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CITY MINDED
City Monitoring and Integrated Design for Decarbonisation

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OUTPUT 1

Methodology and Guidelines (Final)

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Participating Organisations	IRENA - Istarska Regionalna Energetska Agencija Za Energetske Djelatnosti Doo UNIROMA3 - Università Degli Studi Roma Tre UPO - Universidad Pablo de Olavide MIEMA - Malta Intelligent Energy Management Agency
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1. Introduction – Why we need the decarbonisation of Urban context

The growing attention paid to climate change is leading Nations and International Organizations to pursue common goals to limit the inevitable climatic variations that the Planet will experience in the near future. The 195 States that signed the Paris Agreement in 2015 have set a common goal to limit Global Warming "well below" 2°C, pursuing every effort to keep it within 1.5° C. The European Union, following its commitment to global climate action, has set itself the goal of becoming climate neutral by 2050, i.e., achieving net greenhouse gas emissions equal to zero. This ambitious goal is the cornerstone of the "European Green Deal" and, to achieve it, it has set the intermediate target of reducing its greenhouse gas emissions by 55% by 2030, compared to 1990 levels, was set. On 15 November 2022, the world population reached 8 billion people, a milestone in human development (UN, 2022a) and, according to United Nations estimates, should grow to 8.5 billion in 2030, and add 1.18 billion in the following two decades, reaching 9.7 billion in 2050 (UN, 2022b). 56% of the world population currently lives in urban areas and is projected to grow to 68% by 2050. (UN-Habitat, 2022). In Europe, the urbanisation rate was 75% in 2020 and it is expected to increase to approximately 84% in 2050 (UN-Habitat, 2022). All these factors will significantly affect climate change and, consequently, global land use and ecosystems. The long-term strategy of the European Commission has identified cities as strategic points and ideal laboratories for the study and application of transformative and sustainable solutions (EC, 2018). The restructuring of the city and better territorial planning, including that of green spaces, have the potential to become the main drivers for pursuing the goal of eliminating net greenhouse gas emissions by 2050.

The Erasmus+ City Minded project, as well as the Methodology and Guidelines developed and tested in the project's City Decarbonisation Itinerant Workshops, fit perfectly into the objectives of Greenhouse Gas (GHG) emissions reduction set by Europe. For this reason, they represent a valid tool for the climate impact assessment in the urban contexts, suggesting also specific environmental policies for the improvement of inhabited areas.

2. General objective of the Methodology

The main objective of the 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. Specifically, the developed methodology focused primarily on the study and potential transformation of target districts, neighbourhoods, and counties to address site-specific challenges and provide roadmaps for decarbonization of the urban areas.

This final Methodology aims to address the implementation of the Workshops, which are based on the combination of different skills and designed as an innovative teaching and learning experience aimed at university students, but also doctoral students, and young researchers. In particular, the focus is not only on the production of urban sustainability agendas, but rather on the process that leads to their definition and the learning environment in which this process takes place.

Listed below are some of the specific objectives of the City Minded Workshops:

- Bringing together and reinforcing the linkages among higher education, academic knowledge, institutions' experience, and communities' needs and expectations.
- Transferring knowledge about the complex issue of city decarbonisation by consolidating and testing innovative training strategies based on an integrated approach, and by co-creating knowledge on technologies, legal issues, financial management, social engagement, and monitoring tools in the field of urban sustainability, thus enhancing the students' capacities to operate in a real-world setting.
- Designing participatory city decarbonisation scenarios for target district/counties/ neighbourhoods, providing a roadmap for urban decarbonisation and the transition to sustainable and carbon neutral districts/counties/neighbourhoods with the active involvement of students.
- Make the students active and privileged protagonists of the process of urban planning and improvement of the society of which they are part. This through an active participatory process in which students learn new knowledge that they can apply in a practical and operational way with the aim of producing quality results in a limited time.

3. The Workshops: the original structure and its reorganization due to the Pandemic

The methodology was initially conceived and designed to be developed and tested in very operational Workshops, during which teams of experts and students met in a physical place to study a neighbourhood, discovering its strengths and weaknesses with the aim to design an instant planning that would allow to improve the urban district, achieving the Carbon Neutral status at least by 2050. In their original form, the Workshops had to take place over 5 days (usually Monday-Friday), during which teachers and students of the partnership would alternate lectures, field visits of the neighbourhood under study, and numerous co-working sessions during which students, divided into heterogeneous teams, could sit at the table, and redesign the city based on the skills acquired in the lectures. Technical solutions able to solve the specific problems encountered during field visits could be considered and integrated in the decarbonization plans developed by students. The first day of Workshop provide for presentations by local administrations, trade associations, citizens' associations, and other local stakeholders to best present the neighbourhood to students who were preparing to analyse it. On the last day, the results of this intensive Workshop would be presented to the local stakeholders themselves and to all citizens who would have liked to take part in the final conference to show the ideas and proposals emerged from the students' work.

However, the Workshops, as they had been conceived, structured, and described, were not compatible with the restrictions that the World had to put in place to deal with the COVID-19 Pandemic. So, the three Workshops that were foreseen in the project were not carried out in person, but totally remotely. Therefore, since the first Workshop held in Siena (IT), the partners had to rethink the activities in such a way that they could be understood remotely, using platforms such as Google Meet, Zoom or Blackboard. The primary objective was to try to involve the students as much as possible, not only by offering more dynamic frontal lessons, but also trying to make the students active protagonists of the Workshops during the co-working sessions remotely conducted.

Below in this document a theoretical guideline of how the Workshop should be carried out in the presence and an example of how the Workshops were carried out remotely will be presented. In this way the final user of this methodology will have the possibility to apply it in both possible situations.

4. How to carry out the Workshop - Practical suggestions

This Methodology includes indications on how to:

- Select, involve and motivate students and stakeholders;
- Select the neighbourhoods, urban areas, or counties to study;
- Conduct the Workshops, with practical examples of how to structure the days;
- Identify the issues in order to tackle the decarbonisation path in urban systems;
- Propose the educative contents necessary for the preparation of students.

The structure that is presented follows the procedure that was carried out for the realization of the project's Workshops, but we believe that it is not the only possible way. The objective of this document is to provide a "ready-to-use" tool for those wishing to employ it, but, at the same time, a tool that can be modified according to the needs and characteristics of the activity to be carried out. About the issues addressed and the didactic methods identified, those used in our Workshops will be presented because they were considered by the whole partnership as the most suitable and useful for the definition of roadmaps for the decarbonisation of urban systems, but not they are obviously the only ones possible to implement. The City Minded project, by its nature, was born with the intention of integrating and making different disciplines dialogue with each other, implemented by experts from various sectors. We firmly believe that multidisciplinary and transdisciplinary issue can constitute an important source of personal enrichment that can increase the cultural background and skills of the students involved.

For the realization of a City Minded Itinerant Decarbonisation Workshop, some steps must be followed, which are presented below. Most of the indications given are valid both for the online version and in the presence of the workshops. Where necessary, however, specifications will be made to better clarify how to adapt the various aspects to different cases.

4.1 Preparation: covers the start-up and organization phase.
4.2 Execution: implementation, monitoring and on-site management of the activities envisaged by the Workshop.
4.3 Closing event: presentation to the public of the results achieved (on day 5).
4.4 Afterwards: evaluation of the achievement of the planned results and feedback.

4.1 Preparation

The Workshop includes a whole series of preparatory activities, which must be partly carried out by the host institutes and partly by the entire partnership.
Hosting partners take care of the organisation of the Workshop, including logistics and venues for Workshops or identifying the most appropriate online platform available to all partners, students, and stakeholders, identification of the target neighbourhood/county, itinerary for field visits by interacting with local stakeholders or with an appropriate online presentation of the study area and the invitation for online participation with the same local stakeholders, working materials such as cartography and data sets, local dissemination and press releases and so on.
City Minded partners, in view of a project, started the organizational phase at least 1-2 months before the scheduled date for the Workshop; some activities arise even earlier because they concern a thorough and detailed study of the most useful material to be used both for the frontal lessons and for the co-working phases to be carried out by the students.

The Agenda

The work, at the partnership level, begins with the definition of an event Agenda that allows the carrying out of all the planned activities, the frontal lectures, and co-working activities, i.e., the presentations of local stakeholders, the field visits, the final conference, and convivial moments that favour the creation of a jovial environment useful for the success of the event.
The Host Partner will propose a first draft of the Agenda to the other partners. This will be discussed, refined, and supplemented, also based on the availability of local stakeholders, until a final version is reached and should be ready at least 2-3 weeks before the event.
In order to perform all these activities on time and correctly, in addition to the work that each partner will carry out individually, it is necessary to organize at least 3-4 meetings (i.e., one every 2 weeks) before the event, starting almost 2 months earlier, in order to discuss the progress of the work, the Agenda, the logistics, and any problems to be solved.

In-person Workshop:
In setting the Agenda, a first thing to plan for is to keep the morning of Day 1 free of all commitments; this is to enable partners arriving from other regions or abroad to get to the city, leave their bags in their accommodations, get acquainted with the city, and travel to the event venue.
For the same reasons, on the last day, it would be better if the closing event were scheduled for the morning, so that participants can comfortably catch a plane or other means of transportation to return home. In fact, the Workshop is usually held from Monday to Friday, and weekend travel is, usually, more expensive, and complex.
All other days will pre-date a morning session and an afternoon session, during which to distribute the other activities planned in the Workshop. The two daily sessions on Tuesday-Thursday will be

separated by a lunch break to be held possibly all together to foster conviviality and acquaintance among the participants. Table 1 shows a theoretical Agenda of how the Workshop should have been carried out in the in-person version.

Table 1 - A generic layout for a City Minded Workshop agenda.

Day	Part of the day	City Minded Workshop activities	Description	Attendance
Day 1	a.m.	Arrival and Accommodation		
	p.m.	- Institutional greetings - Presentation of City Minded Workshop. - Series of presentations by local authorities. - Conclusion Day 1.	The host partner introduces the project (inviting the project lead partner to speak briefly) and makes an introduction regarding the city, the study area, and the conduct of the Workshop. Then local authorities, citizens' associations and other stakeholders involved are invited to speak, focusing on urban sustainability activities and plans already implemented or underway in the host neighbourhood.	Project partners, Students, Local authorities, Local stakeholders, Press, General public, etc.
Day 2	a.m.	Field visit of the target neighbourhoods	The host institution and a selection of local stakeholder's guide students and teachers through the target district, showing and discussing challenges and opportunities.	Project partners, Students, Local stakeholders.
	p.m.	- Training session - Co-working session - Conclusion and discussion Day 2.	Introductory seminar by Partner 1 regarding their specific topic of expertise. Students are divided into working groups to carry out the exercises.	Project partners, Students.
Day 3	a.m.	- Training session - Co-working session	Introductory seminar by Partner 2 regarding their specific topic of expertise. Students are divided into working groups to carry out the exercises.	Project partners, Students.
	p.m.	- Training session - Co-working session - Conclusion and discussion Day 3.	Introductory seminar by Partner 3 regarding their specific topic of expertise. Students are divided into working groups to carry out the exercises.	Project partners, Students.

Day 4	a.m.	- Training session - Co-working session In addition: additional field visit	Introductory seminar by Partner 4 regarding their specific topic of expertise. Students are divided into working groups to carry out the exercises. In addition: Partners and students conduct a second field visit so that students can refine their ideas and make them more fitting to the target neighbourhood.	Project partners, Students. In addition: Project partners, Students.
Day 4	p.m.	- Co-working session (final presentation assembling) - Conclusion and discussion Day 4	Final wrap-up and assembling of a presentation (ppt or other type chosen by the participating teachers from the partner organizations) that includes all the outputs produced by the students.	Project partners, Students. Local stakeholders (not mandatory)
Day 5	a.m.	- Closing event: Final Public Presentation - Networking lunch.	Final presentation of workshop results: greetings from organizing partner and local stakeholders; sequence of short presentations by representatives of various student groups.	Project partners, Students, Local authorities, Local stakeholders, Press, General public, etc.

Online Workshop:

In this case, the structure of the agenda can be more flexible. One idea might be to concentrate all activities in one part of the day (e.g., afternoons) to make the event less annoying for students and teachers and reduce the time spent in front of the computer; it might be useful to provide a break in the middle of the afternoon.

Site selection

Among the preliminary activities under the responsibility of the host partner is the selection of the site under study during the Workshop. The selection of the site depends on the objectives of the work, the knowledge of the territory, the availability of information and logistical issues. In general, it is good that the site chosen is an urban area, possibly a neighbourhood that is representative enough of the city, with a medium-high population density, heterogeneous characteristics and, in the case of an in-person workshop, the district should be easily accessible. Moreover, it has been suggested to opt for peri-urban areas where to act, avoiding historical or highly urbanised centres, where any hypothesis of intervention (even if only theoretical) would run up against physical, legal and landscape barriers. Another aspect to take into consideration is that it is a neighbourhood that has room for improvement and the logistical and spatial possibilities to allow students to imagine and design improvement solutions. In some cases, due to the needs derived from the methodology, work has been carried out at the county level.

Some features of the neighbourhood that may serve the goals of the Workshop are:

- Discontinuous urban area, interspersed with uncultivated areas or small cultivated plots;
- Residential areas with cottages but mostly mansions, with plenty of roofs without solar or photovoltaic panels;
- Small industrial or commercial areas near the built-up area;
- Landscape and architectural barriers;
- Some points of architectural, historical, naturalistic interest.

For example, in the case of the Siena Workshop, the district (which will be presented better later in this document) was selected considering some aspects: first, a logistical factor was taken into consideration, since it had not yet been decided whether the Workshop had to take place considering in person or remotely. The areas that had initially been contemplated for the study were: San Miniato neighbourhood, Ravacciano neighbourhood, the Historic Centre of Siena, the Via Massetana commercial area; the entire urban area of the city.
The San Miniato neighbourhood, which was very interesting from an urban redevelopment point of view, (e.g., the improvement of public mobility services, routes for slow mobility (cycle and pedestrian), the implementation of Renewable Energy Source, the redevelopment of green areas and houses),was, however, excluded because in a very peripheral position with respect to the central core of the city and therefore complex to physically reach in the case of a workshop in presence. The Historic Centre was excluded because it gave little space to improvement policies given that it is not possible, due to national and local legal limits, to build production plants from renewable sources, such as, for example, photovoltaic and wind power; this would therefore have greatly limited the students' work and would have probably made the results of their activities less "attractive". The Commercial Area of Via Massetana was excluded because, having a very small number of residential buildings, it would not have been sufficiently representative of the City of Siena. The entire urban area was excluded because the preference of the City Minded project was to concentrate the activities on a neighbourhood or, in any case, an urban area or county that represented a portion of a city or the regional scale, depending on the objective achieved with the application of each of the methodologies tested.

The choice then fell on the Ravacciano neighbourhood because:

a) It is easily reachable from the historic centre, as it borders on it;
b) Is representative of the city, being composed of urban area for residential use, commercial area and a large urban green area;
c) Given its heterogeneity of situations, it left room for students to imagine numerous different solutions that would make it possible to redevelop the neighbourhood and aim for the decarbonisation of the area;
d) In addition, another European project (called URBiNAT), wanted to redevelop the green areas of Ravacciano, creating a way of connection with the historic centre. Consequently, the study

developed during the City Minded Workshop could support the activities of this other project (URBiNAT) and foster an exchange of knowledge and skills.

These examples are used exclusively to make people understand which types of reasoning can be used for the choice of the most suitable neighbourhood in which to carry out the study of the Workshop.

Data Collection

The most important preparatory activity, that the whole partnership must carry out, is the collection of data necessary for the elaborations that the various bodies will realize before and during the workshop. The data to be collected can be very varied, quantitative, and qualitative, and depend on the disciplines implemented in the individual workshops. In general, however, these are data that may concern the extension of the study area, the number of inhabitants, the green surface, the age of the buildings in the neighbourhood, the energy consumption, the individual families, the number of cars present, and so on (a more detailed list is reported in section 8.1.3 "The 3rd City Decarbonisation Itinerant Workshop" and Table 2).

The more specific and realistic the site data, the better the results, defining good solutions and more appropriate roadmaps on the study area. For data collection, the key role is in the hands of the body in charge of hosting the workshops; the participating partners will therefore send in time a list containing all the data they need for their studies. The local partner plays a fundamental role thanks to its knowledge of the bodies, offices, national, regional, or city agencies in charge of collecting, processing, and disseminating the necessary statistical data. Moreover, in many cases, especially in extremely varied realities such as in Europe and, especially in the Mediterranean basin, the local partner can also help to solve problems related to the language. It may seem trivial, but in many cases, the documents, reports, and, in general, the administrative material of the offices of many European countries are published exclusively in the local language of the Country in question and this can represent an obstacle for the collection, retrieval, interpretation, and understanding of information.
The hosting partner will, therefore, based on the requests received from the other partners, carry out an in-depth information research activity using Local, Regional, or National Reports, databases, web platforms, offices of various kinds, sector agencies, or, in some cases, using specific tools such as interviews, questionnaires, etc.

Workshop Location

In-person Workshop:
It will be essential for the host partner to book a room that allows welcoming the partners, students, and all the stakeholders who will take part in the workshop, especially on the first day (in which the

presentations of local stakeholders take place) and in the last day of the Workshop (in which the students present the results of their work to all citizens who will take part in the event.
The best thing would be to find a structure (congress centre, universities, etc.) that has at least two types of rooms:

- A large room, like a university classroom, with tables and chairs that can be moved at will, in such a way as to create an easy and creative place for the co-working part of the students; a sort of Think Tank in which students can give free rein to their creativity and put into practice what they have learned in frontal lessons (and in their academic career). Furthermore, since this is a work that also includes a part of territorial planning, spaces will be needed on which to distribute maps, computers, and other material useful for the work of the Teams.
  Another fundamental element will be the presence of many electrical sockets for recharging computers, for any printers and other tools necessary for work, as well as an excellent Wi-Fi network that allows many users to connect simultaneously and easily;

- A large room (which can accommodate at least 50-100 people) where to carry out:
  1) The frontal lessons of the teachers;
  2) Presentations by local stakeholders;
  3) The Final Conference of the Workshop could foresee many participants, also based on how well the event has been correctly promoted locally.

  An important aspect of this room is the possibility of remote connection, given that some speakers may not be present, or the event could be hybrid and therefore include a part of the partnership on-site and the other part from remote.
  In this case, in addition, of course, to a good Wi-Fi connection, computers, projectors, amplifiers, and microphones, are required specialized personnel who are responsible for the connection with the speakers remotely and, if possible, for the streaming of the event.
  The broadcasting of the event in streaming can be an interesting idea even in the case in which the event is exclusively in presence because it can allow its greater diffusion and the achievement of a vast, young audience also coming from different parts of the world.

On the basis of the Agenda that is foreseen, for the first and last day of the Workshop, it may also be useful to provide a catering service for the creation of coffee breaks, also useful for a convivial moment of public relations that could favour dialogue between students, stakeholders, citizens and project partners.

<u>Online Workshop</u>:
In this case, the choice of location turns out to be much easier and up to the individual partners. In some exceptional cases, as was the case with the Workshops held during the Project, it may not even be necessary to choose an actual location. The various participants were housebound due to

the various lockdowns caused by the pandemic, so the location was simply the participants' home or office.
However, in situations that are less out of the norm, if the workshop is held online, the various partners must mainly make sure that they have a good Wi-Fi connection that allows for successful presentations and exercises.

Students and Teachers Selection

The involvement of students and teachers is an activity of competence of all project partners, and it is something on which the quality and characteristics of the workshop will depend.
The choice in many cases depends upstream on the partnership that is set up in the project since each participating collaborator will have the specific skills and knowledge that they will bring into the project and its events.
The workshops such as those of the City Minded project are designed for Bachelor's students, Master's students, Ph.D. students, and young Researchers belonging to various study paths.
Cities are extremely varied places, which can involve a very large number of specialists, and therefore students could derive from studies related to landscape architecture, environmental sciences, and natural sciences, environmental engineering, urban and territorial planning, energy engineering, but also geography, social sciences, agriculture, geology, biological sciences, environmental health, and more.
For the selection of students, it would be important to carry out at least one interview that allows them to understand the curriculum, specific knowledge, and motivation to participate, the ability to work in a team, knowledge of English, etc.
In many cases, especially in small universities, this may be superfluous, both because the number of candidates may be low, and because it is likely that the teachers personally know the students and know who is best suited to participate in the workshop.
The number of students participating in the workshops can be variable and can depend on many factors; in any case, a not excessive number of students would allow a better success of the work to be done. Especially for face-to-face workshops, a number ranging from 20 to 30 students is optimal for dividing 4-5 people into work teams and for logistical reasons.

