
# EURECA: Strumento open-source in continua evoluzione per l'analisi urbana delle prestazioni energetiche degli edifici

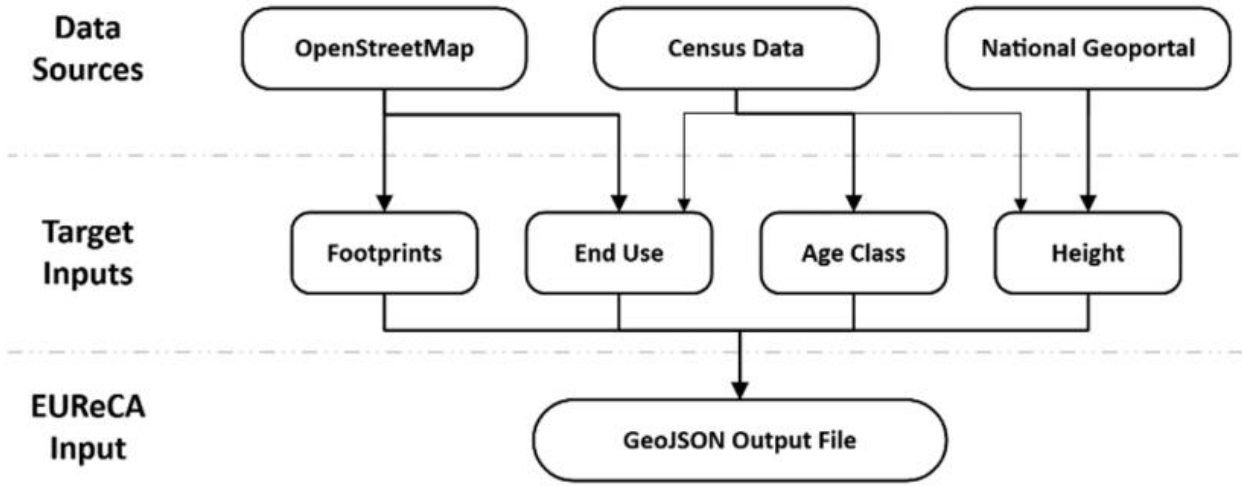
M.H. Khajedehi – Michele De Carli

Cerescente importanza della pianificazione energetica urbana

Necessità di strumenti aperti interoparibili per l’analisi su larga scala

Difficoltà di collegare dati eterogeni

The main challenge is to formalise the framework to obtain the city model from open data sources.

