ENERGY IN BUILT ENVIRONMENT CONFERENCE

Climate-driven solutions for next generation EU cities

Book of posters

Lisbon, 30th of June 2023, LNEG-IAPMEI Campus, Auditorium

PED EU NET

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Poster Session

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Introduction

The Energy in Built Environment Conference posters booklet is a comprehensive compilation of knowledge and insights shared during the inspiring event Energy in Built Environment Conference: Climate-driven solutions for next generation EU cities, held in Lisbon on 30th June 2023. This PED-EU-NET conference brought together leading experts, researchers, policymakers, and industry players to explore climate-driven solutions for the next generation EU cities.

With a primary focus on Positive Energy Districts, this booklet delves into the complex interaction between buildings, users, regional energy networks, mobility, and ICT systems. Through these contributions, the reader will discover an array of strategies, technologies, and collaborative efforts proposed through different works and studies, aiming at shaping the future of sustainable urban development.

The posters presented in this booklet demonstrate the transformative potential of creating energy-efficient, environmentally friendly, and thriving cities for generations to come. The authors extend their invitation to join in the exploration of the forefront of positive change and pave the way towards a brighter and more sustainable urban future.

PED-EU-NET COST Action CA19126

Climate Positive Circular Communities

***Jannika Aalto** [1]*
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The main idea of the research revolves around Positive Energy Districts (PEDs) and Climate Positive Circular Communities (CPCCs), focusing on their integration of buildings, users, and regional energy systems to achieve energy efficiency, enhanced flexibility, and net-zero greenhouse gas emissions. This innovative project fosters collaborative innovation with citizens and stakeholders, showcasing large-scale demonstrations in six European cities. ARV project's development of monitoring frameworks and blueprints aids in planning and operation, while circular economy strategies and socio-environmental goals are pursued through multi-stakeholder co-creation and digital tools. By contributing to Europe's decarbonization goals and the Renovation Wave, ARV project holds the potential to enhance the replicability of PEDs and make valuable contributions to the innovation ecosystem.

PED Database

Beril Alpagut[1]; Paolo Civiero[2]; Michal Kuzmic[3]; GiuliaTurci[4,5]
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The poster "PED Database: Positive Energy Districts" focus is to promote and foster the energy transition in urban areas by implementing innovative concepts known as Positive Energy Districts (PEDs). While a common definition and implementation framework for PEDs are not yet available, pilot experiences are being tested and need to be scaled and replicated to achieve the ambitious goal of implementing 100 PEDs in Europe by 2025. In response to this challenge, the COST Action 'PED EU NET' is leading collaborative research to design and implement an online tool called PED Database. This tool allows users to map, analyze, and compare PED and PED-relevant practices at the international level. The Database covers various thematic sections, exploring multidimensional aspects related to technological, environmental, social, economic, and governance factors. With the involvement of various partnerships and expert teams, the PED Database aims to facilitate peer-to-peer networking, knowledge dissemination, and practical information exchange among municipalities, practitioners, and researchers.

Energy plus house in Nigeria: possibility or probability?

Ezekiel Atiba[1]; Dorota Chwieduk[1]
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The focus is to explore the potential and feasibility of implementing Positive Energy Buildings (PEB) in Nigeria, a country with a population of 200 million and significant challenges in housing and energy. By combining various pillars of PEB/PED, such as energy efficiency, renewable energy generation, passive design strategies, energy storage, and grid integration, the poster aims to investigate the possibility of creating energy-positive single-family houses under Nigerian climatic conditions, specifically in Lagos. Through energy modeling and simulations, the poster demonstrates that PEBs can significantly reduce cooling loads, harness solar energy for domestic hot water, and utilize renewable energy systems to meet the energy demand of the house. The findings suggest that implementing PEBs in Nigeria could help reduce the strain on the national grid while contributing to the country's transition towards distributed energy systems and addressing its energy challenges. Further research may explore the potential for developing a Positive Energy District with multiple buildings under similar climatic conditions.

Pop-C Tool: social platform for Pop Community

Silvia Bossi[1]; Gilda Massa[1]; Paola Clerici Maestosi[1]

[1]*Italian National Agency for Technologies, Energy and Sustainable Economic Development, ENEA, Italy*

The main idea of the research is to emphasize the crucial role of Public Officers and Urban Practitioners in the development of Positive Energy Districts (PEDs). Public officers are individuals working in government or public administration, while urban practitioners are key stakeholders in the urban development industry. Together, they form the Public Officers and Practitioners Community (POP C), which plays a vital role in translating PED strategies into local action. The poster aims to create and support the POP Community by providing capacity-building initiatives and facilitating international cooperation. To address identified needs, the POP C Tool was developed as a repository platform with a social dimension, enabling members to share experiences, collaborate, and exchange inspiration. The tool encourages a collaborative community of public officers and practitioners dedicated to sharing best practices and experiences in advancing urban transitions and PED implementation.

Enhance Urban Energy Management to foster Carbon Neutrality in the built environment

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The poster explores employing blockchain technology in Positive Energy Districts (PEDs) to optimize energy usage and foster user engagement. By using smart contracts and safe data sharing, blockchain ensures privacy and transparency for participants, including private users, public administrations, and energy communities. The approach incentivizes virtuous energy behavior through a cryptocurrency-based system, improves PED operation by redistributing energy loads based on actual needs, and allows local administrations to allocate resources effectively. Challenges include efficiently defining PED boundaries, given differences between physical and electrical layers. Overall, blockchain offers potential to enhance PEDs' effectiveness and promote sustainable energy practices.

Integrated workflow for PEDs

Marco Delli Paoli[1]

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The objective is to emphasize how Positive Energy Districts (PEDs) prioritize climate mitigation strategies centered on energy efficiency, renewable energy production, and energy flexibility.

To ensure climate resilience and energy security, integrating climate adaptive strategies becomes crucial. The text highlights the importance of a collaborative approach and experimentation with tools and methodologies for PED implementation. Regenerative design is seen as an effective approach to address decarbonization and climate adaptation while improving urban district livability and affordability. The integrated parametric workflow combines building performance simulation, microclimatic analysis, and urban energy analysis to guide the design phases and develop climate-adaptive strategies. By considering nature-based solutions and site-specific solutions, PEDs can achieve a regenerative energy transition and optimize energy demand and production.

Lessons learned in transforming a neighborhood into a PED: the Joven Futura Experience

Ana García Garre[1]; Pablo Barrachina[1]; Miguel Miñano[1]; Ricardo Pérez de Zabalza[1]
[1] MIWenergía, Spain

The study indicates that the development of Positive Energy Districts (PEDs) is crucial in achieving European sustainability targets, and various EU-funded projects have demonstrated pilot demonstrations in this direction. The Joven Futura community in Murcia, Spain, serves as a living lab for showcasing innovative solutions for energy efficiency, renewable energy sources, demand response, and local flexibility markets. Lessons learned from the transformation of this traditional neighborhood into an innovative PED highlight the importance of citizen engagement, simplified communication of technical solutions, GDPR compliance for IoT monitoring, co-creation campaigns, and involvement of local trusted parties. As citizens become active participants in R&D projects, interest in new innovations and activities increases, leading to further community involvement.

Functionality and value of green infrastructure in metropolitan areas

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The poster emphasizes the importance of sustainable urban development through green infrastructure systems, which preserve landscapes, support ecosystem services, and mitigate climate change effects. Green infrastructure, particularly water-based solutions like Porous Flooring, Rain Gardens, and Green Roofs, offers numerous benefits, including improved air quality, carbon storage, and reduced urban heat island effects. Integrating green infrastructure in urban planning at various scales contributes to urban resilience, reduces energy costs, and protects human and environmental health. The text presents examples from cities in Turkey to showcase the significance and contributions of green infrastructure applications.

AI for Positive Energy Districts

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District-level energy management, such as Positive Energy Districts (PEDs), enhances energy management efficiency and accelerates the shift to zero emissions in the building sector, contributing to grid stability. Challenges in constructing 100 PEDs in Europe by 2025 include defining PEDs, implementing tools, and addressing technical and non-technical issues. To boost PED replication, this study investigates PED elements, reviews AI techniques (machine learning and natural language processing) for analysis, and identifies important AI methods. Machine learning models like ANN, SVM, and tree-based approaches aid in prediction and classification, while NLP tasks focus on topic modeling and word embedding. A holistic AI approach is essential to align outcomes with the vision of creating sustainable and resilient urban environments, addressing current limitations in modeling certain PED elements.

Perception and social acceptance of PEDs

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Over half the world's population lives in urban areas, which will increase to over two-thirds by 2050, making cities more vulnerable to climate change. Positive Energy Districts (PEDs) are crucial for decarbonizing cities, but their success relies on social acceptance from citizens. A survey of 150 Israeli citizens showed a lack of knowledge about PEDs and renewable energy importance, and limited willingness to participate in the energy transition. Financial reasons were the main driver for participation, followed by environmental considerations. Effective public engagement in decision-making processes is vital for successful climate policies and renewable energy installations in Israel.

A decision support framework for the creation of PEDs- Framework for PED relevant tools and tool chains

Marios Karmellos[1]; Abel Magyari[2]
[1] *The Cyprus Institute, Cyprus*
[2] *ABUD, Advanced Building and Urban Design, Hungary*

The paper proposes a generic framework for establishing Positive Energy Districts (PEDs) using multi-criteria decision analysis (MCDA). This framework integrates various phases, including defining PED boundaries, identifying stakeholders, assessing local needs, and data collection. Decision makers (DMs) use the Analytical Hierarchy Process (AHP) and the Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE) to identify suitable PED options. DMs consider economic, social, environmental, and technical criteria with

personalized weights, necessitating a comprehensive decision-making framework to support PED development.

Challenges and success factors in PEDs implementation

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Positive Energy Districts (PEDs) offer a promising solution for energy efficiency and environmental sustainability, but various barriers hinder their implementation. Challenges related to governance, incentives, social factors, processes, markets, technology, and contextual conditions must be understood and addressed. Working Group 2 of the COST Action PED EU NET aims to provide tools and guidance to overcome these barriers. The study investigates PED challenges and enabling factors through qualitative interviews with key stakeholders in cases such as Vienna, Brussels, and Stockholm. Unclear definitions and lack of guidelines create uncertainties, highlighting the need for strong governance and ongoing support from committed bureaucrats to advocate for PEDs and adapt strategies to emerging challenges.

Collective intelligence for energy flexibility

Ioanna Kyprianou[1] ; Panayiotis Papadopoulos[1]; Salvatore Carlucci[1]

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The COLLECTiEF project focuses on implementing a Collective Intelligence-based demand-side management (CI DSM) system to increase energy flexibility and climate resilience in existing buildings. This aligns with the goals of positive energy districts and the Paris Agreement. The study utilizes empirical evidence from a non-residential living lab to demonstrate how an adaptive model of HVAC control can lead to significant energy savings. The adaptive thermal comfort model, measured through the ASHRAE Likelihood of Dissatisfaction (ALD) index, shows potential for energy savings of 15% to 33% without compromising thermal comfort. The research emphasizes the importance of building occupants' input and the need for ongoing data collection and adaptive approaches to optimize operations in larger-scale positive energy districts, considering changing climate conditions.

GRETA project and the pathway towards energy citizenship

Danila Longo[1]; Andrea Boeri[1]; Beatrice Turillazzi[1]; Saveria Olga Murielle Boulanger[1]; Francesca Sabatini[1]; Martina Massari[1]

[1] University of Bologna, Architecture Department, Italy

Being an energy citizen entails participating in energy discussions within the community, monitoring and regulating energy consumption, making conscious energy choices (like using renewable energy for heating), and even producing and selling their own energy. The Community Transition Pathways (CTPs) developed by the GRETA project support people in transitioning between various participation states and aim at decarbonization. These pathways are accompanied by Energy Citizenship Contracts, which establish roles and benefits among communities, stakeholders, and institutions. A case study in Bologna's Pilastro Roveri area illustrates the use of CTPs, where incremental activities and participatory approaches helped define collaborative paths for the community to become more actively engaged in energy-related matters. This includes co-designing Energy Citizenship Contracts with the local community. Through such efforts, citizens become key players in the energy revolution, contributing to a cleaner and sustainable future.

Framework for PED relevant tools and tool chains

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[2] The Cyprus Institute, Cyprus

The design and development of Positive Energy Districts (PEDs) play a crucial role in sustainable urban development. However, a clear characterization and definition of the tools used in PED planning, design, and operation are essential for successful implementation.

In this study, a framework is developed to determine the most important tools for PED development. The framework analyzes various PED definitions from different projects and initiatives. Keywords from these definitions are categorized into core, secondary, and out-of-scope based on their significance.

The main objective is to identify the essential tool types, exact tools, and tool chains for PED development. By matching the associated keywords with usual tool capabilities, the most important tools for PEDs are determined to be those classified as core and secondary importance. This framework helps ensure effective and sustainable urban development through PEDs.

µBEM for climate smart PED design

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The study highlights the importance of urban building energy modeling (UBEM) tools for designing and evaluating positive energy districts (PEDs). However, current UBEM tools lack consideration of microclimate, leading to inaccurate energy demand estimations. The research proposes a novel workflow using CFD-generated wind pressure coefficients to improve accuracy in cooling energy demand estimations for different urban forms. Results indicate a negative correlation between building floor-to-area ratio (FAR) and cooling load differences. This study emphasizes the need for microclimate aware UBEM to support Climate Smart PED design.

PEDs within Planetary Boundaries

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The concept of Planetary Boundaries (PB) identifies safe operating spaces for human development to ensure Earth system stability. Positive Energy Districts (PEDs) are an emerging concept with the potential to align with PB principles. By integrating scientific understanding and the precautionary principle, PEDs can be assessed in terms of their anthropogenic impact on the Earth system. While the PB framework does not dictate societal development, it provides valuable guidance for decision-makers in designing sustainable paths, encompassing PED implementation. To achieve regenerative sustainability, PEDs should adopt a model that stays within the safe operating space, requiring a fundamental shift in our relationship with the planet.

Uniform smart cities evaluator

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The Uniform Smart City Evaluation (USE) framework is a user-friendly tool for assessing the impact of interventions in smart cities. It utilizes Key Performance Indicators (KPIs) and predefined Project Success Indicators aligned with sustainability goals. The online platform allows customization of KPIs and offers analytical reporting. The RESPONSE project is used as a case study for implementing USE, evaluating projects based on Project Performance, Sustainability Impact, and Sustainability Performance Indexes. The platform provides valuable insights into the effectiveness of smart city projects in achieving sustainability goals.