The choice of teachers/trainers depends on the project partners and their membership in universities, or, in any case, research and/or training institutions. The teacher must be selected among those experts in the specific subject that the partners will intend to develop in the workshop and must be aware of the project and the methodology that is used. Usually, it would be optimal if for each partner there were 2-3 trainers who take care of both the frontal lessons and the support of the students during the co-working sessions.

A feature not to be overlooked is that the trainer has a young vision and a dynamic and engaging approach, in such a way as to attract and interest students with presentations that are captivating and interactive.
Trainers will often have to deal with completely new topics for students from different study paths, in a limited time and in such a way that they are clear and understandable to all.
The lessons will last about 1-2 hours, during which the trainer must explain the key concepts of the methodology and the topic in question and explain the activity that must be carried out in the co-working sessions.
Each partner will have the fundamental task of explaining to the other members of the partnership what kind of students will participate, what is their background, their level of knowledge, and their ability to use specific IT tools, such as Excel, PowerPoint, Geographic Information Systems (GIS) platform, etc. This information will need to be provided in time, so that trainers can tailor their presentations based on the specific "audience" they will be facing.

Stakeholders' involvement

An important point for the success of a Workshop such as those carried out by City Minded concerns the involvement of local stakeholders. These can play a very important role on the first day of the workshop in which the neighbourhood under study and the city are described and presented. It is therefore important to select the right speakers, e.g., public officials of local municipalities, entrepreneurs, representatives of business support organizations, technology experts, researchers, doctoral students, and citizens' associations, living in the target neighbourhood. It is also important that the presence of stakeholders is as balanced as possible between the different categories listed.
Some of the aspects that can be taken into consideration for the right selection of stakeholders are:

a) Relevance for the implementation of the decarbonisation measures of the city;
b) Interest in the project;
c) Representativeness of the target city and district/neighbourhood;
d) Knowledge of the English language (if not, the host partner can act as a facilitator to involve him in the process or, otherwise, a simultaneous translation of the interventions can be provided).

The right choice of speakers will allow students to better understand the city they are going to study, to know its characteristics, peculiarities, merits, defects, and historical anecdotes that can help to better understand its essence. From knowledge comes understanding and respect, essential elements for a correct redevelopment of an urban area, which is not just a set of buildings, but an intricate and complex "ecosystem" rich in history that comes from the people who live there.

The choice of people who will take part in the final event that will take place on the last day is also very important. This is the privileged opportunity in which the students and the partnership of the project can meet and deal with the citizens. The event should be as open as possible to citizens so that they can learn about possible solutions to improve the neighbourhood in which they live and

propose improvements and constructive criticisms to the proposals created by the students. On this occasion, the involvement of local administrations and sector companies is also important, which together, also through the establishment, for example, of energy communities, can put into practice and implement at least part of the improvement measures theorized by the students.

Accommodation and other useful information

In-person Workshop:

The host partner has another very important role, that of facilitating the travel and stay of the other participants, especially those partners who come from another Country and do not probably know the city and the local language.

To facilitate the choice of the right accommodation and flight, in addition to communicating in time the place where the event will happen and the workshop agenda, it would be a good idea to provide information regarding accommodation and logistics.

The host partner should provide:

a) A map indicating the building where the works will take place;
b) Information regarding the best way to get to the location by train, car, bus, and other useful means, suggesting as many options as possible;
c) Useful websites for public mobility and, where present, maps of subways, trains, and buses;
d) An exhaustive and varied list of accommodation solutions covering different options, such as apartments, hotels with different numbers of stars, possibly close to the location where the workshop takes place;
e) Information regarding the possibility of renting bicycles, scooters, or electric cars;
f) Other useful information, such as restaurants, supermarkets, information points, historical and artistic sites, etc.

4.2 Execution

If the preparation part of the workshop has been well thought out and organized, its execution will certainly be easier and could also require a not particularly large effort, both in terms of time and "workforce". Here some tips and tricks, that may be useful for the correct running of a workshop such as those carried out in the City Minded project, are provided.
A fundamental aspect to avoiding the multiplication of efforts for the realization of the event is that each person who is part of the host organization knows well its responsibilities, but that there is at the same time dynamism and adaptability for the problem solving and any unforeseen events.
The organizer's major commitment during the week of the workshop will probably be to ensure that the deadlines set in the Agenda are respected so that all the planned activities can be carried out correctly. The organizers must always keep as a point of reference that of allowing students to work in an environment that favours and facilitates learning of the concepts proposed and the achievement of the workshop objective of carrying out an urban redevelopment and decarbonization project of the neighbourhood.

The City Minded workshops were designed to be divided into training activities, co-working sessions, and field visits to the target area.
Each of these actions will involve the trainers of the various participating institutions, the selected students, and, especially for some parts of the workshop, some local stakeholders of the host city.

- **The training activities** are carried out by experienced delegates from the various project partners to share their knowledge on urban decarbonisation measures, urban planning, renewable technologies, etc.
  These sessions may include lectures, seminars, simulation exercises, and all the teaching methods that the partner responsible for the session deems appropriate.
  Each partner will have an assigned time on a specific day to cover its subject, but the distribution and order of presentations during the week will depend on the Agenda that has been agreed upon.
  The lessons could all be concentrated in the first two days and then leave space for field visits and co-working sessions or, better, these various parts of the workshop could be alternated. The best way could probably be to dedicate individual days to a specific topic, with frontal lecture sessions in the morning and co-working sessions in the afternoon. The lessons of different partners dealing with similar topics could also be merged, to avoid repetition or overlapping and it is, therefore, good that all partners know what the topics are covered by the other experts.
- **The co-working sessions** are the execution of participatory processes aimed at defining a global roadmap of urban decarbonization for a district/neighbourhood of the host city. To favour a work that includes all the aspects that have been the subject of the lessons, students

must be divided into heterogeneous teams, so that the projects are enriched by the exchange and meeting of different skills.

In-person Workshop:

The co-working sessions should be conducted, if possible, in a large room with at least one large table (or groups of tables) for each working group. This gives students a way to arrange workstations as they prefer with computers, tablets, paper maps, sheets of paper, and anything else that might help them hypothesize and graphically design the neighbourhood of the future. The presence of students from all groups in one room allows and encourages collaboration, exchange of ideas and cross-fertilization with each other.

The host partner, also based on the specific requests and needs received from the other partners, must provide all the material useful for carrying out the co-working sessions. This could include, for example, the presence of computers, printers, and other useful tools, but also maps of the target area printed in large size, note paper, pens, pencils, markers, and other stationery material, etc.

Working materials should also include basic cartographies regarding land uses, buildings, green infrastructure, landforms, etc. Moreover, datasets, covering census unit-specific information such as population, number of households, land use areas (built environment, green areas, trees, urban agriculture, gardens, and other Nature-Based Solution) should be provided.

In addition, it is necessary to provide students with any data that have been collected before the start of the Workshop, such as general data on local energy use, private and public transportation (e.g., average commuting distance), water use, food habits, waste production, and management, to better profile the target neighbourhood, urban area, or county. Information on other commercial or manufacturing activities and services, in addition to housing, is also desirable.

Online Workshop:

In this case, to allow group work to take place, it will be necessary to use online platforms that allow for multiple rooms. Many platforms allow a host to manage a variable number of virtual rooms in which to distribute participants in an online event, through different links provided. In this case, each room must have some students and at least one reference teacher who coordinates and facilitates the work and who is competent and available to provide answers and clarification to students.

One effort that the reference teacher will have to make will be to ensure that all students actively participate; this can be facilitated by asking all students to have their cameras on and through the establishment of not too large groups, e.g., 4-5 students.

In addition, it might be helpful if at least one organizer can move around the various rooms so that he or she has a total view of the progress of the work, whether the timelines are met, and whether there are critical issues, including technical ones, to be resolved.
Sharing of data and documents useful for student work can be done using clouds, such as Google Drive, and using shared documents on which students can simultaneously interact.
The workday coordinator should ensure that he or she has a good Wi-Fi connection because such applications require high data consumption, given the simultaneous use of cameras by many users.

Organization of field visits

After choosing the best neighbourhood for the workshop, a very important step is the organization of one or more field visits to the target area.

In-person Workshop:
This activity must be one of the first on the Agenda, possibly on day two. In fact, on the first day, the local stakeholders present the district, its history, and its peculiarities and characteristics; on the second day instead, it is good for the students to see in person and touch the neighbourhood with their hands, so they can take photos, write notes of specific characteristics, collect all the information regarding the potential and the "lack" that the area presents. In this way, the students can then put this information on a map and use them to design the neighbourhood of the future.
Furthermore, in addition to the presence of the host partner who acts as a guide, it would be useful to foresee the presence during the visit to the neighbourhood also of some of the stakeholders who spoke the previous day.
In this phase the experience of the "guide" and the knowledge of the territory are crucial; these can help students to better understand what they are seeing, to get in touch with the reality of the place, its traditions, and its history. This will allow students to respect the neighbourhood more and to highlight and emphasize certain peculiarities in their planning and redevelopment of the area.
Moreover, it could also be useful to carry out a second field visit to be made on the fourth day (possibly in the morning), so that the students, after having imagined, designed, and conceived the solutions for the neighbourhood, can perfect their work, correct any errors of evaluation, and make the project even more fitting with reality. Carrying out this second field visit in the morning would allow students to make any changes to their project (and the presentations they will use for the final conference) in a part of the afternoon of the fourth day.

Online Workshop:
If the workshop was carried out remotely, it would be useful for the host partner, at least a few days before the event, to go to the neighbourhood under study and take photographs of the most significant points of the area to then provide them to the students as material useful for work. These images could integrate territorial information that can be viewed through WebGis tools, such as

Google Maps, Google Earth, dashboards, etc., and help students immerse themselves in the reality of the area.

Registration of participants and Evaluation questionnaire

An important aspect at the management level of the event is to organise and maintain evidence of the registration of participants on the various days of the Workshop; this could be useful, for example, as evidence for project reporting, or to communicate following the event how many people participated and what type of stakeholder were present.
Registration can be done with a signature register at the entrance to the room where the event takes place or, through an online registration by providing a link to the registration form at the entrance (for example by using a QR Code that participants can scan before entering the room), such as the Google Form tool.
The minimum information to be collected should be participant's name, surname, email address and affiliation. The email is important because it allows you to keep in touch with the person and, for example, to send information, updates, newsletters of the project. An online registration form could simplify the collection of further information (e.g., telephone, age, gender, city, and Country of origin, etc.) which could be useful for any statistical evaluations.
In the case of interventions by local stakeholders who do not speak English, it is essential to provide a simultaneous translation service for those who do not speak the local language.

At the end of the event, the administration and storage of the final evaluation questionnaires should be carried out. Many European projects require this evaluation to verify how the event was carried out and if the objectives that had been set have been achieved; in general, this verification can be useful for finding out any errors, oversight, or gaps that the organizer often fails to identify. In the case of itinerant workshops, such as those of the City Minded project, the administration of questionnaires is particularly useful for making improvements in the development of the next stage of the workshops.
In addition to the event, it is good practice to provide certificates of attendance to the participants, in this case, they will be particularly useful for the students and teachers who took part in the workshop.

<u>In-person Workshop</u>:
It could also be useful to think about providing participants with a personalized badge with the name and affiliation, which could facilitate communication and relationships between participants, especially in the case of many participants or people from different countries; in this case, situations where it is difficult to understand the name of participant could arise and so the badge could simplify and avoid misunderstandings.

Online Workshop:
Again, to facilitate communication among participants, in this case, students and teachers should be required from the outset to enter the videotelephony platform using their full name (not nickname) and an abbreviation of their home institution.

Dissemination of the event

The dissemination activity of the event has been included in the "Execution" section, but it involves all the phases of the realization of the event, including the "Preparation" and the "Afterwards" phase. The communication and dissemination of the activities of the event is a very important aspect, with different purposes according to the phase and how it is carried out.

The main role, also, in this case, is played by the partner hosting the event, but the support from the other project partners is also important.
The communication before the event has the task of attracting attention and trying to draw people to participate, both to follow it in presence (in the case of a face-to-face workshop) and, possibly, remotely, via streaming service.
This communication can be carried out using the project's social media and those of the various involved partners, to broaden the audience that is engaged; press releases, newspapers, and newsletters can also be used to reach the widest possible audience.
The communication and dissemination of the event to a wide audience make sense, especially on the first day of the workshop in which local stakeholders present the neighbourhood, but even more so on the last day in which students should present their solutions for a neighbourhood decarbonization roadmap to the citizen.

In-person Workshop:
In addition to social media, a more local diffusion of "old-style" could happen, through the publication of articles in local newspapers, posters, leaflets, and posting on bulletin boards of local structures such as libraries, schools, universities, and churches.
This is because the goal of the last day is to speak to all citizens and, using only social media, there is a risk of excluding a large part of the population, especially the elderly.
In addition, to involve a greater number of participants, both before, during, and, above all, after the event, it is very important to make the project known. The aim will be to let a wide audience know that the workshop has taken place, that there are solutions for the decarbonisation of urban systems, and that these can be found and planned in five days, even by students. This communication must be extended to the widest possible audience, including citizens, local and regional (and national when possible) administrations, but also large and small companies, with the hope of creating a virtuous circle that sets in motion a change and the implementation of at least some of the solutions that have been identified.
For this purpose, social media will certainly play an important role, as also newspapers, interviews with local and non-local radio and television stations, etc.

A useful idea for communication purposes may be to invite all those present (students, teachers, but also any outside participants) to upload the photos taken to a special virtual space. This can be done, for example, by preparing a dedicated Drive folder and providing the link (e.g., via QR code available in the room) to participants; otherwise, there are also Apps that provide this service.

4.3 Closing event

The final workshop event is a very important moment because it is an opportunity to showcase the results achieved to the public, including public authorities, officials, and citizens in the neighbourhood, as well as students, teachers, and stakeholders directly involved in the City Minded Workshops activities.
As mentioned in the previous sections, the final conference needs to be thought out and organized from the earliest planning stages of the Workshop, both in terms of choosing the participants to be involved, promoting the event, choosing the most suitable location, etc.
The project, the city, and the solutions identified must be the protagonists of the final event, but even more so must the students who took part in the Workshop. In fact, at the centre should be them telling about their experience, the work they have done, and the results and improvement solutions they have identified for the study area.
This concluding event needs to be short because it must be attractive, interesting, and engaging for everyone who takes part.
In addition, the presentations must be designed in such a way that all participants can understand the objectives of the project, the work done, and the solutions identified.

Therefore, the suggestion is to carry out the final presentations using various tools such as charts, maps, hand-made sketches, diagrams, and any useful communication to convey the message. All the materials produced by the various groups will be assembled into a single PowerPoint file using a common template to make homogeneous results that can also be very different from each other in content and communication; this will also make the presentation smoother and faster, avoiding wasting time to close and open different files.

Below is a possible idea of how the concluding event of the Workshop could be conducted.
The total duration should be approximately between 75 and 100 minutes, distributed as follows:

- Institutional greetings and welcome speeches by local authorities and the host institution: 5-10 minutes.
- A communication sequence of 4-5 presentations of 10 minutes each, from each partner/teacher and from the various student groups (preferably choosing a representative to speak on behalf of the group): 45-50 minutes.
- Space for questions/comments and discussion with the audience present: 20-30 minutes.
- Acknowledgments and final greetings: 5-10 minutes.

At the end of the workshop proceedings, it would be useful for the partners to conclude the event with a kind of de-briefing to identify the flaws and strengths of the organization; information that could then be useful for the following project meetings.

4.4 Afterwards

The project partners in the weeks following the event should organize a meeting to evaluate the results and contents achieved by the workshop.
The host partner will have the task of presenting to the other partners the results of the workshop carried out, both by providing qualitative information (for example, through the results of the evaluation questionnaires) and quantitative (for example, number of participants) and all the information that he deems useful also to improve the subsequent stages of the project.
All partners, showing the presentation of the host partner, will provide their feedback based on which any changes to the methodology will be considered and applied to the next Workshop.
The best thing would be for the feedback from the various partners to be provided in written form, through the creation of a short report.
Furthermore, all the materials produced in the workshop, including the presentations of the teachers and those of the students on the final day, should be collected and stored, so that they are available to all partners (e.g., using a Google Drive folder).
The feedback from the various partners and all the material collected will then be used to create a Report of the event, which will be coordinated by the host partner, but which will include the contribution of the other members of the partnership. This will contain all the information regarding the selected district, the list of participants, the course of the workshop, the presentation of the topics addressed in the lectures, and the students' work.

The section of these guidelines that has just ended, aimed to give a whole series of suggestions, directions, and advice, also very practical, on how a Workshop like those that were carried out during the City Minded project should be carried out.
The next section, on the other hand, wants to go into more specific and more detail about the project experience.
Thus, the goal is to give the user of these guidelines a full understanding of what the City Minded project consisted of, what its characteristics and peculiarities were, how the Methodology developed is structured, and how the City Decarbonisation Itinerant Workshops were carried out and evolved.

5. Methodology contents and its application

The Methodology presented here is the result of the application, implementation, and evolution of the preliminary Methodology designed and outlined at the beginning of the Project. Below, in this section, the final version of the Methodology is then presented in detail, both its online and applied in-presence form.

The first point to start from, to better understand the nature of the Methodology and what it can offer, is to get to know the components of the City Minded partnership.

This first part is then followed by a presentation of the specific contributions made by the various partners, describing the reasons why certain topics were chosen and the scientific basis from which the tools designed and defined for implementation in the Methodology originate.

To conclude, the various Workshops carried out are presented with a detailed description of the Methodology proposed to the students, both in its theoretical and practical components.

6. The City Minded Partners

The Methodology developed and the workshops conducted, mirror and depend closely on the City Minded project partnership. The characteristics, skills, and peculiarities of each partner outline and identify the methodology itself. In addition, new approaches, skills, and ideas arise from the meeting and collaboration between different partners and people. The whole is more than the sum of its parts; nevertheless, it is important to briefly introduce the partners and their specific competencies that were relevant to the development of the Methodology.

IRENA

Istarska Regionalna ENergetska Agencija
Istrian Regional ENergy Agency

IRENA was founded in 2009 by the Istrian Region. In line with the Intelligent Energy Europe Programme, IRENA was established as an independent non-profit organization providing advisory services on energy issues. IRENA is active in the areas of promotion of Energy Efficiency (EE) and the use of Renewable Energy Sources (RES), promotion of the use of innovative materials and technologies related to reducing energy consumption, implementation of national and regional energy programs and strategies, implementation of the projects dealing with the use of RES and EE in the Istrian Region and preparation of energy renovation studies of public buildings.

In addition to advisory services, IRENA deals with the education of citizens and employees of the public and private sector in areas related to energy and represents a link between all stakeholders related to the issues of the energy sector in the area of the Istrian Region. IRENA has developed and installed several systems using RES in public buildings that have significantly reduced primary

energy consumption. Some of these systems represent unique pilot solutions. IRENA has a significant experience also in the organisation of capacity-building activities with the students at Istrian high schools aiming to provide them knowledge on the detection of energy issues and taking part in real energy refurbishment and installation of RES with strict supervision by certified experts. The experience and gathered knowledge stimulated IRENA to prepare the methodology and modules related to the project's objective of developing an innovative learning environment aiming to bring closer the students to the topics of urban sustainability, climate changes and carbon neutrality of urban areas. The IRENA members that participate in the City Minded project are Mr. Valter Poropat, Mr. Andrea Poldrugovac, Mr. Antonio Franković, Mr. Dalibor Jovanović, Ms. Doris Pajković and Mr. Dino Glavičić.

Website: https://www.irena-istra.hr/hr/podsiteovi/irena/

The University of Siena (UNISI), founded in 1240, is organized in 14 Departments with more than 2,000 researchers and 750 teaching units providing 62 courses to over 16,300 students enrolled in 30 BSc, 32 MSc, and 16 Ph.D. programmes.