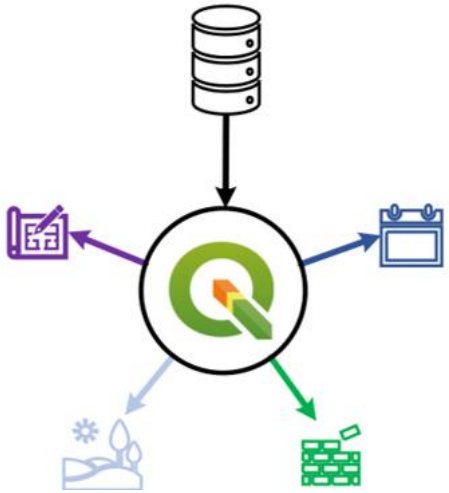


Satellite images
Census and surveys
Cartographies
LiDAR…

Raw data from open databases

Target input elaboration

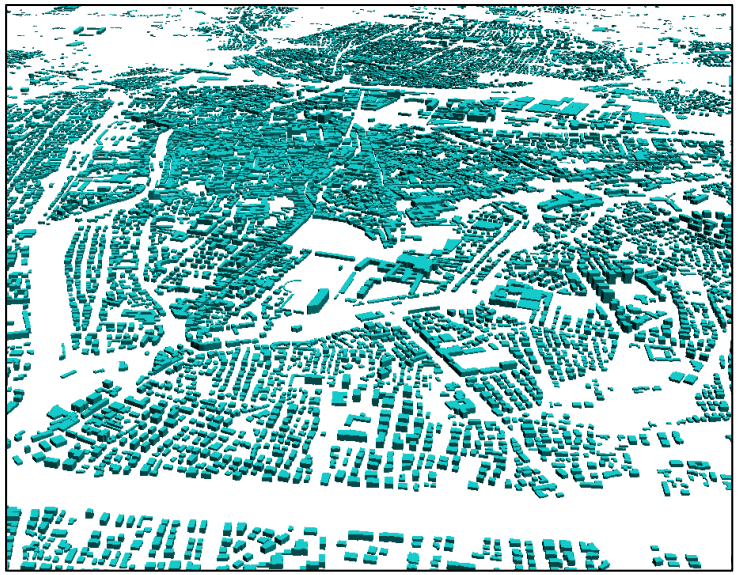
- UBEM simulation
- Evaluation of the results
- Analysis of the intervention scenarios…

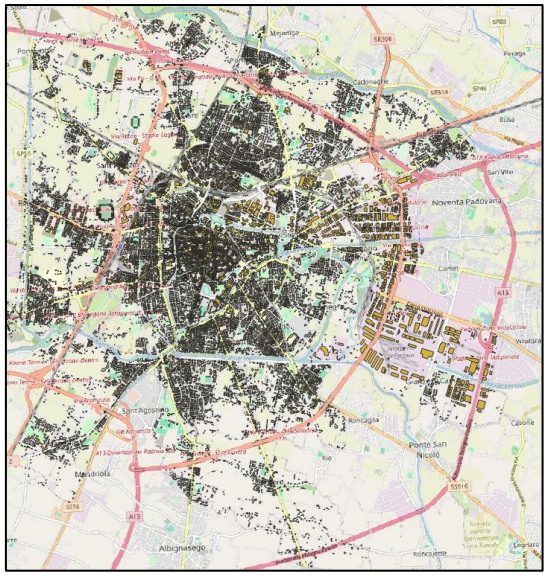


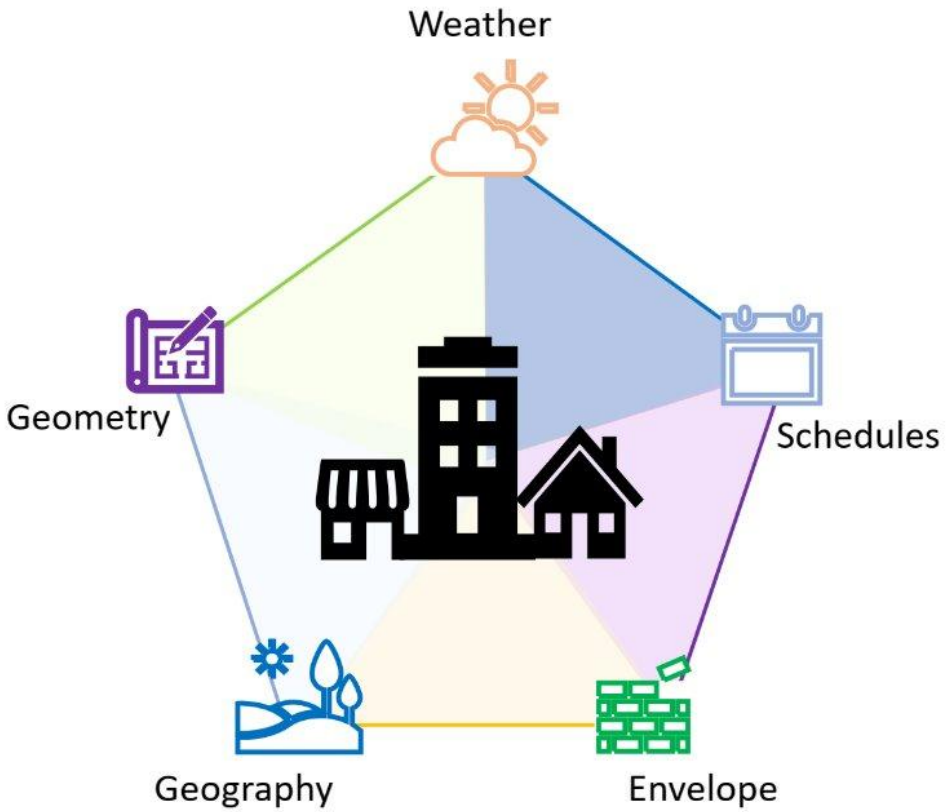
NEST
NETWORK FOR ENERGY SUSTAINABLE TRANSITION

UNIVERSITÀ DEGLI STUDI DI PADOVA

Il popolamento del modello della città rende il modello pronto per la simulazione.

