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CITY MINDED
City Monitoring and Integrated Design for Decarbonisation

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3RD CITY DECARBONISATION ITINERANT WORKSHOP - REPORT

7-11 MARCH 2022, SEVILLE

Responsible Partner:

UNIVERSIDAD PABLO DE OLAVIDE SEVILLA

GCRL Global Change Research Lab

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1. Introduction

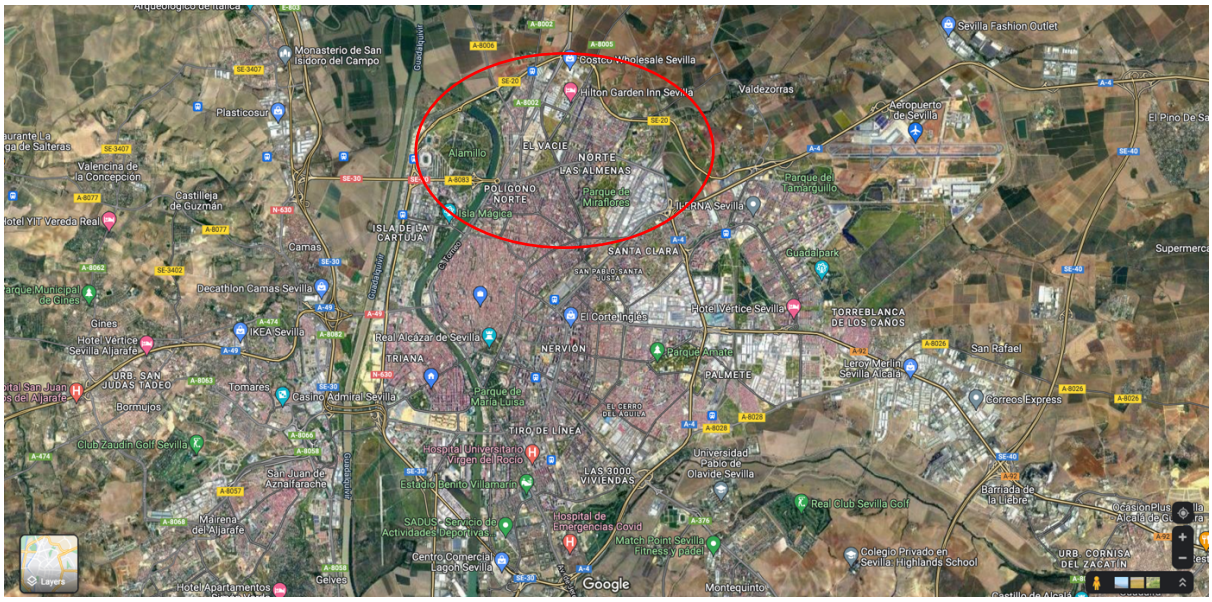
The 3rd City Decarbonisation Itinerant Workshop consisted in a virtual workshop carried out on the Bb Collaborate platform and organised by the University of Pablo de Olavide, Seville, Spain.

The objective of the workshop was to put together project partners (teachers, researchers, or trainers), students, and local stakeholders in order to address common onsite challenges and define collaborative urban decarbonisation roadmaps for Seville and the city's north neighbourhood through a 'learning-by-doing' method.

The workshop was divided into training and co-working sessions; each day 2-3 persons (teachers, researchers, or trainers) from each partner organisation (UNISI, UPO, UNIROMA3, IRENA/MIEMA) presented a training session to implement a site-specific urban decarbonisation roadmap for the selected neighbourhood.

After the training seminars, each partner organised a co-working session with practical exercises to be done by the students. On the first day, in order to better understand the target area, some relevant stakeholders were involved: Antonio García, from UPO, talked about Seville's recent development and main socio-environmental issues and Ángela Lara, from ResCities Project, about experiences of urban resilience; finally, Raúl Puente of the Comité Pro-Parque Educativo Miraflores (Miraflores Educational Park Association) presented the experience developed in the northern district of Seville about urban gardens as multifunctional nature-based solutions.

Regarding the participants, UPO succeeded in involving 7 students, from UPO's Social and Environmental PHD programme.



Seville's North District in Seville's context. Source: Google Maps.

2. Agenda

'City decarbonisation itinerant workshop'

7-11 de march 2022

PROGRAMME

Day 1 – 7th March 2022 (Spanish, translation in English)

16:00 Registration of participants

16:05 Welcome speech. The CityMinded Project (IRENA)

16:10 Introduction. Opening of the Workshop and presentation of the stakeholders (UPO)

16:15 Presentations of stakeholders (en español con traducción al inglés):

- The city of Seville: recent development and main socio-environmental issues (Antonio García, UPO)
- Civil society and climate change: experiences of urban resilience (Ángela Lara, ResCities Project)
- The northern district of the city: the urban gardens as multifunctional nature-based solutions (Raúl Puente, Comité Pro-Parque Educativo Miraflores.

17:30 Assessment and analysis of vulnerability associated with climate change (UPO)

18:15 Co-working session

19:15 Short presentation of group work results

19:45 Discussion about and conclusion of the workshop

20:00 End of day 1

Day 2 – 8th March 2022 (English)

16:00 Registration of participants

16:05 Place-making framework. Town planning, ecological networks and green infrastructure. Urban and landscape design (UNIROMA3)

17:00 Co-working session

19:00 Short presentation of group work results

19:40 Discussion about and conclusion of the workshop

20:00 End of day 2

Day 3 – 9th March 2022 (English)

16:00 Registration of participants

16:05 Carbon accounting and carbon footprint mitigation (UNISI)

17:00 Co-working session

19:00 Short presentation of group work results

19:40 Discussion about and conclusion of the workshop

20:00 End of day 3

Day 4 – 10th March 2022 (English)

16:00 Registration of participants

16:05 Energy efficiency and renewable energy technologies in the active service of the city decarbonization processes (IRENA & MIEMA)

17:00 Co-working session

19:00 Short presentation of group work results

19:40 Discussion about and conclusion of the workshop

20:00 End of day 4

Day 5 – 11th March 2022 (English)

16:00 Registration of participants

16:05 Welcome speech (IRENA)

16:10 Wrap up of the performed activities (UPO)

16:30 Presentation of the co-working session results (UPO)

17:00 Final discussion and conclusions

17:30 End of day 5

3. Participants

Name	***Surname***	***Organization***	***Day 1***	***Day 2***	***Day 3***	***Day 4***	***Day 5***
Partners							
Anna Laura	PALAZZO	UNIROMA3	X	X	/	/	X
Lorenzo	BARBIERI	UNIROMA3	X	X	X	X	X
Federica	DI PIETRANTONIO	UNIROMA3	X	X		X	X
Francesca	MONDELLI	UNIROMA3	X	X	X	X	X
Romina	D'ASCANIO	UNIROMA3	X	X	/	/	X
Simone	BASTIANONI	UNISI	/	/	X	/	/
Matteo	MACCANTI	UNISI	X	X	X	X	X
Massimo	GIGLIOTTI	UNISI		/	X	/	/
Michela	MARCHI	UNISI	X	X	X	X	X
Valentina	NICCOLUCCI	UNISI	/	/	X	/	/
Diane	CASSAR	MIEMA	X	X	X	X	X
Antonio	FRANKOVIĆ	IRENA	X	X	X	X	X
Andrea	POLDRUGOVAC	IRENA	X	X	X	X	X
Amaranta	HEREDIA JAÉN	UPO	X	X	X	X	X
Pilar	PANEQUE SALGADO	UPO	X	X	X	X	X
Josefina	LÓPEZ GALDEANO	UPO	X	X	X	X	X
Stakeholders							
Angela	LARA	ResCities Project	X	/	/	/	/
Raúl	PUENTE	Miraflores Educational Park Association	X	/	/	/	/
Antonio	GARCIA	UPO Depart. Geography, History And Philosophy	X	/	/	/	/
Students							
Jesús María	SANCHÉZ GONZALEZ	UPO, Doctorate in in Environment and Society	X	X	X	X	/
Ladjane de Fátima	RAMOS CAPORAL	UPO, Doctorate in in Environment and Society	/	/	/	/	/

Cinthya Lady	BUTRÓN REVILLA	Doctorate in in Environment and Society	/	X	X	X	/
Lara	DE ARAÚJO MIRANDA	Doctorate in in Environment and Society	/	/	/	/	/
Adrià	IVORRA CANO	Doctorate in in Environment and Society	/	/	/	/	/
Alexandra	PALOMINO	Doctorate in in Environment and Society	/	/	/	/	/
clemence	DELFAUD	Doctorate in in Environment and Society	X	X	/	/	/
Johanna Alexandra	OCHOA RUILOVA	Doctorate in in Environment and Society	/	/	/	/	/
Braulio	ASENSIO ROMERO	Doctorate in in Environment and Society	/	/	/	/	/
Alba Margarita	AGUINAGA BARRAGÁN	Doctorate in in Environment and Society	X	X	X	X	X
Germán	PABLO MIÑÓN	Doctorate in in Environment and Society	X	/	/	/	/
Andrés	MORILLO NAJARRO	Doctorate in in Environment and Society	X	X	X	X	X
Irvy	PINZON PULIDO	Doctorate in in Environment and Society	X	X	X	X	X
Mateo Fernando	COELLO SALCEDO	Doctorate in in Environment and Society	X	X	X	X	X
Nuria Pilar	PLAZA MARTÍN	Doctorate in in Environment and Society	X	X	X	X	X
Carlos	DURÁN TORRES	Doctorate in in Environment and Society	X	/	/	/	/

Anupoma Niloya	TROYEE	UPO – Marie Curie Fellowship	X	X	X	X	X
Eliana Maria	MALDONADO GARCIA	Doctorate in in Environment and Society	X	X	/	/	/
Eduardo	ZAMBRANA ASENCIO	Doctorate in in Environment and Society	/	/	/	/	/
Nelson Andrey	NAVAS GALLO	Doctorate in in Environment and Society	X	X	X	X	X

4. Report from the workshop

Preliminary considerations: structure of the workshop, sequence of the modules, participation

The structure of the Seville's workshop was very similar to the one implemented in Siena and Rome: a first half-day dedicated to the presentation of the hosting city and of the target area, followed by the training and co-working sessions conducted by the hosting organization; three half-days dedicated to the training and co-working sessions conducted by the other partners; and a final half-day dedicated to a wrap-up of the results achieved and of the problems incurred, which involved both partners and participating students.

