Providing insights to realise the potential of solar energy in Spain

Celia Sevilla Sánchez

Introduction

- Project financed by NextGenerationEU funds.

- Objetive: to develop a viewer to show the solar potential of buildings in Spain by reusing public data from different administrations.
  - Second version ready to be released

- The user enters an address and the viewer displays the detailed information about the solar potential and the estimated investment.

- The resolution of the data is 2m

- It includes a dashboard with the estimated and installed solar potential in Spain

- Data source:
  - Buildings:
    - Spanish Cadastre: INSPIRE conformant service (ATOM)
    - Basque Country Government: Basque Country (geographical data base)
    - Navarra Government: (WFS)
  - Elevation model: DSM from IGN with a 2 m grid from LiDAR. Trees and shadows have been considered for the calculation of solar potential.
  - Solar Radiation and cloudiness: PVGIS (European Commission application)
    - Photovoltaic Geographical Information System

    © PVGIS © European Communities, 2001-2017
   - Solar radiation data base for Europe from satellite images (SARAH)

- Data Processing:
  - r.sun (GRASS GIS): Computes direct (beam), diffuse and reflected solar irradiation raster maps for given day, latitude, surface and atmospheric conditions. The shadowing of the topography has been incorporated.

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Data results

- Results are displayed using standard web services:
  - Web Map Service (WMS): https://wms-potencial-solar.idee.es/potencial-solar
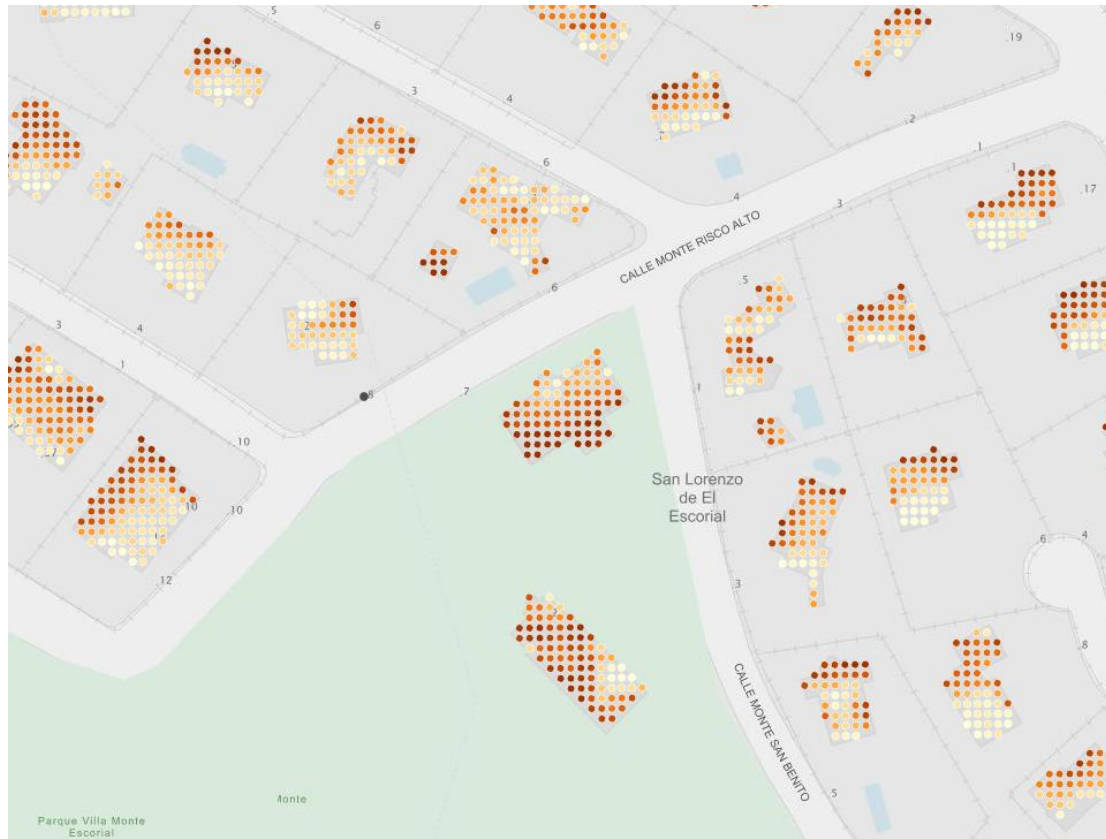
Solar Potential points for buildings (2m grid)
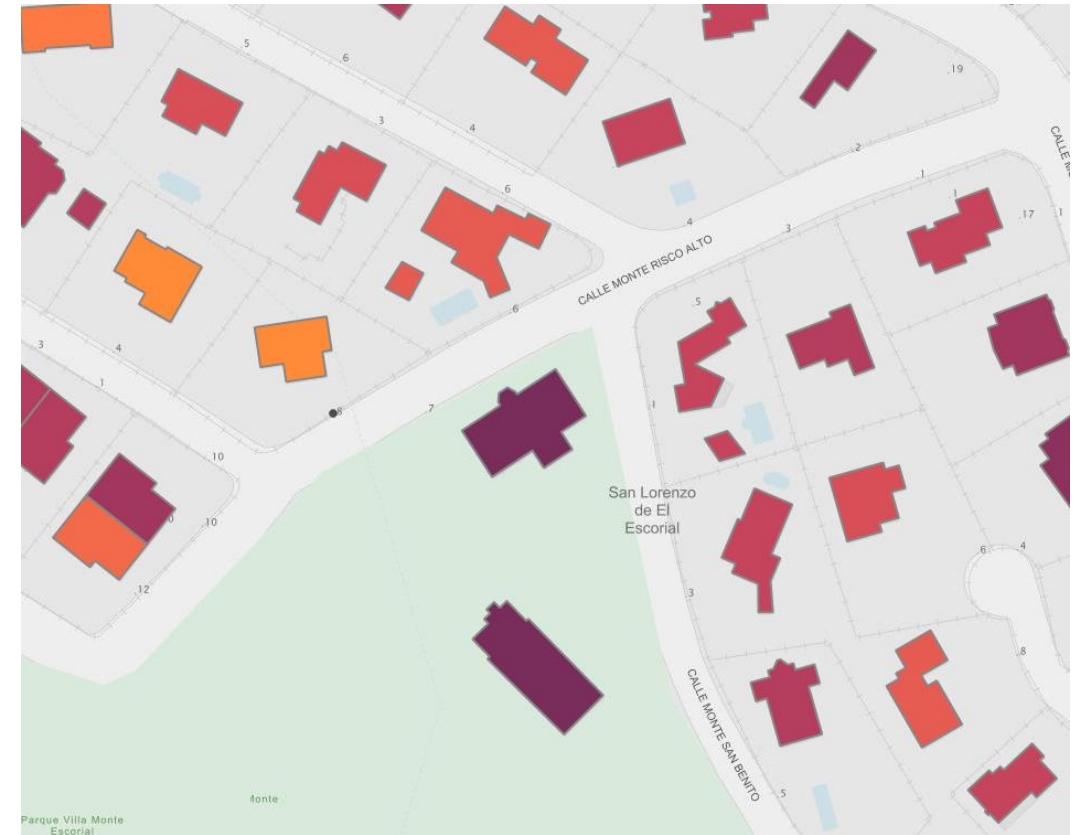
Average Solar Potential of buildings

Data results

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  - Web Map Tile Service: https://wmts-potencial-solar.idee.es/potencial-solar