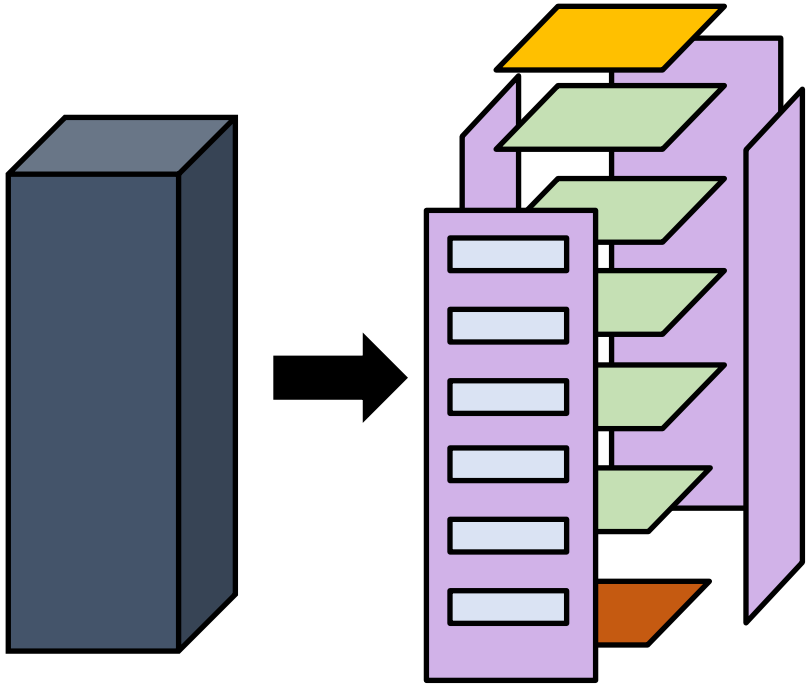




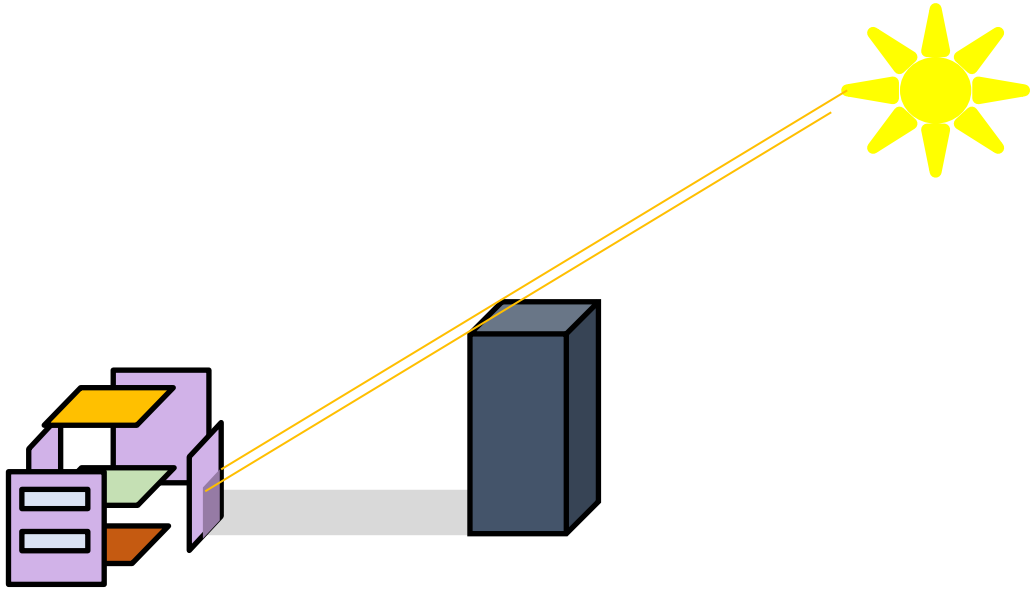

Weather
Geometry
Schedules
Geography
Envelope

EUReCA è uno strumento di simulazione basato su modelli RC che inizia con la pre-elaborazione geometrica.