Limits and opportunities of distributed energy systems in urban environments

Ilaria Montella[1]
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The transition to decentralized urban energy systems is crucial for mitigating climate change effects. The Italian project titled "TECHSTART" explores the role of proximity spaces in supporting decarbonization. Pilot cases in Rome (Testaccio, Balduina, Prima Porta) were examined to assess the limits and opportunities of distributed energy systems in urban environments. The methodology used three levels of assessment: preliminary feasibility, planning and programming, and design. The study compared the energy potential of different districts, considered different electrification scenarios, and calculated the producibility of buildings using PVGIS. The research aims to guide the implementation of Renewable Energy

Communities (RECs) in densely built urban areas, aiding planners in the development of decentralized energy systems.

Positive Energy Districts assessment

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PED.EF is a web application developed by ENEA to assist Local Authorities in driving Positive Energy Districts (PEDs). Using limited inputs on the city's energy accounting, plans, projects, and infrastructure, the tool provides a preliminary assessment and technical feasibility for PED development. The case study of Padova, an Italian city working towards climate neutrality, demonstrates the effectiveness of the tool in identifying existing gaps and enabling factors for transitioning to PEDs. The poster highlights key enabling factors, including adopting a territorial perspective, focusing on sectorial energy consumption during urban planning, emphasizing environmental impact strategies, and having an effective legal and regulatory framework. By linking projects to supporting strategies, the tool facilitates a successful transition to PEDs.

Technical feasibility of a Mediterranean PED in Alcorcon, Spain

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This research aims to develop a methodology to assess the potential of existing Mediterranean districts to be converted into Positive Energy Districts (PEDs). The three-step process includes analyzing the district's initial state through urban and bioclimatic analysis, estimating energy demand based on building typologies, selecting and designing passive and active strategies to improve energy efficiency and supply energy demand, and evaluating the technical feasibility of the PED scenarios by calculating the reduction of energy demand and production of energy from renewable sources on-site or nearby. The approach addresses the challenges faced in implementing PEDs and provides a practical assessment for their potential in Mediterranean cities.

Exploring PEDs: case studies of sustainable urban development in Europe

Michelle Scacco[1]; Juliana Zapata[1]; Silvia Ulli Beer[1]
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Global energy consumption is on the rise, with buildings contributing significantly to this trend. To tackle this issue, programs like Positive Energy Districts (PEDs) and the "2000 Watt Society" have emerged, aiming to improve energy efficiency and curb emissions. This study thoroughly analyzes the implementation of PEDs in Hunziker Areal and PED Groningen,

identifying key aspects, scalability potential, and existing barriers through the lens of a Business Ecosystem Framework. Its objective is to provide valuable insights and best practices for the successful development of PEDs, placing strong emphasis on citizen engagement, sustainable design practices, collaborative stakeholder efforts, and strategic investments in clean energy solutions. The co-evolutionary business ecosystem perspective serves as a crucial facilitator, fostering collaboration and knowledge exchange to pave the way for sustainable and resilient communities.

Transportation in PEDs

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There is a need to focus on transportation modes within Positive Energy Districts (PEDs) to address their impact on energy consumption and emissions. While building energy management systems are well-studied in PEDs, transport is responsible for a significant share of energy consumption and greenhouse gas emissions. To tackle this, three main topics are proposed for research and action: social incentives to encourage walking, biking, and public transport use, environmental studies to determine and reduce emission values of transport modes, and energy economy planning for efficient transportation. Collaborative efforts with municipalities, universities, and transportation entities can enhance these initiatives and promote a new perspective on transportation's role in PEDs. Establishing urban living laboratories across Europe can further emphasize the importance of transportation in achieving sustainable energy goals.

Convivial Positive Energy Districts

Shayan Shokrgozar[1]
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Cities consume a significant share of global energy, largely generated in rural areas, leading to social and ecological justice concerns. For instance, the appropriation of herding land from indigenous communities for energy production raises acceptance issues. To address this, cities must transform their energy mix, involving financial, regulatory, and social changes. Sociotechnical visions that prioritize climate adaptation, energy poverty reduction, and conviviality are crucial. The EU's post-growth deal highlights the importance of exploring options for reduction and sufficiency to prevent de-agrarianization. Convivial positive energy districts should prioritize appropriate technologies with local supply chains to promote a more equitable energy future.

Annex: Posters

COST EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

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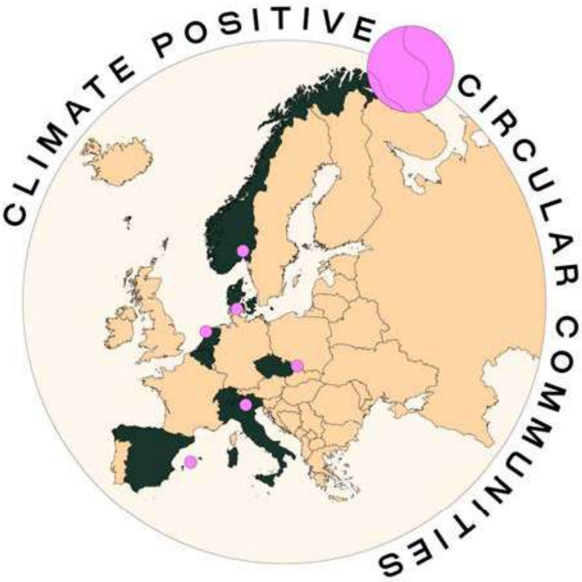
WG3

CLIMATE POSITIVE CIRCULAR COMMUNITIES



ARV is a H2020 EU-funded project aiming at creating Climate Positive Circular Communities (CPCCs)

Jannika Aalto[1]

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INTRODUCTION

Positive Energy Districts and Climate Positive Circular Communities both focus on the interaction and integration between buildings, users, and regional energy, mobility and ICT systems. Energy efficiency, improved energy flexibility and net zero greenhouse gas emissions are shared key objectives, and innovation is co-created together with citizens and other stakeholders. In the ARV project, the technical solutions are supported by the development of monitoring framework as well as a blueprint for planning, (re)design, (re)construction, operation and use of CPCCs.

PROJECT GOALS

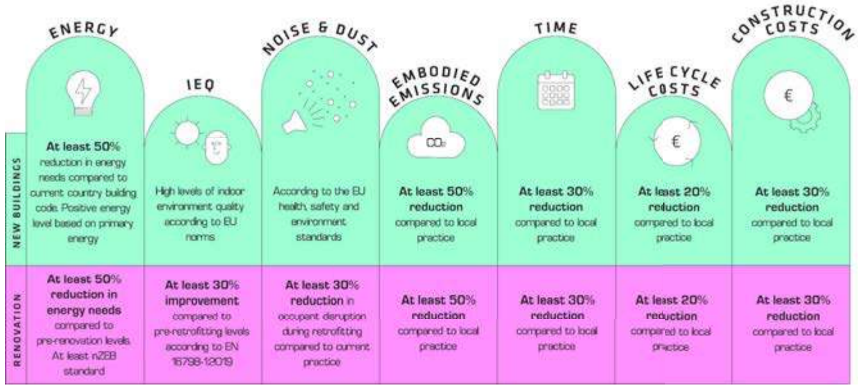
At the core of the ARV project are 6 large scale demonstration projects in six European cities. Each location showcases a range of innovations related to the value chain of a CPCC. Like PEDs, these project communities consist of interconnected buildings with associated infrastructure like grids and technologies for electricity and heat generation, storage, and exchange. Buildings and energy systems are coupled with circular economy strategies and socio-environmental goals, achieved through multi-stakeholder co-creation and the use of innovative digital tools.

EXPECTED RESULTS

All project communities will contribute towards the goal of net-positive energy balance. The developed technologies and innovations include optimized on-site renewable energy production and storage systems, building envelope retrofitting to a nZEB standard, smart building control optimisation and intelligent and flexible district heating management. Various energy community approaches linked to local renewable energy production and sharing are also demonstrated.

ARV will facilitate a fast market uptake and cost-efficient replication of the CPCC concept and underlying technologies and solutions. The project is expected to significantly contribute to the decarbonisation of Europe by 2050, and therefore it supports the EU's climate ambitions and the Renovation Wave.

The project ends in December 2025, after which the results can be comprehensively evaluated. ARV has the potential to provide valuable learnings for the implementation of Positive Energy Districts across different geographical and policy landscapes in Europe. The CPCC blueprints can enhance the replicability of PEDs, and the solutions developed within the project make a valuable contribution to the PED innovation eco-system of novel solutions.



OVERVIEW OF TARGET VALUES FOR NEW AND RENOVATED BUILDINGS IN ARV CPCCS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036723.

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WG1

PED DATABASE

An interactive tool for mapping, analyzing and comparing PED experiences at international level

Beril Alpagut[1]; Paolo Civiero[2]; Michal Kuzmic[3]; Giulia Turci[4,5]

[1]Demir Energy, Turkey; [2]RomaTre University, Italy; [3]Czech Technical University, Czech Republic; [4]Cesena Municipality, Italy; [5]Bologna University, Italy

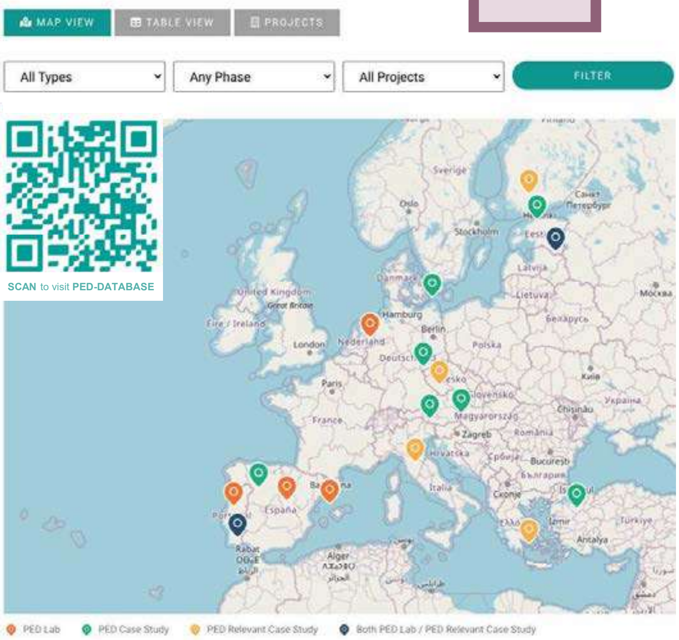

Fig.01 - PED-Database platform first realization. Available online at: https://pedeu.net/map/

INTRODUCTION

Positive Energy Districts (PEDs) are promoted as innovative concepts to foster energy transition following a climate-neutral, sustainable, and resilient perspective for urban areas. Even if a common definition and a shared implementation framework for PEDs are not yet available, a few pilot experiences are being tested and needed to be scaled and replicated in order to reach the ambitious goal of 100 PEDs implemented in Europe by 2025, as stated by the SET Plan 3.2 and to fulfil 100 Climate Neutral Cities by 2030, as stated by the NetZeroCities initiative.

OBJECTIVE

The COST Action 'PED-EU-NET' - in the frame of the activities carried out by the WG1 - is leading a collaborative research to design and implement an interoperable online tool – called PED-Database - that allow to map, analyze and compare PED/PED-relevant practices at international level. The Database is accessible to everyone interested in exploring PEDs; municipalities can use the tool to look for similar examples, get practical information and foster peer-to-peer networking, simultaneously, practitioners and researchers can seek information, analyze data, compare patterns and disseminate knowledge.

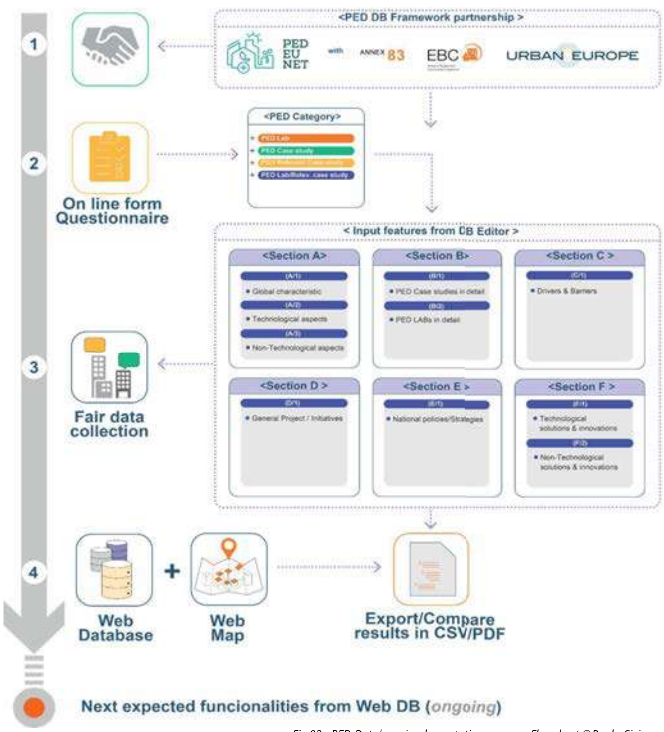

Fig.02 - PED-Database implementation process. Flowchart ©Paolo Civiero

RESULTS & CONCLUSIONS

The partnership – guided by the COST Action 'PED-EU-NET' and involving the IEA-EBC 'Annex 83' and JPI Urban Europe initiatives – develops the Database Framework by identifying a series of characteristic parameters and KPIs through an iterative alignment process and some participatory workshops that allow to map multiple users needs and expectations (Fig.03). According to the identified parameters, the Database is divided into a number of thematic sections (*i.e.,* sections A, B, C, D – already implemented and E, F – in implementation phase) that deepen different PED-related issues in a multidimensional and integrated way, considering technological, environmental, social, economic and governance aspects (Fig.02). A preliminary version of the PED-Database is available online (Fig.01) and 15 PED/PED-relevant case studies, 7 PED-Labs and 7 projects are currently mapped and analysed. A team of expert – called 'DB Editors' - is supporting the first round of data collection and is working at the improvement of some tool functionalities towards a better stakeholders-tailored narrative and a user-friendly perspective.

Fig.03 - PED-Database outreach & dissemination activities. Amsterdam and Bolzano – summer 2022. Photos ©Giulia Turci

WG1

ENERGY PLUS HOUSE IN NIGERIA: POSSIBILITY OR PROBABILITY?

Design of a Positive Energy Building in Sub-Saharan Africa: Lagos, Nigeria as a Case Study

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[1]Warsaw University of Technology, Faculty of Power and Aeronautical Engineering, Institute of Heat Engineering, Poland

INTRODUCTION

With a popultaion of 200 million people, Nigeria is the most populous African country. However, the problems of housing and energy make it among the poorest nation of the world. While the country generates a meagre 8000 MW, the housing deficit is in the neighborhood of 28 million units. This dual problem presents an opportunity for gains in many areas through the implementation of Positive Energy Buildings (PEB) in the country. First, in reducing housing deficits, PEBs will ensure a drastic change to distribued energy systems. Second, the reliance on fossil fuel as source of energy will reduce in the battel to slow down the effect of climate change.

