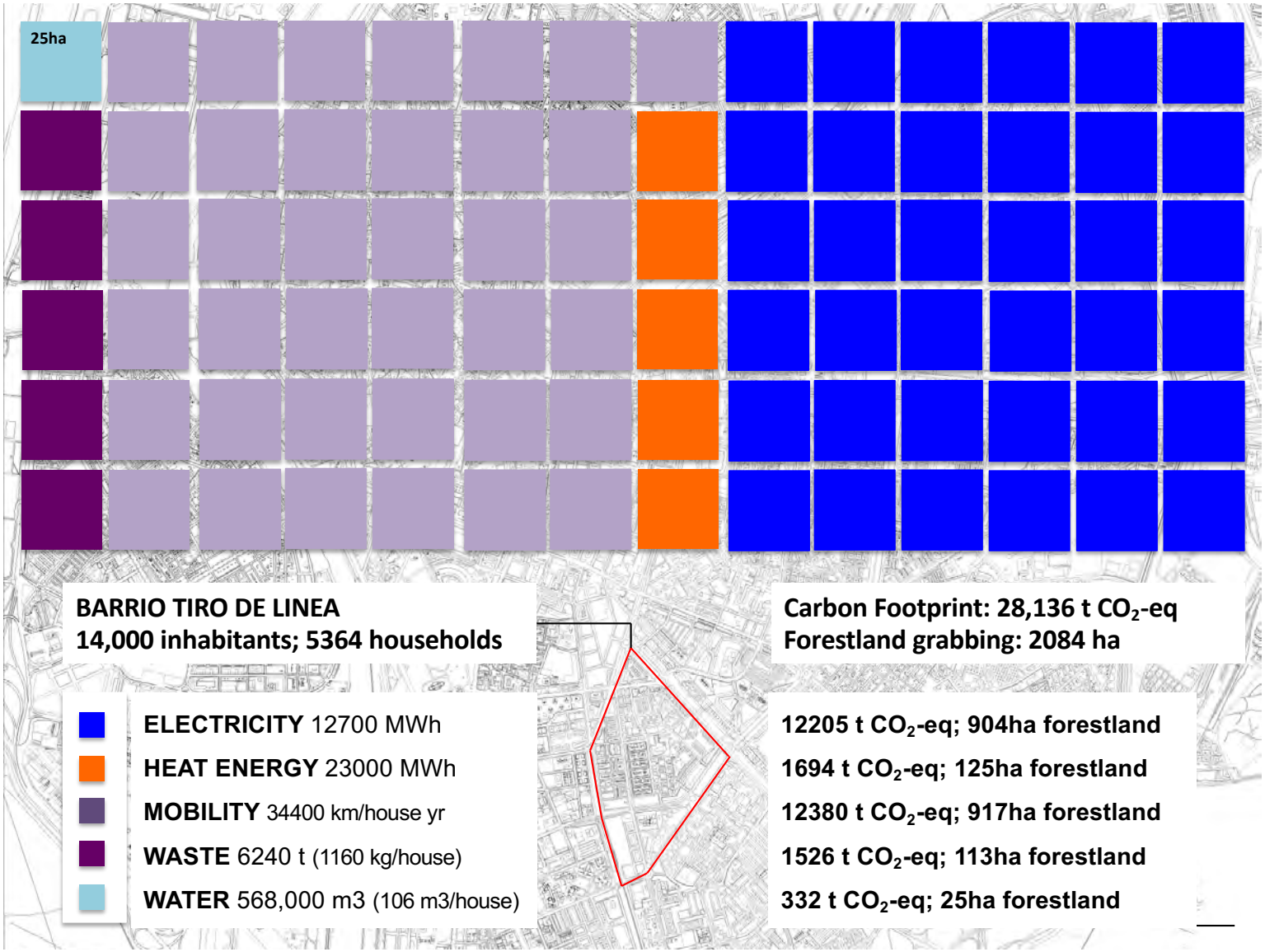
Source: Agencia Andaluza de la Energìa; Anuario Estatistico de la Ciudad de Sevilla 2017

CARBON ACCOUNTING NEIGHBOURHOOD

What is the impact of the Barrio Tiro de Linea?




25ha
BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households
Carbon Footprint: 28,136 t CO_2-eq
Forestland grabbing: 2084 ha
1 km


25ha
BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households
Carbon Footprint: 28,136 t CO_2-eq
Forestland grabbing: 2084 ha
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)
12205 t CO_2-eq; 904ha forestland
1694 t CO_2-eq; 125ha forestland
12380 t CO_2-eq; 917ha forestland
1526 t CO_2-eq; 113ha forestland
332 t CO_2-eq; 25ha forestland


Sevilla
400
años
IMAGINE YOUR CITY
Sevilla
La mirada innovadora

TAPPING INTO THE POTENTIAL

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Copenhague 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

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peatones, bici

coches buses (travías)

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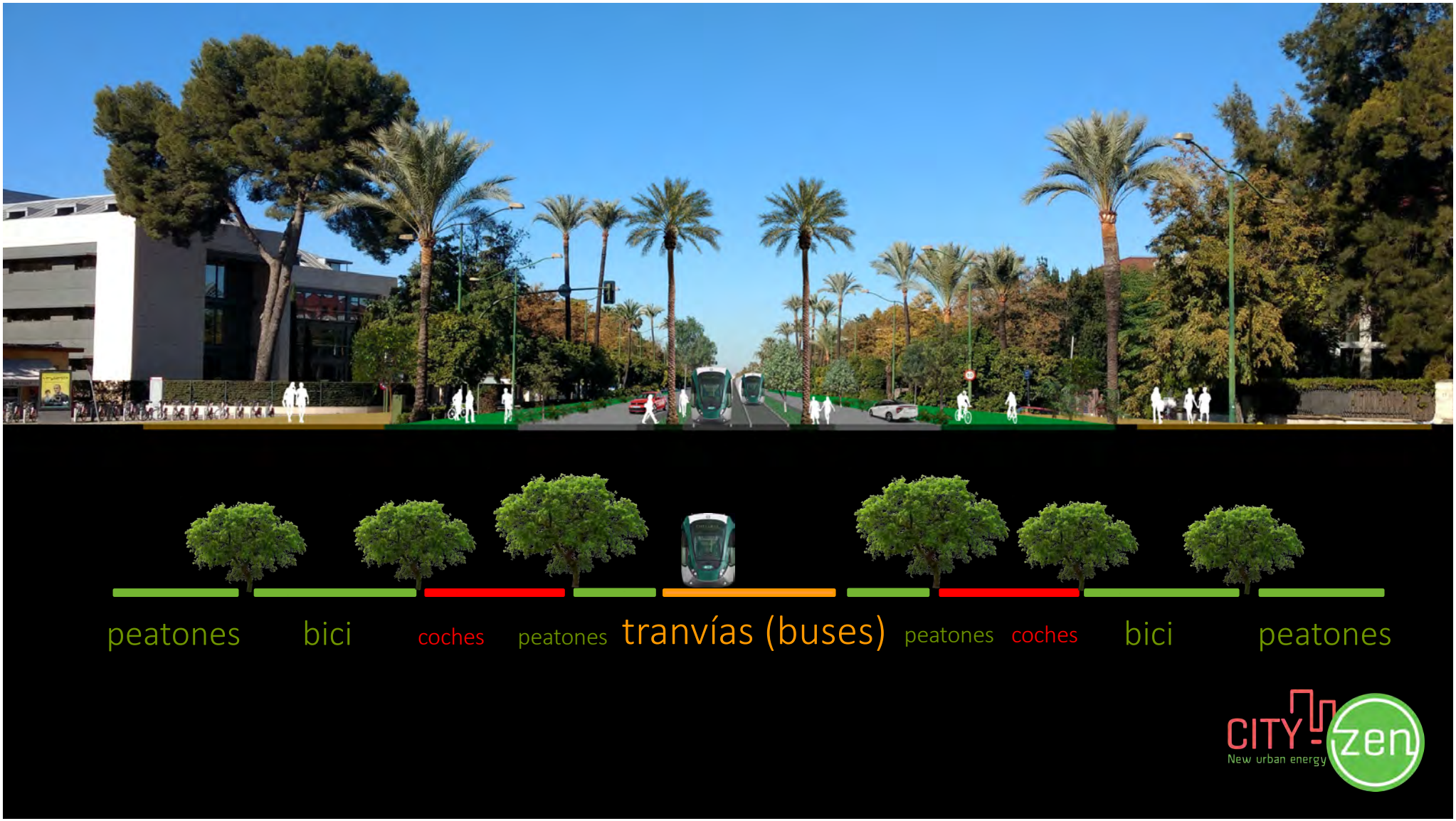
peatones
bici
coches
peatones
tranvías (buses)
peatones
coches
bici
peatones
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Cities

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RESILIENT CITIES
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Manuel Calvo @ The Guardian

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GREEN HEROS
Huerta del Rey Moro
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TIRO DE LÍNEA

TIRO DE LÍNEA

GREEN HEROS CTUED

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NEVERTHELESS
Grupo
E@sy 2000
Infraestructuras
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NEVERTHELESS
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DISRUPTIVE CHANGE

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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

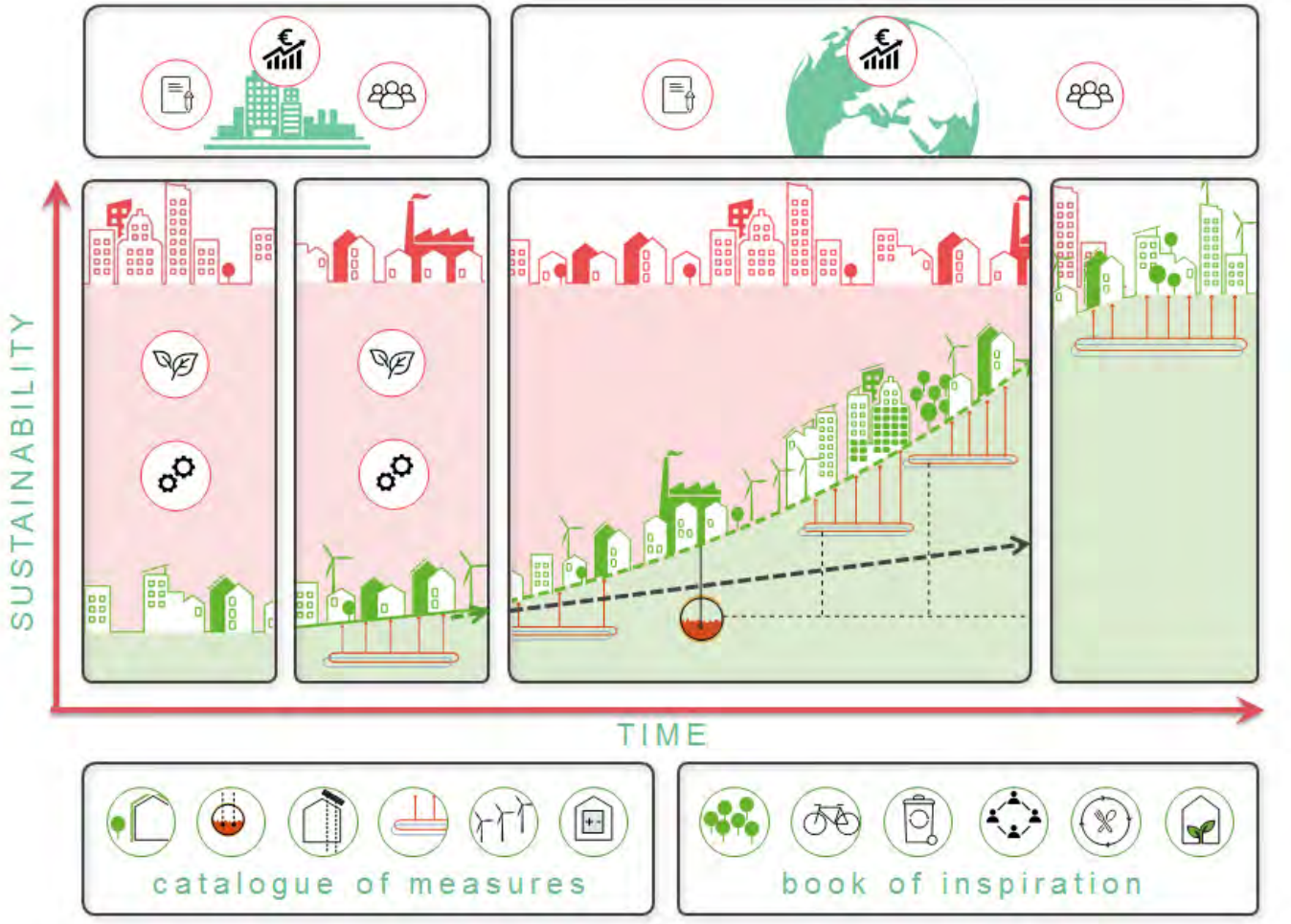
- Prof. **Andy van den Dobbelsteen** (TU Delft)
- Dr. **Riccardo Pulselli** (Universitá di Siena)
- **Matteo Maccanti** (Universitá di Siena)
- Dr. **Han Vandevyvere** (EnergyVille)
- Dr. **Leen Peeters** (Think!E)

Student facilitators

- **Eva Farrugia** (TU Delft)
- **Michael Cobb** (TU Delft)
- **Álvaro Rodriguez 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

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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**

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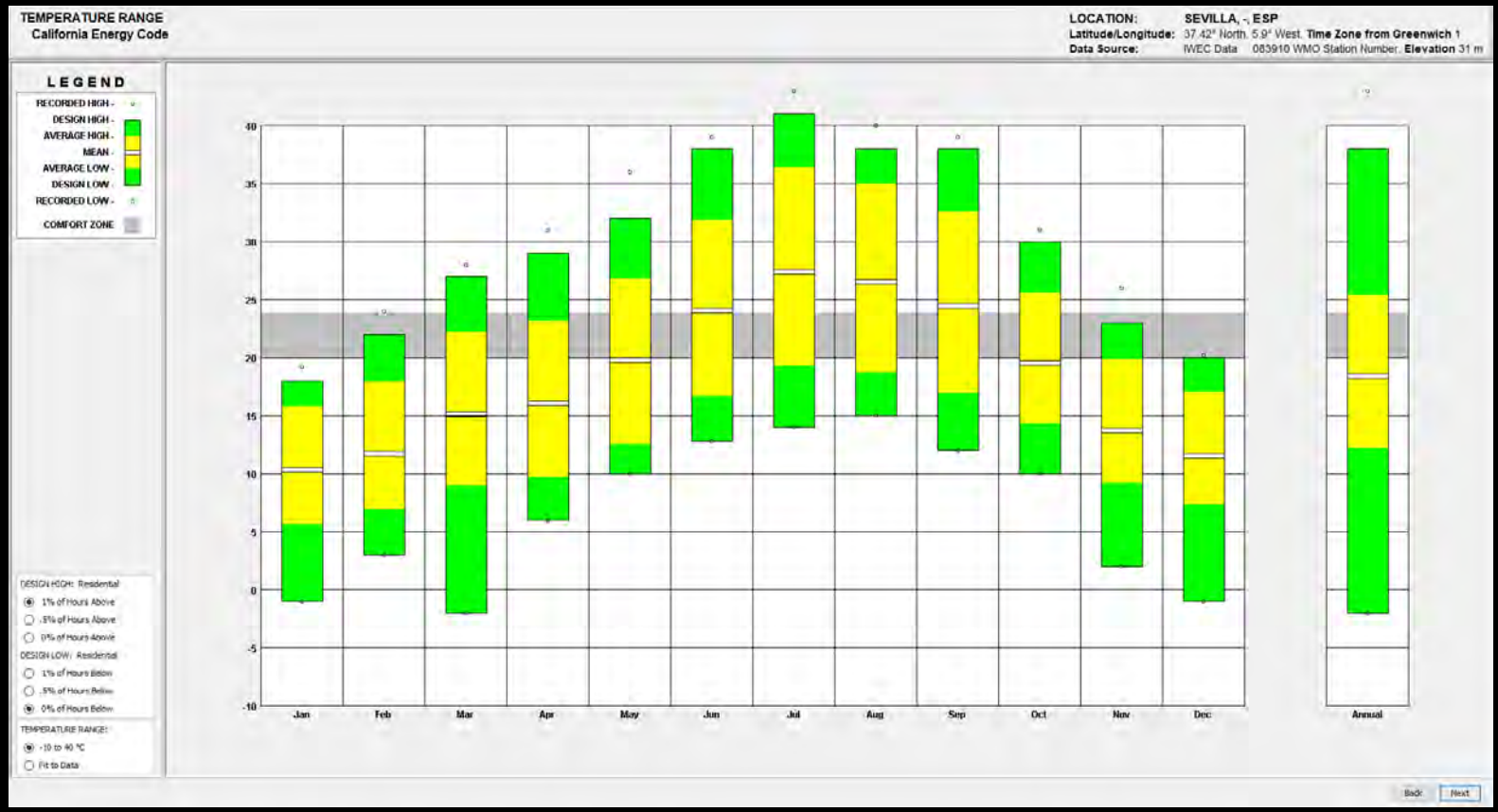
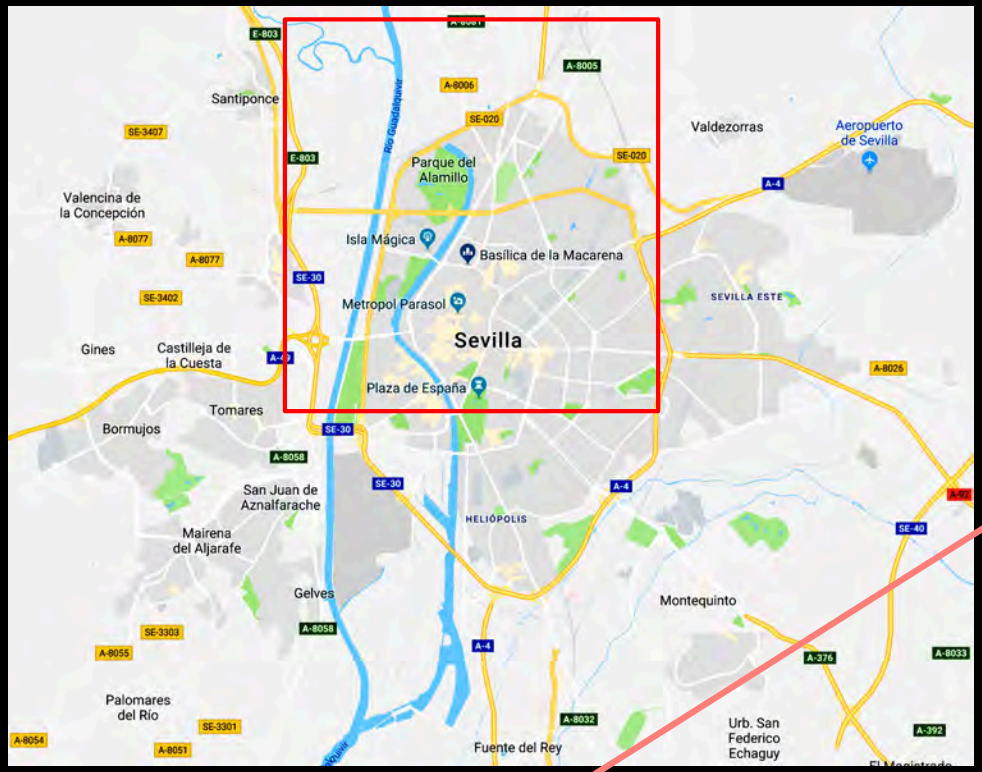
Climate data

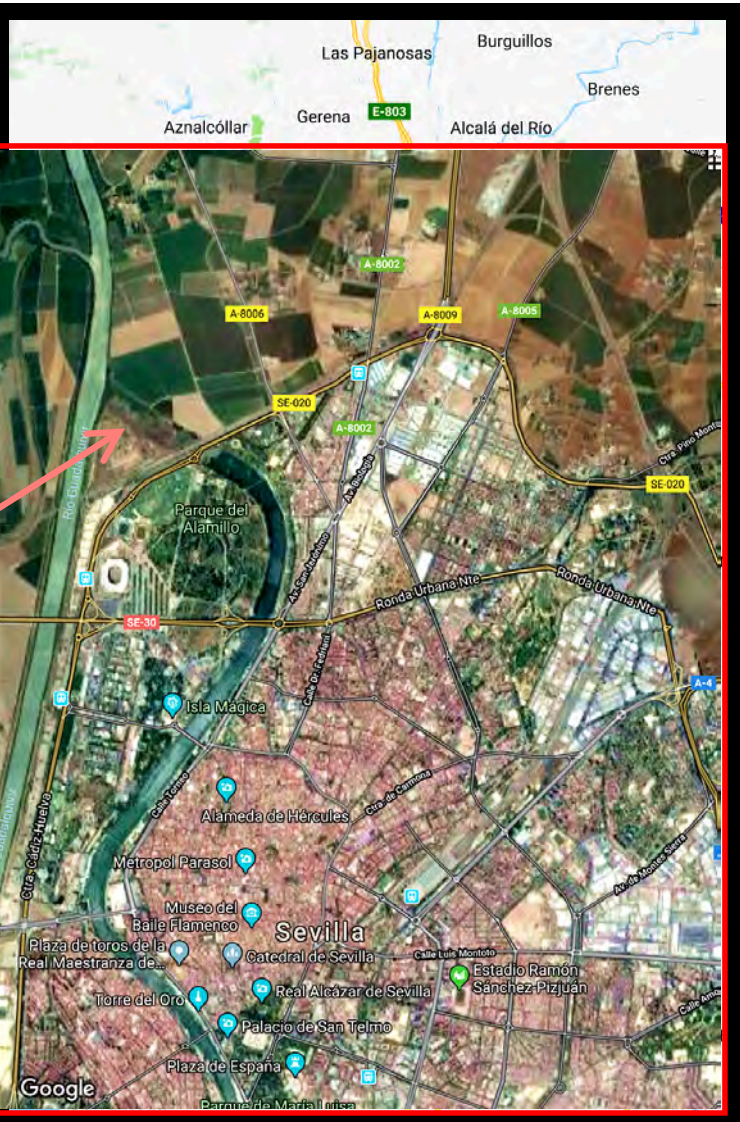
Conclusion: mean temperature ≈ 18ºC → **soil perfect for cooling/pre-heating**



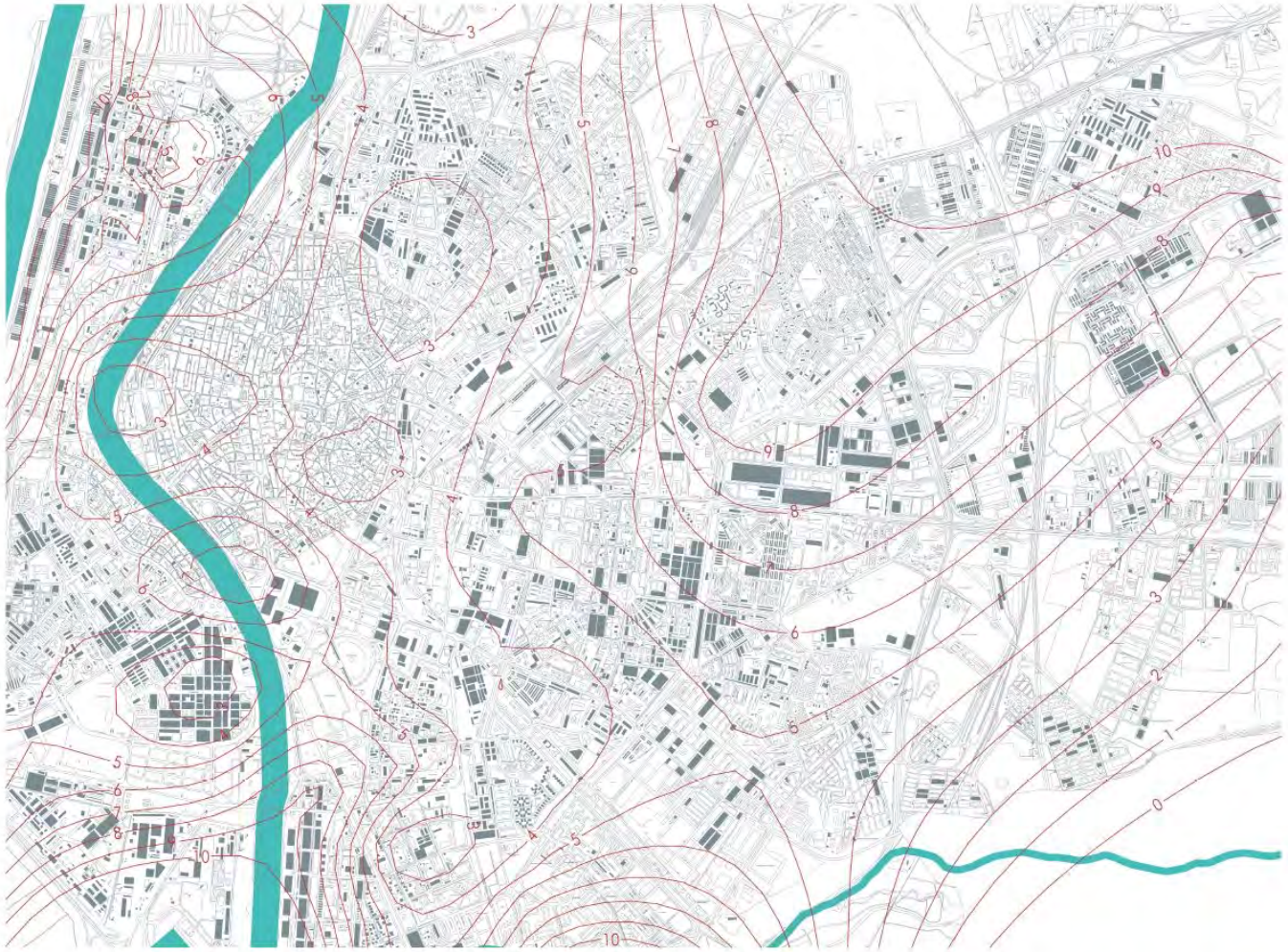
Source: ClimateConsultant / IWEC Data

Water – Guadalquivir & Sevilla





What is happening here?