Le diverse superfici degli edifici vengono classificate per calcolare i parametri necessari per la simulazione.



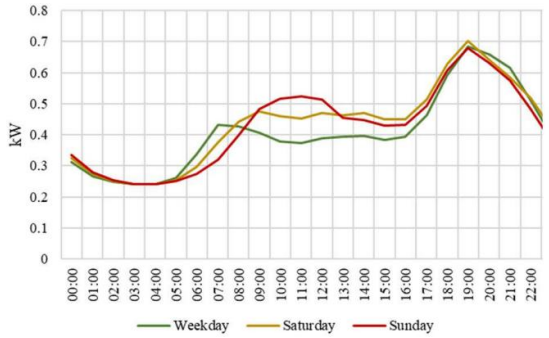
La pre-elaborazione geometrica include anche il calcolo dell'ombreggiamento che aiuta a includere l'interazione degli edifici nell'ambiente urbano.



## ISTAT questionnaire

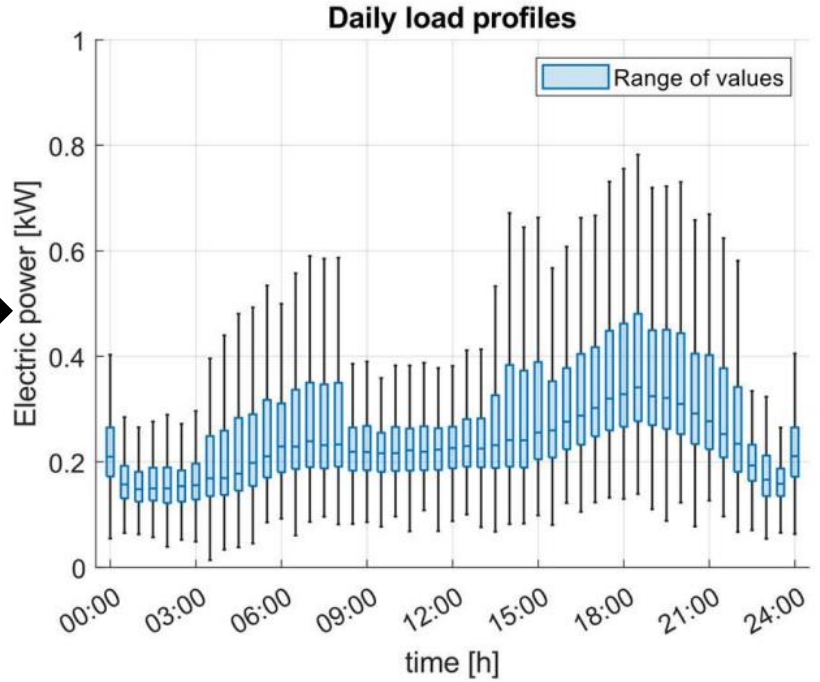
| Appliance | ISTAT code | Description |
|---|---|---|
| Lights | q_7_1-4 | Number of high efficiency and traditional lamps. Typical number of hours of usage. |
| Small appliances | q_8_8-28 | Presence of several small appliances. E.g., kettle, hair dryer, electric grill. |
| Fridge and freezer | q_8_2-8 | Number and size of the fridge and freezer. Age of each of them. |
| Dish washer, washing machine and tumble dryier | q_8_13-24 | Presence of dish washer, washing machine, tumble dryer. Number of cycles per week, subdivided by different temperature range. Age of devices. |
| Screens, TV and computers | q_8_40-47 | Number of screens and computers and number typical time usage for each of them. |

