

Integrating photovoltaics and Nature-based Solutions in the built environment: A holistic approach for urban energy transition in Rimini

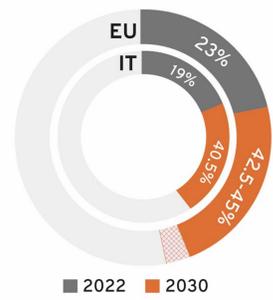
Keywords:
 Urban energy transition;
 Photovoltaic integration;
 Nature-based solution;
 Spatial planning;
 Sustainable development

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BACKGROUND

Europe and Italy

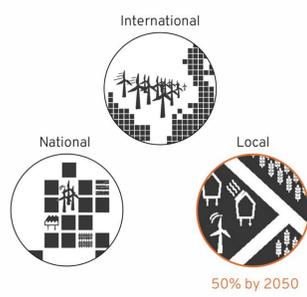
Share of energy from renewable sources



Nature-based concepts (some) to climate change adaptation



Demand for renewable energy generation at different levels



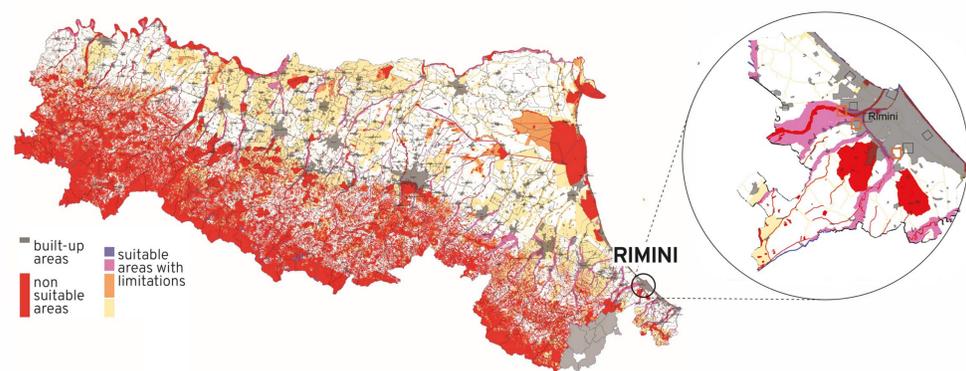
Emilia Romagna region

- Agreement for jobs and climate goals



- 100% renewable energy in 2035
- Developing Nature-based Solutions
- Expanding Urban Forests

- Suitable areas for PV and agri-PV installations in the region Emilia Romagna



Built-up areas are always suitable

Suitable areas & presented case studies

AIM & APPROACH

This research investigates design strategies for integrating photovoltaic systems into built environments, fostering synergy with green infrastructure and connecting public and private open and closed spaces. The aim is to transform energy systems into multifunctional architectural elements that support urban functions and climate adaptation.

The approach emphasizes the integration of these systems as spatial mediators between buildings and the urban landscape, considering their role at multiple scales: landscape (macro), typology (meso), and technological detail (micro).

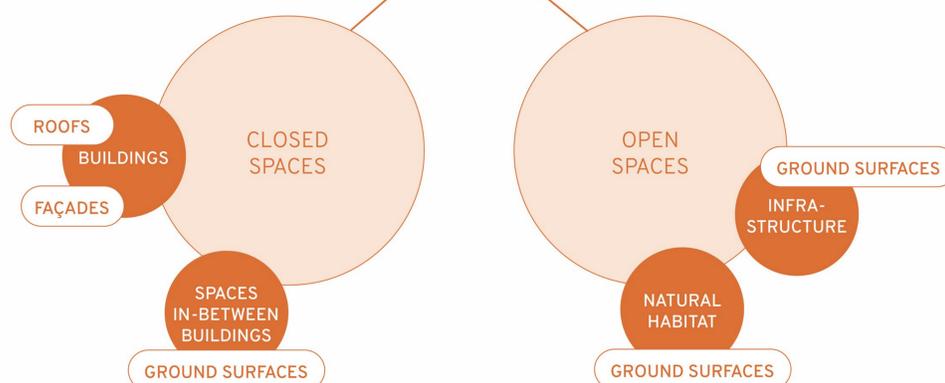
Literature review & Case studies analysis

