

MAKING-CITY Methodology for PED Technologies Selection



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How to fulfill City objectives through PED implementation and energy solutions?

- ▶ Currently, over 68% of Europeans live in cities and this number will rise. In 2050, it is expected that 70% of the world population will live in cities. That's why cities are committing to strong objectives
- ▶ Energy transition needs to happen at urban areas, based on a strong involvement of all stakeholders and the development of strategies aimed at transforming the urban energy system, such as :
 - Nearly zero energy buildings
 - Installation of renewable energy technologies, waste recovery technologies, and innovative storage solutions
 - Local energy communities (which in principle leads to a high involvement of citizens)
 - Suitable (or new) business models to allow all of these transformative solutions
 - **PED is just a combination of the above-mentioned solutions applied in a specific area**



Positive Energy Districts within the city, allows to achieve some positive impacts at district scale



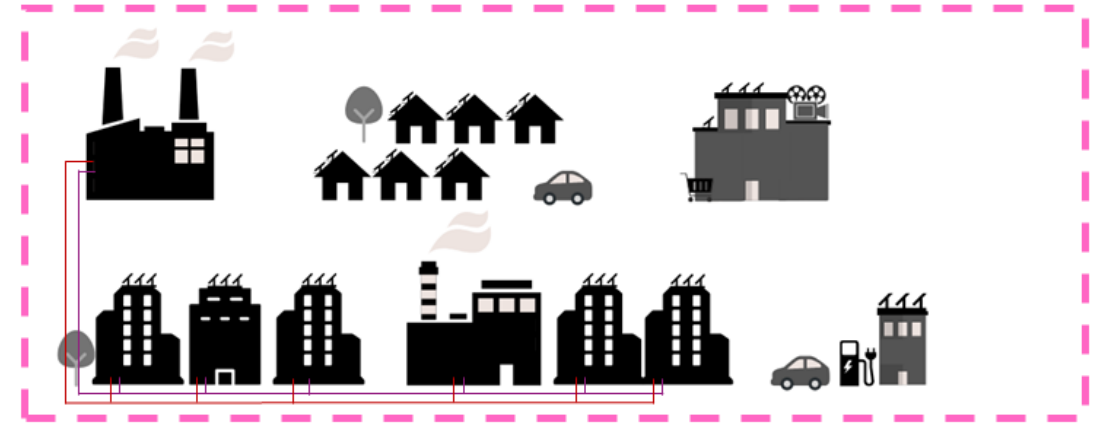
City objectives:

- *Climate neutrality*
- *Good air quality*
- *Decarbonisation, etc.*

PED Definition for MAKING-CITY

“A Positive Energy District is an urban area with clear boundaries, consisting on buildings of different typologies that actively manage the energy flow between them and the larger energy system to reach an annual positive non-renewable primary energy balance”