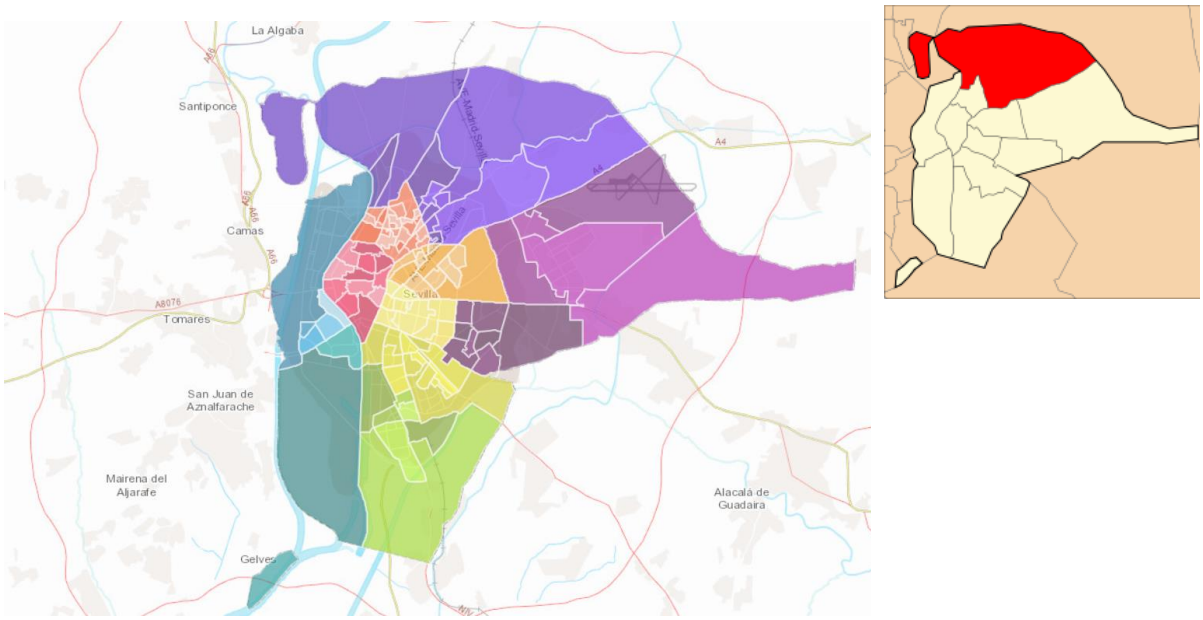
The same procedure was applied to each 'block' of training and co-working session (that is, to each Module): first, a series of presentations on the 'topic of the day' (reflecting each partner's expertise) delivered during a plenary and ending with a Q&A moment; afterwards, students were divided into groups and each group worked in a different virtual room, assisted by one delegate from the partner in charge of the session and (if needed) by one delegate of UPO. Once the group work finished, students and partners' delegates returned to the main room and a spokesperson for each group presented the results achieved in a plenary, triggering further discussion.

Since this time the hosting organisation was UPO, the first Module was dedicated to Vulnerability Indicators. This allowed establishing a clear connection with most of the topics addressed during the stakeholders' session, and provided a general territory-based framework for the following modules.

UPO succeeded in involving 7 students, of them PhD UPO students. The maturity of students and background of participants was a value added for the workshop, allowing for a high degree of knowledge transfer during the co-working sessions.

Case Study

The North Municipal District is strongly characterised by the development of the infrastructures that surround it and that have crossed it during its history. The SE-30 Ring Road (or Ronda Urbana Norte) to the south, the Ronda Super Norte Ring Road and the railway network to the north, the Guadalquivir's Dock and, formerly, the railway to the west, and the Miraflores Park to the east. Large industrial areas and storage buildings, as well as the huge plot of the cemetery occupy the heart of the area, sharply separating the two large inhabited areas. This separation is increased by the high-speed traffic access roads to the city, leaving the neighbourhoods of Pino Montano, San Jeronimo and La Bachillera isolated, as well as the settlement of El Vacie, which separates the Ronda Urbana Norte from the rest of the neighbourhood at which it belongs (Los Príncipes-La Fontanilla, Macarena district).



Seville's Neighbourhoods (North District in red). Source: Seville City Council

The origin of the San Jeronimo neighbourhood must be sought in the development of a primitive rural nucleus that emerges next to the La Algaba path at the sheltered by the Monastery of San Jeronimo de La Buena Vista, this first axis of single-family homes can still be recognised along the axis of Navarra Street, coexisting with large industrial facilities and collective housing actions, which are occupying what used to be land for fertile orchards, such as the neighbourhoods of San Jeronimo or La Papachina.

The creation of the great SE-30 and Super Norte Ring Roads have greatly changed the neighbourhood's connections while at the same time establishing real physical barriers that are difficult to cross on foot or by means of non-mechanised transport.

The form of urbanisation in the case of San Jeronimo has been conditioned by the radial position of the main roads that have articulated it. It represents a very heterogeneous set of buildings, where the public space is constituted as residual, although it has one of the city's

great urban parks, such as San Jeronimo Norte and, on the other side of the Dock, the Alamillo Park. There are therefore four types of housing in this area: a) Pseudo-rural typology, b) The expansion in a closed block (Barriada de San Jeronimo in the 1950s), c) Isolated high-rise housing (barriada de La Papachina), and d) New developments in San Jeronimo in the 90s with a single-family semi-detached house, an isolated block and a closed block.

To the southwest of San Jeronimo there is the neighbourhood of La Bachillera. This neighbourhood organises its growth between two of the historic roads leading out of the city towards La Vega: La Algaba and Alcalá del Río. It sits on the old Villacuernos estate, ceded to the Seville Charity Association in 1948. At that time there were some 12 dairy farms and shacks and the association gradually transferred the land on a rental basis, to the neighbours who began to build their properties. At first, they were immigrants from rural areas. It wasn't until the 1960s that they had access to running water in their homes. The streets remained earthen until 1977. Emerging from a colonising process (occupation of disparate portions of agricultural land, with different degrees of silting), this neighbourhood leaves the road and public spaces with a clear residual character. It is surrounded to the north by an orchard and an electrical substation. It is a self-built neighbourhood with substandard housing characteristics and poor urban habitability conditions, which has generated a certain marginality among its inhabitants.

El Vacie is a slum settlement, the oldest in Europe, where around a hundred families live and which occupies the east side of the cemetery within the neighbourhood, adjoining the wall surrounding it and on land planned for the expansion of the cemetery and part of the Soledad Becerril park, which has prevented the execution and use of the road that borders it, extension of the street, and its maintenance and use.

Pino Montano had a similar origin to San Jeronimo, around the railway development of the Sevilla-Cordoba line. In the 1980s, it grew with new ordered streets as a result of more modern planning and higher quality housing. On the occasion of the Universal Exhibition of 1992, public investments intensified, eliminating the old railway network that ran parallel to the Dock, and recovering the river and its promenade for the city, which had an enormous impact on the development of the neighbourhood, recovering spaces that have been redeveloped like the San Jeronimo Park, in the extreme northwest, and the entire fluvial edge.

Local Stakeholder Engagement

For this workshop, UPO involved the following stakeholders:

- Antonio García, from UPO, talked about Seville's recent development and main socio-environmental issues
- Ángela Lara, from ResCities Project, about experiences of urban resilience;
- Raúl Puente of the Comité Pro-Parque Educativo Miraflores (Miraflores Educational Park Association) presented the experience developed in the northern district of Seville about urban gardens as multifunctional nature-based solutions.

Training sessions

UPO

The UPO team made one presentation on the 7th of March: "Assessment and analysis of vulnerability associated with climate change" by Jesús Vargas (UPO).

The presentation was structured in two parts of approximately 20 minutes each. The first part was a theoretical presentation used as an introduction to the subsequent exercise. This theoretical introduction focused firstly on the main effects of climate change in Spain. Climate change forecasts predict an increase in the frequency and intensity of natural hazards in Spain, among the most serious droughts, floods, and heat waves (IPCC, 2022). This was followed by an introduction to the main strategies for combating climate change: mitigation and adaptation. Afterwards, and as a complement to the rest of the workshop exercises, more focused on mitigation, an approach to adaptation strategies based on risk mitigation was carried out. For this purpose, the risk reduction framework proposed by the IPCC (2012) was presented, with the adaptations to this framework made in the last IPCC assessment report (2022). This framework defines risk as the probability of suffering damage or loss, because of the interaction between natural hazards and vulnerable conditions, where vulnerability is defined as the propensity or predisposition to be adversely affected. The objective of this introduction is to make an approach to the hybrid nature of risks, in which the interaction between natural events and social processes are related to generate risk situations. This framework introduces the importance of the vulnerability component in reducing risk and guiding climate change prevention and adaptation strategies that should complement mitigation strategies.

The second part laid out the theoretical framework of vulnerability assessment and analysis that was to be used in the co-working session The workshop focused especially on 1) Establishing a method that allows students to understand the different components and dimensions of vulnerability. What and why it is important to analyse; 2) Introducing students to the different research techniques, tools and data sources; 3) Training the calculation of composite indices, the representation, comparison and analysis of the results; and 4) Emphasizing the importance of not only measuring vulnerability but also analysing it. This is based on a theoretical introduction to vulnerability and its main components.

$$Vulnerability = Exposure + Sensitivity - Adaptive\ capacity$$

Where;

- Exposure = those elements (human, natural and physical) that can be affected by a natural event.
- Sensitivity = those conditions of the affected system that make it more likely to suffer damage because of a natural hazard
- Adaptive capacity = characteristics and capacities that allow a society to confront hazards while the natural phenomenon is happening (short term response), and those that are part of an ongoing process of learning,

UNIROMA3 - Place-making framework

The team made three presentations on the 8th of March:

- "Introduction to town planning" by Dr. Lorenzo Barbieri.
- "Ecological Networks and Green Infrastructure" by Dr. Romina D'Ascanio.
- "Urban & Landscape Design" by PhD candidate Francesca Paola Mondelli.