Solar Potential for buildings (2m grid)
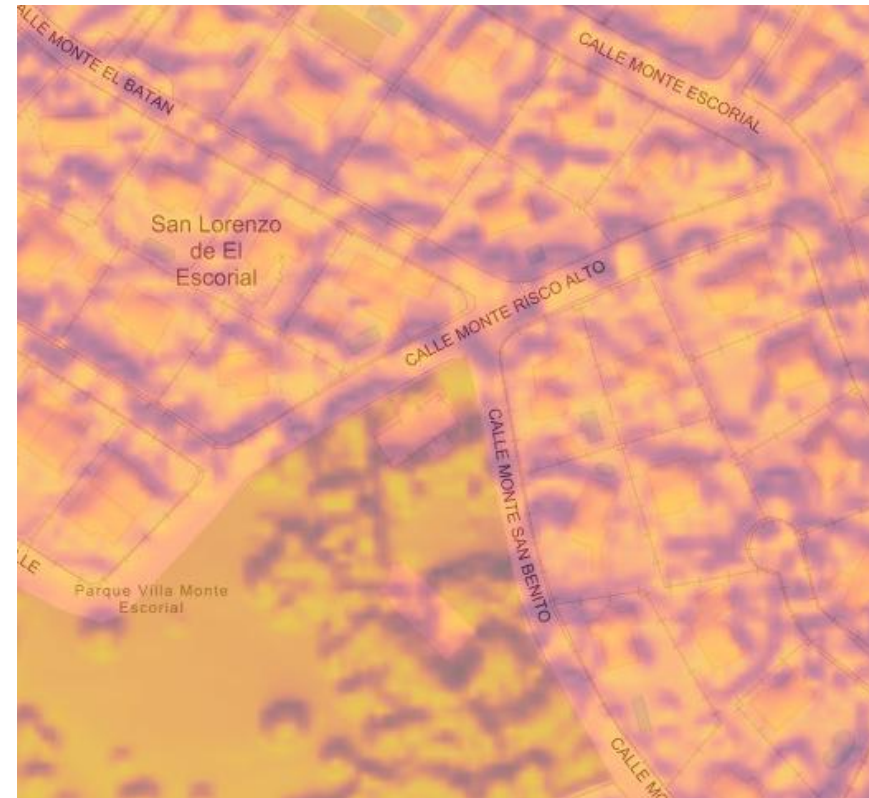
Solar Potential (field solar power plants)

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Viewer

- Open source:
  - PostGIS
  - PyGeoAPI
  - Geoserver
  - MapLibre
  - Superset

https://ignsolarguadaltel.desarrollo.guadaltel.es/solar/ Second version
https://eficiencia-energetica.ign.es/solar/
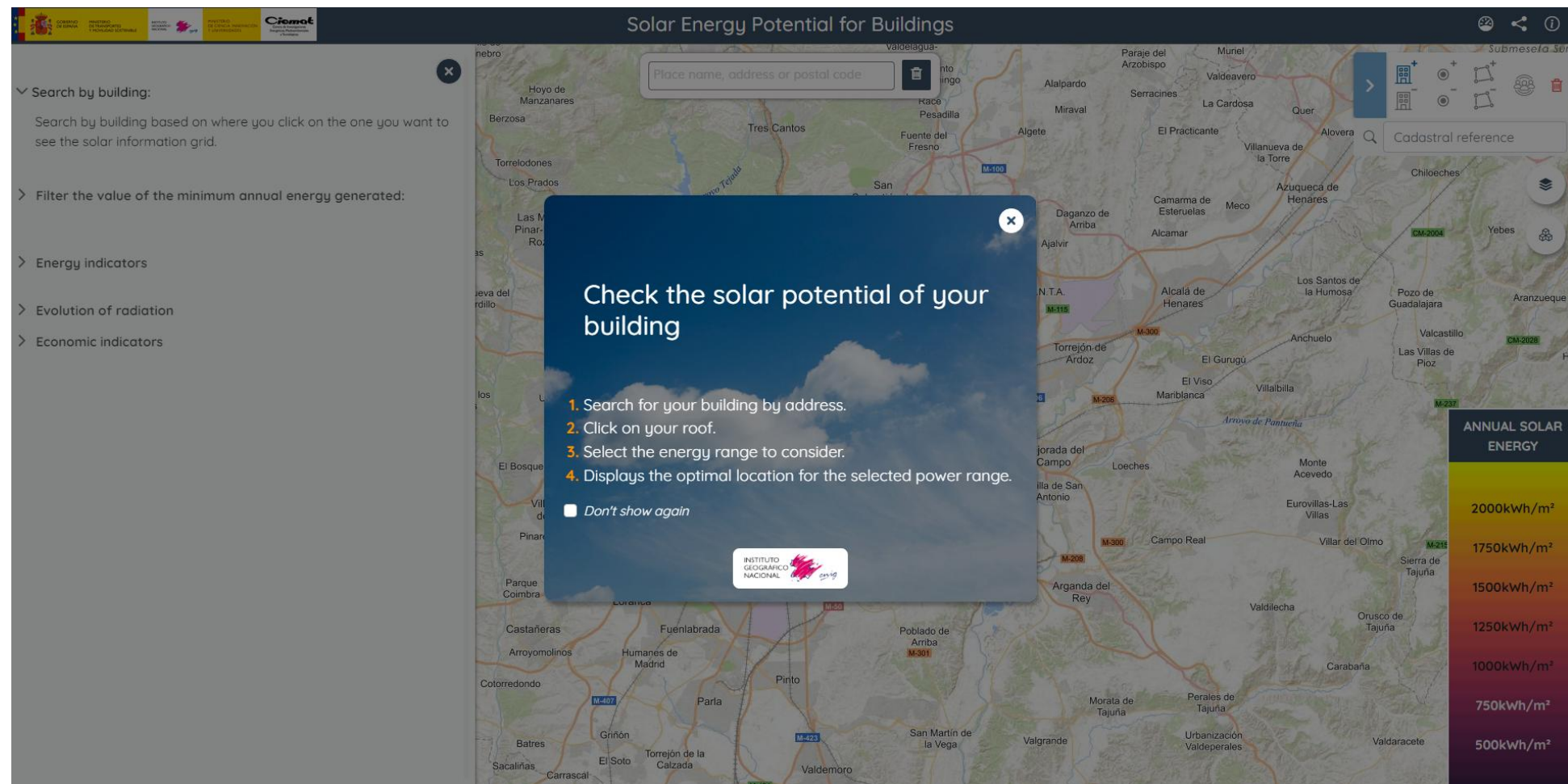
- Data results of energy production (kWh/m²):
  - Annual average photovoltaic production
  - Minimum
  - Maximum
  - Annual
  - Monthly

| Variable	Total
Surface ⓘ	76.00 m²
Average annual value ⓘ	1.697 kWh/m²
Minimum annual value ⓘ	980 kWh/m
Maximum annual value ⓘ	1.962 kWh/m²
Accumulated solar energy ⓘ	129.00 MWh
Annual photovoltaic production ⓘ	24,278.21 kW
Maximum power ⓘ	15.96 kW
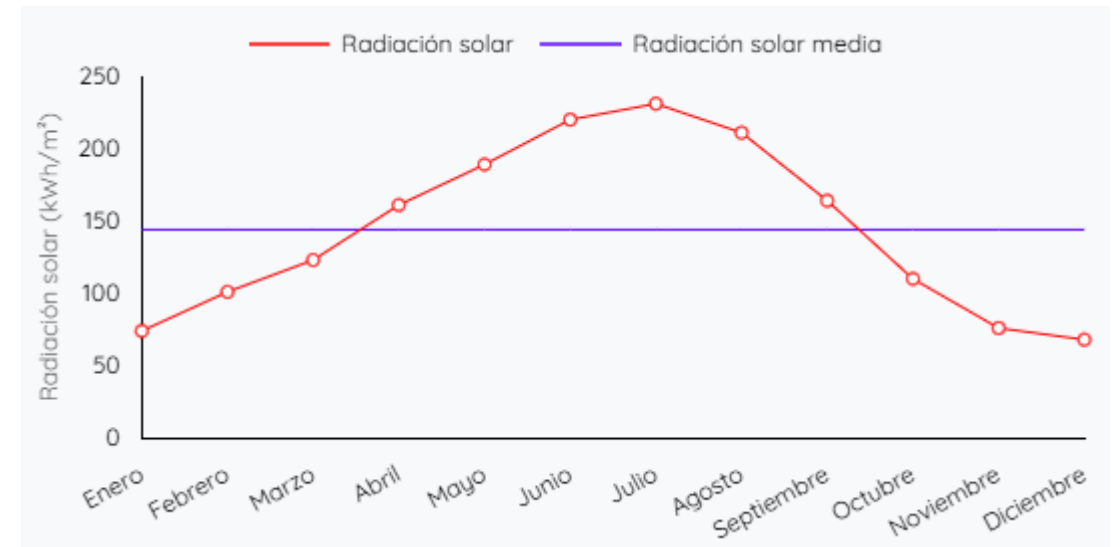
The annual photovoltaic production take into account the efficiency and losses of the installation, which depend on the technology of the panels.