Geographical Boundaries



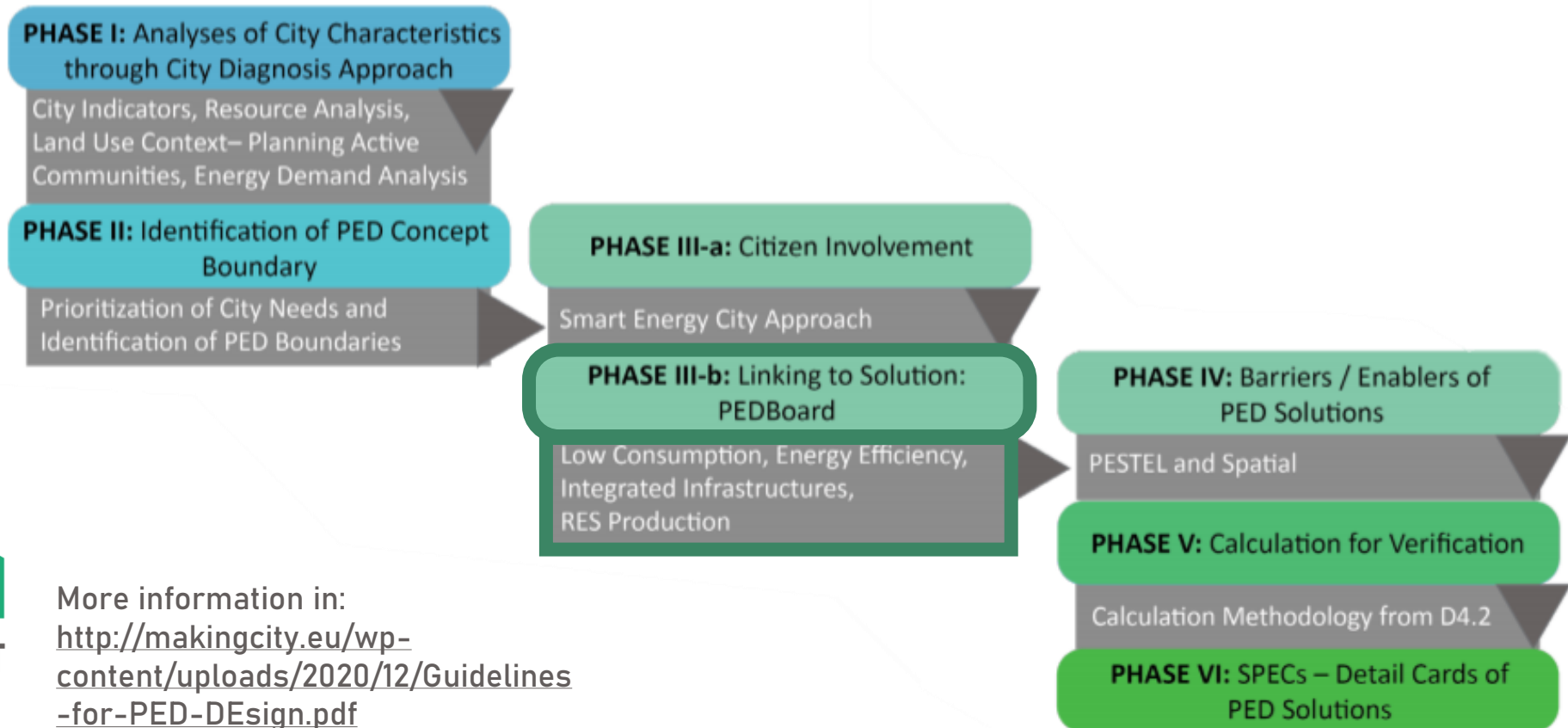
Non-renewable Primary Energy Balance

Primary energy is the energy that has not undergone any conversion in the transformation process, calculated by energy carrier using non-renewable primary energy factors (PEFnren) or total primary energy factors (TPEF). The primary energy balance is calculated as the difference between energy delivered to the district (summed by all energy carriers) multiply by their PEFnren (per energy carrier) and the energy that is exported outside the PED's boundaries multiply by the PEFnren (per energy carrier) of the grid where the energy is exported.

Overall PED design methodology in MAKING-CITY

Procedure composed of the phases encompassing a decision-making route that underlines citizen engagement throughout this process

- ▶ considering the identification process of the PED concept boundary and selection of proper PED solutions peculiar to the cities.



PED technology selection methodology

Procedure to guide cities in the decision-making route for selecting different technical and non-technical solutions that could help cities to achieve a Positive Energy Balance and at the same time, fulfill their city objectives



STEP I: Define the Ambition Level of the PED

Circularity, Air Quality, Self-sufficiency, Climate Neutrality / Net-zero Emissions, Electrification