The first lecture was structured similarly to the one held in Siena during the first decarbonisation workshop, and differently than the one held in Rome during the second workshop. The students had to be introduced to planning topics because had little knowledge on the subject from their previous studies.

After an introduction to the place-making approach and to the concept of decarbonisation, the presentation focused on town planning and provided an introduction to the topic with a short video extracted from the TV series "The Hitchhiker's Guide to the Galaxy", which highlights how sometimes planning decisions look like they are remote and not taking into account their effects on the general population. An explanation of the video followed, underlining that the video shows how planning should not be, and that new approaches, such as community involvement, strive to improve the administration's communication skills and to increase the involvement of inhabitants.

The lecturer then went on to focus on two topics: planning tools in Spain and mobility issues in general, both with a focus on Seville. With respect to the former section, firstly the focus was on the main plans available in Spain, with some examples in Seville: the PGOU for the city as a whole and the sustainable development strategy for the northern district (EDUSI) that is the target area of the workshop. The focus then shifted to the issue of mobility, in particular the first and last mile of a trip. Finally, the public transport context in Seville was described.

The seminar was intentionally generic, as it aimed to paint a picture of town planning to students that had no previous knowledge on the topic. It provided a basis on which the following seminars and the co-working session built on.

The second presentation aimed at explaining the concept of Ecological Networks (EN) within spatial planning and the new approach to Green Infrastructure.

On the ecological perspective, EN can be considered as an interconnected system of habitats whose biodiversity needs to be safeguarded. Thus, the focus is on animal and plant species that are potentially threatened. The geometry of the network has a structure based on core areas, buffer zones and corridors that allow the exchange of individuals in order to reduce the extinction risk of local populations. The EN aims to mitigate habitats fragmentation and ensure the permanence of the ecosystem processes and the connectivity for sensitive species.

The *Plan director para la mejora de la conectividad ecologica en Andalucia* was illustrated in its layers of ecological corridors, Natura 2000 sites, protected areas and strategic axis.

If EN follow a mainly biological and ecological approach, green infrastructure represents an innovative way in which the benefits to communities produced by nature are taken into account in spatial planning. The EN concept has evolved over the years into the more

comprehensive Green Infrastructure framework. Green infrastructure (GI) is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services (EU, 2013).

GI were explained in detail, with references to the scientific literature, especially as regards their multifunctionality and transcalarity. GI serves the interests of both people and nature and has the potential to tackle several problems simultaneously in alternative to traditional grey infrastructure. The GI approach provides multiple functions and benefits to the communities, matching ecological, social, cultural and economic issues at different scales.

The *Estrategia Nacional de Infraestructura Verde y de la Conectividad y Restauración Ecológicas* (2021) and the document *Ciudades Inteligentes y sostenibles. Infraestructura verde y hábitats urbanos integrados* (2020) were introduced.

Furthermore, the French 'trame verte et bleue' strategy was explained as a good practice to take GI in spatial planning. It is a national spatial planning tool aimed at stopping the decline of biodiversity by conserving and restoring ecological continuities to ensure provision of ecosystem services.

Finally, in order to give some insight for decarbonisation at urban scale using GI, some examples of nature-based solutions were given.

The third presentation focused on landscape and urban design strategies for urban decarbonisation, and was divided into five parts.

In the first part, a definition of landscape was provided, underlining how it is structured through the interaction between nature and history. From this broader definition, we moved on to include everyday landscapes, and therefore the concept of proximity, referring to Article 2 of the European Landscape Convention.

In the second part, we focused on providing a dimension of proximity, applying the different radius of influence (from the widest one of 1 Km to the narrowest one of 200 m) on the Norte District in Seville.

In the third part, we presented two famous European good practices in the design of public space of proximity: the "Ville du quart d'heure" (15-minutes city) in Paris, and the "Superblocks" model in Barcelona (Plan Superilles).

The 15-minutes city is an urban regeneration strategy that aims to put the inhabitant at the centre of design, by improving the functional mix of the neighborhood, increasing the amount of green space, and encouraging bicycle and pedestrian mobility, to the detriment of the car.

The case of Paris was presented, showing the main features that characterize the *Ville du quart d'heure*: sustainable mobility (according to the "Plan Vélo"); access to basic services (employment, health care, supplies, learning and recreation); transformation of open spaces through a tactical approach (as for the case of the project "Le Cour Oasis", redesigning schools courtyards to provide new public spaces to the neighborhood).

The case of Barcelona takes advantage from the existing city grid, organizing traffic so to move car traffic to streets outside the neighborhood. In this way, the Plan Superilles guides the

transformations of all open spaces in the city, with the aim of moderating the use of cars by returning to citizens a greener, healthier, safer public space that encourages social interaction and local economies.

In the fourth part, the structure of the Norte District target area was analyzed, to evaluate the applicability of the 15-minutes city model therein. The landscape of the district was broken down into its four main components: orography and hydrography, as far as natural systems are concerned; infrastructure and urban fabric, as far as anthropic systems are concerned.

In order to allow a deeper analysis of the neighbourhood during the co-working session, two relevant schemes were provided: that of the Bike Lanes Network in Seville, and that of the Public Schools. These, indeed, can be considered as a basis to implement the network of proximity in the Norte District, in order to reduce the use of the car.

UNISI Calculation of Seville's Carbon Footprint

The UNISI contribution to the Training session, consisted in two presentations carried out on 9th March 2022:

The first one was "Urban Carbon Accounting – Seville" held by Dr. Matteo Maccanti,

The work carried out consisted of a brief presentation of the climate change related to the increase of greenhouse gases in the atmosphere and the consequent Global Warming. In this context, the Carbon Footprint has been identified as the best methodology to account for and describe the state of territory in terms of levels of greenhouse gases emitted directly or indirectly.

Then the presentation moved on to a more detailed description of the Carbon Accounting Methodology developed and applied during the previous City Decarbonisation Itinerant Workshops in Siena and Rome, with a brief historical account of the logical and working path that led to this framework. It was illustrated that the developed framework is inspired by the IPCC Standard Methodology for GHG Emissions Inventory of Nations, and the implementation carried out by Ecodynamics Group researchers during many projects carried out over the years, including, most notably, the EU FP7 City-Zen Project.

After that, the operational procedure being followed was explained: data collection (from different activity sectors and emission sources); data elaboration; quantification of the Carbon Footprint of the study area (expressed in tons of CO_2eq), using appropriate Emission Factors (EFs); calculation of the area (expressed in hectares) of Equivalent Virtual Forest that would be required to absorb emissions; identification of a set of Mitigation Measures that would avoid or offset emissions; and quantification of the emissions avoided through each proposed action.

Then, the case study (the whole city of Seville), the specific data regarding the electricity, fuel for heating and cooling, fuel for car consumption, and waste and water management, were presented to the students.

Next, the calculation of Seville's Carbon Footprint for each activity sector and emission source was presented; this was also visualized in terms of the Virtual Forestland Equivalent that

would be required for the absorption of emissions. The assessment also allowed for showing the typical household of Seville as a functional unit for assessing the impact of the city and the mitigation scenario, and to compare results with the work carried out in Siena, Rome, and for a typical European household.

After that, the evaluation of a mitigation scenario with a series of measures and actions concerning different spatial (from the household to the whole city) and time scales of implementation (short-, medium-, and long-term mitigation measures, which can be applied in 10-20-30 years) was performed. In the end, a graphical representation of the "decarbonisation" plan for city neighbourhoods by 'crunching' the virtual forestland was carried out, using the Pac-Man Game as a visual tool.

The second presentation called "Carbon Footprint evaluation of the municipality of Seville and possible Mitigation Measures" was held by Dr. Michela Marchi covered the explanation of the exercise that students would go through in the co-working session.

The purposes of the exercise, what the Carbon Footprint is, and a summary of the working framework were briefly explained.

Then the various exercises required of the students were explained, with an illustration of the different equations that were to be used to calculate the Carbon Footprint, the Equivalent Virtual Forestland, and the Mitigation Measures.

Next, the various sheets of which the Excel file that is provided to the students is composed and the various calculations to be performed in the calculation boxes (highlighted in yellow to make them recognizable) were then described in detail. Following this presentation, after a short break, the co-working session began.

IRENA & MIEMA

The energy agencies IRENA and MIEMA presented the following topics on the 10th March:

- "Energy Efficiency in the active service of the City Decarbonisation processes" by Andrea Poldrugovac, IRENA
- "Renewable Energy technologies in the active service of the City Decarbonisation processes", by Diane Cassar, MIEMA

The first presentation focused on the topic of energy efficiency, with particular focus on the building stock of the City of Seville and its energy-efficient improvement by sharing the knowledge about energy efficiency, by detecting potential problems and identifying solutions during the Co-working session and by defining energy efficiency measures which will act as an integral part of the urban decarbonisation roadmap for the target neighbourhood. The presentation was divided into six chapters: presentation of the working group, energy efficiency in the active service of the city decarbonisation process, energy efficiency measures, nearly zero-energy buildings, energy refurbishment of heritage buildings and how to finance renovations. The focus of the session was on how to achieve energy-efficient buildings in the City of Seville. Among different energy consumers in the urban areas, buildings were chosen since the building stock is responsible for approximately 40% of EU energy consumption and

36% of the greenhouse gas emissions. As regards the City of Seville, according to the available data, more than half of the city's building stock was constructed in the period 1960-1989 which leads to a very large energy demand, both in the summer and winter periods due to the lack of energy efficient measures. Buildings are the single largest energy consumer in Europe and about 35% of the EU's buildings are over 50 years old and almost 75% of the building stock is energy inefficient. Unfortunately, only about 1% of the building stock is renovated each year and this number will have to change rapidly in the following years if the targets set in the EU Green Deal are to be achieved. One of the latest and most important initiatives, the "Renovation Wave" was presented to the students, which represents a flagship initiative of the EU Green Deal and of the Next Generation EU recovery plan. The ambition of the Renovation Wave is to rapidly double the current renovation rate of buildings to boost climate protection and circularity while creating thousands of new jobs. To achieve planned targets, it is necessary to conduct relevant energy efficiency measures, which were presented to the students in five typical categories aimed to reduce heating demand, cooling demand, energy requirements for ventilation, energy use for lighting and energy used for heating water. The theoretical session was concluded with presenting what are "Nearly zero-energy buildings (NZEB)", how to conduct energy refurbishment of heritage buildings and at the end how to finance the renovations.