The Department of Physical Sciences, Earth and Environment (DSFTA), is involved on behalf of UNISI, especially engaging the Ecodynamics Group (EG), an internal multidisciplinary team founded in the 1980s by Professor Enzo Tiezzi. The Group's research activity addresses the relationships between environmental and human systems both at the theoretical level, investigating the scientific basis of sustainability, and at the technical-scientific level, developing monitoring indicators and environmental sustainability assessments.

EG has expertise in methodologies for environmental monitoring and assessment and systemic indicators utilised to evaluate the sustainability of systems-processes relative to the direct and indirect use of resources, emission of greenhouse gases, and other impacts on the environment. Among study subjects, there are regional and urban systems, cities and neighbourhoods, buildings and building technologies, mobility systems, waste, and water management. These methodologies and indicators are used as tools

to address choices, inform design, and identify impact mitigation solutions and best practices.

The Ecodynamics Group members that participate in the City Minded project are Prof. Simone Bastianoni, Dr. Matteo Maccanti, Dr. Michela Marchi, Dr. Valentina Niccolucci.

Website UNISI: https://en.unisi.it/
Website DSFTA: https://www.dsfta.unisi.it/en
Website EG: https://www.ecodynamics.unisi.it/en/home-eng/

The University of Roma Tre (UNIROMA3) was established in 1992 and with its 12 departments offers 70 degree courses, 80 post-degree courses and 20 Ph.D. programmes to nearly 40,000 students.

The Department of Architecture has 64 teaching staff members offering 1 degree course, 3 post-graduate courses, 7 third level masters and 2 Ph.D. programmes. The department carries out research on environmental and landscape quality, climate change, urban and regional planning, involvement of civil society in planning, and other urban-related topics. At the international level it is a member of UNISCAPE (European Network of Universities for the implementation of the European Landscape Convention) and AESOP (Association of European Schools of Planning) and is connected with international Universities, in Europe (Spain, France, Switzerland, Portugal, Austria, Germany and Greece) and worldwide (US, Russia, Uruguay, Chile). Since 2011, the department has also organised and hosted the *Biennale dello Spazio Pubblico*, a biennial meeting focusing on the current research and good practice regarding urban public spaces.

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The team working at the Department of Architecture which takes part in the City Minded project includes Prof. Anna Laura Palazzo, Dr. Lorenzo Barbieri, Dr. Romina D'Ascanio, Dr. Francesca Paola Mondelli and Ph.D. Candidate Federica Di Pietrantonio.

Website UNIROMA3: www.uniroma3.it
Website Department: www.architettura.uniroma3.it

Pablo de Olavide University (UPO), created in 1997 in Seville, is a public university, located on a single campus, which has about 15,000 Undergraduate and Postgraduate students (it also receives 1,000 students annually from different international mobility programs (International University Centre Students, 943; and Erasmus Students 567) and 15 Departments. Its more than 1,000 professors and researchers teach 28 Bachelor's degrees, 18 Double Degrees, 5 Double International Degrees, 41 Official Master's degrees and 9 Doctoral Programmes.

The Department of Geography, History and Philosophy is linked to the City Minded project through the Global Change Research Lab, which brings together specialists in Geography, Environmental Sciences, Engineering and Economics who work on some of the socio-environmental challenges posed by change global, among which the assessment and analysis of vulnerability and resilience associated with the effects of climate change stands out.

The Global Change Research Lab members that participate in the City Minded project are Pilar Paneque, Josefina López Galdeano and Amaranta Heredia. Postdoctoral researchers Jesús Vargas and Yago Martín, specialists in vulnerability, resilience, and adaptation to climate change, have also collaborated with some of the project tasks.

Website UPO: https://www.upo.es
Website Global Change Research Lab: http://www.gcrlab.org/

The Malta Intelligent Energy Management Agency (MIEMA) was set up in June 2007 with the support of the Intelligent Energy - Europe Programme and a wide array of public institutions including Ministries and Local Councils.

MIEMA is a non-profit, public-equivalent body initially set up to promote energy efficiency and the use of renewable energy sources. The agency aims to be at the forefront of the national and European effort for sustainable energy and the environment, promoting green growth and fighting climate change. Within its sphere of competence, it provides support to policymakers and develops and implements projects on a national level.

In 2012 the agency's management board has decided to enlarge the scope of the activities of the agency to address wider environmental and climate change issues. The agency is also in the process of developing higher education courses on environmental management.

Since its setting up, MIEMA has implemented more than 30 European projects, all related to the environment and sustainable energy, under a range of different programmes. The agency's technical team includes professionals with different areas of expertise, including engineers, architects, and urban planners.

MIEMA is a member of the European Federation of Agencies and Regions (FEDARENE). In Malta, the agency works closely with the ministries, municipalities, academic institutions, national agencies, policy makers, research institutions, SME networks, financing institutions and professional bodies.

MIEMA members that participated in the City Minded project are Diane Cassar, Jesmond Xuereb, Lawrence Attard, Giulia Elena Xuereb and Jason Masini.

Website: www.miema.org

7. Partner's Contribution to the City Minded Methodology

This part of the guidelines reports the contributions that the various partners of the City Minded project have made to the development of the Methodology, based on their own experiences and expertise. More detail and practical application of the partners' contributions will then be presented in the section on the description of City Decarbonisation Itinerant Workshop experiences.

7.1 UNISI – The Carbon Accounting Methodology

The Carbon Accounting Methodology proposed by UNISI works as a mediating model that offers the opportunity to quickly provide an integrated vision of the city of the future, combining technologies with other measures related to citizens' behaviour at different scales (i.e., neighbourhood, household, and person). It provides the opportunity to systemically evaluate the effects of different solutions and the actions planned. Furthermore, the visual approach developed (e.g., maps and Equivalent Forest game) are useful communication tools for a wide audience including, students, citizens, policymakers, but also companies, administrations, and many other local stakeholders. In our opinion, this methodology is the most appropriate for the outputs to achieve because this approach is generally replicable elsewhere being highly graphical, impactful, transferable, and multi-stakeholder friendly.

This Method is inspired by the IPCC standard methodology for Greenhouse Gases (GHG) Emissions Inventory of Nations (IPCC, 2006; 2019; 2021) and has a dual role:

- To assess the Carbon Footprint of urban neighbourhoods, quantifying the current and direct GHG emissions of the study area;
- To estimate the effects of action plans addressed to carbon neutrality in terms of Carbon Footprint mitigation.

Over the years Ecodynamics Group has carried out several studies on various types of target areas to put into practice and perfect a methodology that was able to "take a picture" of smaller territorial realities than a Nation. This philosophy has made it possible to quantify the Carbon Accounting for Regions, Provinces, Municipalities, urban areas (e.g., a medieval historic centre), or specific activity sectors (e.g., an integrated waste management system) (Bastianoni et al., 2014; Maccanti et al., 2017; Marchi et al., 2012; 2017; 2018). This working method was then applied and tested throughout the EU FP7 City-Zen Project with several applications in the neighbourhood of some European cities (Pulselli et al., 2018; 2019; 2020; 2021; van den Dobbelsteen et al., 2018) to establish a general approach for the urban neighbourhood for decarbonisation including the monitoring of carbon emissions and the estimate of the effects of mitigation measures.
This long methodological path of applicative research led to the definition of the methodology proposed for the City Minded project and tested and perfected during the City Decarbonisation Itinerant Workshops.

The first step of this procedure is to provide a clear picture of the state of the art of urban districts in terms of GHG emissions as the initial condition to organize a plan of integrated measures for neighbourhood retrofitting towards carbon neutrality. This work starts with the data collection to obtain the Carbon Footprint of the area. The data are generally obtained from local or national databases and reports and then scaled down for the study area.

Usually, the sectors considered in this type of analysis are:

- The residential buildings consumptions and waste production/management;
- Productive activities in industries;
- Transport;
- Tertiary sector (e.g., commercial activities, public buildings, administrative services, public lighting);
- Agriculture practices.

The considered human activities belong to specific emission sectors (i.e., Energy, Industrial activities, Waste and Agriculture, Forestry, and Other Land Use – AFOLU). Once collected, activity data are properly elaborated and aggregated representing different human activities at the urban level, as main emissions sources.

The emission sources considered in this study are energy use (we are accounting for electricity, natural gas, and other fuel used for lighting, appliances, cooling, heating, domestic water heating, and cooking), mobility (concerning all the fuel used for all public and private vehicles), waste management (that considers the total waste production and how it is managed), water consumption (quantity of tap water per capita per day), and eating habits. For the latter, three types of diet are considered: a diet with medium-high consumption of animal protein, a balanced diet, and a balanced diet with purchase of local food.

All the activity data are then converted into tons of carbon dioxide equivalent (CO_2eq) using specific emission factors (expressed in kg CO_2eq/unit activity). The three main greenhouse gases released into the atmosphere, considered in the analyses, are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), converted into CO_2eq applying the respective 100-year Global Warming Potential (GWP).

The next step of the methodology is aimed at better understanding the intensity and size of impacts of the study area. To do this, the Carbon Footprint of the urban area is represented and visualized in terms of virtual forestland equivalent, i.e., the equivalent surface covered by a relatively young forest that would be needed to absorb an equivalent amount of carbon emissions generated within the area. In the end, a dynamic representation of the decarbonisation plan for city neighbourhoods by 'crunching' the virtual forestland was carried out. A sequence of mitigation actions and policies are applied to show how they could progressively reduce the carbon footprint of the urban area potentially bringing impacts to zero.

The Carbon Accounting Mitigation Action can be implemented at different scales, involving both citizens and technological solutions. The citizens can change their daily behaviour, reducing their energy, water, and food consumption and implementing environmentally friendly attitudes (like waste recycling). The technological solutions can reduce the climate impacts on single households, buildings, building blocks, roads, and entire neighbourhoods. Both simple and complex technological solutions may be introduced in the urban systems at different times.

The various interventions, activated in the mitigation plan, can happen in the short-term (about 10 years), in the medium-term (about 20 years), and in the long-term (more than 30 years), depending on the complexity of their implementation.

7.2 UNIROMA3 – Placemaking Framework

The so-called "Placemaking" refers to an integrated approach to planning and management of public spaces that exploit local knowledge and needs in order to improve the well-being and quality of life of communities (Schneekloth, 1995). Placemaking is a participative and collaborative process based on the enhancement of specific features of a place and the fulfilment of people needs for the improvement of the public space and liveability. It is based on a long-term, future oriented process that recognises the uniqueness of a place. It involves listening to the people who live, work, visit,

study and play in a place, to discover their needs and aspirations. It uses short and long-term interventions to build on the place's existing qualities.

Generally speaking, place-making, typical to the urban design practice, proves a most relevant part of the current reflection on cityscape, affecting the rules and codes of its composition and shaping insiders' and outsiders' perceptions. Amongst different attitudes, two main approaches stand out. They share two main assumptions: (i) an effective and socially sustainable recovery and possible re-use of heritage should be place-specific; (ii) the main focus should be on public space, deemed as the most authentic dimension of a city. Accordingly, both approaches entail dynamic surveys of all kinds of outdoor spaces.

The first approach, by far the most enduring in the Italian experience, intends the city as an assemblage of meaningful forms standing like the words in a sentence. This metaphor of the City as a Text allows for overwriting, i.e. introducing new elements and uses according to the inhabitants' needs, provided that they respect the span and rhythm of the pre-existing 'text'.

Therefore, the building fabric displays continuous layers and rearrangements of the pre-existing materials, more or less consistent with each other, often resulting in forms that are wholly or partly different from the original ones, while the overall image and identity of the city persist.

In line with the European Landscape Convention (2000), the second approach is based on the aspirations of the public with regard to the landscape features of their surroundings. In other terms, any public decision regarding the transformation of the cityscape requires knowledge of public opinion. Participatory planning, combining expert and common knowledge is able to guide communities towards a shared vision of the future, merging common and individual perceptions and memories.

To sum up, any urban transformation, including those aimed at decarbonisation, 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. This is crucial to ensure the social sustainability of decarbonisation actions, as well as their compatibility with the life of urban communities. The Place-making Module is based on this assumption and intends to provide students with basic capabilities of cityscape interpretation, taking into account their different backgrounds and the variety of the neighbourhoods selected as case studies.

The placemaking methodology has been addressed to define strategies for the improvement of the urban environment, and adaptation measures to climate change and decarbonisation to put in place. Furthermore, through surveys, drawings, sketches, analysis of the stakeholders involved, it is possible to define the tangible and intangible networks of the case study.

The applied methodology, mainly rooted in the discipline of urban planning and design, is divided into different phases: (i) experience, (ii) analysis and (iii) strategies.

The first fundamental step for the application of this methodology is the acquisition of a basic knowledge of the study area. For this reason, the first phase should include training lessons, aimed

at providing the basic tools for reading and analysing the context, and a field trip during which students can annotate, sketch and pin down the significant elements of the area.
Then the mapping of all the values and criticalities of the study area, both on a neighbourhood scale and on an urban and (if possible) regional scale, will be reported. Specifically, the mapping concerns the mobility system, the environmental system and the network of public spaces and services.
Working in groups, the students can provide a sort of community map to record and represent the spatial knowledge of local communities, their experience, and scientific features. Simultaneously a simplified SWOT will help students list the strengths and weaknesses of the case study. SWOT analysis is an analysis of the sectorial or territorial context in which an intervention program is implemented. The purpose of the analysis is 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. The SWOT analysis is designed to facilitate a realistic, fact-based, data-driven look at the strengths and weaknesses.
Finally, in the phase of the definition of the strategy the methodology envisages representing on a map the possible design solutions to be implemented for the improvement of mobility, green areas, public space, and services. At the same time, objectives and activities should be listed, intended as follows:

- Objective – Concise statement describing specific, critical, actionable, and measurable things to do in order to effectively execute the strategy and achieve the project vision. Objectives often begin with action verbs such as increasing, reducing, improving, achieving, etc. (e.g., improving soft mobility).
- Activity – Detailed and operative tasks and actions to be carried out to achieve each objective. Activities often begin with operative action verbs such as implementing, designing, planning, defining, etc. (e.g., implementing bicycle paths along the main roads).

7.3 UPO – The Vulnerability Index

The Vulnerability Index proposed by UPO want to introduce students in the hybrid nature of risk through the assessment and analysis of vulnerability in different study cases. Natural hazards are defined as the probability that a dangerous natural event causes damage to the population, the economy or/and the environment (natural and built systems). Climate Change forecasts predict an increase in the frequency and intensity of natural hazards. In particular, the Mediterranean countries (Italy and Spain) the predictions indicate an increase of droughts, floods, and heat waves (IPPC, 2014). Therefore, disaster risk management strategies must be oriented towards prevention and mitigation of the effects that these events can cause. To do this, it is essential to know how sensitive the society exposed is and to what extent they are prepared to face these risks. Vulnerability assessment and analysis have become one of the main tools for preventing and

mitigating natural hazards effects on society, economy, and environment (UNISDR, 2015; EEA, 2018).

Thus, the objective of this workshop 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. For this we start explaining the risk equation (Risk = Hazard * Vulnerability). This working method 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; Vargas, Olcina & Paneque, 2022; Martín & Paneque, 2022),

The methodological framework adopted by Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2012; 2014) defines vulnerability based on three main components: Exposure, Sensitivity, and Adaptive Capacity (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 drought while the natural phenomenon is happening (short-term response), and those that are part of an ongoing process of learning, experimentation and change in relation to the way these phenomena are confronted through preparedness, prevention, and mitigation (long-term response).

To adopt adequate prevention, mitigation, and adaptation measures, it is not enough to measure vulnerability, but it is also necessary to analyse the causes that generate vulnerable conditions. In this way we identify weak points, and we can guide management strategies to correct them. Therefore, we will use a methodology in two stages: vulnerability assessment and analysis of the causes that generate the vulnerability.

The assessment of vulnerability and its quantification is generally carried out by means of a composite index. A composite index is formed when individual indicators are compiled into a single index based on an underlying model. The composite index should ideally measure multidimensional concepts which cannot be captured by a single indicator. So, we use a specific methodology to calculate a vulnerability compound index (VI) that will allow us to know the degree of vulnerability of each of the study cases. Once we have calculated the VI we use the vulnerability structure triangle to analyse causes of vulnerability and compare results from different study cases.

Due to the multidimensional nature of vulnerability, we will work with data of a different nature (social, physical, environmental, institutional, and economic) and with different research techniques and sources of information (data analysis, surveys, documents, etc.). In addition, we pay special

attention to the inclusion of indicators of adaptive capacity. Among these indicators, a special role will be given to those that allow measuring the social perception of risk and public opinion in relation to the risks associated with climate change. This methodology may be used to advance knowledge of the social and institutional aspects involved in the degree of vulnerability of different urban districts or counties.

The first step is to select the variables and indicators to characterize each of the vulnerability components (Exposure, Sensitivity, and Adaptive Capacity) and calculate the value of the indicators. Afterwards, the indicators must be normalized on a scale from 0 to 1. Once normalized, we apply a weighting of the drivers to integrate them into the different Indices of Exposure, Sensitivity and Adaptive Capacity with equal weights, so that each of the indicators contributes the same weight to the composite index. Finally, we must aggregate the three Indices into the final Vulnerability Index, so that the VI value determines the vulnerability level (from very low to very high) of each case study.

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

The Energy Efficiency and Renewable Energy Technologies methodology ensures a systematic and comprehensive approach in order to expand the student's knowledge and motivate them to analyse the selected urban 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 with the maximisation of the use of renewable energy technologies.

The topics related to the module include the following:

- Analysis of the building stock in the target urban area,
- Energy efficiency measures,
- Nearly zero-energy buildings,
- Energy refurbishment of heritage buildings,
- Financing renovations,
- Urban energy systems and the urban energy strategy,
- Renewable energy technologies,
- Prosumers and self-consumption,
- Urban micro- grids and energy communities,
- Building typologies and challenges to energy renovation,
- Energy auditing,
- Presentation of different best practices.

The developed methods and procedures are adapted for the students with a different levels of knowledge on the presented topics and with the aim to raise awareness about the importance of conducting selected energy efficiency measures on the targeted buildings together with the use of

renewable technologies, both aiming to the achievement of targets set in the local/regional/ national energy plans, but also to provide a healthier, greener and sustainable environment. The part related to energy efficiency is focused on the building stock of the target neighbourhoods and their energy-efficient improvement by sharing the knowledge about energy efficiency, detecting potential problems, and identifying solutions during the co-working session. The focus of the exercise is on how to achieve energy-efficient buildings in the target neighbourhood. 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. 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 these numbers in the following years will have to change rapidly if the targets set in the EU Green Deal will be achieved.

The module starts with the analysis and presentation of the building stock in the target urban area and then in order to improve the energy efficiency of the buildings, the measures in the module are explained and proposed to reduce the consumption of energy needed for:

- Heating
- Cooling
- Lightening
- Ventilation
- Hot water

By taking into consideration that urban areas have also the possibility to expand by the construction of new buildings, the module provides the latest requirements for new buildings, also called nearly-zero energy building standards which are mandatory for all new private and public buildings and explains the peculiarities of the protected heritage areas which represent a significant which represent a significant share of urban areas in Europe.

The characteristics of an urban energy system are highlighted during the first part of the module section related to RES, emphasizing the challenge brought around by the high density of population and activities which results in high energy use and emissions. The challenge can also be considered an opportunity since the high concentration of economic and human capital resources can be mobilized to institute innovation and investment in the energy sector. In view of this, the integration of renewable energy sources within the urban context is considered a key element in the decarbonisation process of cities.

An urban energy strategy is defined next, where the following four main pillars are presented:

- **Maximising energy efficiency:** Building up on the first part of the module, the first aim of the strategy is to reduce the overall consumption of the buildings in the urban area through energy renovation,

- **Renewable Energy:** the next step in the strategy is the integration of renewable energy systems within existing buildings to cover part of the energy needs of the urban area,
- **Self-consumption:** maximise energy self-consumption on site through additional technologies such as energy storage follows the integration of RES with the aim reducing losses and empowering building owners,
- **Smart load management:** the last step of the strategy focuses on the management of loads to decrease costs and reduce stress on the grid infrastructure.