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Viewer

- Calle Monte Escorial 1, San Lorenzo de El Escorial

https://eficiencia-energetica.ign.es/solar/

Viewer
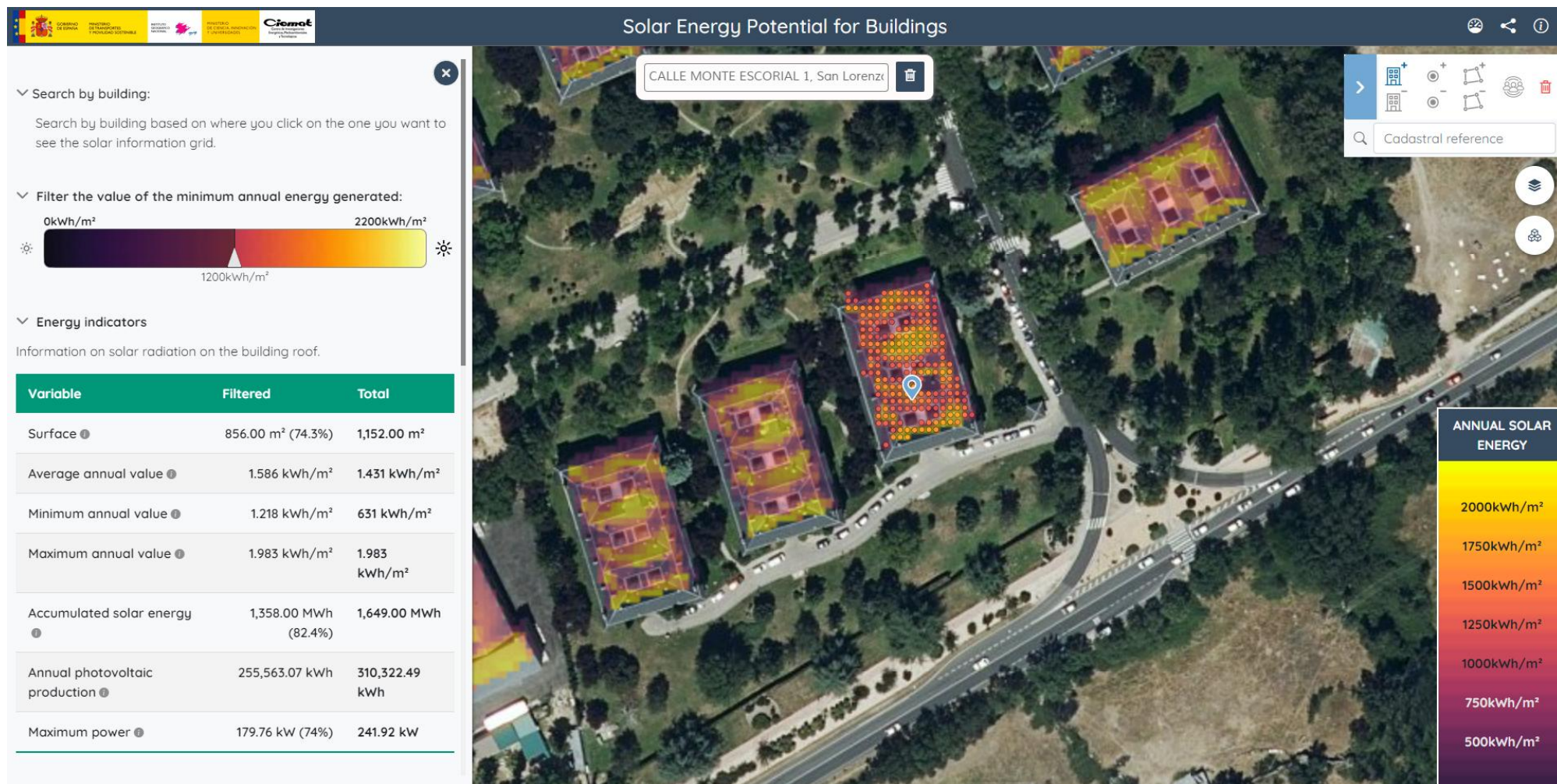
- Enter the consumption data for the 36 apartments
  - 1 apartment
    - Peak 64 kWh
    - Flat 56 kWh
    - Valley 75 kWh
  - without heating system

Consumption data

Enter your monthly consumption data for each electricity period.

Period	Tip	Flat	Valley
Grid consumption (kWh)	2304	2016	2700
Price (€/kWh)	0,21	0,15	0,12

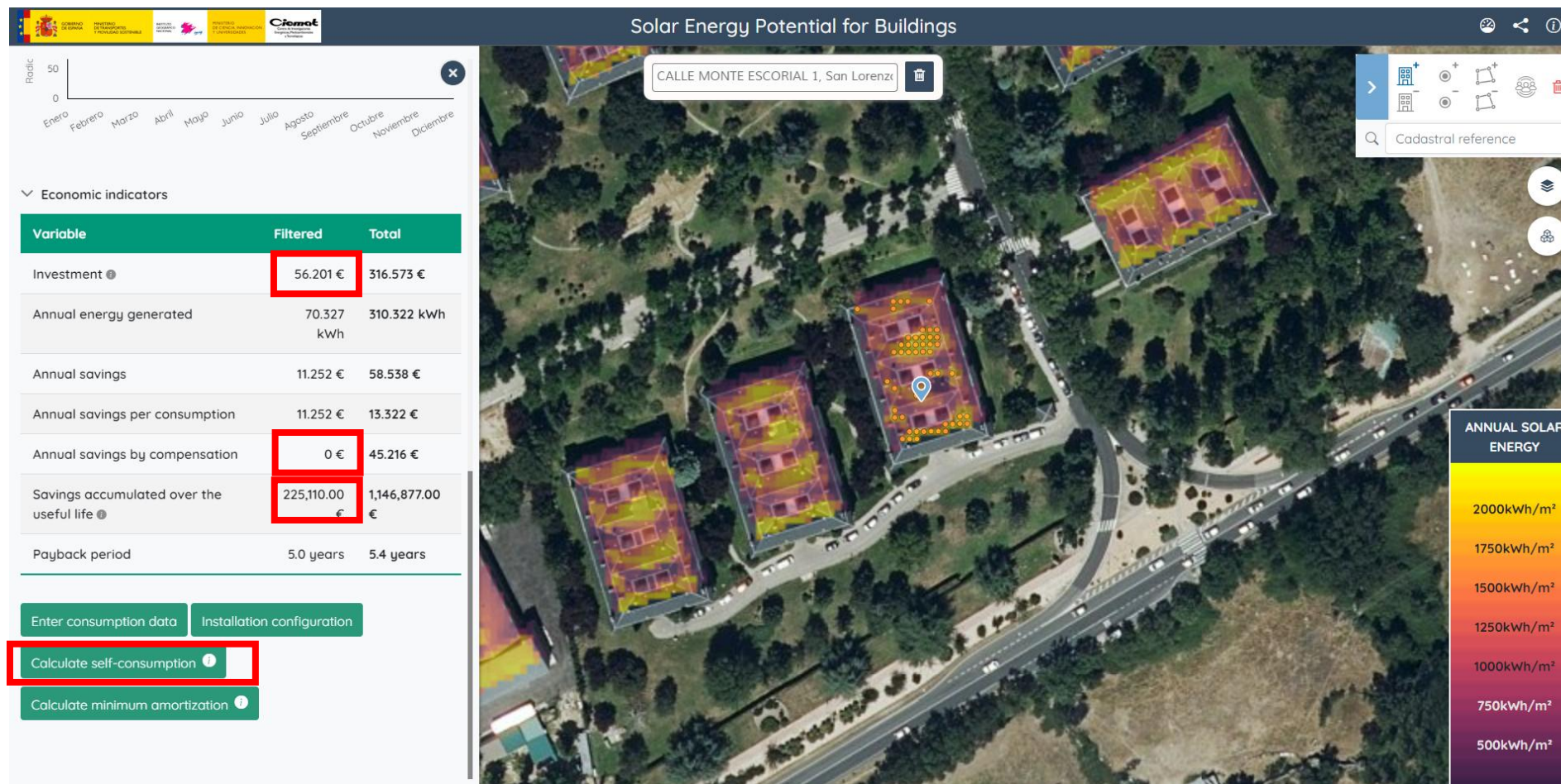Compensation for excess energy discharged into the grid (€/kWh):