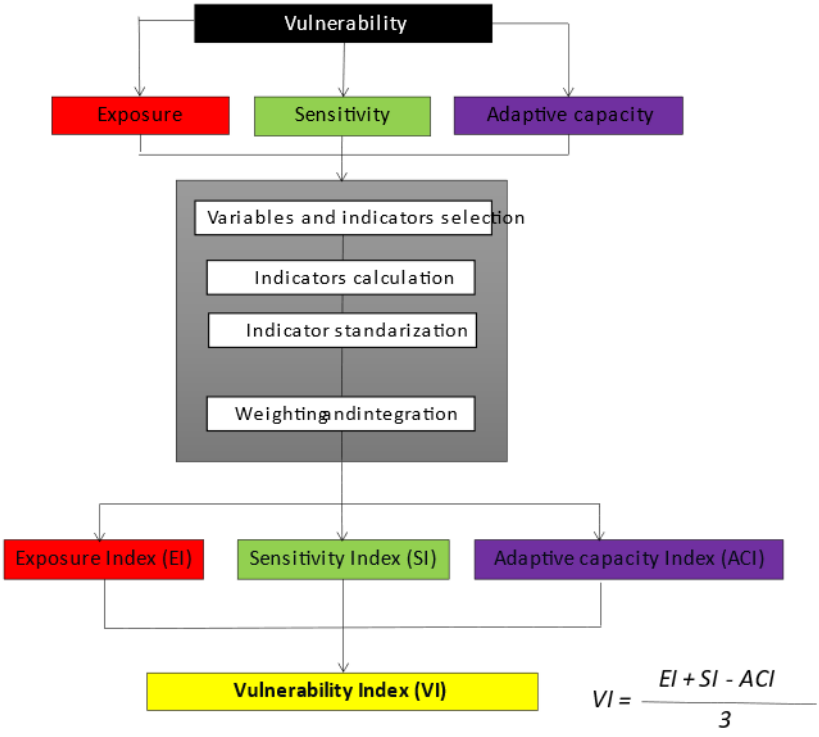
The second presentation focused on the integration of renewable energy systems within the urban environment. The following six main topics were presented: urban energy systems and the urban energy strategy, renewable energy technologies, prosumers and self-consumption, urban micro-grids and energy communities, identification of different building typologies and challenges to energy renovation, and an overview of the energy auditing processes. Photovoltaic panels, micro-wind turbine and combined heat and power plants were presented as different types of renewable technology that can be used within the urban scenario for the generation of clean energy by integrating the systems within existing buildings. A number of best practices from Malta and other European countries in relation to the integration of RES for self-consumption were also presented. These included building-integrated photovoltaic systems, PV facades, solar parking shading devices and geothermal heat pumps. Photovoltaic technologies (conventional panels and BIPV), micro-wind and combined heat and power systems were presented as possible solutions to be integrated in different building types within the City of Seville. The potential of energy storage solutions and smart micro-grids were also discussed to further maximise self-consumption of energy produced through renewable energy technologies within the buildings.

Co-working sessions

UPO

The exercise proposed completed the theoretical introduction.
This exercise was divided into three complementary parts: vulnerability assessment, vulnerability analysis and results debate. The starting point was the risk equation (risk = hazard * vulnerability). To assess vulnerability, we adopted the methodological framework proposed by Intergovernmental Panel on Climate Change (IPCC) (2012,2014) which defines vulnerability based on three main components: Exposure, Sensitivity, and Adaptive capacity. Figure 1 shows the methodological proposal to assess vulnerability.

Figure 1. Methodological framework



For the case study of Seville, the scale used for the analysis was the municipality (as opposed to the cases of Siena (regional scale) and Rome (province scale). Although the theorical framework is the same used on Siena and Roma workshops, work scale conditions the availability of data, so the variables and indicators used to characterize vulnerability have been adapted. To calculate each components a set of variables and indicators were selected. These variables and indicators were selected based on two criteria: 1) availability of data; 2) that were diverse enough to capture the multidimensional nature of vulnerability (social, natural, economic, institutional, and technological) and allow students to train different tools and research techniques and data. Tables 1, 2 and 3 present the set of indicators selected of each component.

Table 1. Exposure variables, indicators, and units of measure.

Exposure	**Population**	**Population exposed** (Total municipality population/total province population)	**%**
	Housing stook	**Housing stock exposed** (Total municipality houses/total province houses)	**%**
	Forestry areas	**Forestry areas exposed** (Total forestry areas/total area)	**%**

Table2. Sensitivity variables, indicators and units of measure.

Sensitivity	**Population**	**Unemployment rate** (Number of unemployed people/total active population)	**%**
	Population	**Dependent population** (Population under 16 and over 65/ total population)	**%**
	Housing stook	**State of the Building** (number of ruinous + bad + deficient residential buildings)/(number of total residential buildings)	**%**
	Green areas	**Forestry protected areas** (Protected areas surface/forestry surface)	**%**

Table 3. Adaptive capacity variables, indicators, and units of measure.

Adaptive capacity	Climate change planning	Municipality adaptation plan	0-1
	Emergency planning	Municipality emergency plan	0-1
	Education	Education level	%

	Climate change and natural risk perception	CC and Risk Perception	0-1 (trough survey)
	Institutional Trust	Institutional Trust	0-1 (trough survey)

The students were divided into three groups, each of which calculated the vulnerability index for one municipality (Guillena, Gerena and Guadalcanal). The following material was distributed to guide the exercise.

- Instruction form (PDF document): Step-by-step instructions to find the required information and perform the calculation of each of the indicators.
- Result form (Excel document). Template for the presentation of the results.

Once the indicators of each component were calculated we used the triangle structure of vulnerability (adapted from Liu et al. 2013) to analyse the contribution of each component to the final vulnerability value. Finally, the results were presented.

Results

Figure 2 shows the vulnerability assessment results for each study case (exposure index, sensitivity index, adaptive capacity index and the final vulnerability compound index).

Figure 2. Vulnerability Index results

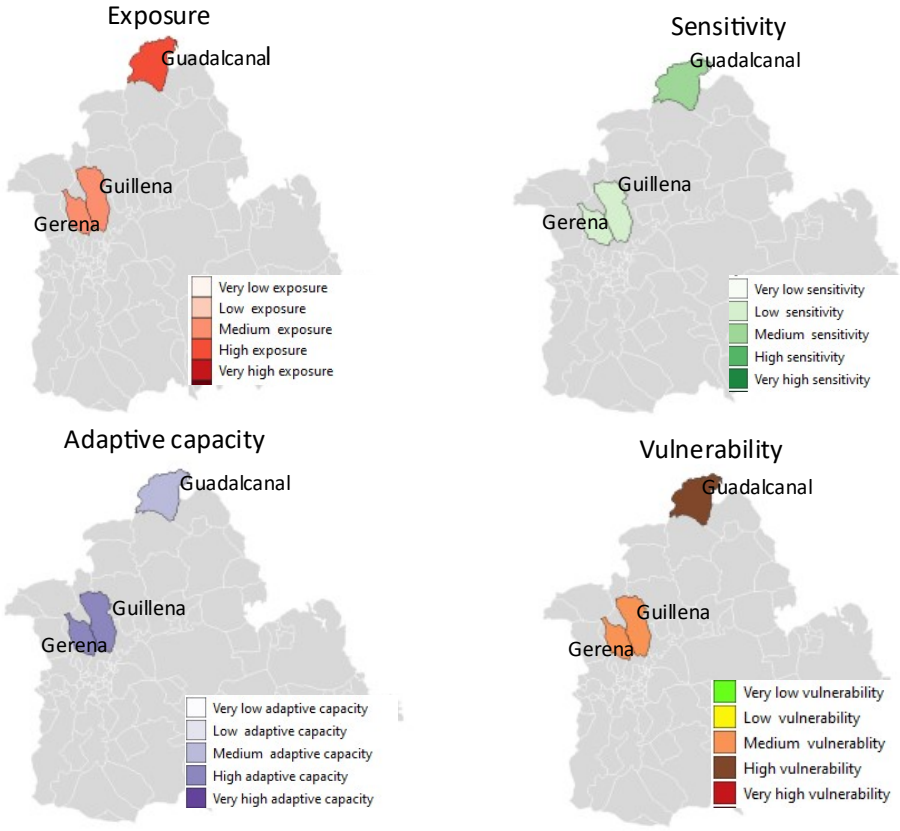
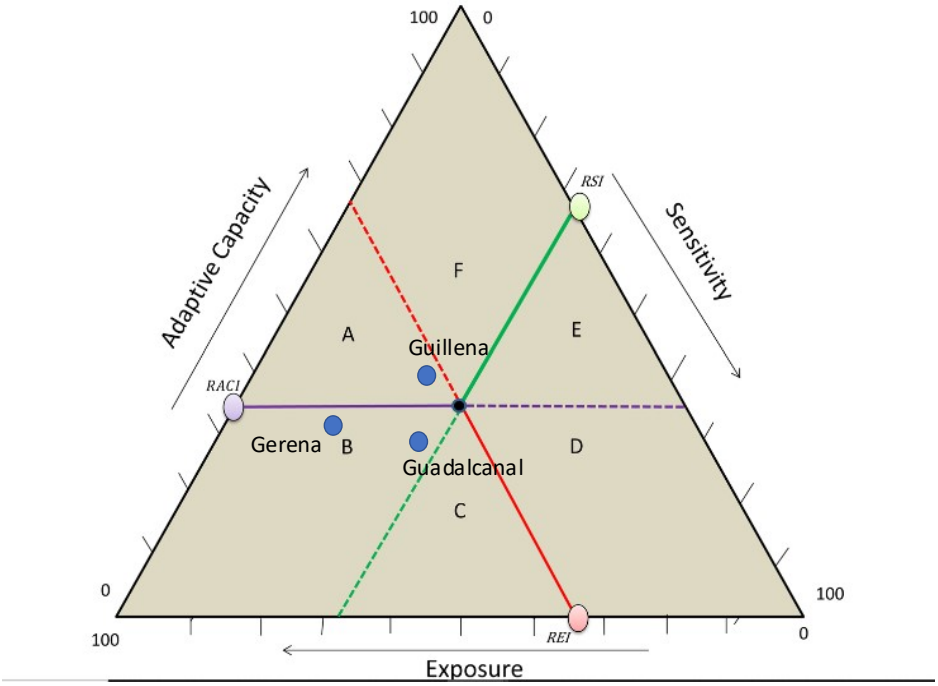


