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POCITYF

PED-wise solutions for sustainable heritage cities

MAKING-CITY Webinar

28/04/2021

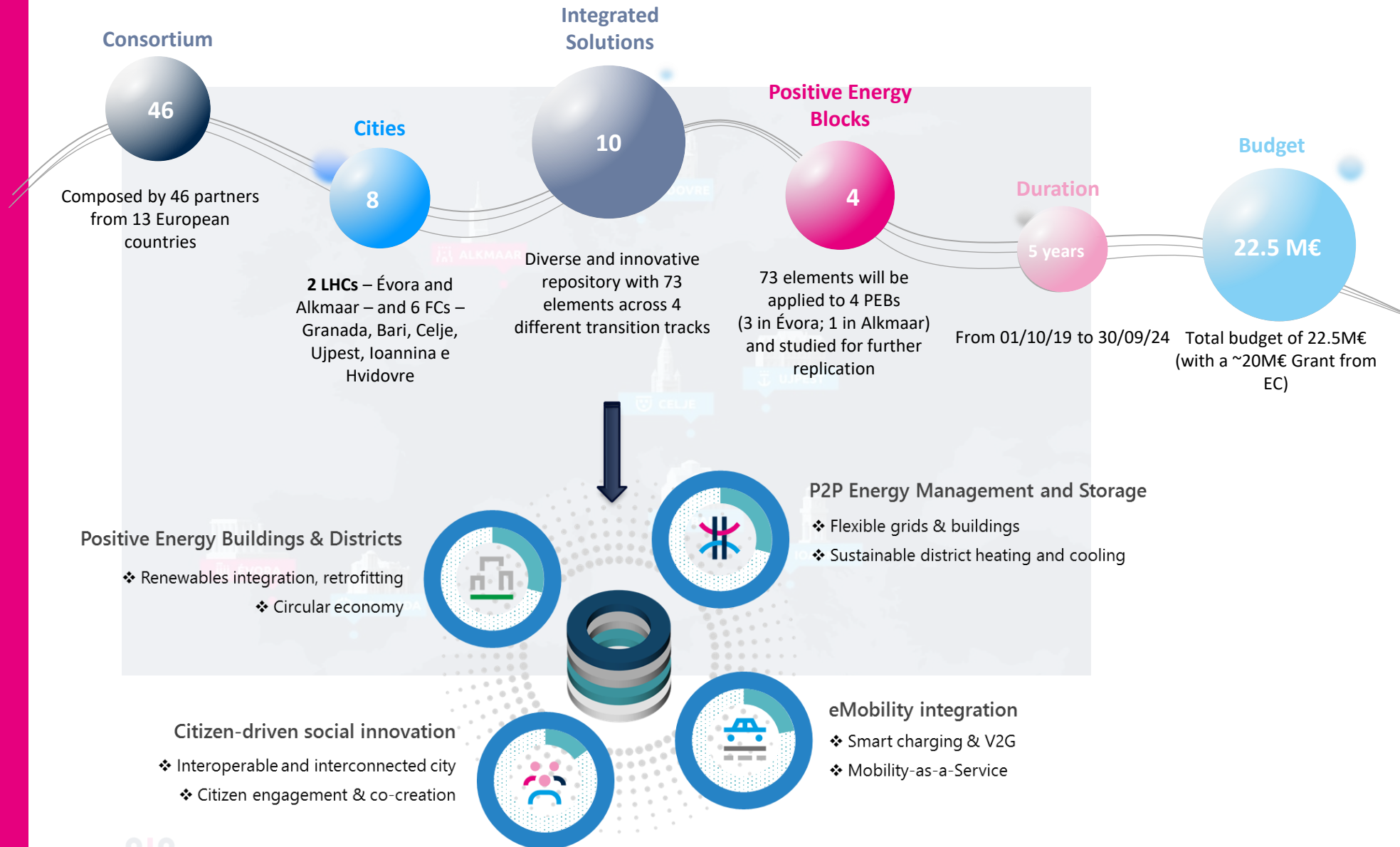


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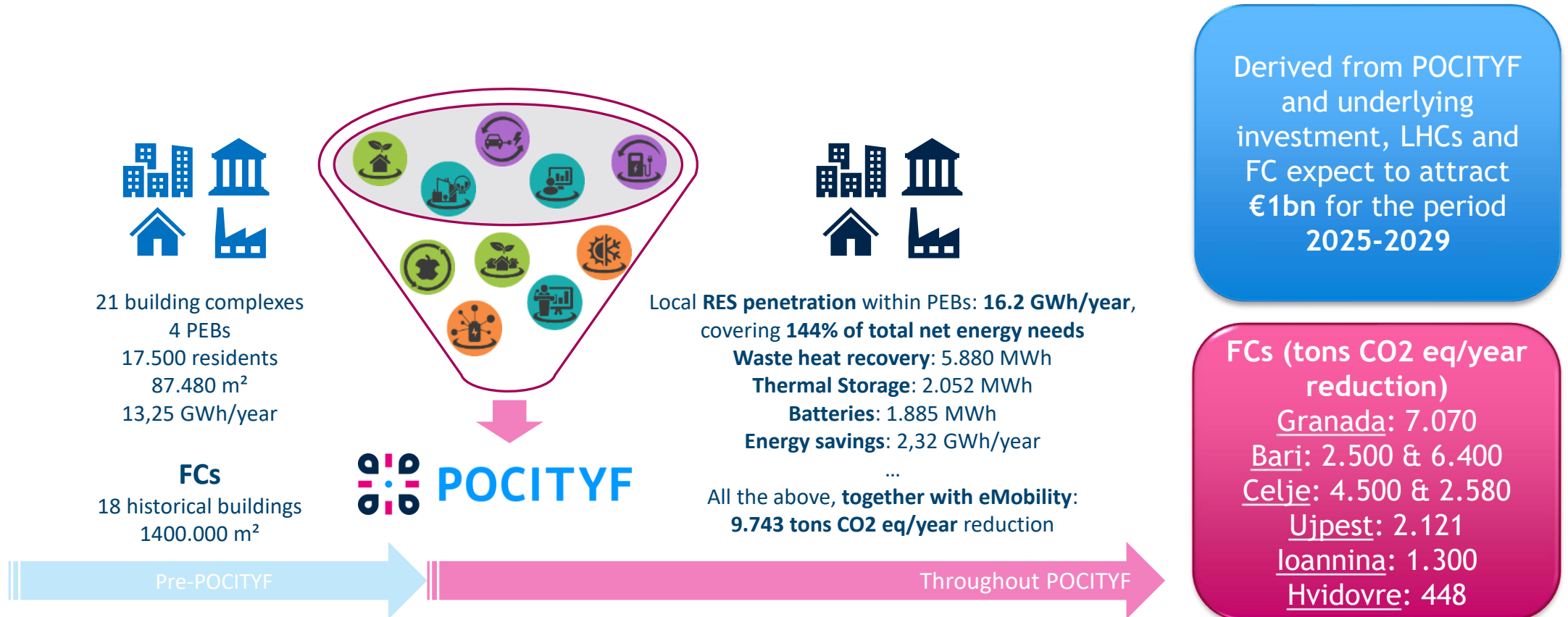
Structure

- POCITYF at a glance
- Evora LH - PED/PEBs, highlights and technology examples
- Alkmaar LH - PED/PEBs, highlights and technology examples
- Moving forward - Conclusions