Escala 1/25000

0 500 1000 2000 m

Mapa geotécnico básico de Sevilla **5**
Profundidad del nivel freático (m)

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MACRO SCALE

WATER IN THE CITY

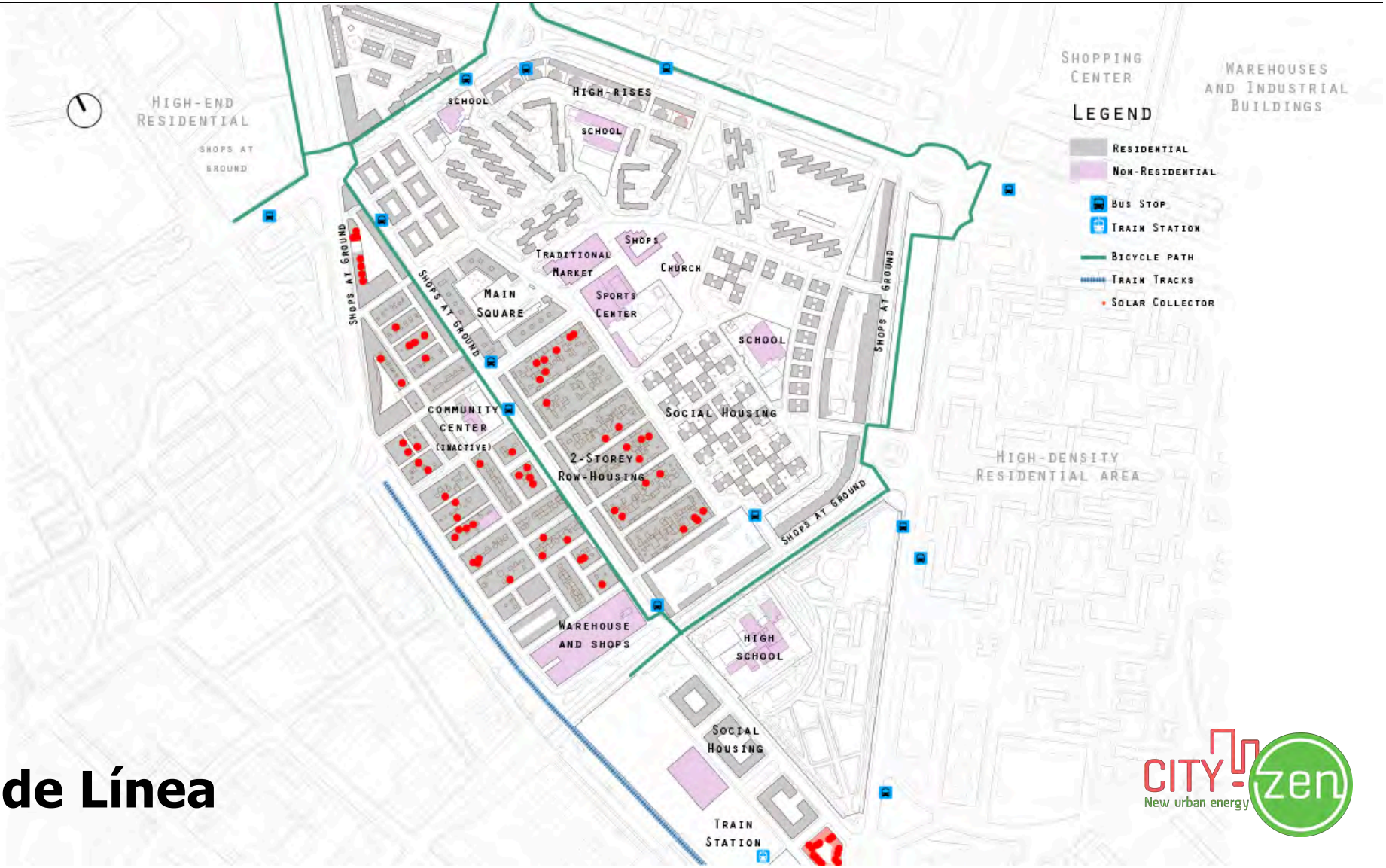
Reconnect the city to the Guadalquivir and use flowing water to cool and humidify it

MACRO SCALE

WATER IN THE CITY

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

Tiro de Línea



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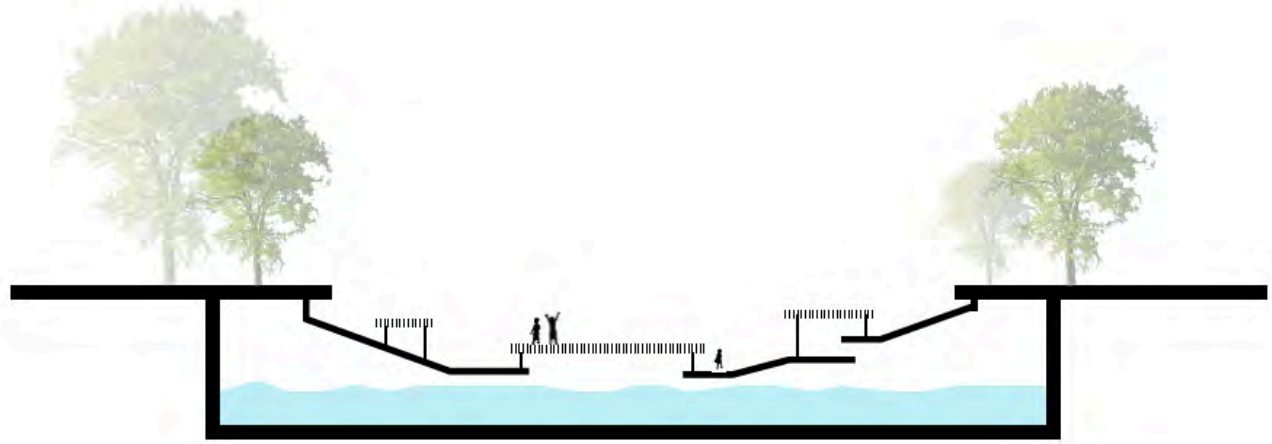
MESO SCALE

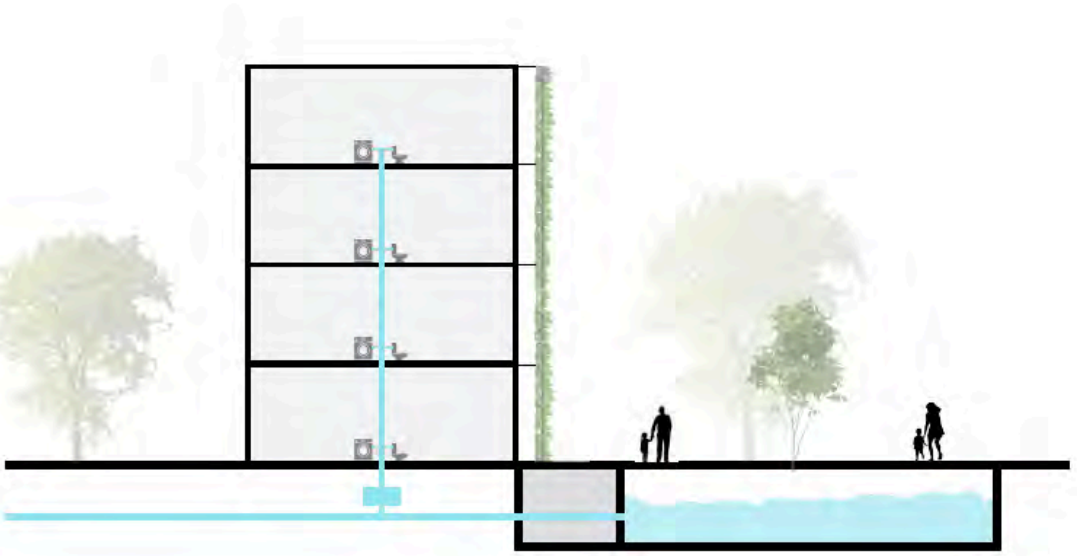
CAPTURE & STORE

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



MICRO SCALE
CAPTURE & USE

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



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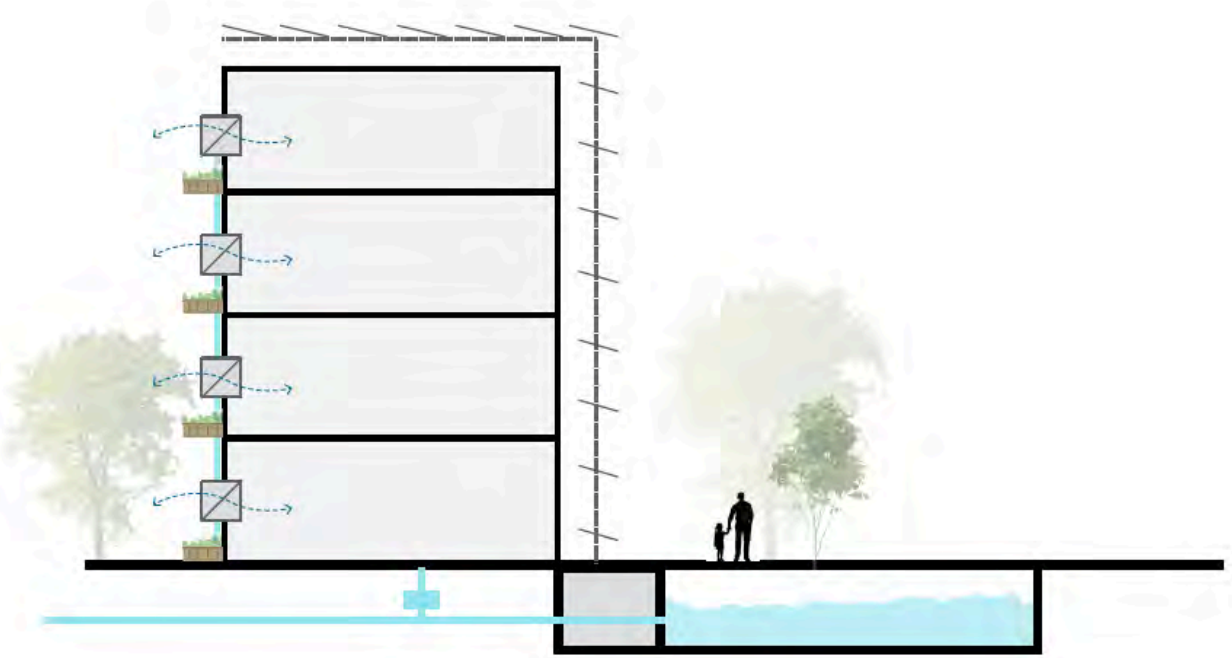
MICRO SCALE

CAPTURE & REUSE

Condensate Irrigation from Heat Exchangers



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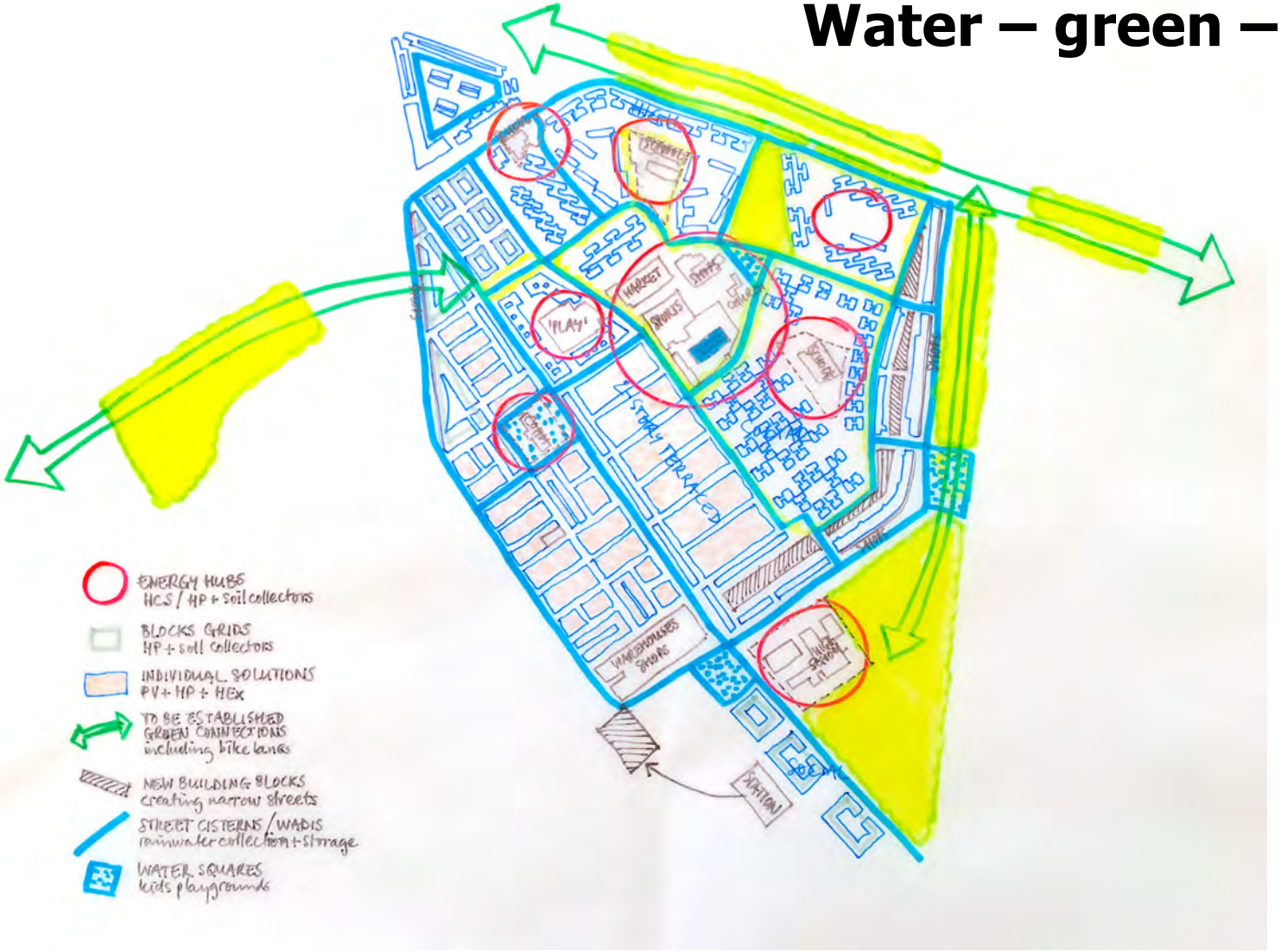
Tiro de Línea
Water infra

Water – green – energy hubs



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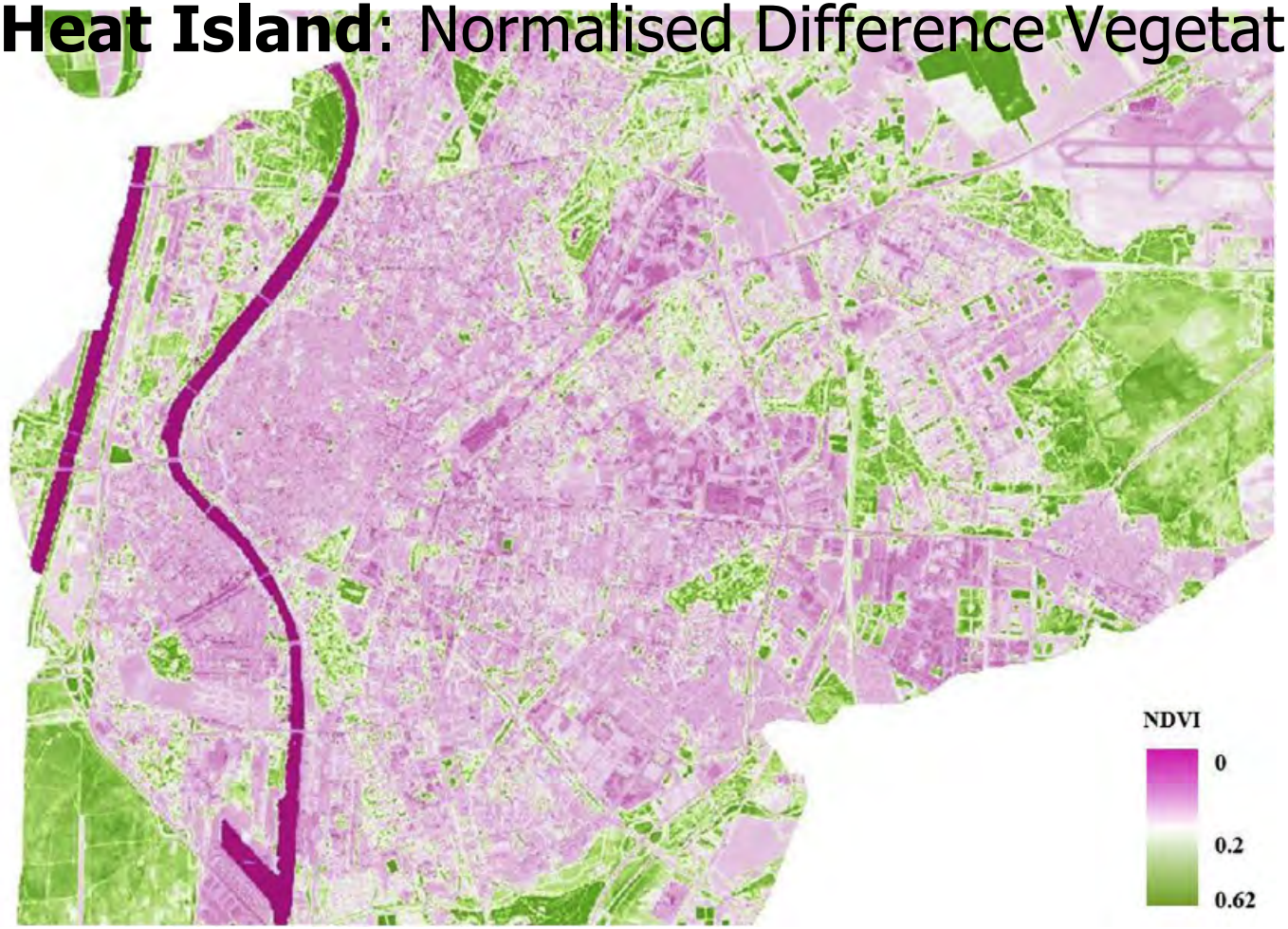
Kronsberg

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

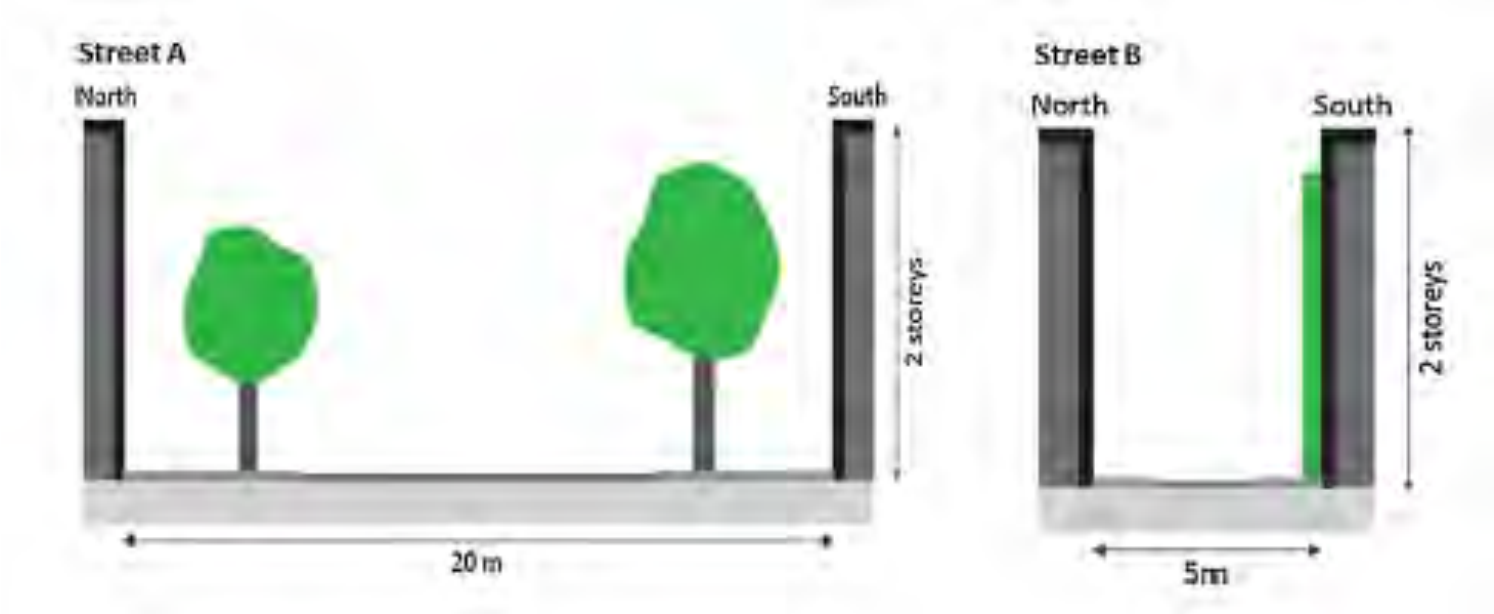
Percentage of green roofs needed due to climate change

Table 2
Estimation of the green roof surface necessary to mitigate ΔT due to climatic change.

Period	SERES climatic scenario	T^{CC}_{max} (°C)	ΔT_{max} (°C)	Landsat 7 ETM+			
				$NDVI^{CC}$ (dim)	S^{CC}_{ug} (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

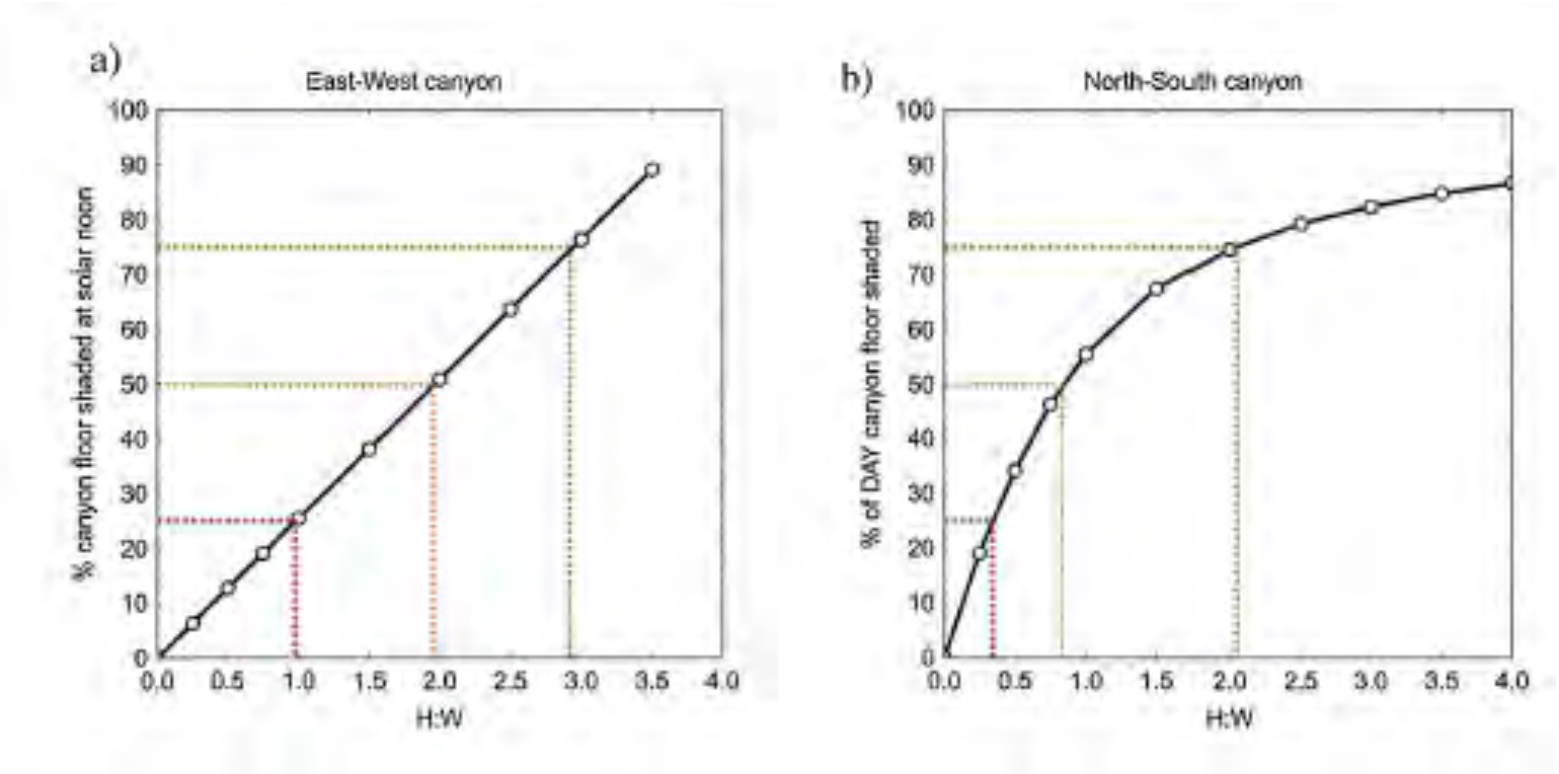
Herrera-Gomez S., Quevedo-Nolasco A., Pérez-Urrestarazu L. (2017); The role of green roofs in climate change mitigation - A case study in Seville (Spain); Building and Environment 123, p. 575-584

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

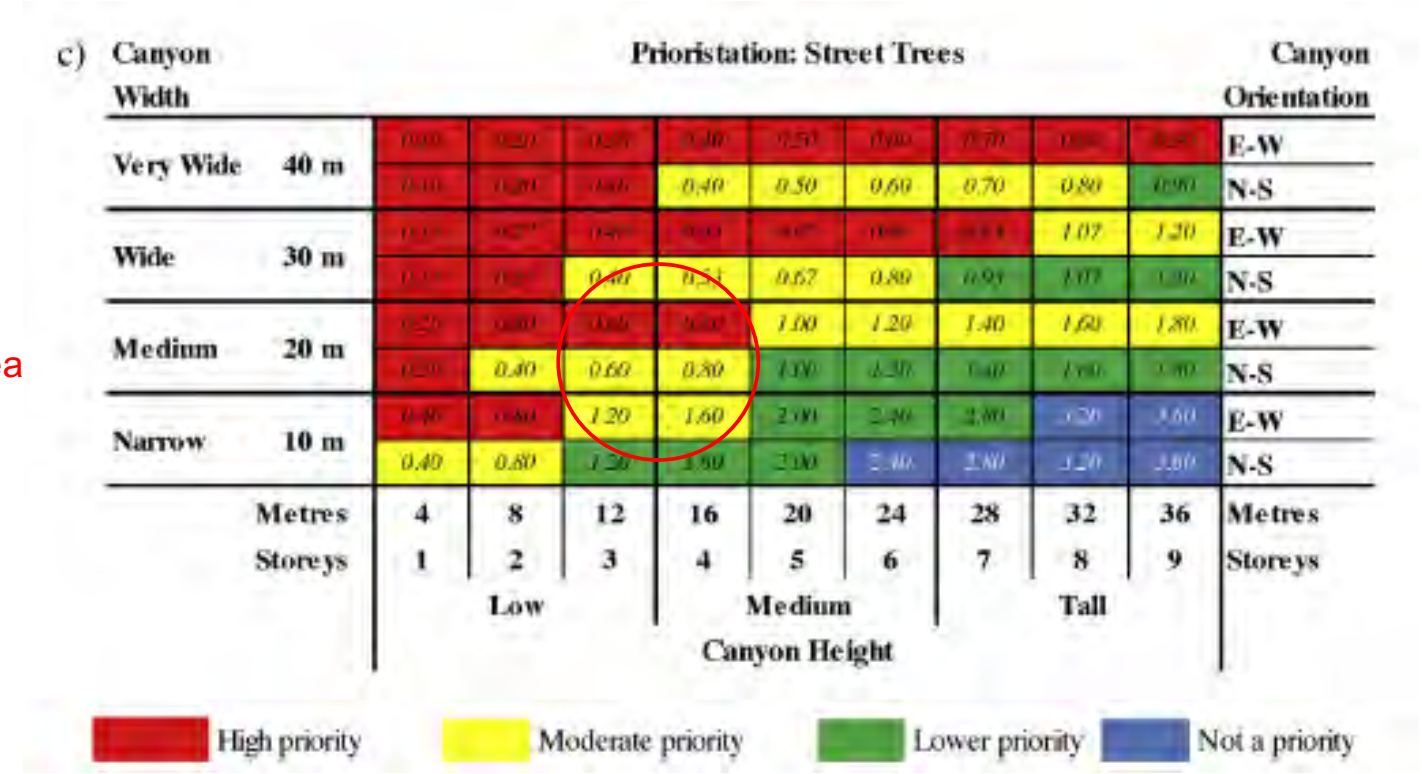
Percentage of street shaded with different height/widths



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



c) Canyon Width — Prioristation: Street Trees — Canyon Orientation

Canyon Width		Canyon Orientation
Very Wide	40 m	E-W
		N-S
Wide	30 m	E-W
		N-S
Medium	20 m	E-W
		N-S
Narrow	10 m	E-W
		N-S

Metres	4	8	12	16	20	24	28	32	36	Metres
Storeys	1	2	3	4	5	6	7	8	9	Storeys
		Low			Medium			Tall		

Canyon Height

High priority | Moderate priority | Lower priority | Not a priority

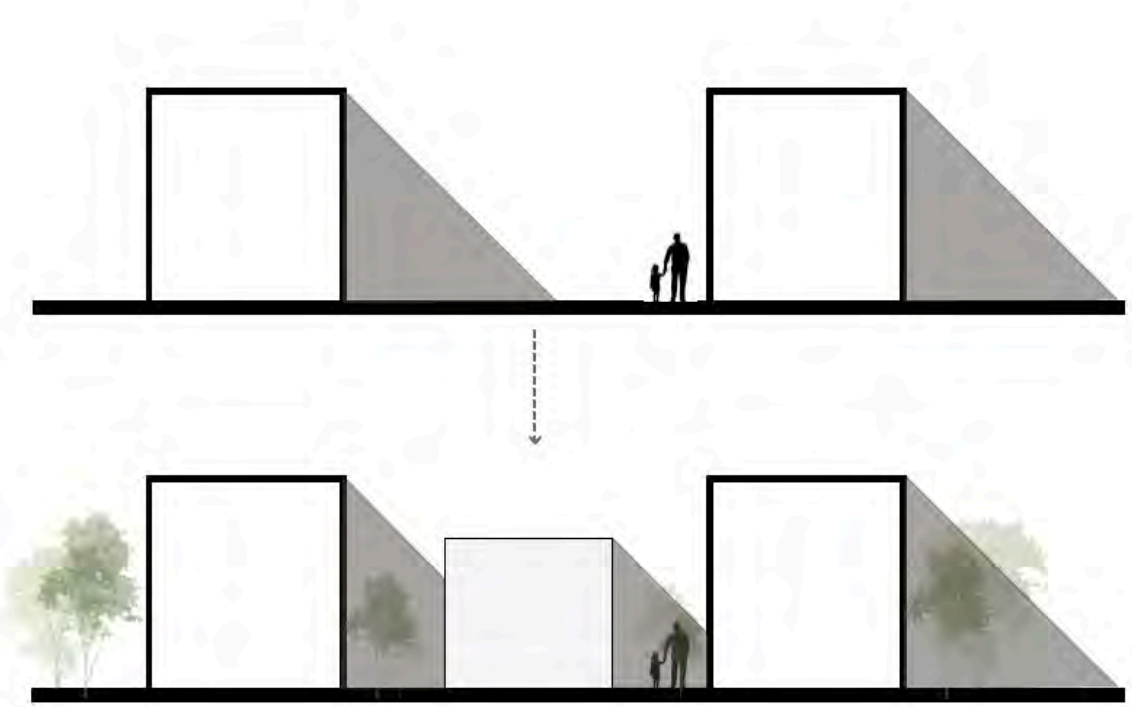
Norton A. et al. (2015); Planning for cooler cities: A framework to prioritise green infrastructure to mitigate high temperatures in urban landscapes; Landscape and Urban Planning 134, p. 127–138

