FINAL CONFERENCE PROCEEDINGS

PATHWAYS TOWARDS GREEN TRANSITION OF EUROPEAN URBAN AREAS

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CITY MINDED
City Monitoring and
Integrated Design for Decarbonisation

Co-funded by the Erasmus+ Programme of the European Union

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CONFERENCE

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Methodology and guidelines – a roadmap for the establishment of the CITY MINDED itinerant workshops

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1. Introduction

The main objective of the Erasmus+ City Minded project was to develop and test an innovative and creative, European-scaled learning environment in which students, specialists, and stakeholders can collaborate to identify and design the best solutions for decarbonizing European cities. The methodology developed focused primarily on the analysis and potential transformation of target districts, neighbourhoods, and counties to address site-specific challenges and provide roadmaps for the decarbonization of urban areas. The sustainability of cities is currently a fundamental challenge: 75% of the world population now lives in urban areas and it will grow further in the coming years (EC, 2022a). In Europe, the urbanisation rate was 72% in 2015 (EC, 2022a) and is expected to increase to approximately 84% in 2050 (EC, 2022b). Furthermore, building stock is responsible for approximately 40% of EU energy consumption and 36% of the greenhouse gas emissions (EC, 2020). For this reasons, urban areas are the perfect testbed for energy transition and decarbonisation models. The methodology described herein was tested in four European cities during the three City Decarbonisation Itinerant Workshops (Siena - IT, Rome - IT, and Seville – ES) and the Intensive Course (Valletta – MT) carried out within the activity of the City Minded project.

2. The City Minded Methodology

The City Minded Decarbonisation Itinerant Workshops aims to address the improvement of the methodology, based on the combination of different skills, and designed as an innovative teaching and learning experience aimed at university students, Ph.D. students, and young researchers. Each workshop starts with a meeting with local stakeholders and policymakers to talk about the study area and highlight peculiarities, strengths, and weaknesses of the urban system that students will analyse. The focus of the Workshops is to design urban sustainability agendas, as well as to create the process that leads to plans definition and the learning environment in which this process takes place. This framework is the result of the sum and integration of the skills and expertise of the City Minded partnership, composed by IRENA (Istrian Regional Energy Agency), UNISI (University of Siena), UNIROMA3 (Roma Tre University), UPO (University Pablo de Olavide) and MIEMA (Malta Intelligent Energy Management Agency). Each partner has proposed a module of the methodology, which is explained to students in training sessions and applied in co-working sessions so that in a short time (usually 5 days) students may define a decarbonization roadmap of the study area.

2.1 UNIROMA3 – Community Mapping

The Place-making Module intends to provide students with basic knowledge of urban landscape interpretation, considering their different backgrounds and the variety of the neighbourhoods selected as case studies. To ensure the social sustainability of decarbonisation actions, any urban transformation, should be underpinned by the ability to read the codes, forms, and elements that shape the cityscape, and to understand their relationships with the experience, the memory, and the needs of the inhabitants. The place-making methodology has been addressed to define strategies for the improvement of the urban environment, putting in place adaptation measures to climate change and decarbonisation pathways. The method is divided into different phases: a) experience; b) analysis; and c) strategies. Therefore, the first step is the acquisition of basic knowledge of the study area, through training lessons (aimed at providing the basic tools for reading and analysing the context), and field visits of the study area during which students can annotate, sketch and pin down the significant elements of the area or conduct surveys to the population. Then the mapping of the mobility system, the build-up landscape, green urban areas, and the network of public spaces and services with all the values and criticalities of the study area is reported. The students can provide a community map to record and represent the spatial knowledge of local communities, their experience, and scientific features. Thanks to a simplified SWOT analysis, students can list the Strengths, Weaknesses, Opportunities, and Threats of the case study. In this way, they were able to identify on a satellite map three main features: barriers (natural and artificial), connections (ecological and mobility), and key elements (main natural spaces, derelict areas, and public spaces). Finally, students developed a more critical thinking exercise, during which they devised objectives and actions for the urban improvement of the urban area and highlighted on the map possible solutions for mobility (e.g., soft mobility and sustainable transport connections), green infrastructure (e.g., green areas, parks, community gardens, green corridors) and public space (squares, co-working hubs).