0,20

The result of the calculation is an estimate and should not be taken as binding. The default values have been obtained from average consumption, surface area and tariff data in Spain.
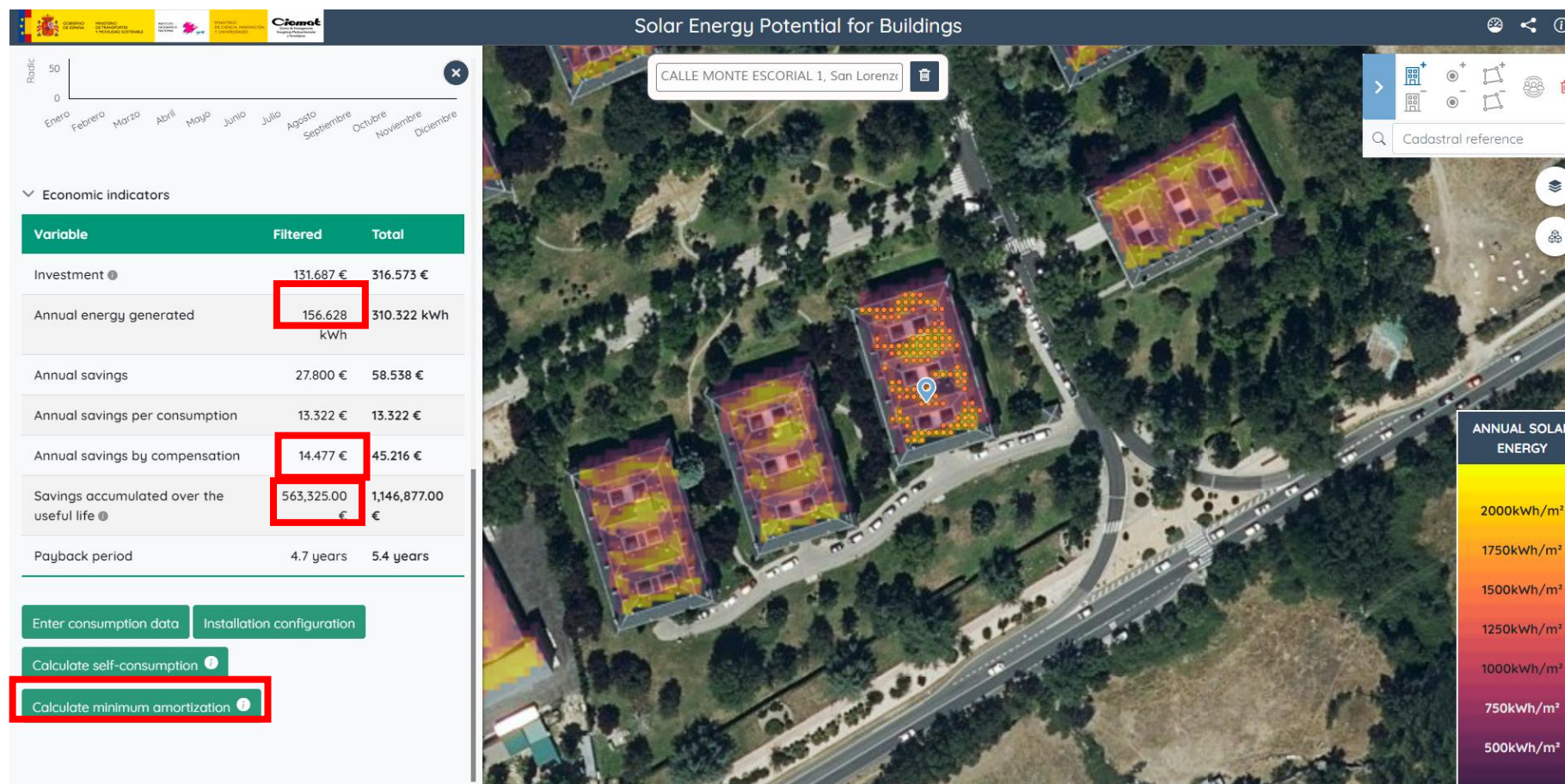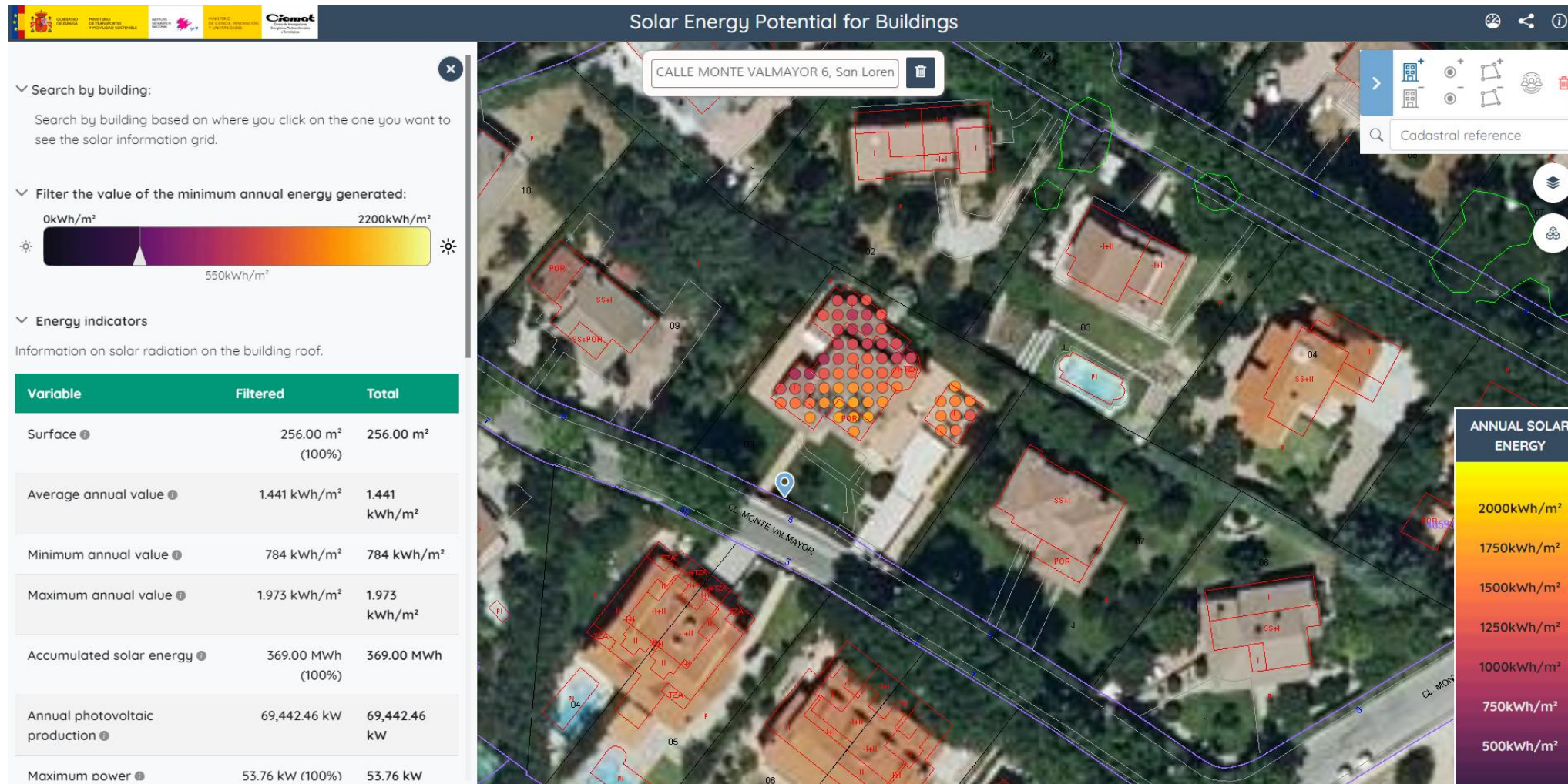
Apply   Default values

