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ASSESSMENT OF URBAN-SCALE POTENTIAL FOR SOLAR PV GENERATION AND CONSUMPTION

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Objective of the study

Describe a **method** for evaluating the **potential for PV** production and self consumption for the building stock of a city

Considering:

- **Irradiation**
- Orientation and **shading**
- Building energy demand and **consumption**
- **Regulation** (self-consumption (shared at building level) and net metering)
- **Economic** viability

Context & case study definition

Energy consumption in **cities: 60%** to **80%** of the **global energy** use and **increasing**

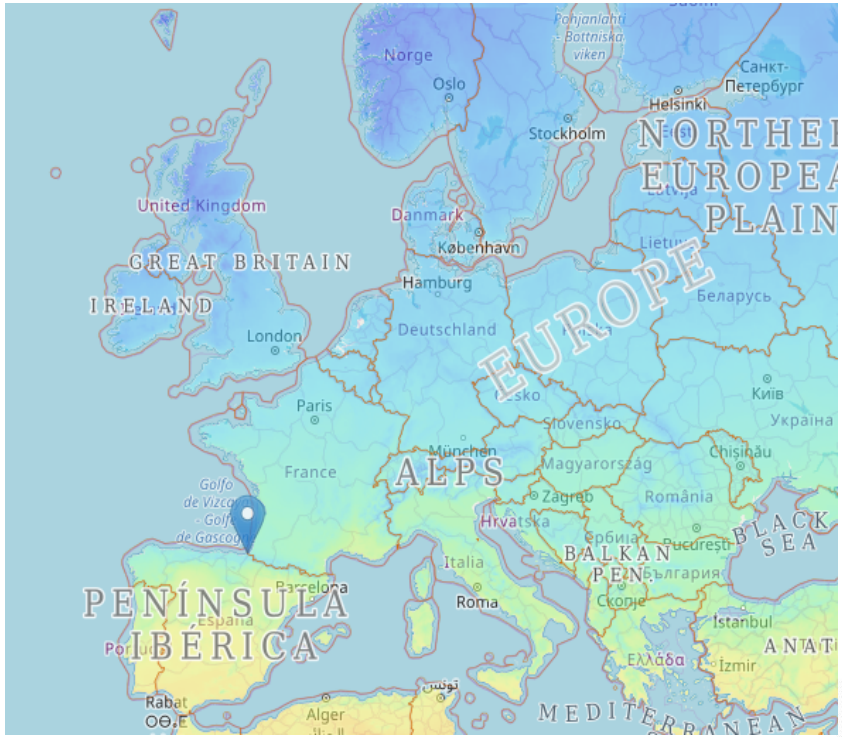
On-site electricity generation potential benefits:

- Reduce investment in grid infrastructure
- Reduce transport and distribution losses
- Reduce GHG emissions

PV→ most **competitive** and **adequate** technology for urban areas

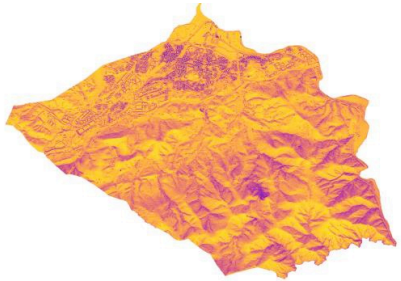
Context & case study definition

- City of **Irun**
- 61.983 inhabitants
- Predominance of 4 to 6 storey building
- Annual solar irradiation: 1.300kWh
- Actively involved in sustainability programs.

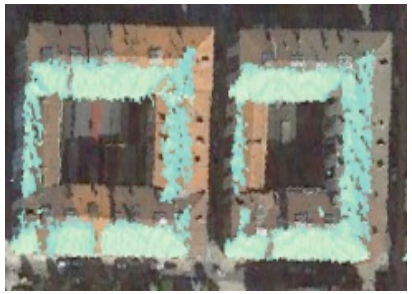


Methodology: 4 steps

Building level **energy characterization**



Solar map for the municipality



Profitability thresholds and rooftop characterization

Size optimization based on **legislation** model

Methodology:
Step 1: Energy Characterization

Building energy characterization at city level with **Enerkad** [1]