STEP II: Linking to Technology Packages

PEdBoard, Interaction with SPECs

STEP III: Prioritization of Technologies

Demand-side, Supply-side Solutions, Integrative Infrastructures

STEP IV: Barriers / Enablers of PED Solutions

PESTEL and spatial evaluation at district level

STEP V: Scenario Building

Discuss Results and Generate Scenarios

STEP VI: Calculation of Annual Energy Balance

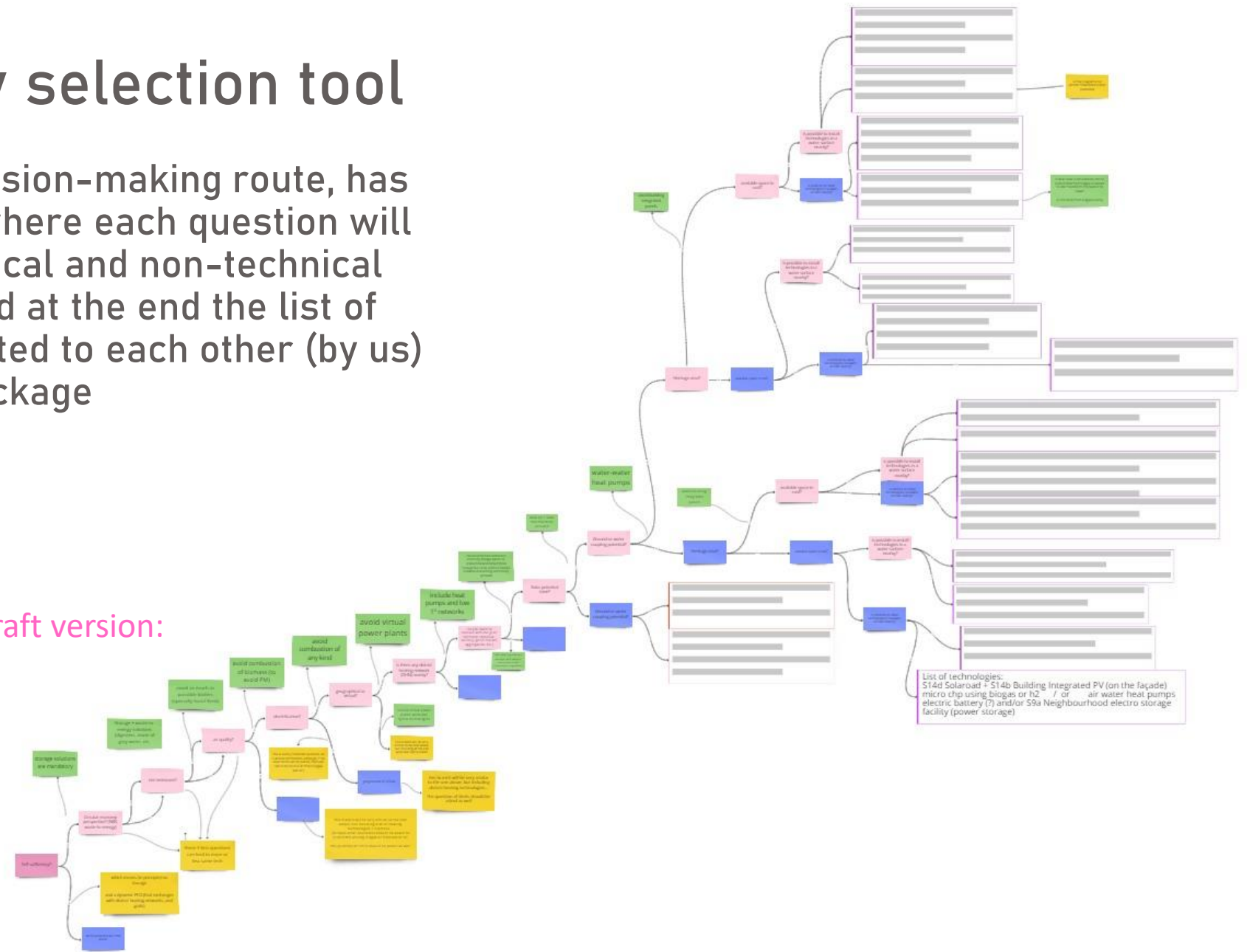
Calculation Methodology developed within T4.1

DESIGN of PEDs in CITIES

PED technology selection tool

The algorithm of the decision-making route, has behind a decision tree, where each question will add/remove some technical and non-technical solution from the list, and at the end the list of technologies are connected to each other (by us) forming a technology package

Draft version:



PED technology solution tool in MAKING-CITY + ATELIER

The decision tree will be programmed in a web-based tool accessible to all cities, where different YES/NO questions are asked and several technology packages are recommended.

The questions are divided in three blocks:

Ambition Level/Objective

1. Self-sufficiency
2. Net-zero emissions
/ Climate Neutrality
3. Circularity
4. Electrification
5. Air quality

Concept boundary

1. Geographical
2. Virtual
3. Functional

City and district Context / Characteristics

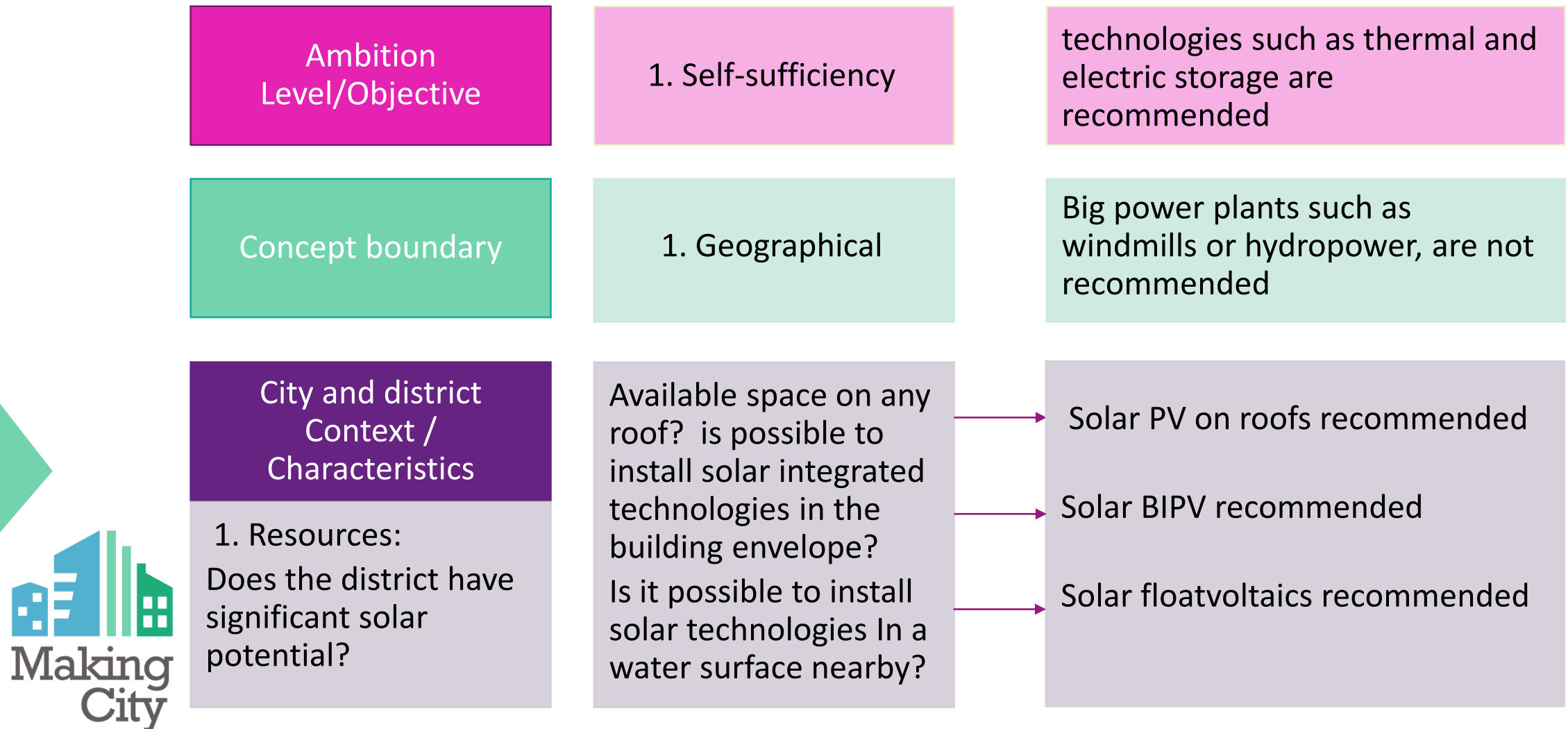
1. Resources
2. Urban Macroform
3. Land-Usage
4. Energy
Infrastructure
5. Energy Services
6. Social Structure



For today we just have a memo-tool in a Macro in Excel.