POCITYF at a glance



Structure and ambition

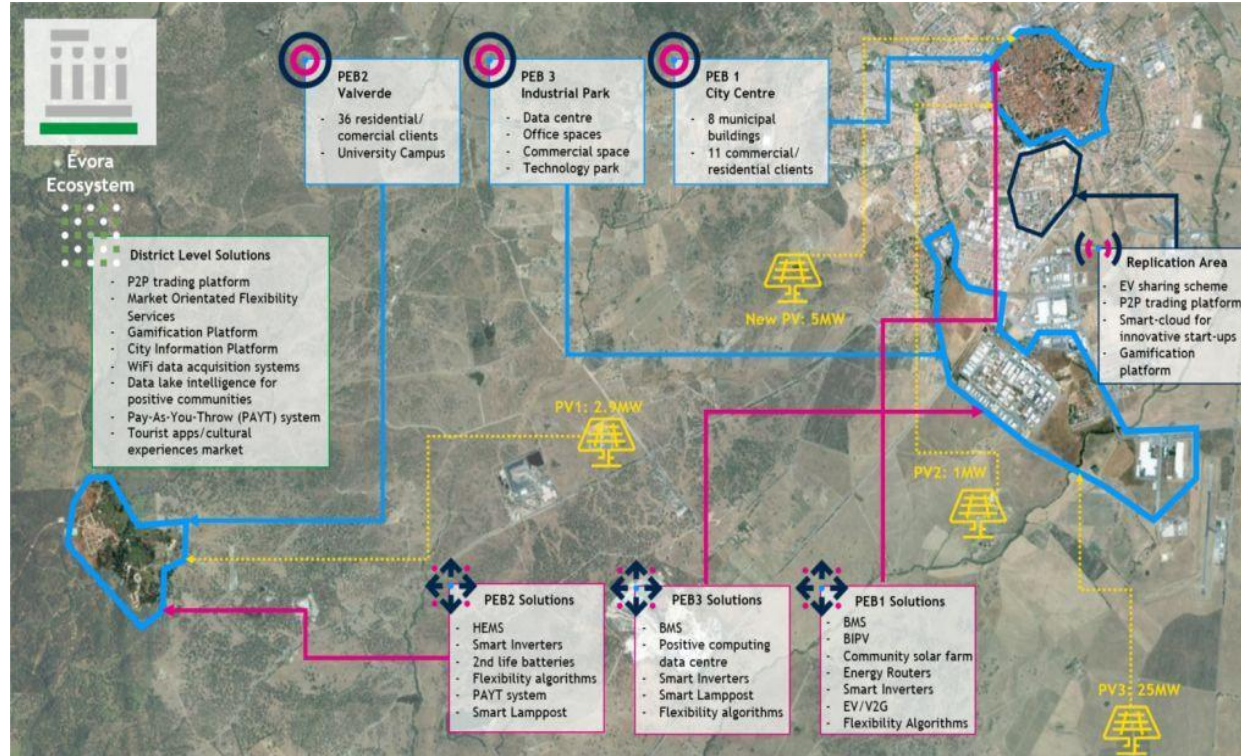




Évora LH



Evora PED/PEB limits and solutions



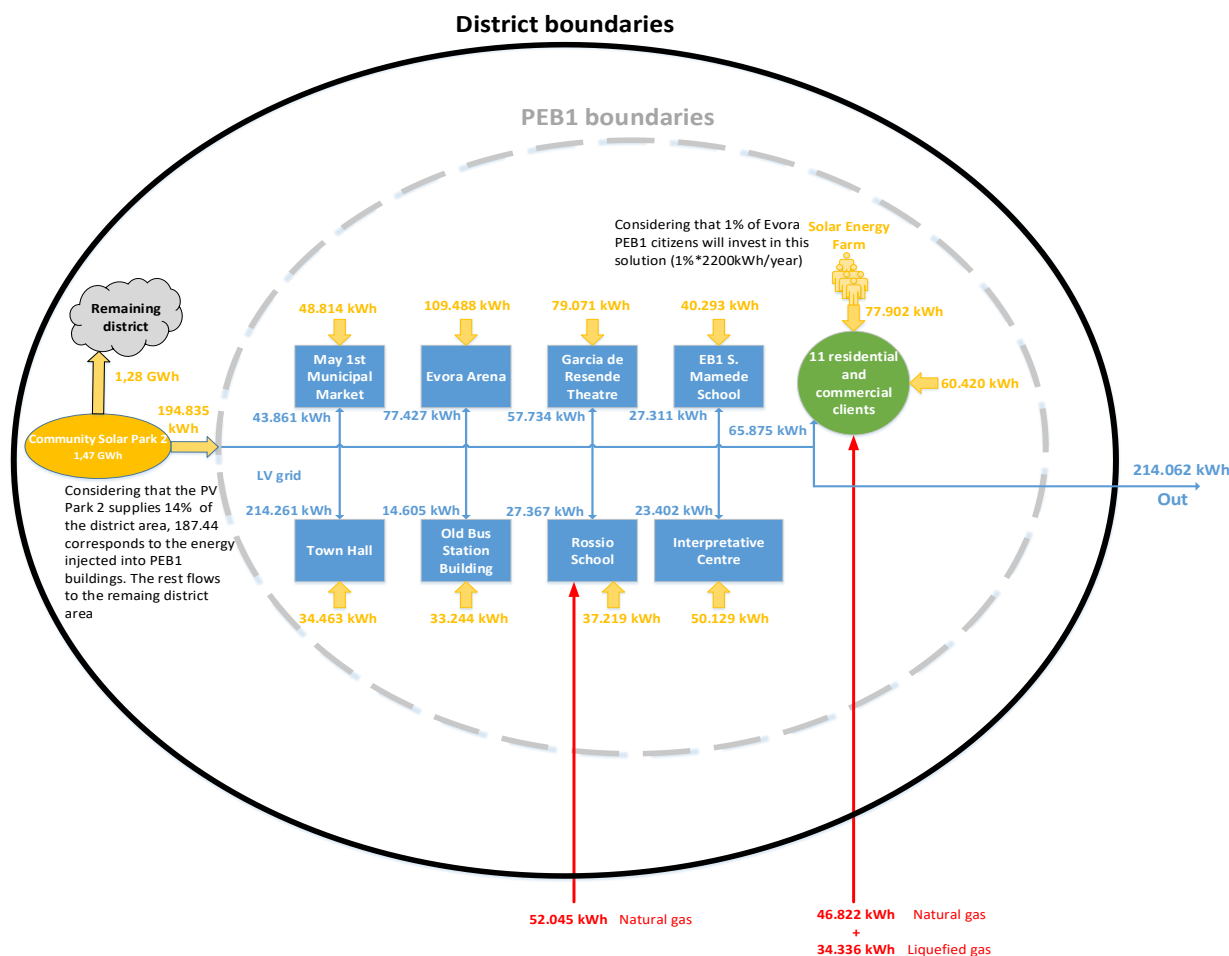
• Main Highlights

- 3 different blocks of demonstration, encompassing the City's main challenges
- 4 Groups of solutions: positive energy buildings, mobility, storage and flexibility, and stakeholders' solutions co-creation
- Several **district-level solutions**, oriented to provide the Municipality an holistic vision of the city and endow local stakeholders with new smart city solutions
- PEDs have been designed to encompass each PEB taking into account incoming energy flows from PV Plants

• Main Challenges

- PEB1 (City Centre) poses tremendous challenges, endowing anyhow, new opportunities for cultural sites
- COVID-19 has brought new challenges to this already daunting project

Example: PED 1 - City Centre



• Main Focus

- Novel BIPV solutions + Energy Routers + Smart Inverters
- Building Energy Management Systems
- Community Solar Energy Farm (CSEF)

• District Level

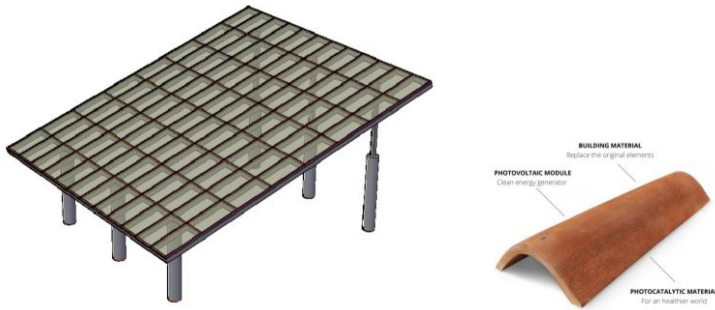
- Solar Park feeds the PED in addition to PEB entities
- A rich list of PED interventions are planned:

Smart Lamppost	PAYT system	EV charging management platform and systems	Smart distribution system for goods (EV sharing scheme)	Digital transformation in Social Innovation	Gamification platform	Tourist apps	Cultural experiences market place	TIPPING Approach	CIP // Wi-fi data acquisition system // Data Lake Intelligence for positive communities // Smart-cloud for innovative start-ups
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- All Building/PEB level solutions integrate with the PED level towards increased efficiency and sustainability of the district

Example: PED 1 - BIPV Solutions

BIPV solutions (ONYX and Tegola)



• Key aspects

>> Expected increase of generation in PEB 1 Municipal Buildings of ~68 MWh/y

>> The challenges are real!