CITY-zen New urban energy

PASSIVE ENERGY
RENOVATION STRATEGIES

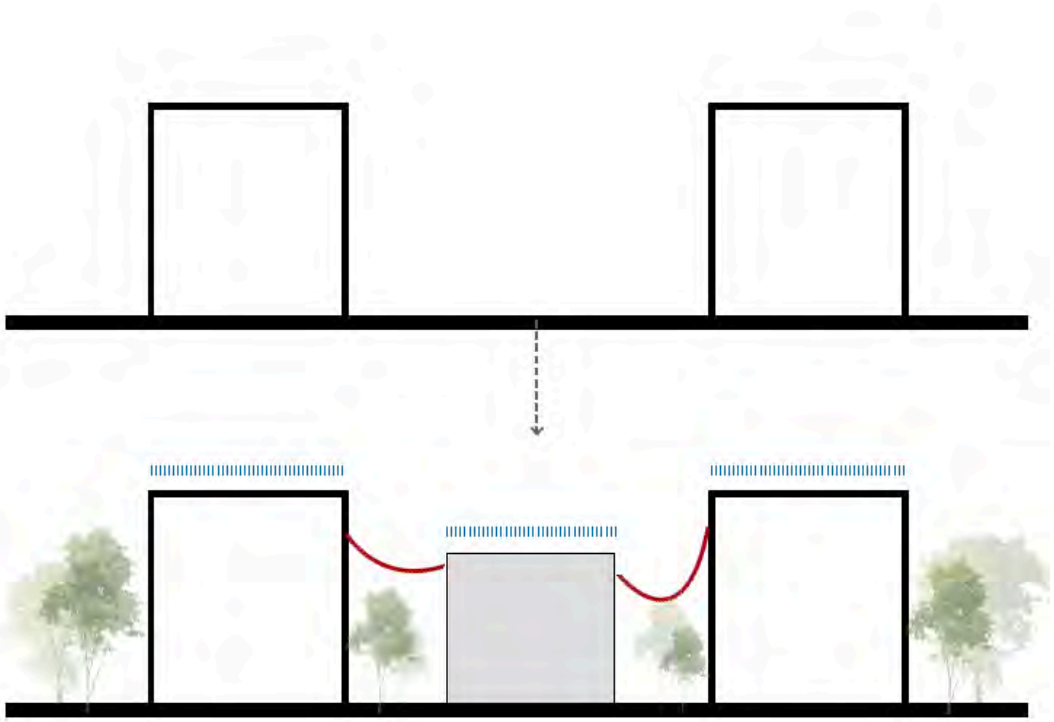
INNER-CITY DENSITIES - SELF SHADING

INCREASED SHADING MEANS COOLER PATHS TO WALK ALONG AND COOLER BUILDINGS



CITY-zen
New urban energy

PASSIVE ENERGY
RENOVATION STRATEGIES
INNER-CITY DENSITIES



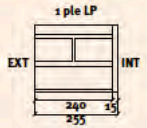
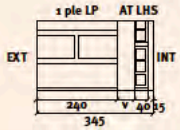
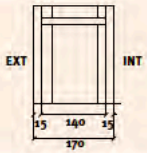
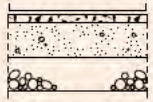
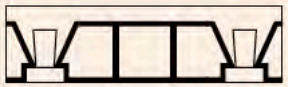
CITY-zen
New urban energy

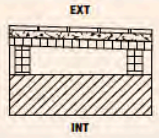
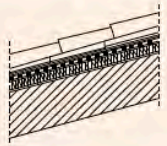
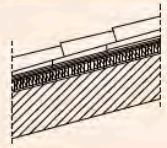
New Stepped Strategy for energy-positive (re) design

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

CITY-zen
New urban energy

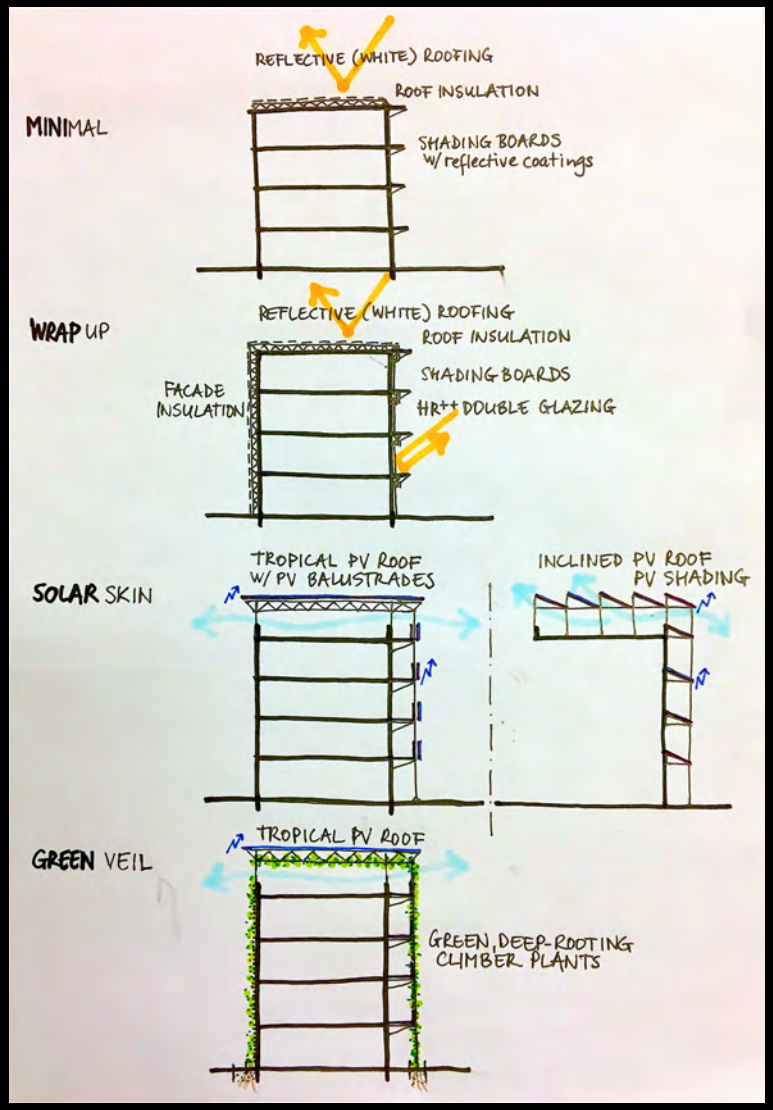
Typical facades and roofs

Nombre	Transmitancia	Capas materiales	Secciones
Fachada 1	U = 2.65 W/m² K	"1 pie LP métrico o catalán 40 mm < G < 60 mm" + "Enlucido de yeso 1000 < d < 1300"	
Fachada 2	U = 1.57 W/m² 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 W/m² 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 W/m² K	"Piedra caliza dura [2000 < d < 2190]"	
Suelo 1	U = 3.06 W/m² 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 W/m² 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 W/m² 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 W/m² 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 W/m² 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]

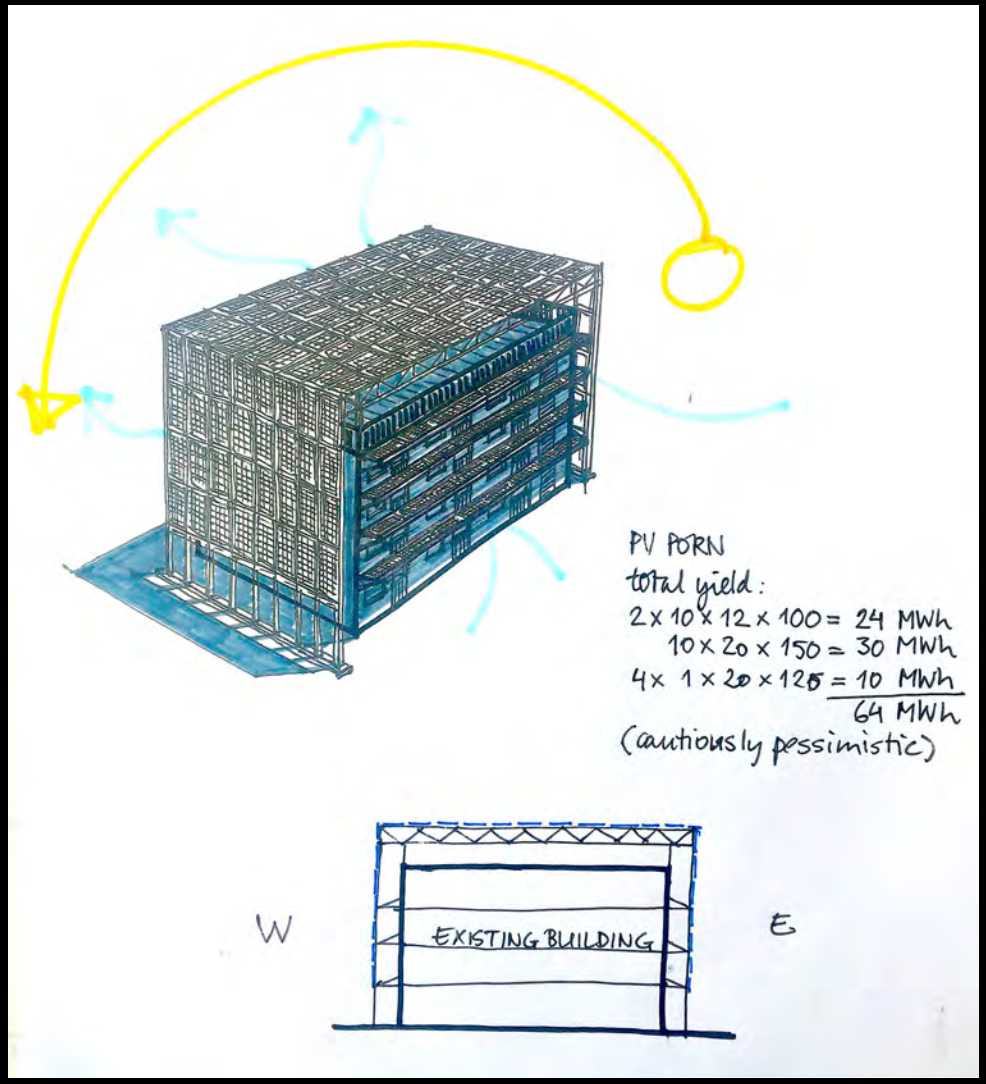
CITY zen
New urban energy



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**

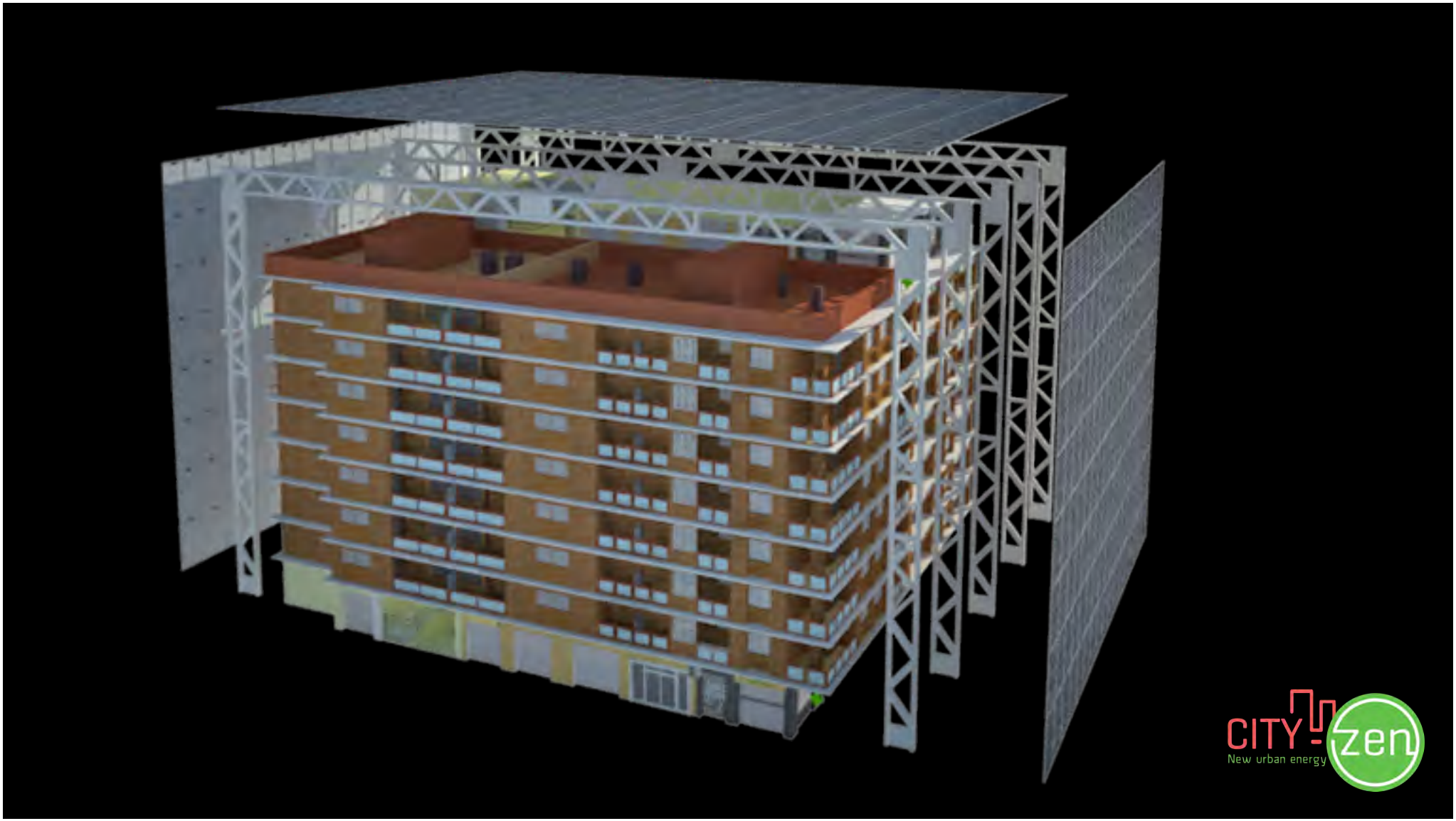
CITY-zen
New urban energy



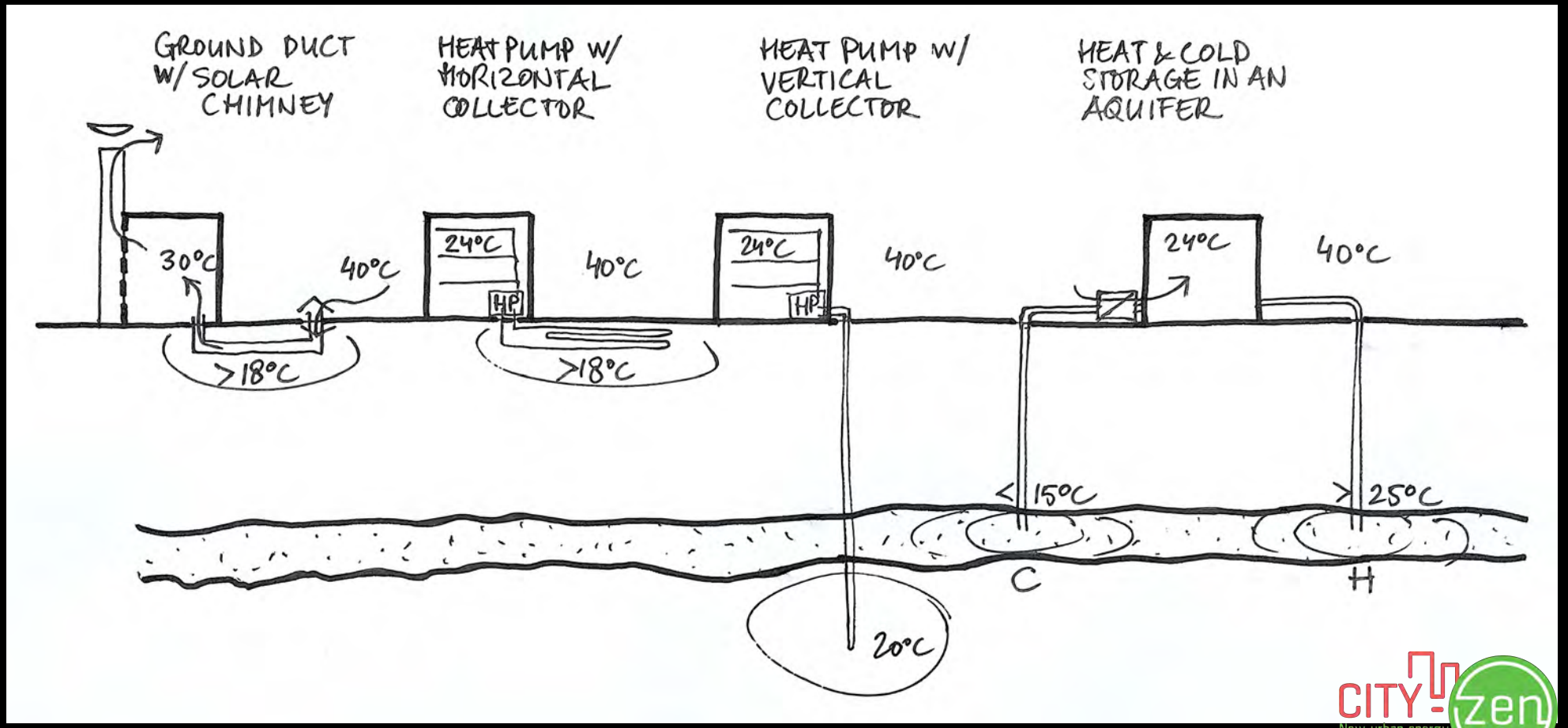
PV porn

- **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

CITY-zen
New urban energy


CITY-zen
New urban energy

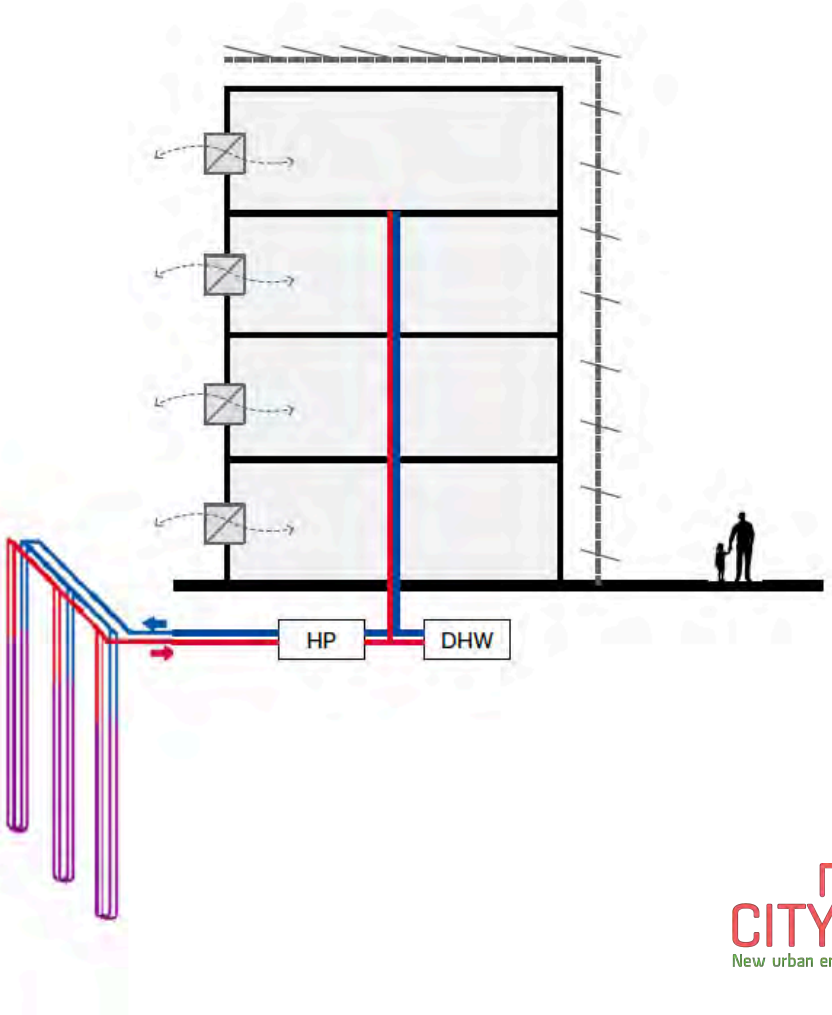
Soil energy options – from passive to active



ACTIVE ENERGY RENOVATION STRATEGIES

INDIVIDUAL

Vertical soil collectors, individual heat pumos, PV panels and heat exchangers



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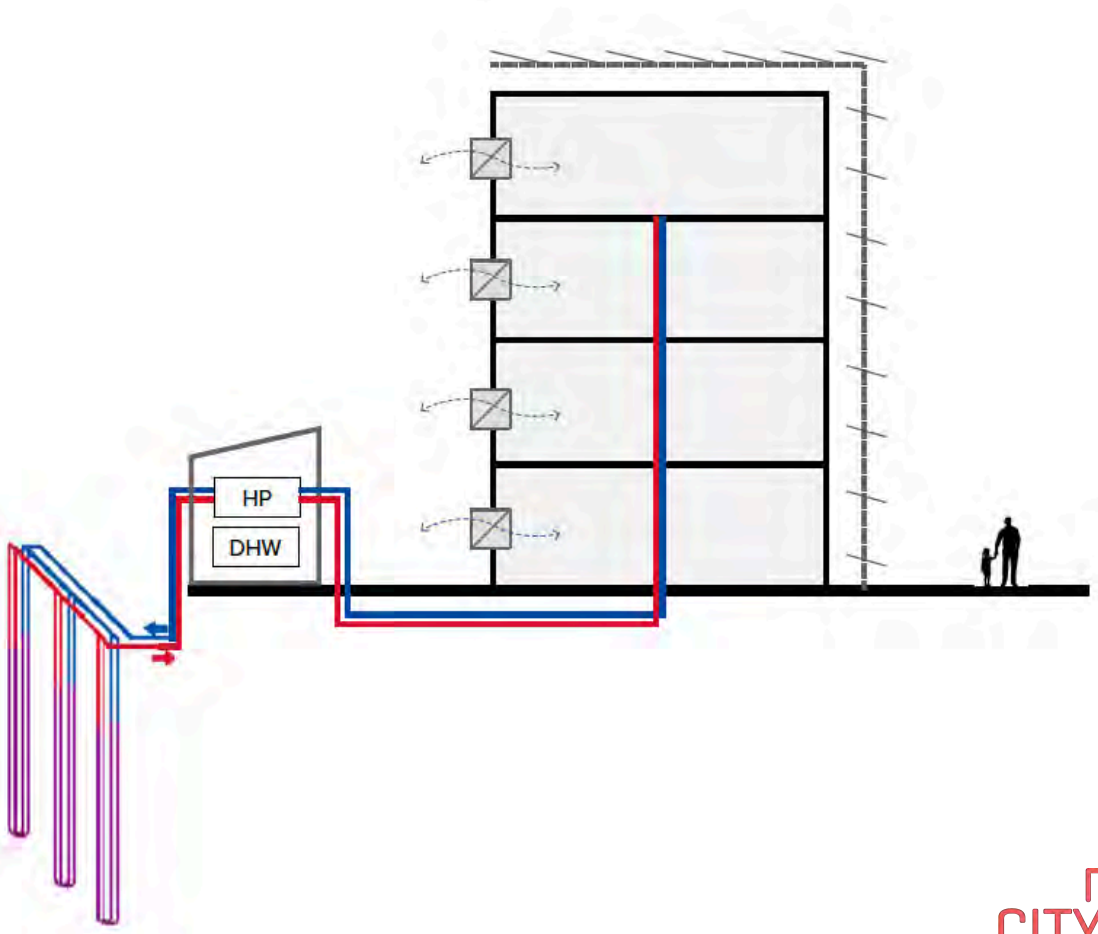
New urban energy

ACTIVE ENERGY RENOVATION STRATEGIES

COLLECTIVE

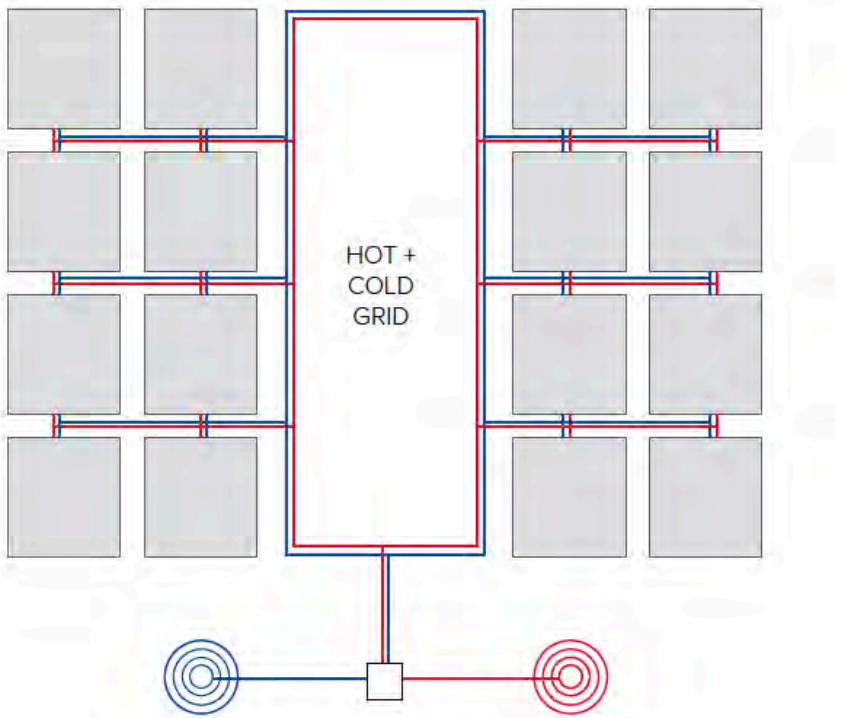
Collective system with a cool/warm air supply and a professionally- managed system.



