Positive Energy District in Skanste - Riga

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June Workshop

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Positive Energy Districts

AmsTErdam BiLbao cItizen drivEn smaRt cities

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No.864374

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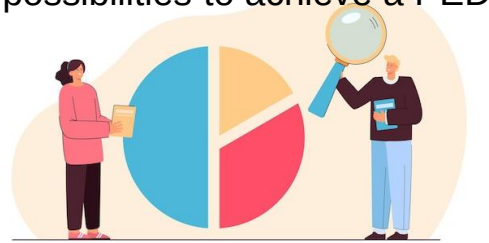
The area of Skanste

possibilities to achieve a PED



What is a Positive Energy District?

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Energy paradigm and trends in communities and cities

- Post-COVID era:
  - **Sustainable yet safe** manner of **mobility**: e-bikes, walking, public transport…
  - Importance of **green areas**, creating new and liberating spaces of sociability
  - **Holistic planning**: potential synergies can get lost if we do not plan **integrating urban spaces and systems**
  - Increasing complexity: **new actors** in the energy system (communities, P2P, roles get diffuse)
  - Towards high **digitalization** (e-platforms, one-stop-shops, IoT, urban digital platforms, digitalization of services...)
  - **Net zero climate targets**

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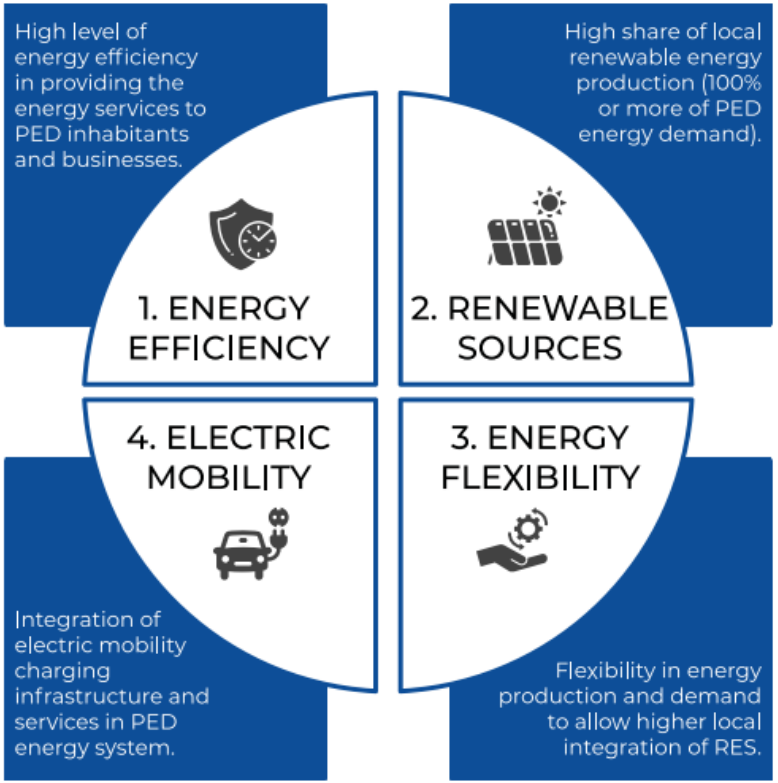
What is a PED?

- The European Strategic Energy Technology Plan (SET Plan) defines Positive Energy Districts as ***"a district with annual net zero energy import and net zero carbon emissions, working towards an annual local surplus production of renewable energy"***
- In ATELIER, the **target for the districts is to have an annual positive energy balance**, measured in primary energy.
- This means that more energy is exported from the district than what is imported.



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Why PEDs?

- Need to transition to **sustainable and climate neutral cities** and **districts**
  - **Positive energy balance**: which helps to compensate areas that cannot be retrofitted (historical areas, etc.)
- They answer to **multiple sustainability needs**:
  - **Affordable**
  - **Inclusive**
  - High level of standard **living**
  - **Connected** (with urban energy systems and citizens)
- Today, based on a yearly basis, **only 1,3% of the EU's residential building stock** is undergoing a medium to **deep energy retrofit**. With the EU's climate goals in mind, such retrofit needs to become more prevalent.
- **PEDs** can have an **instrumental role** in this effort, and this way, **contribute to realising the European Green Deal's targets**.