OBJECTIVE

The objective of this work is to show the potential and the possibility of implementing and operating an energy plus single family house under the Nigerian climatic conditions. Some of the pillars PEB/PED such as energy efficiency, renewable energy generation, passive design strategies as well energy storage and grid intergration are combined to investigate the posibility of a PEB in Lagos Nigeria. We aim to provide specific design techniques to realize a PEB not only in Nigeria but also possible replacibility in other developing countries in Africa.

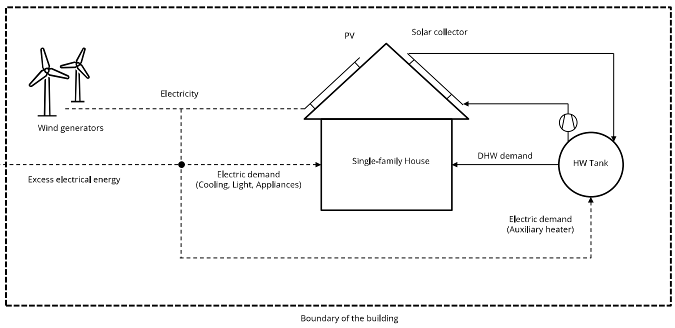

Figure 1: Schematic of the PEB system simulated on TRNSYS

Electricity	kWh
Light and appliances	(5781.9)
Auxiliary heating in SDHW	(213.9)
Air conditioning	(5635.7)
Annual electricity from PV	5,600.1
Annual electricity from wind	9,359.05
Balance	**3327.49**

Table 1: Yearly electricity consumption and production

RESULTS & CONCLUSIONS

Using the energy modeling software, TRNSYS 18, the energy demand of a single-family house with an occupancy of 6 people and floor area of 141.6 m2 under Lagos, Nigeria climatic conditions was simulated for the period of a year. While there was no heating demand throughout the year, cooling load stood at 19,708.64 kWh. Passive design strategies such as introduction of greenwalls on the eastern, southern & western facing walls, roof shading with solar panels, removing windows on the western side, improving window quality and adding window shading were implemented. The cooling load was reduced by 20% to 15,847 kWh.

Parametric simulations of a solar domestic hot water (SDHW) system were made with TRNSYS. With an optimum collector area of 6m2, flowrate of 60 kg/hr, 95% of 4459.93 kWh energy demand for the SDHW was covered by solar energy.

The plug load for electrical appliances, water pumps and Air conditioner to cool the house was estimated at 11,631 kWh.

A renewable energy system consisting of eighteen 300W solar panels covering a significant portion of the eastern and western sides of the roof (18 × 1.7m2 each side) and three 3.5 kW wind turbines was simulated to meet the energy demand of the house. The total annual energy production was 14,959 kWh. The summary of the annual electricity consumption and production is presented in table 1.

These findings point to the possibility of achieving an implementing a positive energy building in Nigeria. PEB in Nigeria not only help to reduce reliance on the already overwhelmed national grid but an opportunity for the country to take a giant leap to distributed energy system while solving its energy problem.

Further area of research would be to investigate the possibility of a development Positive energy district consisting of several buildings under the same climate.

WG4

POP-C TOOL: SOCIAL PLATFORM for POP COMMUNITY

A new tool for public officers and practitioners community for capacity building and knowledge exchange on PED

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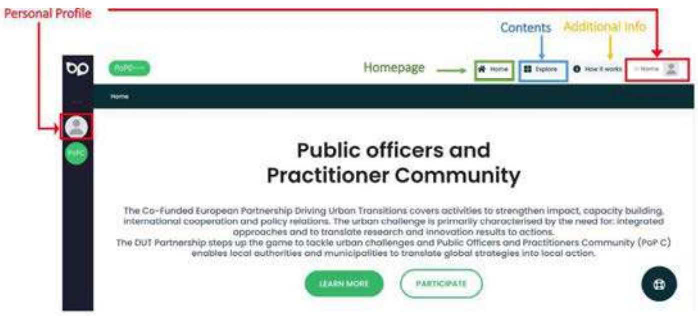
INTRODUCTION

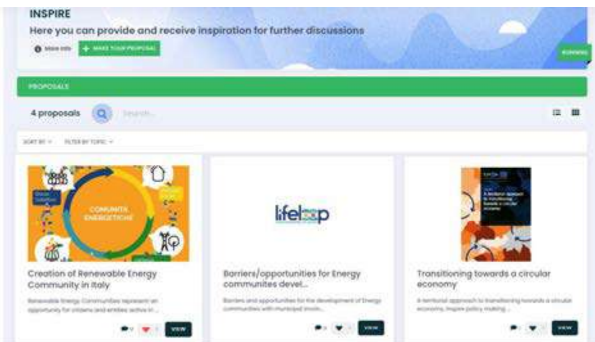
Some Public Officers and urban Practitioners play a key role to PED development. Public officers are employees working in a public - service relationship in central or local government or elsewhere in the public administration. Urban practitioners work for the urban development industry in some capacity. They are key stakeholders in the development of urban projects and have the technical knowledge and financial resources to implement new PED projects. Public Officers and Practitioners Community (POP-C) enables local authorities and municipalities to translate PED strategies into local action.

OBJECTIVE

Our aim is to create, support and animate members of the POP Community to translate urban transition into local actions through capacity building on main gaps and international cooperation. We individuated 2 needs: 1) stand alone workshops or workshop series do not provide effective capacity building: a repository platform is needed; 2) a repository platform allows effective on demand activities but deep diving is a hard job: the social dimension is needed

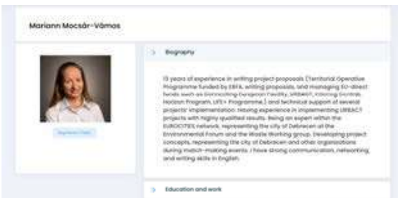
For this reason, we developed the POP-C Tool, a repository platform with the social dimension specifically designed for members of the POP Community.





RESULTS & CONCLUSIONS

POP-C tool was developed on bipart platform at the link: https://popc.bipart.it/intro
Members can personalize their personal profile providing info on biography, education and work relevant to PED and urban transition. The tool provides a repository platform on 4 identified gaps allowing bilateral communication among members. Two participatory processes are possible: TELL – Tell your experience and INSPIRE – Provide and recieve Inspiration. The POP-C Tool can actively support the creation of an international and collaborative community of public officers and practitioners willing to share their experiences and good practices.



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WG2

ENHANCE URBAN ENERGY MANAGEMENT TO FOSTER CARBON NEUTRALITY IN THE BUILT ENVIRONMENT

A Blockchain-based approach for a Smart Energy Interaction among and within PEDs

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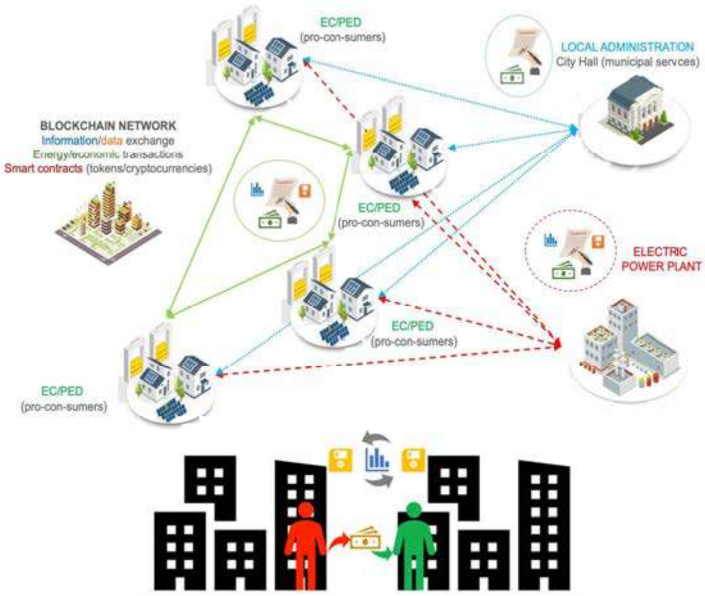
[2]Environmental Research and Innovation Department, Luxembourg Institute of Science and Technology (LIST), Luxembourg

INTRODUCTION

- Urban settings are responsible for almost 40% of energy utilization and pollutant emissions worldwide.
- EU puts emphasis on smart climate-driven solutions aimed at optimizing the energy performance of built environments by reducing energy use (retrofit interventions) and fostering the integration of renewable energy sources (RES).
- This is possible with Positive Energy Districts (PEDs), which include prosumers (e.g., Energy Communities – ECs) collaborating in urban energy management.

OBJECTIVE

- We envision the possibility of employing an innovative blockchain-based approach to manage interactions (e.g., smart contracts [1], safe data sharing [2]) among and within PEDs to foster users' engagement.
- Blockchain technology could allow to consider participants' energy behavior and feedbacks ensuring privacy and transparency [3], thus favoring the involvement of private users, public administrations and other stakeholders (e.g., energy managers/suppliers/ECs).



CONCLUSIONS

Similarly to [4], the proposed blockchain-based approach [4] would help optimizing PED operation by:

- Incentivizing more virtuous energy behavior of individual users based on a cryptocurrency-based system (crypto-district-currency).
- Properly considering the need for privacy, transparency, engagement, environmental and human health benefits, as well as the stakeholders' role in the interaction/integration between PEDs and local/national electricity systems.
- Encrypting information and exchanging it directly between users, instead of being stored on an external database (subject to possible cyber-attacks).
- Allowing smart energy planning, identifying ad hoc possible interventions to improve the performance of the associated PED.
- Improving the Peaks to Average Ratios (PAR) of power load in the PED, by employing users' behavioral data to plan and redistribute energy loads based on actual needs [5, 6].
- Allowing local administrations to better allocate their resources, assigning them proportionally and differentially among more and less virtuous neighborhoods and communities.

However, the physical/geographical entity/extension of the PEDs is often different than its electrical/energy layers. Therefore, how to establish PED boundaries more efficiently?

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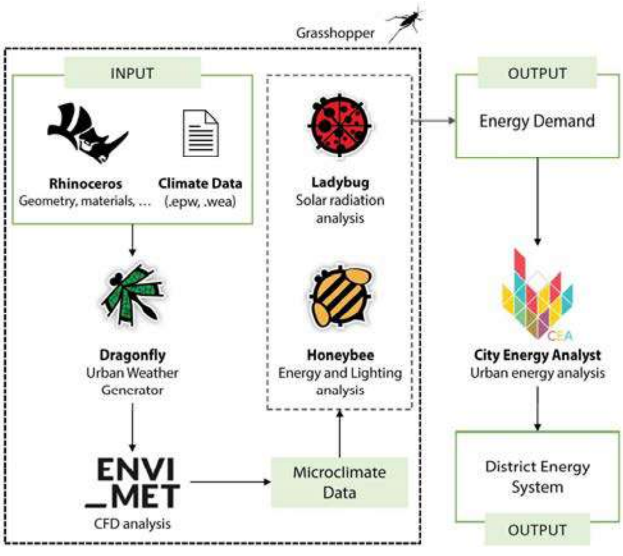
WG4

INTEGRATED WORKFLOW for PEDs

Exploring tools and climate-adaptive strategies to support collaborative implementation of Positive Energy Districts

Marco Delli Paoli[1]

[1]*Department of Planning, Design, Technology of Architecture, Sapienza University of Rome, Italy*



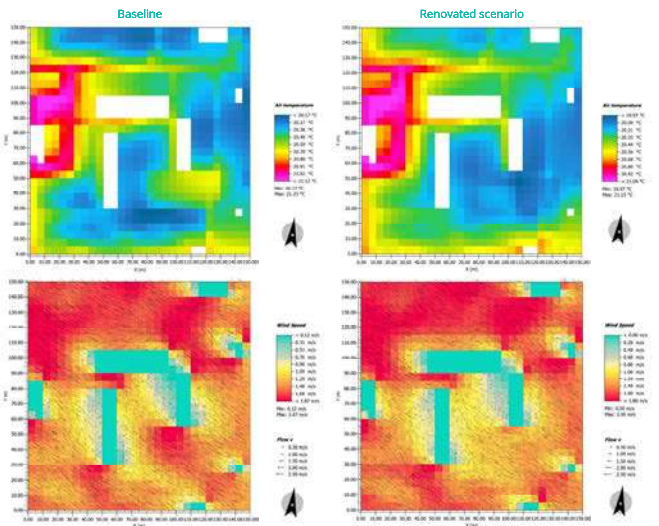
Integrated parametric workflow

INTRODUCTION

Positive Energy Districts climate mitigation strategies mainly deal with energy efficiency and renewable energy on-site production, in order to ensure the balance among energy efficiency, clean energy production and energy flexibility. Integrating climate-adaptive strategies has set to be the main priority by ensuring resilient urban districts towards climate neutrality and energy security. Facing climate change scenario raises several challenges to realise climate proof urban areas paving the base for a collaborative approach, promoting the experimentation of tools and evaluation methodologies towards the implementation of PEDs. Regenerative design can address both the decarbonisation and climate-adaptive strategies from the early stages with the aim of improving the liveability and the affordability of urban districts.

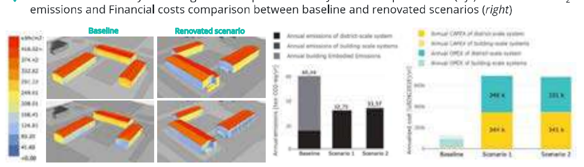
METHODOLOGY

Existing UBEM approaches have been identified in order to define the state of the art about planning and design methods adopted in PED projects. Useful tools for building energy simulations and microclimatic analysis were identified, tested and selected, aiming at maximising their interoperability potential and overall support to collaborative PED planning practices. As a result, an integrated parametric workflow has been defined, with the objective to guide each design phase from early stages supporting the collaborative implementation of PEDs. Coupling building performance simulation and Computational fluid dynamics analysis, preliminary detailed context analysis and feasible strategies to reduce the energy demand are developed in order to define future scenarios considering climate change impact on a real case study.



△ Air Temperature and wind speed analyses of baseline and renovated scenarios.

▽ Solar radiation analysis during summer period – 21st June/21st September – (*left*) and Annual CO_2 emissions and Financial costs comparison between baseline and renovated scenarios (*right*)



RESULTS & CONCLUSIONS

Urban climate can address the energy planning at district scale in order to develop site-specific strategies and solutions investigated through the integrated parametric workflow collecting the following 3D model-based tools: ENVI-met for microclimate analysis, Ladybug Tools for building performance simulations and City Energy Analyst for urban energy analysis. In order to validate the workflow, climate-adaptive strategies have been defined to explore the contribution of nature-based solutions to the overall microclimatic environment and the social ecological performance and the impact on energy needs of a residential "towards-PED" in a boreal climate area (Dfb). Feasible future renovated demand-side scenarios have been developed ensuring the balance among renewable energy production, efficiency and flexibility. Energy systems optimization has been provided with the actual energy demand in the renovated scenario, measuring the most relevant integrated benefits listed below:

- Winter ventilation reduction and lower rate of heating demand up to 36%;
- Summer solar radiation reduction up to 9% for East and West facades;
- Run off volume reduction of 57% with lower values of outdoor peak discharge;
- Air pollutant sequestration increase provided by the new trees (up to 15% of CO_2);
- DH network optimization comparing annual CO_2 emissions and financial costs.