ACTIVE ENERGY RENOVATION STRATEGIES

COMMUNAL

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



CITY-zen
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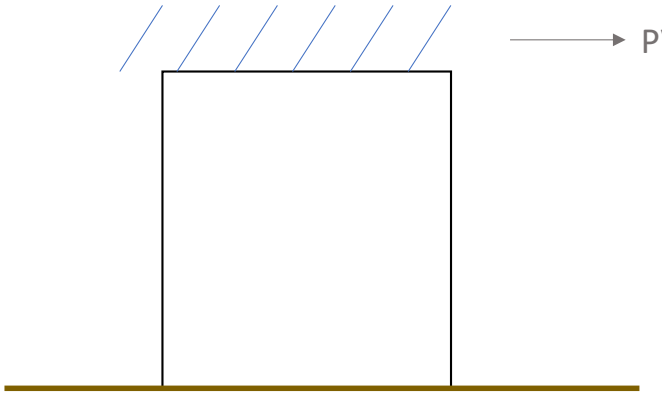
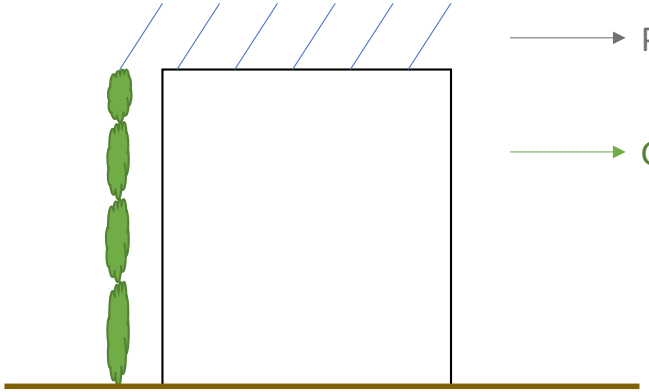
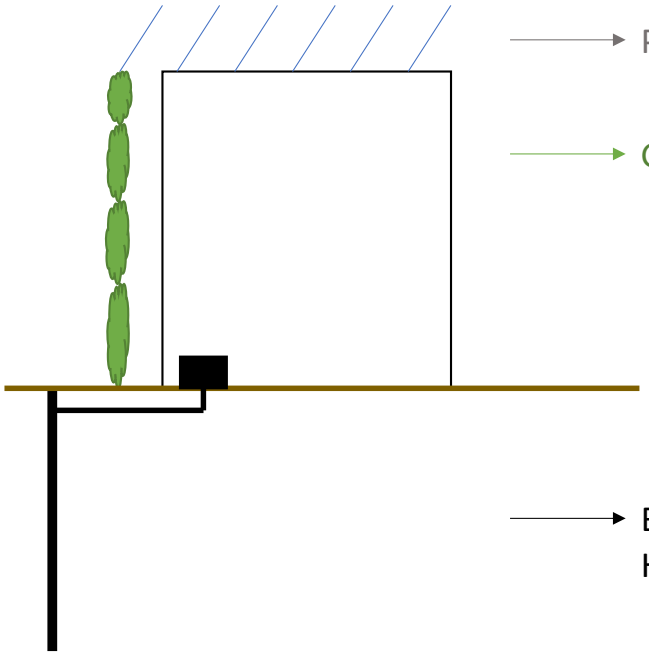


PV: 4.2 kW/flat → 4200 €



PV: 4.2 kW/flat → 4200 €

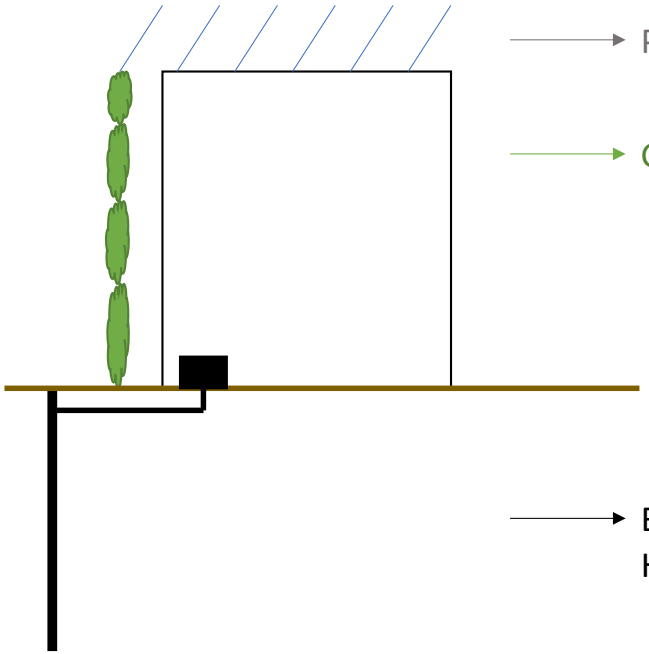
Green: 4000 €/ housing block



PV: 4.2 kW/flat → 4200 €

Green: 4000 €/ housing block

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



→ PV: 4.2 kW/flat → 4200 €

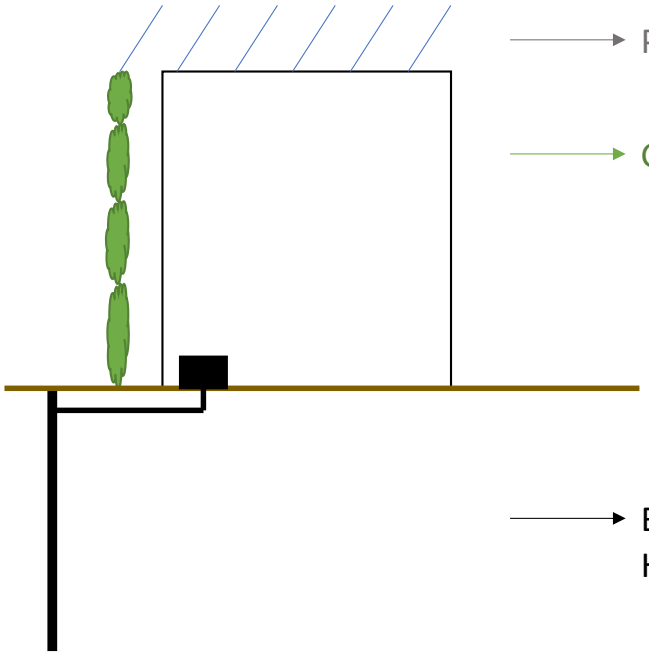
→ Green: 4000 €/ housing block

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

→ **Investment 4200 € + (4000 €)/3 + 1250 € + 4000 € = 10 783 €**
→ **Annual energy cost 630 €**
→ **Annual maintenance 100 €**

→ **10 year balance: 18 083 €**

CITY-zen
New urban energy



→ PV: 4.2 kW/flat → 4200 €

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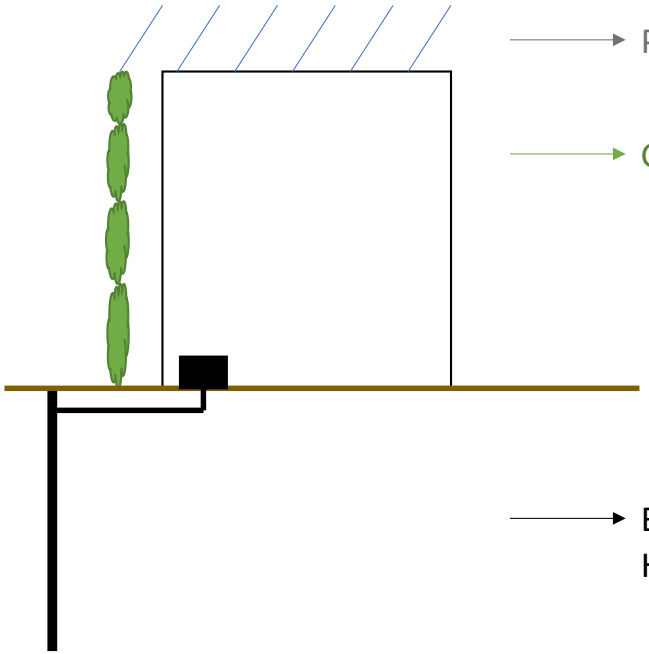
→ ENERGY COOPERATIVE

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

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

CITY-zen
New urban energy



PV: 4.2 kW/flat → 4200 €

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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

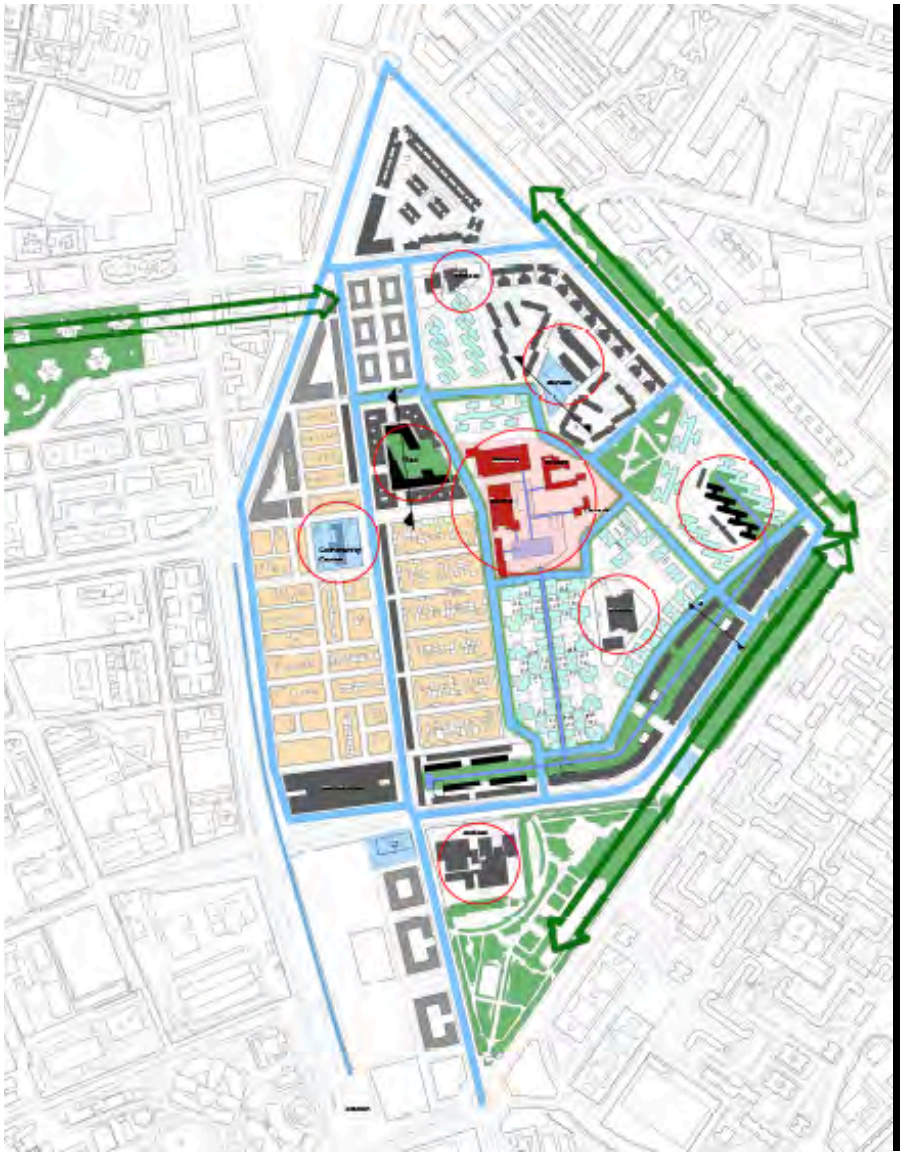
Mierda...

CITY zen
New urban energy

An energy cooperative could involve waste processing

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

CITY-zen
New urban energy

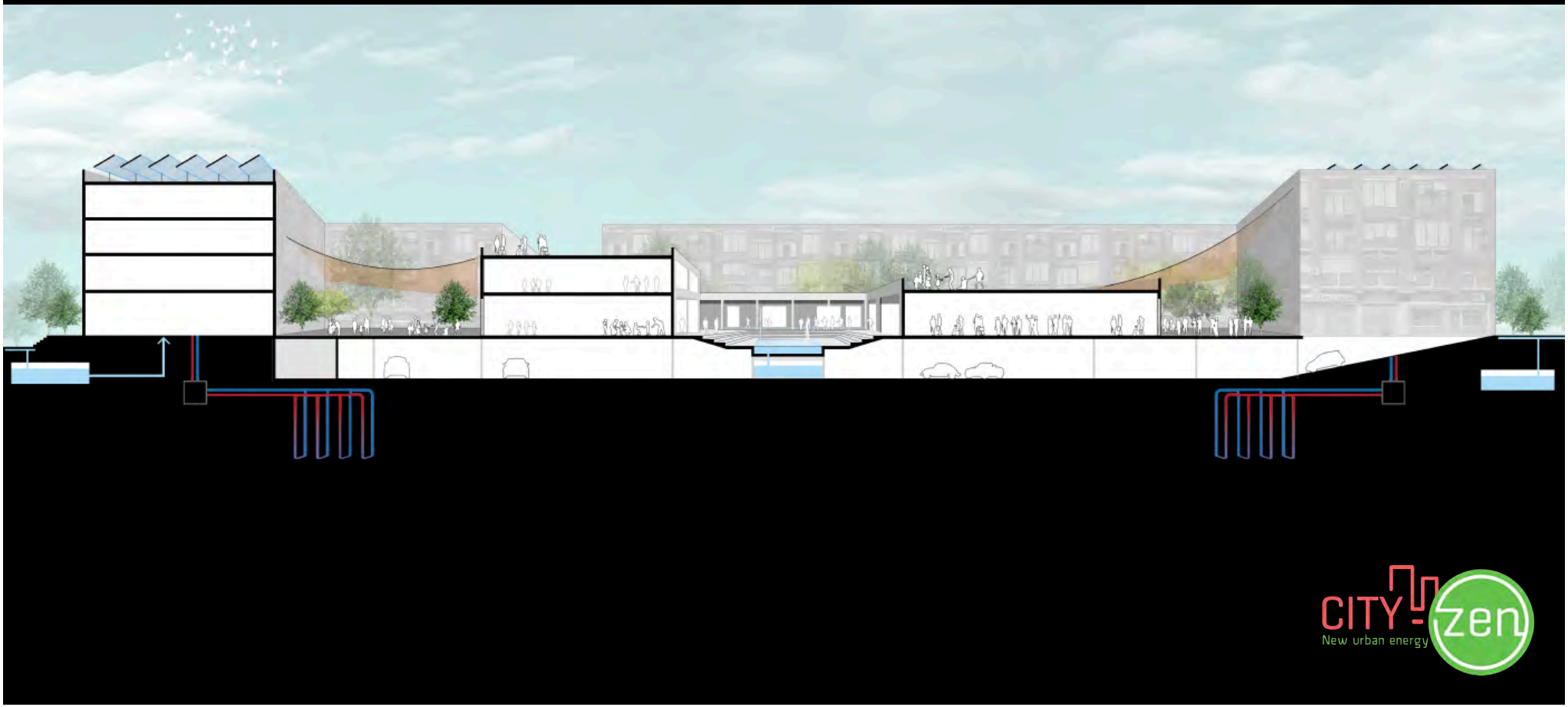


Tiro de Línea sostenible

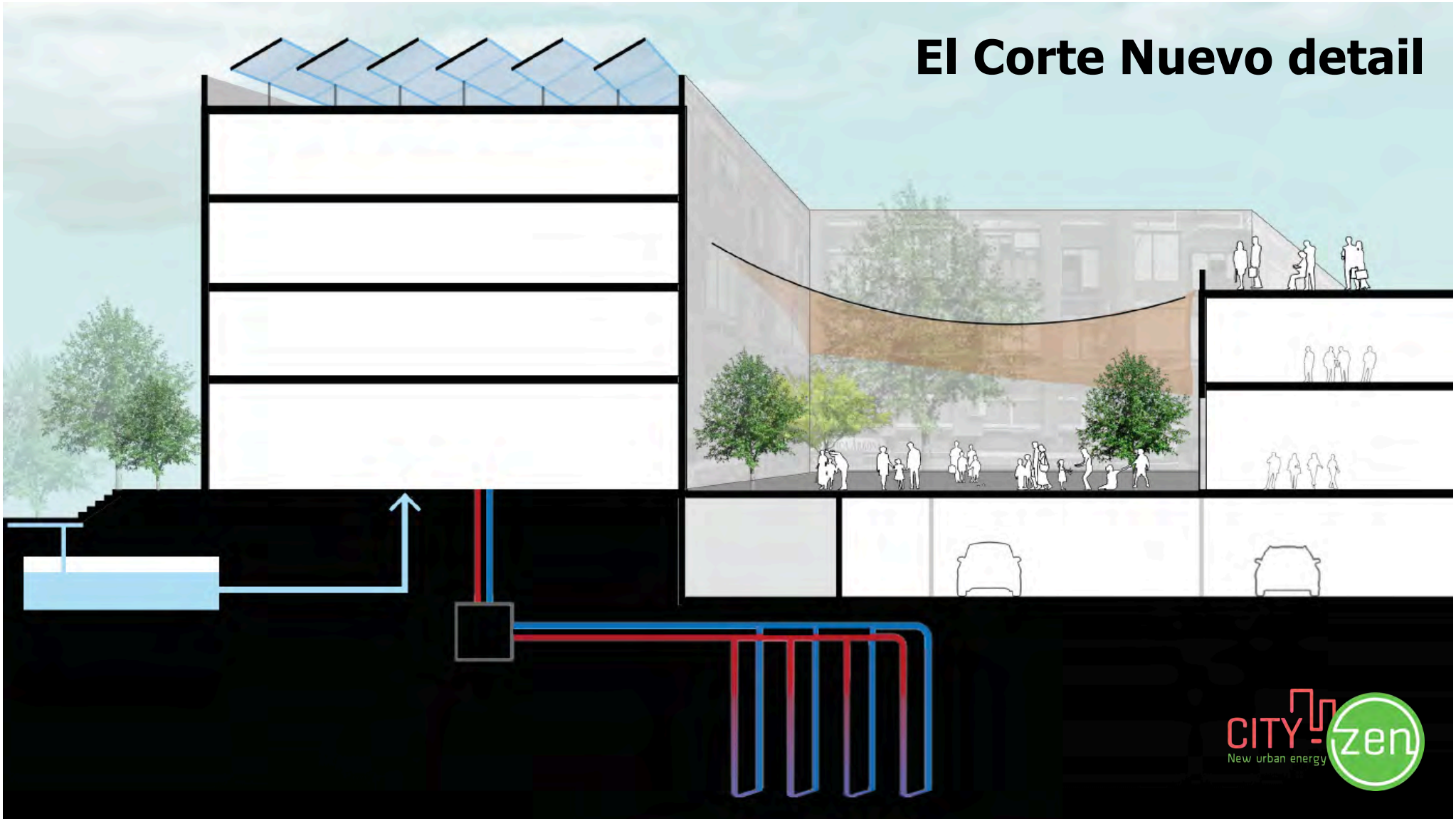
- Rainwater collection and usage
- Green infrastructure
- Energy renovation of buildings
- Energy cooperations that serve energy hubs
- Clean waste management
- Sustainable mobility: bikes and electric cars