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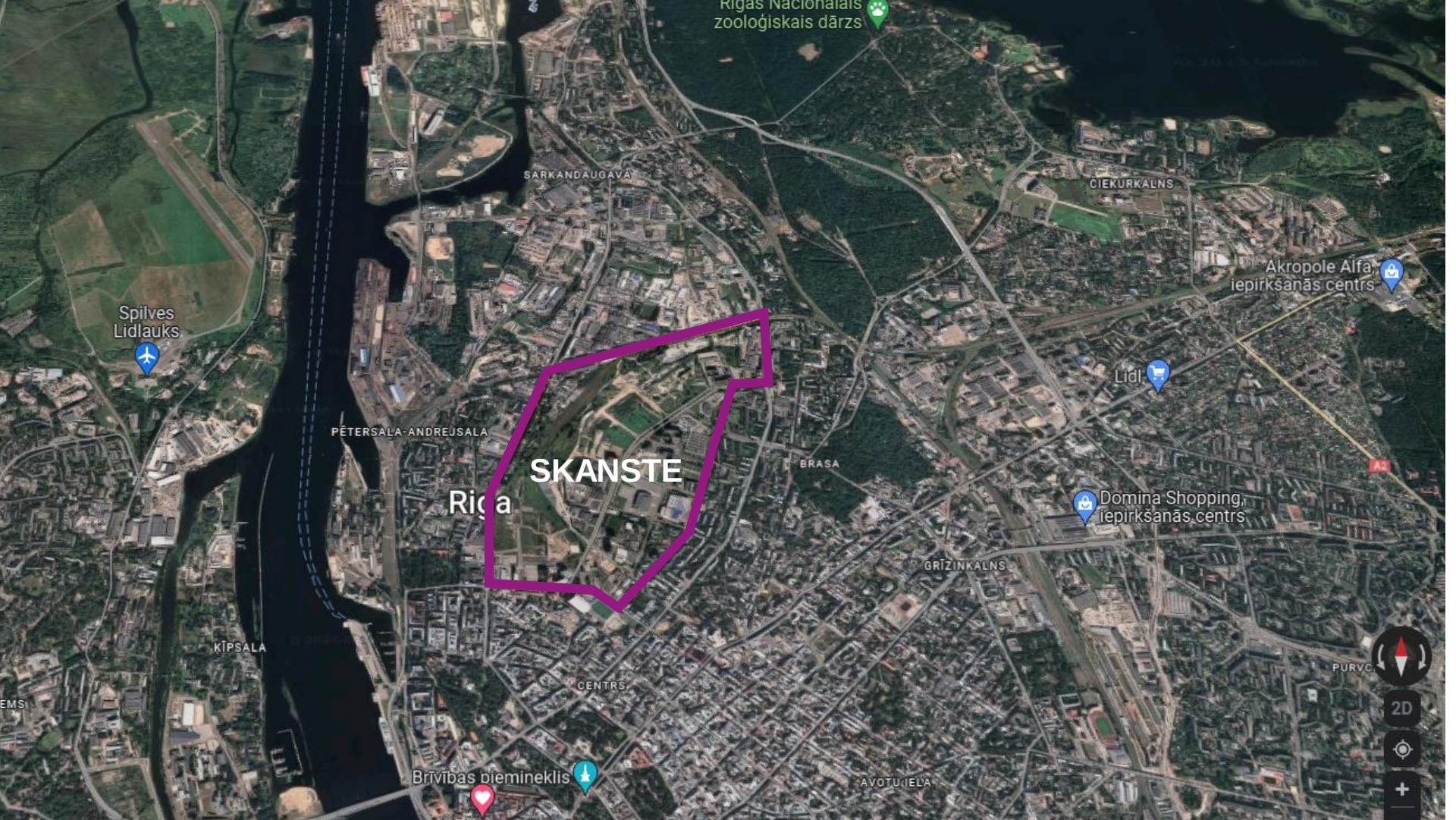
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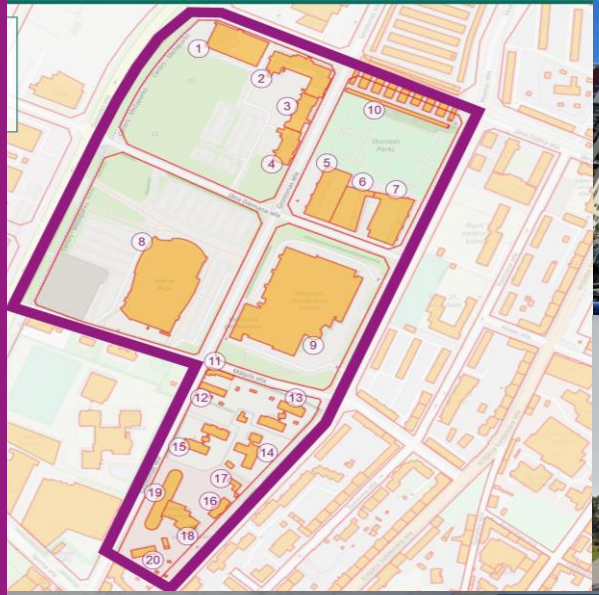
SARKANDAUGAVA
ČIEKURKALNS
Akropole Alfa iepirkšanās centrs
Spilves Lidlauks
Lidl
PĒTERSALA-ANDREJSALA
SKANSTE
Rīga
BRASA
Domina Shopping, iepirkšanās centrs
GRĪZINKALNS
KĪPSALA
CENTRS
Brīvības piemineklis
AVOTU IELA
2D

Skanste



What are the possibilities?