All the solutions are now defined and re-designed according to DRC guidelines, Municipality requirements and Schools' requests

- New PV shingles
- Reallocation of Tegosolar PV and ONYX solutions (partially)
- Inclusion of a parking lot to circumvent Theatre's constraints in accommodating ONYX canopy (additional plans to afforest the parking lot)
- Substitution of Old Bus Station per **Vista Alegre School**;
- Sized new canopies for the schools, thus enlarging the covers in the playgrounds

>> Moving forward:

- Submit the final report to DRC's approval
- Formation and validation of a **Renewable Energy Community** (must be approved by national authorities)

Traditional PV Shingle (Tegola+Dyaqua)



Pre-pilot: Pompei historical area

- The total area occupied was 24 m² (rooftop)
- Total power ~ 2 kWp (350 units)



POCITYF Demo: Evora's Town Hall

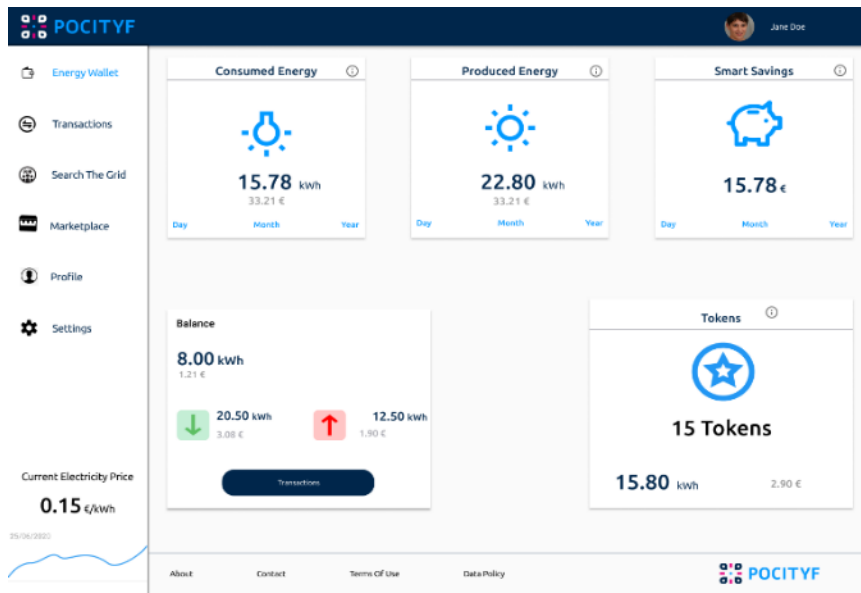
Key tech and demo aspects

- ✓ Tile in clay + modern photovoltaic technology
- ✓ Thermal inertial properties of tiles unaltered
- ✓ Installation without tubs and / or fixing brackets
- ✓ No infiltrations and thermal bridged issues
- ✓ Exact shape replication of traditional roofing elements and color - Invisible Solar tech
- ✓ No glass on top of panels
- ✓ Aesthetical and architectural integration with surrounding buildings
- ✓ Non-toxic recyclable materials

- Panel weight: 21 kg/m²
- Total weight of the technology: 40 kg/m²
- Total area: 370 m²
- Total power ~ 30 kWp (4900 units)
- Energy production: 43.720 kWh/year
- Specific annual yield: 1.460 kWh/kWp

Example: All PEDs - P2P platform

P2P Energy Trading Platform



Key aspects

>> Demo sites

- All Évora PEBs

>> <http://demo.kimatica.com>

>> Main features

- Energy Wallet
 - Consumed energy, produced energy, smart savings (savings resulting from the use of energy flexibility), energy balance, tokens
- Donation module

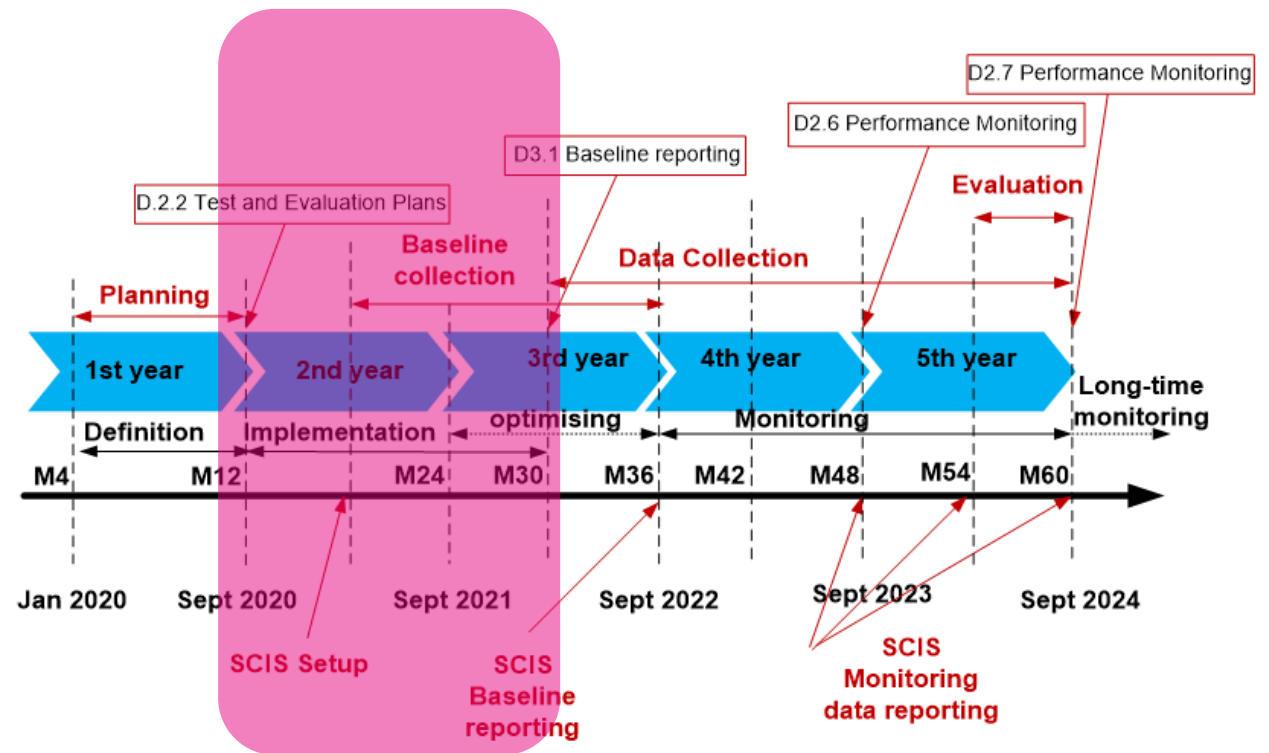
>> Next actions linked with challenges

- Assess the deployment's approach taking into account new PT legislation

Moving forward..

