

DESIGNING POSITIVE ENERGY DISTRICTS: WHERE URBAN PLANNING MEET SUSTAINABILITY

ENERGY-EFFICIENT AND ENERGY-FLEXIBLE URBAN AREAS OR GROUPS OF CONNECTED BUILDINGS WHICH PRODUCE **NET ZERO GREENHOUSE GAS EMISSIONS** AND ACTIVELY MANAGE AN ANNUAL LOCAL OR REGIONAL **SURPLUS PRODUCTION OF RENEWABLE ENERGY**. THEY REQUIRE INTEGRATION OF DIFFERENT SYSTEMS AND INFRASTRUCTURES AND INTERACTION BETWEEN BUILDINGS, THE USERS AND THE REGIONAL ENERGY, MOBILITY AND ICT SYSTEMS WHILE SECURING THE ENERGY SUPPLY AND A GOOD LIFE FOR ALL IN LINE WITH SOCIAL, ECONOMIC AND ENVIRONMENTAL SUSTAINABILITY

URBAN PLANNING FOR ENERGY EFFICIENCY

Urban planning for energy efficiency is key to achieving **Positive Energy Districts (PEDs)** and supporting the energy transition. It requires a clear definition of geographic boundaries to be treated as single energy units.

- What about the **context** in which PEDs aim to be developed?
 - as at today, small scale PEDs already find **burdens** in their planning process – *large scale projects still sounds surreal*
 - **residential areas** are currently being studied – *industrial areas aren't even considered yet*
 - **retrofitting** vs creation of a **new district?** *that's the dilemma!*
 - **climate conditions** dictate the rules of the game: *PVs in London and wind farms in Florence? maybe not really..*
- But why moving out of the comfort zone given by the **existing energy infrastructures?**
 - renewable, independent energy production doesn't sound cool enough?
 - a key common thread is the goal that a *building, neighborhood, or district* is able to meet its **energy demands** from low-cost, locally available, environmentally friendly renewable sources

RENEWABLES AND ENERGY SHARING

Because PEDs prioritise **local generation of renewable energy** such as *solar, wind, geothermal, and biomass*, the choice of technologies depends on local climate, space availability, and existing infrastructures

- **Combination of multiple renewable sources** to balance energy supply and demand, improve resilience, and ensure a stable, low-carbon energy system – *increasing the (already high) cost?*
- **Decentralised production** coupled with shared systems is the key to success: **smart grid** integration to balance production and consumption – *tragedy of the common, something to say..?*

ARCHITECTURE THAT WORKS WITH NATURE

Architecture plays a crucial role in **integrating technical solutions**: the shape of buildings, the choice of materials and the integration of RE systems must be considered from early stages of the project

- **Architectural and urban planning** design must take into account social, economic, and environmental dimensions of the urban context – *interdisciplinarity ensure that the resulting design takes each diverse perspectives into account?*