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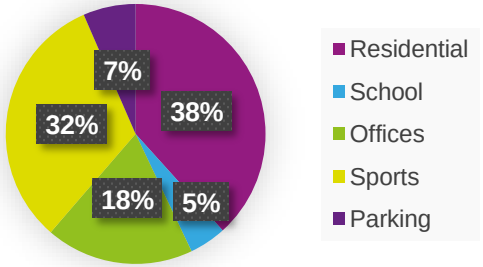
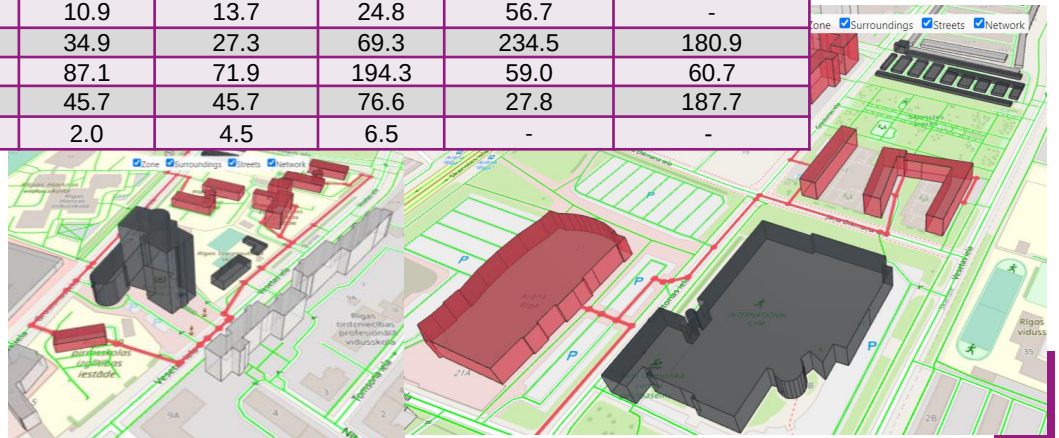
1 Energy efficiency

LOWER THE DEMAND
OPTIMISE CONSTRUCTION
SMART IoTs

Buildings in Skanste are already efficient (A or B class, except schools) or have been renovated recently. Deep renovation is expensive; and might not bring additional benefits for buildings that are already in good shape. Electricity consumption could be reduced through changing to more efficient appliances

kWh/m²	Thousand m²	Cooling	Heating	DHW	Lighting	Ventilation+ Appliances	Total El.	Total DHN	Total Gas
Residential	57.3	-	40.8	10.1	10.9	13.7	24.8	56.7	-
School	6.9	-	**172.8**	20.2	34.9	27.3	69.3	234.5	180.9
Offices	27.6	11.3	43.7	7.1	87.1	71.9	194.3	59.0	60.7
Sports*	48.0	4.0	45.8	43.3	45.7	45.7	76.6	27.8	187.7
Parking	9.8	-	0.0	0.0	2.0	4.5	6.5	-	-





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What are the possibilities?

2 Renewable Energy Production

PV on roofs, façades, canopies, solar roads or solar bikelines, organic PV shapes (for bikes' storage sheds, public furniture, etc.), etc.

Solar energy potential generation	Yes
Wind energy potential generation	33 W/m2
Geothermal energy potential generation	Low tº
Energy potential generation	Yes (river at 6.3 km, lake at 5 km)
Waste heat potential	Yes
Forest waste	Yes
Gas grids	Yes, all connected
Refueling Stations	No

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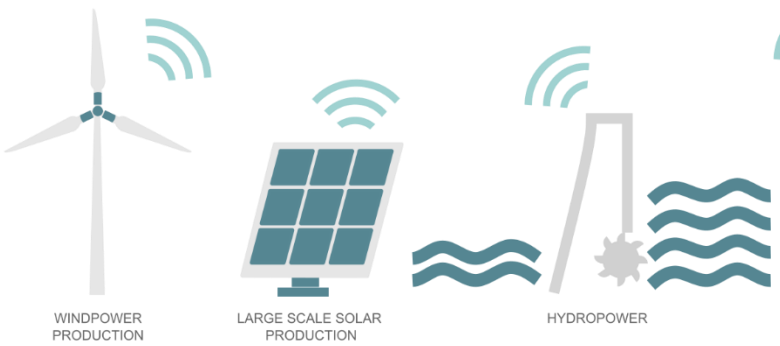
What are the possibilities?