Figure 3 shows the vulnerability structure triangle wit result of three study cases
Figure 3. Vulnerability structure triangle results.



References

IPCC (Intergovernmental Panel on Climate change) (2012). Managing the risks of extreme events anddisasters to advance climate change adaptation. In: Field CB, Barros V, Stocker TF, Qin D, DokkenDJ, Ebi KL, Mastrandrea MD, Mach KJ, Plattner G-K, Allen SK, Tignor M, Midgley PM (eds)Available from Cambridge University Press

IPCC (Intergovernmental Panel on Climate change) (2014). Summary for policymakers. In: Field CB, BarrosVR, Dokken DJ, Mach KJ, Mastrandrea MD, Bilir TE, Chatterjee M, Ebi KL, Estrada YO, Genova RC,Girma B, Kissel ES, Levy AN, MacCracken S, Mastrandrea PR, White LL (eds) Climate change 2014:impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. Contribution of workinggroup II to the fifth assessment report of the intergovernmental panel on climate change. CambridgeUniversity Press, Cambridge

IPCC, 2022: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

Liu X, Wang Y, Peng J, Braimoh A, Yin H (2013). Assessing vulnerability to drought based on exposure,sensitivity and adaptive capacity: a case study in middle Inner Mongolia of China. Chin Geogr Sci23(1):13–25

UNIROMA3

The co-working session introduced the concepts of decarbonisation and urban environment and used the tools of community mapping and SWOT analysis in order to set a place-making framework to plan and design green infrastructure for decarbonisation at local scale, and define objectives and action for future strategies. The team adopted a wide perspective on decarbonisation, by including those aspects that highlight its connections to other topics:

- town planning, because the structure of a city can influence decarbonisation;
- climate change, because the reduction of greenhouse gas emissions mitigates its effects;
- green infrastructure, as their employment serves as a means to achieve decarbonisation.

Community mapping can be defined as a way to make citizens express their views on the development of their neighbourhood. It is a set of approaches and techniques that combines the tools of modern cartography with participatory methods to record and represent the spatial knowledge of local communities.

The SWOT analysis is method adopted to define the development of regional and urban intervention, which derive from an enhancement of the strengths and a containment of the weaknesses in the light of the framework of opportunities and threats that usually derive from the external situation. SWOT analysis is designed to facilitate a realistic, fact-based, data-driven look at the strengths and weaknesses.

The co-working session aimed to produce an urban analysis on the three aspects highlighted in the training session: mobility, green infrastructure, public spaces. Therefore, students were divided into two groups, where they worked together on four qualitative exercises divided in two sessions: the first one more analytic, the second one more strategy-oriented.

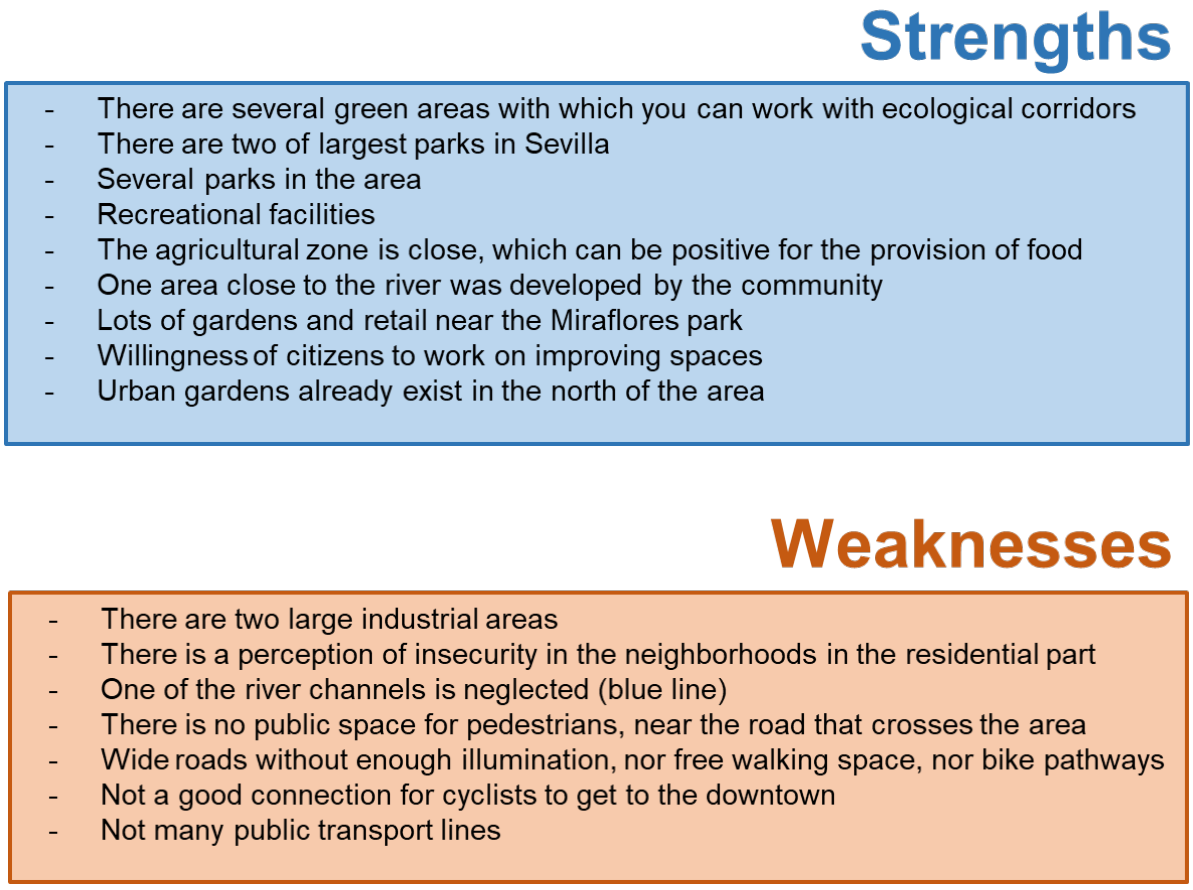
In the first session, students were asked to highlight strengths and weaknesses of the target neighbourhood, in a sort of simplified SWOT, and to identify on a satellite map three main features: barriers (natural and artificial), connections (ecological and mobility) and key elements (main natural spaces, derelict areas, public spaces).

In the second session, based on the analysis, students developed a more critical thinking exercise, during which they devised objectives and actions for the urban improvement of the district, and highlighted on the maps 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).

Both groups produced interesting results, taking into account that they did not have a background in town planning and many did not know the area well. However, each group had at least one member who lived in Seville and had some knowledge of the area. The simplified SWOT analysis helped the students highlighting the important features of the area. The

students developed interesting lists of objectives and activities and did a quick research on the area to develop solutions for the neighbourhood. To sum up, the exercise was useful to both the students, who gained knowledge of the area and acquired tools to assess it, and the teachers, who had the chance to further improve the place-making framework and co-working session.

Figure 1. Results of the first session of the exercise: Analysis (group 2)