Evaluating the urban microclimate contribution on the energy demand and on-site production potential has set to be the main priority in planning PEDs towards the regenerative energy transition. Evidence-based design approach allows to support practitioners and decision-makers in implementing site-specific solutions based on effective climate-adaptive design strategies.

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WG3

LESSONS LEARNED IN TRANSFORMING A NEIGHBOURHOOD INTO A PED: THE JOVEN FUTURA EXPERIENCE

Ana García-Garre[1]; Pablo Barrachina[1]; Miguel Miñano[1]; Ricardo Pérez de Zabalza[1]
[1]MIWenergía, Spain

INTRODUCTION

The development of Positive Energy Districts (PEDs) is a key issue to reach the European sustainability targets. In this way, several EU-funded projects have developed pilot demonstrations that worked toward this direction. In Spain, the Joven Futura community has been involved in research projects and has started the transformation of the neighbourhood into a PED. In the last years, they have installed 2 PV plants to share energy within the district and 2 more are planned to be part of the first Local Energy Community in Murcia. The deployment of an EV-chargers network is also planned as a step toward being a PED. In this work, we present the main lessons learned from the experience of MIWenergia on transforming a traditional neighbourhood into an innovative one, and the key issues when involving the people in the demonstration activities.

DESCRIPTION OF THE PILOT SITE

The Joven Futura neighbourhood is located in Murcia, Spain and includes residential dwellings, commercial premises, playgrounds, gardens, and a sports club. Joven Futura comprises 23 multi-family apartment buildings with similar characteristics per dwelling regarding size (70-80 sqm) and the number of rooms (3 bedrooms and 2 bathrooms). The idea to create an innovative district in Murcia started in 2016 with the possibility of MIWenergia participating in a Horizon 2020 proposal. Some reasons for choosing this neighbourhood were the standardized buildings, which helps with the replicability; the profile of the residents: young families and people much more aware of their energy consumption and its environmental impact; and finally, a strong neighbourhood association that helps in the relationship with the residents.

PROJECTS & IMPACTS

Joven Futura has participated since 2017 in 5 EU projects, transforming itself into a "living lab" for the demonstration of innovative solutions for energy efficiency (EE), renewable energy sources (RES), demand response (DR), proactive buildings, local flexibility markets (LFM), energy communities, etc. There are 2 ongoing (PRECEPT and DE-Risk), 2 finished (UtilitEE and DRIMPAC) and 1 about to start. The progress has been remarkable, impacting the neighbourhood in several areas:

- Technology and RES: 80 dwellings with IoT monitoring infrastructure and automated control for efficient and flexible management of their energy consumption. An application is being developed for the management of energy communities with dynamic energy sharing. It is installed 20 kWp of PV generation and 120 kWp are planned for 2023-2025.

Consumers reverse the general trend of opting for fixed tariffs (which discourage efficiency) and prefer ToU tariffs, as they gain control, can apply DR, and save energy costs while contributing to the grid stability.

- Social and community: The creation of Murcia's first Local Energy Community (CELM) started in Joven Futura, with more than 30 members.
    - Increasing awareness & empowerment regarding energy decisions
    - Launch of crowdfunding to finance new energy generation resources
- Urban development: The new project incorporates the district's energy plan with the municipal mobility, renovation, and resources plans. Murcia City Council will integrate the actions undertaken there into the city strategy

LESSONS LEARNED

- Citizens' participation in R&D requires a trustworthy relationship with them and local stakeholders. Citizen engagement is difficult to sustain, especially if they do not have immediate benefits. Providing small and direct incentives always helps.
- Technical solutions should be explained in a simplified way to average citizens to obtain an understanding of how the project will affect their daily lives.
- IoT monitoring is intrusive for householders. It is necessary fully GDPR compliance to inform the users about the data collected, as well as safety and privacy policies.
- Co-creation campaigns and local trusted parties' involvement help citizens feel a true part of the project, increasing their participation and their useful feedback.
- After participating in R&D projects, the interest in new innovations, projects and activities increases exponentially, helping to involve other people in the community.

PRECEPT
Less Energy > Smarter Buildings

ACKNOWLEDGMENTS
This work has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958284 (PRECEPT)

WG2

FUNCTIONALITY AND VALUE OF GREEN INFRASTRUCTURE IN METROPOLITAN AREAS

Case of Turkey

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[1]Fine Arts and Design Faculty, Bilecik Seyh Edebali University, Turkey

GREEN INFRASTRUCTURE MANAGEMENT

In recent years, we have been faced with ecological problems all over the world. Global warming and climate change are just one of the consequences of this process. In this context, sustainable urban development has emerged as an important concept. The green infrastructure system contributes to the preservation of the regional image, landscape character, urban identity and local differences and to make the spaces more interesting and unique aesthetically. Green infrastructure, which is considered as a strategically planned network of natural and semi-natural areas; It aims to improve urban ecosystems, contribute to the protection of biodiversity, reduce the effects of climate change and benefit people by supporting ecosystem services.

WATER MANAGEMENT

In particular, green infrastructure systems based on water resources are systems that integrate sustainable ecological functions and cultural values. In addition to its environmental, social, societal and economic functions, Green Infrastructure has many benefits such as improving air quality, carbon storage, reducing the impact of urban heat islands, protecting natural habitats and biodiversity, ensuring healthy growth of cities, and contributing to the increase of recreation areas. In this context, especially Porous Flooring, Rain Garden, Precipitation Water Plant Strip and Green roof applications are of great importance in green infrastructure works.

RESULTS & CONCLUSIONS

Today, green infrastructure applications in the world's cities are important in terms of reducing energy costs, reducing the damage caused by floods, and protecting human and environmental health. Green infrastructure is an approach that foresees the collaboration of various disciplines at different scales, and brings original solutions by working with current urban planning and design ideas. Green infrastructure, when properly planned and prioritized, can provide a wide range of benefits for both individuals and nature.

In summary, if green infrastructure is included in urban planning at any scale, it will also contribute to urban resilience. Therefore, within the framework of this concept, especially in zoning plan studies, green infrastructure strategies should be determined for different layers of the city and sub-scale plans should be made gradually. Apart from the zoning plans, green infrastructure components must be included within the scope of environmental plans, special-purpose plans, regional plans and national development plans. Within the scope of this study, the importance of green infrastructure applications in Turkey and their contributions will be examined by presenting examples from the cities implemented.

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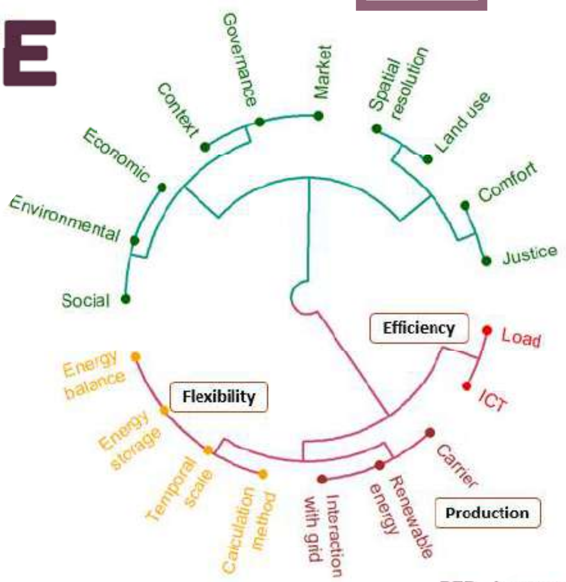
WG1

AI FOR POSITIVE ENERGY DISTRICTS



PED elements

Perspectives of two artificial intelligence techniques on characterizing positive energy districts

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INTRODUCTION

District level energy management could reduce the volume of interactions with the grid, thus making the energy system more stable. The Positive Energy District (PED) is one of methods for improving energy management efficiency while accelerating the transition to zero emissions in the building sector. Difficulties of the construction of 100 PEDs by 2025 in Europe comprise an unsettled definition of PED, need for multiple development phases, insufficient implementation tools, and other technical and non-technical challenges. It is important to characterize PED and find out the common solutions necessary to boost the replication potential of PED.

OBJECTIVE

- Investigate the elements of PED for characterization
- Review two AI techniques, machine learning (ML) and natural language processing (NLP), that have been used for analyzing the elements
- Identify the most important AI methods
- Outline research gaps and working directions for accelerating the adoption of AI techniques for PED

RESULTS & CONCLUSIONS

- The most important models for ML are ANN, SVM and tree-based approaches that can be used for prediction and classification at different phases.
- For NLP, the tasks are focused on topic modeling, word embedding and training large language models, e.g., BERT, for stakeholder matching, sentiment analysis, metadata analysis, etc.
- However, there are still a number of PED elements that have not shown potentials to be modeled by ML or NLP.
- A holistic approach of AI is required to ensure the outcomes to be aligned with the vision of creating sustainable and resilient urban environments.

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WG4

PERCEPTION AND SOCIAL ACCEPTANCE OF PEDs

Case study: Israel

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[2]Arava Institute for Environmental Studies, Israel

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INTRODUCTION

Over half of the world's population lives in urban areas, which is expected to increase to over two-thirds by 2050. Cities will be more vulnerable to climate change. Developing PEDs should be the heart of the city's decarbonization. But developing PEDs successfully depends on citizens. Without them, the PEDs cannot operate successfully. Therefore social acceptance of the PEDs is crucial - social acceptance: "a favorable or positive response relating to a proposed or in situ technology or socio-technical system, by members of a given social unit (country or region, community or town and household, organization)" (Upham et al. 2015, p. 102). Yet, more is needed to know about the PEDS in this regard.

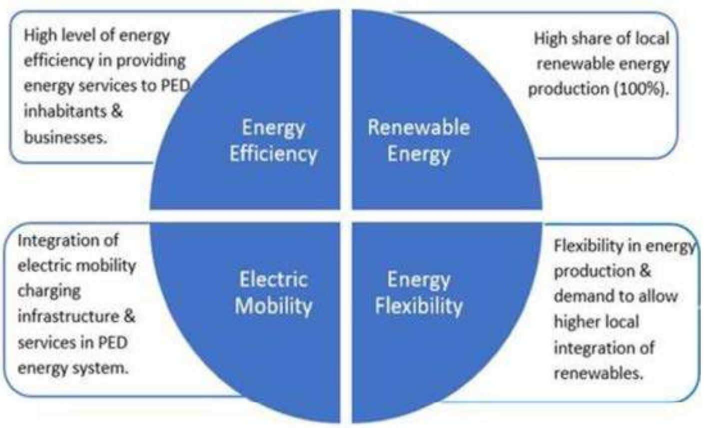
METHOD

The study takes a quantitative approach using a 150-sample survey. The survey was conducted to understand the general knowledge of PED and the willingness to participate in such an initiative as a PED. The survey had 27 questions. It was divided into five main parts. The first part was general questions about the respondents, and then the rests were about the PED system based on the four pillars of the PED energy system (energy efficiency, renewable energy, electric mobility, and flexibility). The survey sample included Israeli citizens (above 18 years old) living in Israel. The survey was conducted online in May 2023, and the response rate was 100%.

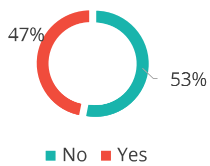
RESULTS & CONCLUSIONS

Social acceptance of PED is crucial in times of climate crisis. Yet, little is known about PEDs in the world and Israel. 150 Israeli citizens were asked through a survey to examine their perceptions of PEDs. The main findings were the following: (a) a lack of knowledge about PED and the importance of renewable energy, energy efficiency, flexibility, and mobility; (b) a lack of willingness to participate in the energy transition; (c) main drivers to participate in PED project: financial (70%), environmental reason (14%), the influence of neighbors (7%), energy security (4%), and the rest 5% marked other reasons. The result shows the efficient engagement of the public in planning, developing, and implementing climate policies and REs installations. We have echoed that effective public participation in decision-making processes needs to be improved in Israel.

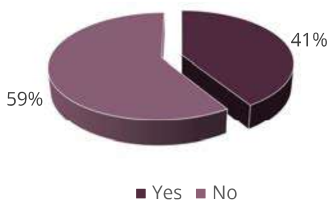
THE FOUR PILLARS OF PED ENERGY SYSTEMS (source: PEDs solution booklet)



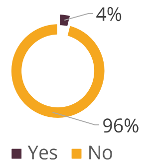
Have you considered replace your combustion engine fueled vehicle to electric vehicle?



Have you ever heard about people producing and consuming their own energy (prosumers)?



Have you ever heard about Positive Energy District (PED)?



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WG2

A DECISION SUPPORT FRAMEWORK FOR THE CREATION OF PEDS

A multicriteria decision support framework for the creation of PEDs: Local energy planning and multi-stakeholder engagement

Marios Karmellos[1]; Abel Magyari[2]

[1]The Cyprus Institute, Cyprus

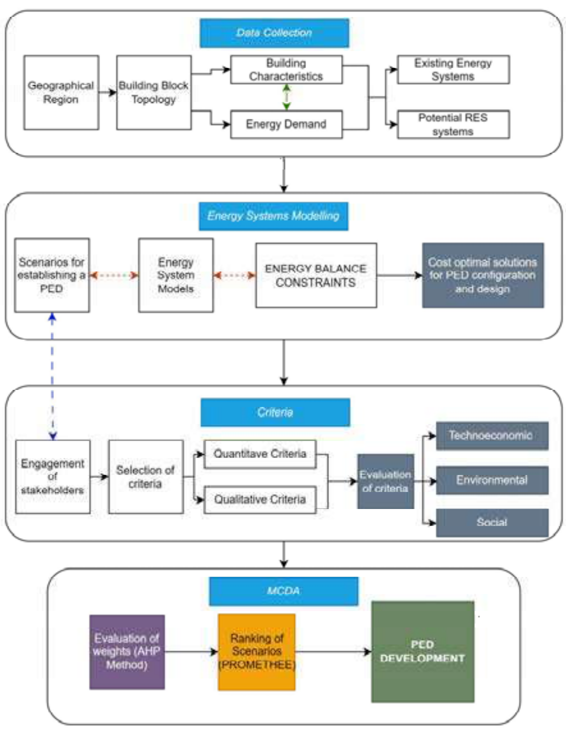
[2]ABUD, Advanced Building and Urban Design, Hungary

INTRODUCTION

Establishment of PEDs is a challenging process involving multiple stakeholders and different processes. In order to create a PED several phases are required, such as the clear definition of the PED boundaries, identification of involved stakeholders, assessment of the local needs, selection of decision criteria, and data collection. Further, in the design process several tools are applied in order to identify alternative actions for a PED (e.g. energy systems models).

