Positive Energy Districts が目指すビジョン
（国際エネルギー機関活動報告）

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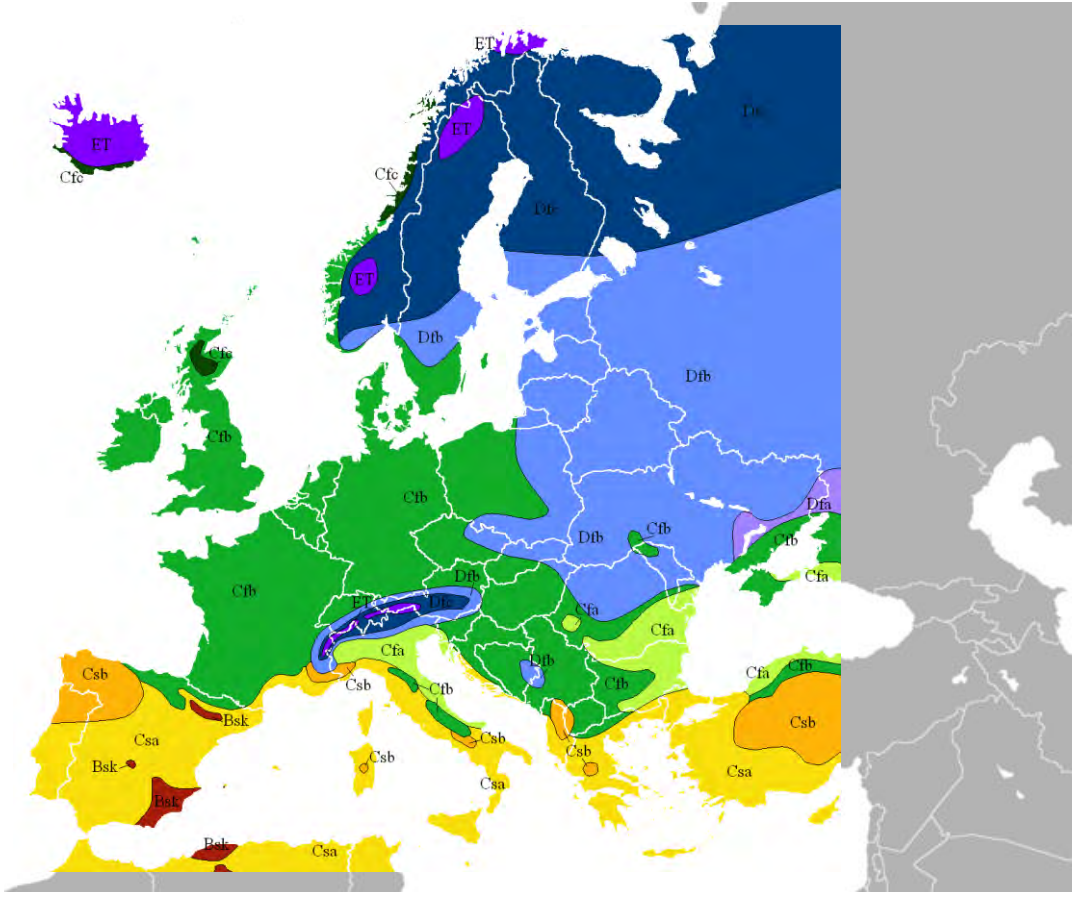
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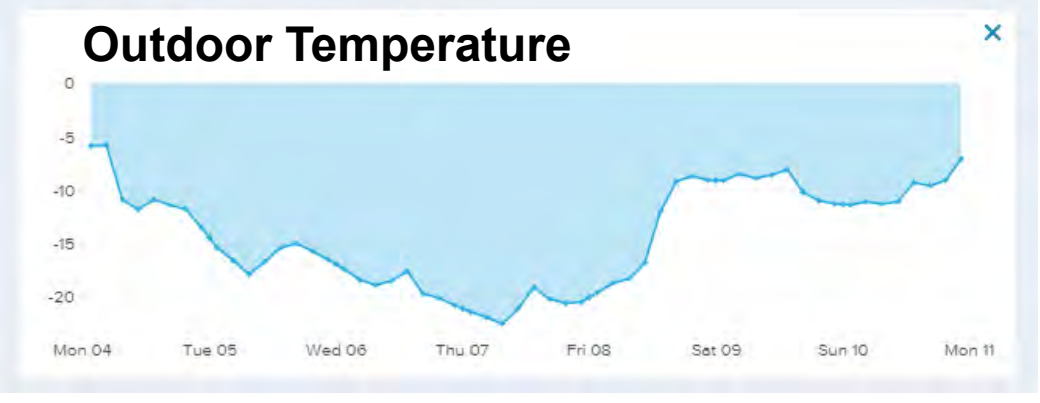
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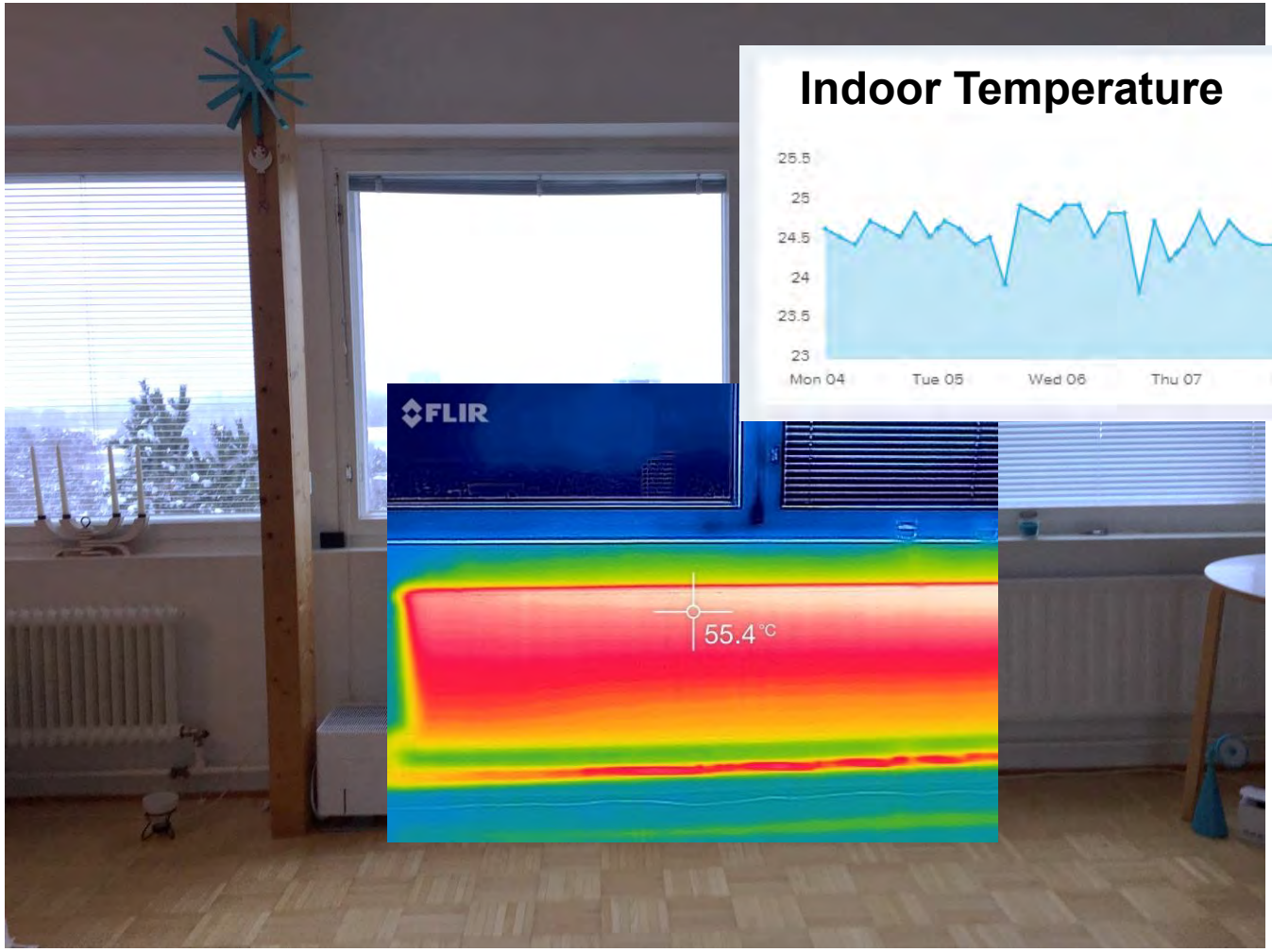
Indoor Temperature
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25
24.5
24
23.5
23
Mon 04
Tue 05
Wed 06
Thu 07
Fri 08
Sat 09
Sun 10
Mon 11
FLIR
55.4 °C