Different types of renewable energy technologies which can be used in the urban environment are presented, included micro-wind, combined heat and power systems and photovoltaic technologies (conventional PV panels and building-integrated systems). The next section of the module is dedicated to energy self-consumption and local energy communities, a relatively recent concept that has been introduced officially by the European Union as part of the Clean energy for all Europeans package. Micro-grids and technologies that can be used to maximise renewable energy self-consumption such as battery storage systems are also introduced. The advantages of distributed energy generation through renewable energy for households, public buildings, commercial buildings as well as the grid operators are also highlighted.

The next part of the module focuses on the identification of different building typologies within the urban context and understanding specific barriers and challenges to energy renovation and the integration of renewable energy technologies. This is followed by the presentation of a strategy for defining solutions and mitigation measures to address the challenges and barriers.

The final part of the module is dedicated to the presentation of best practices and innovative projects from different European countries in relation to the integration of renewable energy systems within buildings.

The methodology was designed particularly for the project City Minded and it aims to be easily replicable on different scales and according to the single workshop needs. The lectures and relevant exercises are in strong correlation with other modules and complement each other in order to achieve the goal of having carbon neutral and sustainable urban areas.

8. The Workshops carried out during the City Minded Project

The Methodology developed by the Project was tested in three European cities, analysing very different urban contexts, both in terms of size, population density, type of housing, and intrinsic characteristics of the neighbourhood or city. The typology of students was also very varied: students from numerous different disciplines took part, coming from various parts of the world, not only from European realities, belonging to different levels and study paths, such as Master's Degrees and Research Doctorates, but also young researchers.

The three City Decarbonisation Itinerant Workshops took place in Siena (Italy), Rome (Italy), and Seville (Spain) in the online form and were the opportunity to test, evaluate and improve, time after time, the Methodology that is described here. A fourth application of the Methodology took place within the Intensive Course which carried out in Valletta (Malta), during which the Methodology tested in the online Workshops was applied in its defined and most complete version. This latest application was also the only breakthrough in attendance. We, therefore, believe that it is useful for the purpose of this methodology and its usability to describe both methods of carrying out it, both online and face-to-face.

8.1 Workshops in online version

The first three workshops that were held online (Siena, Rome, and Seville) are briefly described below, and a focus of the third workshop, the one held in Seville, is presented as a more complete example of an online workshop.

8.1.1 The 1st City Decarbonisation Itinerant Workshop

When: 23rd to 27th of November 2020.
Where: Siena, Italy – *online event.*
Leading Partner: UNISI – Università degli Studi di Siena.
Participating Student: around 20 students attending the Master's Course in Ecotoxicology and Environmental Sustainability at the Department of Physical Sciences, Earth and Environment at the University of Siena.
Brief description: The Workshop aimed to bring together the project partners (teachers, researchers, or trainers), students, and local stakeholders to face the common challenges on site and define collaborative roadmaps for urban decarbonisation for the Ravacciano neighbourhood in Siena. This was the first opportunity to test the Workshop remotely, using the Cisco Webex platform.
The Ravacciano district is home to about 1630 inhabitants, with an average density of 35.6 inhabitants/hectare. It is a relatively old neighbourhood, the first settlement of which was built in the 1930s. The inhabited area grew up to the 70s and 80s and then remained almost unchanged, without significant construction in the following years. The district is located between the valleys of

Follonica and Ravacciano and borders the ancient city walls; on the north side, it borders a productive and commercial district.

The Workshop has been divided into training and co-working sessions. The interventions of the first day focused on the description of the Project and the presentation of the City of Siena and the Ravacciano neighbourhood by representatives of the municipal jurisdiction and exponents of the URBiNAT project. The latter aims to create an urban health corridor to connect the neighbourhood with the historic centre, through the redevelopment of old paths and urban gardens which have been abandoned for decades. During each of the other days of the Workshop, 2-3 persons (teachers, researchers, or trainers) from each partner organization presented a training session to implement a site-specific urban decarbonisation pathway for the selected neighbourhood. After the training seminars, each partner organised a co-working session with practice exercises to be done by the students, using simple programs/websites that are easily found by all students, such as Excel, PowerPoint, and Google Maps.

8.1.2 The 2nd City Decarbonisation Itinerant Workshop

When: 1st to 5th of March 2021.

Where: Rome, Italy – *online event.*

Leading Partner: UNIROMA3 – Università Degli Studi Roma Tre.

Participating Student: 24 students, of which nine Ph.D. students, eleven students from the Bachelor's degree in Architecture, three from the Master's degree in Architectural Design, and one from the Master's degree in Engineering.

Brief description: The Workshop focused on the study of the neighbourhood Torrino-Mezzocammino in Rome. The Workshop was carried out online, using the Teams virtual platform. The Torrino-Mezzocammino neighbourhood lies in the south-western part of the city of Rome, just outside Rome's ring road, known as Grande Raccordo Anulare (GRA). It is a very recent neighbourhood, as it was only definitively declared a residential area in 1990, when a consortium of landowners was established, allowing the preparation of a development plan for the area.

The first inhabitants moved in 2008, with most works still ongoing, both on the amenities and on the houses. The neighbourhood covers around 190 ha. As of March 2021, some areas are still being developed. The neighbourhood features a rectangle of roads at its centre, enclosing a large open space, still waiting to be developed into an urban park. Torrino Mezzocammino is well connected to the surrounding road system: apart from the ring road, street Ostiense/del Mare and street Cristoforo Colombo connect it to the city centre and to the seaside. What lacks is a public transport connection: despite being bordered by the metro Roma-Lido railway, the neighbourhood has no station, nor it is expected to be built soon. Bicycle paths cross all parks and footpaths are large and well maintained, so the inhabitants can easily move around the neighbourhood sustainably.

The Workshop was divided into training and co-working sessions; each day 2-3 persons (teachers, researchers, or trainers) from each partner organisation presented a training session and organized a co-working session with practical exercises to be done by the students.
On the first day, some relevant stakeholders have involved: the Torrino-Mezzocammino Consortium and the local neighbours' association. The results of a survey aimed at assessing the inhabitants' perception of their neighbourhood completed the presentation of the target neighbourhood. Other presentations served to frame it into the overall dynamics and issues of the City of Rome, providing an overview of the transformations of the urban area between the city centre and the littoral, and the vulnerability to climate change in the city.

8.1.3 The 3rd City Decarbonisation Itinerant Workshop

When: 7th to 11th of March 2022.
Where: Seville, Spain – *online event.*
Leading Partner: UPO - Universidad Pablo de Olavide.
Participating Student: 7 students from Master's and Ph.D. (Environmental Studies & Social Sciences) living in three different countries (Colombia, Ecuador, and Spain).
Description:
The structure of the Seville 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 workshop week kicked off with the interventions of three stakeholders from Seville, North Municipal District, that could frame the city in its context and provide both locals and guests with useful information about its history and urban development, as well as about some initiatives that have been taking place in the last decades.
The case study for Seville was the North Municipal District. This area 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 neighbourhood quite isolated.
Antonio García (UPO) held a presentation about Seville's recent development and main socio-environmental issues. This was followed by Ángela Lara García (ResCities Project), who tackled how current experiences of urban resilience are shaped by civil society in the context of climate change.

And lastly, Raúl Puente (Plataforma Parque Miraflores) put his focus on the northern district of the city, where an initiative to build urban gardens has served as a multifunctional nature-based solution to tackle the degradation of the area.

The rest of the week was followed by the presentations and exercises working mainly on a county scale or in the northern district of Seville. Since this time the hosting organisation was UPO, the first Module was dedicated to Vulnerability Indicators, followed by UNIROMA3 - Place-making framework, UNISI Calculation of Seville's Carbon Footprint and Energy Efficiency and Renewal Energy technologies in the active service of the City Decarbonisation processes. These presentations allowed for 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. After these theoretical and framework presentations for each day's topic, students were divided into small groups of 3 or 4 people to work on an exercise that applied the concepts just learned to the case study of Seville. This gave the students the chance to see both the applications of the concepts and the challenges that can spring during the process. Students were encouraged to discuss, ask, and contribute their thoughts on the process.

The wrap-up session carried out on the last day included an open discussion and joint assessment of the results of the workshop, which involved all partners and participating students. The most important remarks can be summarised 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 the 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 was presented simply and communicatively; moreover, they appreciated being 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.

The Training and Co-Working Sessions
UNISI

Training session

The UNISI presentations consisted of the explanation of the Urban Carbon Accounting Methodology for the City of Seville to the students. The contribution consisted of two presentations carried out by two researchers of the UNISI Team.

The first one started with a brief explanation of climate change-related to the increase of greenhouse gases in the atmosphere and the consequent greenhouse effect. In this context, the Carbon Footprint has been identified as the best methodology to account for and describe the state of the territory in terms of levels of greenhouse gases emitted directly or indirectly.

Subsequently, the methodology developed and applied during the Itinerant Decarbonisation Workshop of the project was described in more detail, with a brief historical account of the logical and working path that led to this framework; from the IPCC guidelines, up to the City-Zen project, passing through the territorial applications in different areas of Italy.

The practical steps necessary for the application of the methodology were explained: the collection of data (divided by emission source and sector of activity), the processing of these data, and the use of specific emission factors to obtain the values of Carbon Footprint (expressed in t CO_2eq) and the procedure necessary to convert these emissions into hectares of virtual forest equivalent necessary to absorb the emissions of the study area.

This was followed by the presentation of the study area, with its contextualization at the level of the territory, region, and nation; this is a fundamental step because the boundaries of the system that we are going to analyse must be defined immediately, both for the collection of specific data and for the assumptions that must be made for data on a larger scale.

Regarding the data collection, has been illustrated in detail:

The sectors of activity considered:

- Households and city;
- Productive activities;
- Transport;
- Tertiary sector;
- Agriculture.

The emission sources considered:

- Energy use (electricity, natural gas, and other fuels) for lighting, appliances, cooling, heating, domestic water heating, and cooking;
- Mobility: Consumption of gasoline, diesel, and LPG for public and private vehicles;
- Waste management, i.e., total solid waste production and management (Landfill, Incinerator, Compost, Recycling);
- Water consumption, i.e., water consumption per Population Equivalent (PE).

- Food consumption. In this case, three hypothetical average diets were considered 1) diet with medium-high consumption of animal protein; 2) balanced diet; 3) balanced diet with purchase of local food.

The following pieces of information were then explained in detail:
data on demographics (resident population, number of dwellings, number of households, inhabitants per household, number of cars and other vehicles), is useful for making assumptions about other realities studied in previous workshops or literature; data on electricity production (renewable and non-renewable) for the Province of Seville, data on the consumption of electricity and other energy sources, such as natural gas, for each of the sectors analysed; data on the extent of urban green areas in the City of Seville.
Table 2 shows the list of activity data that were needed to calculate the Carbon Footprint of the Municipality of Seville.

Table 2 - Activity Data for the Carbon Accounting of the Municipality of Seville.

INPUT	UNIT	VALUE
GENERAL DATA		
Population	n.	694,492
Buildings number	n.	482,772
Vehicles number	n.	328,665
Households number	n.	280,758
Tourists	n.	5,886,862
Total surface	ha	14,142
ELECTRICITY CONSUMPTION FROM NATIONAL GRID		
Industrial sector	MWh_e	446,738
Residential sector	MWh_e	705,418
Transport	MWh_e	17,059
Tertiary sector	MWh_e	502,477
Agriculture sector	MWh_e	60,960
TOTAL	**MWh_e**	**1,732,652**
ELECTRICITY PRODUCTION		
Import from the national grid	MWh_e	1,732,652
Natural gas	MWh_e	7,085
Biomass	MWh_e	591,130
Hydroelectric	MWh_e	19,040
Wind	MWh_e	130,624
PV	MWh_e	715,112
Concentrated Solar Power (CSP)	MWh_e	2,001,427
TOTAL RES	**MWh_e**	**5,197,069**
Thermoelectricity	m^3	26,443,934
FUELS CONSUMPTION		
INDUSTRIAL		

Coal	t	19,313
Natural gas	m^3	87,075,237
Diesel	t	844
Fuel oil	t	376
LPG	t	1,970
Other petroleum	t	31,221
RES (biomass and biogas)	m^3	13,878,278
RESIDENTIAL		
Natural gas	m^3	13,380,026
Diesel	t	4,943
LPG	t	17,265
RES (biomass and biogas)	m^3	11,972,633
TERTIARY		
Natural gas	m^3	9,637,013
Diesel	t	962
LPG	t	365
RES (biomass and biogas)	m^3	3,530,504
AGRICULTURAL		
Natural gas	m^3	5,462,455
Diesel	t	35,694
LPG	t	183
RES (biomass and biogas)	m^3	4,718
MOBILITY		
Natural gas	m^3	5,018,353
Diesel	t	202,093
LPG	t	457
Kerosene	t	19,631
Gasoline	t	44,849
RES (biomass and biogas)	t	25,838
WASTE PRODUCTION		
Landfill	t	308,288
Recycling	t	9,535
TOTAL	**t**	**317,823**
Anaerobic digestion	m^3	73,147,964
WATER		
Person Equivalent (PE)	PE	710,620
m^3 water treated	m^3	41,420,000
FOOD CCONSUMPTION		
inhabitants	n. inhabitants	694,492
LAND USE (UPTAKE)		
Green urban area	ha	806

The result of the Carbon Accounting of the City of Seville was then shown, with the detail for the different emission sources and activity sectors; these results were illustrated with the graphic

expedient of the equivalent forest that would be needed to absorb the calculated emissions: a series of 500 squares, each with an area of 5 km^2 were compared, to scale, with a map of the City of Seville to make it better understood how much forest would be needed for the emissions uptake (Figure 1).

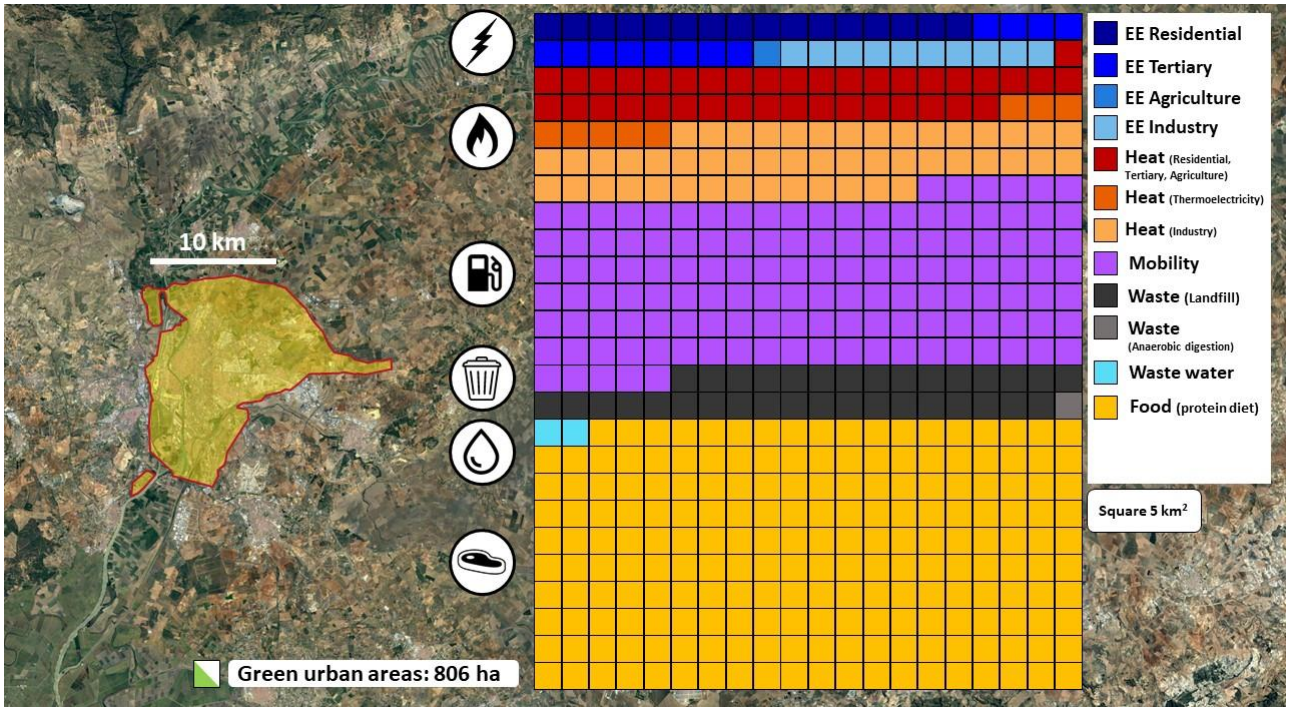


Figure 1 - Scaled representation of the equivalent virtual forest that would be required to absorb gas emissions from the City of Seville.

Carbon Accounting was then shown at a smaller scale by an individual dwelling, allowing comparison with the study of the average European dwelling shown in Pulselli et al. (2019) and the studies done during the Siena and Rome Workshops. Again, a graphical gimmick was used to give students a better understanding of the magnitude of emissions from the individual dwelling; the equivalent forest needed for the uptake was represented in terms of a virtual garden area, taking a soccer field as the reference measure: each dwelling would need a forest-covered garden, about one and a half soccer fields wide.

Then, after explaining the methodology, its applications, results, and some graphical ways to show the numbers obtained, possible mitigation actions to reduce emissions were illustrated. These can be structured based on different spatial scales (household, building, building block, street, neighbourhood) and different time scales (short-, medium-, and long-term measures, with time scales of 10, 20, and 30 years).

Table 3 presents some of the offsetting measures that have been assumed and show the effect in terms of CO_2eq emission reduction that results.

These measures are derived from those identified and described in detail by Pulselli et al. (2019); among the 25 proposed measures, some were selected based on the specific characteristics and potential of the study area.

For each measure illustrated in Table 3, the specific sector of activity on which it is going to act, the consumption savings (based on specific literature, as indicated in Pulselli et al., 2019), the penetration of the policy in the population that has been assumed, and the potential reduction in terms of t CO_2eq, including for the total Carbon Accounting of the City of Seville, are illustrated.

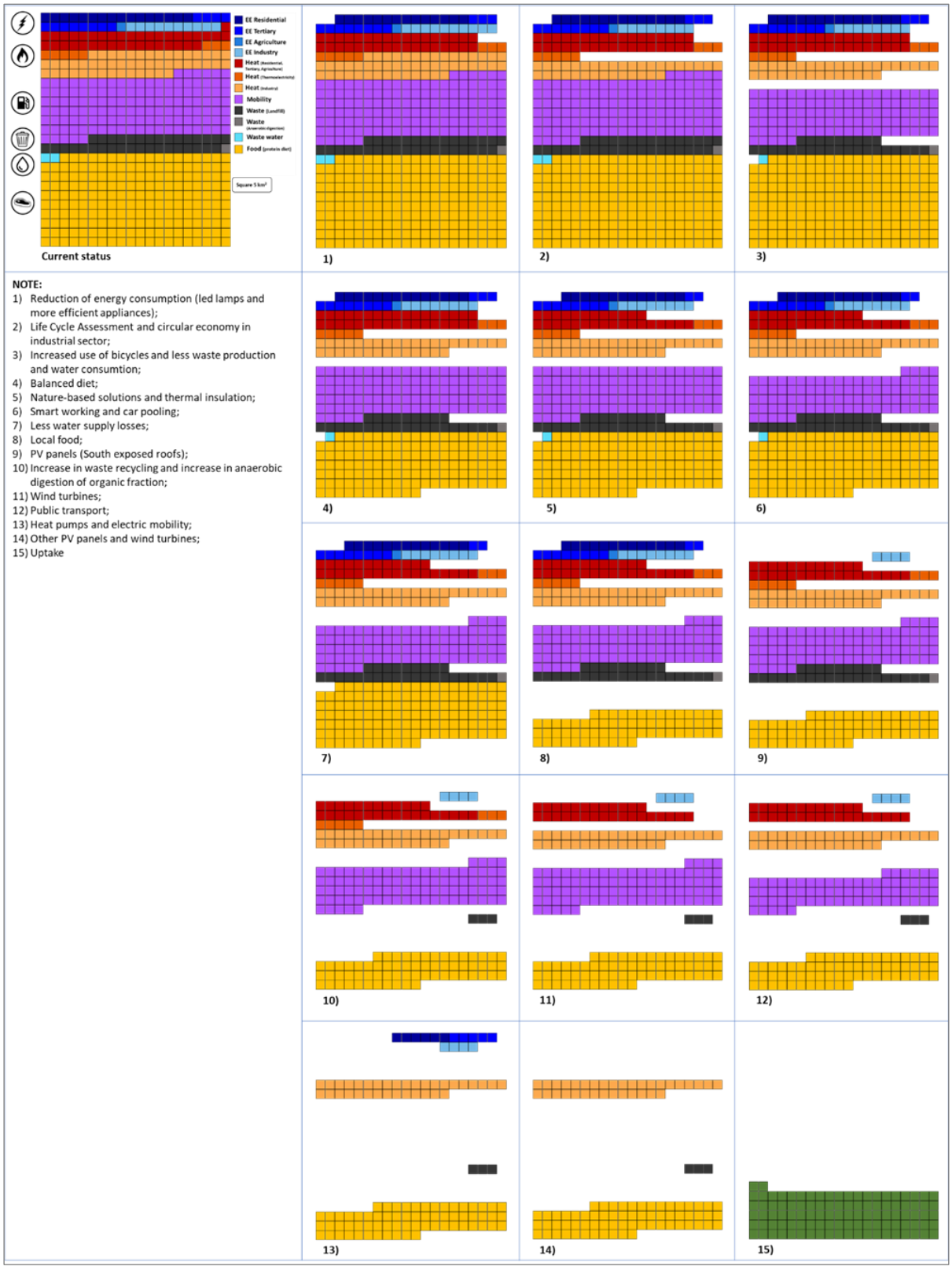
In the list shown, some of the measures are repeated because this is a process that takes place over a time frame ranging from zero to about 30 years, and therefore for some measures (e.g., waste reduction, installation of photovoltaic panels or wind turbines) they can be implemented and deepened in different time steps. In addition, for example, it is assumed that the performance of photovoltaic panels from here to 30 years will improve due to technological advancements, which is why, after a first measure that affects only south-facing roofs, a second one is assumed to be installed in north-facing roofs.