## ARERA load profiles




# Profili consumo elettricità sviluppato per il contesto italiano

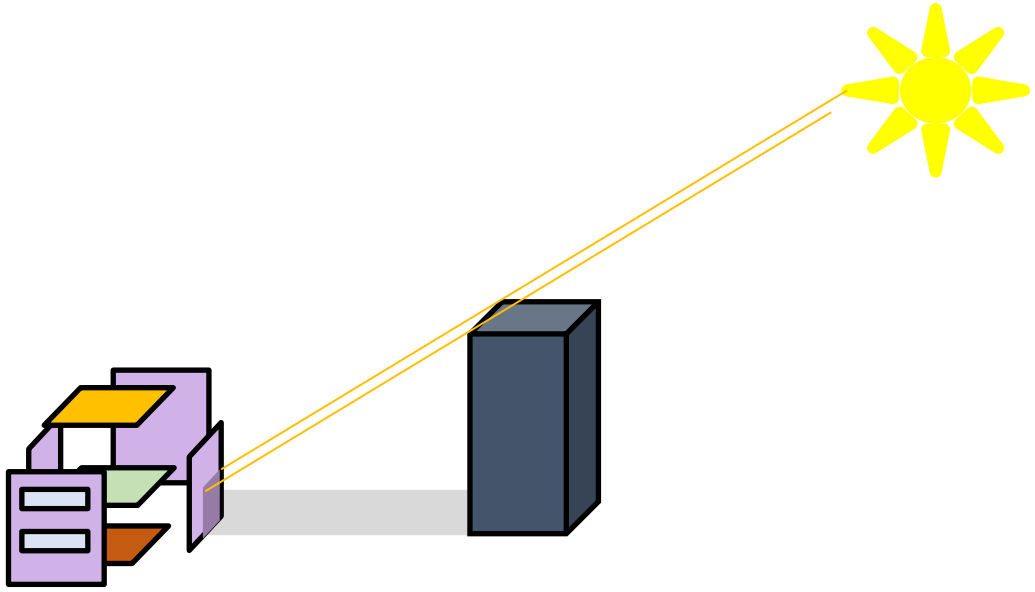
| [%] | Piemonte | Veneto | Umbria | Lazio | Campania | Puglia | Sicilia | Sardegna |
|---|---|---|---|---|---|---|---|---|
| Refrigerator | 99.6 | 99.8 | 98.9 | 99.3 | 99.9 | 99.8 | 99.7 | 99.8 |
| Small appliances | 98.4 | 99.6 | 99 | 98.2 | 98.8 | 98 | 98.2 | 98.4 |
| Light | 98.5 | 97.2 | 97.3 | 98.1 | 98.2 | 98.1 | 98.1 | 98.9 |
| Washing machine | 97.3 | 97.3 | 96 | 95 | 98.1 | 95.5 | 95.3 | 96.8 |
| TV | 95.4 | 95.4 | 95.2 | 96 | 97.5 | 94.7 | 95.2 | 96.7 |
| Electric oven | 73.6 | 66.1 | 78.6 | 62.1 | 69.7 | 73.6 | 69.7 | 63.1 |
| PC | 50.4 | 53 | 50.8 | 51 | 54.6 | 52.6 | 49 | 53 |
| Microwave oven | 50 | 54.7 | 29.6 | 33.1 | 35.4 | 37.1 | 35.2 | 53.8 |
| Dishwasher | 44.2 | 50.5 | 42.5 | 35.1 | 22 | 30.8 | 17.9 | 25.2 |
| Freezer | 24.8 | 35.7 | 39 | 20.4 | 20.3 | 12.5 | 14.1 | 40.4 |
| Cooling split | 6.3 | 23.7 | 5.6 | 14.9 | 14.4 | 18.7 | 22.5 | 22.8 |
| Electric cooktop | 3.2 | 2.3 | 1.7 | 2.9 | 3.7 | 2.9 | 1.6 | 2.2 |
| Clothes dryer | 1.6 | 4.5 | 1.4 | 1 | 0.8 | 1.2 | 0.4 | 2.7 |