CITY-zen
New urban energy

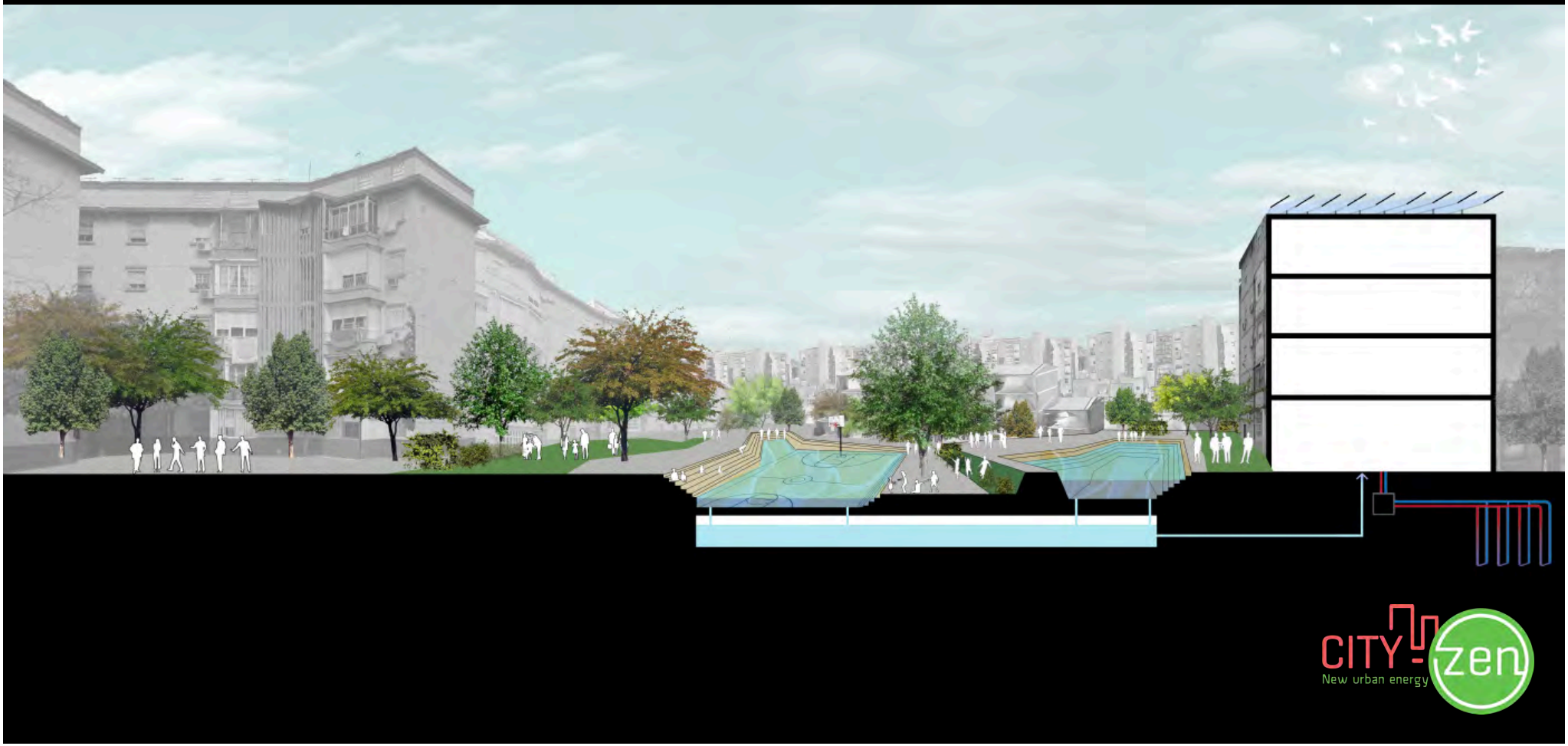
El Corte Nuevo



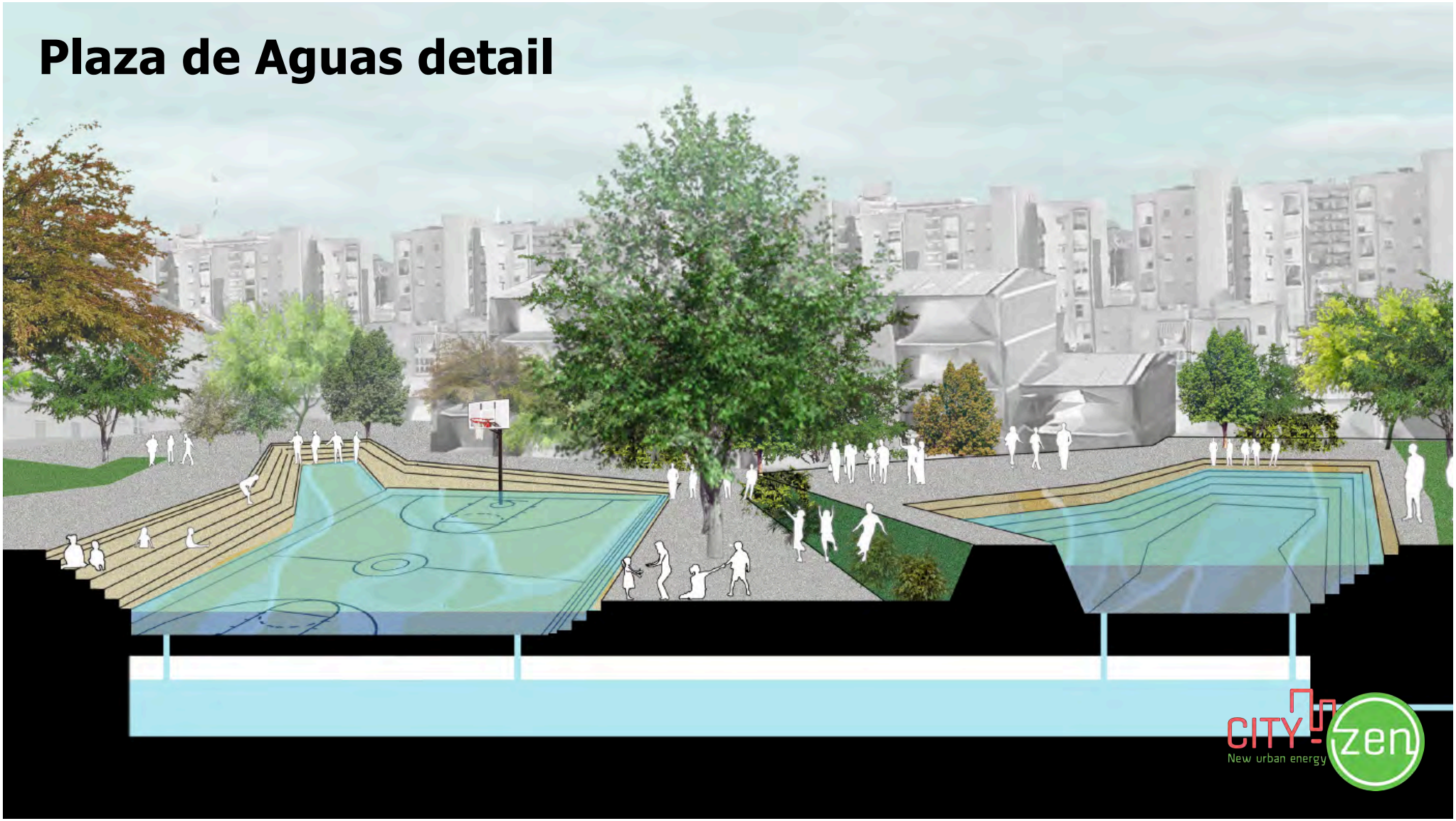
El Corte Nuevo detail



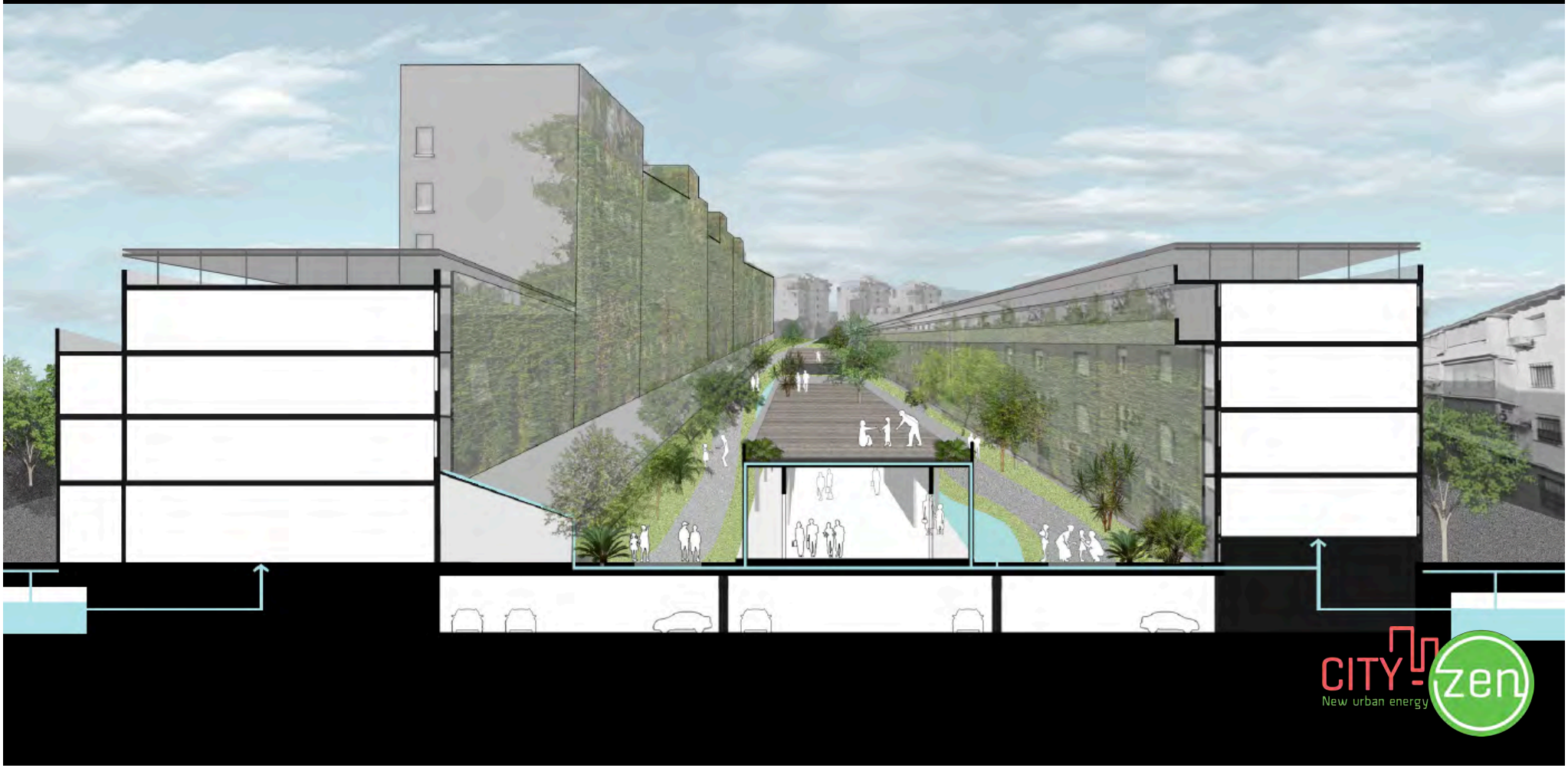
Plaza de Aguas



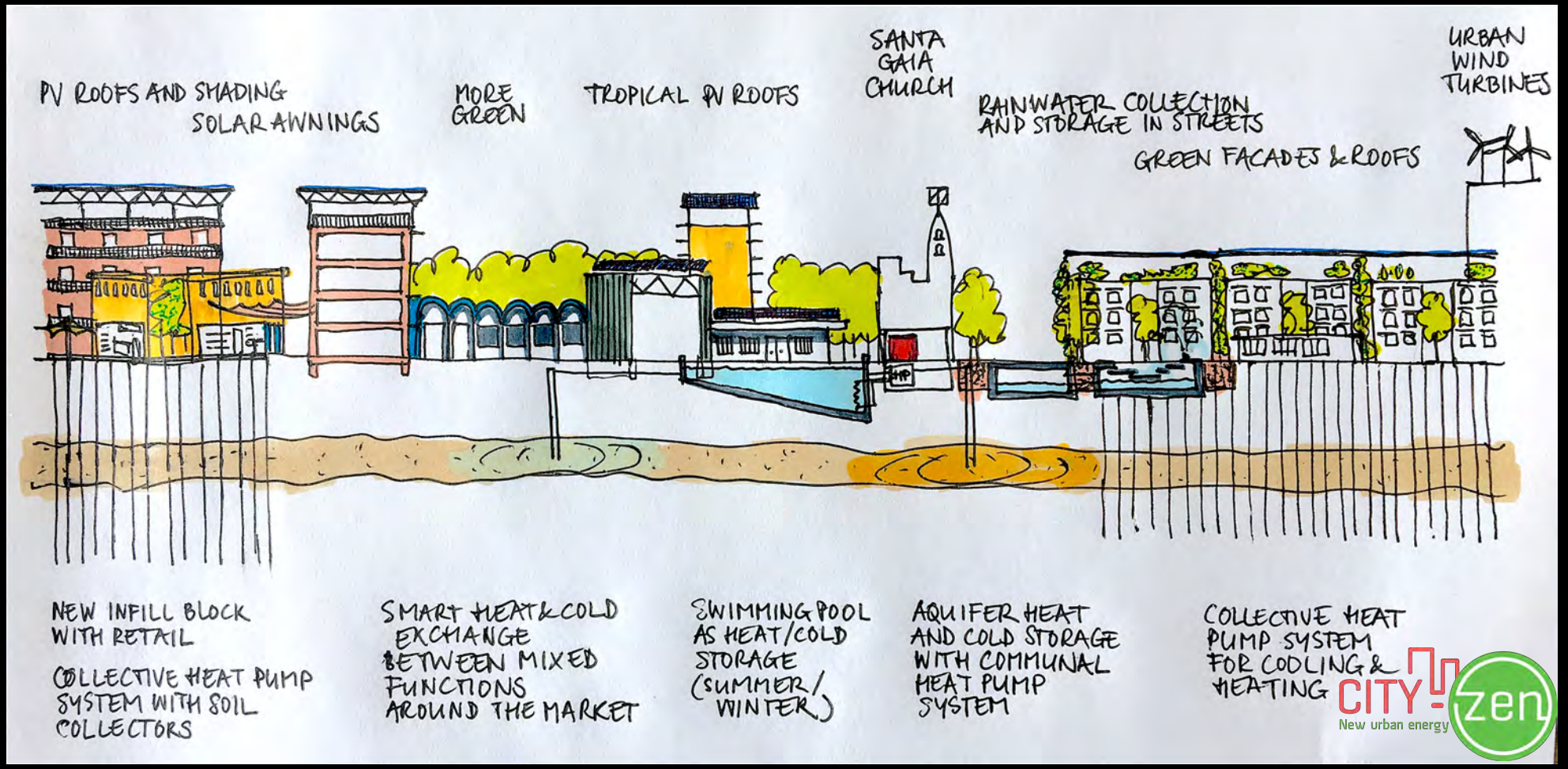
Plaza de Aguas detail



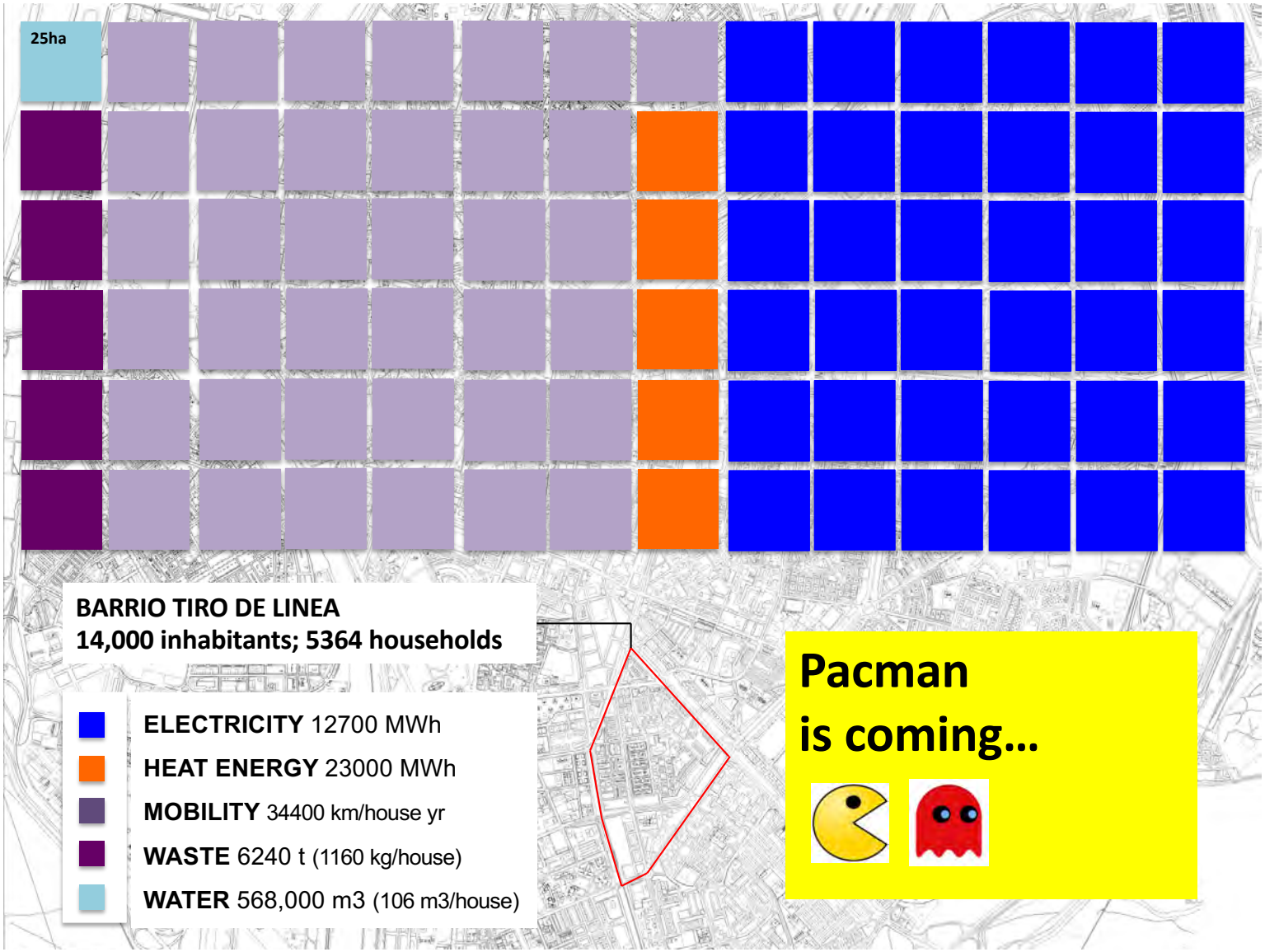
Rambla verde

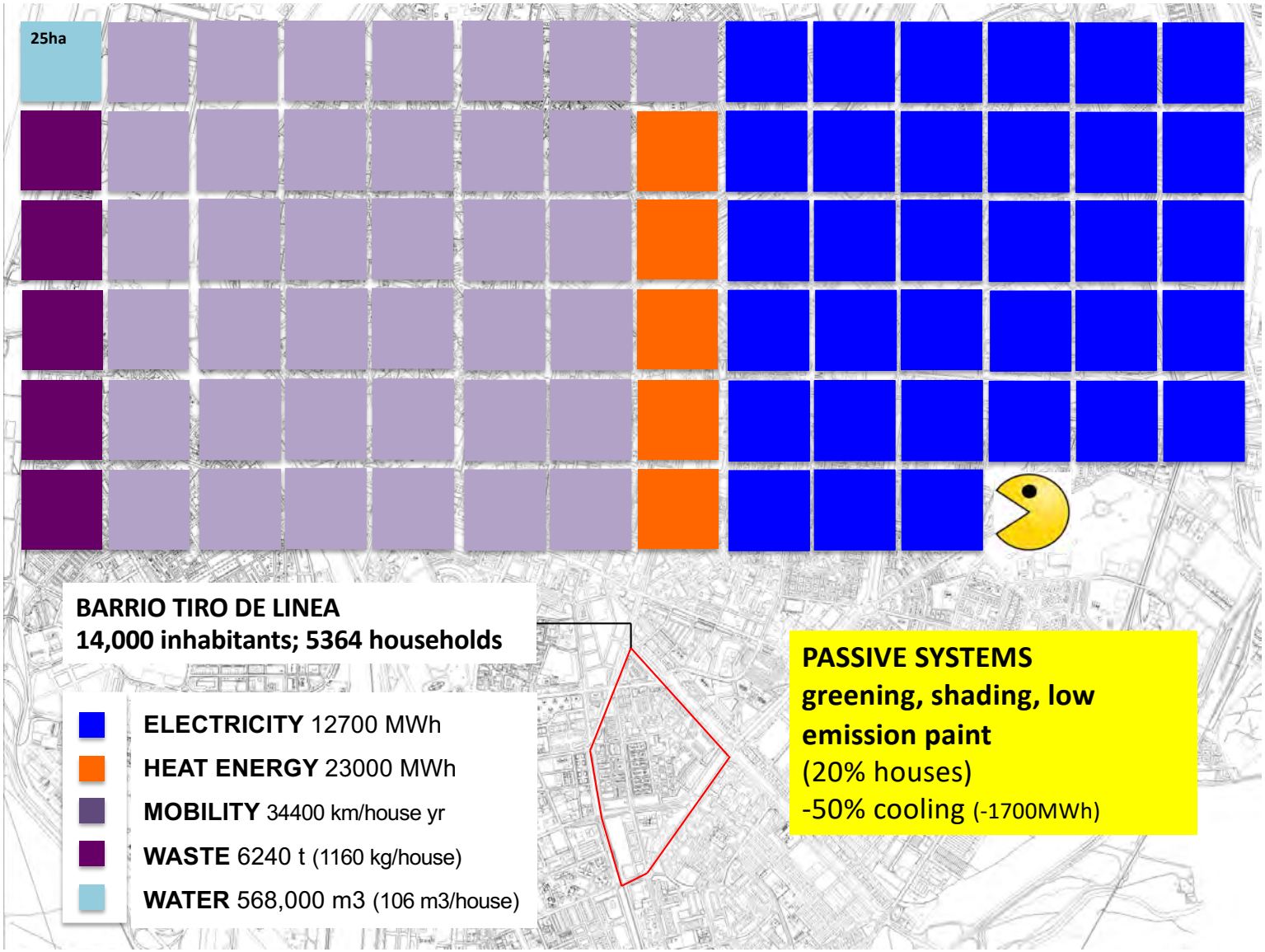


Tiro de Línea sostenible



CARBON FOOTPRINT MITIGATION MEASURES


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)
Pacman
is coming…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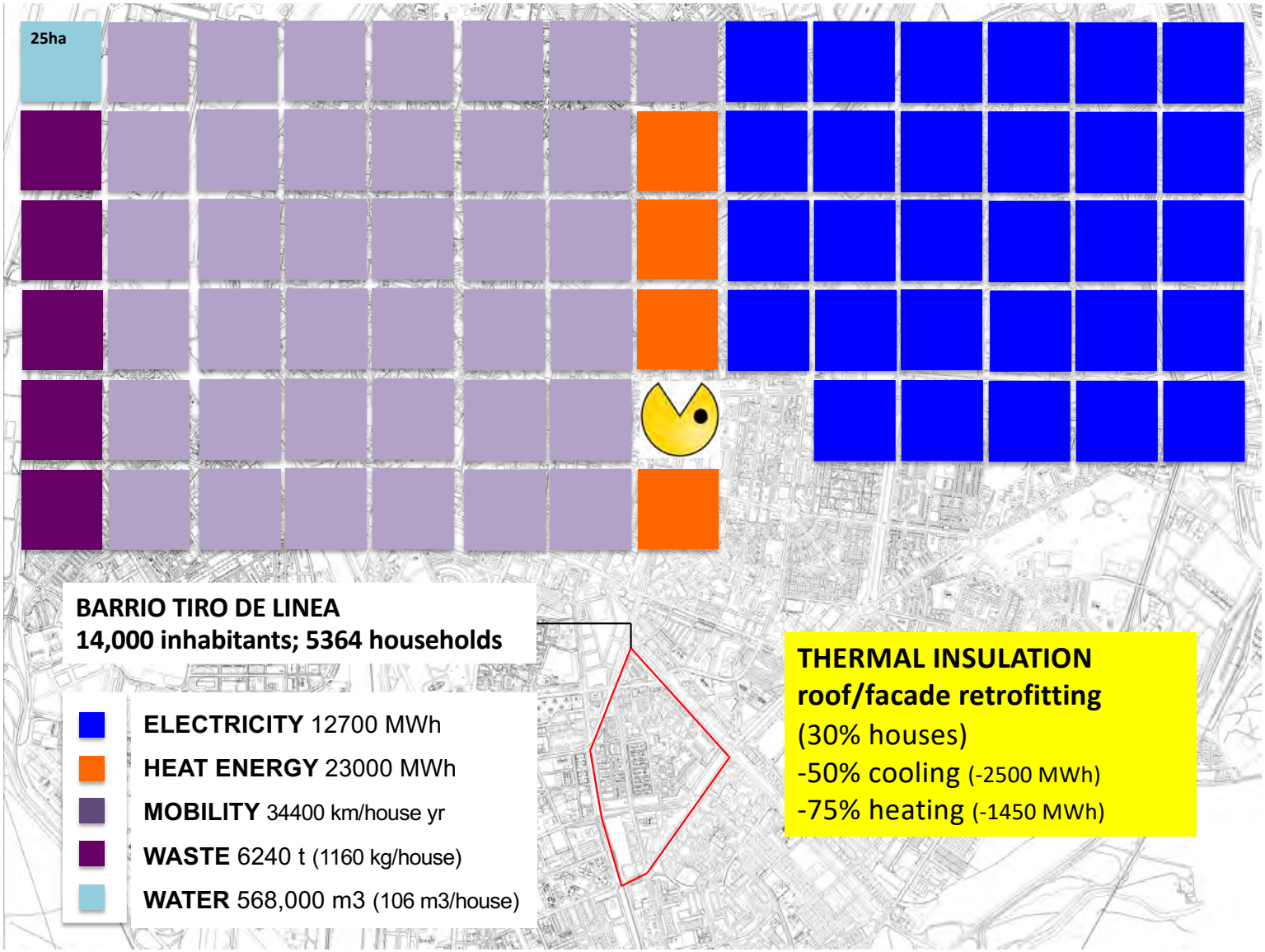
HEAT ENERGY 23000 MWh
MOBILITY 34400 km/house yr
WASTE 6240 t (1160 kg/house)
WATER 568,000 m3 (106 m3/house)
PASSIVE SYSTEMS
greening, shading, low emission paint
(20% houses)
-50% cooling (-1700MWh)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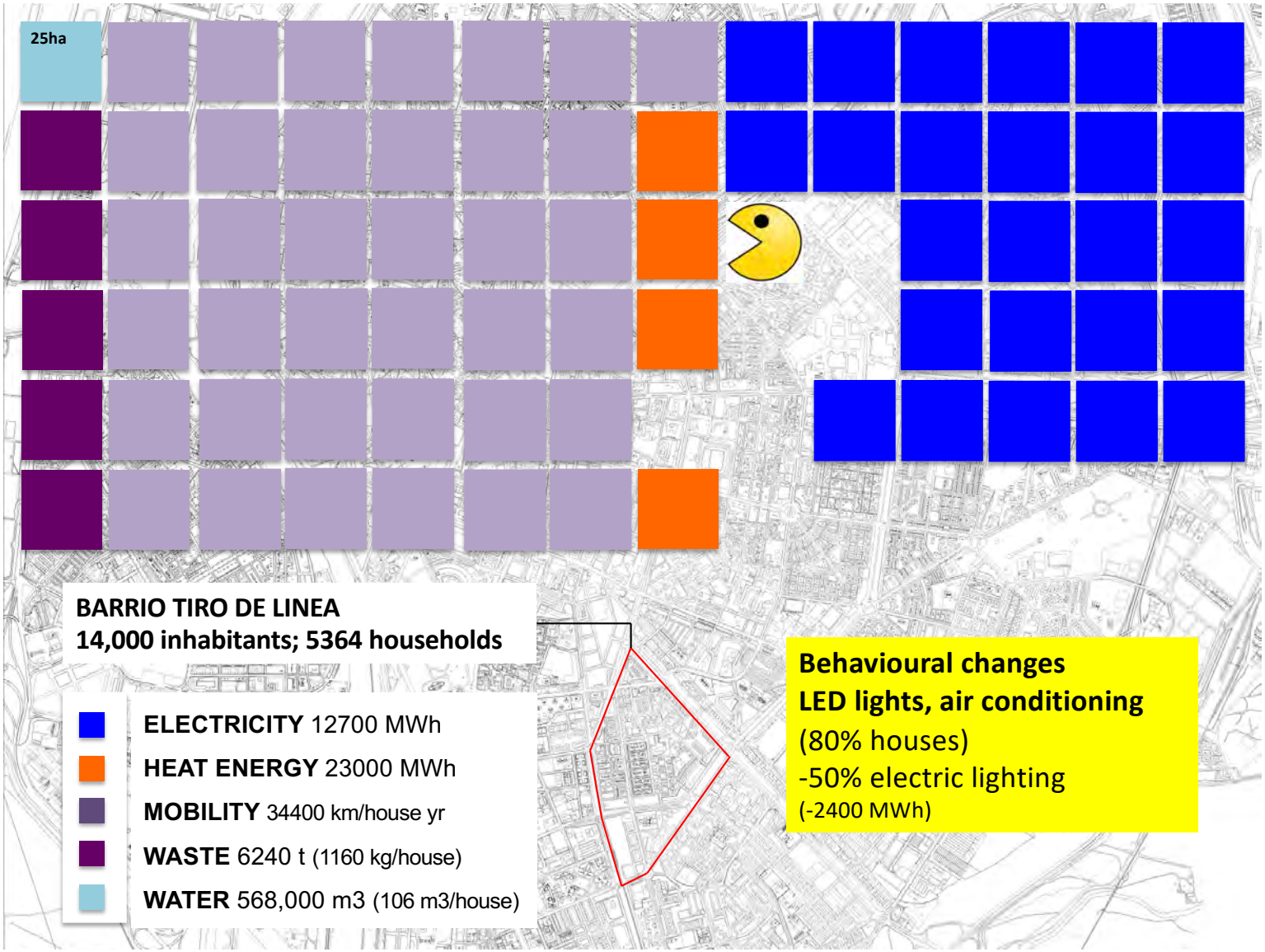
MOBILITY 34400 km/house yr
WASTE 6240 t (1160 kg/house)
WATER 568,000 m3 (106 m3/house)
THERMAL INSULATION
roof/facade retrofitting
(30% houses)
-50% cooling (-2500 MWh)
-75% heating (-1450 MWh)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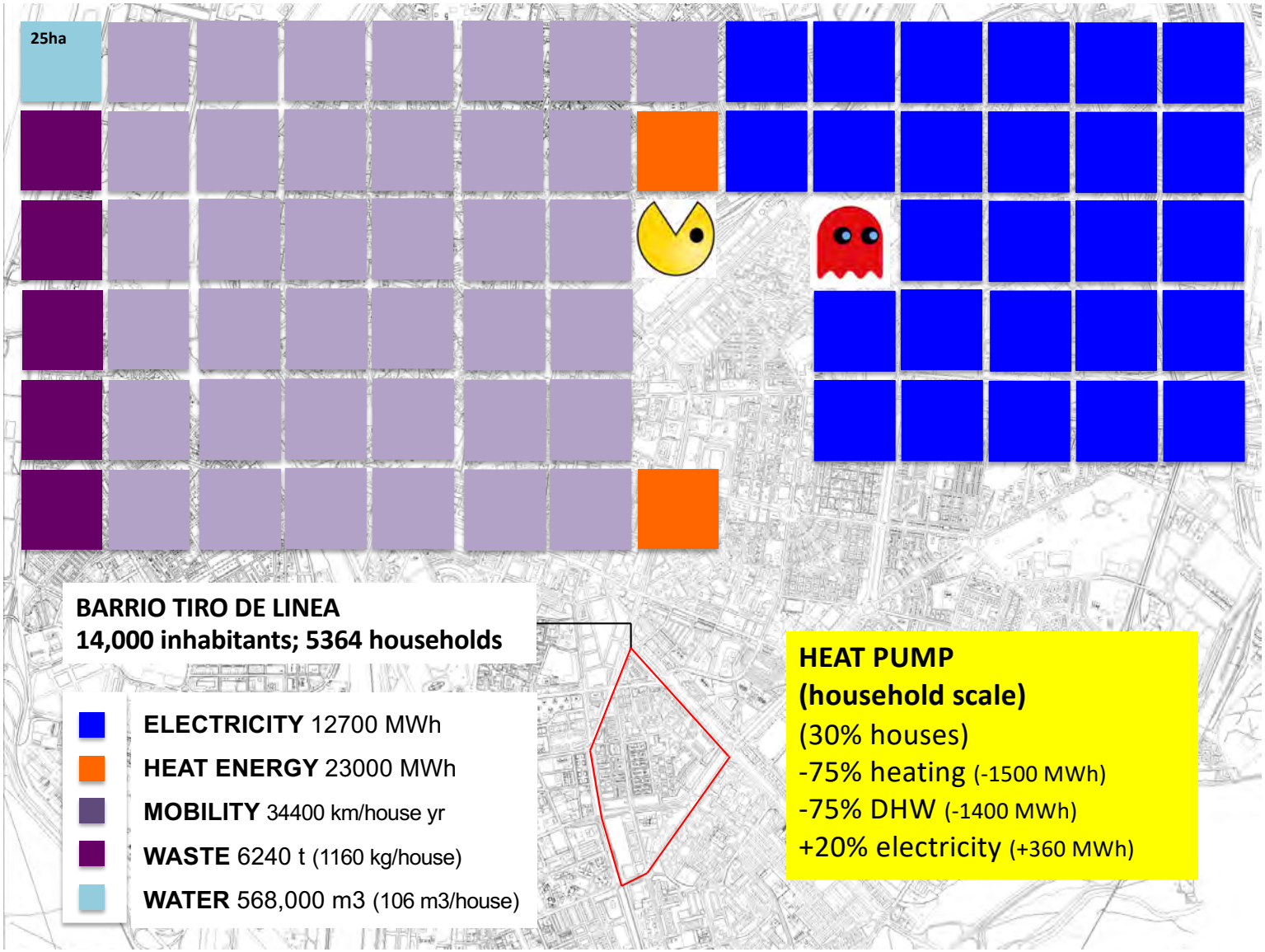
ELECTRICITY 12700 MWh
HEAT ENERGY 23000 MWh
MOBILITY 34400 km/house yr
WASTE 6240 t (1160 kg/house)
WATER 568,000 m3 (106 m3/house)
Behavioural changes
LED lights, air conditioning
(80% houses)
-50% electric lighting
(-2400 MWh)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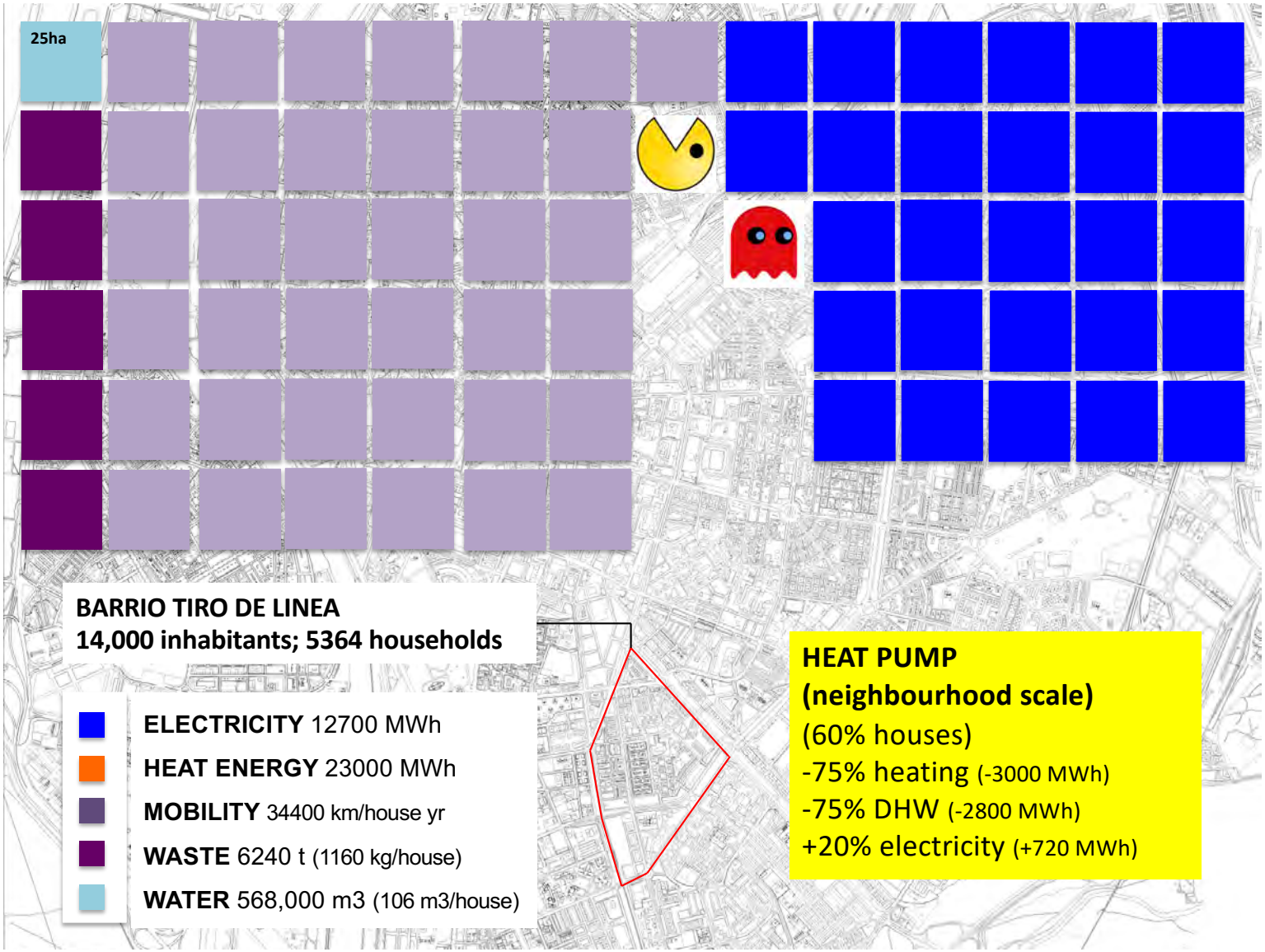
ELECTRICITY 12700 MWh
HEAT ENERGY 23000 MWh
MOBILITY 34400 km/house yr
WASTE 6240 t (1160 kg/house)