- The replication potential of each solution (including business models etc) will be investigated under WP5 (BMs) and WP8 (Replication) of POCITYF
- FCs currently build their concrete Replication Visions under a dedicated framework
- Updates to come in next year(s)

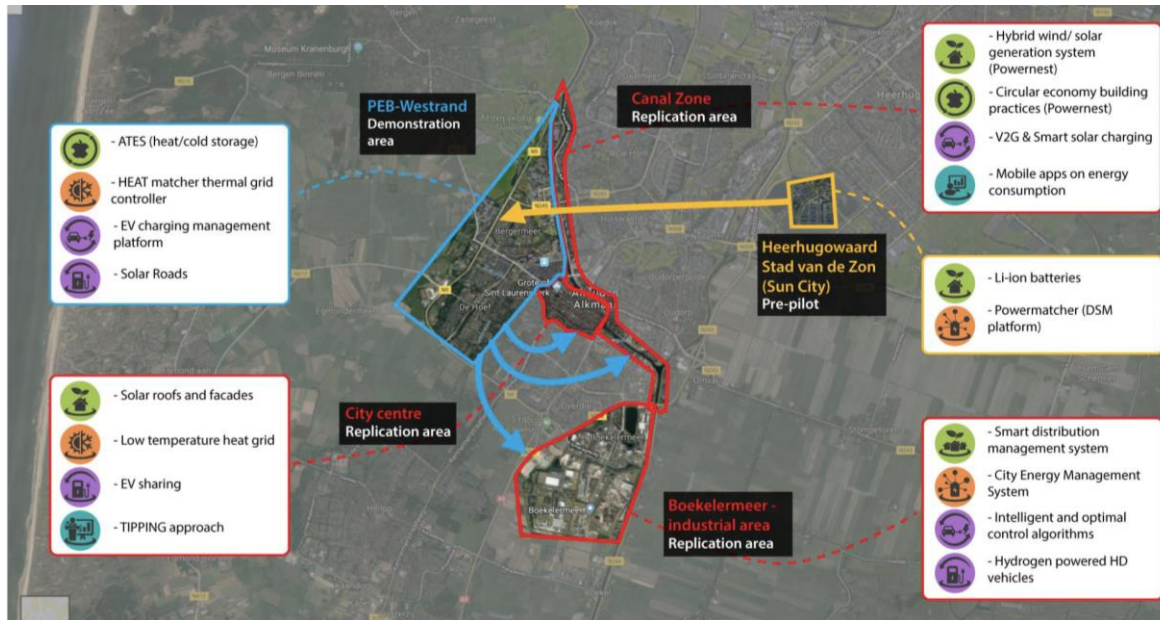
Stay tuned!!!



Alkmaar LH



Alkmaar PEB/PED limits and solutions



• Main Highlights

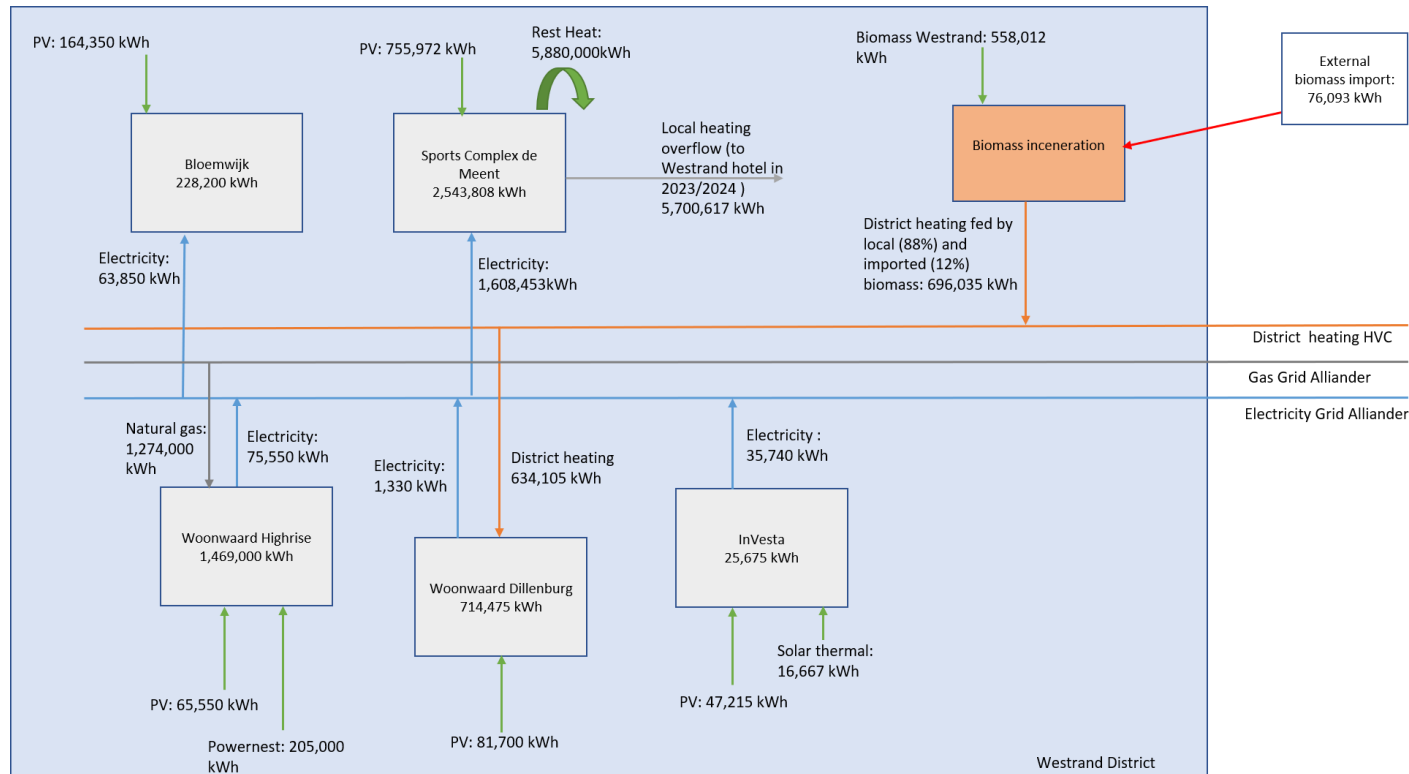
- 1 PED including a series of Buildings/PEBs
- PED corresponds to a well-defined city district (Westrand)
- Several district-level solutions



• Main Challenges

- Restructuring of PED limits due to unforeseen changes → New areas are adjacent or not far from original PED
- COVID-19 has brought new challenges to this already daunting project

PED 1 - Westrand



• Main Focus

- PV generation + storage
- District Heating
- Grid Management
- V2G and e-charging
- Circular practices
- Citizen engagement



• District Level

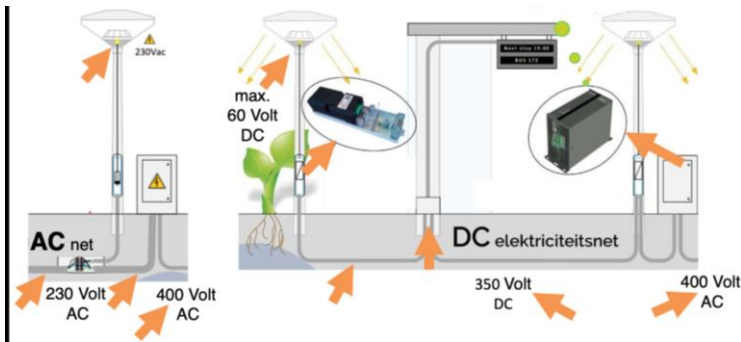
- Biomass plant feeds PED
- A rich list of PED interventions are planned:

DC Grid	Smart Grids/Heat Island	Energy management	EV Sharing	Solar Screens	P2P Platform	CIP/Gamification Platform/Design Based Value Mapping
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- All Building/PEB level solutions integrate with the PED level towards increased efficiency and sustainability of the district

Example: PED 1 - DC grid and lampposts

DC Lampposts



• Key aspects

>> The challenge is real!

Original plan: DC grid with smart lampposts

- Disappointing pre-pilot results in Heerhugowaard: only 7 (out of 150) DC Smart lampposts in operation, which can be controlled by management in the cloud. Other 143 lampposts cannot not be controlled by the smart LED driver.
- Cabling doesn't have a continuous feeding of 350 Voltage
- No powerline communication possible with the individual lampposts.

>> Mitigation:

Installation of 92 lampposts within a DC grid in Oranjebuurt

- In district Oranjebuurt which borders the Westrand area in the south and to be placed before October 2021.

>> The solution splits the original technology to DC grid + lampposts and smart lampposts (AC driven)

Example: PED 1 - V2G + solar charging

V2G buses and Solar charging (Connexxion)



• Key aspects

>> The challenge is real!