Table 3 - Mitigation measures for the City of Seville.

Activity sector on which the measure acts	Measure	Unit	Saving rate	Penetration in the target area	CF reduction (t CO_2eq saved)	CF Seville (t CO_2eq)
Time Zero - Total CF of Seville Municipality	/	/	/	/	/	3,371,862
Electricity (Residential and Tertiary)	LED + appliances + air conditioner	MWh	-10%	100%	-18,891	3,352,971
Electricity (Industrial)	Life Cycle Assessment	MWh	-20%	100%	-13,974	3,338,997
Natural gas and other fuels (Residential, Tertiary and Agriculture)	Boiler efficiency test	MWh	-10%	100%	-25,573	3,313,424
Natural gas and other fuels (Industrial)	Circular economy	MWh	-30%	100%	-98,753	3,214,672
Fuel (Mobility)	Bikes	t	-80%	25%	-176,480	3,038,191
Waste to landfill	Less waste production	t	-20%	90%	204,782	3,242,973
Water treatment	Less water consumption	m^3	-20%	90%	-2,087	3,240,887
Food consumption	Balanced diet	/	-35%	100%	-467,671	2,773,216
Electricity (Residential and Tertiary)	Nature Based Solutions (NBS) and Urban Heat Island Effect (UHIE) reduction	MWh	-15%	50%	-10,269	2,762,946
Natural gas and other fuels (Residential, Tertiary and Agriculture)	Thermal insulation	MWh	-30%	50%	-34,523	2,728,423

Fuel (Mobility)	Smart working	t	-50%	30%	-105,888	2,622,535
Waste to landfill	More recycling	t	-40%	100%	-172,927	2,449,608
Waste (Anaerobic digestion)	More organic waste recycling	m^3	-30%	100%	-2,140	2,447,468
Water treatment	Less grid losses	m^3	-60%	100%	-5,703	2,441,765
Food consumption	Local food	/	-50%	100%	-434,266	2,007,499
Electricity (Residential, Tertiary, Agriculture, Industrial, Transport)	PV panels on south exposed roofs	m^2	6,195,000	620 ha	-193,780	1,813,719
Natural gas (Thermoelectricity)	Wind turbines (3 MW)	n	47	/	-51,456	1,762,264
Fuel (Mobility)	Public transport	t	-80%	25%	-120,007	1,642,257
Waste to landfill	More recycling	t	-80%	100%	-207,512	1,434,745
Waste (Anaerobic digestion)	More organic waste recycling	m^3	-70%	100%	-3,495	1,431,250
Electricity (Residential and Tertiary)	PV panels on North-facing roofs	m^2	120,000	12 ha	-3,754	1,427,496
Natural gas and other fuels (Residential, Tertiary and Agriculture)	Heat pumps	MWh	/	/	-195,632	1,231,864
Fuel (Mobility)	Electric mobility	t	/	/	-480,026	751,838
Electricity (Residential)	PV panels on canopy	MWh	1,200,000	120 ha	-37,536	714,302
Electricity (Tertiary and Industrial)	Wind turbines (3 MW)	n	59	/	-64,593	649,709
Carbon Uptake	Forestland	/	/	/	-649,709	0

In the end, a dynamic representation of the “decarbonisation” plan for city neighbourhoods by ‘crunching’ the virtual forestland was carried out. This was done using a playful gimmick inspired by pop culture: a small Pac-Man eats the squares of emissions that are avoided through the adoption of various mitigation actions (Figure 2).



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 2 - Carbon Footprint mitigation scenario for City of Seville.

The second presentation given was even more practical than the first and was intended to explain in detail the conduct of the exercise that the students, shortly thereafter, would go on to perform. Compared to the first presentation, a more in-depth explanation was carried out regarding the Carbon Footprint tool, the principles behind it, and the purposes for which it is used. The objectives of the exercise were explained, and then the students were explained in detail how the Excel file provided to them was structured and what the various steps and calculations to be performed should be.

After the Training session was over and some of the students' doubts were answered, they were divided into groups and, after a break of 5-10 minutes, they moved on to the co-working session.

Co-working session

The exercise proposed by the University of Siena had the following aims:

a) Quantifying the Carbon Footprint (CF) of the Seville Municipality;
b) Quantifying the virtual equivalent forest area needed to absorb GHG emissions;
c) 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 them 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 was inventoried; 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 provided to the students presents a list of offsetting measures as was shown in Table 3. Students in this way were able to simulate the Carbon Footprint mitigation effect due to the implementation of certain policies.

Due to time constraints, students were then asked to devote the last part of their group work to the hypothesis of installing 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 4, indicating that mobility had a greater impact (43%), followed by electricity consumption (16%) and the fossil fuels used 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 analysed territorial system (44%).

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.

Table 4 - Carbon Footprint of the Municipality of Seville.

ACTIVITY SECTOR	Carbon Footprint	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%**

After this initial exercise, students were asked to reason about possible mitigation policies that could be applied to the city. Due to time constraints among the 25 possible mitigation actions (as reported in Pulselli et al., 2019), UNISI teachers had already set up the Excel file for students to work on two policies: the installation of photovoltaic panels and wind turbines to increase the share of energy from renewable sources.

Therefore, students have identified on 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 3). 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%.

Moreover, the installation of about 42 wind turbines (4 MW each) was hypothesized in the area near the Guadalquivir River, characterized by cropland, grassland, and vacant lots just outside the boundaries of the municipality (yellow shape in Figure 4). Inside the municipal area, there are no necessary spaces for the installation of wind turbines 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 3 - Potential location of PV panels (red boxes). Source: Google Earth.

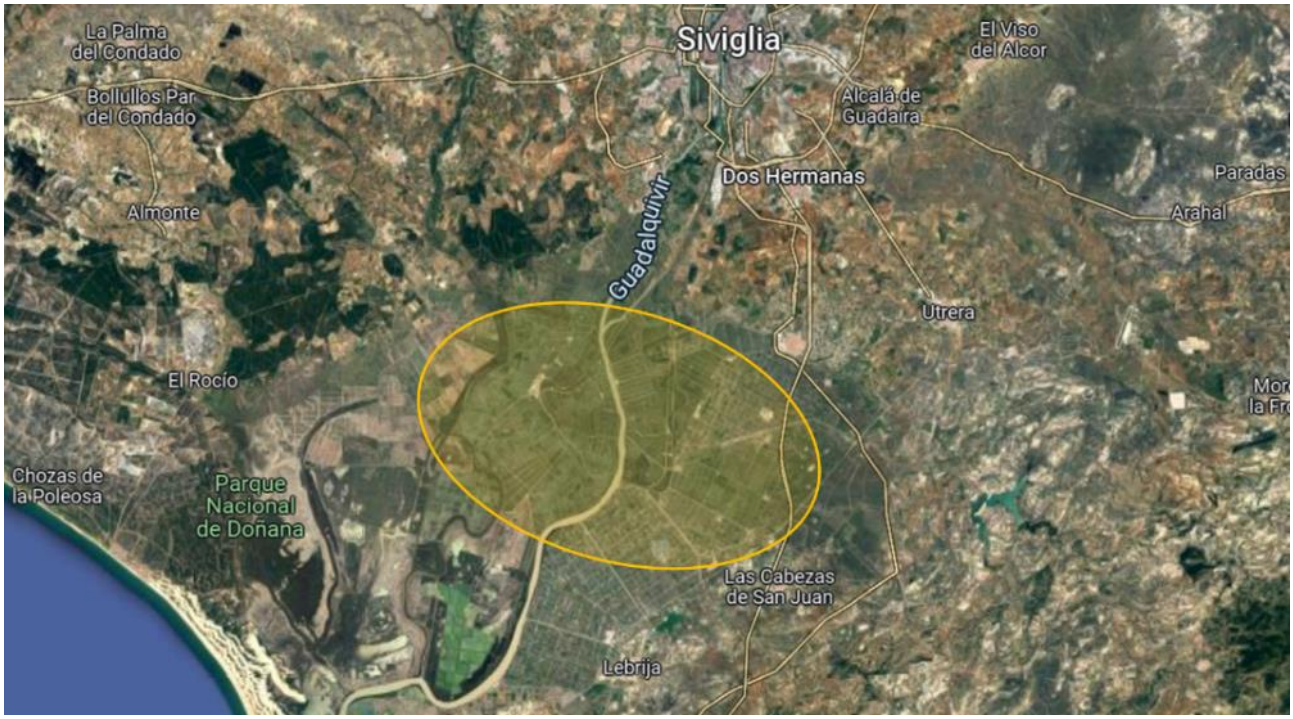


Figure 4 - Potential location of wind turbines (yellow box). Source: Google Earth.

UNIROMA3

The three presentations by UNIROMA3, carried out by three researchers of the team, encompassed three main topics: town planning and mobility, ecological networks and green infrastructure, and urban and landscape design.

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 of the subject from their previous studies.

After an introduction to the place-making approach and the concept of decarbonization, 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. Concerning the former section, firstly the focus was on the main plans available in Spain, with some examples in Seville: *The Plan General de Ordenación Urbana* (PGOU) for the city as a whole and the sustainable development strategy for the northern district (*Las Estrategias de Desarrollo Urbano Sostenible Integrado* - 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 of the topic. It provided a basis on which the following seminars and the co-working session were built on.

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

From the ecological perspective, EN can be considered 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 to reduce the extinction risk of local populations. The EN aims to mitigate habitat 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 follows 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 (Benedict & McMahon, 2002; Benedict & McMahon, 2006; Grădinaru & Hersperger,

2019). The EN concept has evolved over the years into a more comprehensive Green Infrastructure framework (EU, 2011). 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 (EC, 2013).

GI was explained in detail, with references to the scientific literature, especially as regards their multifunctionality and transcalarity (Davies et al., 2006; Hansen & Pauleit, 2014). 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.

Then, the strategies and documents available at the national level in Spain about green infrastructure were introduced such the *Estrategia Nacional de Infraestructura Verde y de la Conectividad y Restauración Ecológicas* (MITECO, 2021) and the *Ciudades Inteligentes y sostenibles. Infraestructura verde y hábitats urbanos integrados* (Feria-Toribio et al., 2020).

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 the provision of ecosystem services (Clergeau & Blanc, 2013).

Finally, to give some insight into decarbonization at an urban scale using GI, some examples of nature-based solutions were given (EC, 2015).

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

In the first part, a definition of the landscape was provided, underlining how it is structured through the interaction between nature and history (Calzolari, 2000). 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 (Council of Europe, 2000).

In the second part, we focused on providing a dimension of proximity, applying the different radii 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, two famous European good practices in the design of public space of proximity are presented: the "Ville du quart d'heure" (15-minutes city) in Paris (Moreno, 2021), and the "Superblocks" model (Plan Superilles) in Barcelona (Plan Superilles) (Rueda, 2016).

The 15-minute city is an urban regeneration strategy that aims to put the inhabitant at the centre of the design, by improving the functional mix of the neighbourhood, 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 neighbourhood) (Hidalgo, 2020).
The case of Barcelona takes advantage of the existing city grid, organizing traffic to move car traffic to streets outside the neighbourhood. In this way, the Plan Superilles guides the transformations of all open spaces in the city, intending to moderate the use of cars by returning to citizens a greener, healthier, safer public space that encourages social interaction and local economies (Ajuntament de Barcelona, 2019).
In the fourth part, the structure of the Norte District target area was analysed, to evaluate the applicability of the 15-minute 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.
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, to reduce the use of the car.

Co-working session

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

- Town planning, because the structure of a city can influence decarbonization;
- Climate change, because the reduction of greenhouse gas emissions mitigates its effects;
- Green infrastructure, as their employment, serves as a means to achieve decarbonization.

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 a method adopted to define the development of regional and urban intervention, which derives from an enhancement of the strengths and 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 of the three aspects highlighted in the training session: mobility, green infrastructure, and public spaces. Therefore, students were divided

into two groups, where they worked together on four qualitative exercises divided into two sessions: the first one more analytic, the second one more strategy oriented.
In the first session, students were asked to highlight the 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).

Results

Both groups produced interesting results (Figures 5-10), considering 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 site. The simplified SWOT analysis helped the students highlight the essential features of the area. The students developed interesting lists of objectives and activities and did 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 site and acquired tools to assess it, and the teachers, who had the chance to further improve the place-making framework and co-working session.

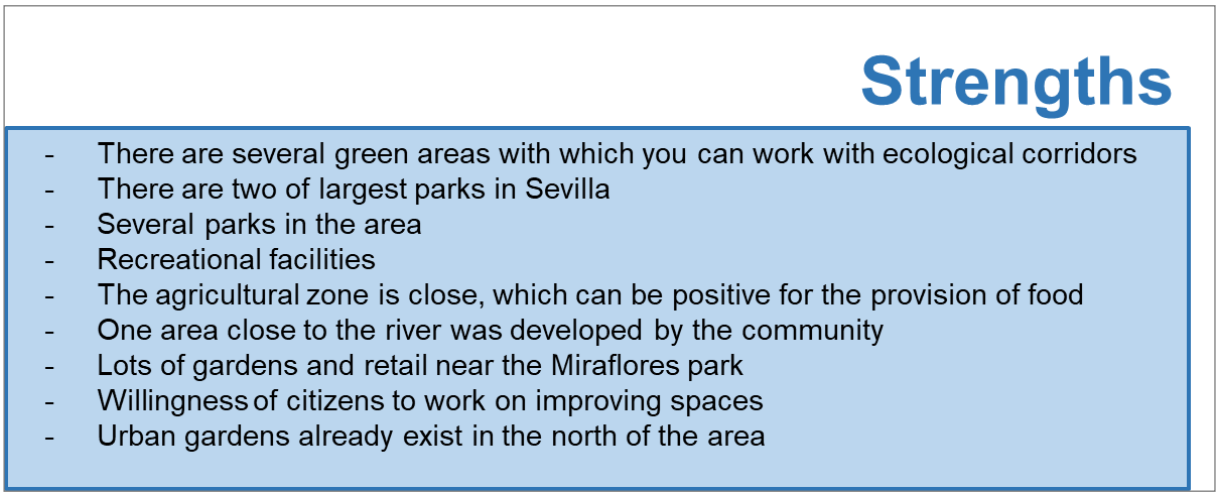


Figure 5 - Results of the first session of the exercise: Analysis – Strengths (Group 2).

Weaknesses

- There are two large industrial areas
- There is a perception of insecurity in the neighborhoods in the residential part
- One of the river channels is neglected (blue line)
- There is no public space for pedestrians, near the road that crosses the area
- Wide roads without enough illumination, nor free walking space, nor bike pathways
- Not a good connection for cyclists to get to the downtown
- Not many public transport lines

Figure 6 - Results of the first session of the exercise: Analysis – Weaknesses (Group 2).

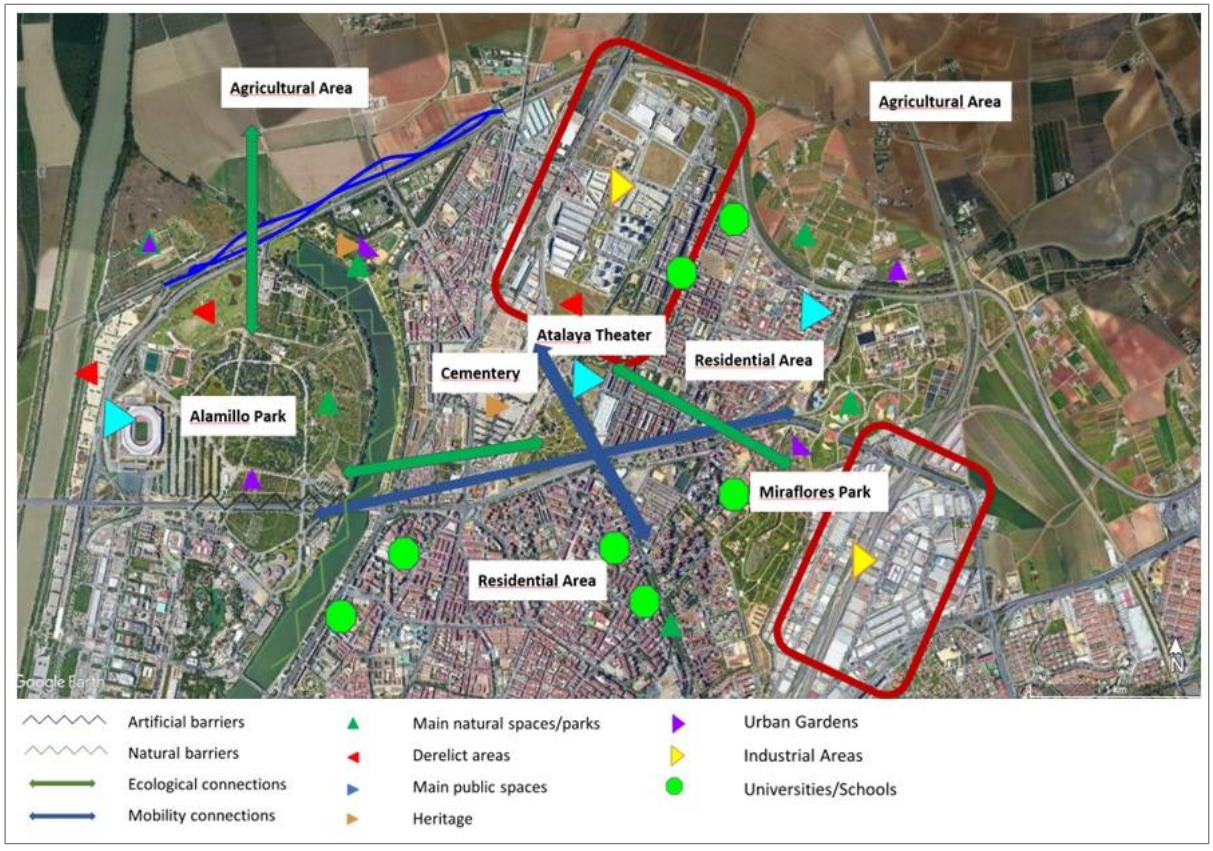


Figure 7 - Results of the first session of the exercise – City map with key (Group 2).