2 Renewable Energy Production

In most districts, especially in densely populated areas, space is an issue and positivity becomes difficult.

Virtual boundaries/ City level

Energy Generation: **Power generation**



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What are the possibilities?

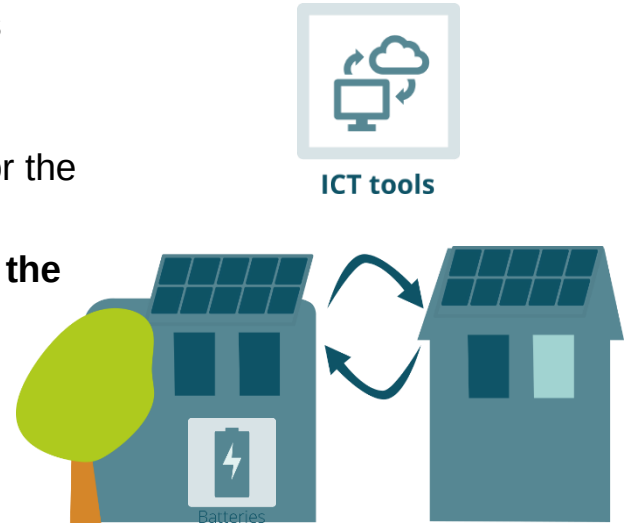
3 FLEXIBILITY

Flexibility options for PEDs: demand-response (e.g. power-to-heat solutions), offer ancillary services (f,V,black-out, etc.), RES dispatch when needed, etc.

Networks are supported with e-storage and market models (energy communities, flexibility markets and P2P)

Storage can help to increase self-consumption, reduce interaction with grids, and interact only when necessary (for the grid) and for the interest of the user.

In Latvia the **net metering allows to compensate part of the bill to a certain extent** (if it does not exceed the annual consumption of the previous accounting year).



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What are the possibilities?

4 Sustainable Mobility

Public transport, alternative mobility (micromobility, biking, etc.) and pedestrian areas are promoted.

Low-emission zones.

Smart logistics for reducing last-mile associated emissions

Car pooling/ car-sharing.

EVs can help on system storage capacity.

When industry is involved, hydrogen production or carbon sinks of CO_2 used for production of synthetic fuels could be used

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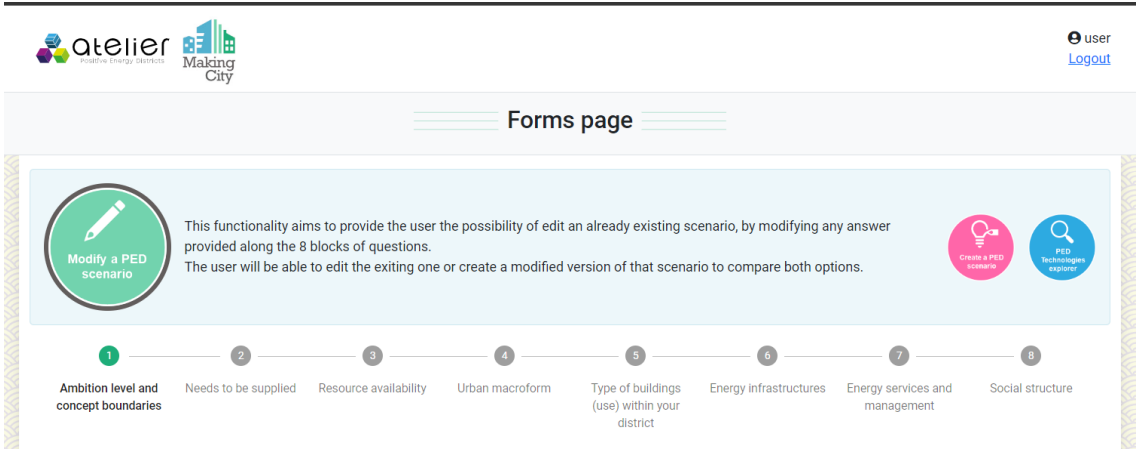
Vauban, Freiburg

How do we integrate them all?