District heating production plants

District heating is decentralized energy, Finnish Energy's members produce heat in:

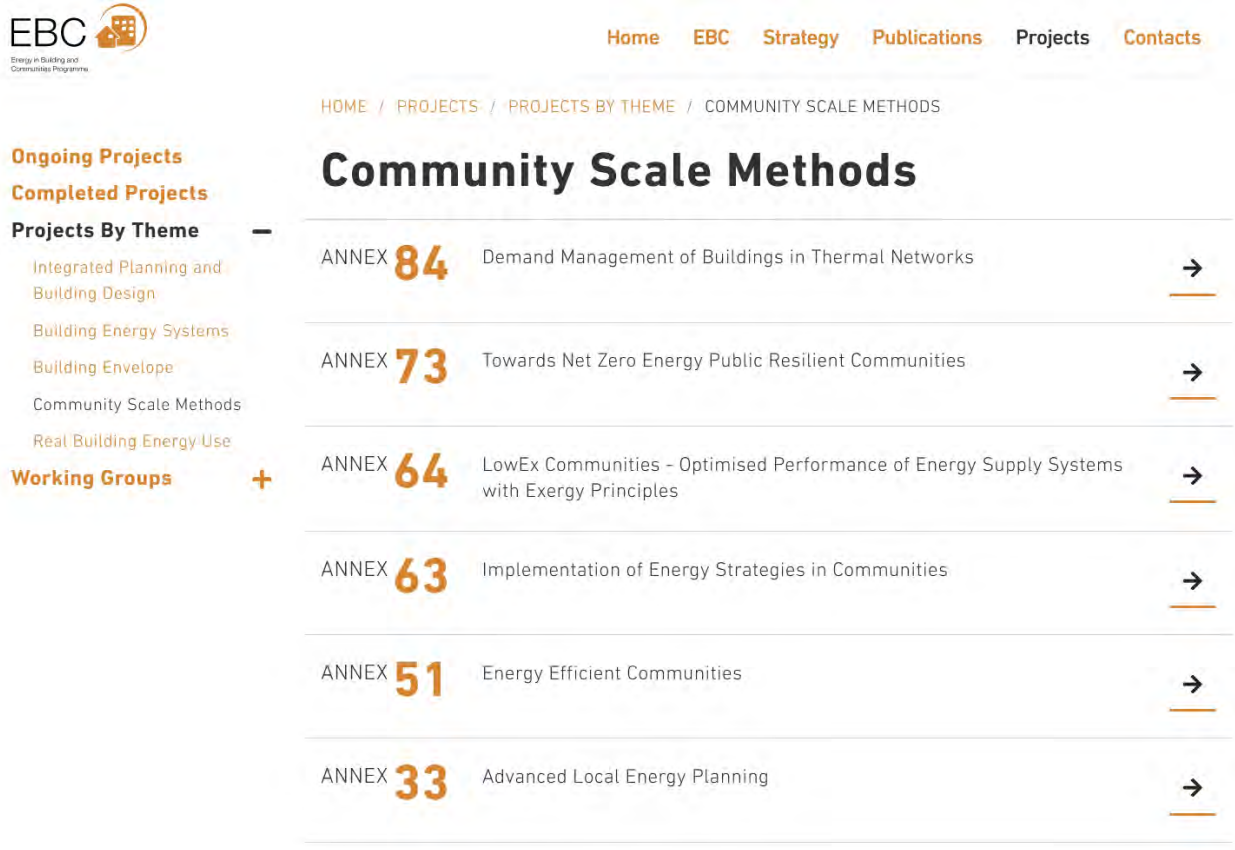
- 166 towns
- 104 CHP plants
- 1129 heat-only boilers