https://eficiencia-energetica.ign.es/solar/

Viewer

- Calculate self-consumption:
  - investment 1.561 €/apartment -> 6,255 € saving in 25 years

https://eficiencia-energetica.ign.es/solar/

Viewer

- Calculate minimun amortisation:
  - investment 3,658 €/apartment -> 15,647 € saving in 25 years

https://eficiencia-energetica.ign.es/solar/

Viewer

- Calle Monte Valmayor 6, San Lorenzo de El Escorial

https://eficiencia-energetica.ign.es/solar/

Viewer

- Filter points over 1720 kWh/m²
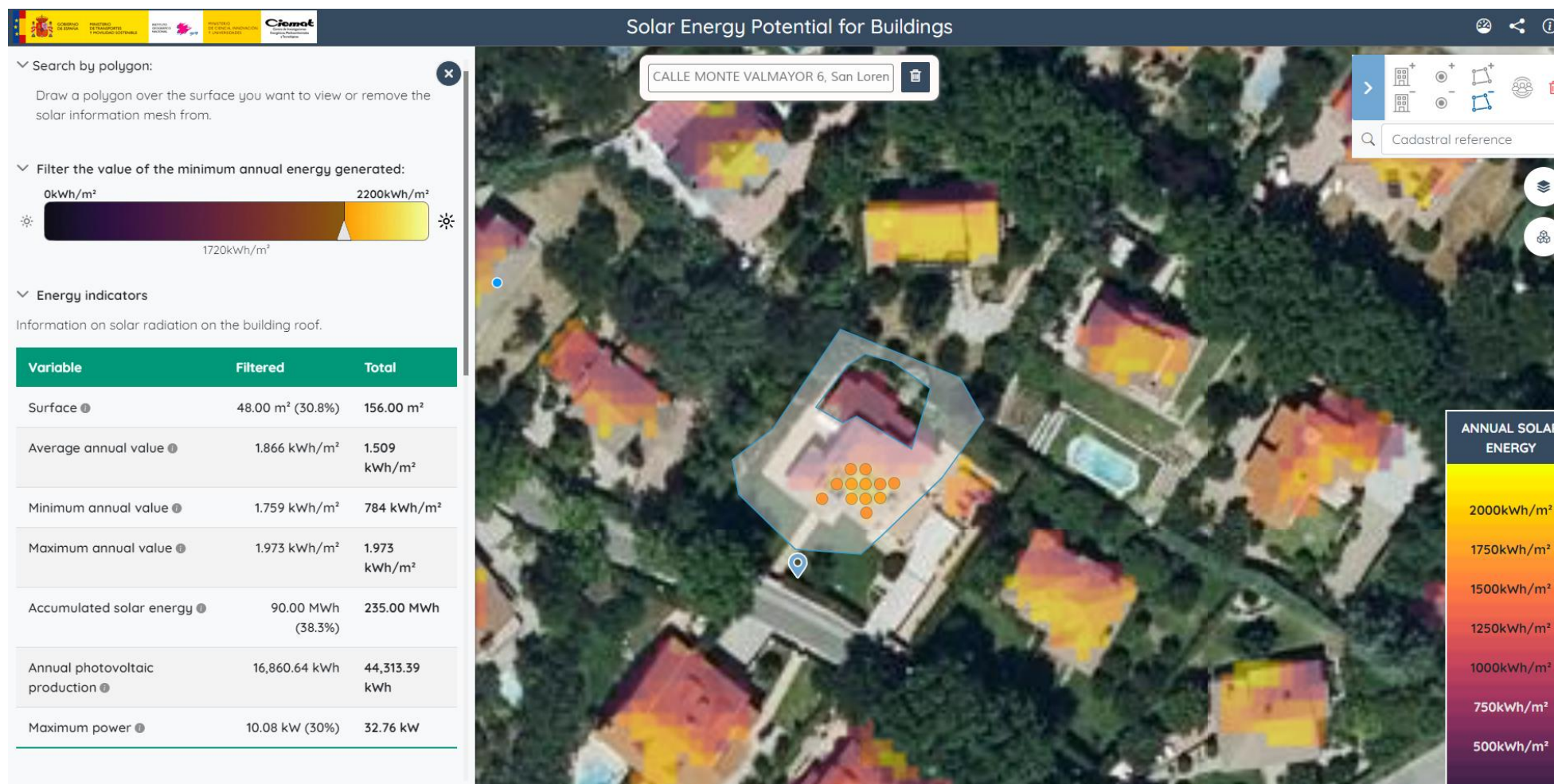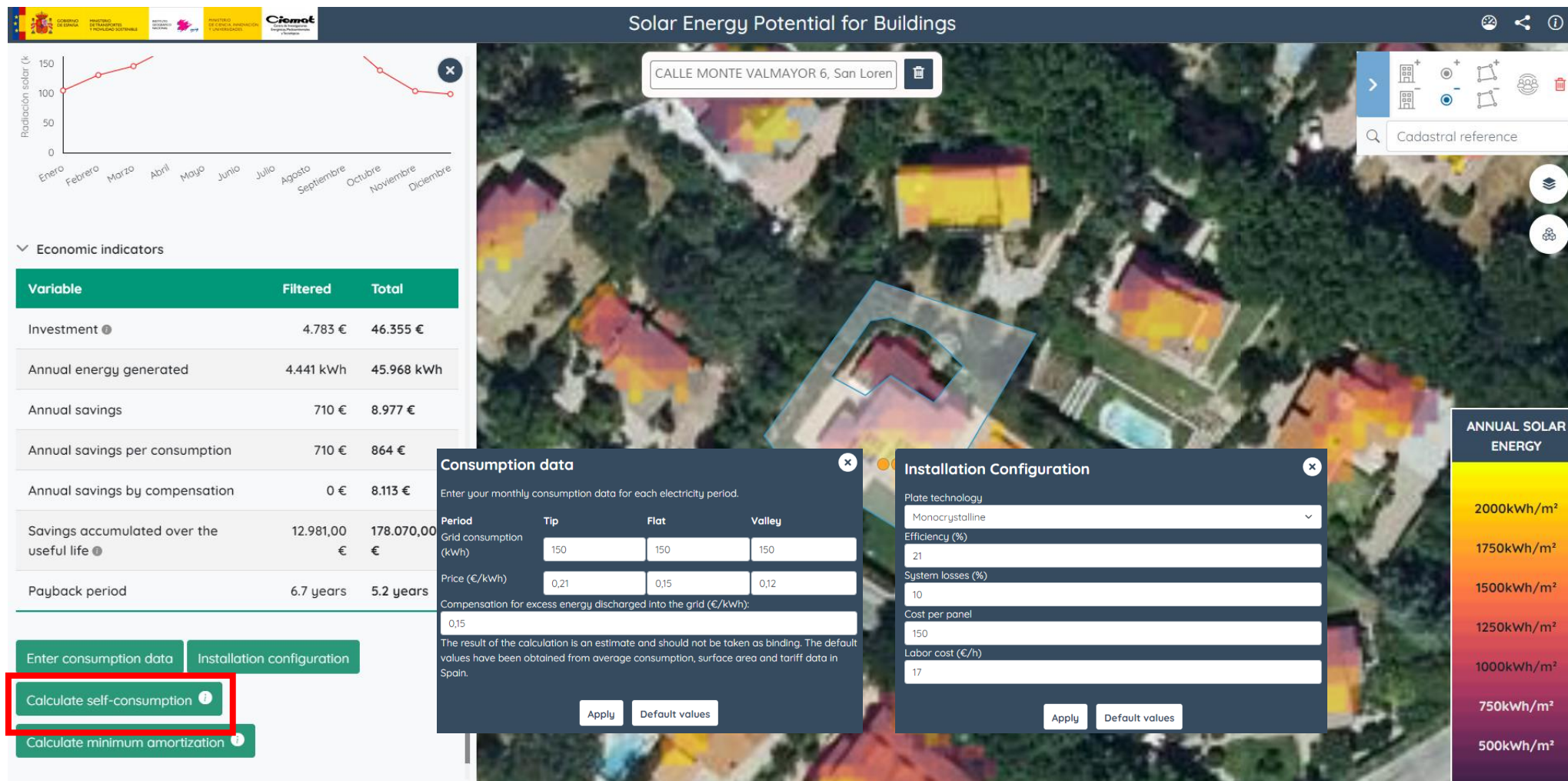
https://eficiencia-energetica.ign.es/solar/