PED tool process https://tools.cartif.es/ped-tool/



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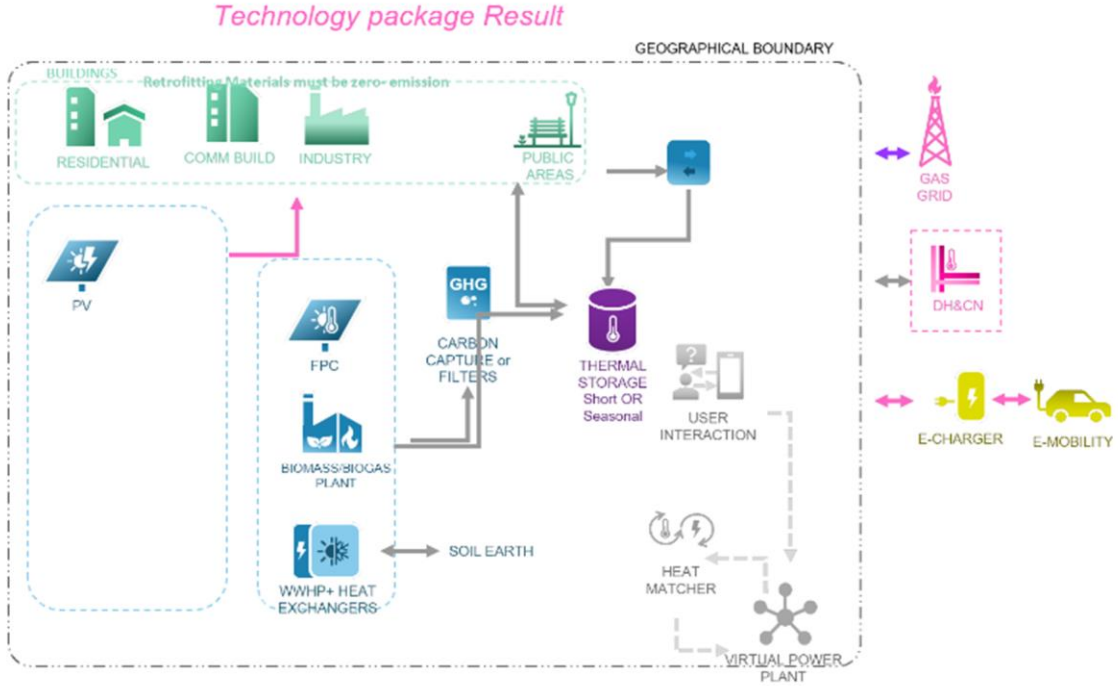
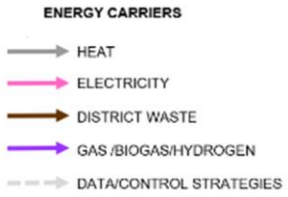
How do we integrate them all?



See more at:
https://tools.cartif.es/ped-tool/

Recommendations are given with connection to a full catalogue of solutions



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How do we integrate them all?

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Explore the catalogue

PED Technologies explorer

This functionality aims to provide the user the possibility of e
the Catalogue data base. Download Catalogue