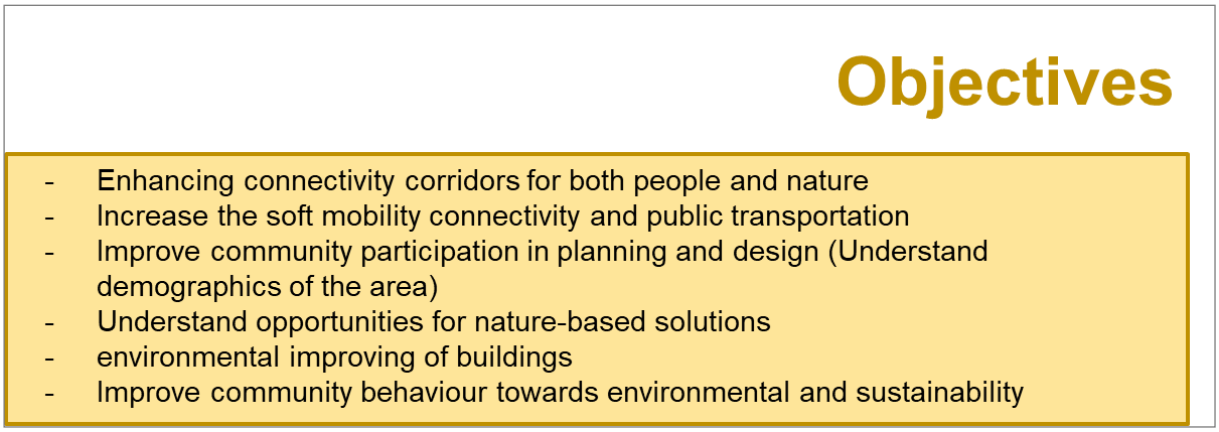


Figure 8 - Results of the second session of the exercise: Strategies - Objectives (Group 2).

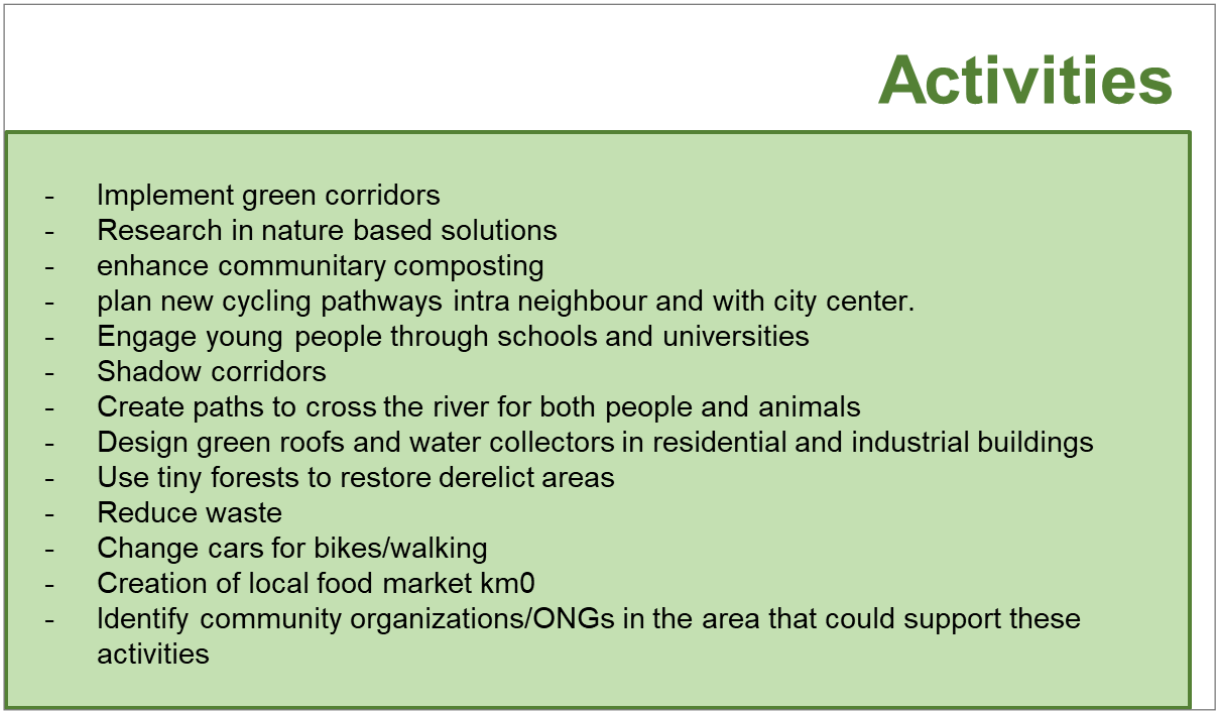


Figure 9 - Results of the second session of the exercise: Strategies - Activities (Group 2).

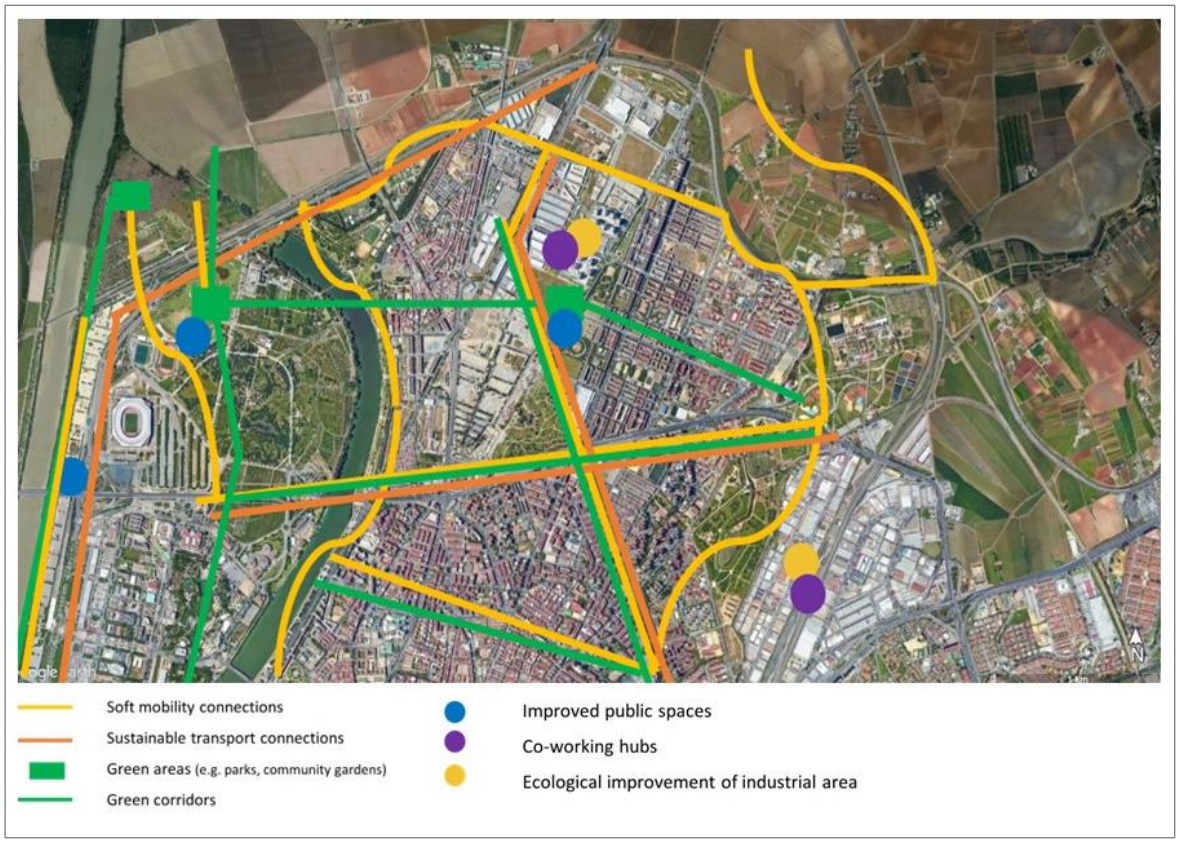


Figure 10 - Results of the second session of the exercise - City map with key (Group 2).

UPO

Training sessions

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. Afterward, 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 (IPCC, 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 approach the hybrid nature of risks, in which the interaction between natural events and social processes are related to generating 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.

Co-working sessions

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 the IPCC (2012, 2014) which defines vulnerability based on three main components: Exposure, Sensitivity, and Adaptive capacity. Figure 11 shows the methodological proposal to assess vulnerability.

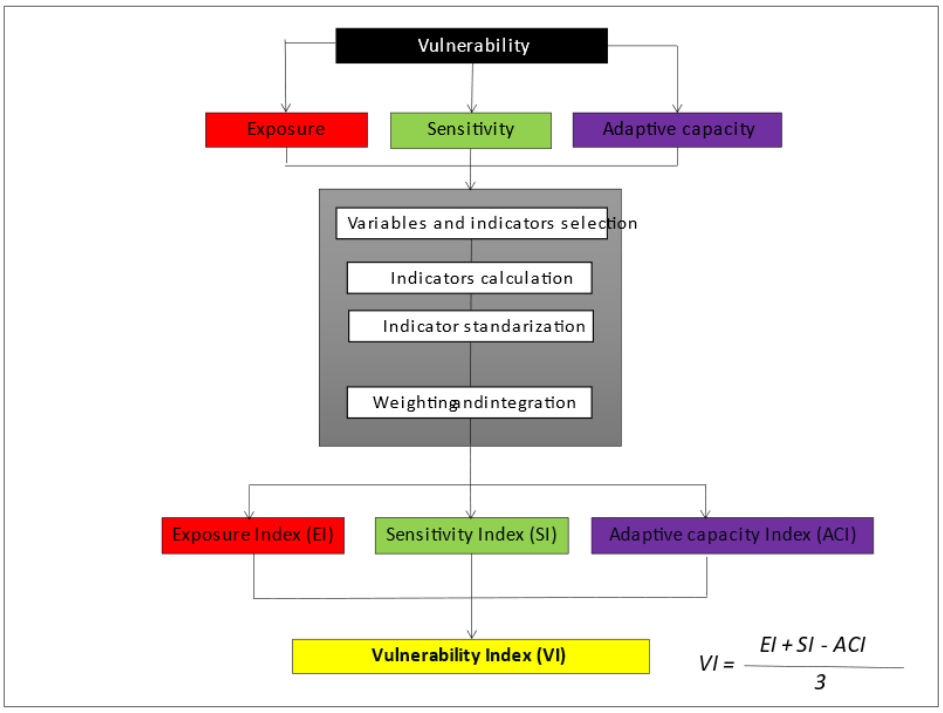


Figure 11 - UPO's Methodological framework.

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 theoretical framework is the same used in 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 component 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 5, 6, and 7 present the set of indicators selected for each component.

Table 5 - Exposure variables, indicators, and units of measure.

	Variable	Indicator	Unit 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)	**%**

Table 6 - Sensitivity variables, indicators, and units of measure.

	Variable	Indicator	Unit 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 stock	**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 7 - Adaptive capacity variables, indicators, and units of measure.

	Variable	Indicator	Unit 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 12 shows the vulnerability assessment results for each study case (exposure index, sensitivity index, adaptive capacity index and the final vulnerability compound index).

Figure 13 shows the vulnerability structure triangle wit result of three study cases.

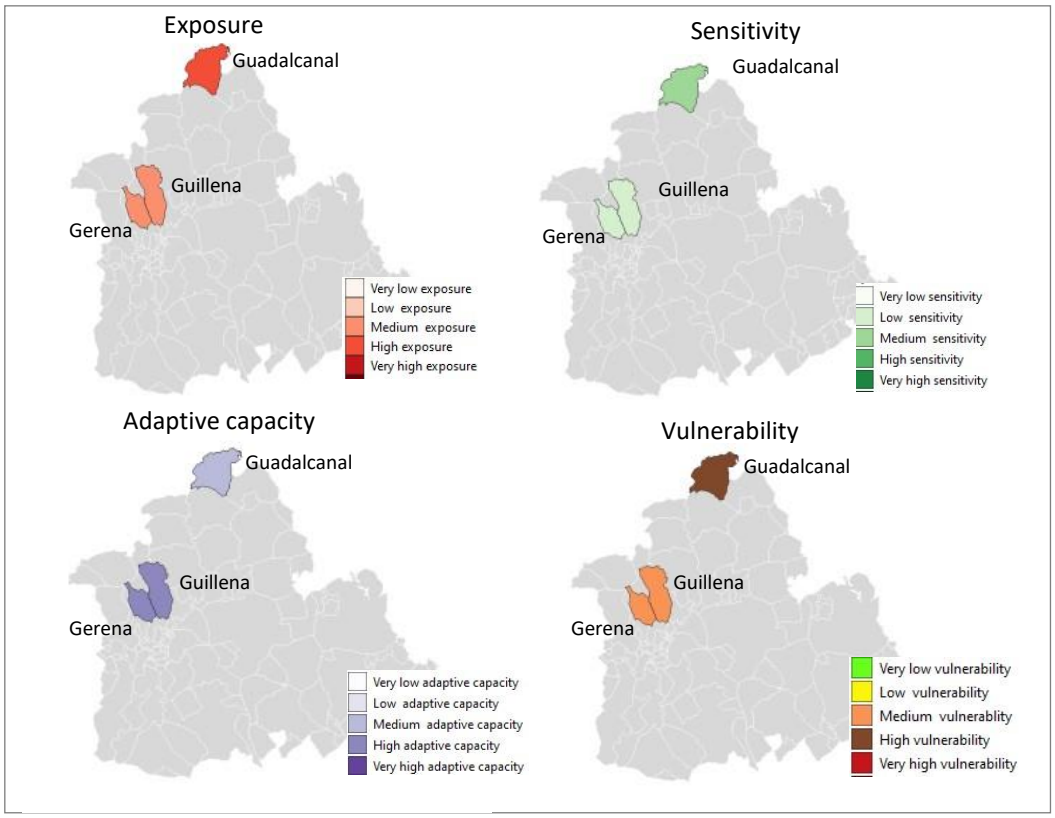


Figure 12 - Vulnerability Index results.

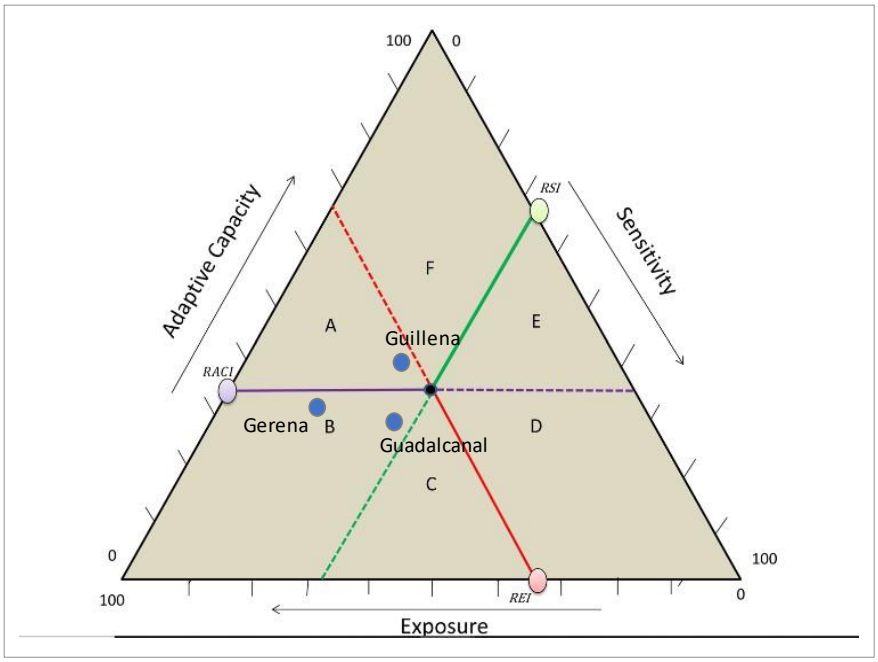


Figure 13 - Vulnerability structure triangle results.

IRENA/MIEMA

Training session

The session related to energy efficiency and renewable energy technologies started with the module related to the analysis of the building stock of the City of Seville and its possible energy-efficient improvement. The first part of the module was related to sharing knowledge about energy efficiency, detecting potential problems, and identifying solutions that will be analysed during the co-working session. The analysed and proposed energy efficiency measures will then 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 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 (Table 8) which leads to very large energy demand, both in the summer and winter periods due to the lack of energy-efficient measures.

Table 8 - Seville building stock.

Seville building stock		
Time of construction	**Quantity**	**Share**
-1950	16,123	3.34%
1950-1959	21,104	4.37%
1960-1969	71,557	14.82%
1970-1979	106,808	22.12%
1980-1989	72,957	15.11%
1990-1999	92,406	19.14%
2000-2009	76,644	15.88%
2010-	23,343	4.84%
Empty Building lots	1,795	0.37%
Non defined	35	0.01%
Total	**482,772**	

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 (Figure 14),

which represents a flagship initiative of the EU Green Deal and 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.

Figure 14 - Renovation Wave priorities, source: European Commission.

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 concluded with presenting what is "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 turbines, 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. Several best practices from Malta and other European countries concerning 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 into different building types within the City of Seville. The potential of energy storage solutions and smart microgrids were also discussed to further maximize the self-consumption of energy produced through renewable energy technologies within the buildings.

Co-working session

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 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 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 onto 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 tasks 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 the Triana neighbourhood. As the highest energy consumers within the building, the first group identified the electronic equipment (computers and other), lighting, and heating and cooling systems.
Proposals for energy efficiency improvement/RES included the installation of lighting sensors and LED lights, the 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 Electric Energy (EE)/Renewable Energy Sources (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 (Figure 15). The building was built in the 1960s 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 provides shading.

Figure 15 - Selection of target building/zone in the City of Seville.

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 (Figure 16) 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 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.

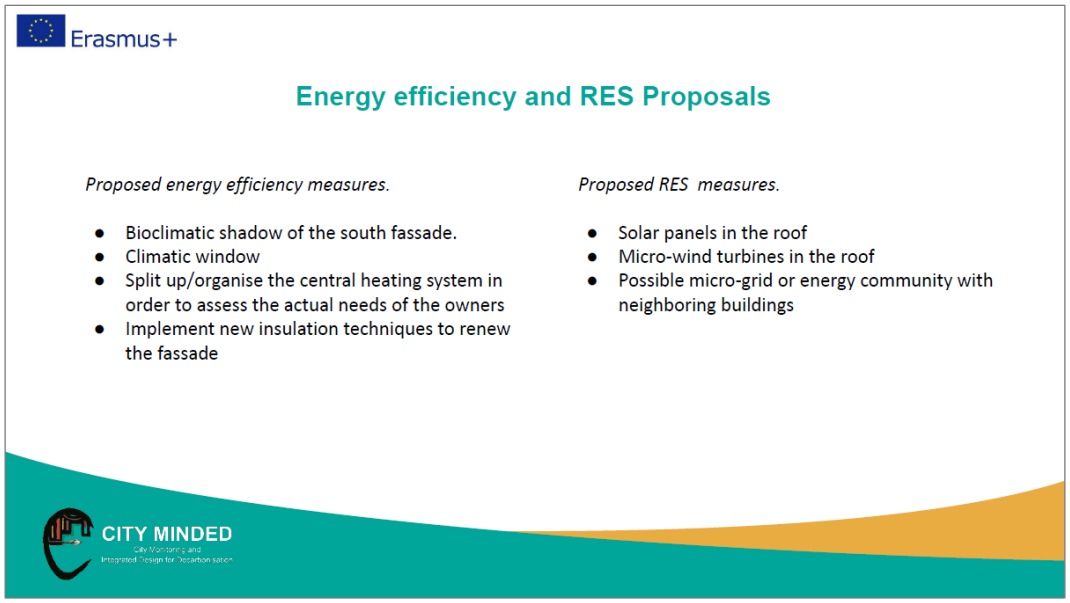
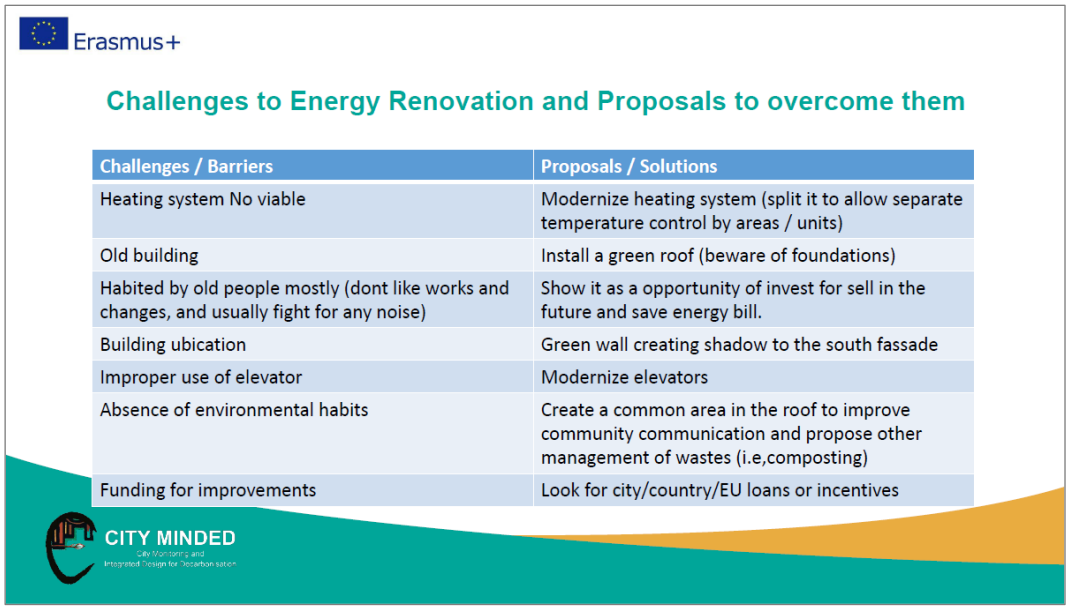


Figure 16 - Proposed energy efficiency and RES measures for the selected area.