Original plan : V2G for buses and Solar charging at sports complex De Meent

2 issues:

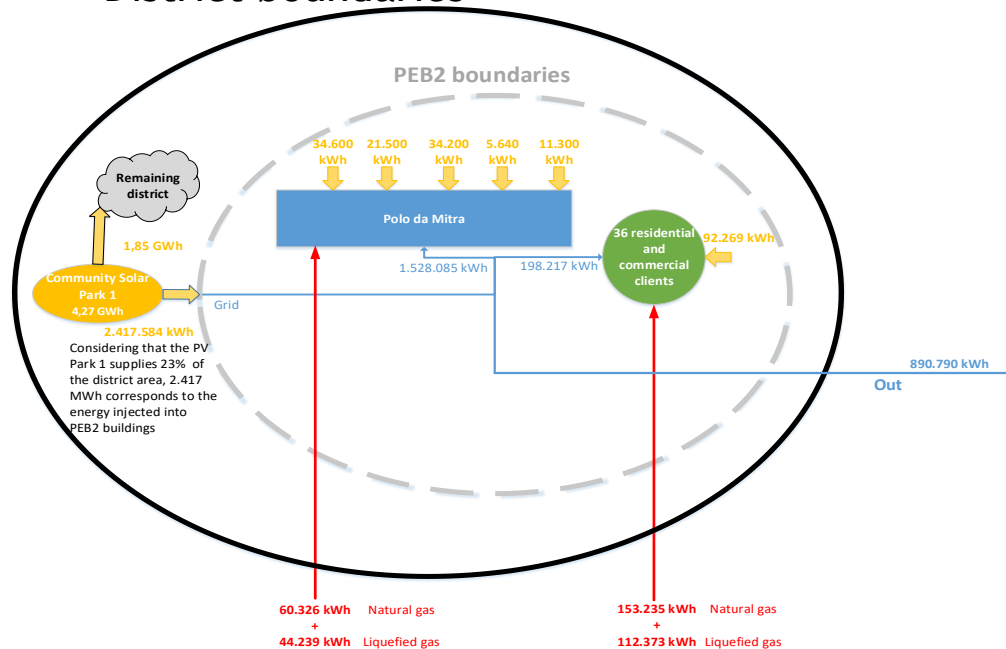
1. V2G for buses not applicable yet: missing hardware and software to allow for V2G-services from OEM, required legislation for V2G on buses is missing and communication between buses and chargers and grid connections are not standardised.
2. Solar charging: location of De Meent is not suitable for buses' charging, no stations or storage available at De Meent, no DC-DC chargers at depot Connexxion or De Meent, no restricted area for testing available, bus batteries need high power charging (too much for DC solar charging), ...

>> Mitigation:

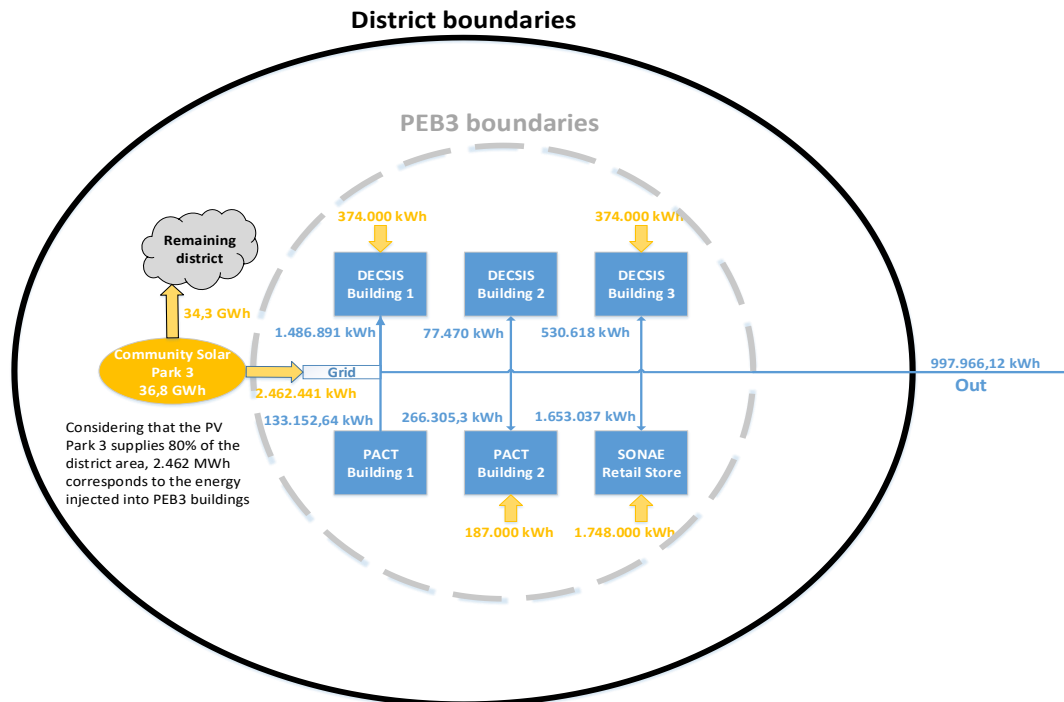
1. VDL (OEM) to provide a bus with V2G services to test as soon as possible to Alkmaar (expected not before 2022)
2. Virtual transferral of the solar energy from De Meent to the buses.

PED 2 - Tech park

District boundaries



PED 3 - Valverde village





POCITYF

Thank you!
Questions?



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Making City webinar on PED technologies

Rudy Rooth
Local Project manager Amsterdam

AmsTERdam BiLbao ciTizen drivEN smaRt cities



atelier
Positive Energy Districts



PED Definition - Background

- BEST (Building Energy Specification Table) is an effort to a standardized way of calculating buildings/districts energy performance across Europe
- For Energy balance calculations in ATELIER we refer to Guidelines 2012/C 115/01 accompanying Commission Delegated Regulation (EU) 244/2012 supplementing Directive 2010/31/EU on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements

NOTICES FROM EUROPEAN UNION INSTITUTIONS, BODIES, OFFICES AND AGENCIES

EUROPEAN COMMISSION

Guidelines accompanying Commission Delegated Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements

(2012/C 115/01)

Definitions, also for district

■ See the EU document

Primary energy for a building is the energy used to produce the energy delivered to the building. It is calculated from the delivered and exported amounts of energy carriers, using primary energy conversion factors. Primary energy includes non-renewable energy and renewable energy. If both are taken into account it can be called total primary energy.

■ In ATELIER, we used total primary energy

5. CALCULATION OF THE PRIMARY ENERGY DEMAND RESULTING FROM THE APPLICATION OF MEASURES AND PACKAGES OF MEASURES TO A REFERENCE BUILDING