Source: District Heating in Finland 2016, Finnish Energy


Sherlock Pub
Fortum

IEA, International Energy Agency

Community Scale



https://www.iea-ebc.org/

Annex 83

Positive Energy Districts

Annex
83

Project duration

Ongoing (2019 - 2024)

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Participating countries (provisional)

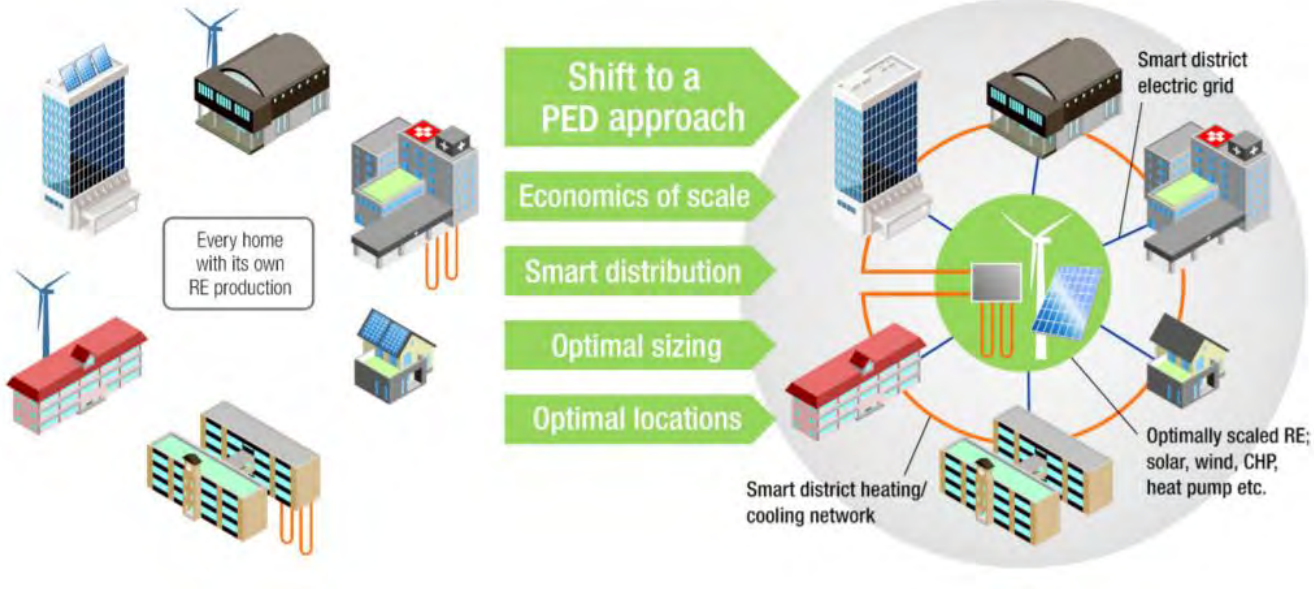
Austria, Belgium, Canada, P.R. China,
Denmark, Finland, France, Germany, Ireland, the Nether-lands,
Portugal, Spain, Switzerland, UK, USA

Further information

www.iea-ebc.org

PEDs can include

All types of buildings present in the urban environment and they are not isolated from the energy grid.