WATER 568,000 m3 (106 m3/house)
HEAT PUMP
(household scale)
(30% houses)
-75% heating (-1500 MWh)
-75% DHW (-1400 MWh)
+20% electricity (+360 MWh)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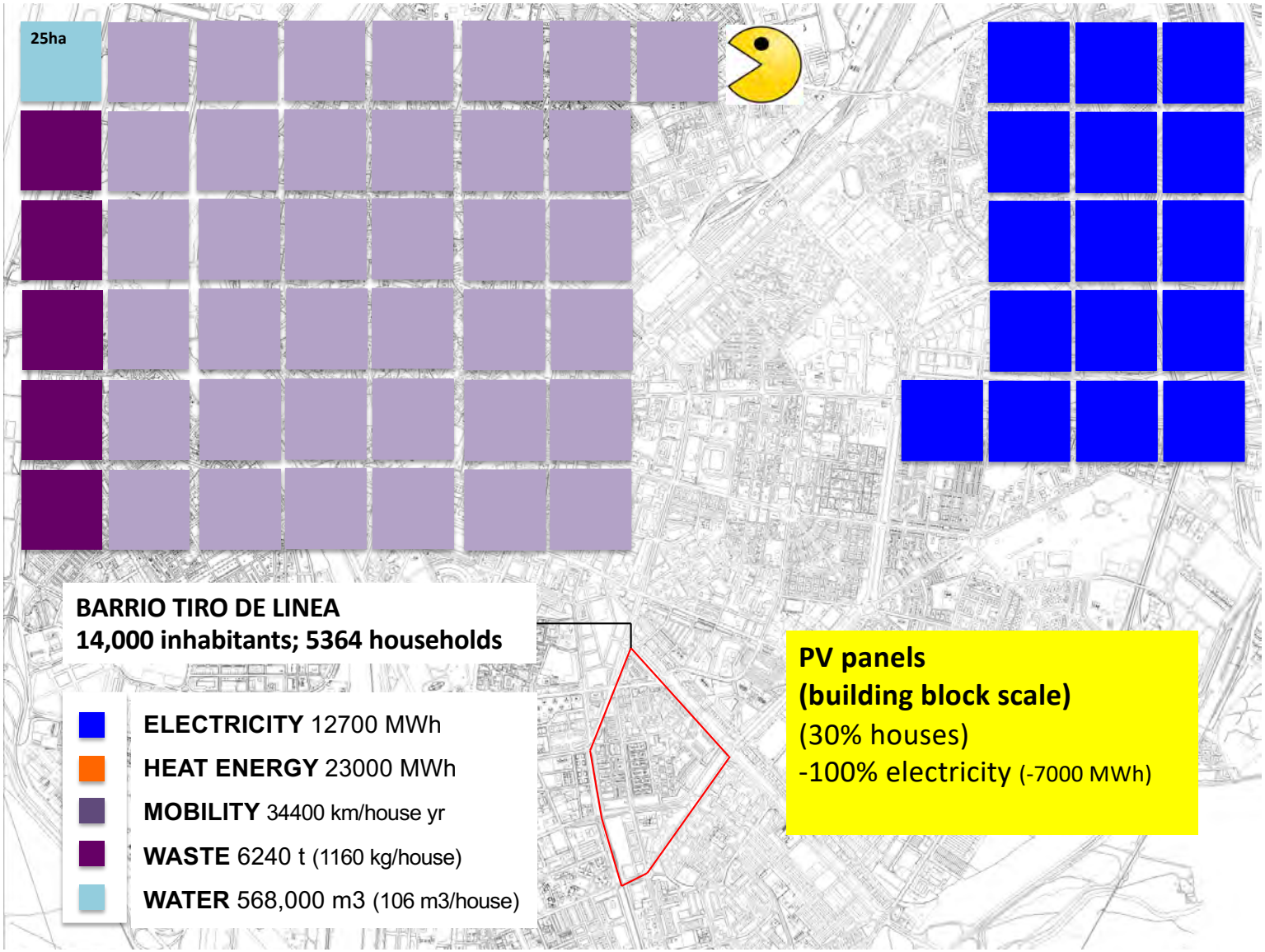
BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households
ELECTRICITY 12700 MWh
HEAT ENERGY 23000 MWh
MOBILITY 34400 km/house yr
WASTE 6240 t (1160 kg/house)
WATER 568,000 m3 (106 m3/house)
HEAT PUMP
(neighbourhood scale)
(60% houses)
-75% heating (-3000 MWh)
-75% DHW (-2800 MWh)
+20% electricity (+720 MWh)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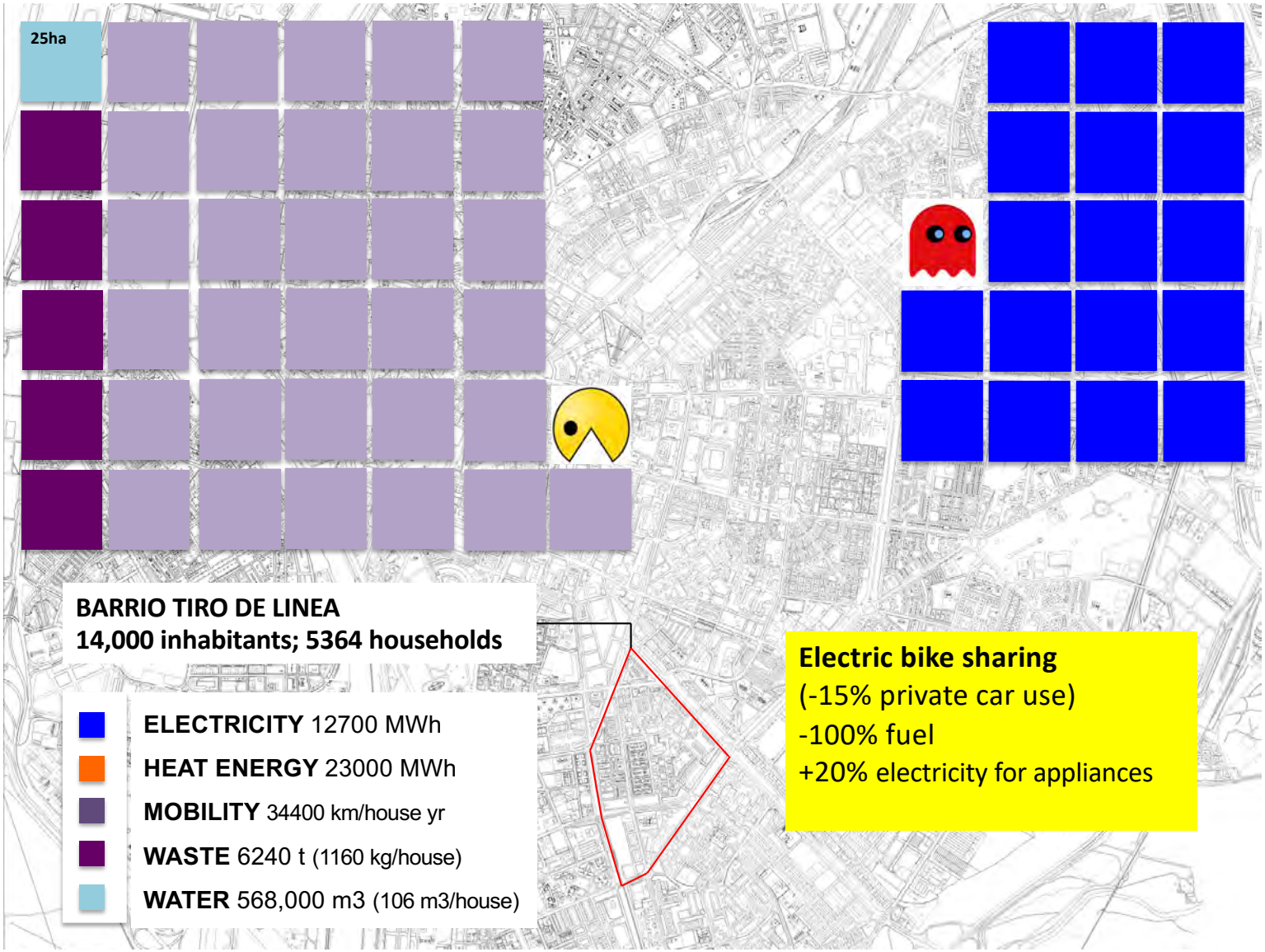
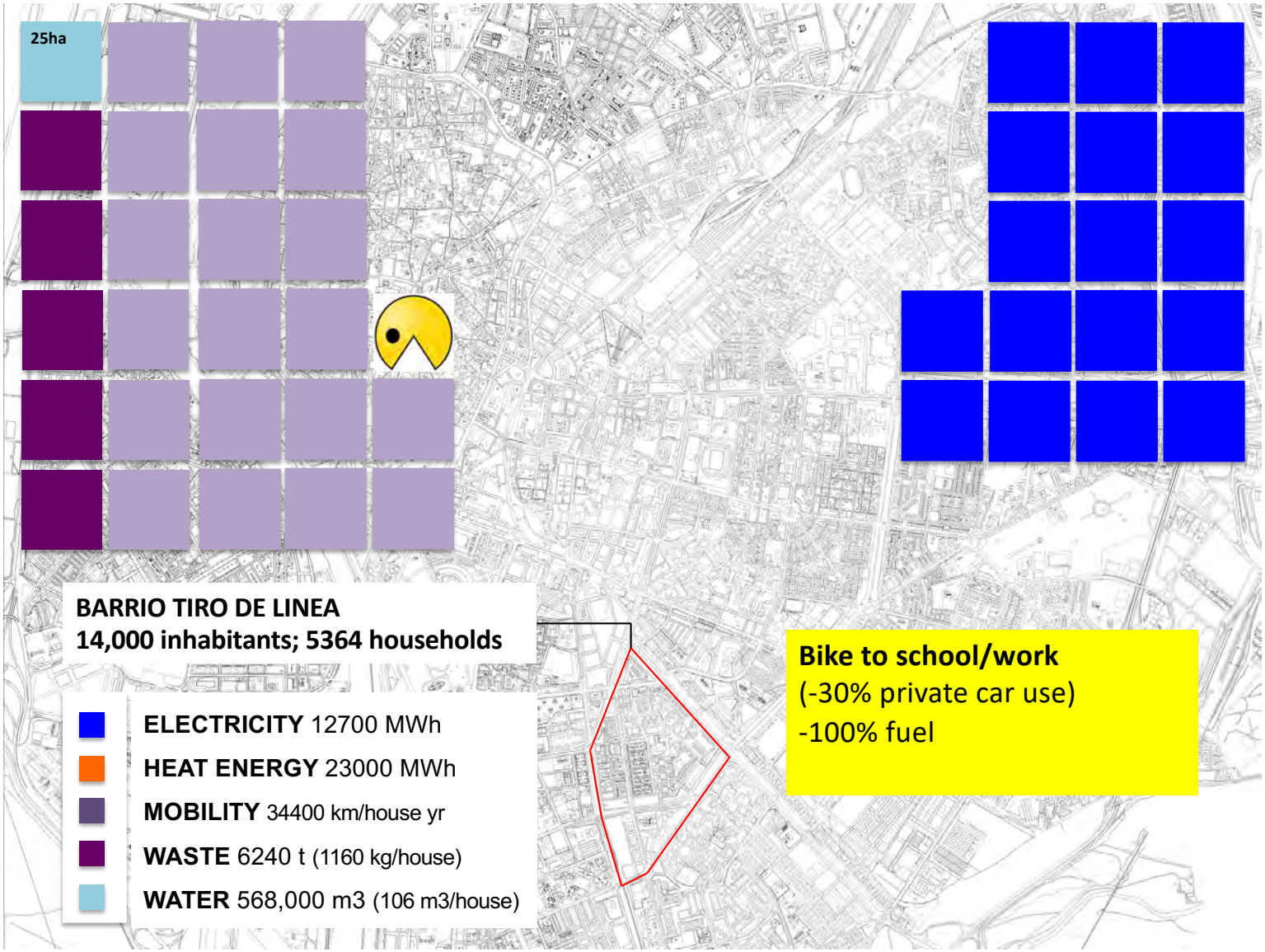
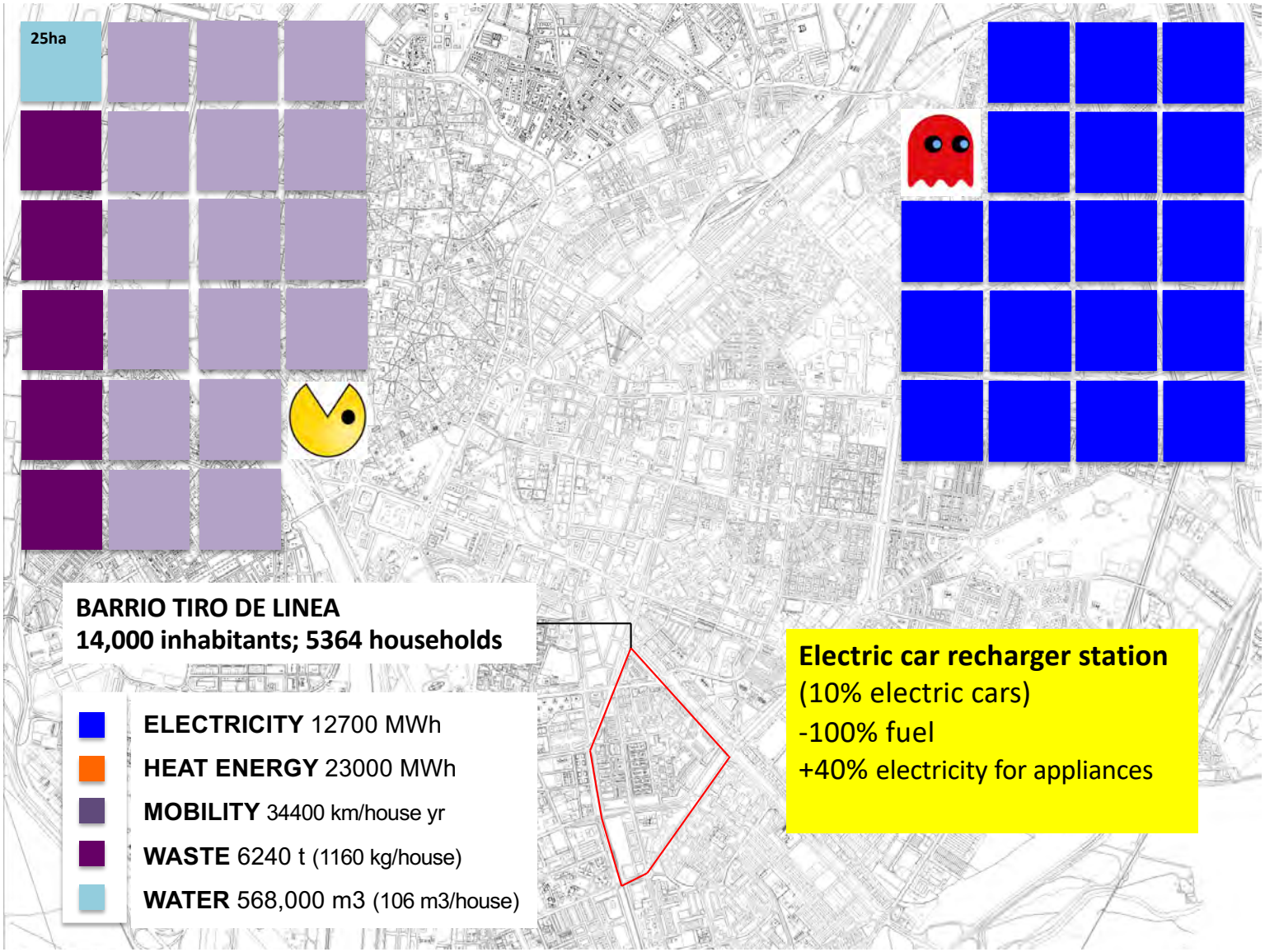
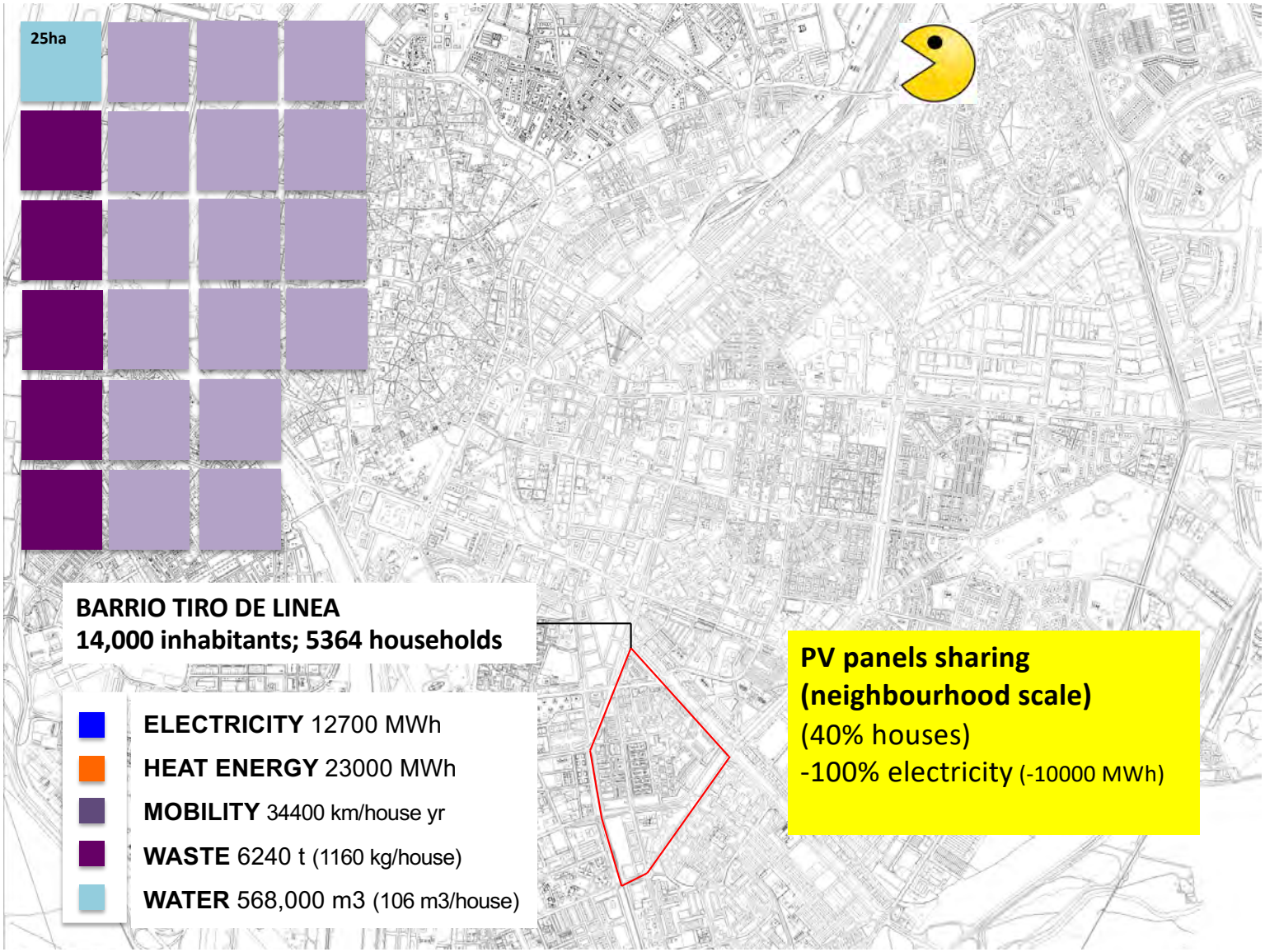
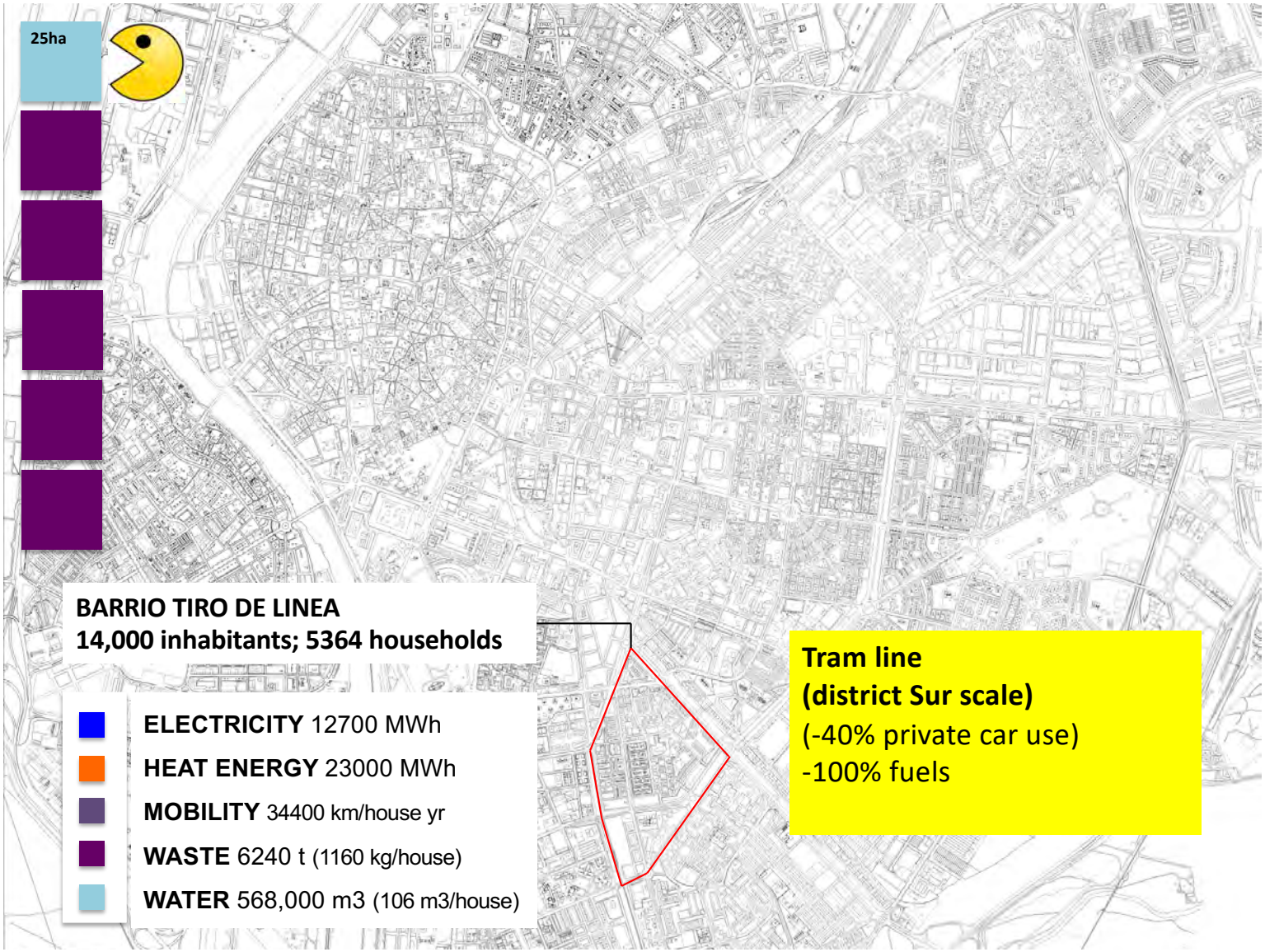
MOBILITY 34400 km/house yr
WASTE 6240 t (1160 kg/house)
WATER 568,000 m3 (106 m3/house)
PV panels
(building block scale)
(30% houses)
-100% electricity (-7000 MWh)

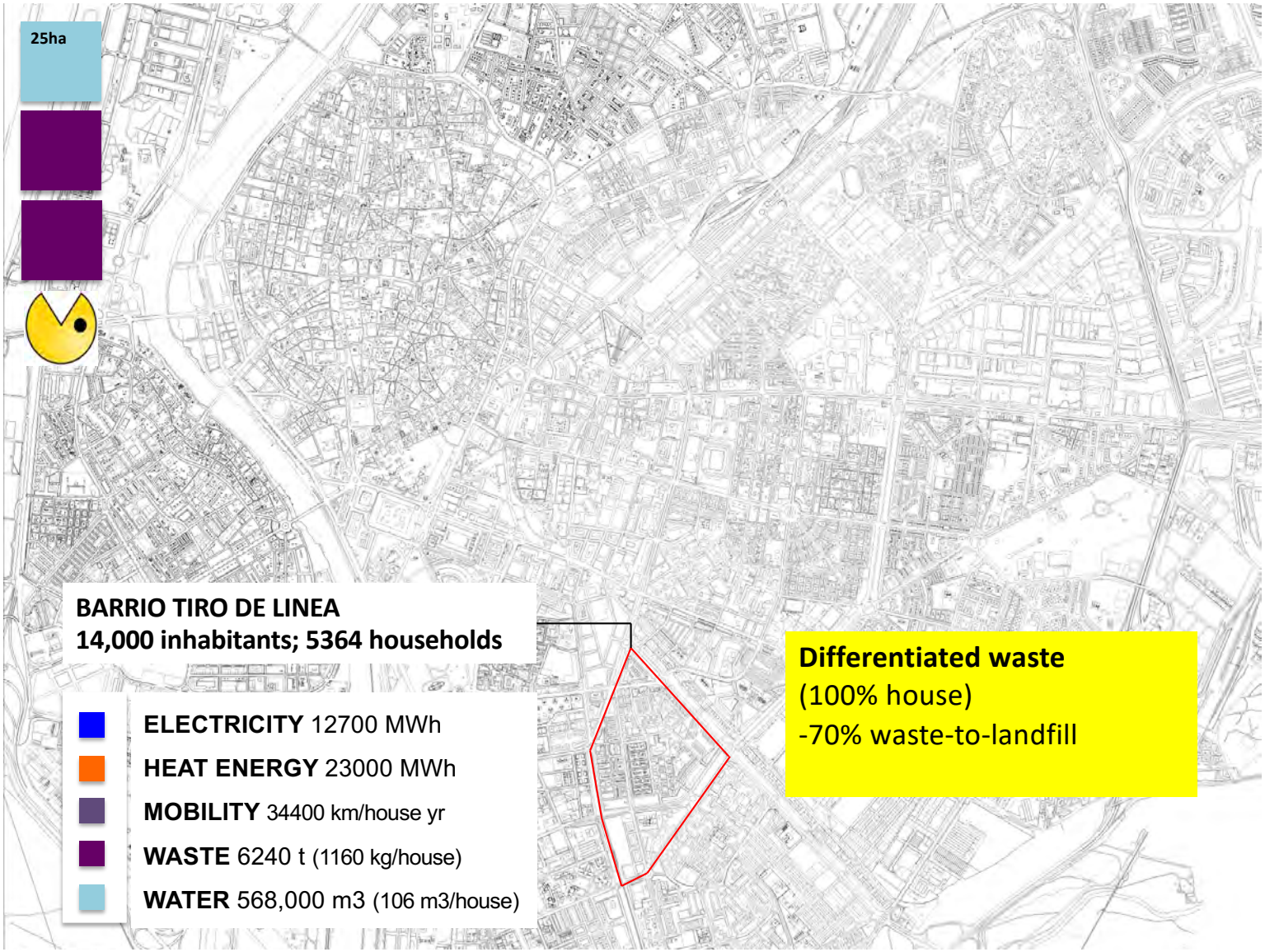

25ha
BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households
ELECTRICITY 12700 MWh
HEAT ENERGY 23000 MWh
MOBILITY 34400 km/house yr
WASTE 6240 t (1160 kg/house)
WATER 568,000 m3 (106 m3/house)
Electric bike sharing
(-15% private car use)
-100% fuel
+20% electricity for appliances

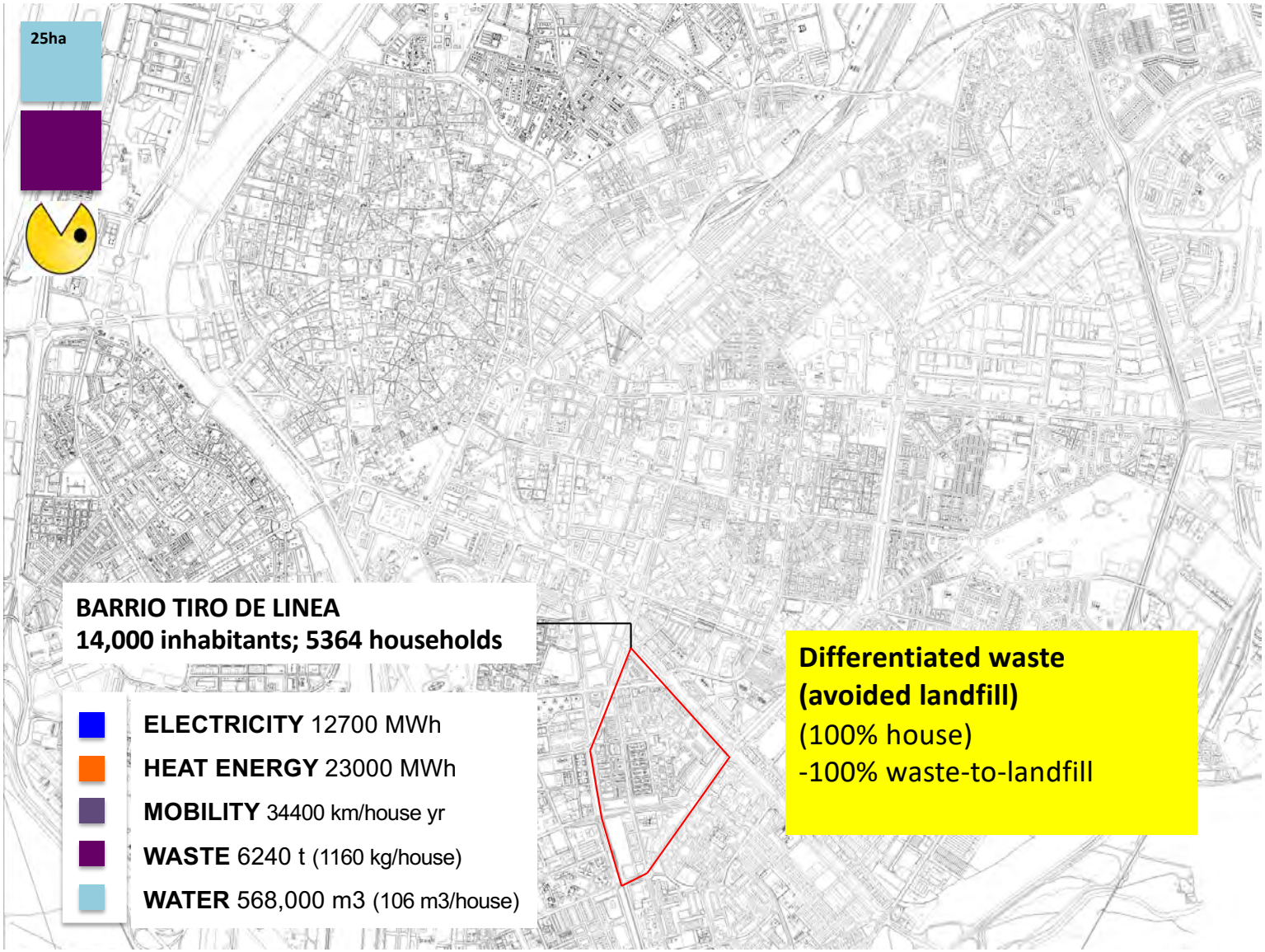

25ha
BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households
ELECTRICITY 12700 MWh
HEAT ENERGY 23000 MWh
MOBILITY 34400 km/house yr
WASTE 6240 t (1160 kg/house)
WATER 568,000 m3 (106 m3/house)
Bike to school/work
(-30% private car use)
-100% fuel