Calculation based on the city **cadaster** and degree day method:

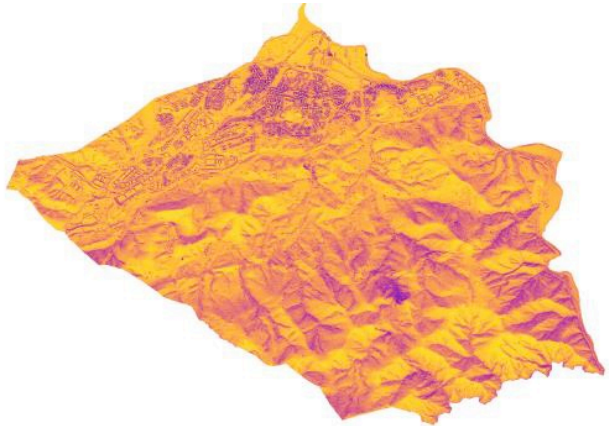
- Construction year
- Geometry

Calculates heating, cooling and electricity demand and **energy consumption**

ENERKAD

[1] European Commission, “European Union’s H2020 Programme, ‘PLANHEAT Project.’ ‘Grant Agreement’ 723757, as part of the call H2020-EE-2016-RIA-IA.”

Methodology:
Step 2: Solar map



Calculation of solar irradiation

Considers shading and orography

Based on filtered Digital Surface Model (**UMEP** plugin for **Qgis**) and

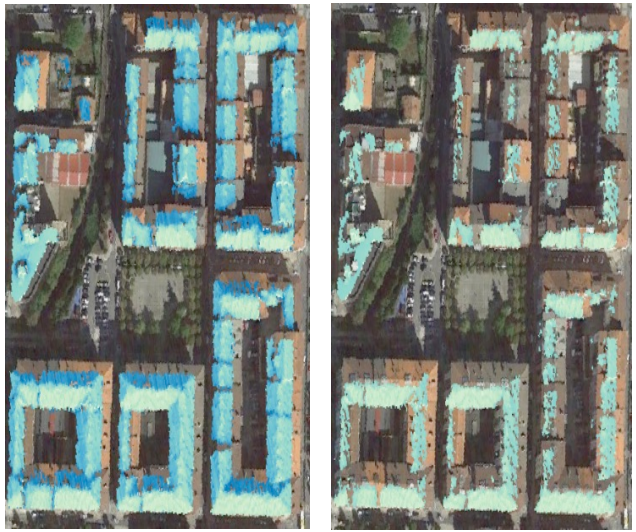
climatic file and boundary layer of the municipality.

Methodology:
Step 3: Profitability threshold and rooftop characterization

Definition of **irradiance thresholds** associated to **economic performance** and rooftop characterization

Calculation of the return of investment for a given irradiation threshold

Irradiance threshold (kWh/ m^2 year)	Return of investment (years)
1100 (kWh/ m^2 year)	<10 years
925 (kWh/ m^2 year)	<12 years