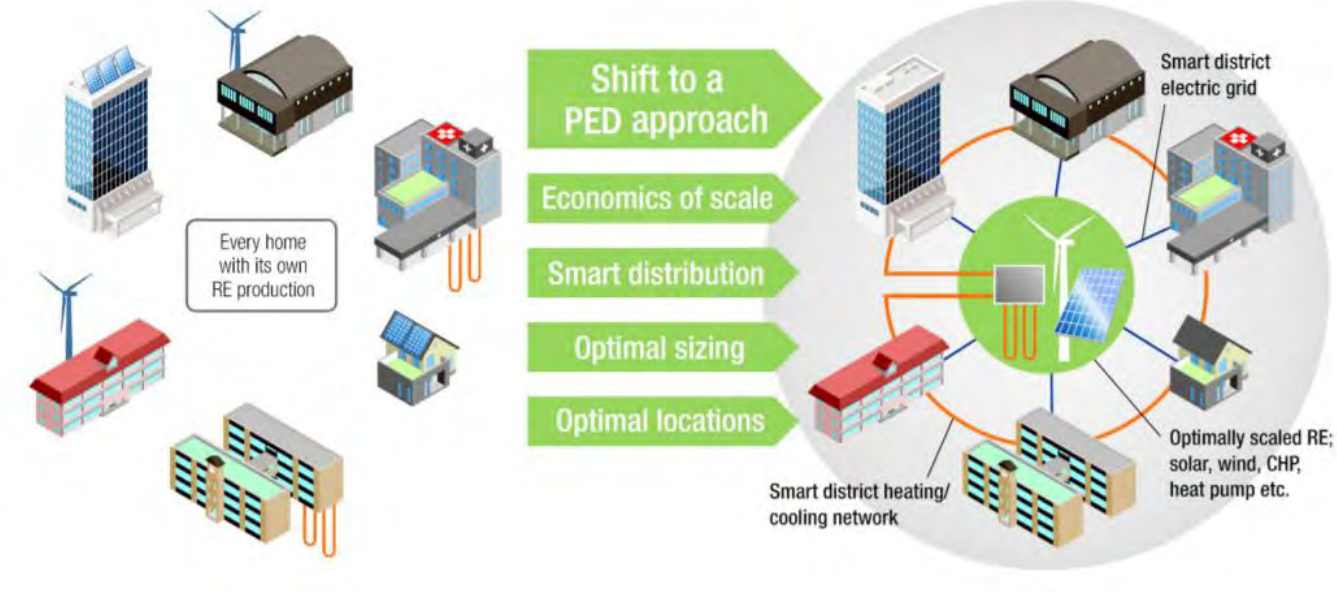


Goal of a PED requires

Improving energy efficiency

Cascading local energy flows by making use of any surpluses

Using low-carbon energy production to cover the remaining energy use.



Basic principle of PEDs

Create an area within the city boundaries, capable of generating more energy than consumed.

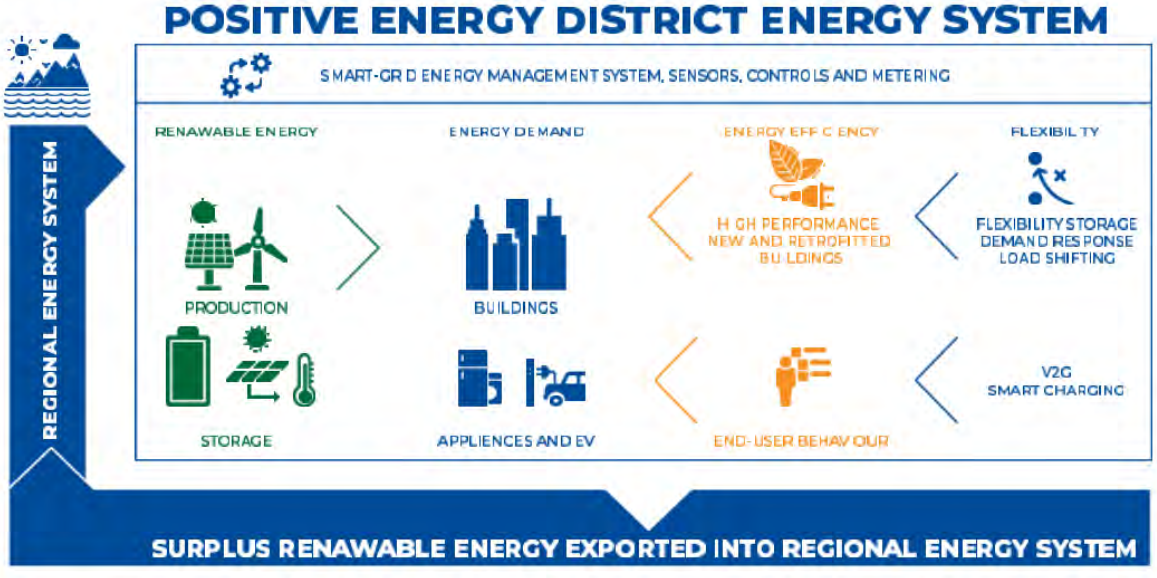
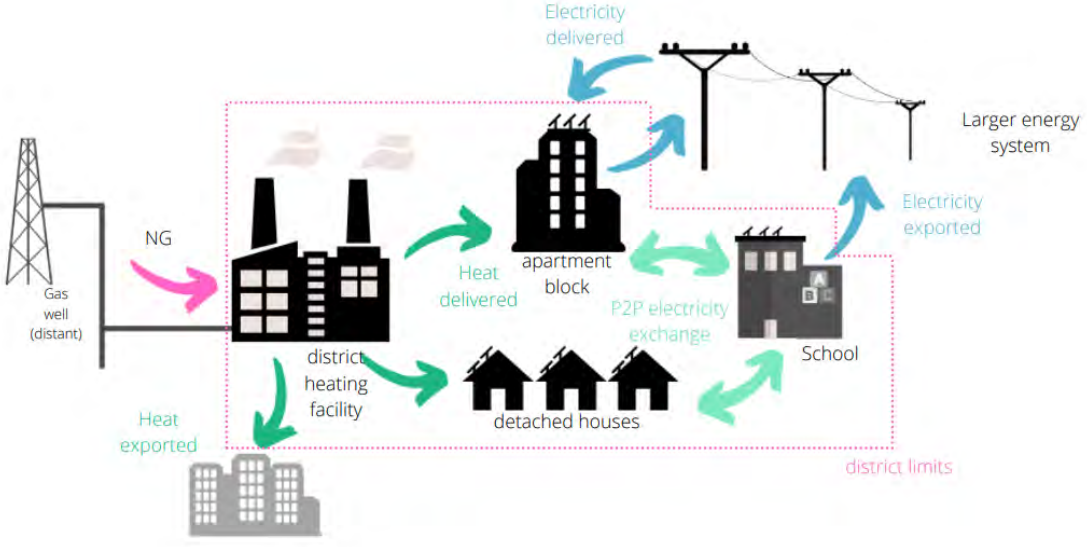