Regulatory framework analysis

Concept design development for selected areas

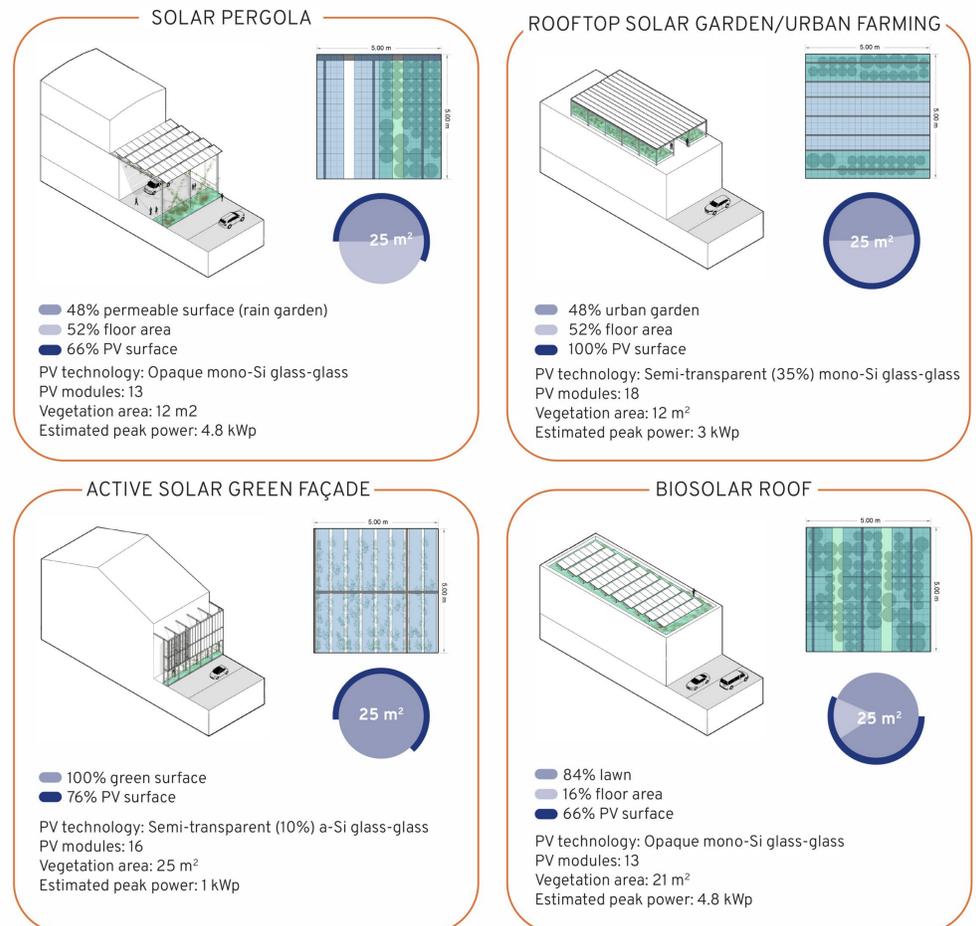
Definition of design principles

HABITAT IN URBAN SPACES

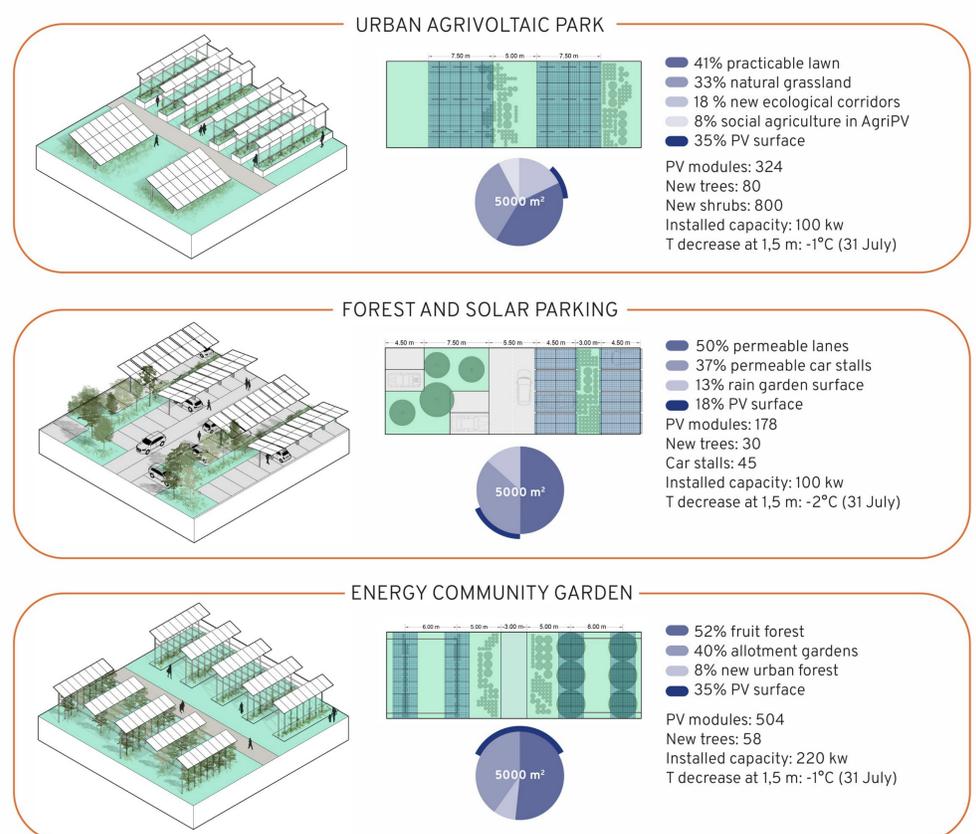


RESULTS

Design principles for closed spaces - 25 sqm sample units



Design principles for open spaces - 5000 sqm sample units



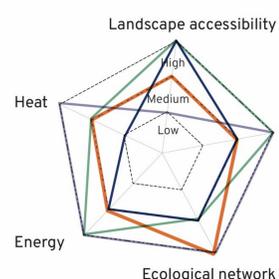
CONCLUSIONS

The design principles were evaluated in relation with five potential improvement features.

Testing these design solutions in Rimini revealed transferable principles, showing that the energy transition can drive spatial, ecological, and social transformation. However, solutions must respond to site-specific conditions.

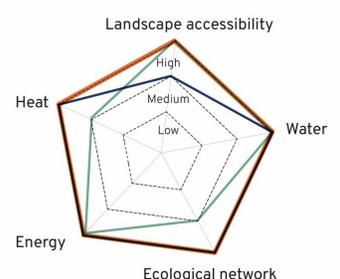
Closed spaces

- Solar Pergola
- Rooftop Solar Garden / Urban Farming
- Active Solar Green Façade
- Biosolar Roof



Open spaces

- Urban Agrivoltaic park
- Forest and Solar Parking
- Energy Community Garden



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