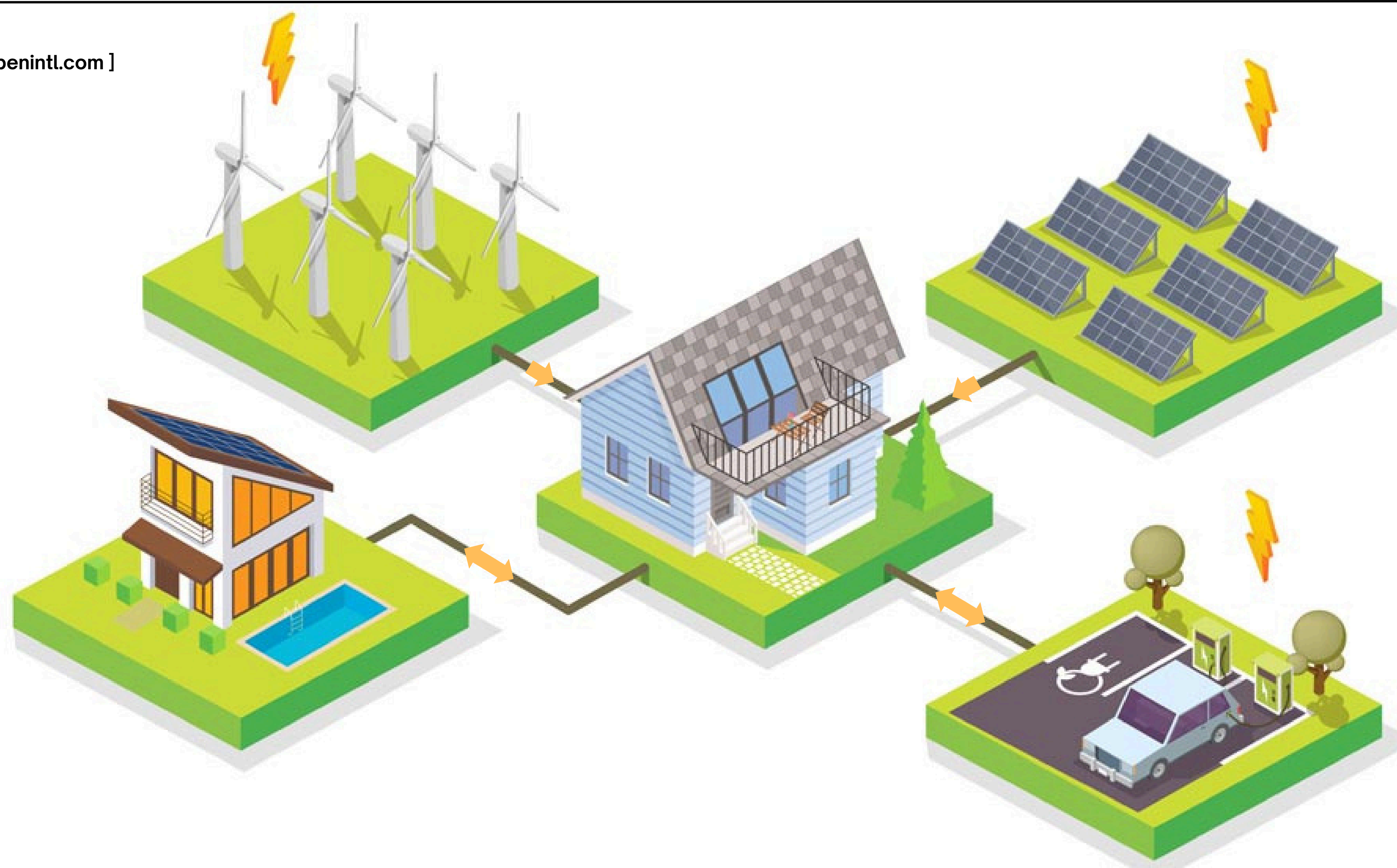
[Vauban District, Freiburg, Germany]



GREEN INFRASTRUCTURE

- **Rooftop plantings** strongly complement PEDs by enhancing **energy efficiency** through **thermal comfort**
 - Vegetation mitigates urban heat through *shading, albedo, and evapotranspiration*
 - Green surfaces can reduce temperatures by 2–17°C – in summer, cooling dominates; in winter, green roofs insulate
- What are the potential **pest problems** associated with **rooftop greenery**, and how can they be managed in PEDs?
 - PEDs can use different sources of profits to fund solutions to reduce pest infestation risks

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SUSTAINABLE MOBILITY AND ACCESSIBILITY

- **Electric mobility** can enhance PEDs through **renewable energy integration** and **energy storage**
 - EVs can store surplus during renewable generation peaks, helping to balance *supply and demand*
 - Vehicle-to-Grid (V2G) allows EVs to *return energy to the grid during peak demand*
- How can PEDs and energy providers create a sustainable system to promote **V2G participation** among EVs owners?
 - Education of EVs owners, offers of battery insurance, and ensure stable V2G participation while providing low-cost electricity and securing peak-time power flexibility

WHY PEDS AND URBAN PLANNING MATTER

- Why are PEDs **critical** for the future of sustainable urban development?
 - Cities consume 67% of global primary energy and emit over 70% of energy-related CO₂
 - Over 50% of people live in cities today, expected to reach 70% by 2050
- How can we **accelerate** the implementation of PEDs?
 - Outdated regulations block local energy solutions (e.g., solar panels on terraces) and need to be *revisited* to favour PEDs expansion