Figure: Simple graph energy system PED in wider context | Adapted from Amsterdam University of Applied Sciences

Positive Energy District solution booklet, EU Smart Cities Information System, November 2020

Basic principle of PEDs

Agile/flexible enough to respond to the variation of the energy market because a PED should not only aim to achieving an annual surplus of net energy.

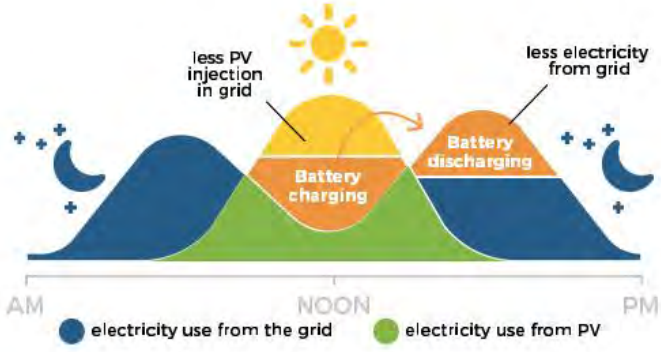


Positive Energy District solution booklet, EU Smart Cities Information System, November 2020

Basic principle of PEDs

It should also support minimizing the impact on the connected centralized energy networks

by offering options for increasing onsite load-matching and self-consumption, technologies for short and long term storages, and providing energy flexibility with smart control.



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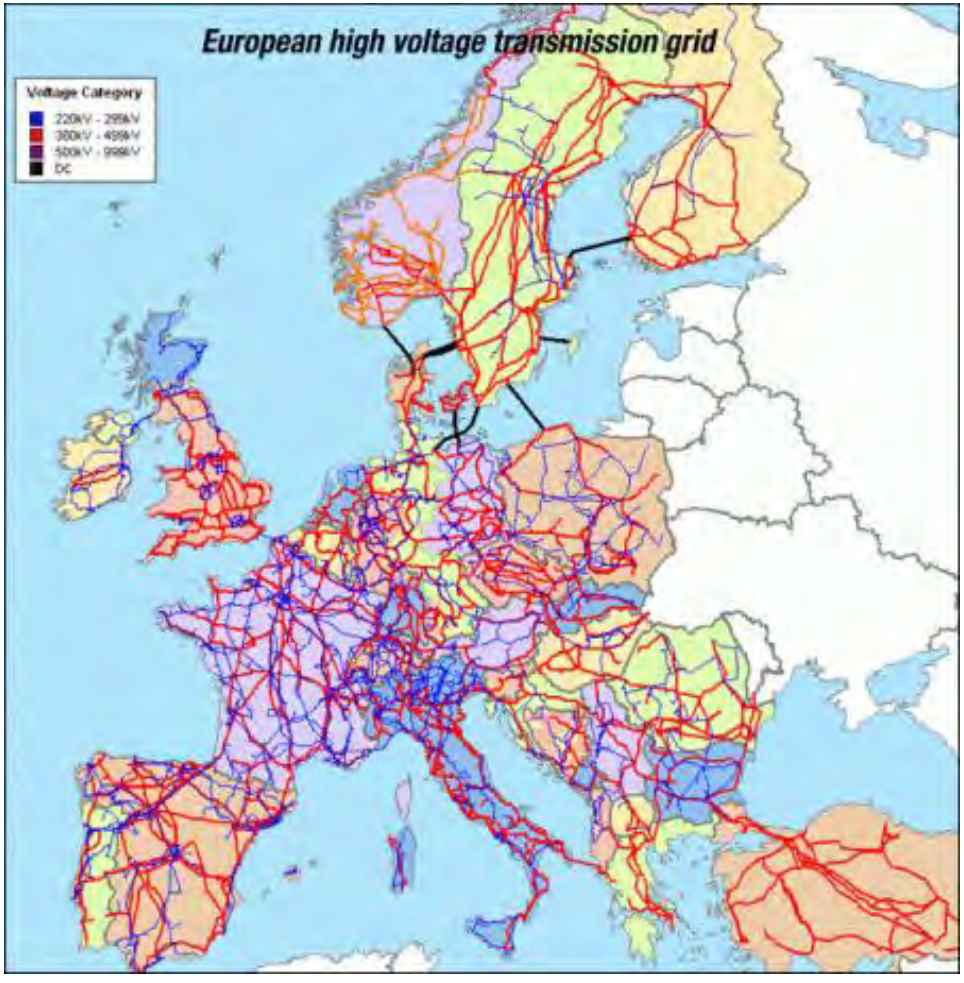


https://energyanalyst.co.uk/introduction-valuing-interconnectors/

MAKING-CITY, Horizon 2020 project

https://makingcity.eu/

MAKING-CITY, Horizon 2020 project

2

LIGHTHOUSE CITIES

6

FOLLOWER CITIES

https://makingcity.eu/

Groningen

To achieve this energy transformation, the city council of Groningen adopted in 2011 a Master Plan aims at making **Groningen energy neutral by 2035.**

"Groningen Energises 2015-2018" completed this political willingness followed by the 2017 "Next City" plan and its core objective of turning the city of Groningen into a **real-life lab for energy transition**.