SPEC CARD

Category 1
LOW ENERGY CONSUMPTION

Solution 1
Building Envelope Retrofitting in Residential buildings

Title

Graphical Detail

S1b Residential Building (Private House) retrofitting

General Data for the solution in bullets

City / Country | Making_City | Technical Partner Name & contact Details

SPEC CARD

SUPPLY SIDE SOLUTIONS

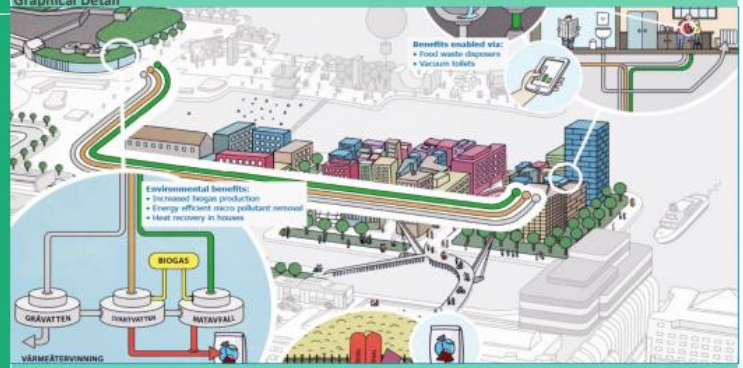
Category 4
RENEWABLE ENERGY SYSTEMS

Solution 15
Waste-To-Energy

Title

Graphical Detail

S21a Residential waste to biogas



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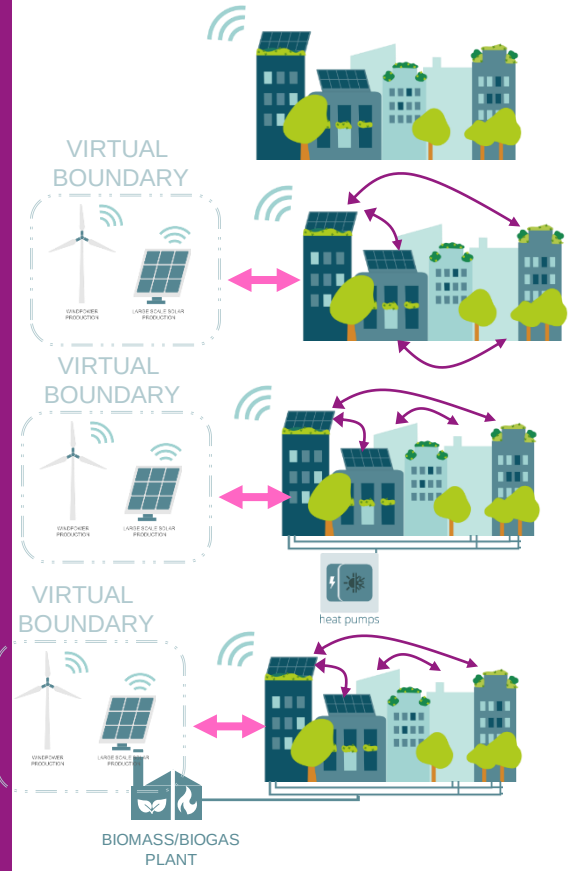
Feasibiliy studies for Skanste

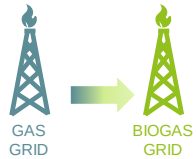
https://www.freepik.es/vector-gratis/concepto-evaluacion-credito-diseno-plano-dibujado-mano_20548556.htm

Scenarios studied in detail:



1. PV on roofs: All building produce and self-consumed. Exports are injected to the grid.
2. Collective PV: Buildings produce and share energy within the district. If there is excess of PV, the excess is injected into the grid.
3. Collective PV & HPs: buildings with DHN are supplied at a lower temperature
4. Collective PV and greener (biomass) DHN

3&5: Gas replacement with biogas with household waste



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Results

Baseline

- 32 GWh/yr (not PED)
- 337.5 k€/month[a]
- 3343.2 tons CO_2
- 11.18 GWh from GRID
- 5.96 GWh from district heating network
- 5.82 GWh from natural gas

Variables	1. PV in roofs (net metering with excess)	2. Collective PV (12.5 MWp; sharing excess)[c]	3. Collective PV & HPs (15 MWp; sharing excess)[c] & biogas[d]	4. Collective PV (13.75MWp), greener DHN & biogas[d]
Economic savings	33 k€/month	163.8 k€/month	160 k€/month	147 k€/month
Environmental impact	265 tons CO_2 reduction	1266 tons CO_2 reduction	3062 tons CO_2 reduction	2785.7 tons CO_2 reduction
Local production	1.4 GWh/yr production of PV	11.6 GWh/yr production of PV	13.9 GWh/yr production of PV	12.7 GWh/yr production of PV
Primary energy balance	27.35 GWh/yr (not PED)	9.92 GWh/yr (not PED; thermal)	**-2.91 GWh/yr** (PED)	**-0.09 GWh/yr** (PED)
Investment	1.8 M€, payback in ~5 years[b]	13.8 M€, payback in ~ 7 years	20 M€, payback in ~11 years	15.8 M€, payback in ~9 years

[a] ONLY energy costs: 22.2 k€/month DHN, 15.6 k€/month Gas, 299.7 k€/month for electricity costs (Prices of 2022; excluding subsidies from gas). Annual costs divided equally between the 12 months. [b] depends on building, [c] PV does not fit in the district; could be replaced partially with wind production off-shore (potential of 17.5 GWh/yr. with a turbine of 3.45 MW). INV cost of 13.7 M€ (10.5 years); [d] assuming gas grid becomes greener

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Let's take a closer look...

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Baseline

- 32 GWh/yr (not PED)
- 337.5 k€/month[a]
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Variables	1. PV in roofs (net metering with excess)	2. Collective PV (12.5 MWp; sharing excess)[c]	3. Collective PV & HPs (15 MWp; sharing excess)[c] & biogas[d]	4. Collective PV (13.75MWp), greener DHN & biogas[d]
Economic savings	33 k€/month	163.8 k€/month	160 k€/month	147 k€/month
Environm				785.7 tons CO_2 uction
Local production	1.4 GWh/yr production of PV	11.6 GWh/yr production of PV	13.9 GWh/yr production of PV	12.7 GWh/yr production of PV
Primary energy balance	27.35 GWh/yr (not PED)	9.92 GWh/yr (not PED; thermal)	**-2.91 GWh/yr** (PED)	**-0.09 GWh/yr** (PED)
Investment	1.8 M€, payback in ~5 years[b]	13.8 M€, payback in ~ 7 years	20 M€, payback in ~11 years	15.8 M€, payback in ~9 years

What are the benefits for my building? How much do I need to invest?