2.2 UPO – The Vulnerability Index

This Module wants to introduce students to the nature of risk through the assessment and analysis of vulnerability in different case studies. Vulnerability assessment has become one of the main tools for preventing and mitigating natural hazards' effects on society, the economy, and the environment. The proposed method is based on the framework adopted by Intergovernmental Panel on Climate Change (IPCC) that defines vulnerability based on three main components: Exposure, Sensitivity, and Adaptive Capacity (Vulnerability = Exposure + Sensitivity - Adaptive Capacity) (IPCC, 2012; 2014). It was applied and tested throughout different research projects with several applications in the river basin scale (droughts and floods) and in urban areas (heatwaves) (Vargas & Paneque, 2017; 2019; Martín & Paneque, 2022; Vargas, Olcina & Paneque, 2022). A specific methodology to calculate a vulnerability compound index is used to evaluate a) vulnerability assessment; b) analysis of the causes that generate the vulnerability. After that, the vulnerability structure triangle is applied, to analyse the causes of vulnerability and compare results. Due to the multidimensional nature of the vulnerability, are used data of different type (social, physical, environmental, institutional, and economic) and source (official database, surveys, interviews, official reports, etc.). The first step is to select the variables and indicators to characterize each of the vulnerability components and calculate the value of the indicators. Afterward, the indicators are normalized on a scale from 0 to 1. Then, a weighting of the drivers is applied to integrate them into the different Indices of Exposure, Sensitivity, and Adaptive Capacity which contribute the same weight to the composite index, i.e., the Vulnerability Index (VI), which quantifies the vulnerability level (from very low to very high) of each case study. Each students group selected a case study for which calculate VI by following a series of steps. Starting from the calculated indices, that compose the Vulnerability Index, it was analysed how the VI is structured, evaluating how each of the components influences its final value. This allows a first approach to the causes that generate vulnerability. Once each group had calculated the VI for their case study, the results were shared and the index values for each district compared.

2.3 UNISI – The Carbon Accounting Methodology

This Module aims to quickly assess the Carbon Footprint (CF) mitigation of an urban neighbourhood, above all quantifying the current and direct Greenhouse Gases (GHG) emissions and removals of the study area, and then estimating the effects of action plans toward carbon neutral status. The combination of new devices and technologies, as well as other measures related to citizens' behaviour and initiatives organized by local staff and administrations provide the opportunity to evaluate the effects of different solutions and mitigation plans. The visual approach developed (i.e., maps and Equivalent Forest game) is a useful communication tool for a wide audience, such as citizens, policymakers, companies, and other local stakeholders. This method is inspired by the IPCC Standard Methodologies for GHG Emissions Inventory of Nations (IPCC, 2006; 2019; 2021) and based on the research work carried out to adapt it to the evaluation of subnational scales, like regions, provinces, municipalities, neighbourhoods, or specific activity sectors (Marchi et al., 2012; 2017; 2018; Bastianoni et al., 2014; Maccanti et al., 2017; Pulselli et al., 2018; 2019; 2020; 2021). The method starts with the data collection, usually obtained from local administrations and operators. However, sometime much information come from national databases and official reports, which contain data that must be split to urban level applying specific downscaling parameters. The collected activity data are subsequently elaborated and aggregated. Several specific emission sectors (i.e., Energy, Industrial activities, Waste, and Agriculture, Forestry, and Other Land Use – AFOLU) and emission sources (e.g., energy use, mobility, waste, and wastewater management, and eating habits) are considered to quantify the overall GHG balance of the analysed urban district, considering both climate-altering emissions and removals. All the human activity data are converted into tons of carbon dioxide equivalent (CO^2eq) using specific emission factors (expressed in kg CO^2eq/unit activity). To better understand the climate change pressure in the study area, the CF is represented and visualized in terms of virtual forestland equivalent, i.e., the forest surface needed to absorb carbon emissions generated within the area. In the end, a sequence of mitigation measures is applied to show how they could progressively reduce the carbon footprint of the urban area potentially obtaining a net GHG balance (i.e., all the emissions are reduced towards mitigation pathways or compensated by local ecosystems uptake). A dynamic representation of the decarbonisation plan for city neighbourhoods by ‘crunching’ the virtual forestland is carried out. The "Pac-Man" game is used as a gimmick; the yellow creature appears every time a mitigation measure is applied to the neighbourhood, eating the equivalent forest squares corresponding to the amount of CO2eq emissions saved thanks to the application of the action.