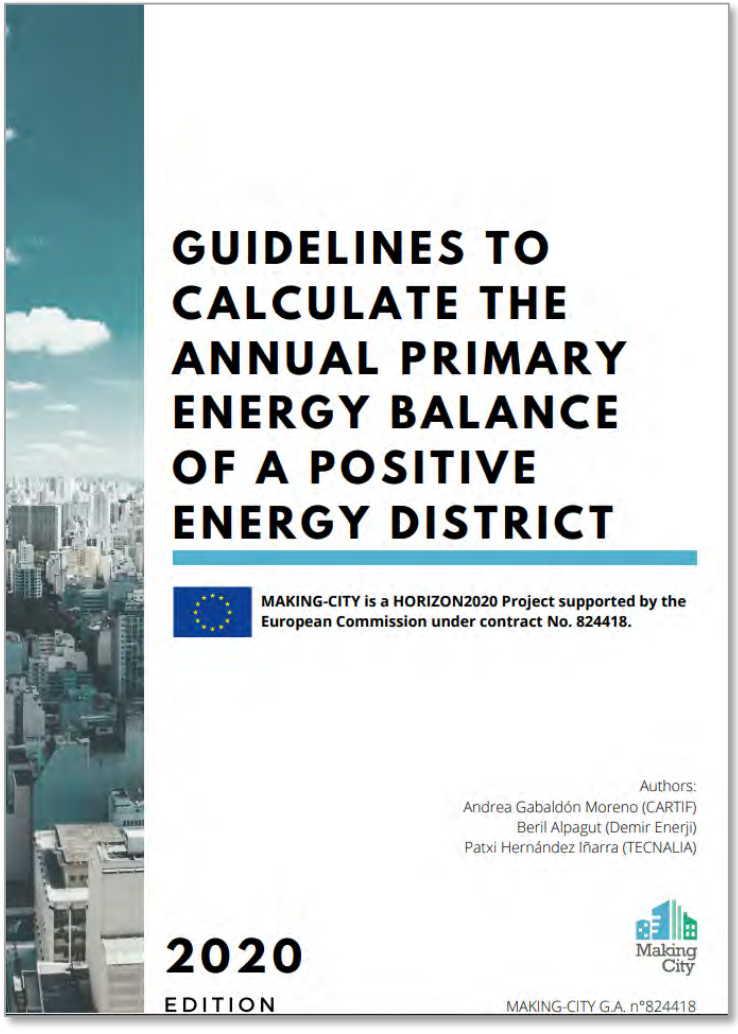
As member of the Global Covenant of Mayors for Climate and Energy, Groningen committed to reduce by 70% its gas emissions in 2030 while establishing a sustainable use, consumption and energy production.

PED Implementation – Groningen

Retrofitting of residential buildings (floors, roofs, fronts, windows, smart thermostats and sensors to real-time measuring of energy consumption…) **in order to maximise infrastructure performance**.

Solar panels will be installed on the roofs of some buildings and car parks. In addition, **Solar thermal panels** will support **geothermal heat pumps** which are directly connected to the **geothermal district heating system**.

The surplus of thermal energy produced by some residential buildings will be **stored and used during energy demand peaks**. On the other hand, biogas technology will be used to collect and "digest" -under high pressure and thanks to bacteria-, waste and waste water produced by public sport and catering facilities.



METHODOLOGY

To calculate your primary energy balance (in terms of non-renewable primary energy) you can follow this eight-step methodology:

Making City

1

DEFINE YOUR PED BOUNDARY

The boundary is defined by the spatial and administrative relationship between the final energy consumption and the energy generation units (inside the buildings or beyond the boundaries, e.g. the grid). Depending on the relationship, your PED can have virtual, geographical or functional boundaries.

2

CALCULATE YOUR ENERGY NEEDS

Heating, cooling, domestic hot water and electric energy needs must be identified. The need could be determined by several approaches including monitoring, calculations based on bills, simulation, standards or statistical data.

3

CALCULATE YOUR ENERGY USE

The amount of energy used to cover the demand is established as thermal and electric energy use, i.e. the energy input needed to satisfy the needs. It can also be identified as the useful energy output of the thermal and electrical generation systems.

4

CALCULATE YOUR ON-SITE GENERATION

Once the energy systems used to cover the determined energy uses are identified, .alculate the useful output of these systems (i.e. the energy generation). Then, identify if there is any remaining energy needs to be covered by non-renewable energy systems or external grids.

5

ESTIME THE ENERGY DELIVERED

Both the output and input of each system are linked with a source of energy inside or outside the boundary for each energy carrier. A greater energy consumption over a renewable energy generation within the boundary indicates an import (in) from outside the boundary. A greater renewable energy generation within the boundary over energy import from outside the boundary indicates an export (out) to outside the boundary.