Barriers to energy renovation (Figure 17) 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. In the last task of the exercise (Figure 18) the group measured the area that could be used for the installation of PV on the selected building in the amount of 738 m^2 and according to the available space, the group proposed installation of 105 kWp photovoltaic powerplant which could produce on an annual basis 147 MWh of electricity.



Challenges / Barriers	Proposals / Solutions
Heating system No viable	Modernize heating system (split it to allow separate temperature control by areas / units)
Old building	Install a green roof (beware of foundations)
Habited by old people mostly (dont like works and changes, and usually fight for any noise)	Show it as a opportunity of invest for sell in the future and save energy bill.
Building ubication	Green wall creating shadow to the south fassade
Improper use of elevator	Modernize elevators
Absence of environmental habits	Create a common area in the roof to improve community communication and propose other management of wastes (i.e,composting)
Funding for improvements	Look for city/country/EU loans or incentives

Figure 17 - Detected challenges for energy renovation and proposals to overcome them.

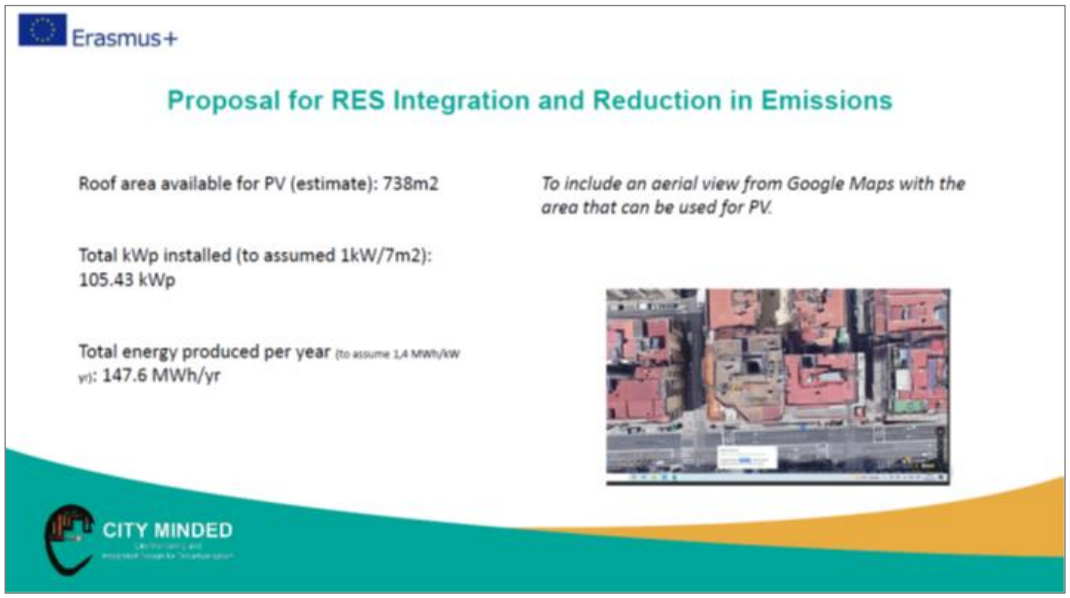


Figure 18 - PV installation potential for a residential complex in the City of Seville.

The group work 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 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.

8.2 Workshops in face-to-face version

8.2.1 The Intensive Course

When: 11th to 22nd of July 2022.
Where: Week 1 – *Online*; Week 2 – *Face-to-face*, Valletta, Malta.
Leading Partner: MIEMA - Malta Intelligent Energy Management Agency.
Participating Student: 7 students (2 from UNIROMA3, 2 from UNISI and 3 from UPO).
Description: The Malta Intensive Course was organised over 2 weeks in July 2022. The first week of the course was held online via Zoom and aimed to give an overview of the City Minded project and the partnership. Each partner presented the respective thematic areas of carbon accounting, place-making framework, vulnerability associated with climate change, energy efficiency, and renewable energy technologies.
The second week of the course was organised in Valletta, Malta. This was the first opportunity to have a face-to-face project activity and brought together the project partners (teachers and researchers), students, and local stakeholders from the City of Valletta. Collaborative roadmaps for the urban decarbonisation of Valletta were elaborated during the course by taking into consideration the different thematic areas addressed.

Valletta is the capital city of Malta, located on a peninsula between two natural harbours, Marsamxett and the Grand Harbour. It is the southernmost capital of Europe and the European Union's smallest capital city with an area of 0.61 km^2. Valletta was designed by engineer Francesco Laparelli da Cortona, appointed by Pope Pius V and the foundation stone of the city was laid by Grand Master Fra Jean de Valette of the Hospitaller Order of St John the Baptist (Order) on 28 March 1566. The city is characterised by its fortifications and presently has a population of around 5,800. It was officially recognised as a World Heritage Site by UNESCO in 1980 and was the European Capital of Culture in 2018. Valletta was designated as an Urban Conservation Area in 1995 and all properties in Valletta are considered to be of historical value and conserved.
The first day of the second week of the course was primarily dedicated to presentations by local stakeholders which covered different aspects and perspectives concerning the City of Valletta. Topics included green communities coordinated by the Valletta Cultural Agency, background to the city's history and evolution, and the rehabilitation of the historic building where the course was hosted (the Valletta Design Cluster). The stakeholders' presentation served to give a holistic representation of Valletta and allowed the students to better understand the context of the city, its particularities, and possible challenges which need to be overcome as part of an urban decarbonisation strategy. Thematic area presentations from the project partners/teachers followed the stakeholders' interventions.
An on-site visit of the target area was carried out during the morning of the second where the host from MIEMA explained and showed different characteristics of the city and the students

had the opportunity to ask questions and take notes/photos. The following part of the workshop was dedicated to co-working sessions for the different thematic areas, moderated by the respective teachers. The students were divided into two groups for all the co-working sessions which enabled the students to interact with each other and work on the different exercises prepared by the teachers. The groups made use of different resources such as maps of Valletta and the neighbouring port region and Google maps and have the opportunity to walk around the building and surrounding area.

After each co-working session, both groups presented the results of their collaborative work. After the completion of all the exercises, the groups worked on the preparation of a site-specific urban decarbonisation roadmap on the afternoon of the fourth day, compiling the results from the different co-working sessions. The roadmaps were presented by the groups on the last day of the course.

The following is the Agenda that was created for the conduct of the Intensive Course, both the first part held online and the second part carried out at the Valletta Design Cluster (Tables 9 and 10).

Table 9 - Agenda of the first week of the City Minded Intensive Course - online week.

Week 1, Day 1 - July 11th 2022	
14:00	Registration of the participants
14:05	Welcome speech, IRENA
14:10	Introduction and opening of the Intensive Course on City Decarbonisation, MIEMA
14:20	The CITY MINDED project: urban sustainability, decarbonisation, and climate change, Presented by CITY MINDED project partners
14:45	Thematic Area 1: Carbon Accounting and Carbon footprint mitigation, UNISI
16:15	Conclusion
17:00	End of day 1
Week 1, Day 2 - July 12th 2022	
14:00	Registration of the participants
14:05	Thematic Area 2: Place-making framework, UNIROMA3 - Town planning - Ecological networks & Green infrastructure - Urban and Landscape design
15:45	Conclusion
16:00	End of day 2
Week 1, Day 3 - July 13th 2022	
14:00	Registration of the participants
14:05	Thematic Area 3: Assessment and analysis of vulnerability associated with climate change, UPO - Vulnerability to Natural Hazards in a Climate Change Context

15:45	Conclusion
16:00	End of day 3
Week 1, Day 4 - July 14th 2022	
14:00	Registration of the participants
14:05	Thematic Area 4: Energy Efficiency and Renewable energy technologies in the active service of the city decarbonisation processes, IRENA&MIEMA
15:45	Conclusion
16:00	End of day 4
Week 1, Day 5 - July 15th 2022	
14:00	Registration of the participants
14:05	Wrap up of the performed activities, IRENA
14:20	Presentation of the workshop results (moderated by MIEMA with the participation of partners and students)
15:15	Presentation of the work program for the 2nd week of the Intensive Course, MIEMA
15:30	Open discussion
16:00	End of day 5 and week 1 of the Intensive Course on City decarbonisation

Table 10 - Agenda of the second week of the City Minded Intensive Course - in-person week.

Week 2, Day 1 - July 18th 2022	
14:00	Registration of the participants
14:15	Welcome speech, IRENA
14:25	Introduction and opening of the 2nd week of the Intensive Course on City Decarbonisation, MIEMA
14:30	Presentation of the target neighbourhood (or the City of Valleta), MIEMA
14:40	'Bridging the tangible with the intangible – 'green' communities at the Valletta Design Cluster, Ruby-Jean Cutajar, Valletta Design Cluster
15:00	ReCovering a Noble European City, Jesmond Xuereb, MIEMA Director and Valletta Local Council's first executive secretary
15:20	SUSTAINABLE CONSERVATION: An integrated approach within the Rehabilitation of the Old Civil Abattoir into the Valletta Design Cluster, Perit Amanda De Giovanni, Restoration Directorate
15:40	Q&A / Discussion
16:00	The CITY MINDED project: urban sustainability, decarbonisation, and climate change, Presented by CITY MINDED project partners
17:00	Conclusion
17:15	End of day 1
Week 2, Day 2 - July 19th 2022	

Morning Session	
09:30	Registration of the participants
09:35	On-site visit of the target area
11:30	Project management meeting *(Project Partners only)*
13:00	Steering Committee *(Project Partners only)*
13:30	End of morning session
Afternoon session & Dinner	
15:00	Registration of the participants
15:05	Thematic Area: Place-making framework, UNIROMA3 - Work in groups
16:30	Presentation and discussion of group work results
17:00	End of afternoon session
19:30	Networking dinner: San Giovanni Restaurant, St. John's Square Valletta
Week 2, Day 3 - July 20th 2022	
Morning Session	
09:00	Registration of the participants
09:05	Thematic Area: Assessment and analysis of vulnerability associated with climate change, UPO - Work in groups - Vulnerability Index calculation and representation
11:30	Presentation and discussion of group work results
12:00	End of morning session
Afternoon Session	
14:00	Registration of the participants
14:05	Thematic Area: Carbon Accounting and Carbon footprint mitigation, UNISI - Work in groups
15:45	Presentation and discussion of group work results
16:00	End of day 3
Week 2, Day 4 - July 21st 2022	
09:00	Registration of the participants
09:05	Thematic Area 4: Energy Efficiency and Renewable energy technologies in the active service of the City decarbonisation processes, IRENA & MIEMA - On-site visit of the target area - Group work
12:00	Presentation and discussion of group work results
12:30	End of morning session
Afternoon Session	

14:00	Registration of the participants
14:05	Work in groups on the preparation of a site-specific urban decarbonisation roadmap - a compilation of the results from co-working sessions
17:00	End of day 4
Week 2, Day 5 - July 22nd 2022	
09:00	Registration of the participants
09:05	Wrap up of the performed activities, MIEMA
09:30	Presentation of the workshop results (moderated by MIEMA with the participation of partners and students)
11:00	Final discussion and lessons learnt
12:00	Conclusion and end of the Intensive course

The contributions of the Partners are presented below, following the order in which the co-working sessions were conducted during the Valletta Intensive Course.

UNIROMA3

Training session

The three presentations by UNIROMA3, carried out by three researchers of the team, encompassed three main topics: town planning and mobility, ecological networks and green infrastructure, and urban and landscape design.

The first lecture was structured similarly to the ones held in Siena and Seville during the first and third decarbonisation workshops respectively, 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 of the subject from their previous studies.

After an introduction to the place-making approach and the concept of decarbonization, 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 innovative 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 Malta and mobility issues in general. With respect to the former section, firstly the focus was on the main plans available in Malta, with some examples in the islands: the Strategic Plan for the Environment and Development (SPED) for the islands and the Grand Harbour Local Plan, which regulates the area of Valletta, the target area of the workshop. The focus then shifted to the issues of mobility, in particular, the first and last mile of a trip. Finally, the public transport context in Malta was described.

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

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

The Habitat Directive (1992) was briefly presented highlighting that it introduced the concept of ecological network and the NATURA 2000 Network. Also, the ESDP – European Spatial Development Perspective (1999) was introduced to remark that the ecological network was identified as a priority tool to strengthen the policies for the protection and enhancement of the European natural and ecological heritage.

From the ecological perspective, EN can be considered 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 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.

Some relevant examples of Ecological Networks plans were illustrated. Furthermore, specific maps on Natura 2000 and environmental schemes in Malta were presented.

If the Ecological Networks 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 (Benedict & McMahon, 2002; Benedict & McMahon, 2006; Grădinaru & Hersperger, 2019). The EN concept has evolved over the years into a more comprehensive Green Infrastructure framework (EC, 2011). 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 (EC, 2013).

The Green Infrastructure framework was explained in detail, with references to the scientific literature, especially as regards their multifunctionality and transcalarity (Davies et al., 2006; Hansen & Pauleit, 2014). 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. Also, the new European Strategy for Biodiversity was presented (EC, 2020). This strategy aims to reverse these trends and stop the loss of green urban ecosystems. The promotion of healthy ecosystems, green infrastructure, and nature-based solutions should be systematically integrated into urban planning, including in public spaces, infrastructure, and the design of buildings and their surroundings. To give some insight into decarbonization at an urban scale using GI, some examples of nature-based solutions were given (EC, 2015).

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 the provision of ecosystem services (Clergeau & Blanc, 2013).

Finally, to better understand the tools available in Malta the following documents were illustrated: Malta's National Biodiversity Strategy and Action Plan, 2012-2020 (2012), Investing in the Multi-functionality of GI. An Information Document to support GI Thinking in Malta (2019) and the Green Paper on Greening Buildings in Malta (2021).

The third presentation was about landscape and urban design, trying to understand how city design at a small scale can operate to build a Carbon Neutral city.

In the first part, a definition of the landscape was provided, underlining how it is structured through the interaction between nature and history (Calzolari, 2000). 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 (Council of Europe, 2000).

In the second part, we focused on providing a dimension of proximity, applying the different radii of influence (from the widest one of 1 km to the narrowest one of 200 m) on the historic centre of Valletta. As a result, we have tried to reflect on the role that urban morphology has on the perception of proximity, and the importance that a dense urban fabric has in encouraging walking.

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-minute city) in Paris (Moreno, 2021), and the "Superblocks" model (Plan Superilles) in Barcelona (Rueda, 2016).
The 15-minute city is an urban regeneration strategy that aims to put the inhabitant at the centre of the design, by improving the functional mix of the neighbourhood, 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 neighbourhood) (Hidalgo, 2020).
The case of Barcelona takes advantage of the existing city grid, organizing traffic to move car traffic to streets outside the neighbourhood. In this way, the Plan Superilles guides the transformations of all open spaces in the city, intending to moderate the use of cars by returning to citizens a greener, healthier, safer public space that encourages social interaction and local economies (Ajuntament de Barcelona, 2019).
In the fourth part, the structure of the Valletta historic centre was analysed, to evaluate the applicability of the 15-minute city model therein. The presentation tried to emphasize how urban morphology and the small size of Valletta were perfect for pedestrian use of the streets. At the same time, it was highlighting the importance, in this context, to be able to balance the density by recovering public spaces as much as possible, and also allowing the creation of small green areas, which would help to fight heat islands. The grid of the urban fabric that characterizes the city of Valletta is very similar to the grid of the example district in Barcelona: therefore, trying to adopt a similar approach like the Supermanzanas model could be an interesting experiment for the coworking session: relieving traffic, creating a new hierarchy of streets, and imagining small design interventions (also through tactical urbanism), in the open spaces that are recovered.

Co-working session

The co-working session was carried out in-person for the first time in two years in Valletta, Malta. Two researchers carried out two parallel groups with four and three students respectively. Throughout one afternoon the students analysed and proposed solutions for the City of Valletta, the capital of Malta (Figure 19 a-d).
In the first session, students were asked to highlight the strengths and weaknesses of Valletta, 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 Valletta, 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).

During both exercises, the students interacted with one another and the tutors. They were given posters and maps, where they could highlight strengths, weaknesses, objectives, and actions, both in writing and on the maps themselves. All the students also had their computers, which they could use to look for further information and examples from other urban contexts.

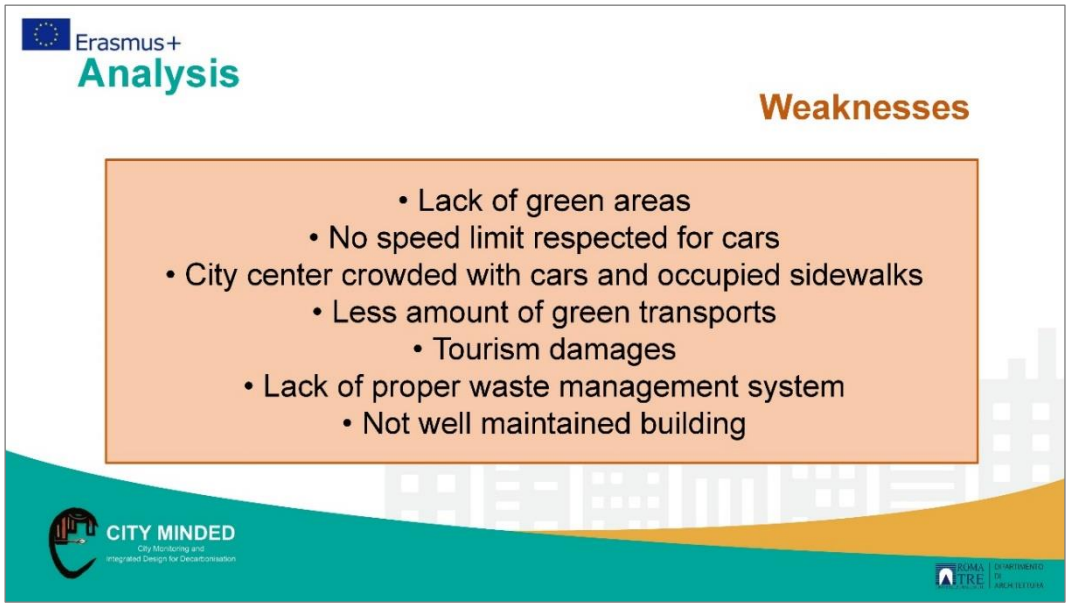
Figure 19 a-d - Students working and presenting the results of the first and second sessions of the exercise.

Results

Both groups produced original results, considering that most students had no background in town planning and did not know the area well. The students prepared a PowerPoint presentation to illustrate the results of their analysis and strategies for the sustainable development of Valletta and the improvement of its liveability.