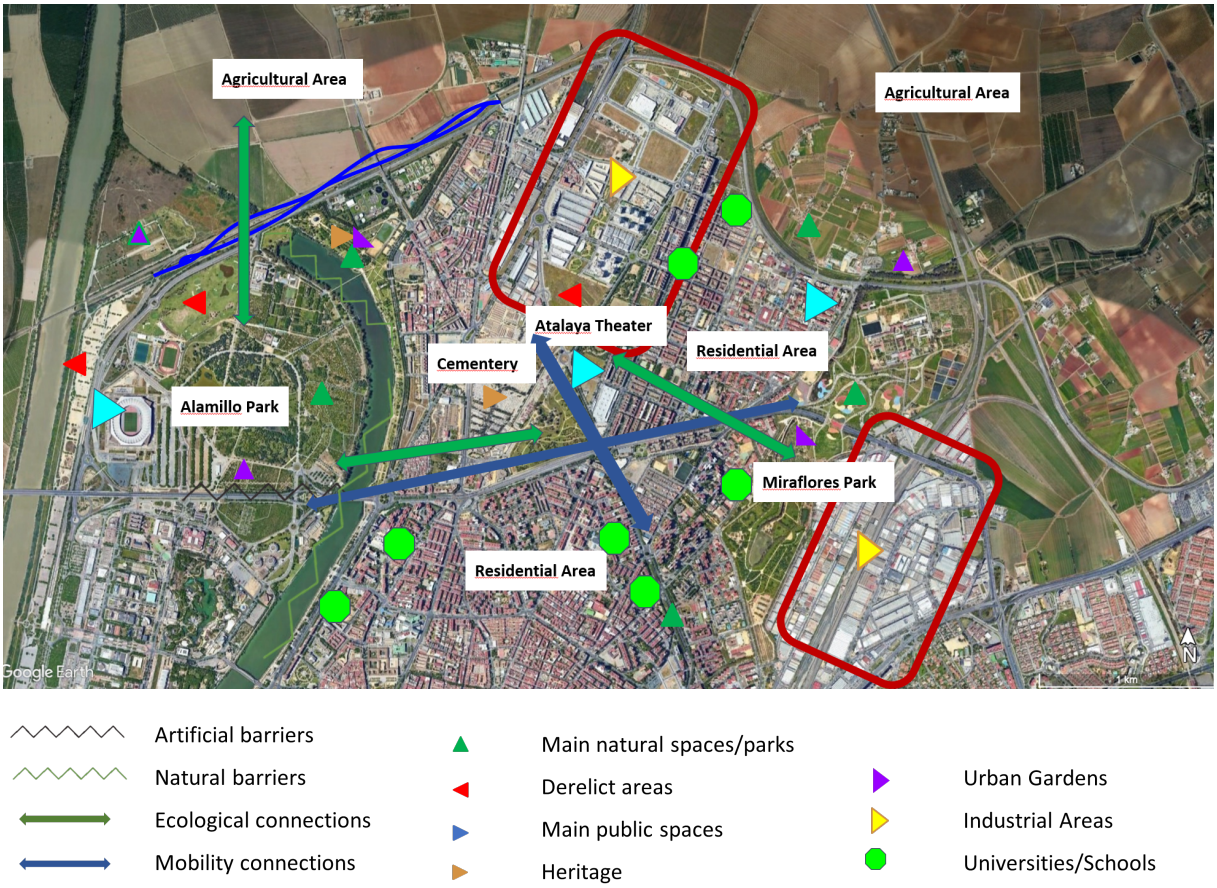


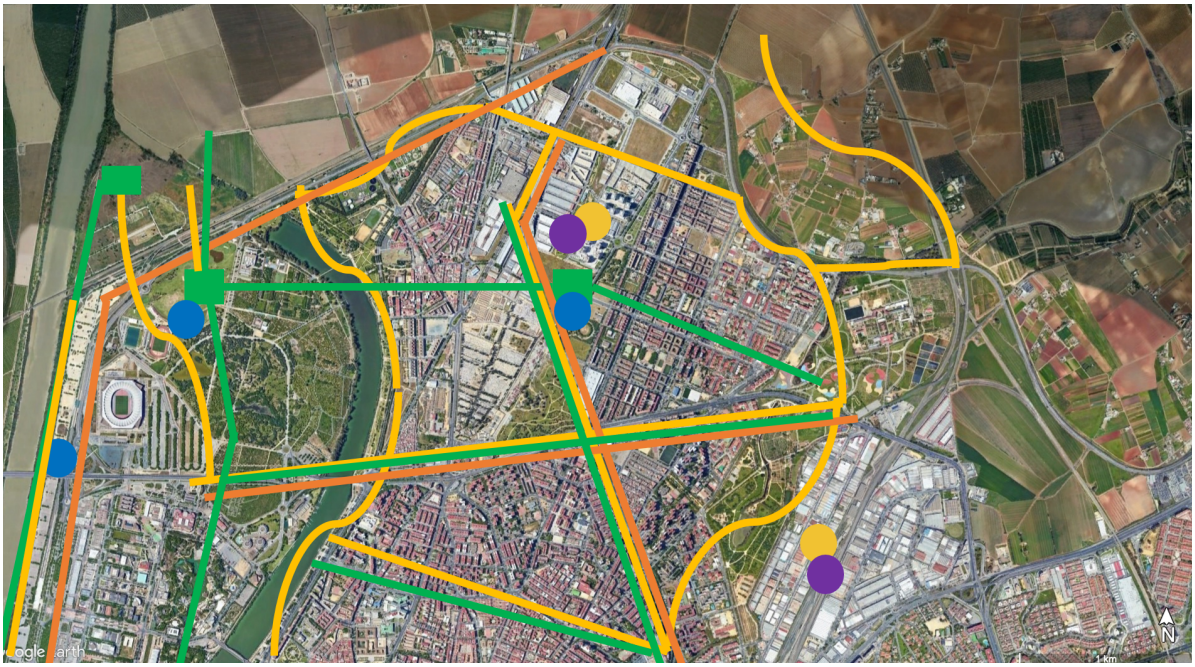
Figure 2. Results of the second session of the exercise: Strategies (group 2)

Objectives

- Enhancing connectivity corridors for both people and nature
- Increase the soft mobility connectivity and public transportation
- Improve community participation in planning and design (Understand demographics of the area)
- Understand opportunities for nature-based solutions
- environmental improving of buildings
- Improve community behaviour towards environmental and sustainability

Activities

- Implement green corridors
- Research in nature based solutions
- enhance communitary composting
- plan new cycling pathways intra neighbour and with city center.
- Engage young people through schools and universities
- Shadow corridors
- Create paths to cross the river for both people and animals
- Design green roofs and water collectors in residential and industrial buildings
- Use tiny forests to restore derelict areas
- Reduce waste
- Change cars for bikes/walking
- Creation of local food market km0
- Identify community organizations/ONGs in the area that could support these activities



UNISI

Description of the exercise

The exercise proposed by the University of Siena, during the 3rd City-Minded Workshop, had the following aims:

1) Quantifying the Carbon Footprint (CF) of the Seville Municipality;
2) Quantifying the virtual equivalent forest area, needed to absorb GHG emissions;
3) Discussing potential policies and simulating the CF mitigation of the Municipality paying more attention to photovoltaic and wind power.

Students were divided into 2 Working Classrooms, and, within each group, they nominated a leader who would play the role of spokesperson. Students had about 2 hours to develop the exercises, discussing among themselves. At the beginning of the tutorial, students were provided with an Excel file, containing the information needed for the calculations. At the end of the exercise, students met in the Common Classroom to talk about the results obtained in each Working group.

The CF of the Municipality of Seville were inventoried, considering the emission sectors of origin, divided into impact sub-categories (Figure 1).

Emission sectors	Impact sub-categories
1) Energy	✓Transport ✓Heating for residential and tertiary sectors ✓Energy production in industry ✓Electricity production and consumption
2) Waste	✓Landfill ✓Anaerobic digestion ✓Wastewater treatment plants
3) Agriculture, Forestry and Other Land Uses (AFOLU)	✓Green areas uptake

Figure 1: Emission sectors and impact sub-categories.

Emissions were calculated, applying the following basic Equations 1 and 2:

$$CF_i = AD_i \times EF_i \quad \text{(Eq. 1)}$$

$$CF_{TOT} = \sum_{i=1}^{n} CF_i \quad \text{(Eq. 2)}$$

Where:

***CF**$_i$* = carbon dioxide equivalent (CO_2eq) emissions in one year (kg CO_2eq);

***AD**$_i$* = activity data (e.g., tons of gasoline consumed for transport);

***EF**$_i$* = emission factor per unit of activity (kg CO_2eq/t gasoline for transport).

The assessment methodology associates a specific emission factor (EF_i) to each human activity (AD_i).

The virtual equivalent forest areas, needed to absorb the GHG emissions, were estimated considering a removal rate of 1.3 kg CO_2 $(m^2)^{-1}$.

The Excel file also provided a list of mitigation policies, indicating the consumption savings, the policy penetration in the population and the potential electricity production from renewable resources. Students discussed the benefits of the environmental policies and simulated the Carbon Footprint mitigation due to the implementation of some policies. In particular, the emissions reduction was developed, hypothesizing the installation of photovoltaic (PV) panels and wind turbines: the places where these devices could be installed, and the potential production of the obtained electricity were identified.

Results

The CF of the Municipality of Seville is reported in Table 1, indicating that mobility had the greater impact (43%), followed by the electricity consumption (16%) and the fossil fuels use for the industrial sector (16%). Also, the waste sector contributes to 12% of the total GHG emissions, considering the low percentage of recycling and the massive waste disposal in landfills. A protein diet contributes to the total emissions increase of about 66%, covering a significant fraction of the total climate impacts of the analyzed territorial system (44%).

Table 1: Carbon Footprint (CF) of the Seville Municipality.

ACTIVITY SECTOR	CF	Percentage on the total
	t CO_2eq	%
1) ELECTRICITY	**322,095**	**16%**
Industrial sector	83,047	4%
Residential sector	131,135	6%
Transport	3,171	0.2%
Tertiary sector	93,409	5%
Agriculture sector	11,332	0,6%
2) FUELS CONSUMPTION	**584,903**	**29%**
Industrial sector	329,175	16%
Residential sector	93,504	5%
Tertiary sector	22,863	1%
Agriculture sector	139,360	7%
3) MOBILITY	**882,402**	**43%**
4) WASTE	**234,668**	**12%**

5) WATER	**11,592**	**0.6%**
TOTAL (sum 1+2+3+4+5)	**2,035,660**	**100%**
FOOD protein diet	1,336,203	40%
FOOD balanced diet	866,726	30%
FOOD balanced diet + local food	505,590	20%
UPTAKE	**-2,596**	**0.1%**

The virtual equivalent forest area of the Municipality of Seville is 249,855 ha, compared to 806 ha of the current green urban areas (i.e., parks, gardens, and lawns) which, expressed in terms of virtual forest equivalent, measured 192 ha (Figure 2).