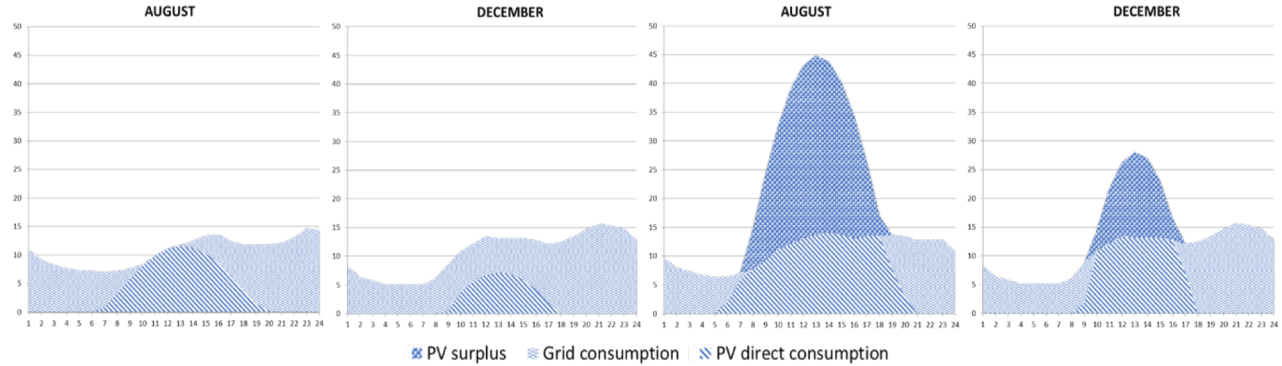


Methodology:
Step 4: Size optimization based on legislation model

PV **size optimization** based on economic performance and possible legislations

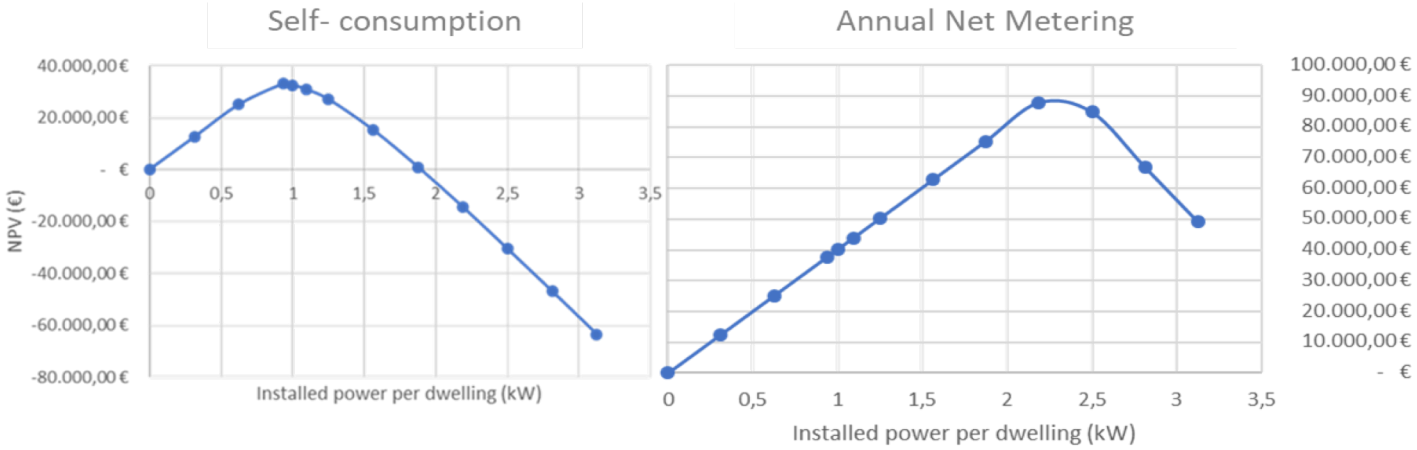
3 case studies

1. Self consumption (at building level)
2. Net metering
3. Theoretical maximum potential

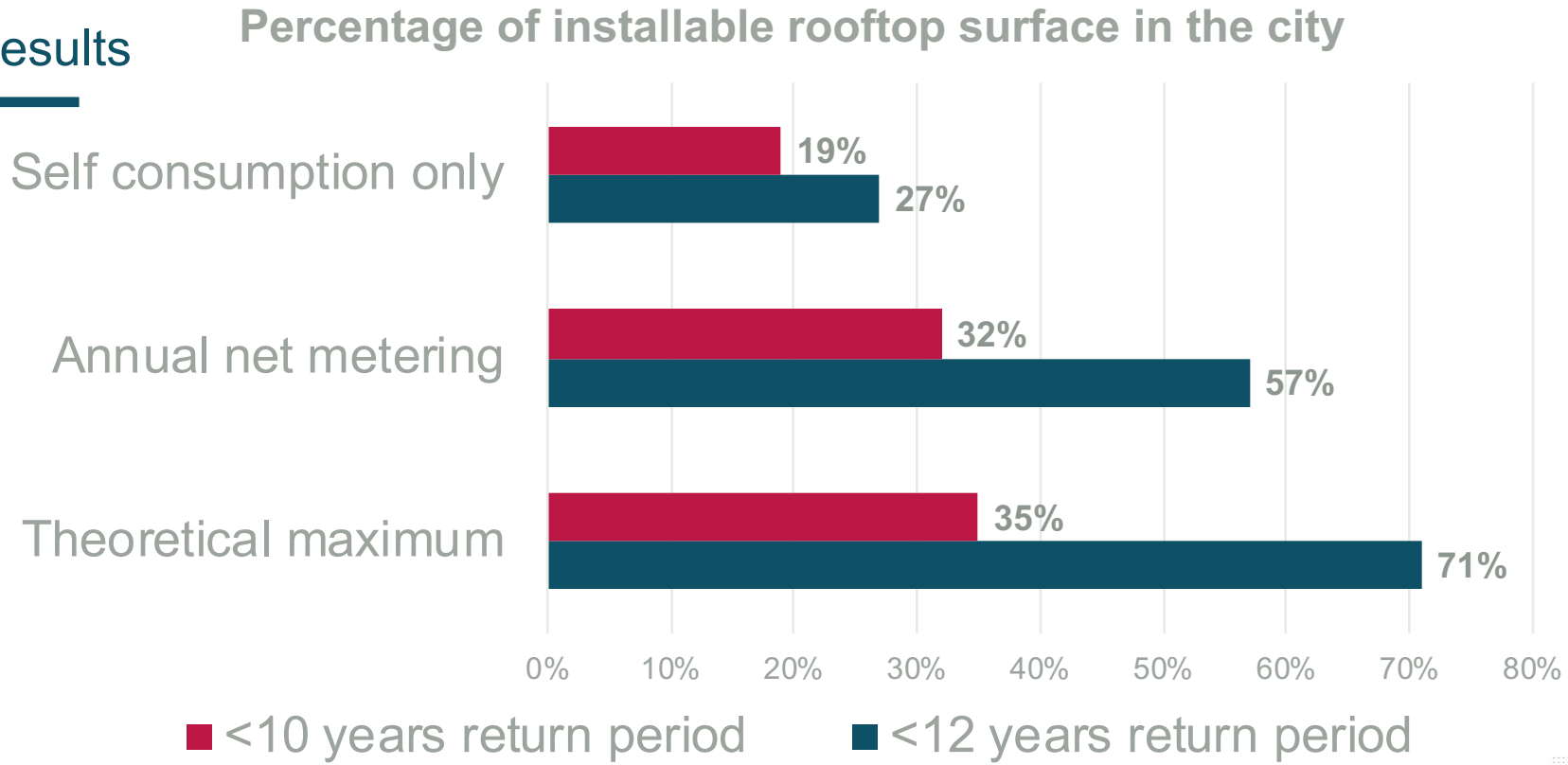


Methodology:
Step 4: Size optimization based on legislation model

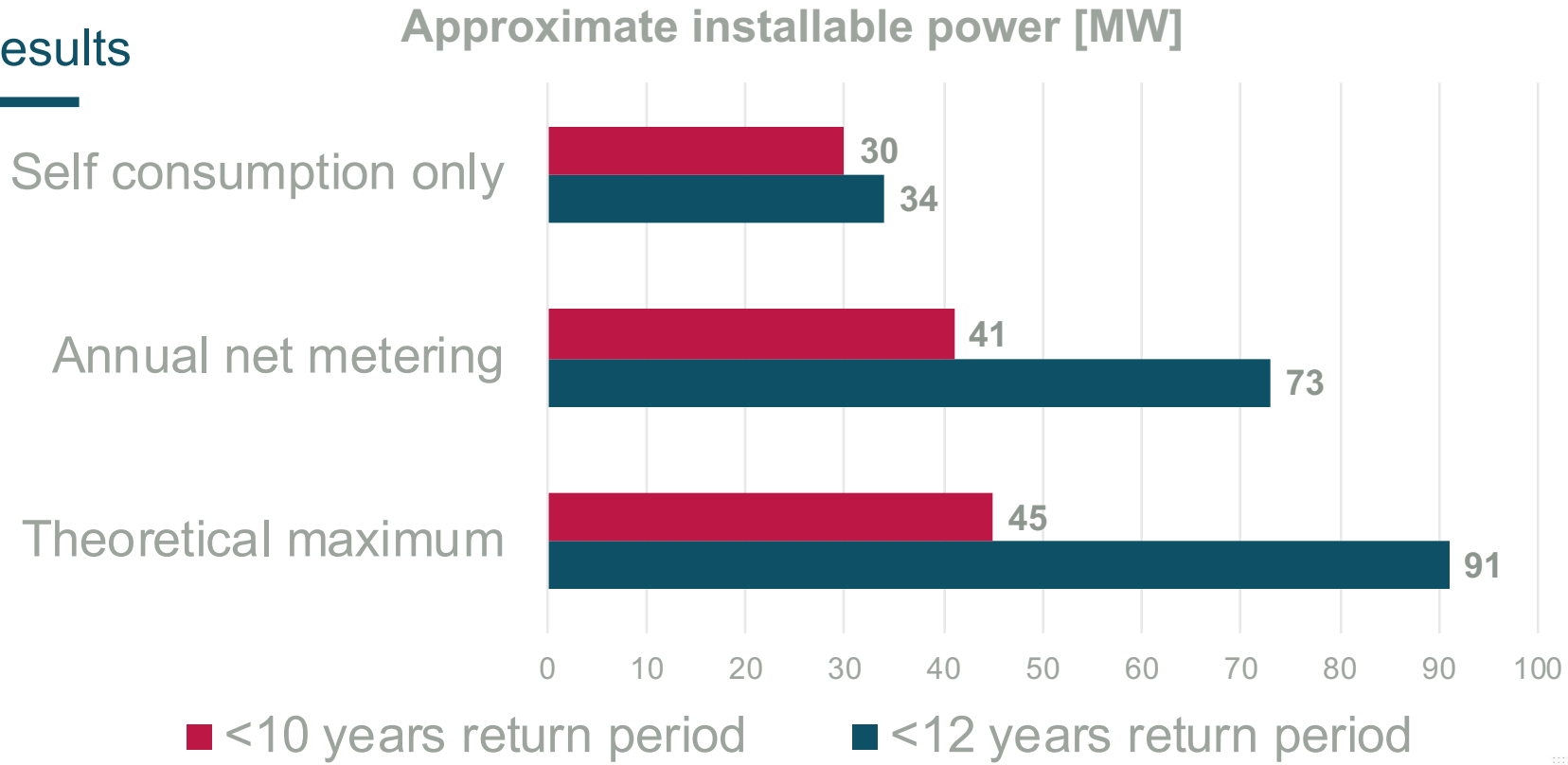
- *Self-consumption: 29% of the building demand*
- *Net metering: 100% of the building demand*
- *Theoretical maximum potential: 100% available building roof surface*



Results


Percentage of installable rooftop surface in the city
Self consumption only
19%
27%
Annual net metering
32%
57%
Theoretical maximum
35%
71%
0%
10%
20%
30%
40%
50%
60%
70%
80%
<10 years return period
<12 years return period

Results


Approximate installable power [MW]
Self consumption only
30
34
Annual net metering
41
73
Theoretical maximum
45
91
0
10
20
30
40
50
60
70
80
90
100
<10 years return period
<12 years return period

Results

Solar power energy share. Percentage of building stock **electricity consumption fed by solar PV.**

Threshold	Theoretical maximum	**Self-consumption only**	Annual net metering
1100 kWh/m^2.year	32%	**17%**	29%
925 kWh/m^2.year	59%	**24%**	48%

Results

Solar power energy share. Percentage of building stock **electricity consumption fed by solar PV.**

Threshold	Theoretical maximum	**Self-consumption only**	Annual net metering
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Conclusions

Importance of a **well oriented regulation** for renewable energy integration

Policy makers

- Possible to understand the impacts of each regulatory framework

Consumers

- Can identify the potential of their own buildings
- Shows a great potential for building integrated PV

Public administration

- Realistic view of PV potential to analyze promotion mechanisms

Thank you

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