Students were required to a) quantify the CF of the studied urban system; b) quantify the virtual forestland equivalent area needed to absorb total GHG emissions; c) discuss potential policies (brainstorming activity); d) simulate the CF mitigation of the City. To do this, students were equipped with an Excel file for the calculations (where activity data specific emission factors, and other conversion factors are provided), the teachers' presentations, and some scientific articles for further research.

2.4 IRENA & MIEMA – Energy efficiency and renewable energy technologies in the active service of the city decarbonisation processes

This Module ensures a systematic and comprehensive approach to expand the student’s knowledge and motivate them to analyse the study area in the terms of the existing building stock and its characteristics, focusing on the energy needs and its improvement by proposing relevant energy efficiency measures and the implementation of the Renewable Energy Sources (RES). Considering that urban areas have also expanded by the construction of new buildings, the latest requirements for new fabricated buildings are considered (called nearly-zero energy building standards, which are mandatory for all new in Europe are provided). The method starts with the analysis and presentation of a specific building and then the measures in the module are explained and proposed to reduce the consumption of energy needed for heating, cooling, lightening, ventilation, and hot water. An urban energy strategy is defined next, where four main pillars are presented: a) maximize energy efficiency, through energy renovation; b) integration of RES systems within existing buildings; c) maximize energy self-consumption using energy storage to reduce energy losses; d) carry out smart load management to decrease costs and reduce stress on the grid infrastructure. Then some solutions are presented: different types of RES for the urban environment (micro-wind, heat and power systems, photovoltaic panels, etc.); energy self-consumption and local energy communities; micro-grids and battery storage systems. The next part focuses on the identification of different building typologies within the urban area and understanding specific barriers and challenges to energy renovation and the integration of RES systems. This is followed by the presentation of a strategy for defining solutions and mitigation measures to address the challenges and barriers. The final part is dedicated to the presentation of best practices and innovative projects from different European countries concerning the integration of RES systems within buildings. Students had to select a building/group of buildings in the study area and then identify aspects of the area which have a bad energy performance and what would be the main energy consumers. Then they should propose measures to maximise the energy performance and identify challenges and mitigation measures for the implementation. The last task was to propose an implementation timeline (short, medium, long term) for the identified measures.

3. Conclusion

The methodology here presented was designed, implemented, and tested as part of the Erasmus+ City Minded project, to offer students a tool that would integrate different working methods that aim to study, improve, and implement the urban context. The four modules presented are integrated to create a framework that allows observing the context from both a qualitative and quantitative point of view. This operational tool, in addition to allowing the identification of problems, flaws, and merits of a neighbourhood, aims to identify realistic solutions and proposals to make the urban area more sustainable, smart, and, if possible, carbon neutral in the medium- to long-term. The Covid-19 Pandemic that began when the City Minded project started, put a strain on the initial structure that had been planned. Three individual 5-day workshops and a 15-day Intensive Course were planned. The events were all intended to be held in presence in different European locations, but this was only possible for the last of them. The Pandemic forced a complete revaluation and restructuring of the planned methodology, to find the most engaging and interesting ways possible for students to have remote experiences that mimicked face-to-face group work.

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