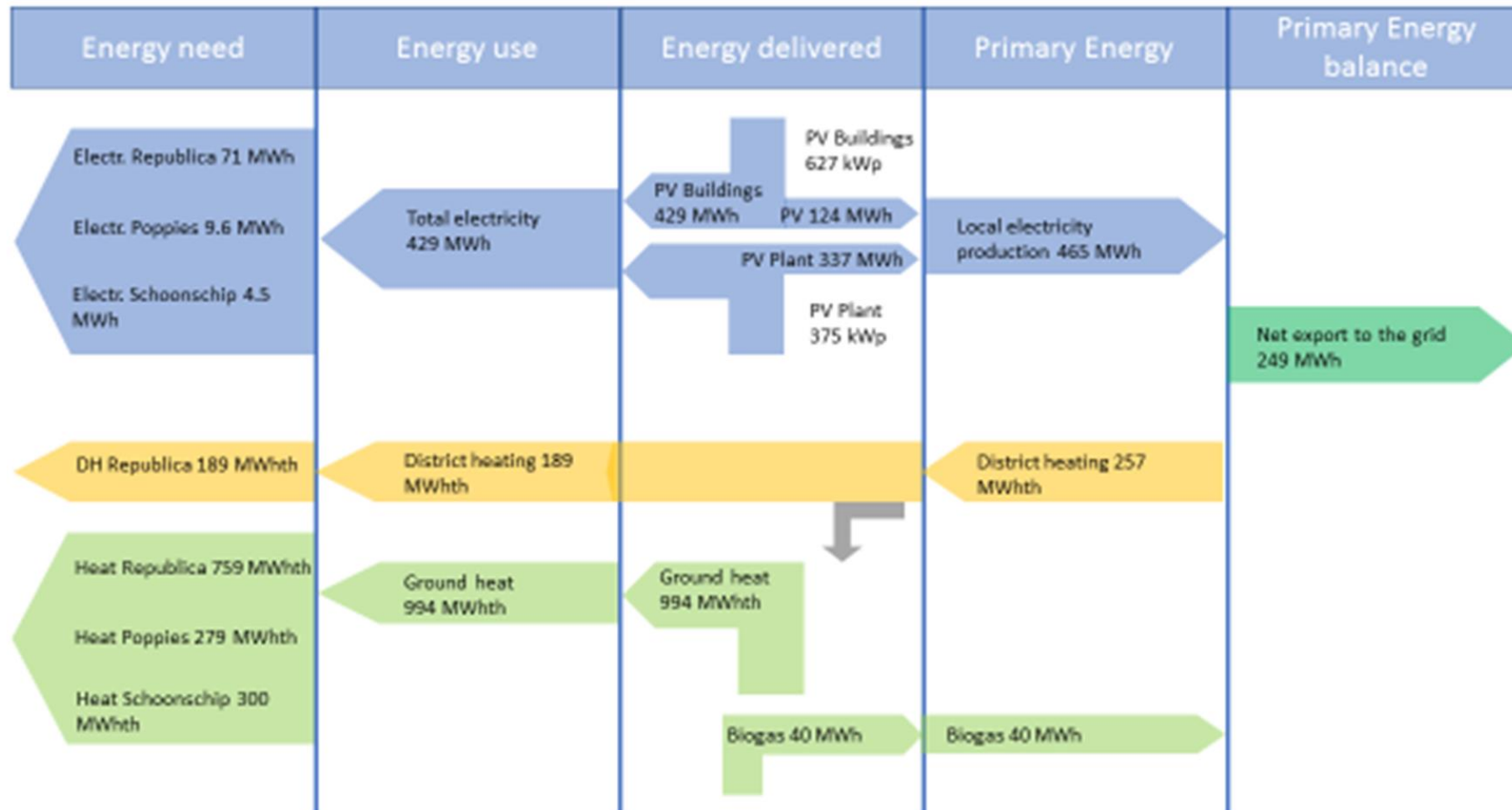
The objective of the calculation procedure is to determine the annual overall energy use in terms of **primary energy**, which includes energy use for heating, cooling, ventilation, hot water and lighting. The main reference for this is Annex I to Directive 2010/31/EU which applies fully also to the cost-optimal framework methodology.

Scope of the PED BEST calculation

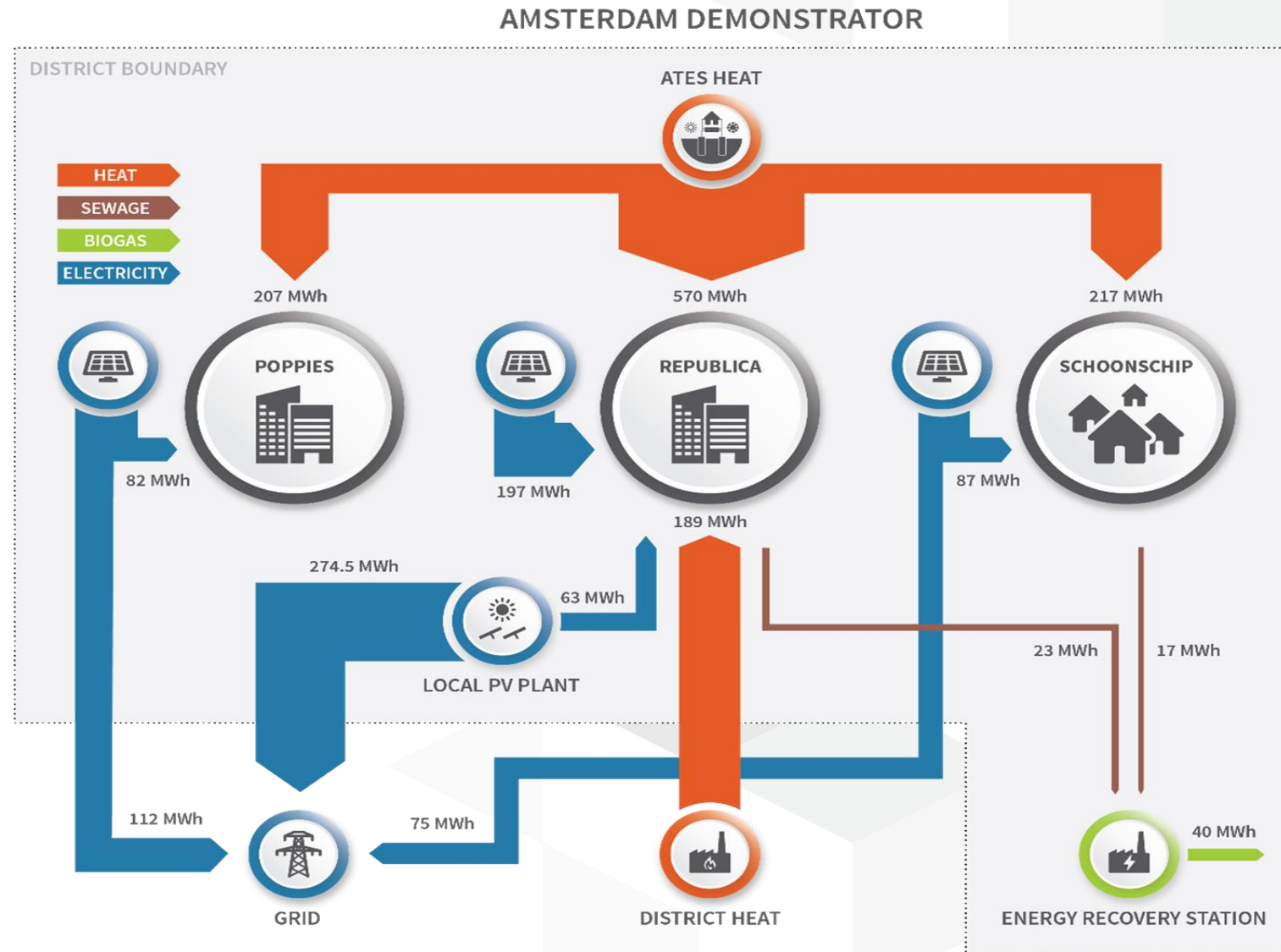
- Based on EU BEST template for PED projects
 - The step to calculation of Primary Energy is not required for the ATELIER proposal, we do it because of the EU energy flow diagram guidelines
 - All energy is about operation of the district, not construction or demolition
 - Energy for mobility has not been included
 - Energy for consumer electricity has not been included (so only the so-called "building-bound energy" is taken into consideration)
 - Energy consumption in the public space of the Positive energy district has not been included
 - For Amsterdam, locations included are Republica, Poppies, Schoonschip, A local RES power plant and the Energy recovery station

Amsterdam resulting example

District energy flow diagram, values per year



Energy flow between buildings



PED definition Summary

- The ATELIER BEST sheets show details and factors used.
(h2020-best_en-Amsterdam-v4feb2019-combined_annotated_20july2020.xlsx)
- Amsterdam used $PEF=1.01$ for green electricity. There is no planned net electricity import
- Discussions on definition of a PED are ongoing in Europe:
Positive Energy Districts and Neighbourhoods are an integral part of **comprehensive approaches** towards sustainable urbanisation including **technology, spatial, regulatory, financial, legal, social and economic perspectives**. They require **interaction and integration between buildings, the users and the regional energy, mobility and ICT system**. In this sense, a Positive Energy District is seen as an **urban neighbourhood with annual net zero energy import and net zero CO₂ emissions working towards a surplus production of renewable energy, integrated in an urban and regional energy system**. Active management will allow for **balancing and optimisation, peak shaving, load shifting, demand response and reduced curtailment of RES, and district-level self-consumption of electricity and thermal energy**. A Positive Energy District couples built environment, sustainable production and consumption, and mobility to reduce energy use and greenhouse gas emissions and to create added value and incentives for the consumer. Furthermore, implementation has to come with a **high and affordable standard of living** for its inhabitants.