Viewer

- It shows the investment of panels installation

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Solar communities

- Buffer to the solar power plant (1 km (direct conection) and 2 km (using power lines))

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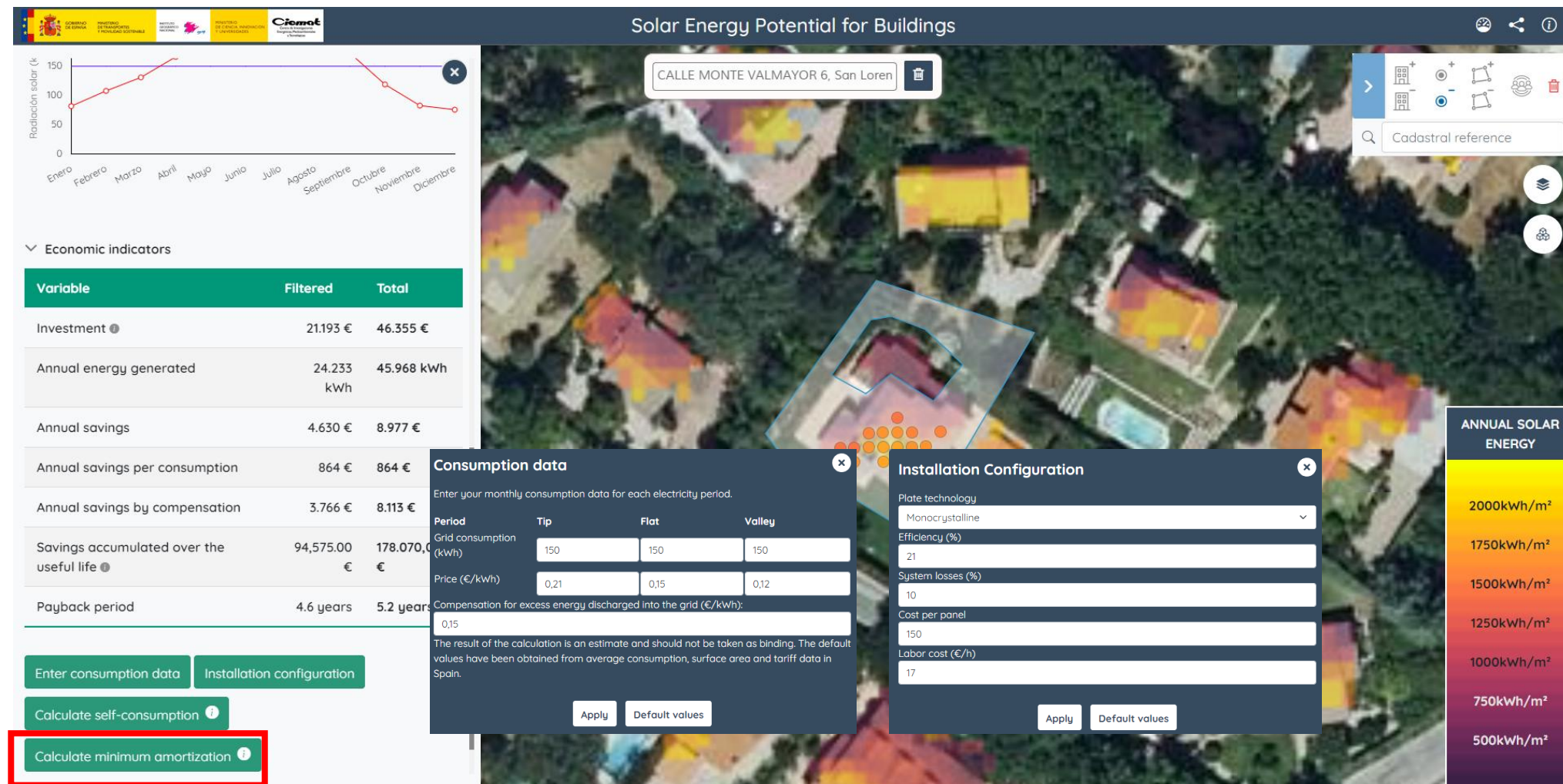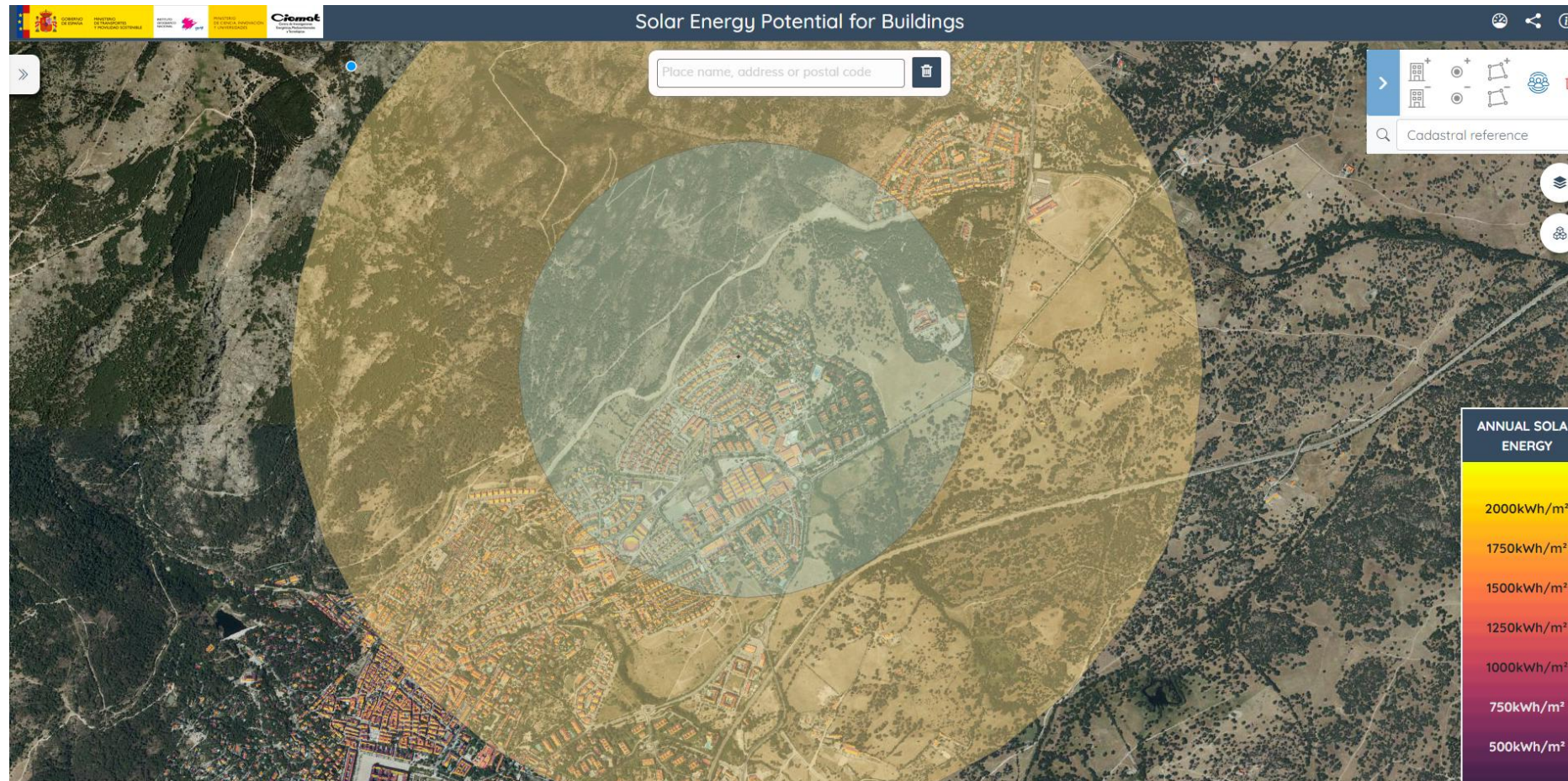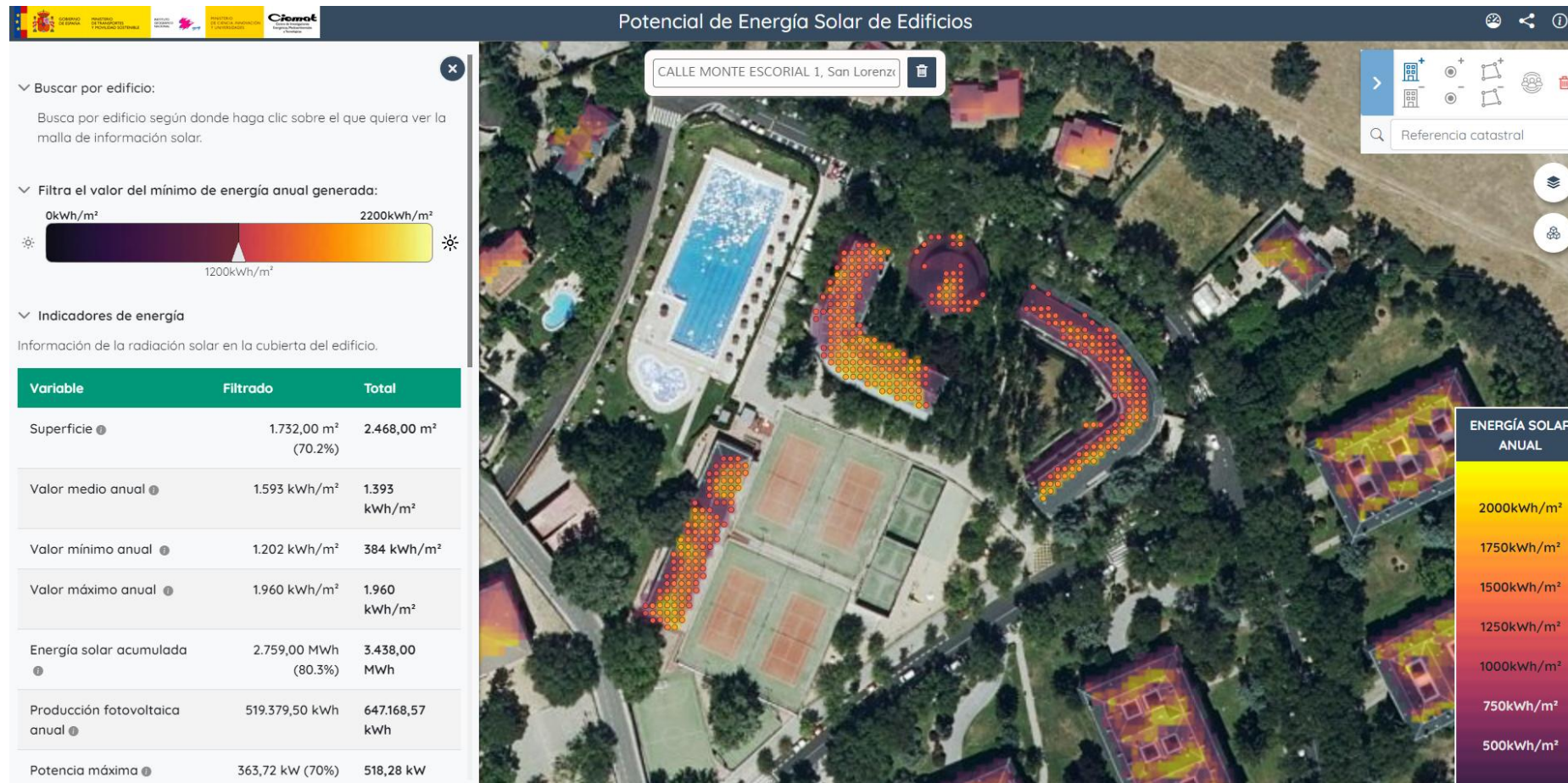
3D View