NEST
NETWORK FOR ENERGY SUSTAINABLE TRANSITION

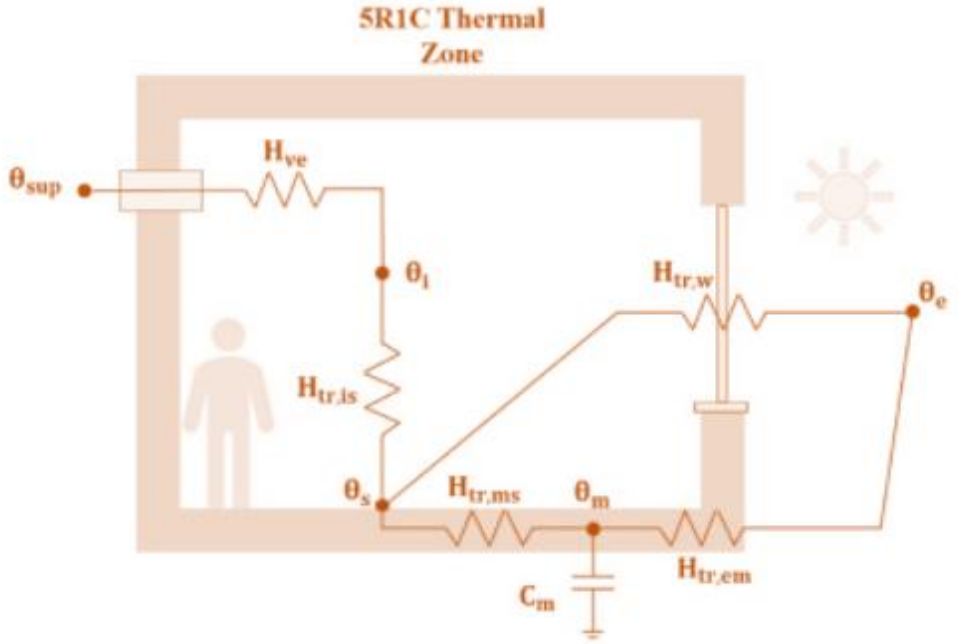
Università degli Studi di Padova

La pre-elaborazione geometrica include anche il calcolo dell'ombreggiamento che aiuta a includere l'interazione degli edifici nell'ambiente urbano.

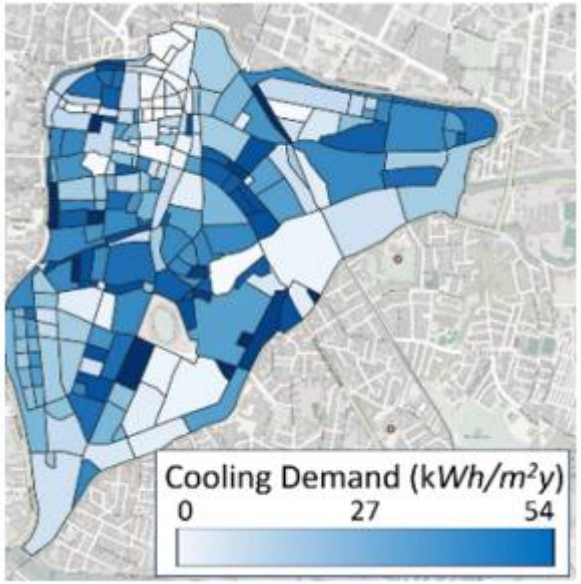


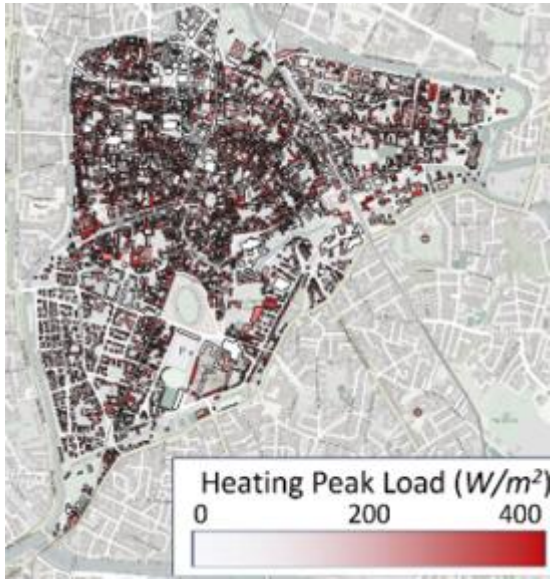
Lo strumento utilizza i parametri calcolati per simulare le prestazioni degli edifici in base a 5R1C (ISO 13790) o 7R2C (VDI 6007)