ATELIER Summary and Goals



- ATELIER is a smart city project that demonstrates Positive Energy Districts (PEDs) within 8 European cities with sustainability and carbon neutrality as guiding ambitions.
- The project will:
 - Showcase innovative solutions that integrate buildings with smart mobility and energy technologies
 - Create a surplus of energy and balance the local energy system.
 - Help the fellow cities Bratislava, Budapest, Copenhagen, Krakow, Matosinhos and Riga to replicate and adapt successful solutions
 - Establish local PED Innovation Ateliers to co-produce locally embedded, smart urban solutions
- ATELIER has the ambition to pave the way for “energy positive cities” in Europe.

ATELIER Amsterdam demonstrator ingredients

- Positive energy buildings
- PV plant
- Smart mobility
- Smart micro-grids
- Local energy communities
- Sewage energy recovery



Amsterdam PED group of technologies

- Heating by ATES and heat pumps
- Building-PV + PV plant for required electricity
- Smart mobility (Shared electromobility and smart charging)
- Smart micro-grids (Building energy management, Peak shaving, local exchange)
- Local energy communities
- Sewage energy recovery



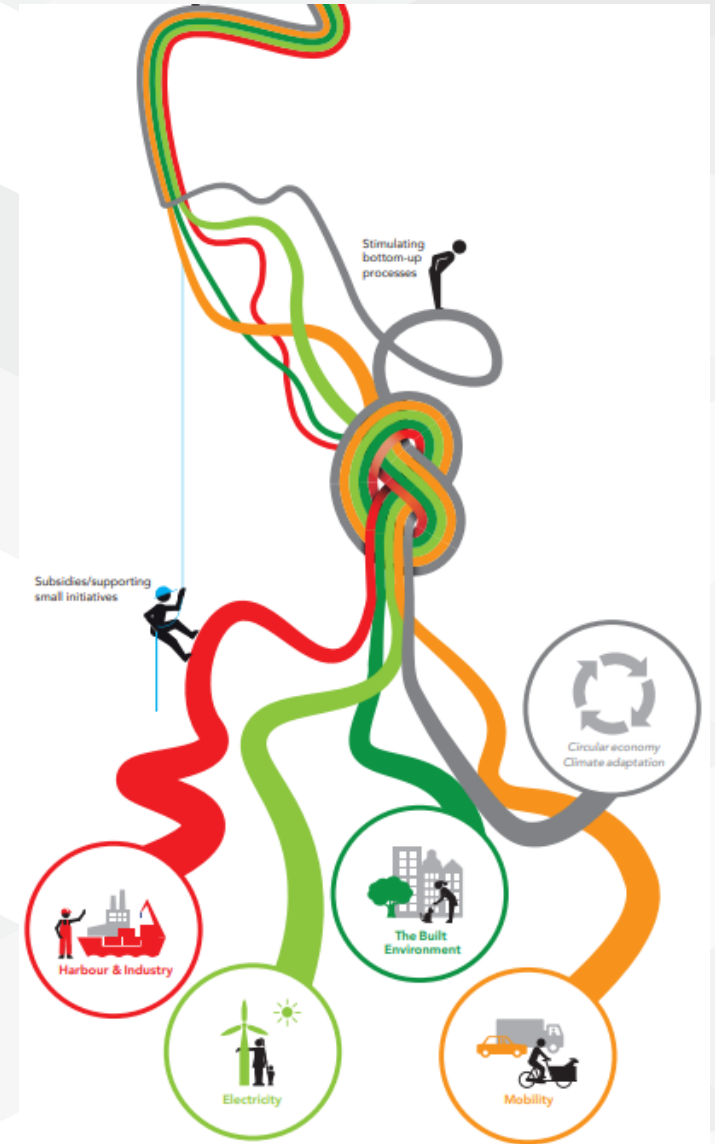
Barriers / Enablers for PED Implementations

Barriers

- Space limitations in dense environments
- Existing energy regulations

Enablers

- EU stimulation for energy cooperatives with local ownership
- Dutch exemption regulation (allowing deviation from a number of energy law regulations)
- An ambitious Climate roadmap 2050



Contact

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Sustainable energy Positive & zero cARbon Communities

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28.04.2021, Making City virtual conference

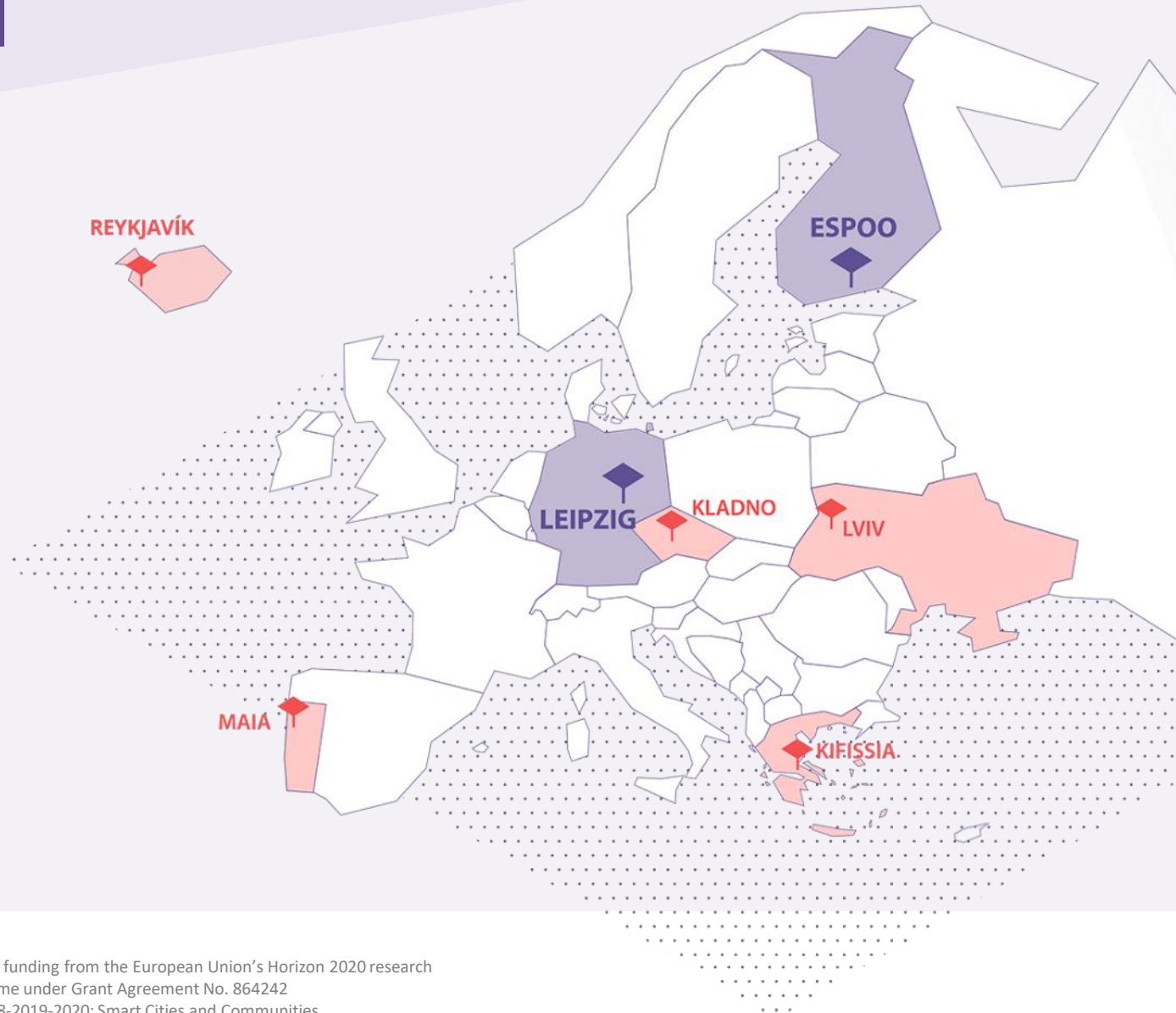


Horizon 2020
European Union funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 864242
Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities

Our target cities

SPARCS is demonstrating
44 innovative interventions
in **2 Lighthouse Cities**,
and **hands-on feasibility studies**
in **5 Fellow Cities**
to support
replication planning



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Interventions & actions at city level ...