6

CALCULATE THE PRIMARY ENERGY

Weight your energy imports (delivered to the PED) and exports (delivered outside the PED) per energy carrier using primary energy factors, in order to calculate the primary energy exported and the primary energy imported. Primary energy factors could be taken from national or international standards.

7

CALCULATE THE ENERGY BALANCE

The primary energy balance is calculated as the difference between the primary energy imported to the PED boundaries minus the primary energy exported outside the PED's boundaries.

8

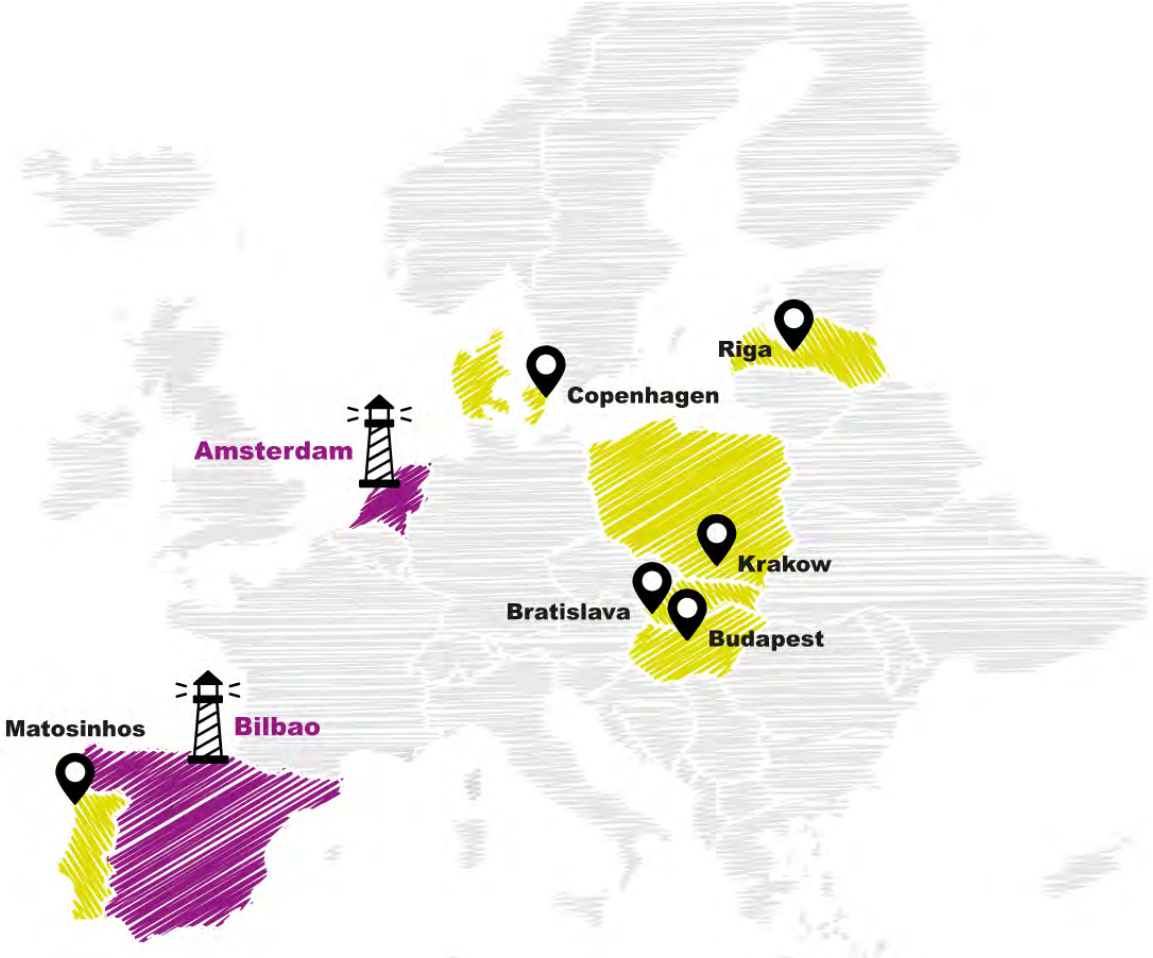
SANKEY DIAGRAM

Once all the steps are finalized, an energy flow diagram can be drawn (known as Sankey diagram), based on the energy flows identified in the previous steps (energy needs, energy uses, energy delivered and primary energy columns).

2020.https://makingcity.eu/wp-content/uploads/2021/01/MCGUIDE-6.pdf

AmsTErdam BiLbao cItizen drivEn smaRt cities

ATELIER is an EU-funded Smart City project aiming to create and replicate Positive Energy Districts (PEDs) within two Lighthouse Cities and six Fellow Cities.


Riga
Copenhagen
Amsterdam
Krakow
Bratislava
Budapest
Matosinhos
Bilbao

Bilbao

Zorrotzaurre island

5,500 new homes, 150,000 m^2 of office spaces, citizen spaces (154,000 m^2) and social and cultural facilities (93,500 m^2)

According to **Bilbao's Strategy for Sustainable and Integrated Urban Development**, Zorrotzaurre will become a residential and business district in the future.

Framework for deploying and testing new sustainable concepts, principles and solutions that will be used as an example for the whole city.

An initial district scale vision has been developed by the city:

The island will be accessible **by zero-emissions vehicles** only and the idea is to implement a zero emission energy supply scheme with 100% electric public transportation.