Per i vari edifici è possibile impostare diversi sistemi di riscaldamento e raffreddamento (pompe di calore, refrigeratori, caldaie, caldaie a condensazione,...).
Per ogni edificio è possibile modellare diverse tecnologie rinnovabili (solare termico o fotovoltaico).



I risultati possono essere utilizzati per comprendere la densità del consumo di energia, le emissioni e il consumo di energia primaria in diverse parti della città. Tali risultati possono aiutare a comprendere le migliori politiche per mitigare i problemi causati dai cambiamenti climatici o dagli effetti delle isole di calore urbane o per propagare scenari rispettosi del clima e resilienti.



# Prova EUReCA!

EURECA Public

Edit Pins | Watch 1

main | 13 Branches | 2 Tags | Go to file t | Add file | Code

Mohamad-k97 Bug fix 100- problem with ISO

- docs
- eureca_building
- eureca_modelica_classes/ExampleFiles
- eureca_ubem
- .gitignore
- .readthedocs.yaml
- LICENSE
- MANIFEST.in
- README.md
- pyproject.toml
- requirements.txt

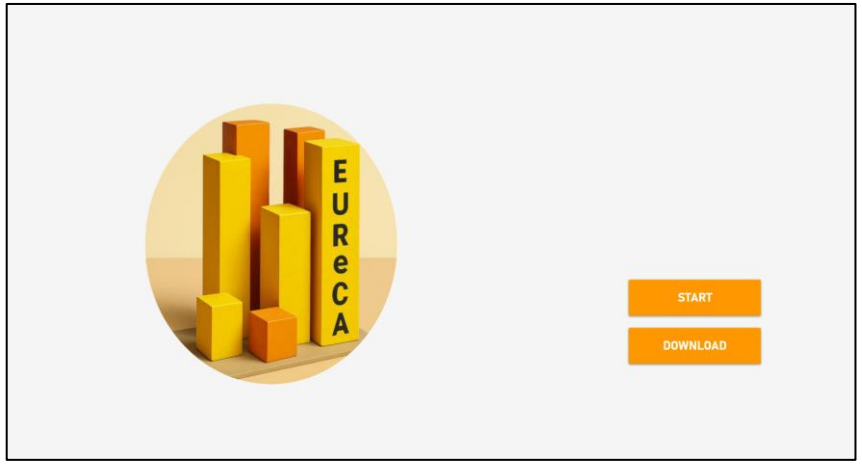
```
                "name": self.cityjson.j["metadata"]["referenceSystem"]
            }
        }

        self.output_geojson["features"] = []


        self.json_buildings= {}
        [(self.json_buildings.update({i:self.cityjson.j['CityObjects'][i]})) for i in self.cityjson.j['CityObjects'] if self.cityjson.j['CityObjects'][i]['type']=='Building']
        self.buildings_objects = {}
        self.buildings_info = {}

        for bd_key, bd_data in self.json_buildings.items():
            # Setting the attributes of the building
            vertices_list = self.cityjson.j['vertices']

            name = bd_key  # Heating plant of the building
            envelope = self.envelopes_dict[bd_data['attributes']['Envelope']]  # Age-class of the building

            surf_counter = 0
            max_height = 0.
            min_height = 1000.
            footprint_area = 0.
            surfaces_list = []
            for geo in bd_data['geometry']:
                if geo['type'] == 'MultiSurface':
                    boundaries = geo['boundaries']
                    for surface in boundaries:
                        for subsurface in surface:
                            surf = []
                            for vert_id in subsurface:
                                surf.append(tuple(vertices_list[vert_id]))

                            surface = Surface(
                                name = f"Bd {name}: surface {surf_counter}",
                                vertices = surf,
                            )

                            if surface.surface_type != "GroundFloor":
                                self.__city_surfaces.append(surface)
```