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Lighthouse Cities

ESP00

DISTRICTS

Leppävaara

Espoonlahti

Kera



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PED Definitions

▶ Positive Energy Districts

▶ Autonomous

- ▶ completely self-sufficient but not an island

▶ Dynamic

- ▶ bidirectional energy trading with PEDs and electricity grid and district heating network.
Annual production > demand

▶ Virtual

- ▶ energy generation and energy storage outside the geographical boundaries of the district.

Positioning Positive Energy Districts in European Cities

by  Oscar Lindholm *  Hassam ur Rehman  and  Francesco Reda 

VTT Technical Research Centre of Finland, P.O. Box 1000, FI-02044 Espoo, Finland

- ▶ “Positive Energy Districts are energy-efficient and energy-flexible urban areas which produce net zero greenhouse gas emissions and actively manage an annual local or regional surplus production of renewable energy. They require integration of different systems and infrastructures and interaction between buildings, the users and the regional energy, mobility and ICT systems, ...

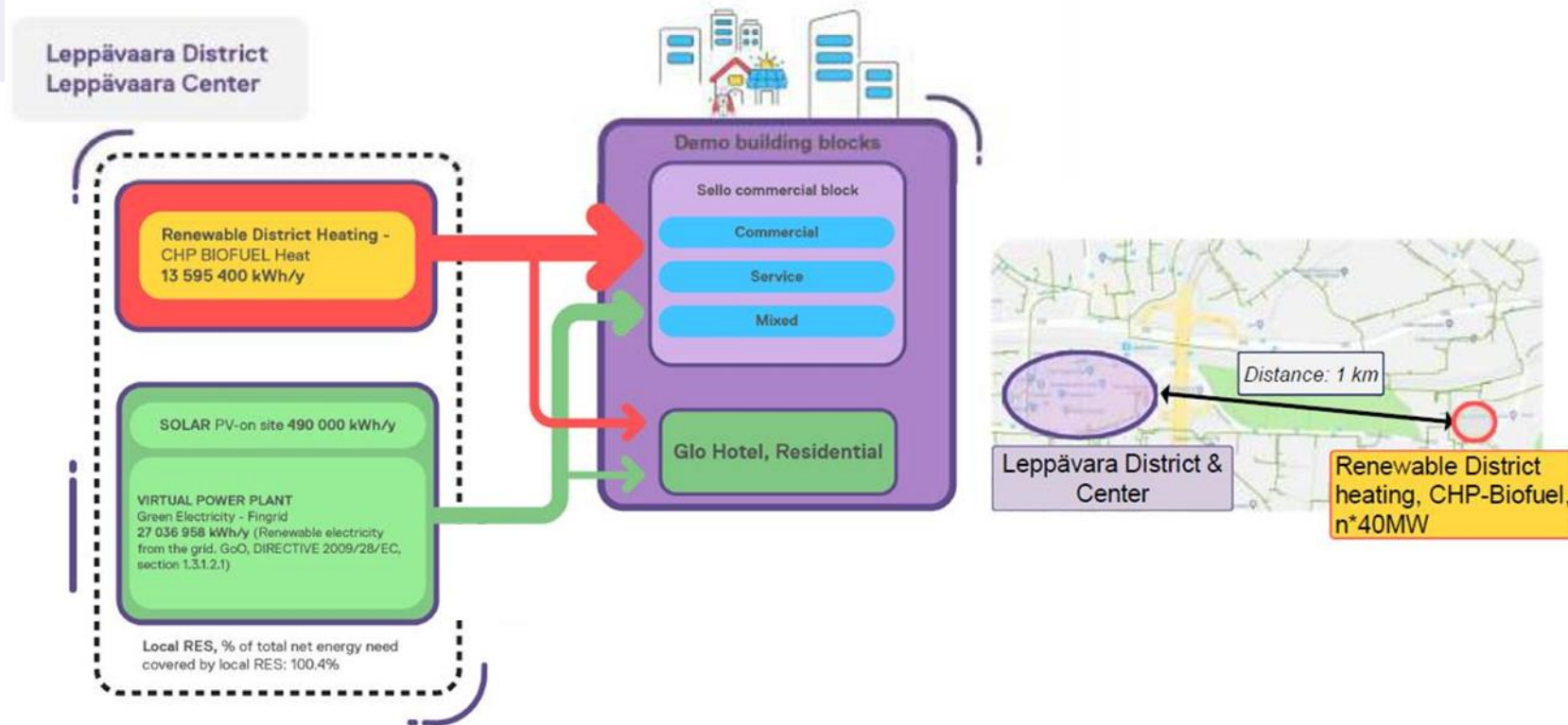
Source: https://jpi-urbaneurope.eu/wp-content/uploads/2020/06/PED-Booklet-Update-Feb-2020_2.pdf



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Leppävaara District Energy Flow Chart



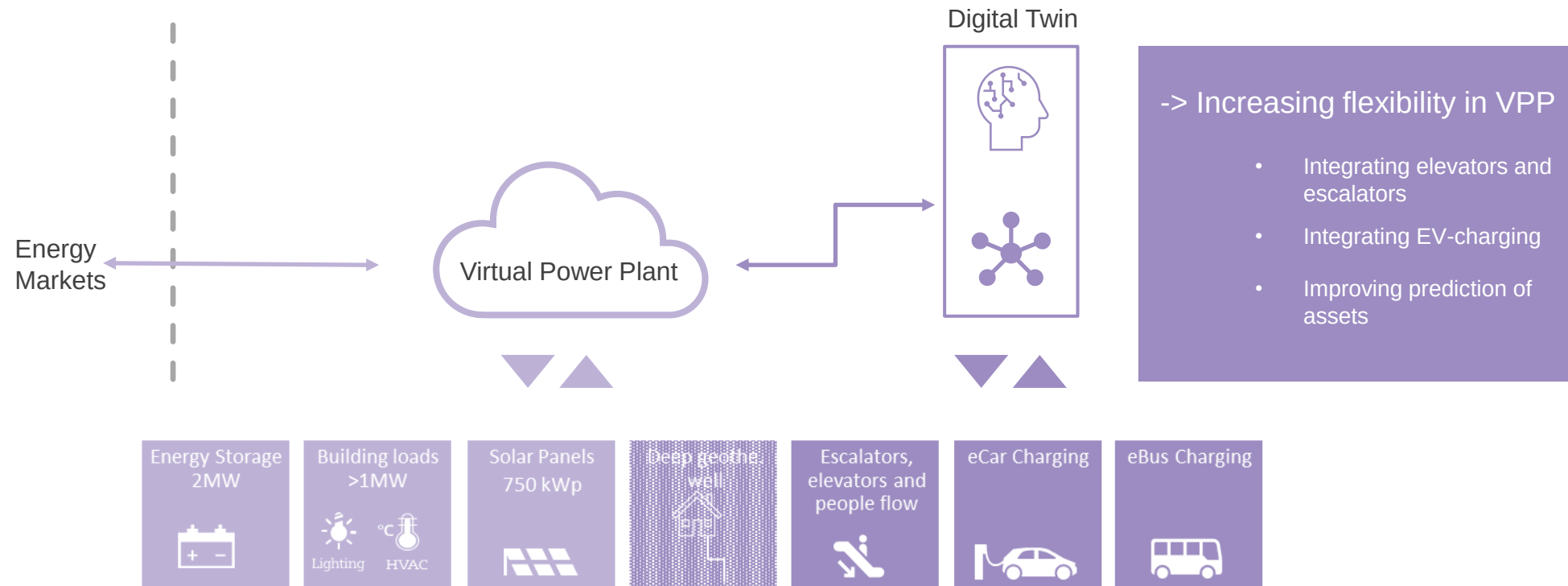
Sustainable energy Positive & zero carbon Communities



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Sello Block demonstration site intervention example



Sello Block demo site intervention example



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