PED technology solution tool in MAKING-CITY + ATELIER

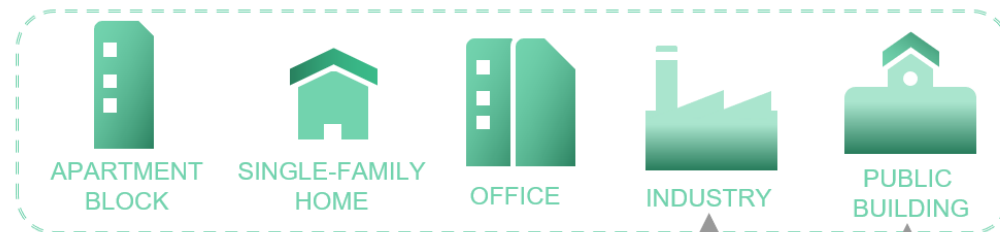
For example



PED technology solution tool in MAKING-CITY + ATELIER

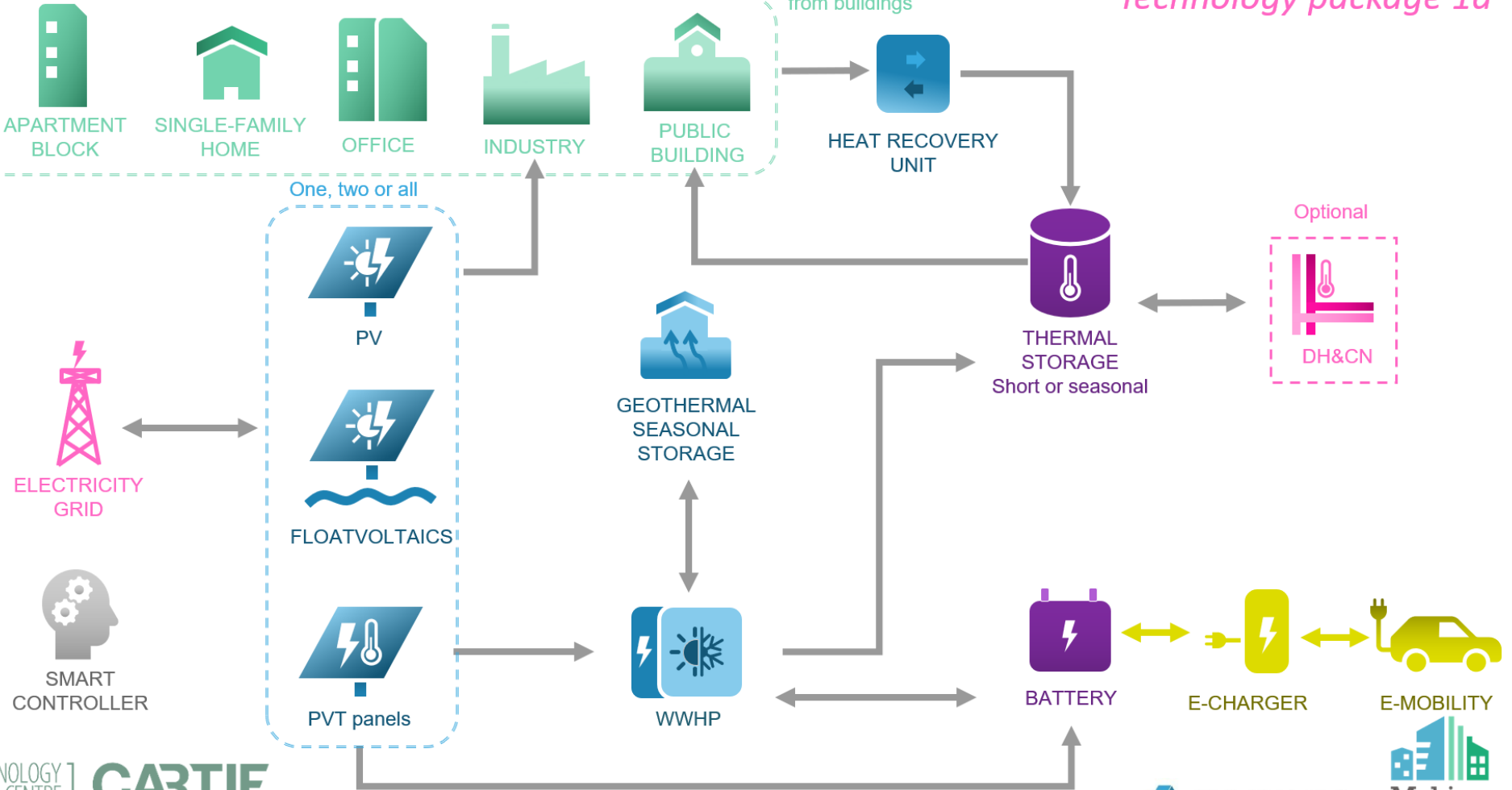
The combination of these technologies will result in a recommend technology package such as this one:

APPLICATION IN:



Grey water from buildings

Technology package 1a



PED technology solution tool in MAKING-CITY + ATELIER

- ▶ The recommendations will be to inform the city about the possibilities of technologies, connections between technologies, buildings, storage, and mobility solutions, and possibly, about non-technical solutions, such as business models could be recommended.
 - ▶ The city will be capacitated to prioritize some of the recommended technology packages at step III.
 - ▶ At step IV, the city will analyze possible barriers/enablers of the PED solutions (if there are any)
- At step V, several scenarios (with possibly different capacities of the supply side) will be generated to assess which one is more suitable for the district to become a PED