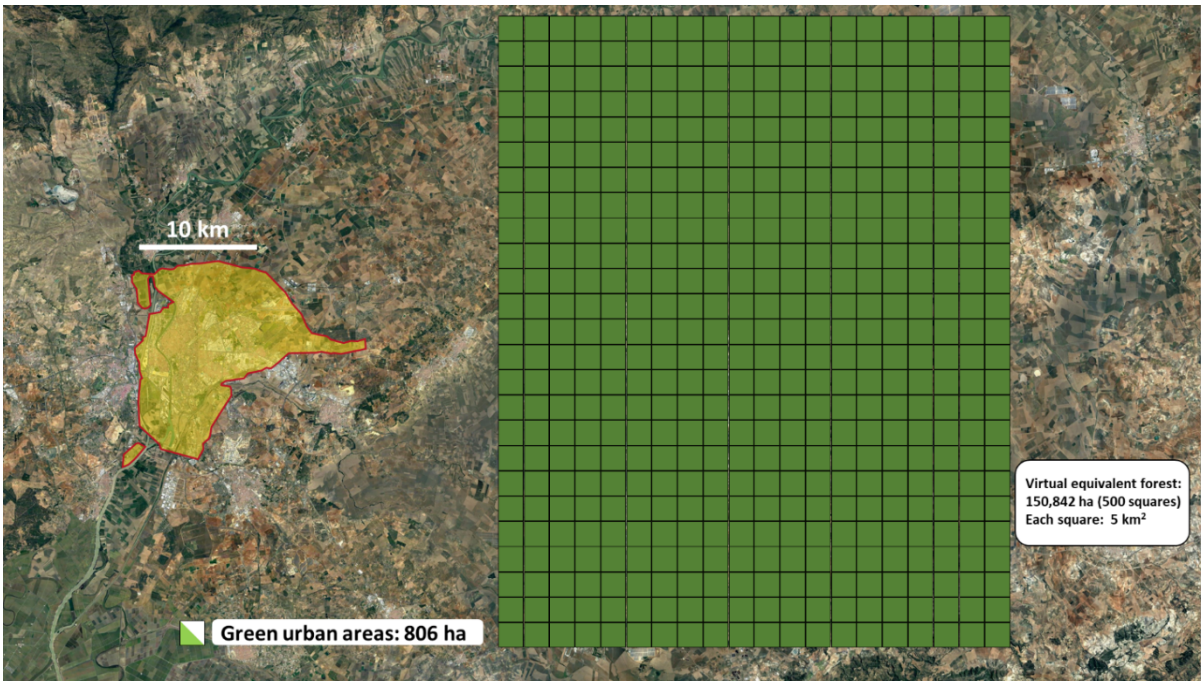
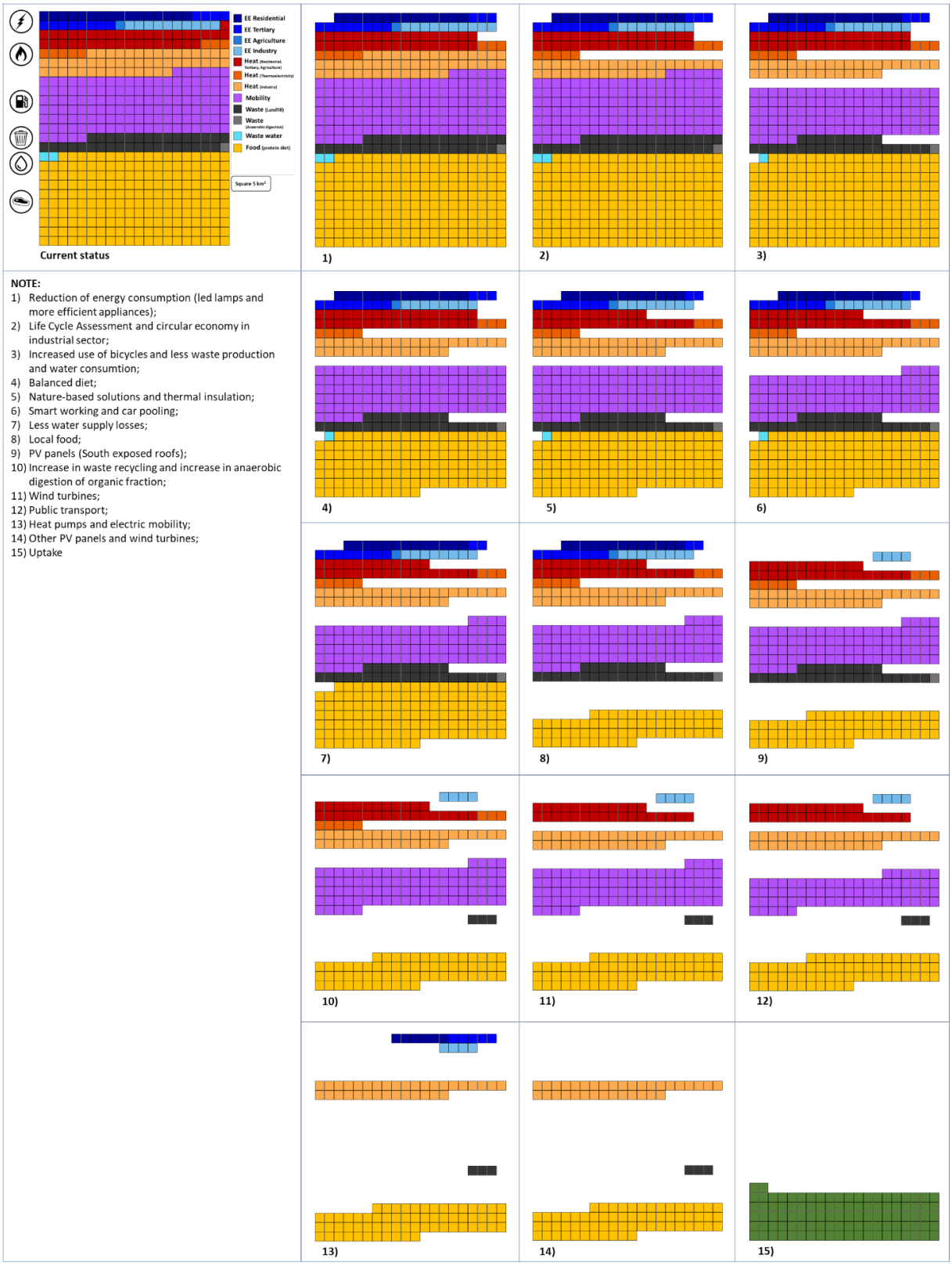


Figure 2: Virtual Equivalent Forest area of the Municipality of Seville.

The CF mitigation of Municipality of Seville, due to the environmental policy implementation, is shown in Figure 3. The most beneficial policies are the electricity production from photovoltaic (PV) panels and the transition to electrified devices for heating and transport, to achieve the carbon neutral condition.



NOTE:

1) Reduction of energy consumption (led lamps and more efficient appliances);
2) Life Cycle Assessment and circular economy in industrial sector;
3) Increased use of bicycles and less waste production and water consumtion;
4) Balanced diet;
5) Nature-based solutions and thermal insulation;
6) Smart working and car pooling;
7) Less water supply losses;
8) Local food;
9) PV panels (South exposed roofs);
10) Increase in waste recycling and increase in anaerobic digestion of organic fraction;
11) Wind turbines;
12) Public transport;
13) Heat pumps and electric mobility;
14) Other PV panels and wind turbines;
15) Uptake

Figure 3: Carbon Footprint (CF) mitigation of Seville Municipality.

Students have identified on the Google Earth maps the surfaces available to install PV panels and the number of wind turbines that can be introduced in the municipal area.

The installation of PV panels on the buildings and warehouses roofs in the industrial area has been suggested (red boxes in Figure 4). The installation of about 290 ha of PV panels was simulated, with the annual production of 580,000 MWh of electricity, mitigating the CF due to electricity consumption of 33% and that of the overall Municipality of 5%.

Figure 4: Potential location of PV panels (red boxes).

Moreover, the installation of about 42 wind turbines (4 MW each one) was hypothesized in the area near the Guadalquivir River, characterized by cropland, grassland, and vacant lots just outside the boundaries of the municipality (yellow box in Figure 5). Inside the municipal area there are not the necessary spaces for the installation of wind turbines, in fact, it is a densely inhabited and built territory. These turbines would be able to produce 294,000 MWh of electricity each year, mitigating the CF due to electricity consumption of 17% and that of the overall Municipality of 7%.

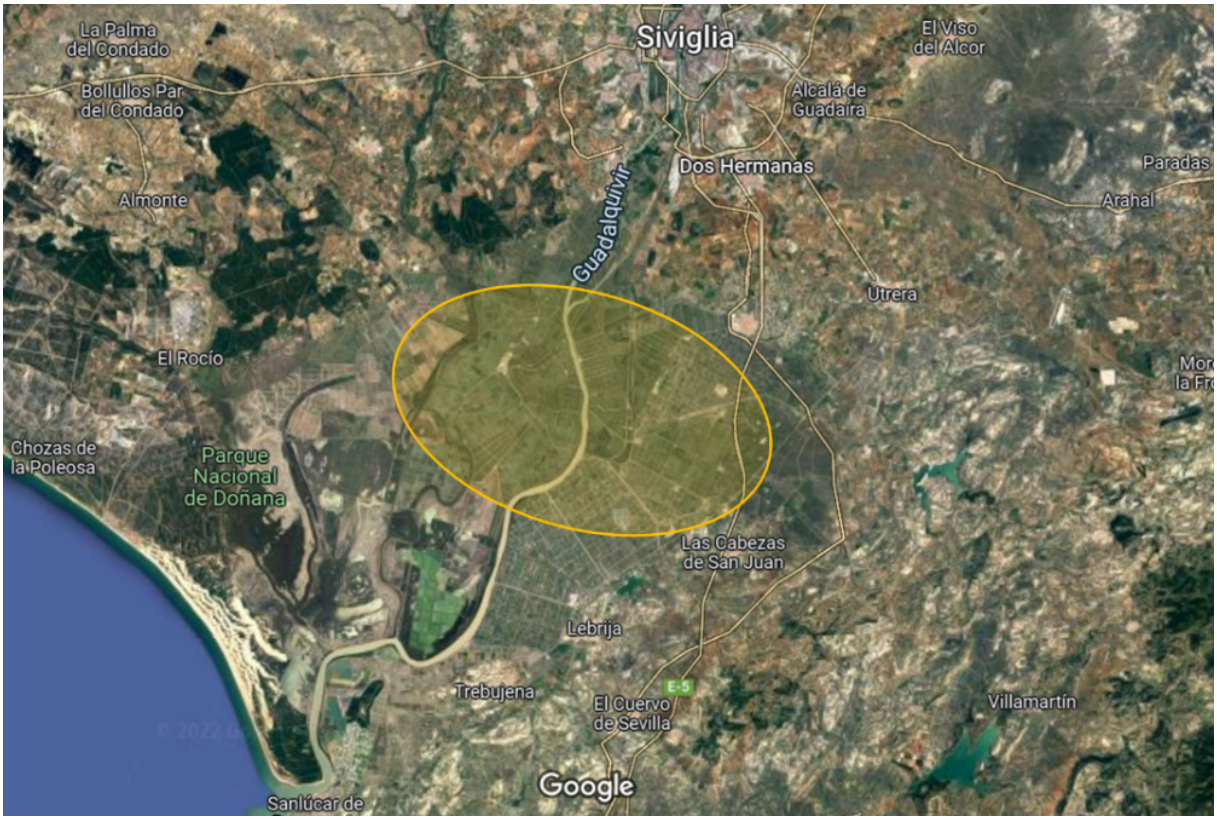


Figure 5: Potential location of wind turbines (yellow box).