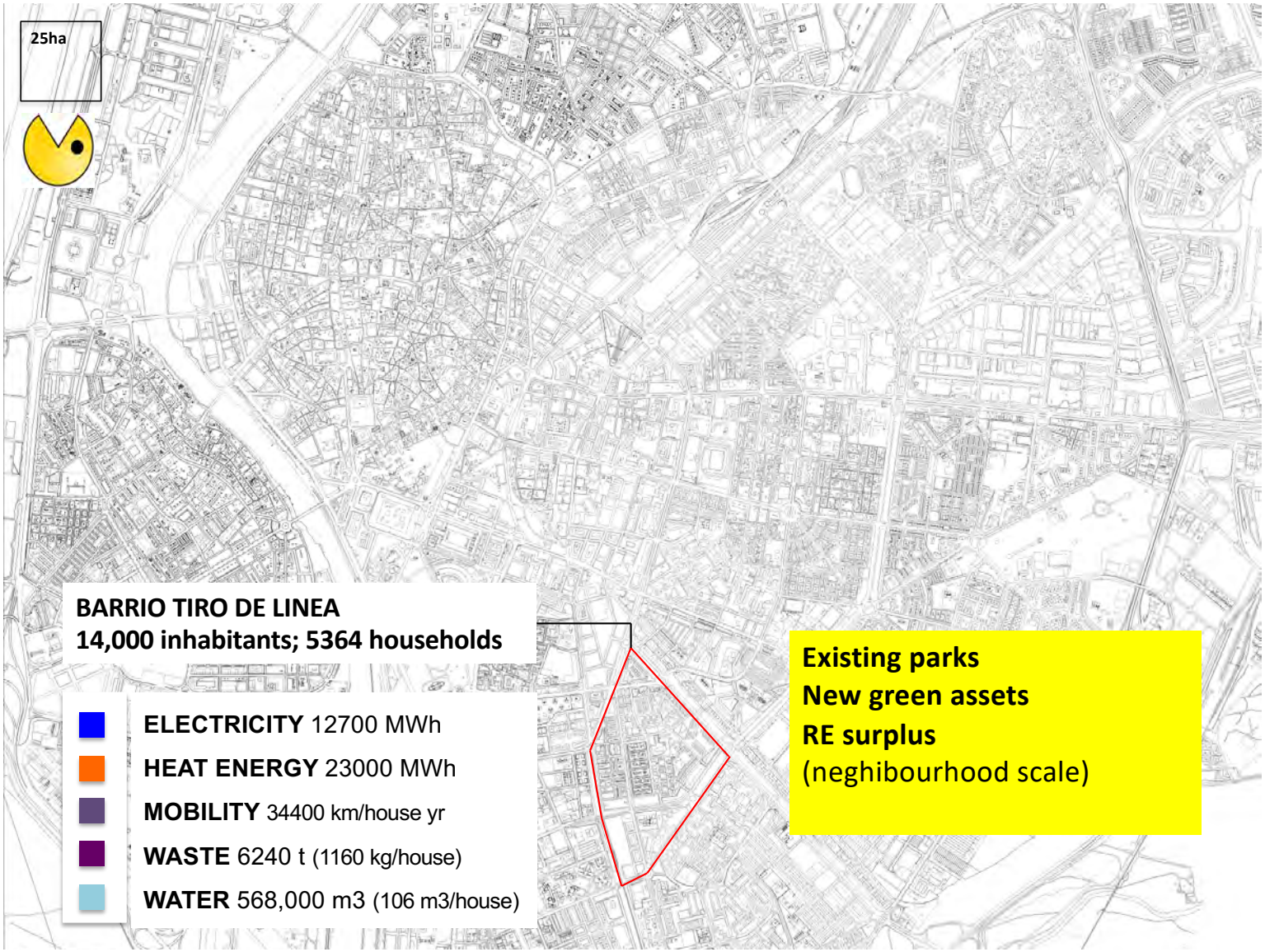

25ha
BARRIO TIRO DE LINEA
14,000 inhabitants; 5364 households
ELECTRICITY 12700 MWh
HEAT ENERGY 23000 MWh
MOBILITY 34400 km/house yr
WASTE 6240 t (1160 kg/house)
WATER 568,000 m3 (106 m3/house)
Electric car recharger station
(10% electric cars)
-100% fuel
+40% electricity for appliances


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
(neghibourhood 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…

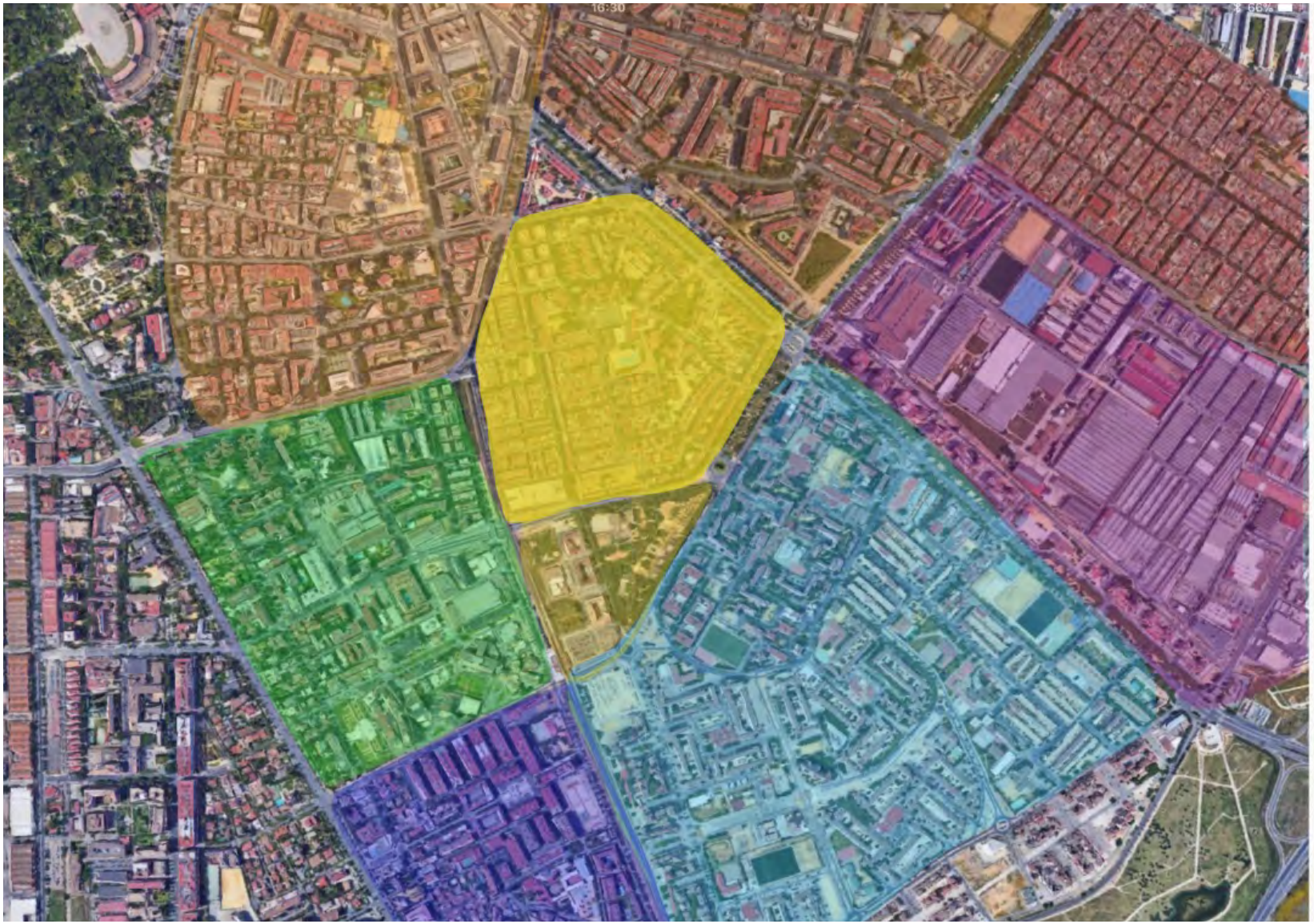
Professor Greg Keeffe

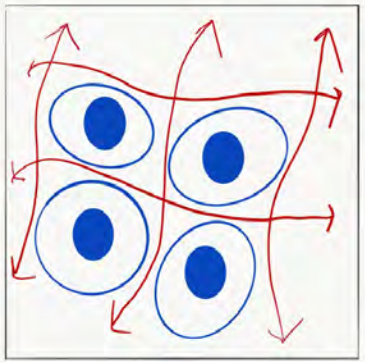
Head of School
Natural and Built Environment

Queens University Belfast.

Dora Vancso
Laura Solarino
Antigoni Karaiskou
TU Delft

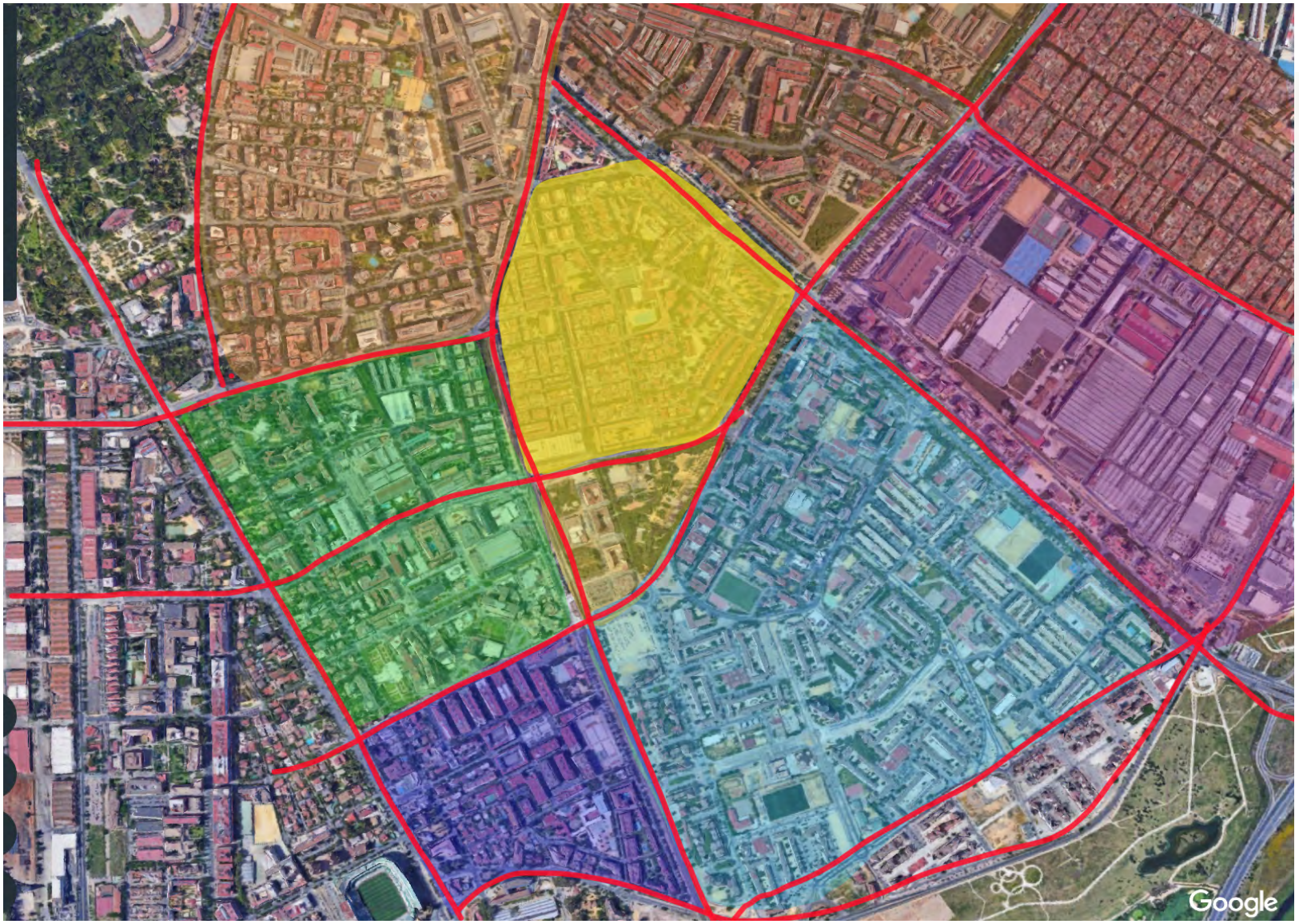
CITY-zen
New urban energy

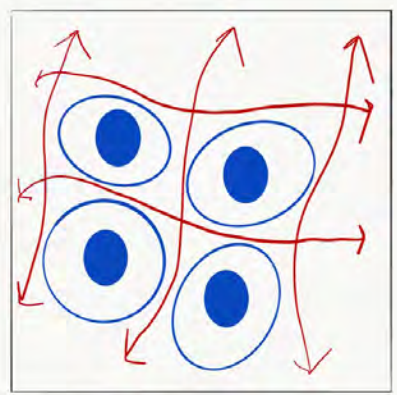




Barrios
urbanism

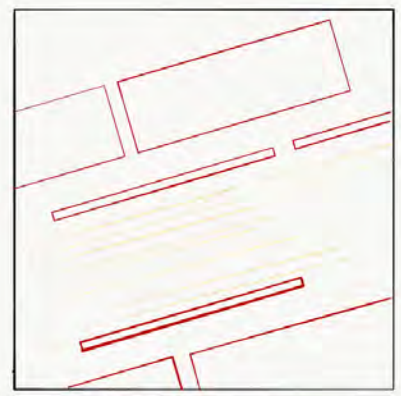
CITY-zen
New urban energy





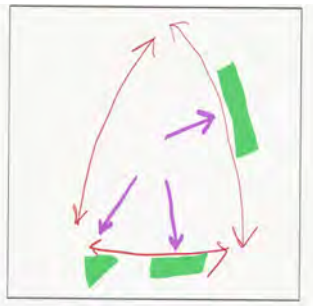
Barrios
urbanism

CITY-zen
New urban energy



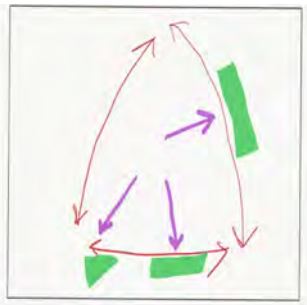
Over-roaded
Urbanism

CITY-zen
New urban energy



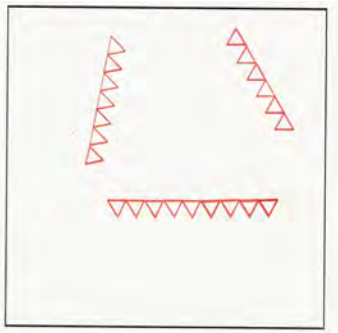
How big is big enough!

CITY-zen
New urban energy



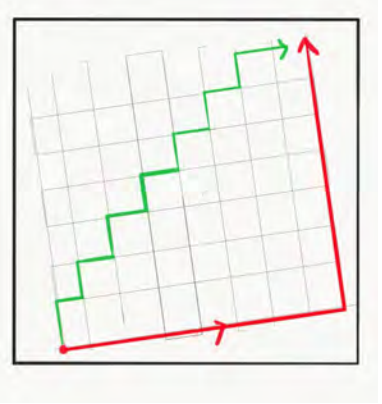
Unpacked
Green

CITY-zen
New urban energy

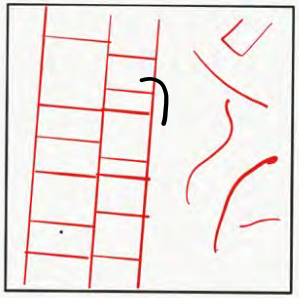


Hard edge

CITY-zen
New urban energy

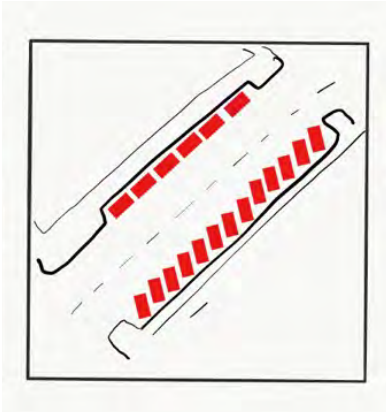


City desire line



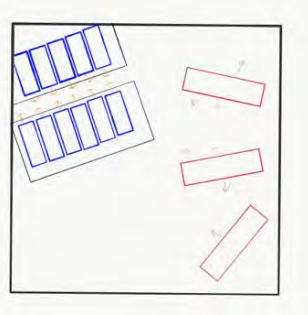
Permeable/non-permeable space

CITY-zen
New urban energy



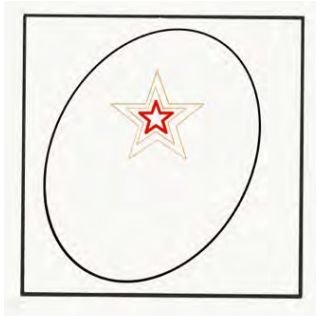
Cars cars and more cars

CITY-zen
New urban energy



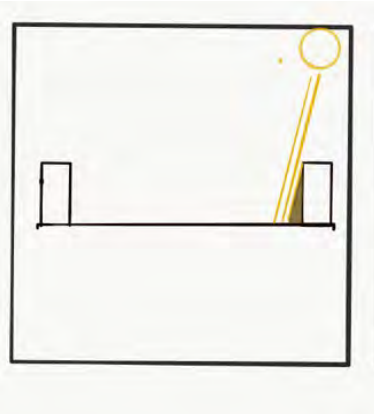
Surveyed and non-surveyed space

CITY-zen
New urban energy



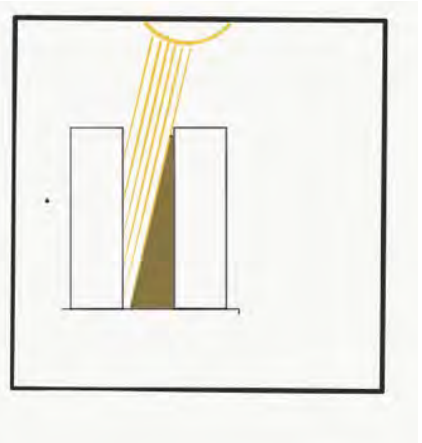
Over-centralised space

CITY-zen
New urban energy



Over-scaled external space

CITY-zen
New urban energy



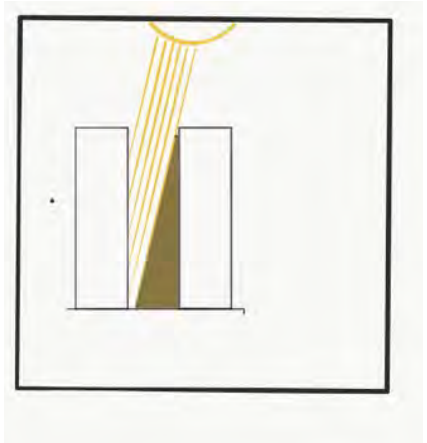
Correctly proportioned space

CITY-zen
New urban energy

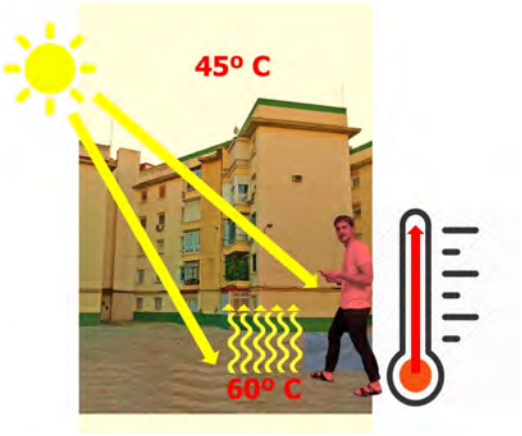
Seville Climate Projections. UK Met Office

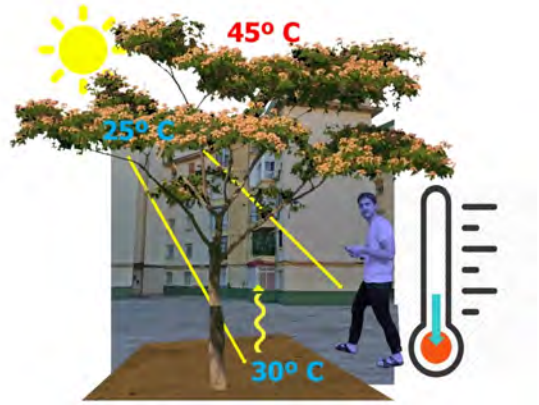
Year	Average Temp	Average High	Maximum Temp
2017	19.4	35	45
2070	24	45	55