STEP I: Define the Ambition Level of the PED

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STEP II: Linking to Technology Packages

PEdBoard, Interaction with SPECs

STEP III: Prioritization of Technologies

Demand-side, Supply-side Solutions, Integrative Infrastructures

STEP IV: Barriers / Enablers of PED Solutions

PESTEL and spatial evaluation at district level

STEP V: Scenario Building

Discuss Results and Generate Scenarios

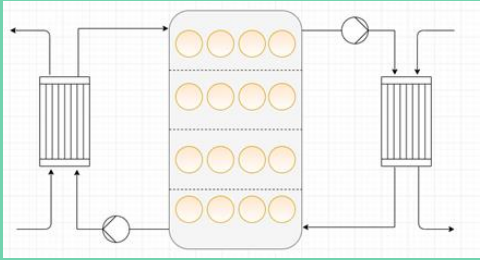
STEP VI: Calculation of Annual Energy Balance

Calculation Methodology developed within T4.1

DESIGN of PEDs in CITIES

PED technology solution tool in MAKING-CITY + ATELIER

When the technology package is recommended, the user/city can access to more information individually per technology

SPEC CARD	SYSTEM INTEGRATION SOLUTIONS		
	Category 3		
	INTEGRATED INFRASTRUCTURES		
	Solution 10 Thermal storage		
Title	Graphical Detail		
S10a Phase transfer Liquid tank			
	- Match hot water supply and demand - Prolong the heat pump life time - Increase thermal energy storage intensivity compared to conventional water thermal storage - With increase of energy content it could be possible to have smaller thermal storage units		
City / Country	Making_City	Technical Partner Name & contact Details	
Finland / Oulu	Yes	VTT Technical Research Centre of Finland Ltd	
Implementation Time		Initial Investment	

Integration with other smart solutions	BARRIERS / ENABLERS _ PESTEL STUDIES	
Using heat pumps will increase temperature of Distric heating low temperature return water and store it in to latent heat thermal storage tank.	Political: Economic: Price compared to conventional tank is higher Social: Technical: Additional changes to heating installation may be necessary Environmental: Phase change material used is not toxic Legal:	
Potential for Replication	Expected Impacts - Benefits	
Indicate if the system is already in use in other cities, kind of a valuation is also possible.	If the size of the thermal storage can be reduced compared to conventional storage tanks, interest towards it will increase. additionally if the energy capacity of it can be utilised fully it can solve some problems relating to drilling boreholes for energy storage. Since ground is used as a heat dump during the summer this could be possibly replace by using proper phase change materials. Problems regarding the thermal storage tanks usually are related to their size.	
Developer (if relevant) Who has developed this solution?		
Operator Who is operating this solution?		
Customer(s) or user(s) Who is this solution targeting ? For instance, who is saving energy thanks to the implementation of this solution?		
Implementer Who is implementing this solution?		
Financer How / By whom has the implementation of this solution been financed?		
Other impacted stakeholder(s) (if relevant) Who else is impacted by the deployment of this solution?		
Revenue Streams/ Monetized Value		



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PED technology solution tool in MAKING-CITY + ATELIER

The memo macro has been shared among the cities, so they can play with it and give us already feedback for the future tool

- ▶ Easy-going questionnaire
 - (yes/no questions)
 - With definition of each question in each step 
- ▶ At the end, an “apply” button will show the recommended technology packages

- ▶ At the web-based tool, it would be possible for other projects and initiatives to provide their technologies if they want



MAKING-CITY and ATELIER PED technology selection guide

For MAKING-CITY “A Positive Energy District is an urban area with clear boundaries, consisting on buildings of different typologies that actively manage the energy flow between them and the larger energy system to reach an annual positive non-renewable primary energy balance”, whereas for ATELIER is “Positive Energy Districts (PED) are energy efficient districts that have net zero carbon dioxide (CO₂) emissions and work towards an annual local surplus production of renewable energy (RES).”
SETPlan

The following Excel Files aims to guide any city for the selection of a technology package to be deployed in the PED area When answering to a question “Yes” make sure that your city context (i.e. political, regulatory, social context, etc.) will allow the sentence to be true.