[a]ONLY energy costs: 22.2 k€/month DHN, 15.6 k€/month Gas, 299.7 k€/month for electricity costs (Prices of 2022; excluding subsidies from gas). Annual costs divided equally between the 12 months. [b]depends on building, [c] PV does not fit in the district, could be replaced partially with wind production off-shore (potential of 17.5 GWh/yr with a turbine of 3.45 MW). INV cost of 13.7 M€ (10.5 years); [d]assuming gas grid becomes greener

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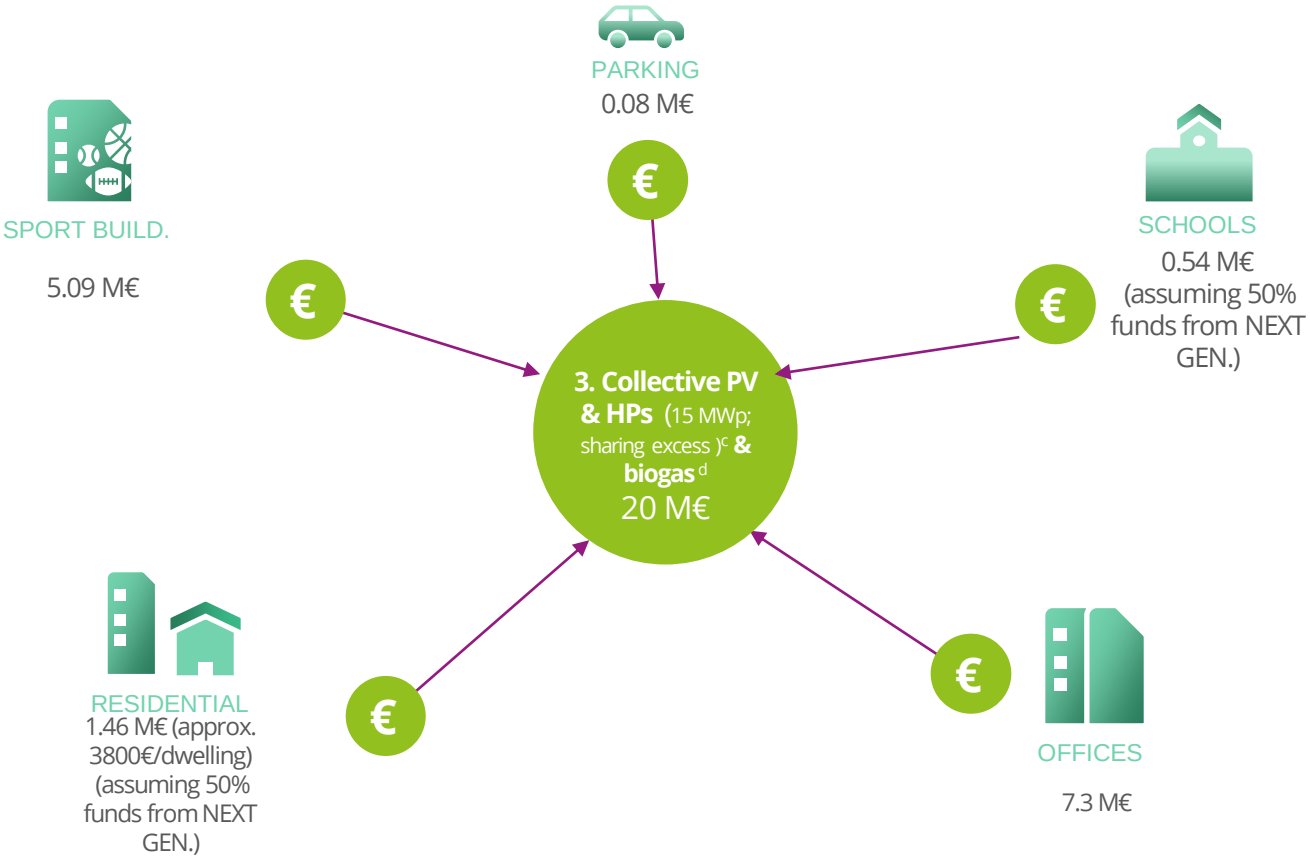
Collective investment



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Building 8 and 9 to become prosumers – benefits all.