Climate similar to Dubai by 2070

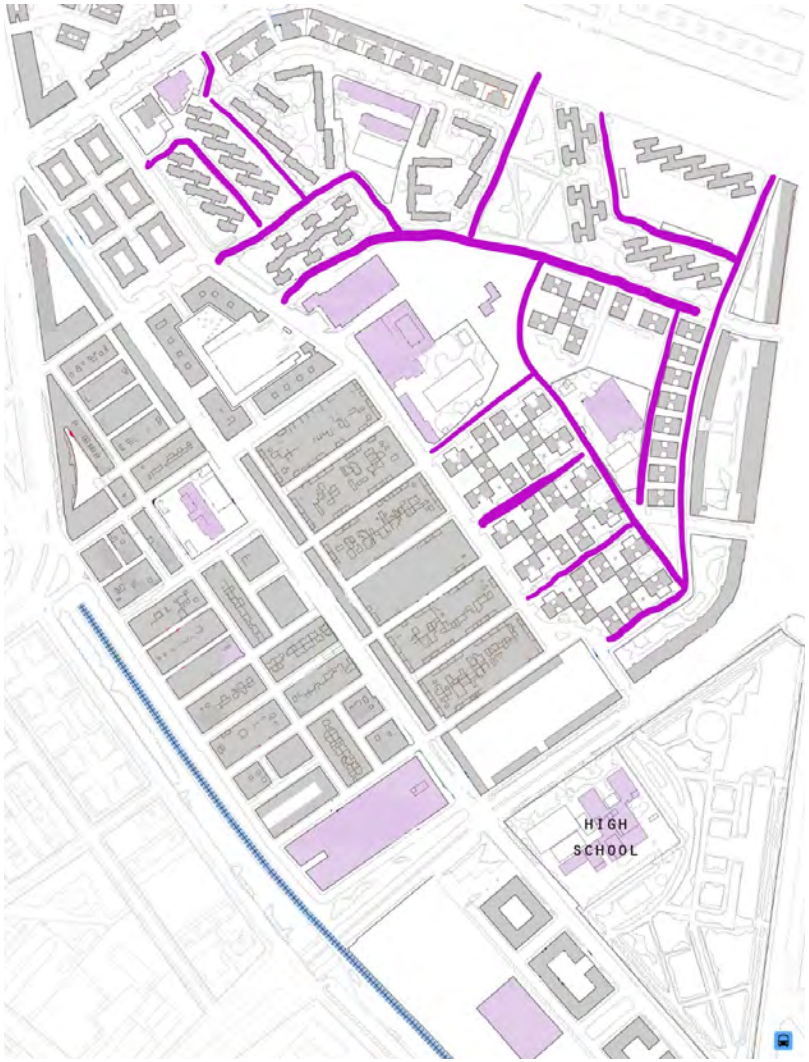


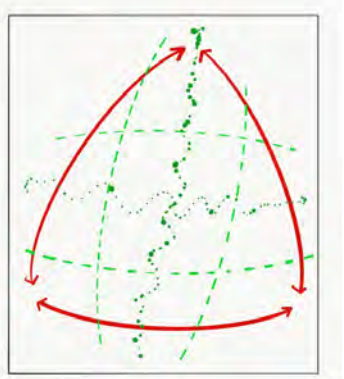
Correctly proportioned space





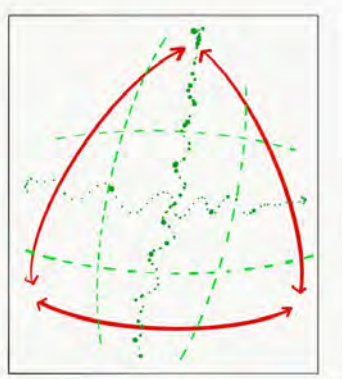
CITY-zen
New urban energy





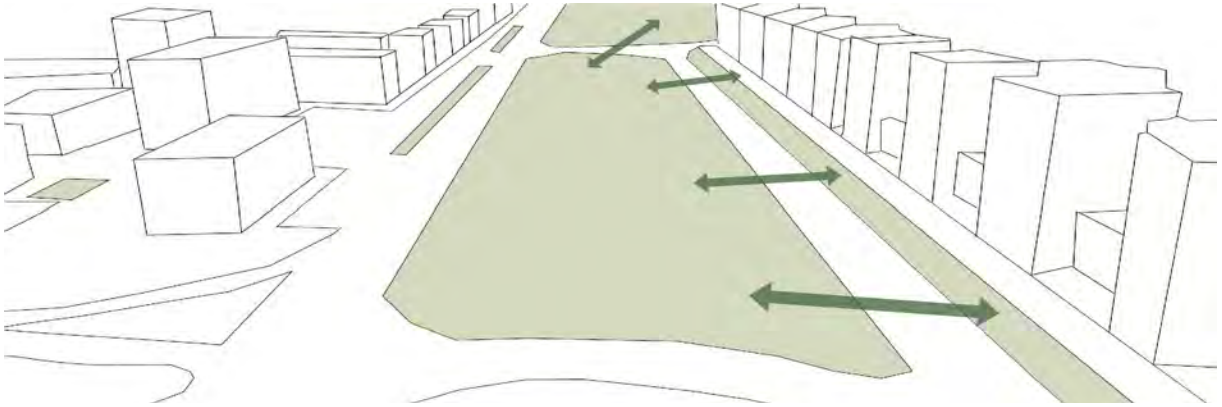
Perforated urbanism

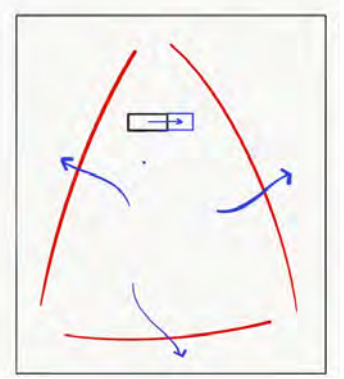
CITY-zen
New urban energy



Perforated urbanism

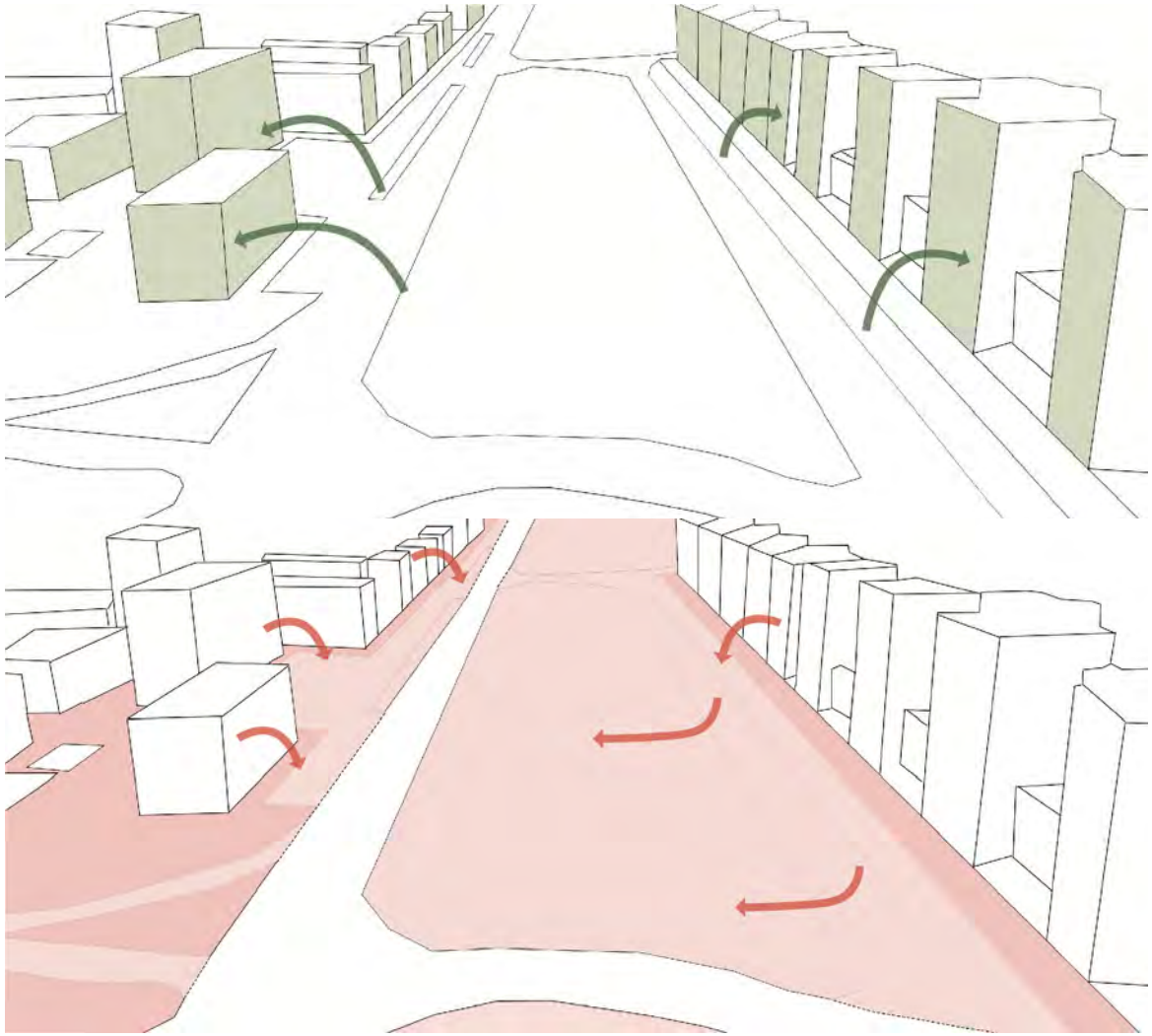
CITY-zen
New urban energy

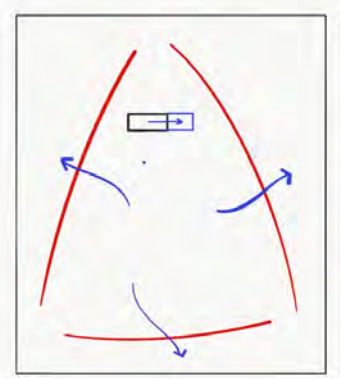




Unpack the neighbourhood

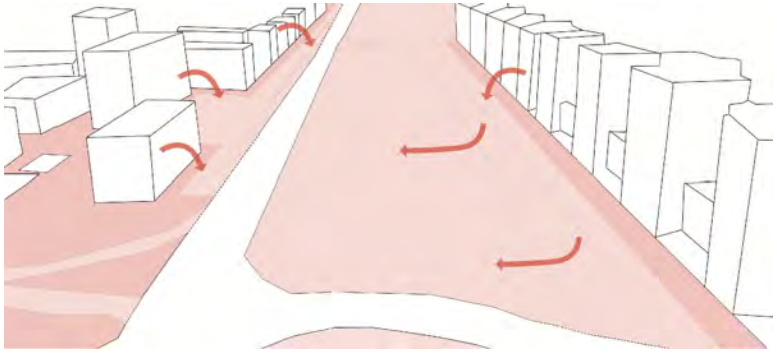
AVENIDA BENITEZ CARRASCO - BEFORE

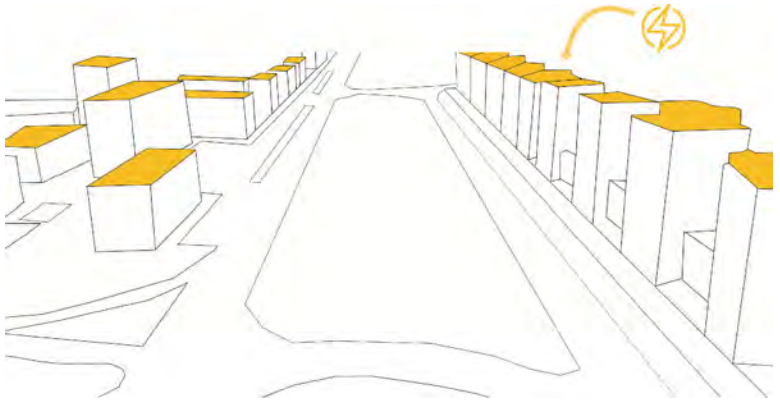




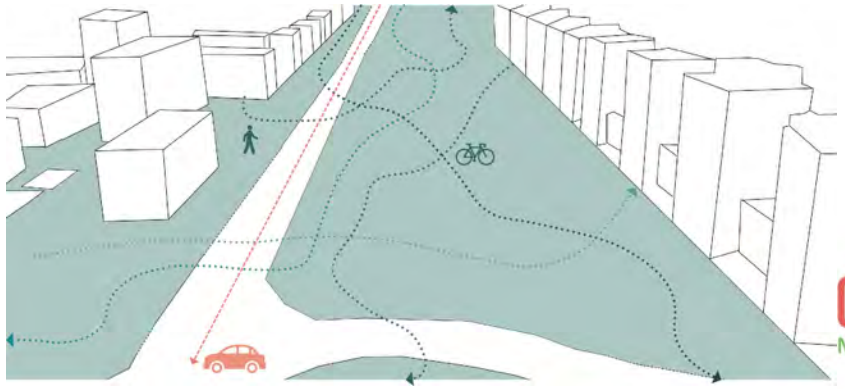
Unpack the neighbourhood

CITY-zen
New urban energy

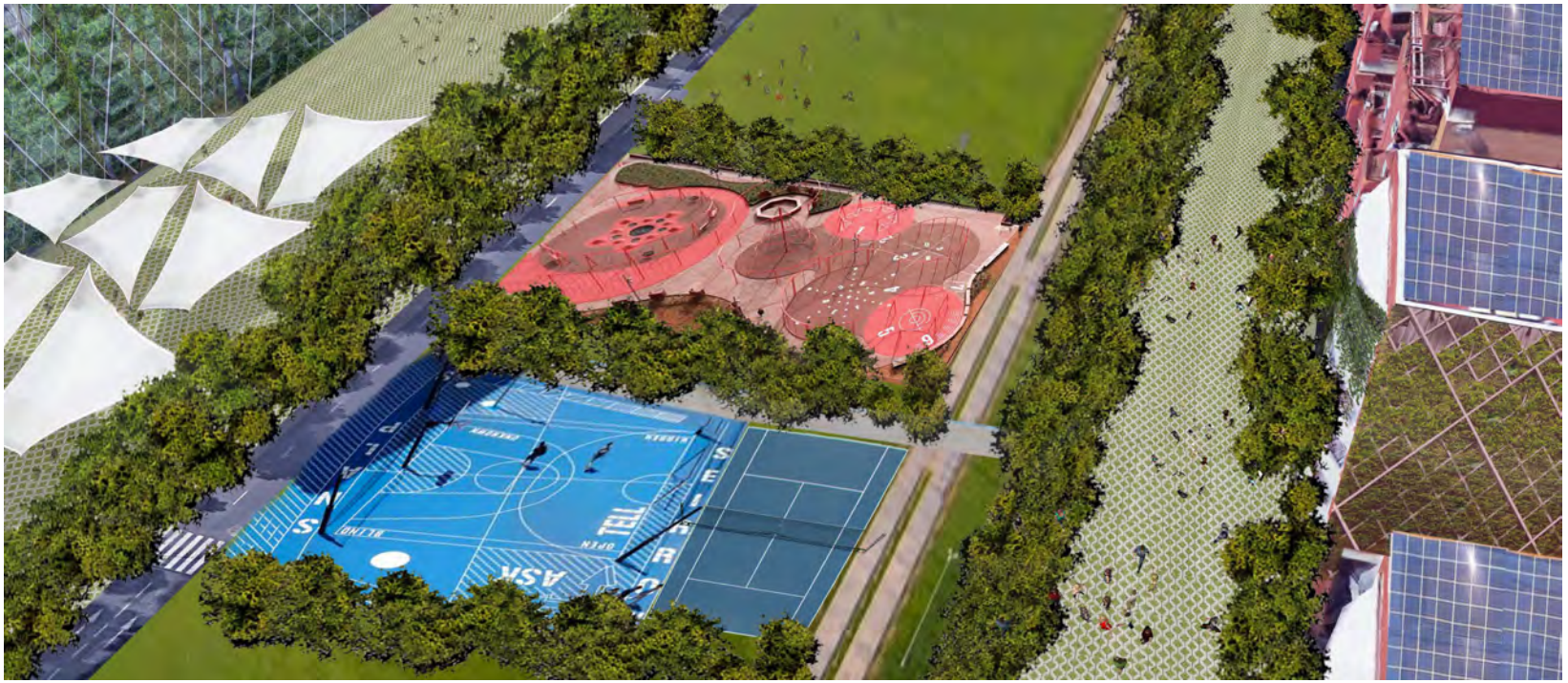


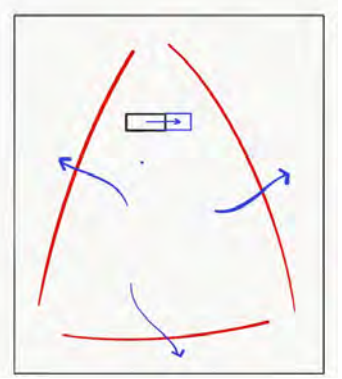


Unpack the neighbourhood



CITY-zen
New urban energy

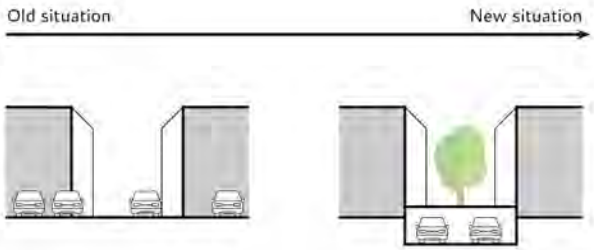




Unpack the neighbourhood

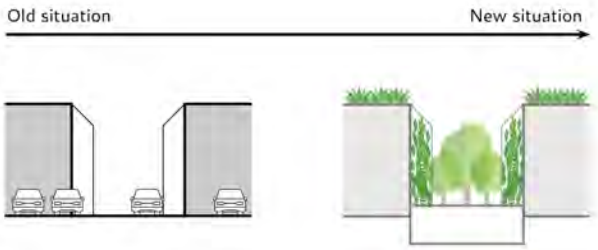
CITY-zen
New urban energy

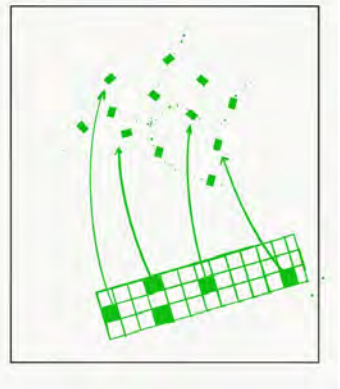
UNDERGROUND PARKING



URBAN OASIS

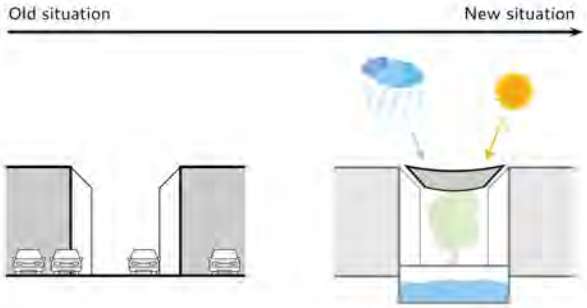
Shading (trees)
Vertical farming/gardens
Rooftop gardens



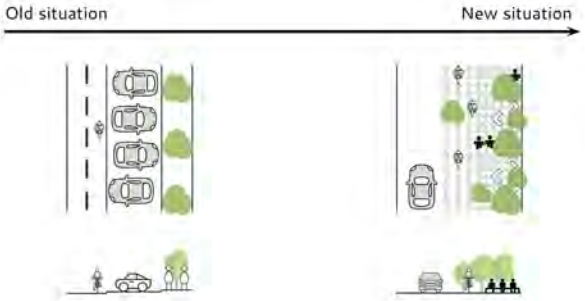


Unpack green space – make oases

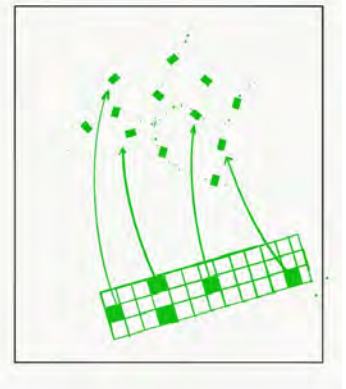
SHADING (WATER STORAGE+PV)



FROM STREET TO SHARED PAVEMENT

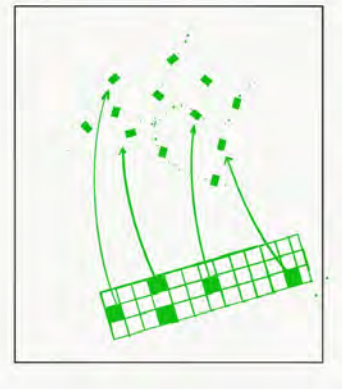


CITY-zen
New urban energy



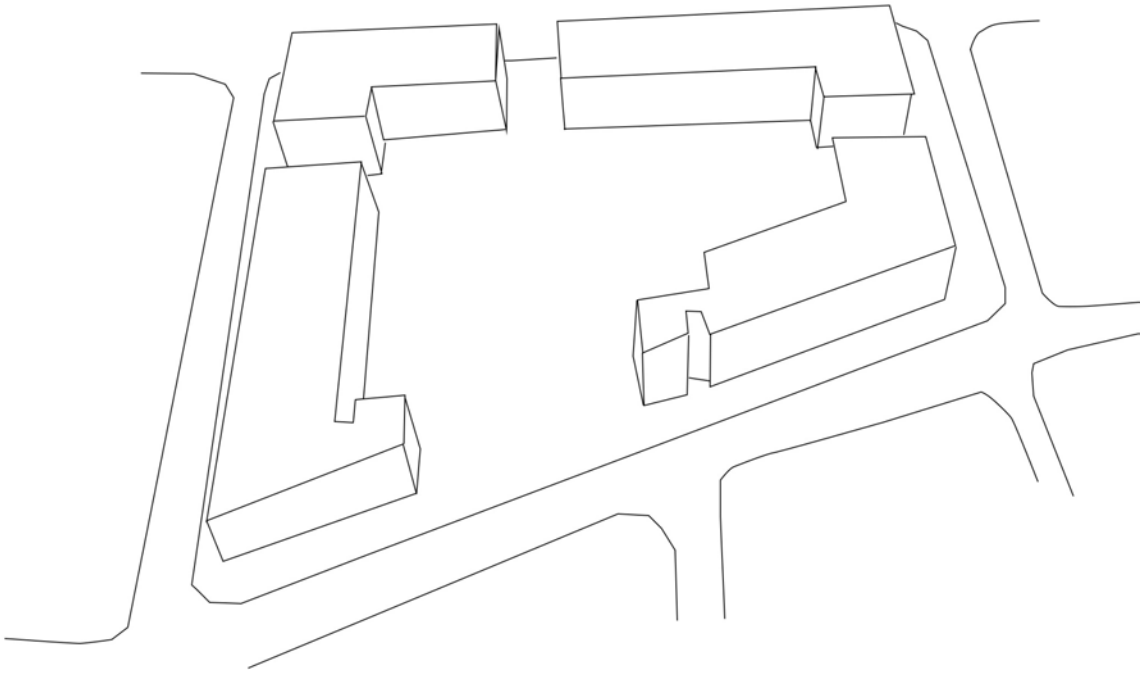
Unpack green space – make oases

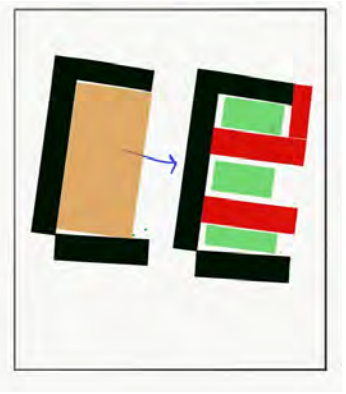
CITY-zen
New urban energy



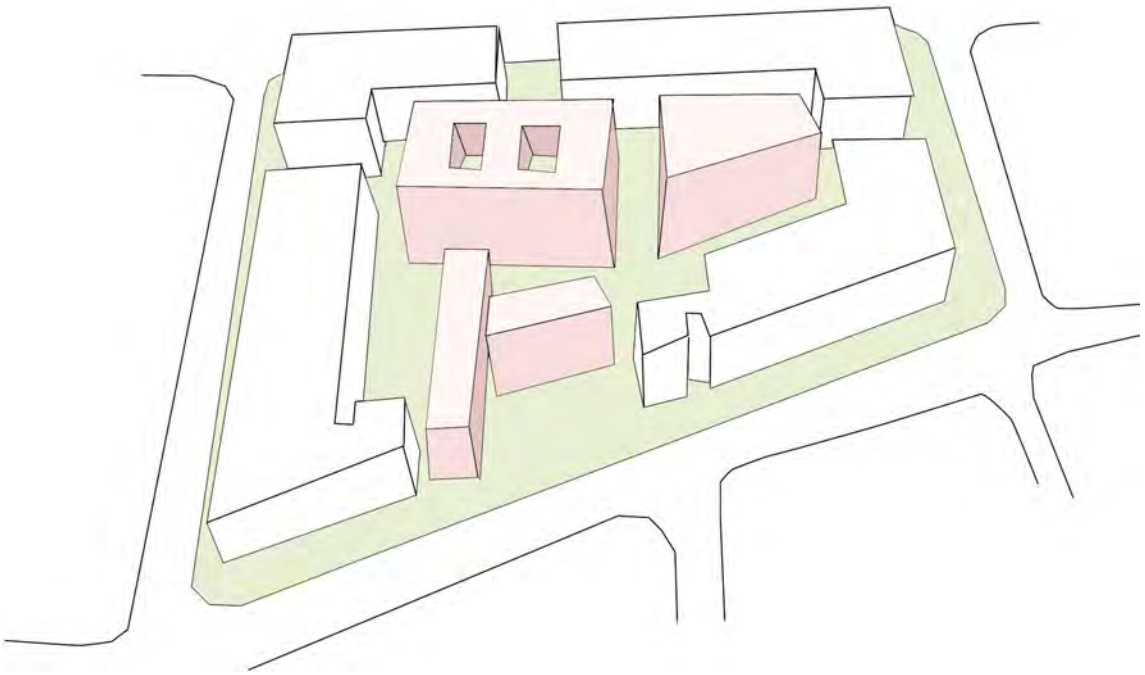
Unpack green space – make oases

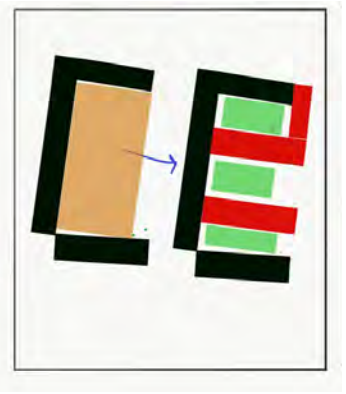
CITY-zen
New urban energy





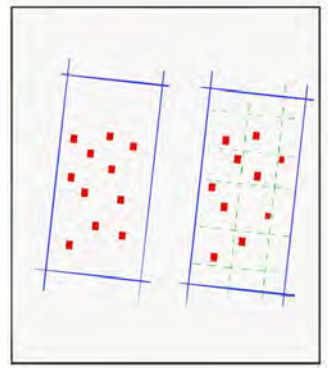
Densify urban space – create shade





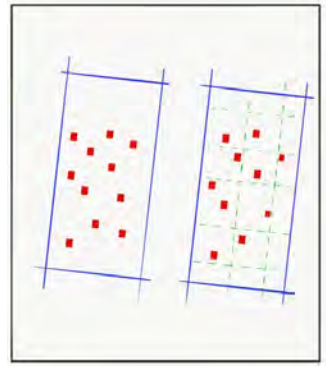
Densify urban space – create shade

CITY-zen
New urban energy



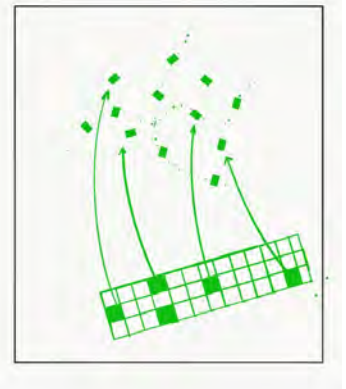
Make small
green routes

CITY-zen
New urban energy



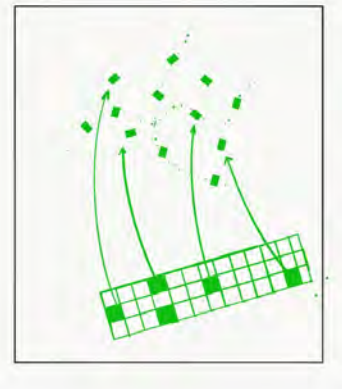
Make small
green routes

CITY-zen
New urban energy



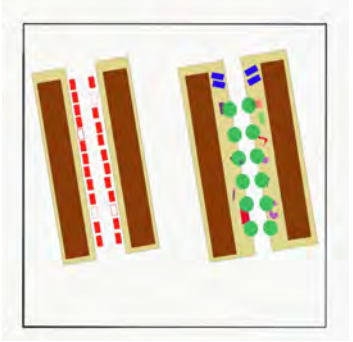
Unpack green space – make oases

CITY-zen
New urban energy



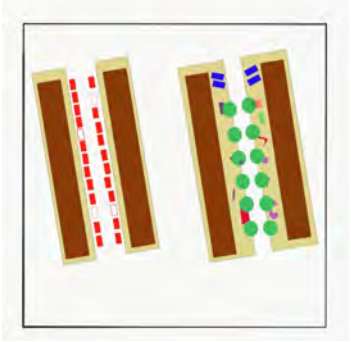
Unpack green space – make oases

CITY-zen
New urban energy



Reclaim the street – with car-share!

CITY-zen
New urban energy



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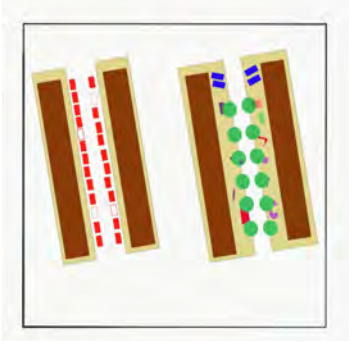

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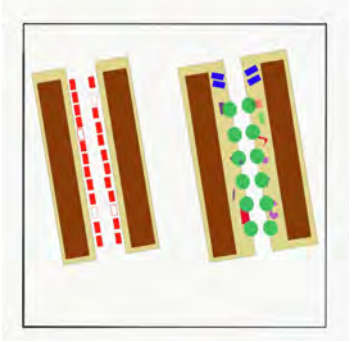

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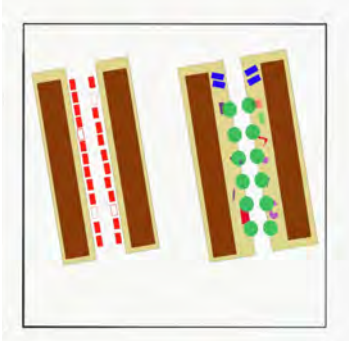

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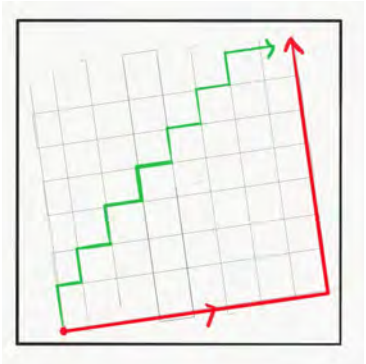
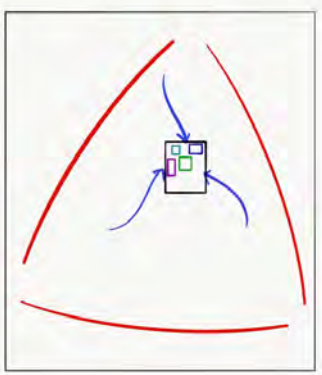


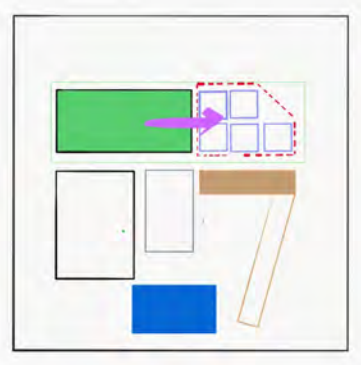
Bike-friendly routes go through the neighbourhood

CITY-zen
New urban energy



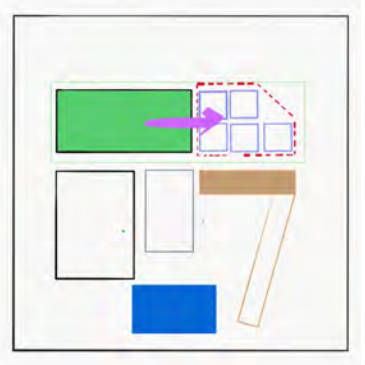
Repack the neighbourhood

CITY-zen
New urban energy



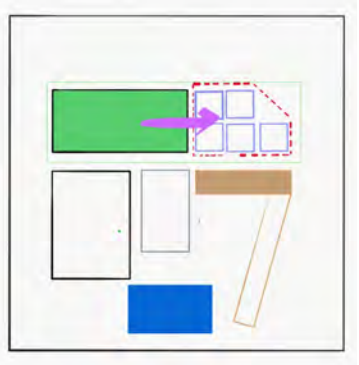
Unpacking the market makes new exciting public space

CITY-zen
New urban energy



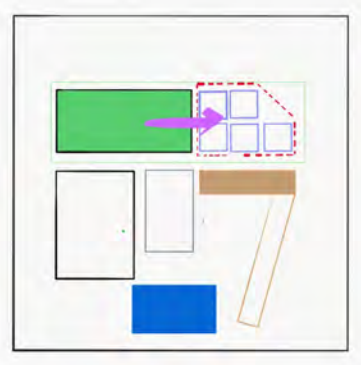
Unpacking the market makes new exciting public space

CITY-zen
New urban energy



Unpacking the market makes new exciting public space

CITY-zen
New urban energy

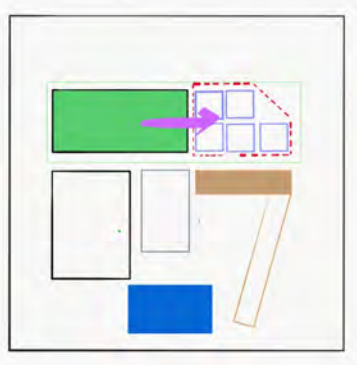


Unpacking the market makes new exciting public space

CITY-zen
New urban energy

10% GREEN

50% GREEN



Unpacking the market makes new exciting public space

30% GREEN

80% GREEN

CITY-zen
New urban energy

NOW

To conclude

CITY-zen
New urban energy

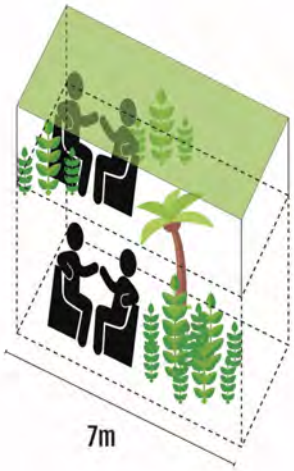
STEP 1: 25% GREEN

DIFFERENT GREENS

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

CITY-zen
New urban energy

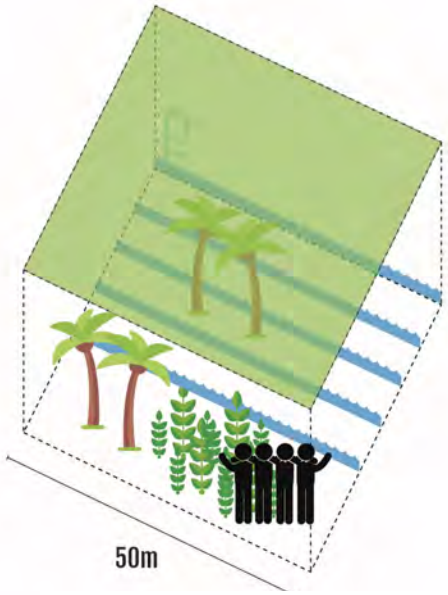
STEP 2: 50% GREEN



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

CITY-zen
New urban energy

STEP 3: 75% GREEN



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

CITY-zen
New urban energy

STEP 4: 100% GREEN

CITY-zen
New urban energy

Muchas gracias.

Roadshow

Sevilla – Taller energía

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