- 3D View with the average (MapLibre)
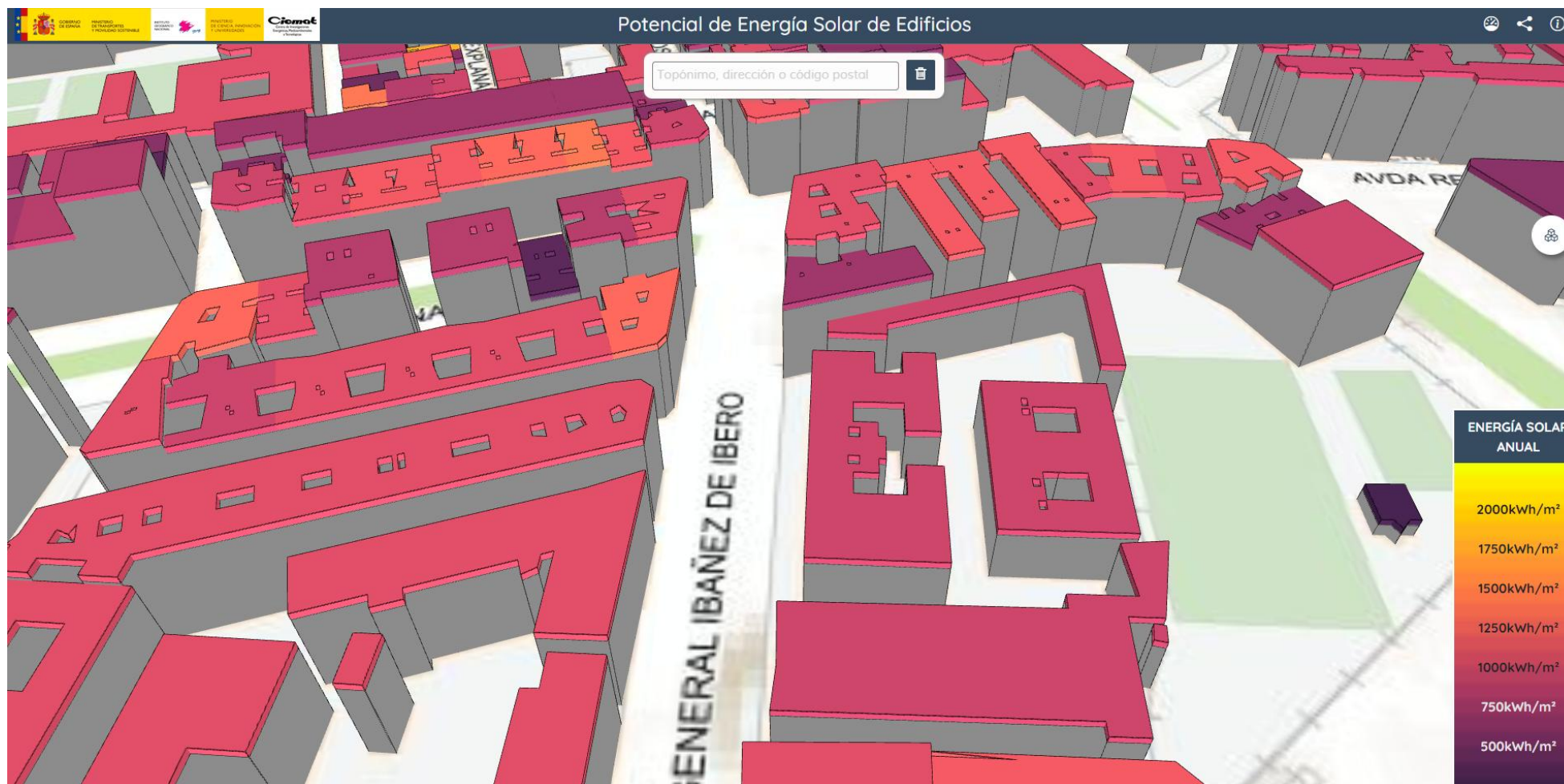
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Dash Board