Possible PV canopies in B8&B9:

1. PV in roofs (net metering with excess)

952 kWp
~1250 MWh/y

B8: 8.7
B9: 14.2
k€/month (savings)

0.4 M€ B8, PB: 4.5 y
0.65M€ B9, PB: 4.7 y

3. Collective PV+HPs (sharing excess) **+Biogas**

Total for the district:15 MWp
13.9 GWh/yr
For B8&B9: 30.86%

B8: 37.2
B9: 35.3
k€/month (savings)

Investment is shared.
- B8: 3.5M€ (21.7%), PB: 8yr
- B9: 1.5 M€(9.1%), PB: 3.6 yr

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B18&19 - RCC Rietumu Capital Centre

Baseline

- 9.2 GWh/yr (not PED)
- 110 k€/month (electricity only)
- 670 tons CO_2
- 4.12 from GRID (> 90% B18)
- GWh from natural gas

SCENARIO RESULTS

	1. PV in roofs (120 kWp in B19 shared excess only with B18)	3. Collective PV & HPs (15 MWp; sharing excess [c] & biogas [d]
Economic savings	2762.2 €/month (VS 364.3 €/month for B19 when does not share)	B18: 67.8, B19: 0.27 k/month
Environmental impact	22 tons CO_2 reduction	B18: 0.7, B19: 0.002 k·tons CO_2 reduction
Local production	128.8 GWh/yr production of PV No excess	4.5 GWh/yr production of PV
Primary energy balance	**8.8 GWh/yr** (no PED alone)	**-0.35 GWh/yr** (PED)
Investment	It's already there: but, it was: 132k of inv. With 4 yr. of PB	B18: 5.4 M€, payback in ~6.7 years

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Building 1 – office

Baseline

2.86 GWh/yr (not PED)	36.2 k€/month	236.88 Tons CO_2	1.24 GWh from GRID	0.62 from district heating network	-

Possible parking lots (B1)

SCENARIO RESULTS

	1. PV in roofs	3. Collective PV & HPs (15 MWp; sharing excess [c] & biogas [d]
Economic savings	877 €/month	20.3 k/month
Environmental impact	3.56 tons CO_2 reduction	0.25 k·tons CO_2 reduction
Local production	32.7 MWh/yr production of PV	1.5 GWh/yr production of PV
Primary energy balance	**2.8 GWh/yr** (no PED alone)	**-0.26 GWh/yr** (PED)
Investment	38 k€, PB: 3.66 years	B1: 1.8 M€ (11.2%), payback in ~7.6 years

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Residential buildings

Baseline

- 5.07 GWh/yr (not PED)
- 50 k€/month (126 €/ month/dwelling)
- 673.2 Tons CO_2
- 1.42 GWh from GRID
- 3.25 GWh/yr from district heating network
- -

Nº	Costs Savings (€/year / dwelling)	Investment (€/dwelling)
Building 2	175.6	2220.7
Building 3	958.0	4992.2
Building 4	1267.8	5811.1
Building 5	461.2	3537.9
Building 6	115.0	2447.4
Building 7	400.3	3532.2

SCENARIO RESULTS

	1. PV in roofs (120 kWp in B19 shared excess only with B18)	3. Collective PV & HPs (15 MWp; sharing excess [c] & biogas [d]
Economic savings	50 k€/month (100-300€ per dwelling per year)	18.76 k€/month (563€/year per dwelling)
Environmental impact	16.3 tons CO_2 reduction	0.7 k·tons CO_2 reduction
Local production	234 MWh/yr production of PV No excess	2.5 GWh/yr production of PV
Primary energy balance	**4.7 GWh/yr** (no PED alone)	**- 0.41 GWh/yr** (PED)
Investment	278 k€ (534-1500€ per dwelling) PB: 4 yrs	1.5 M€, payback in ~10 years (with an average inv. Of 3760€/dwelling)

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Kindergarden - Buildings 13-16,20

Possible canopies (as sport area)

Baseline

- 2.1 GWh/yr (not PED)
- 18.5k €/month
- 308 Tons CO_2
- 0.48 GWh from GRID
- 1.44 from district heating network
- 0.13 GWh from natural gas

SCENARIO RESULTS

	1. PV in roofs (120 kWp in B19 shared excess only with B18)	3. Collective PV & HPs (15 MWp; sharing excess [f] & biogas [d]
Economic savings	3053 €/month	6 k/month
Environmental impact	7.5 tons CO_2 reduction	0.3 k·tons CO_2 reduction
Local production	123 MWh/yr production of PV No excess	0.9 GWh/yr production of PV
Primary energy balance	**1.97 GWh/yr** (no PED alone)	**-0.09 GWh/yr** (PED)
Investment	148 k€ investment, PB: ~4.5 years	0.5 M€, payback in ~8 years

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Together
Everyone
Achieves
More

Your vision matters,

We want to hear from you

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THANK YOU

atelier
Positive Energy Districts

Contact us: Andrea Gabaldón, Carla Rodríguez, Paula Serrano, Carolina Pastor

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slido

Describe the session in one word

ⓘ Start presenting to display the poll results on this slide.

slido

What could be improved?

ⓘ Start presenting to display the poll results on this slide.

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