OBJECTIVES & METHODOLOGY

The objective of this paper is to propose and develop a generic framework based on multi-criteria decision analysis (MCDA) which will be used by decision makers to identify the most suitable options for developing a PED. This framework aims to integrate all the required steps for the establishment of a PED., and will consider local needs and specific criteria. It will be based on the Analytical Hierarchy Process (AHP) and the Preference Ranking Organization Method for Enrichment Evaluation method (PROMEETHE).



RESULTS & CONCLUSIONS

When developing a PED, DMs must consider several criteria, such as economic (e.g. investment cost, operational costs, payback period), social (creation of jobs, social acceptance, contribution to local welfare), environmental (annual reduction of CO_2 emissions, annual renewable energy generation, impact on the environment), and technical (maturity of technology and feasibility) criteria. Since DMs have personal preferences they will evaluate criteria with different weights, according to their own views, thus a comprehensive decision-making framework is necessary to support the development of PEDs.

The proposed framework is divided into four different areas:

Data Collection

- Information about geographical region, building block topology (characteristics and energy demand), details on existing and potential energy systems

Energy Systems Modelling

- Development of scenarios for establishing a PED and respective energy systems models and identify cost optimal solutions. The energy models can be developed using appropriate tools for energy systems modelling for local energy systems, and the results serve as an input to the MCDA framework.

Criteria

- Engagement with stakeholders, selection and evaluation of criteria.

MCDA

- Application of MCDA methods to select a scenario and develop a PED. AHP is a method based on pairwise comparison between different options and can be applied to calculate the weights for each criterion. Then PROMETHEE can be a applied to rank the available options.

This framework that will be developed could become a part of the suite of available tools for designing PEDs and applied to specific case studies for evaluation.

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WG2

CHALLENGES AND SUCCESS FACTORS IN PEDs IMPLEMENTATION

Understanding the implementation processes of PEDs: lessons learned from PED case studies

Thaleia Konstantinou[1]; Savis Gohari[2]; Silvia Soutullo Castro[3]; Touraj Ashrafian[4]; Lina Murauskaite[5]; Emanuela Giancola[3]; Bahri Prebreza[6]; Mingming Liu[7]; Laura Aelenei [8]

[1]Faculty of Architecture and The Built Environment, Delft University of Technology, the Netherlands; [2]Department of Civil and Environmental Engineering, Norwegian University of Science and Technology, Norway; [3]Energy Department, CIEMAT, Spain; [4]Architecture and Built Environment, Northumbria University, UK; [5]Laboratory of Energy Systems Research, Lithuanian Energy Institute, Lithuania; [6]Power Systems Department, University of Pristina, Kosovo; [7]School of Electronic Engineering, Dublin City University, Ireland; [8]Renewable Energy and Energy Efficiency Unit (UEREE), Laboratório Nacional de Energia e Geologia, Portugal

Stockholm Royal Seaport.
Source: Cities4PEDs Atlas, https://energy-cities.eu/project/cities4peds-resources/

INTRODUCTION

The implementation of positive energy districts (PEDs) is recognized as a promising approach to achieving energy efficiency and reducing the negative environmental impact of climate change. However, there are several barriers to the implementation of PEDs that need to be addressed. These barriers include governance, incentives, social, process, market, technology, and context challenges, which require a profound understanding of the priorities, ambitions, strategies, contextual conditions, administrative conditions, policies, economic and technical resources, and existing solutions of cities.

OBJECTIVE

Working group 2 of the COST Action PED-EU-NET aims to provide guides and tools that can help overcome these barriers. This paper investigates the challenges and enabling factors of PEDs by drawing on experiences from several PED cases, including Vienna, Brussels, Stockholm, Salzburg, Lisbon, and Evora. Since the PEDs concept focuses on interconnected and interrelated structures and processes, sufficient details are required to unravel the complexities of a given situation. The study employs a multiple case study approach with qualitative interviews of key stakeholders of the PED implementation in the selected case studies.

Source:
https://www.synikia.eu/neighbourhoods/demo-neighbourhood-austria/

RESULTS & CONCLUSIONS

The absence of a clear definition of PED, along with the lack of established guidelines and best practices, lead to uncertainties and limitations in achieving shared understanding and alignment of stakeholders' efforts. Recognizing the complexity and expertise required, a central actor within the governance system equipped with substantive skills and knowledge is crucial for effective coordination and accountability. The dynamic political landscape requires ongoing support from committed bureaucrats to advocate for PED and secure resources. Furthermore, regular review and adaptation of goals and strategies are necessary to address emerging challenges and capitalize on opportunities for improvement.

Cases	Main objectives	Blocking factors	Enabling factors
Stockholm	Technical and economic aspects	Low local RES production Involve construction companies	Political commitment
Vienna	Social, normative and governance factors	Citizen engagement	Collaboration of local Stakeholders
Brussels	Social, governance and economic factors	Low financing instruments	Coordination Platform to manage the transformation process
Lisbon	Transformation process and technical aspects	Low involvement of developers to increase financing instruments.	Energy connexions between nearby districts
Evora	Governance and regulatory aspects	Low consideration of heritage requirements from the beginning	Consideration of different interests in decision-making process.
Salzburg	Governance and social aspects	Involvement of inappropriate agents to the phases project	Governance model

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WG3

COLLECTIVE INTELLIGENCE FOR ENERGY FLEXIBILITY

COLLECTiEF

An eu project which develops software and hardware solutions to smart up existing buildings

Ioanna Kyprianou[1]; Panayiotis Papadopoulos[1]; Salvatore Carlucci[1]
[1]Energy, Environment and Water Research Center, The Cyprus Institute, Cyprus

COLLECTiEF AND STUDY OBJECTIVES

The COLLECTiEF project implements, tests, and qualifies such a system, relying on the development of software and hardware packages for Collective Intelligence-based demand-side management (CI-DSM). This increases data security, energy flexibility and climate resilience of existing buildings and contributes to the energy and climate goals set by the Paris Agreement, establishing shared goals with those of positive energy districts. This study uses empirical evidence from a non-residential living lab to show how an adaptive model of HVAC control can result in considerable energy savings.

METHODOLOGY

Field measurements (temperature, relative humidity, and internal air quality data) from a living lab, situated in the Grenoble Electrical Engineering Lab are used to monitor HVAC power use and indoor environmental quality. They provide assessments of on the one hand static and on the other adaptive thermal comfort indices over the energy used in HVAC systems, through respectively calculating the Predicted Percentage of Dissatisfied (PPD) and the ASHRAE Likelihood of Dissatisfaction (ALD) indicators. The energy saving potential of adaptive thermal comfort models in the design of HVAC control algorithms is therefore estimated.

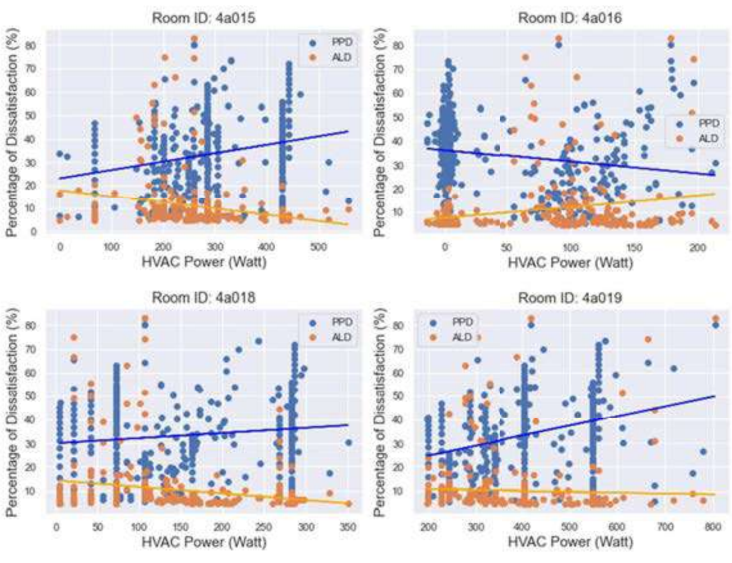

Figure 1. Comparative analysis of the percentage of dissatisfaction for PPD and ALD with respect to HVAC power use per zone of the living lab. The blue and orange lines show the linear regression of the data points for the PPD and ALD, respectively.

RESULTS & CONCLUSIONS

This work proposes the use of adaptive thermal comfort models in the design of HVAC control algorithms with regards to the state-of-practice rational models for reducing buildings energy use. Figure 1 presents a comparative analysis of the percentage of dissatisfaction (%) generated by the PPD and ALD indices with respect to HVAC power use per zone. Specifically, each dot corresponds to a specific time interval of 1 hour in which the calculated index, along with the instantaneous HVAC power use, is measured. The blue and orange lines show the linear regression of the data points for PPD and ALD indices, respectively. From the experimental data, it can be shown that the adaptive thermal comfort model, which is expressed by the ALD index, can provide additional energy savings or more room for energy flexibility without affecting the perceived thermal comfort of the building users. Considering a linear relation between thermal comfort and power use, the adoption of the adaptive thermal comfort approach in the design of control strategies could provide energy savings between 15% and 33% without compromising thermal sensation.

This implies to significant energy savings through adaptive temperature set points in the design of HVAC control algorithms and shows the potential of living labs and adaptive approaches in optimizing operations in larger scale positive energy districts. Nevertheless, keeping in mind the pivotal role of building occupants, design of PEDs should ensure a level of flexibility while considering the changing climate and therefore continuing to collect user data and adjusting operational models as time progresses.

WG4

GRETA PROJECT AND THE PATHWAY TOWARDS ENERGY CITIZENSHIP

GRETA GReen Energy Transition Action is a European research project (2021-2023) that paves the way for active citizenship and the development of energy communities.

Danila Longo[1], Andrea Boeri[1], Beatrice Turillazzi[1], Saveria Olga Murielle Boulanger[1], Francesca Sabatini[1], Martina Massari[1]

[1]University of Bologna, Architecture Department, Italy

GRETA H2020 PROJECT

The EU aims to achieve climate neutrality by 2050. The goal can only be achieved if citizens are involved in the energy transition (clean energy). GRETA (GA 101022317) explores the dynamics and the social aspect of the current energy revolution. What kind of knowledge, social structure, technology or financial resources are needed to become an active energy citizen? An energy citizen is a person or group of people who actively participate in the transition to the use of clean energy.

OBJECTIVE

The Community Transition Pathways (CTPs) are the mechanism developed by GRETA with which people will be supported in the transition between the various states of participation and are real accompanying paths that aim at decarbonisation. The project investigates how CTPs can strengthen and regulate the relationships between actors involved in the transition through the creation of Energy Citizenship Contracts (ECCs). The Contracts are the operational result of the Pathways, i.e. tools through which communities, local stakeholders and institutional players can mutually recognize roles and benefits.

Being energy citizens means:

- to discuss energy issues within your community
- to monitor and regulate your energy consumption
- to make conscious energy choices (such as heating with renewable energy)
- to produce and sell their own energy

Map by Giulia Turci

Ph. Pietro Muzzi, Martina Garbin, Jiauxuan Han, Lorenzo Brunello

RESULTS & CONCLUSIONS

For Bologna, the case study is the Pilastro-Roveri area. It was chosen for its geographical configuration (large but physically well-defined area), functional (residential, services, and productive use) and social (presence of a high percentage of associations, active citizens, civic organizations and committees). Furthermore, it is home to the largest rooftop solar photovoltaic plant in the EU and has a district heating plant (waste-to-energy plant). The area was involved in a series of participatory activities aimed at defining collaborative paths to understand how to make the communities transit from different states of initial commitment to more active levels towards the issue of energy. In the case study, GRETA identified and described the community's attitude towards energy through a series of incremental activities, such as collective neighborhood trekkings, participation in monthly round tables with local associations, participation in neighborhood events, mini-interviews with members of the local community and codesign workshops dedicated to the co-design of Energy Citizenship Contracts.

Ph. Ajesh Kumar

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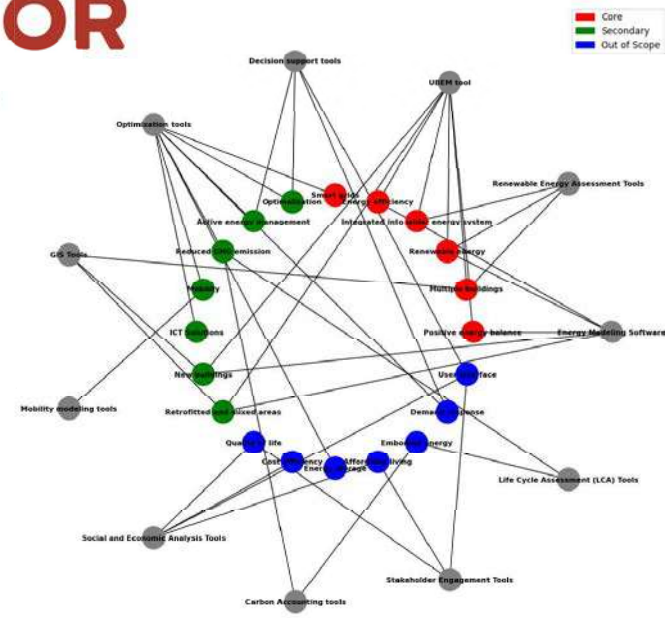
WG2

FRAMEWORK FOR PED RELEVANT TOOLS AND TOOL CHAINS



Defining Appropriate Tools and Tool Chains for Positive Energy Districts: Framework Development and Analysis

Abel Magyari [1], Marios Karmellos[2], Andras Reith[1]

[1]ABUD, Advanced Building and Urban Design, Hungary

[2]The Cyprus Institute, Cyprus

INTRODUCTION

The design and development of PEDs are essential to sustainable urban development and require a range of tools and methods to be effective. However, without a clear characterization and definition of the tools and tool chains used in PED planning, design, and operation, it can be challenging to implement sustainable urban development strategies successfully.

Defining appropriate tool chains for PEDs requires analyzing the current tools and methods used for planning, design, and operation. However, determining which ones are crucial is a difficult task, due to the absence of a widely accepted PED definition.