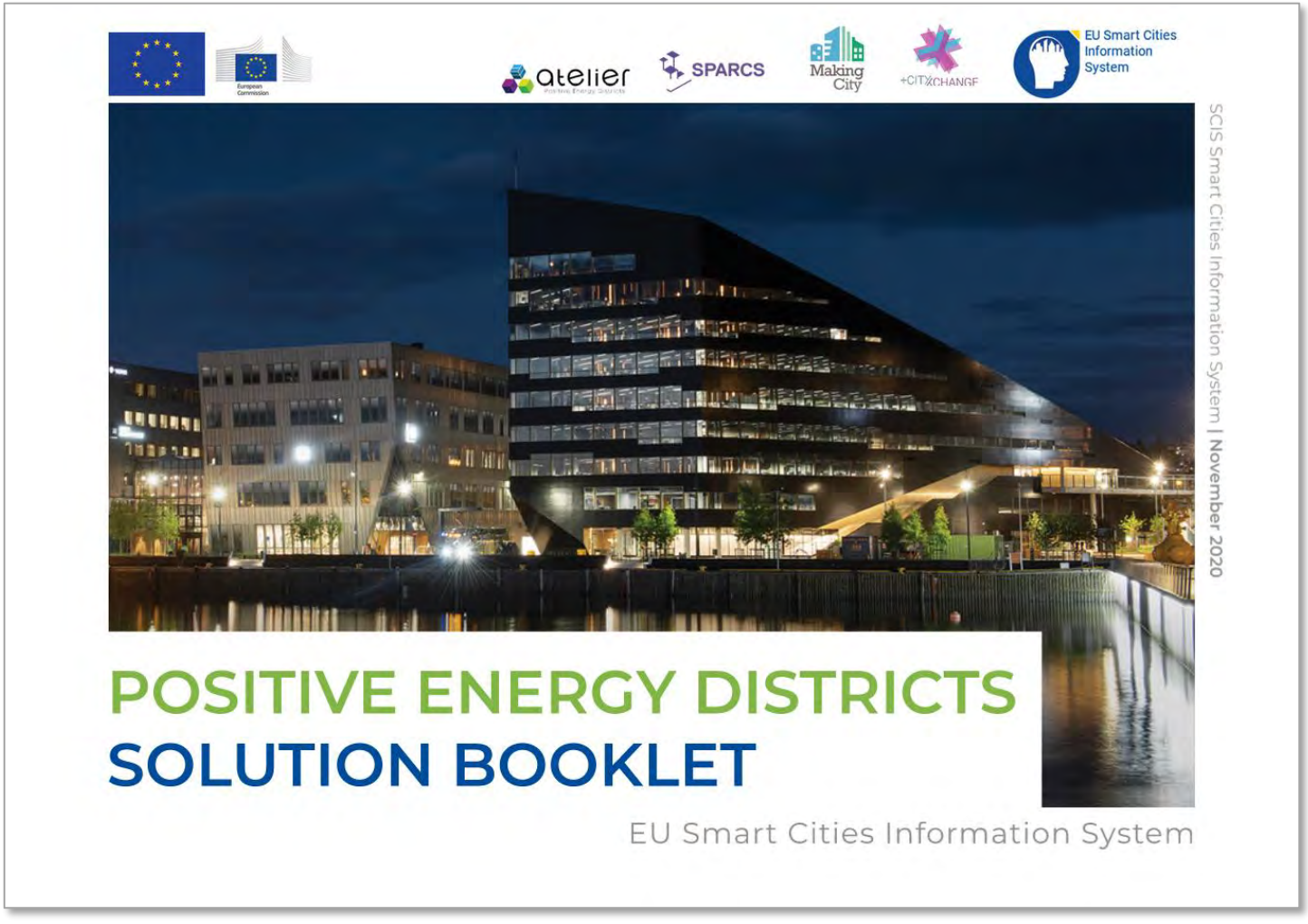
Amongst other implementations, interactive bus shelters will provide information on the **energy flows, storage and local renewable generation**, a seating area with weather protection, and many other functionalities for citizens.

PED Implementation - Bilbao

The local PED will be developed in three locations as part of Zorrotzaurre island: North, Centre and South.

The three areas are connected via a geo-exchange loop which is a system that will use geothermal and hydrothermal renewable energy.

The loop covers the thermal demand of the PED locations and to export the surplus to the rest of the island and, eventually, outside the island.



Positive Energy District solution booklet, EU Smart Cities Information System, November 2020

Planned deliverables from Annex83

A. **Definitions and Key Concepts for PEDs**
B. **Methods, Tools and Technologies for realizing PEDs**
C. **Governance Principles and Impact Assessment for PEDs**
D. **Case Studies on PEDs and related Technologies**

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知見の共有と日本におけるPEDの実現可能性を議論

街区単位で取り組む都市の低炭素化施策の国際動向
シミュレーション手法・影響評価手法の国際動向
国際比較から俯瞰するPEDの方法論
社会構造・経済背景・要素技術の国際比較
街区単位で取り組む先行事例の調査（視察）

IEA EBC

- https://www.iea-ebc.org/
- https://annex83.iea-ebc.org/

Projects Cases

- https://makingcity.eu/
- https://smartcity-atelier.eu/
- https://www.sparcs.info/
- https://cityxchange.eu/
- https://smart-cities-marketplace.ec.europa.eu/

Guidelines To Calculate The Annual Primary Energy Balance Of A Positive Energy District 2020.

- https://makingcity.eu/wp-content/uploads/2021/01/MCGUIDE-6.pdf

Positive Energy District solution booklet

- https://cityxchange.eu/wp-content/uploads/2020/12/1606985144968.pdf