- It shows the solar potential estimated and installed

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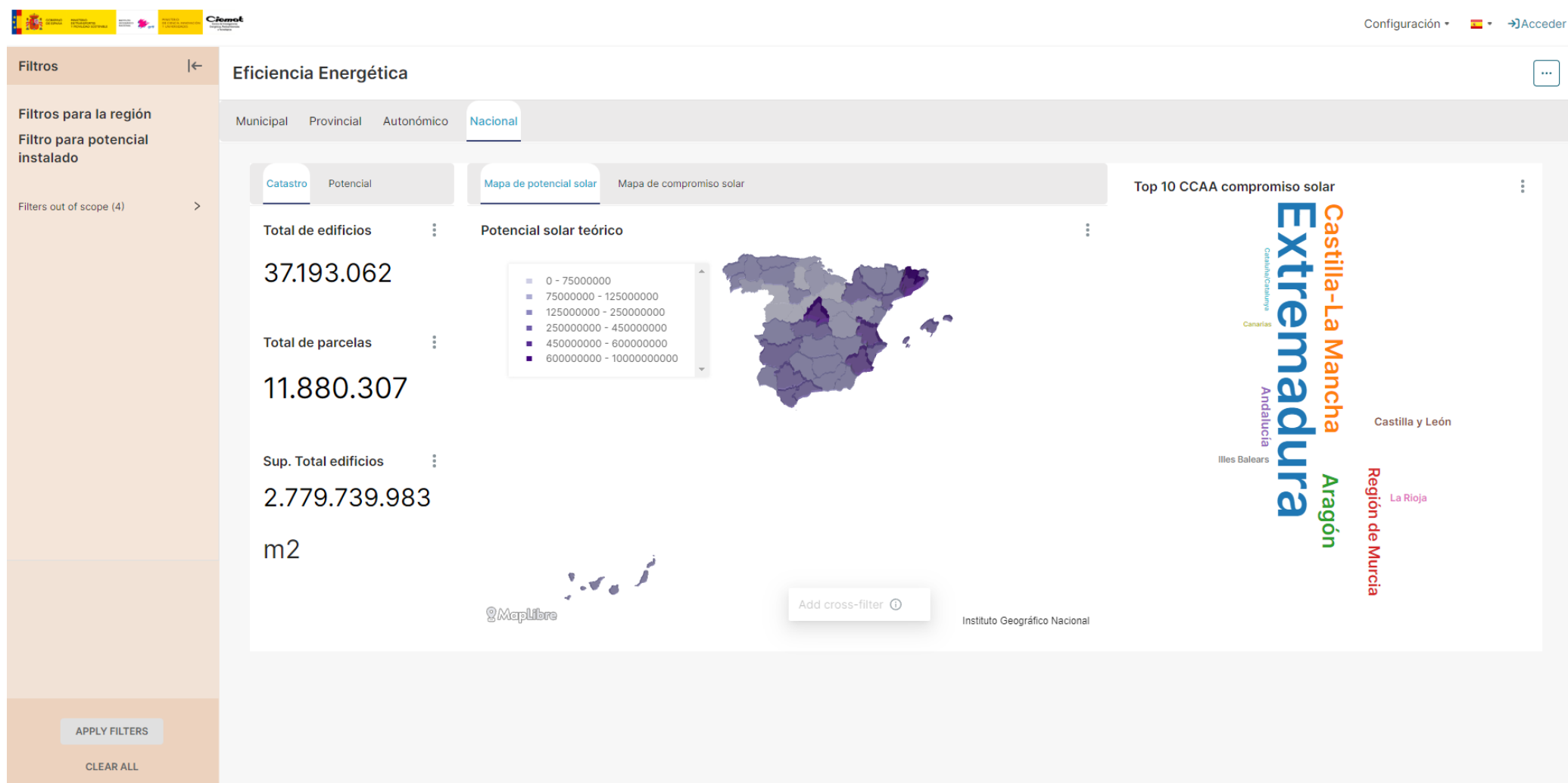
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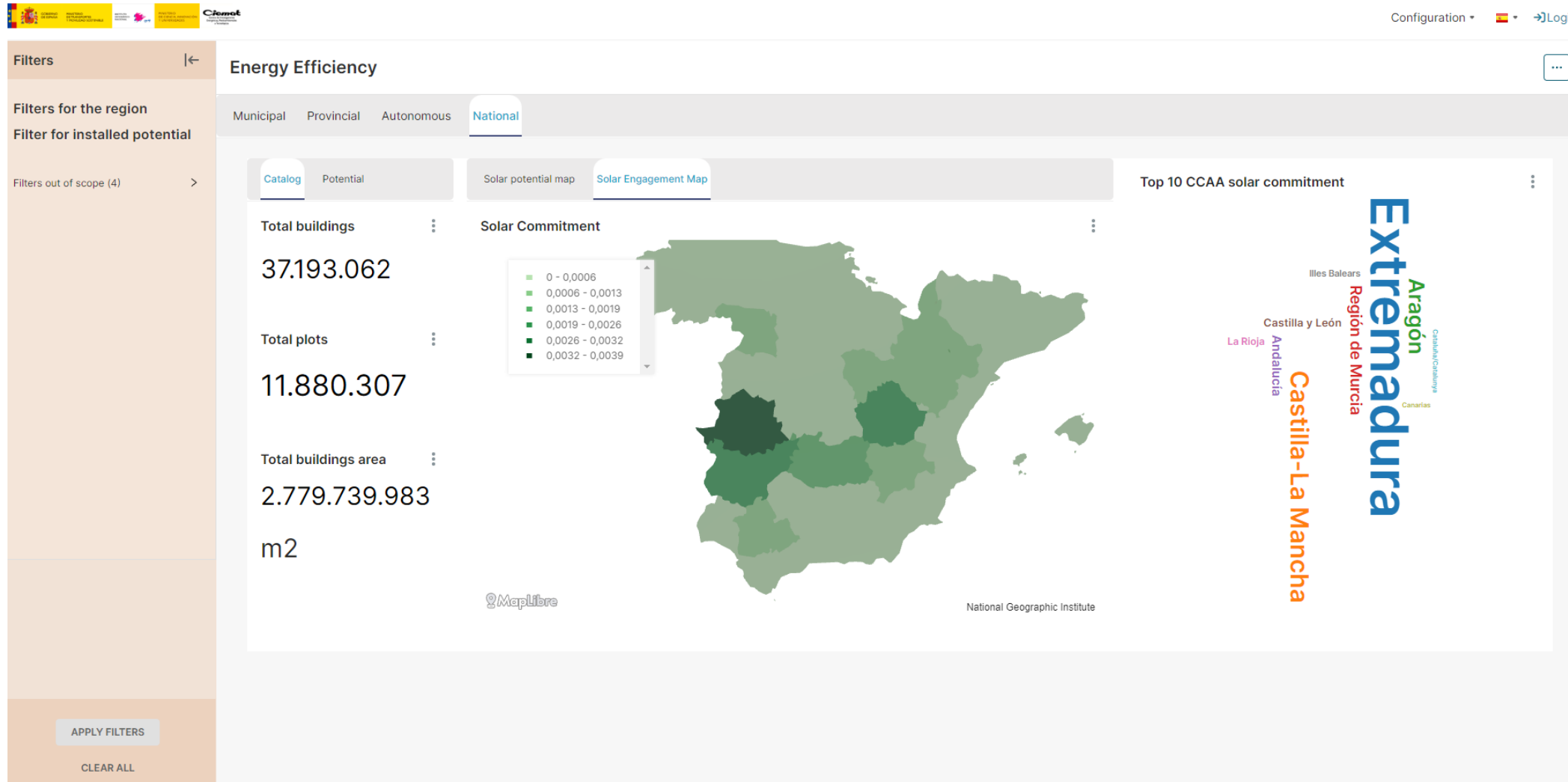
- Solar potential estimated and installed

Conclusions

- Energy efficiency is a priority of general interest, not only for **economic reasons** due to rising electricity and gas prices, but also for **ecological and sustainability** reasons.

- Spain's location is highly appropriate for realising 100% clean solar energy. But the photovoltaic investment is far from desired

- The viewer help users to know the solar potential of buildings, the optimal location of the solar panels and the estimated of the investment.

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Thank you

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