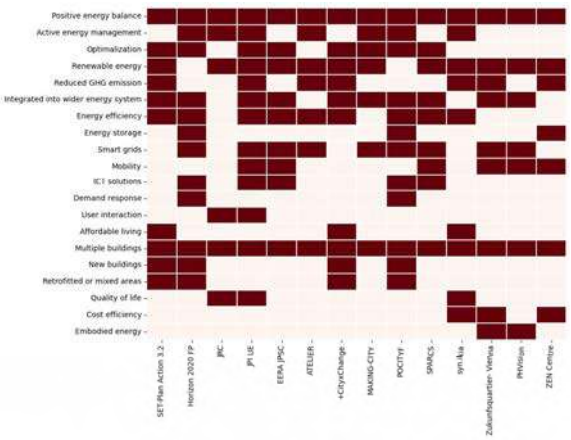
OBJECTIVE

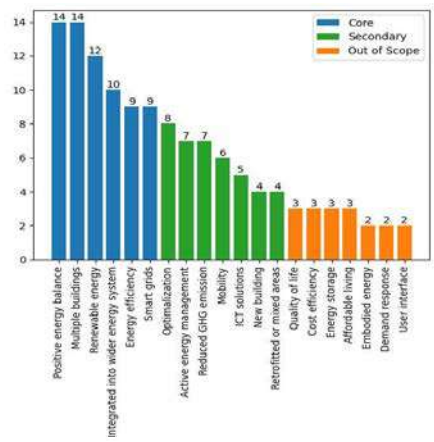
In this study, a framework is developed by analyzing the currently available PED definitions across multiple PED projects, and initatives. The framework sorts definitions and tools into core, secondary, and out-of-scope categories based on their perceived significance. The main objective of the framework is to help define what are the most important tool types, exact tools and tool-chains for the development of a PED.

RESULTS & CONCLUSIONS

Initially, keywords were identified across all 14 analyzed definitions, followed by the creation of a heatmap that reflected the frequency of these keywords, whether they were explicitly stated or implied. The significance of these keywords was then determined based on their frequency across the 14 projects. Keywords found in 9-14 projects were classified as 'Core', those found in 4-8 projects were deemed 'Secondary', and those appearing in less than 3 projects were categorized as 'Out of Scope'. The results of this classification are presented below.

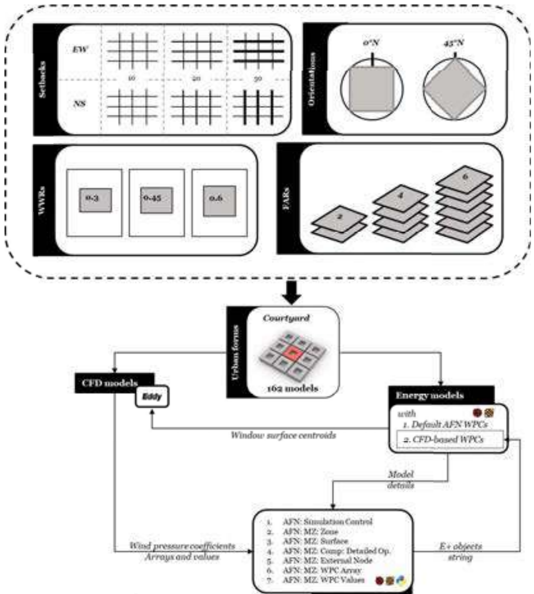
After categorizing the keywords into the three categories, tool types based on literature review and expert opinion are defined. To define which tools are able to cover the needs of the categories, the associated keywords are matched with the usual tool capabilities for each tool types resulting in a network graph. To resolve the main objective, tools associated with Core and Secondary importance can be seen as the most important tools for PED development.





WG2

µBEM for CLIMATE SMART PED DESIGN



Methodology flowchart

Microclimate-integrated Urban Building Energy Modelling for Climate Smart PED design

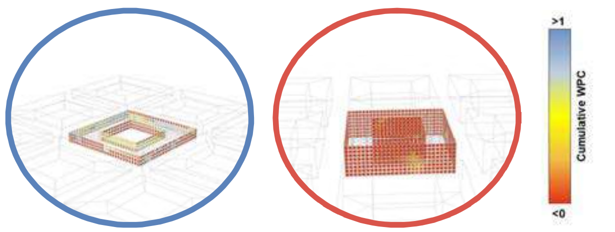
Naga Venkata Sai Kumar Manapragada[1]; Jonathan Natanian[1]
[1]The Environmental Performance and Design Lab (EPDL), Technion-Israel Institute of Technology, Israel

INTRODUCTION

Today, urban building energy modeling (UBEM) tools are instrumental for designing and evaluating positive energy districts (PEDs). UBEM tools can simulate the energy generation potential of urban energy systems (UESs) and the energy demand of building energy systems (BESs). Nevertheless, the present-day UBEM tools, by default, do not consider the microclimate, which can lead to an inaccurate estimation of urban building energy demand (UBED). The PEDs that meet the UBED with renewable energy can reduce greenhouse gas emissions, making cities climate-smart.

OBJECTIVES & METHODOLOGY

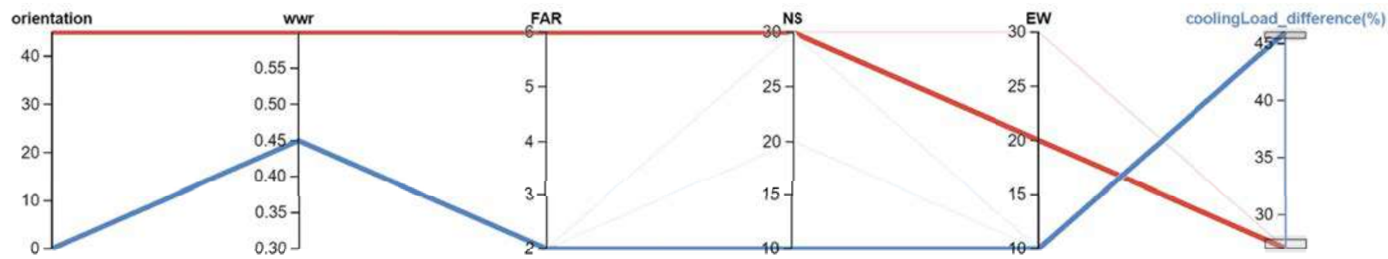
Thus, the study examines the difference in building cooling energy demand when considering local wind flow. Courtyard-type urban forms with varying building (floor-to-area ratio (FAR) and window-to-wall ratio) and urban (orientation and setbacks) design parameters are simulated using default and CFD tool-generated wind pressure coefficients (WPCs). A novel workflow is developed to automate the parametric µBEM and perform 162 simulations in the Rhinoceros-Grasshopper platform with the Ladybug tools and Eddy3D plugins.



Window surface-specific cumulative wind pressure coefficents

RESULTS & CONCLUSIONS

The findings revealed that the default WPC considered by the UBEM tools undermined the cooling energy demand by not considering urban form-impacted wind flow. The study has shown a negative correlation between FAR and percentage differences in cooling load. The models with FAR 6 showed a cooling load difference of 27%, while those with FAR 2 observed 45%. Although the WPCs are higher in the case of low FAR models, the solar exposure on high FAR models reduced the opportunity for window opening resulting in less deviation in cooling demand results. This study assesses only the impact of local wind on urban buildings' cooling energy demand. The urban building's deviation would have changed if local climate variables like dry- and wet bulb temperature are accounted for. Overall, the study explains the significance of µBEM to accurately estimate the UBED and make informed decisions for Climate Smart PED design.



Models with minimum and maximum percentage difference in cooling load

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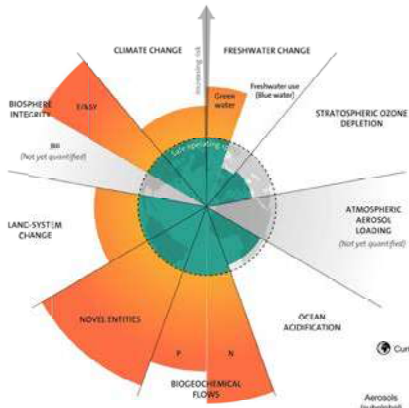
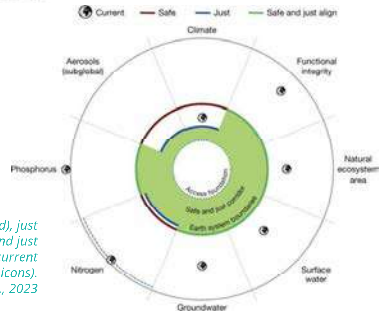
WG4

PEDS WITHIN PLANETARY BOUNDARIES



Planetary Boundaries: Licenced under CC BY-NC-ND 3.0 Credit: "Azote for Stockholm Resilience Centre, based on analysis in Persson et al., 2022 and Steffen et al., 2015"

Exploring the concept of a safe operating space for PEDs



Visualization of safe ESBs (dark red), just (NSH) ESBs (blue), cases where safe and just (NSH) boundaries align (green) and current global states (Earth icons). Source: Rockström et al., 2023

Giulia Marredda[1]; Maria Beatrice Andreucci[1]; Matthias Haase[2]
[1]Department of Planning, Design, Technology of Architecture, Sapienza University of Rome, Italy
[2]ZHAW Zurich University of Applied Sciences, Switzerland

INTRODUCTION

In 2009, Johan Rockström led a group of 28 internationally renowned scientists to identify the nine processes that regulate the stability and resilience of the Earth system. The scientists proposed quantitative planetary boundaries (PB) within which humanity can continue to develop and thrive for generations to come. Crossing these boundaries increases the risk of generating large-scale abrupt or irreversible environmental changes. The PB framework has generated enormous interest within science, policy, and practice, while PED is still an emerging concept, and data and information limitations present challenges. Nonetheless, PED benchmarking seem possible using available data, and referring to planetary boundaries is an informative exercise for both policy implementation and future research.

METHODOLOGY

This on-going research (Haase, Andreucci et al., E2023) aims at shedding lights on the importance of relating the PED concept to the PB and stimulating a science-policy-practice debate on sustainability and sustainability assessment of PEDs.

By combining improved scientific understanding of the Earth system (ES) functioning with the precautionary principle, the PB framework identifies levels of anthropogenic perturbations below which the risk of destabilization of the ES is likely to remain low - a "safe operating space" for global societal development. A zone of uncertainty for each PB highlights the area of increasing risk. The current level of PEDs anthropogenic impact on the ES, and thus the risk to the stability of the ES, has consequently to be assessed by comparison with the proposed PB.

Hammarby Sjöstad, Sweden.
Photo credits: Maria Beatrice Andreucci

RESULTS & CONCLUSIONS

There is an urgent need for a new paradigm that integrates the continued development of human societies and the maintenance of the ES in a resilient and accommodating state. The PB framework can contribute to this ambition by providing a science-based analysis of the risk that human perturbations will destabilize the ES at the planetary scale.

The PB framework does not dictate how societies-or PEDs-should develop. These are political decisions that must include consideration of the human and economic dimensions, including equity, not incorporated in the PB framework. Nevertheless, by identifying a safe operating space for humanity on Earth, the PB framework can make a valuable contribution to decision-makers in charting desirable courses for societal development, encompassing PED implementation.

The PED experiences gathered so far at European level show that their focus is not on the planetary boundaries, with efforts concentrated on energy efficiency, and clean energy production, and limited attention paid to energy flexibility.

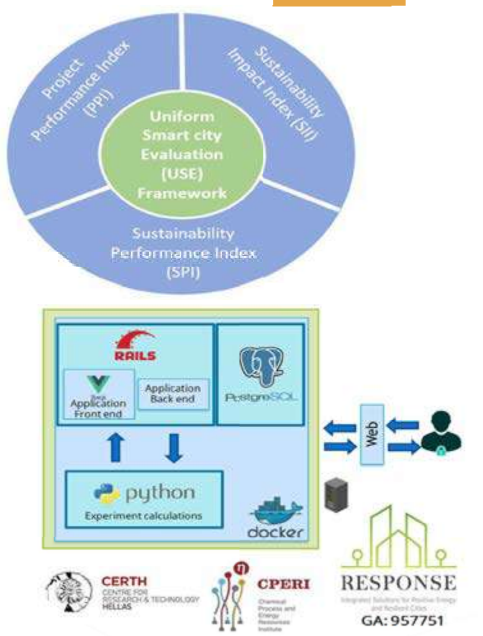
In conclusion, two aspects can be highlighted:

1) Since the very early stage of a PED development, there should be a focus on a regenerative sustainability model (John T. Lyle, 1996) for the built environment that allows us to plan and design settlements and urban areas that stay within the "safe operating space";

2) Regeneration of the Earth system will require a fundamental shift in the way we think about our relationship with the planet.

WG3

UNIFORM SMART CITIES EVALUATOR



Uniform Smart Cities Evaluator: A platform built to evaluate, benchmark, and compare smart cities and communities' projects – RESPONSE project as a case study

Georgios Martinopoulos[1]; Chrysostomos Sergios Tasios[1]; Andreas Seitaridis[1]; Nikolaos Nikolopoulos[1]

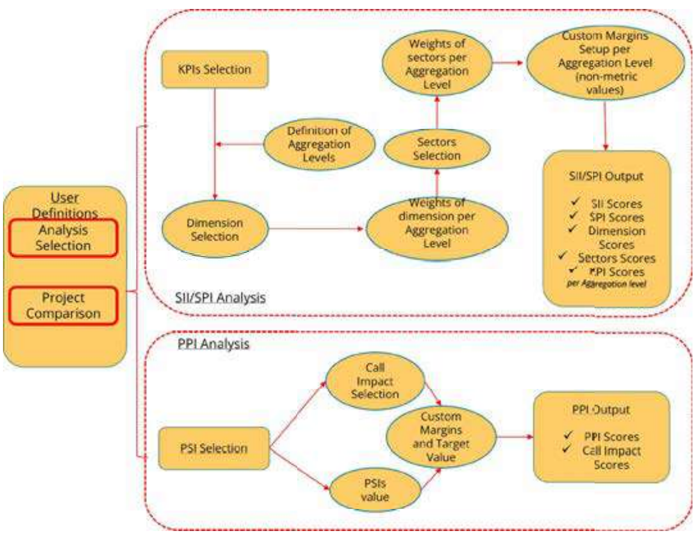
[1]Centre Research and Technology Hellas, Chemical Process and Energy Resources Institute (CERTH/CPERI), Greece

INTRODUCTION

An important component for designing and implementing a smart city concept is the evaluation of the impact of the demonstrated solutions, mitigating emissions and increasing the self-sustainability and climate resilience of a city according to their sustainability vision. Towards that end, a unified evaluation framework that can assess the effectiveness of the interventions and long-term performance progress of city-level interventions, named as Uniform Smart City Evaluation (USE) framework designed to be usable also by even non-experts, facilitating the design and selection of most promising interventions, has been developed and is presented.