The instructions to use the tool are the following:

- 1- Select the ambition level or objective of your district. For now the tool only allows to select 1. So, choose the one you prioritize the most
- 2- Select your concept boundary (geographical, virtual or functional boundary) of your district.
- 3- Answer the questions to know your district context and its characteristics.
- 4- Select “Apply”. This way the list of recommended technology packages with different combination of technologies will appear. Don't forget to check the SPEC cards developed by MAKING-CITY to know more about an individual technology!.

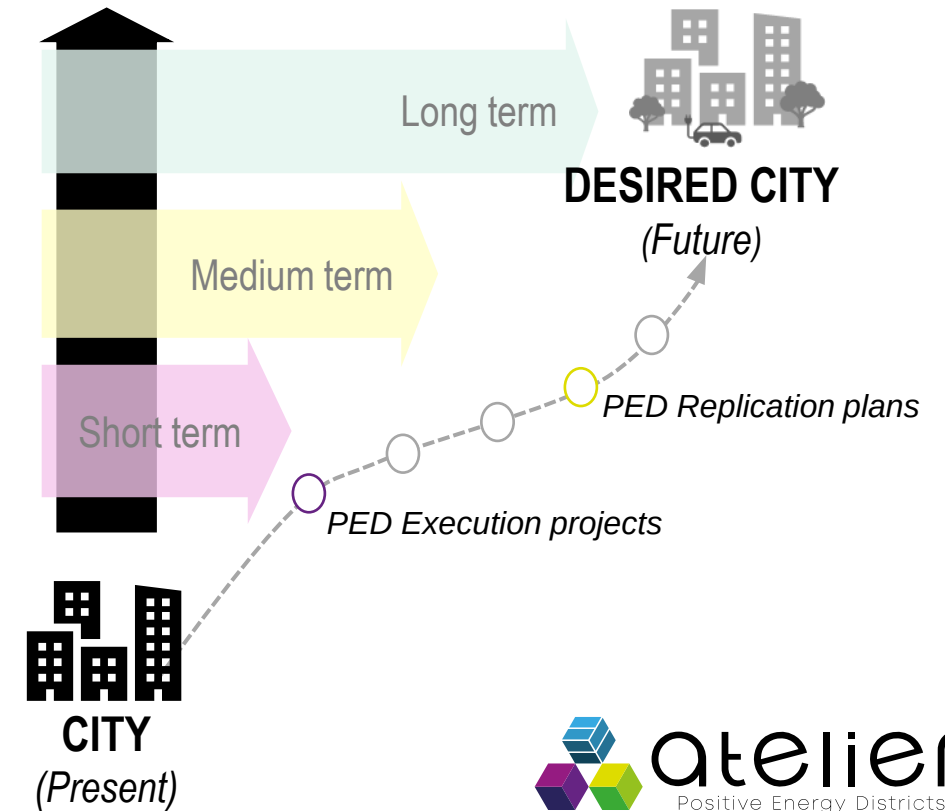
Ambition level or Objectives of your district	Self-sufficiency 
Concept boundary	
District context and its characteristics	
Needs to be supplied	
in general, do you have space heating needs in the district?	YES 
in general, do you have space cooling needs in the district?	
in general, do you have Domestic hot water needs in the district?	
in general, do you have electricity needs in the district?	YES 
Resource availability	
Does the district have significant solar potential?	YES 
Solar-related questions:	Available space on any roof? YES 
Is it possible to install solar integrated technologies in the building envelope?	YES 
Is it possible to install solar technologies in a water surface nearby?	YES 
Is it possible to install solar technologies in a parking lot or an empty lot nearby?	YES 
Does the district have significant wind potential?	
APPLY	



PED technology solution tool in MAKING-CITY + ATELIER

To sum up:

- ▶ The tool will guide cities in the decision-making route for selecting different technical and non-technical solutions that could help cities to achieve the PED concept
- ▶ And therefore, be a step closer in the energy transition towards the desired city



Thank you

Any question?

For any question contact us:

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- Estefanía Vallejo (estval@cartif.es)



All the reports of the project will be available for download on the MAKING CITY website: www.makingcity.eu



Project coordinator: Cecilia Sanz Montalvillo, CARTIF

Contact us:



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Next step:
Calculate your balance!

- ▶ Guidelines to Calculate the annual primary energy balance of a PED:
- ▶ friendly tool that helps you of the district
- ▶ Visual guide, with tables to fill in to calculate the non-renewable annual primary energy balance