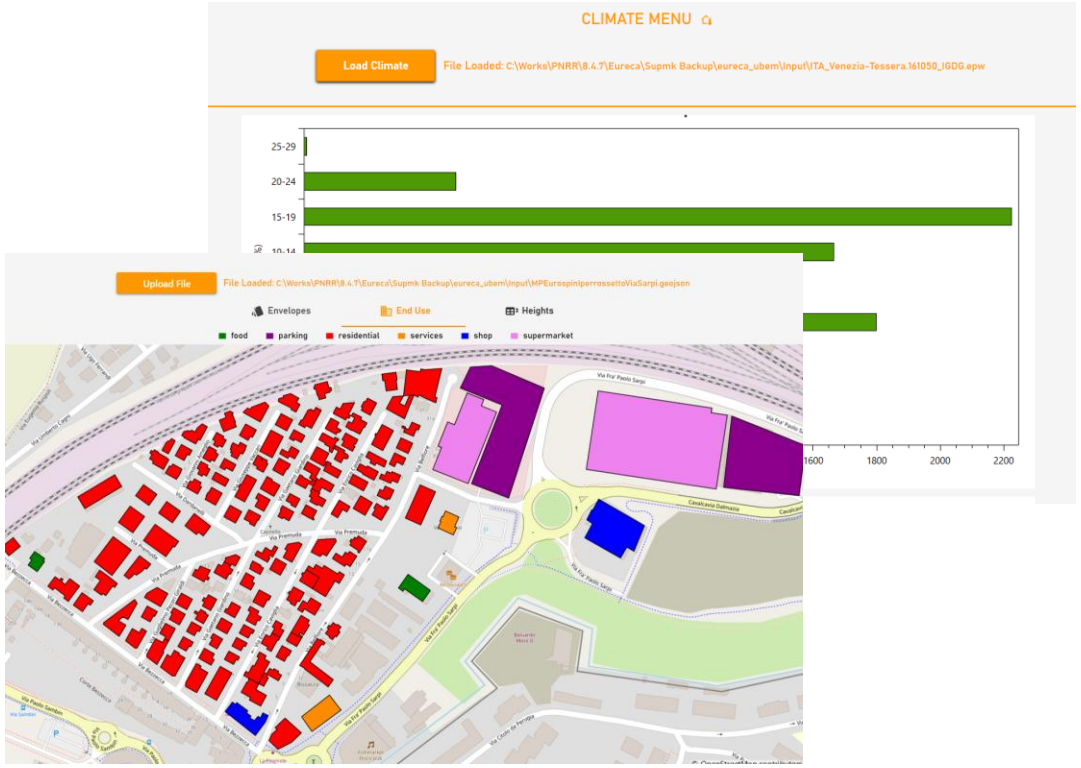
GitHub

NEST Network for Energy Sustainable Transition

Università degli Studi di Padova

# E l’interfaccia grafica è in arrivo




NEST
NETWORK FOR ENERGY SUSTAINABLE TRANSITION

Università degli Studi di Padova

Funder: ProComponentject funded under the National Recovery and Resilience Plan (NRRP), Mission 4 2 Investment 1.3 - Call for tender No. 1561 of 11.10.2022 of Ministero dell'Università e della Ricerca (MUR); funded by the European Union .–NextGenerationEU

Award Number: Project code PE0000021, Concession Decree No. 1561 of11.10.2022 adopted by Ministero dell'Università e della Ricerca (MUR), CUPC93C22005230007, according to attachment E of Decree No. 1561/2022, Project title"Network 4 "Energy Sustainable Transition – NEST

Finanziato dall'Unione europea
NextGenerationEU

NEST
NETWORK FOR ENERGY SUSTAINABLE TRANSITION