OBJECTIVE

USE is supported by an online platform, that utilizes a variety of KPIs along with predefined Project Success Indicators. The evaluation is conducted along three axes and their respective indices, the Project Performance (PPI), Sustainability Impact (SII), and Sustainability Performance Indexes (SPI), in accordance with the UN Sustainable Development Goals (SDG). The platform offers i) expendability in terms of KPI availability, ii) custom margins to evaluate the effectiveness of various activities towards PED status and iii) analytical reporting through a GUI. RESPONSE project (GA 957751) will be used as a case study for the implementation of the methodology.



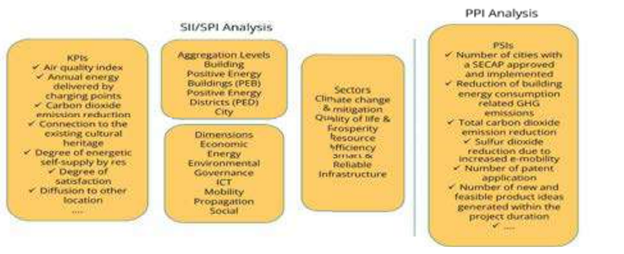
THE FOUR PHASES OF THE METHODOLOGICAL APPROACH

METHODOLOGY & CONCLUSIONS

The methodological approach followed is structured into four phases; namely i) definition of the RESPONSE selected indicators' functional units, ii) normalization of each indicator to a uniform scoring scale based on relevant sustainability goals or city targets, iii) weighting techniques for defining weights per dimension and/or axis, iv) aggregation techniques used for spatio-temporal levels and for the composite index.

Within RESPONSE, for the calculation of SII, a set of 100 weighting points were distributed to the KPIs included in each dimension; namely Energy, Environment, Mobility, ICT, Economic, Social, Governance, Propagation. Furthermore, the weighting of dimensions was also considered, and an equal weighting approach was followed.

Concluding, the easy to utilize USE platform allows for an easy and accurate comparison of SCC projects. The deriving composite indices can lead to valuable insights regarding the impact of the evaluated SCC project on the overall city sustainability level, following adequate post-processing.



REQUIRED INPUTS FOR SII/SPI & PPI ANALYSIS

WG1

LIMITS AND OPPORTUNITIES OF DISTRIBUTED ENERGY SYSTEMS IN URBAN ENVIRONMENTS

Limits and opportunities of distributed energy systems in urban environments. An experimentation in the urban pattern of Roma.

Ilaria Montella[1]

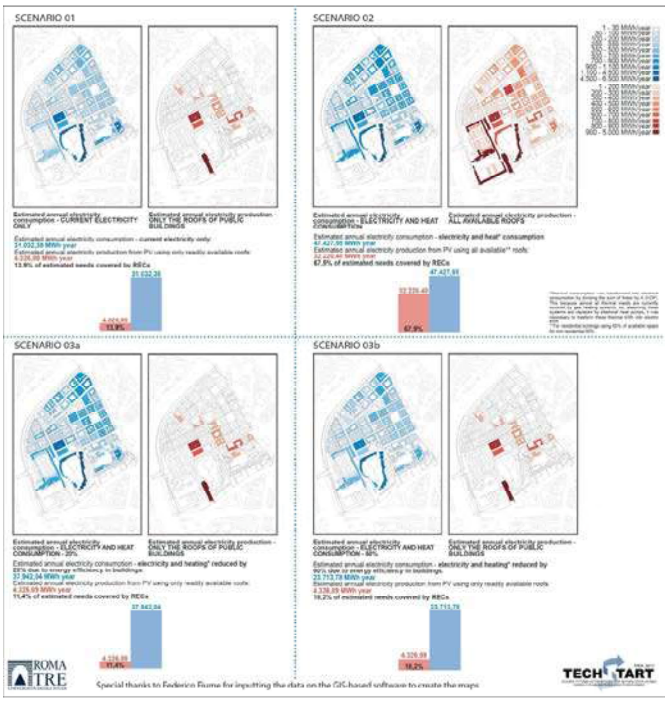
[1]Università degli Studi Roma Tre, Italy

INTRODUCTION

The transition to decentralized urban energy systems is a key point in mitigating the climate change effects. To reach the green transition, it is not enough to promote efficiency but also to increase decarbonisation by developing decentralised energy systems. Discussing the role of proximity spaces in supporting decarbonization, this poster presents results of italian PRIN (Projects of Relevant National Interest) titled «TECHSTART-key enabling TECHnologies and Smart environmenT in the Age of gReen economy. Convergent innovations in the open space/building system for climaTe mitigation» (RU Manager: Professor Paola Marrone).

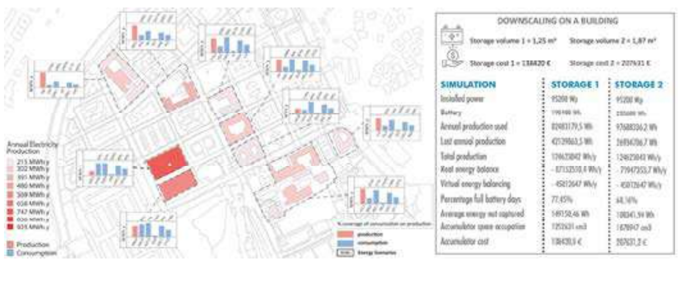
OBJECTIVE

With reference to pilot cases in Rome (Testaccio, Balduina, Prima Porta), this contribution explores the limits and opportunities of distributed energy systems in urban environments, investigating how the spatial organisation of some different urban pattern can affect configuration and sizing of the energy system. The methodology highlighted elements useful to guide the implementation of RECs in densely built urban contexts, and is articulated in three levels of assessment: preliminary feasibility assessment, planning and programming, and design.



RESULTS & CONCLUSIONS

In the first level (Fig. top), to compare the energy potential of the districts, the same production limit of 200 kWp was set using the RECON tool (Renewable Energy Community ecONomic simulator). In Testaccio, a single block was sufficient, in Balduina 5 small buildings, in Prima Porta 17 small buildings, covering different percentages of current electricity consumption. For the second level (Fig. left), thermal and electrical consumption data were reported on GIS, and four sequential scenarios were elaborated which, starting from current electrical consumption, also included electrification of thermal consumption and envelope efficiency. For the third level (Fig. below), the producibility of all buildings was calculated with the PVGIS Photovoltaic Geographical Information System tool, highlighting the percentage of energy produced in relation to consumption and sizing the storage. The aim of this work is to understand how the design of decentralised energy systems can be addressed in urbanised contexts, supporting planners in the development of RECs.



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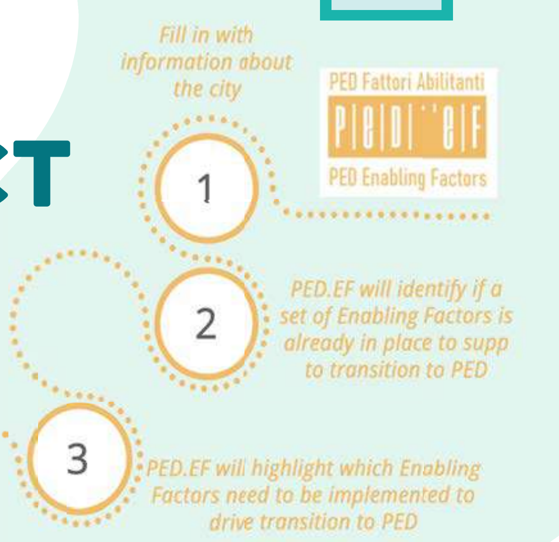
WG4

POSITIVE ENERGY DISTRICT ASSESSMENT



Positive Energy District Assessment Tool – PADOVA case study

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[2]DA Department, Alma Mater Studiorum University of Bologna, Italy

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INTRODUCTION

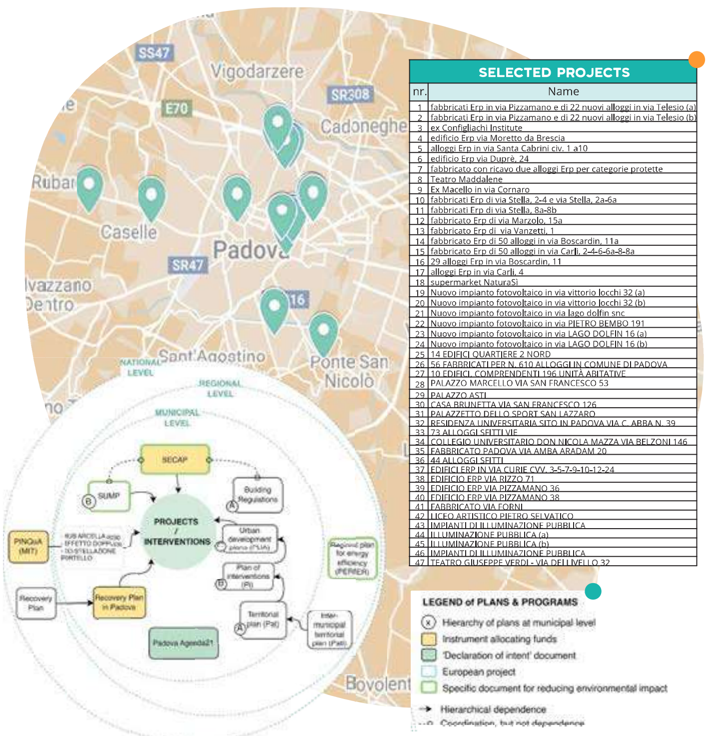
PED.EF is a web application developed by ENEA (paola.clerici@enea.it). Based on a limited set of inputs (general information on the city, municipal energy accounting, municipal programs and plans, projects, public lighting infrastructure and energy communities) the tool provides the preliminary assessment and technical feasibility to support Local Authorities aiming to drive to Positive Energy District.

The selected case study refers to the city of Padova, one of the fifty-three Pilot Cities (1st round) approaching climate neutrality signing the Climate City Contract within 2024.

OBJECTIVE

Cities lead climate action facing significant structural barriers: organizational, procedure and procurement, technical and funding. PED.EF is the tool which supports Local Authorities in developing technical and economic feasibility study in order to identify existing gaps. Padova is one of the nine Italian cities (Bergamo, Bologna, Firenze, Milano, Parma, Prato, Roma and Torino) of the EU Mission 100 CNC.

By an effective framework (rules, regulations and programs) and a bunch of projects supporting transition to PEDs, the poster highlights Enabling Factors supporting transition to PED for the case study of Padova.



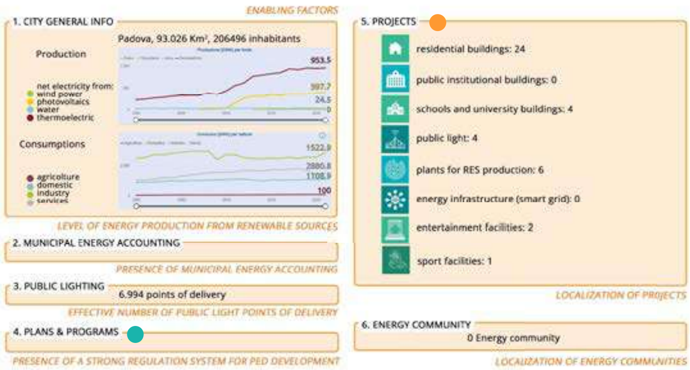
SELECTED PROJECTS	
nr.	Name
1	fabbricati Erp in via Pizzamano e di 22 nuovi alloggi in via Telesio (a)
2	fabbricati Erp in via Pizzamano e di 22 nuovi alloggi in via Telesio (b)
3	ex Configliachi Institute
4	edificio Erp via Moretto da Brescia
5	alloggi Erp in via Santa Cabrini civ. 1 a10
6	edificio Erp via Duprè, 24
7	fabbricato con ricavo due alloggi Erp per categorie protette
8	Teatro Maddalene
9	Ex Macello in via Cornaro
10	fabbricati Erp di via Stella, 2-4 e via Stella, 2a-6a
11	fabbricati Erp di via Stella, 8a-8b
12	fabbricato Erp di via Marzolo, 15a
13	fabbricato Erp di via Vanzetti, 1
14	fabbricato Erp di 50 alloggi in via Boscardin, 11a
15	fabbricato Erp di 50 alloggi in via Carli, 2-4-6-6a-8-8a
16	29 alloggi Erp in via Boscardin, 11
17	alloggi Erp in via Carli, 4
18	supermarket NaturaSì
19	Nuovo impianto fotovoltaico in via vittorio locchi 32 (a)
20	Nuovo impianto fotovoltaico in via vittorio locchi 32 (b)
21	Nuovo impianto fotovoltaico in via lago dolfin snc
22	Nuovo impianto fotovoltaico in via PIETRO BEMBO 191
23	Nuovo impianto fotovoltaico in via LAGO DOLFIN 16 (a)
24	Nuovo impianto fotovoltaico in via LAGO DOLFIN 16 (b)
25	14 EDIFICI QUARTIERE 2 NORD
26	56 FABBRICATI PER N. 610 ALLOGGI IN COMUNE DI PADOVA
27	10 EDIFICI, COMPRENDENTI 196 UNITÀ ABITATIVE
28	PALAZZO MARCELLO VIA SAN FRANCESCO 53
29	PALAZZO ASTI
30	CASA BRUNETTA VIA SAN FRANCESCO 126
31	PALAZZETTO DELLO SPORT SAN LAZZARO
32	RESIDENZA UNIVERSITARIA SITO IN PADOVA VIA C. ABBA N. 39
33	73 ALLOGGI SFITTI VIE
34	COLLEGIO UNIVERSITARIO DON NICOLA MAZZA VIA BELZONI 146
35	FABBRICATO PADOVA VIA AMBA ARADAM 20
36	44 ALLOGGI SFITTI
37	EDIFICI ERP IN VIA CURIE CVV. 3-5-7-9-10-12-24
38	EDIFICIO ERP VIA RIZZO 71
39	EDIFICIO ERP VIA PIZZAMANO 36
40	EDIFICIO ERP VIA PIZZAMANO 38
41	FABBRICATO VIA FORNI
42	LICEO ARTISTICO PIETRO SELVATICO
43	IMPIANTI DI ILLUMINAZIONE PUBBLICA
44	ILLUMINAZIONE PUBBLICA (a)
45	ILLUMINAZIONE PUBBLICA (b)
46	IMPIANTI DI ILLUMINAZIONE PUBBLICA
47	TEATRO GIUSEPPE VERDI - VIA DEI LIVELLO 32

RESULTS & CONCLUSION

PED.EF identifies Enabling Factors in place to support the transition to Positive Energy District, such as:

- adoption of a territorial perspective to design a successful PED strategy;
- focus on the sectorial aspect related to energy consumption at urban planning stage;
- focus on strategies related to environmental impact;
- effective legal and regulatory framework.

To support PED transition: *connect the dots!;* linking projects to strategies which support their implementation.