IRENA & MIEMA

The exercise with the students was divided into seven tasks, each following and complementing the previous one. Students were divided into two groups. The first task was to select a target building or a target zone. Each group was asked to select a different building type or a group of buildings within the City of Seville. The first group had to select a school building and the second group had to select a residential area (a block of apartments or a group of houses in a street). The second task was the identification of main energy consumers within the building/s chosen and to list the three highest energy consumers according to their opinion and to explain why they have chosen them. The third task was related to the proposal of energy efficiency or renewable energy interventions. Based on the highest energy consumers identified as part of the second task, each group was asked to propose what energy efficiency measures may be implemented in the building/set of buildings to reduce the consumed energy and improve the energy performance of the buildings. Depending on the building characteristics, students were also asked to propose any renewable energy technologies that can be integrated. The fourth task was focused on detecting possible challenges that will make the energy improvement difficult both for the energy efficiency measures and renewable energy sources (financial, social, legal or technical barriers to energy renovation). In the fifth task, based on the challenges and barriers identified, students had to propose solutions to overcome the challenges. A more practical task was the sixth one which

was related to the estimation of the potential energy generated yearly by the installation of photovoltaic (PV) panels on the selected building. Each group was asked to measure the area that can be used for the installation of PV on the selected building/group of buildings through Google Maps. Then they had to estimate the size of the PV system that can be fitted on to the roof (kWp), and at the end calculate the potential energy generated yearly. Each group prepared a short presentation with all the results of the above-mentioned tasked and present them to the professors and the audience of the workshop.

The first group selected the Colegio Maristas San Fernando, a religious school located in Triana neighbourhood. As the highest energy consumers within the building, the first group identified the electronic equipment (computers and others…), lighting and heating and cooling systems. Proposals for energy efficiency improvement/RES included the installation of lighting sensors and LED lights, use of PV/Solar/Thermal panels, insulation measures for windows and walls, use of the use of adequate temperature controllers and in the end, constant and regular system maintenance. The main barriers identified were the poor maintenance of the system, lack of funds and lack of knowledge about EE/RES. The proposed solutions included the development of scheduled plans for the system maintenance, the organisation of training for building owners/managers, promotion and fostering of public financing, crowdfunding and energy performance contracting, better planning of the reconstruction works and organisation of raising awareness campaigns.

The second group focused on the residential building located on the corner of Virgen de Lujan 22 street. The building was built in the 1960's and it has 8 floors on two separate stairs (areas) with 2 or 4 units per floor per area, so there are more than 30 individual units. The building is perpendicular to the North-South /East-West orientation which increases the sun exposure, and it doesn't have any taller buildings around which provide shading. As regards the main energy consumers, the group identified the heating system as the highest energy consumer in the building. The group stated that ubication (southwards) is not favourable for the apartments and this is the reason why one area overheats while the other is cold, creating tension among neighbours. The second main energy consumer is the air conditioners during the warm season with the consequence that all the heating from the machines is released to the street. The third main identified energy consumer is the elevators (4 of them, 2 main elevators that are new and 2 service elevators that are old). Proposed solutions related to the EE included the installation of the bioclimatic shadow of the south facade, windows with double/triple glazing, adaptation of the central heating system in order to assess the actual needs of the owners and implementation of new insulation techniques to renew the facade. As regards the RES, the group proposed the installation of solar panels and micro-wind turbines on the roof and the possible establishment of a microgrid or energy community with neighbouring buildings. Barriers to energy renovation included inadequate heating system, age of the building, absence of environmental habits, lack of funding, irregular use of elevators and older population of the building. As the possible solutions to overcome the barriers, the group proposed the modernisation of the heating system (by splitting the central system in order to allow separate temperature control by areas/units), building a green roof and green

wall to create a shadow to the south facade, modernisation of the elevators, creation of a common area in the roof to improve community communication, improvement of the waste management (i.e, composting), use of city/country/EU loans or incentives for the EE/RES improvement.

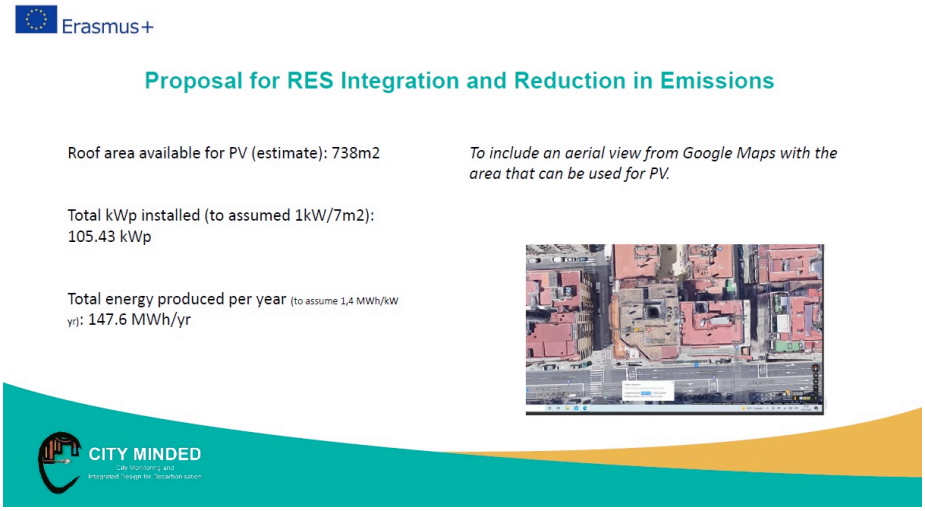


Figure 1: PV Installation Potential for a Residential complex in the City of Seville

The presentations of both groups showed that the students obtained a good understanding of energy efficiency and renewable energy within the urban context and how to identify the correct solutions for different building categories. A particularly important point that was highlighted is the importance of focusing on buildings located in the urban areas, both in terms of energy efficiency improvement as well as for the installation of renewable energy technologies in the buildings to minimise the use of green areas for energy production.

Conclusions on the 3 City Decarbonisation Itinerant Workshops.

The wrap-up session carried out on the last day included an open discussion and joint assessment on the results of the workshop, which involved all partners and participating students.

The most important remarks can be summarized as follows:

- The different backgrounds of students participating in the three workshops make their approach to the co-working sessions extremely different: this is both a value added and a challenge for partners, since it entails a continuous adaptation and tailoring of the contents and procedures of the training. In UPO workshop, all were doctoral students in subjects related to the environment.
- The online mode proved very challenging for both partners and students. Nonetheless, the procedure adopted proved effective in the end, promoting successful interaction and collective work.
- Participating students managed to think about all the different aspects of decarbonisation, making meaningful connections among the different modules and with the contents presented by the stakeholders, and exploiting them to make reasonable and wide-range proposals to reduce the carbon footprint of the target neighbourhood.
- Students found it interesting to address themes that are only marginally treated in university courses, and that were presented in a simple and communicative way; moreover, they appreciated to be guided in the use of external data and information (i.e. statistical data) that they are not used to search for and exploit.
- Students lamented that the short duration of the sessions and the online mode made it difficult to go into more depth on the project topics, and to present the results of the co-working sessions in a more accurate and captivating way.

At the end of the workshop, an online satisfaction questionnaire was submitted to the participating students (according to a model provided by UNISI).

The Evaluation Questionnaire for Students. Main results.

An analysis of the filled-in questionnaires led to the following results:

⇒ 4 out of the 7 participants answered the questionnaire.

⇒ the average age of the participants was 39 years old.

⇒ they were all based in different countries: Spain, Ecuador, Colombia and US.

⇒ there was a mix of occupations related to education. From the organizational aspects of the workshop, the ones that were more highly appreciated were: the structure of the programme, the online facilities and the discussions; the one least valued was the event administration.

⇒ Cooperating and interacting with other participants was the most satisfying part of the workshop.

⇒ 75% of participants had previously participated in previous events.

⇒ The most appreciated strengths of the workshops were the diversity and internationalization of the organizing team and participants, and the chance to interact in smaller groups.

⇒ The suggested improvements were to hold the workshops face-to-face and to organize the materials in an accessible drive prior to the lectures.

Final remarks

In conclusion, the workshop was very appreciated by the participating students, which demonstrated a good level of involvement and especially valued the relevance of the topics addressed, and the interactive, international and interdisciplinary dimensions of the experience, being most students not based in hosting university. Moreover, the format adopted can be considered innovative.

The online mode allowed for a satisfactory level of collaboration among students, and the structure of the workshop agenda and the organization of the modules seem to be effective. The most appreciated aspects were the structure of the programme, and the online facilities and the discussions.