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WG2

TECHNICAL FEASIBILITY OF A MEDITERRANEAN PED IN ALCORCÓN, SPAIN

Technical feasibility of converting existing Mediterranean districts into Positive Energy Districts: a methodology and case study

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INTRODUCTION

The deployment of Positive Energy Districts (PEDs) is currently facing a set of diverse and complex challenges, mainly arising from their novelty and the lack of practical experience. In that sense, there is a clear need for translating concepts and strategies into instruments that support the design, planning and operation of PEDs. The present research aims to address this gap, by introducing a methodology to assess the potential of an existing district to be converted into a PED, in the specific context of Mediterranean cities which, in addition to presenting similar climatic characteristics, share common urban pattern and habits.

OBJECTIVE

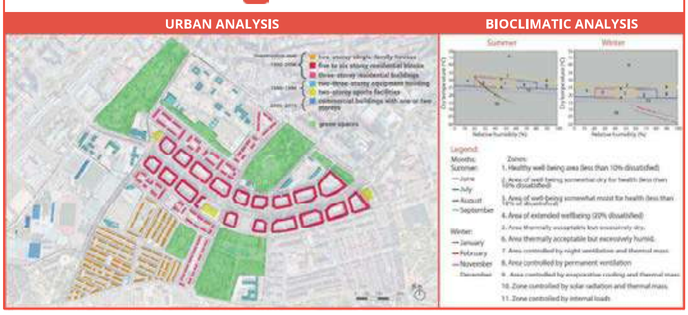
The aim of this research is to develop a novel methodology which enable estimate the PED potential of Mediterranean districts, by following a three steps process. The first step consists of analysing the initial state of the district through the study of its bioclimatic and urban characteristics, and estimation of its energy demand. Then the second step enables to select and design a set of passive and active strategies to be implemented within the district. Finally, the technical feasibility of the scenarios is evaluated by calculating their annual energy balance. The workability of the approach has been tested on a case study of a district of Alcorcón, Spain.

RESULTS & CONCLUSIONS

1 Evaluation of the initial state of the district through:

- Urban analysis, studying land use, age and typologies of buildings
- Bioclimatic analysis with the Adapted Comfort Climograph (ACC) gathering and adding data to the bioclimatic charts of Olgyay and Givoni
- Energy demand estimation based on buildings typologies and using the software ce3X

1 INITIAL STATE OF THE DISTRICT



2 Selection and design of strategies complementing and aligned with ongoing initiatives:

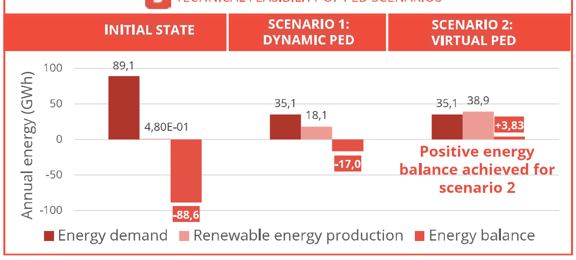
- Passive strategies to improve energy efficiency and mitigate heat island effects
- Active strategies to supply remaining energy demand

2 SELECTION AND DESIGN OF STRATEGIES

3 Evaluation of the technical feasibility of the PED scenarios, calculating:

- Reduction of energy demand
- Production of energy based on renewable sources onsite (autonomous PED or dynamic PED) or nearby (virtual PED)
- Annual energy balance

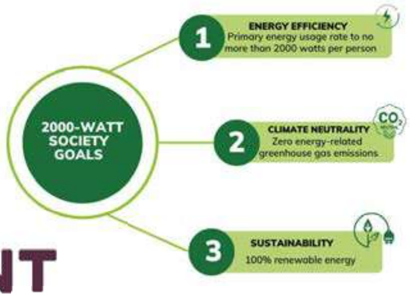
3 TECHNICAL FEASIBILITY OF PED SCENARIOS

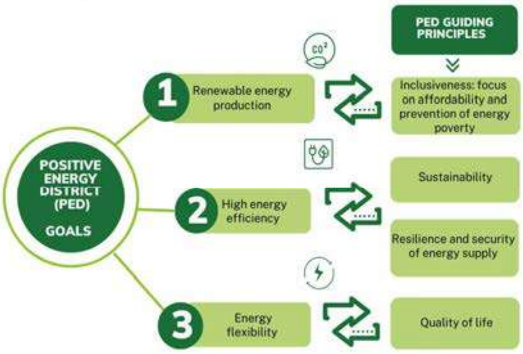


ACKNOWLEDGMENTS
The research presented in this paper has received funding from the Spanish Ministry of Science and Innovation via a doctoral grant to the second author (FPU20/07591) and from the Comunidad de Madrid through the call Research Grants for Young Investigators from Universidad Politécnica de Madrid as part of the project APOYO-JOVENES-21-LI6SVQ-77-664ZUQ.

WG1

EXPLORING PEDs: CASE STUDIES OF SUSTAINABLE URBAN DEVELOPMENT IN EUROPE





A comparative case study of EU specific and Swiss specific Positive Energy Districts (PEDs) from a Business Ecosystem Perspective

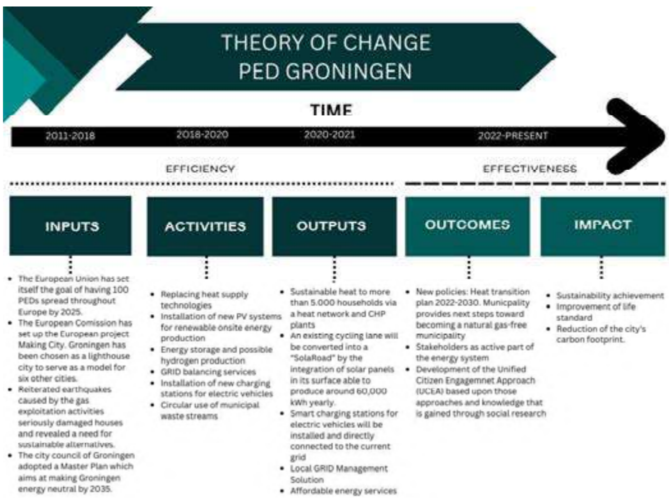
Michelle Scacco[1]; Dr. Juliana Zapata[1]; Dr. Silvia Ulli-Beer[1]
[1]Zurich University of Applied Sciences, Institute for Sustainable Development, Switzerland

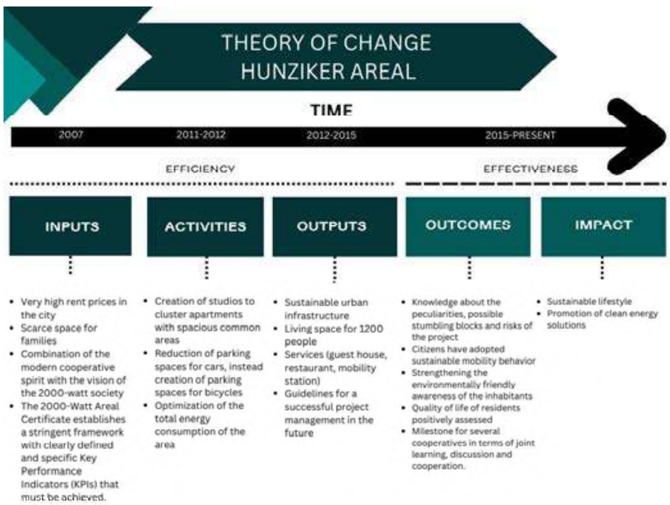
INTRODUCTION

Global energy consumption is rapidly increasing, with buildings accounting for approximately 40% of this consumption (Hassan et al., 2014), and 30% of global greenhouse gas emissions (Abergel et al., 2017). To address this issue, programs like Positive Energy Districts (PEDs) in Europe and the "2000-Watt Society" in Switzerland have been developed to enhance energy efficiency, reduce CO2 emissions, and meet climate targets.

OBJECTIVE

The objective of this study is to analyze the implementation of Positive Energy Districts through two case studies, namely Hunziker Areal in Switzerland and PED Groningen in the Netherlands. The study aims to examine the development of these ambitious programs and identify key aspects, potential scalability, and barriers using an integrative Business Ecosystem Framework (Speich, M., Ulli-Beer S., 2023). By doing so, we seeks to contribute to a sustainable energy transition by providing insights, best practices, and recommendations for the successful implementation of PEDs.





RESULTS & CONCLUSIONS

The implementation of Positive Energy Districts (PEDs) as sustainable urban development projects requires a holistic vision, encompassing policies, strategies, and resources. Case studies of Hunziker Areal and PED Groningen reveal the importance of citizen integration, sustainable building design, stakeholder collaboration, transparent communication, and continuous investment in clean energy solutions.

The co-evolutionary business ecosystem perspective provides a systematic theory of change for the PEDs.

The development and management of a common resource pool for the business ecosystem supports a competitive implementation of future PEDs. Collaboration, knowledge sharing, and research networks are essential for replication and the transition to sustainable communities.

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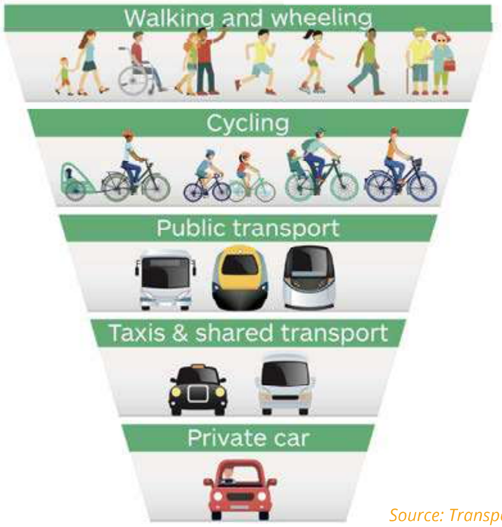
WG3

TRANSPORTATION in PEDs



Source: Transport Scotland

A Study for Importance of Transportation Modes in PEDs /Transportation in PEDs

Mine Sertsöz[1]
[1]Eskisehir Technical University, Turkey

INTRODUCTION

While there are many studies and applications on building energy management systems in PEDs, the importance of transportation modes in PEDs is one of the issues in the background. According to European Environment Agency Report, building in the EU are responsible for 40% of our energy consumption and 36% of greenhouse gas emissions. Transport is responsible for 28% of energy consumption however a quarter of the EU's greenhouse gas emissions, with road transport representing the greatest share (72% in 2019).

OBJECTIVE

In order to reduce this huge rate energy consumption and also greenhouse gas emissions -the most important-, a new perspective can be given to PEDs by establishing new laboratories and conducting studies on three main topics such as social, environmental and energy economy.

For this purpose, starting from a small scale (neighborhood, village) and then gradually expanding the area -all of Europe- urban living laboratories can be designed to emphasize the importance of transportation in PEDs.

RESULTS & CONCLUSIONS

It is aimed that these laboratories will consist of three topics, the explanations of which are given below. These three topics can be increased and expanded if needed after the project has started.

1. Social: People can be encouraged to walking, biking and using public transport. This incentive can be done by sharing with the society how they contribute to the environment and economy with their transportation choice. This is just one example of incentives and examples can be multiplied.
2. Environmental: Existing and generating new laboratories and the emission values of transportation modes can be determined and researches can be made on how to reduce them.
3. Energy Economy: How to plan the most efficient transportation for both passenger car and public transportation users? What can countries gain financially thanks to these plans?

Protocols can be prepared with municipalities, universities, local governments, and other entities in the transportation sector (vehicle manufacturers etc.) for to enhance this aim.

With the realization of these topics, it will be explained how the modes of transportation effect to amount of energy consumption and emission. Transportation, which was not taken into account before, will gain a new perspective and importance for Peds thanks to these laboratories.

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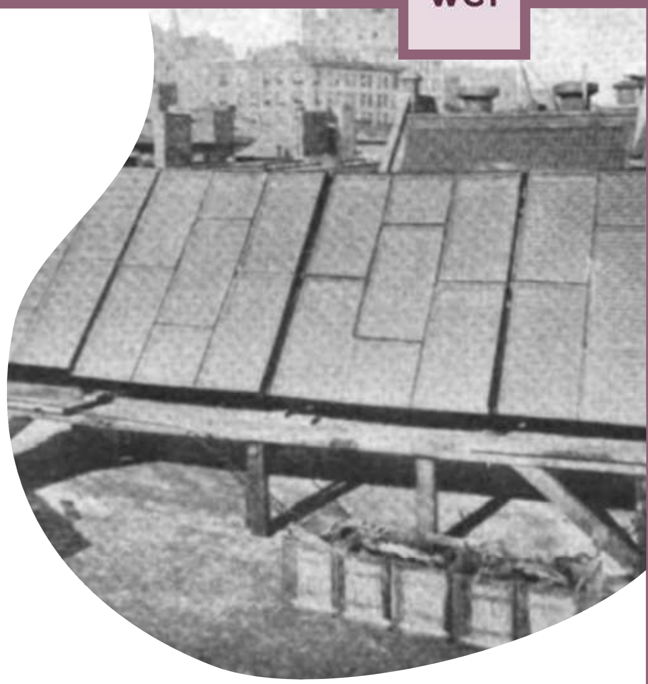
WG1

CONVIVIAL POSITIVE ENERGY DISTRICTS



Convivial Positive Energy Districts: Degrowth Socio-technical Imaginaries for Energy Futures

Shayan Shokrgozar[1]

[1]Centre for Climate and Energy Transformation, University of Bergen, Norway

INTRODUCTION

Cities consume two-thirds of the global energy supply, but much of the burden of generating this energy comes from rural areas. This dynamic has caused issues of social acceptance among agropastoral and indigenous communities, such as the Sami peoples in Finnoscandia, whose herding land is appropriated for energy production.

OBJECTIVE

Addressing the social and ecological justice concerns that arise from this unequal distribution of burden and benefits requires that cities make changes to alter their energy generation mix. This spatial transformation requires not only financial, regulatory, and legal changes but also a shift in social and technological imaginaries across sectors and amongst the citizenry. With the imperative of climate adaptation and mitigation on the horizon, and the inadequate provision of necessities such as adequate shelter, food, energy (i.e. energy poverty), and thermal comfort for all citizens, the need for new sociotechnical visions is doubly important.

RESULTS & CONCLUSIONS

To this end, exploring options for reduction and sufficiency has become a growing interest in the EU, as evidenced by the post-growth deal, challenging hegemonic and incumbent ideas and institutions. These trends call for exploring the implications of such new trajectories for urban districts and neighborhoods, focusing on what it would take to attain convivial positive energy districts. Sociotechnical futures which not only prevent de-agrarianization of rural areas for urban and industrial energy use but also prioritize the use of appropriate and convivial technologies with local supply chains.

Photos:
Top-right: George Cove's third solar panel; Literary Digest 1909.
Bottom left: Using the same supporting structure for two sources of renewable energy. InnoVentum.
Bottom right: A convivial wind turbine in an agropastoral context. InnoVentum.

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