The first group analysed the urban scale mainly focusing on the lack of green spaces and sustainable transport, the negative effects of tourism, and a large number of cars in the city. Furthermore, they recognised the high value of the seaside and the sea and the possibility to involve local people in activities (Figure 20 a-c). They then defined their strategy, encouraging practices of reuse, and

defining the intervention to pedestrianize the city and to improve the quality of buildings through urban regeneration and energy efficiency projects (Figure 21 a-c).



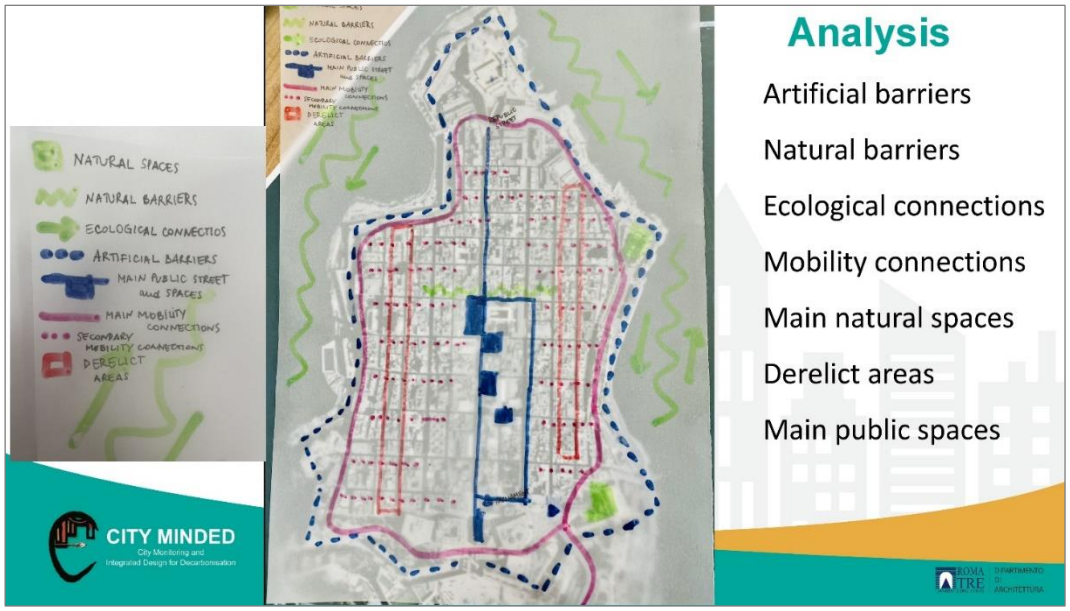


Figure 20 a-c – Elaborations of the analysis of the first group.

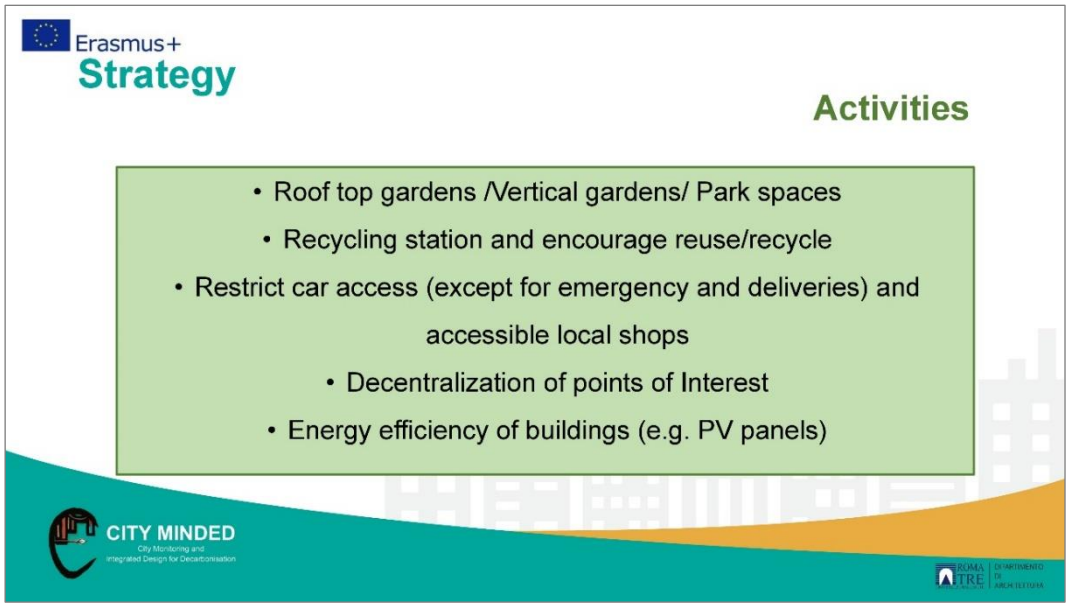
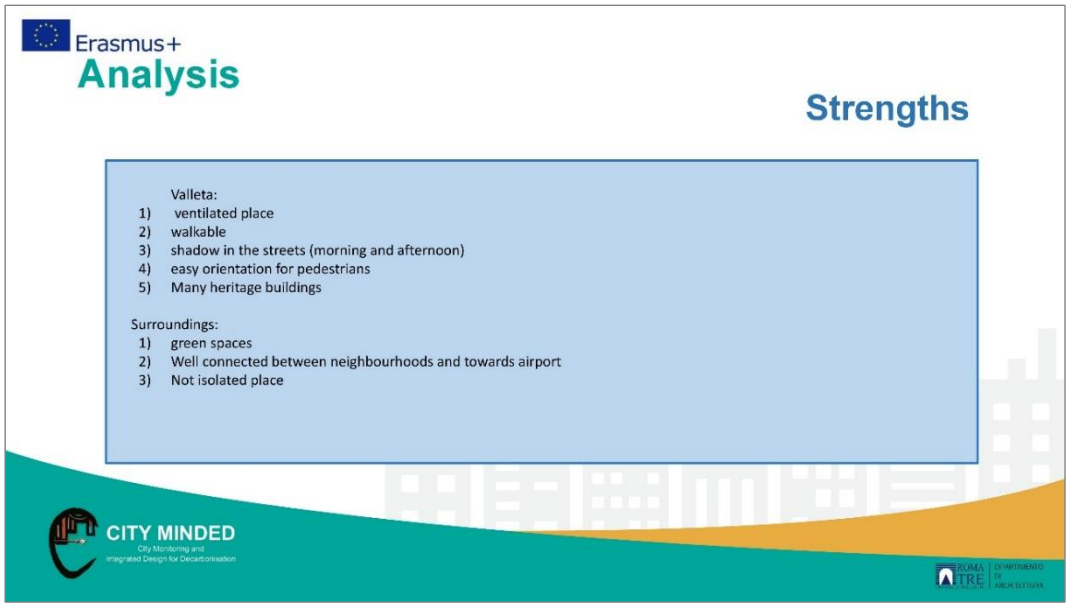
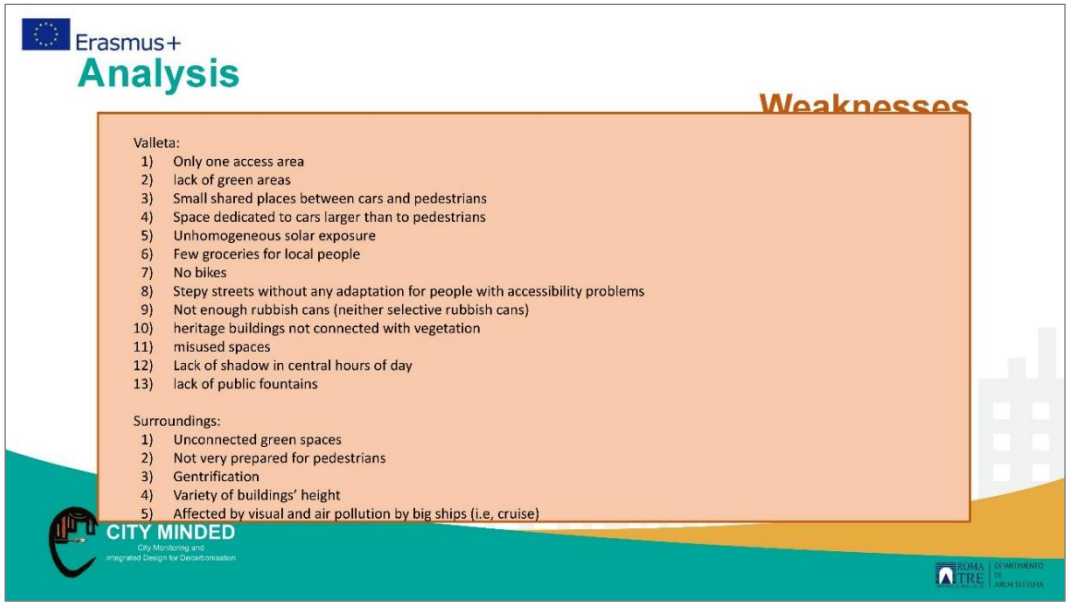


Figure 21 a-c – Elaborations of the strategy of the first group.

The second group analysed the city level, mainly focusing on the lack of green spaces, the overload of cars also within the very historical part of the city and the lack of bicycles, and the lack of building maintenance. They also considered the hinterland to frame a wider understanding, especially related to the green areas and open spaces (Figure 22 a-d). Then they defined the objective and the actions, according to their strategy, to promote pedestrianization intervention in many areas of the city and to free the city from a load of cars, to implement green infrastructure, and to enhance the accessibility to the sea (Figure 23 a-c).


Erasmus+
Analysis
Strengths
Valleta:
1) ventilated place
2) walkable
3) shadow in the streets (morning and afternoon)
4) easy orientation for pedestrians
5) Many heritage buildings
Surroundings:
1) green spaces
2) Well connected between neighbourhoods and towards airport
3) Not isolated place
CITY MINDED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Analysis
Weaknesses
Valleta:
1) Only one access area
2) lack of green areas
3) Small shared places between cars and pedestrians
4) Space dedicated to cars larger than to pedestrians
5) Unhomogeneous solar exposure
6) Few groceries for local people
7) No bikes
8) Stepy streets without any adaptation for people with accessibility problems
9) Not enough rubbish cans (neither selective rubbish cans)
10) heritage buildings not connected with vegetation
11) misused spaces
12) Lack of shadow in central hours of day
13) lack of public fountains
Surroundings:
1) Unconnected green spaces
2) Not very prepared for pedestrians
3) Gentrification
4) Variety of buildings' height
5) Affected by visual and air pollution by big ships (i.e, cruise)
CITY MINDED

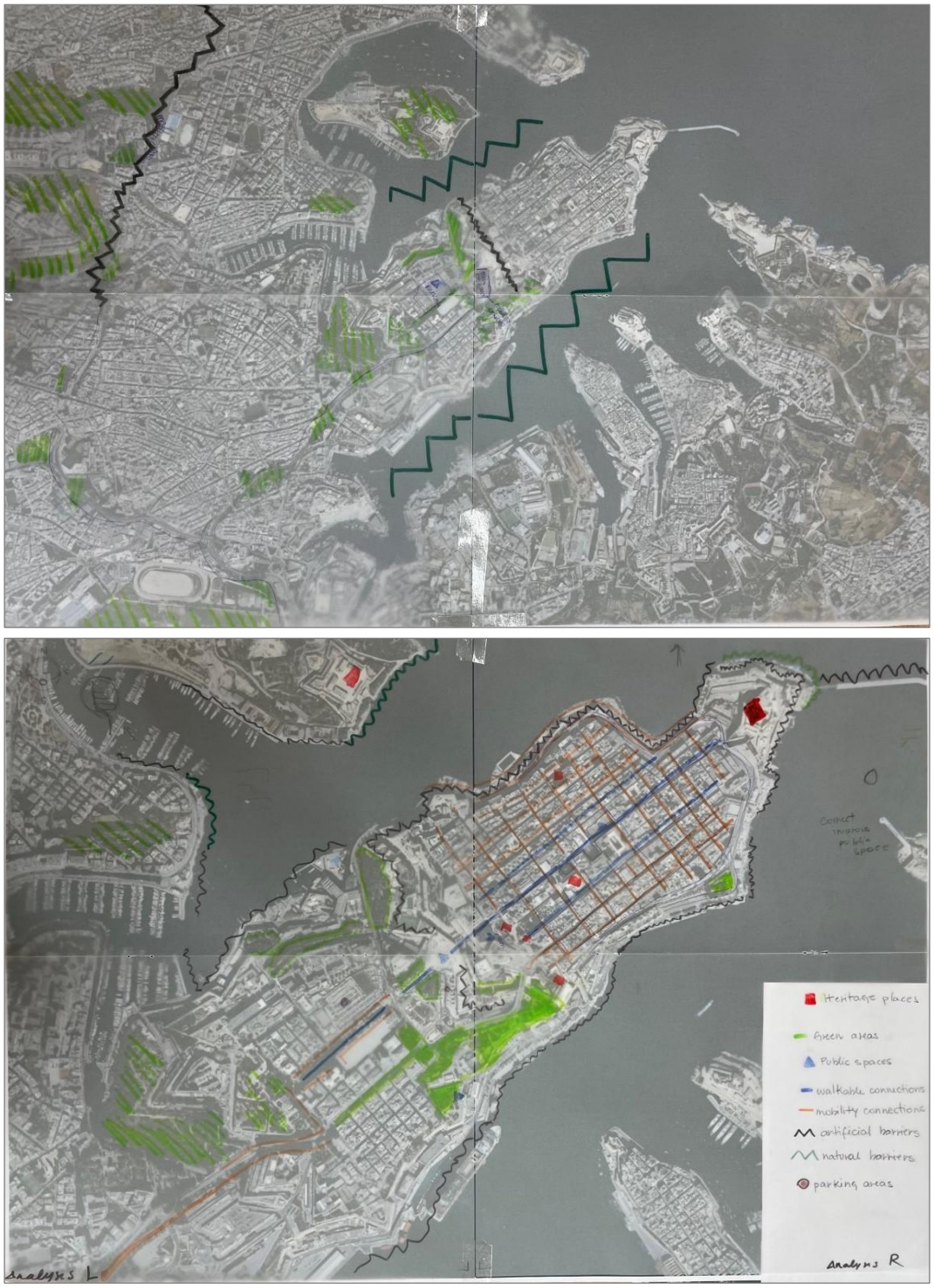
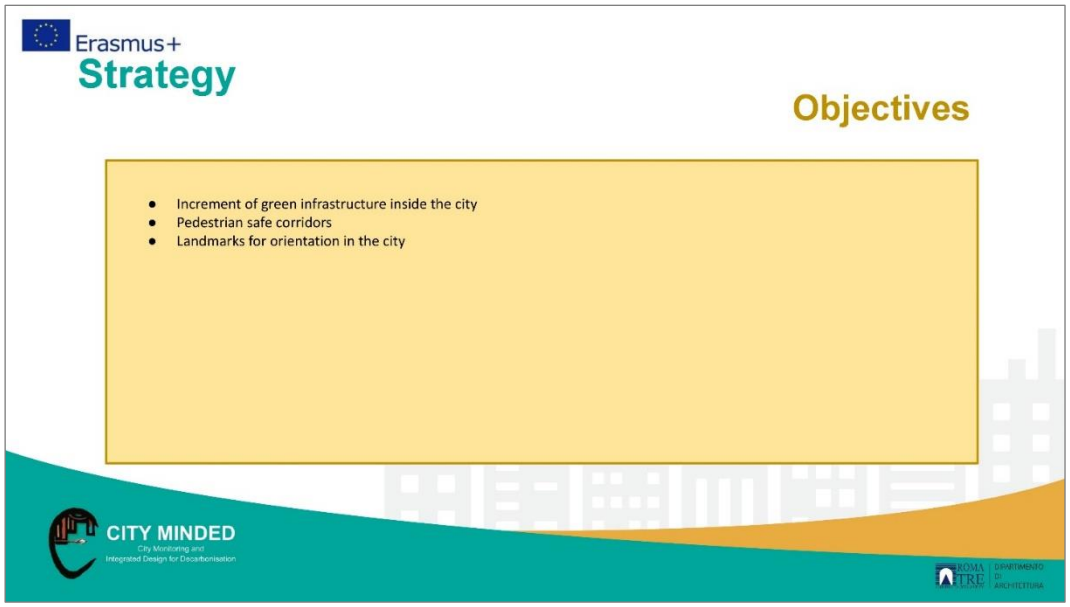


Figure 22 a-d – Elaborations of the analysis of the second group.


Erasmus+
Strategy
Objectives
Increment of green infrastructure inside the city
Pedestrian safe corridors
Landmarks for orientation in the city
CITY MINDED
City Monitoring and Integrated Design for Decarbonisation

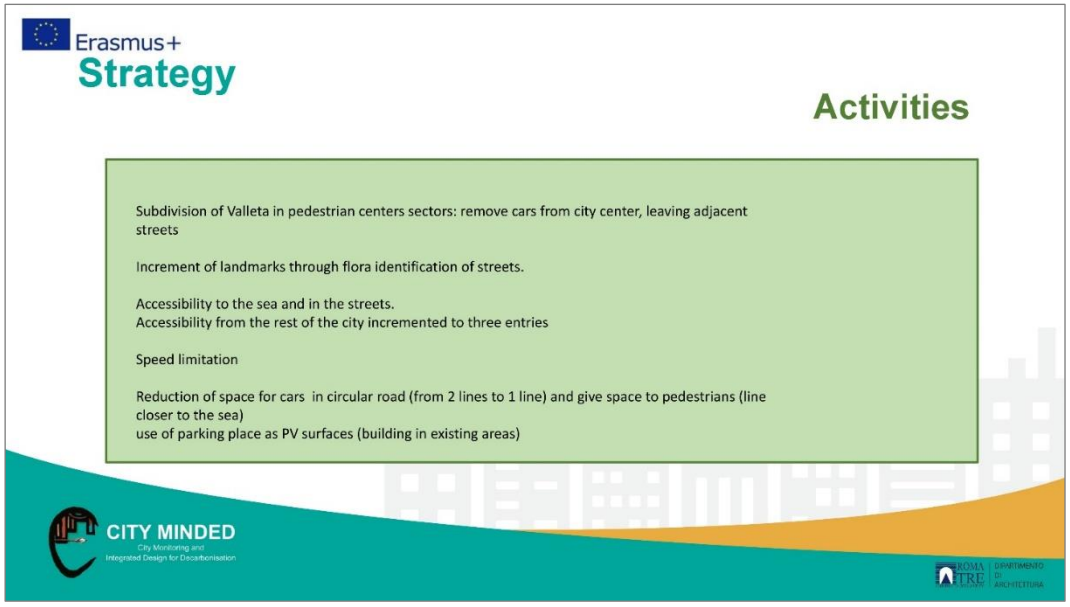

Erasmus+
Strategy
Activities
Subdivision of Valleta in pedestrian centers sectors: remove cars from city center, leaving adjacent streets
Increment of landmarks through flora identification of streets.
Accessibility to the sea and in the streets.
Accessibility from the rest of the city incremented to three entries
Speed limitation
Reduction of space for cars in circular road (from 2 lines to 1 line) and give space to pedestrians (line closer to the sea)
use of parking place as PV surfaces (building in existing areas)
CITY MINDED
City Monitoring and Integrated Design for Decarbonisation

Figure 23 a-c – Elaborations of the strategy of the second group.

Both groups used effective representation methods, focusing their attention on the themes of sustainable mobility and pedestrianization but also on the increase of green areas and trees for cooling the city. Their strategies have created tangible and intangible networks within the city of Valletta but also with the surrounding areas

The students greatly appreciated the opportunity to be part of an in-person workshop, with those who had already participated in the City Minded online workshops a few months earlier. The difference between actually engaging with people and places personally as opposed to through a computer screen was very evident, not only for the human contact factor but also because of the importance of experiencing a place in person to better plan for it.

UPO

Training session

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 Malta. Climate change forecasts predict an increase in the frequency and intensity of natural hazards in Malta, 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. Afterward, 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 generating 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.

Co-working session

The starting point of the learning methodology was the risk equation (Risk = Hazard * Vulnerability). To assess vulnerability, we adopted the methodological framework proposed by the IPCC (2012, 2014) which defines vulnerability based on three main components: Exposure, Sensitivity, and Adaptive Capacity. Figure 24 shows the methodological proposal to assess the vulnerability.

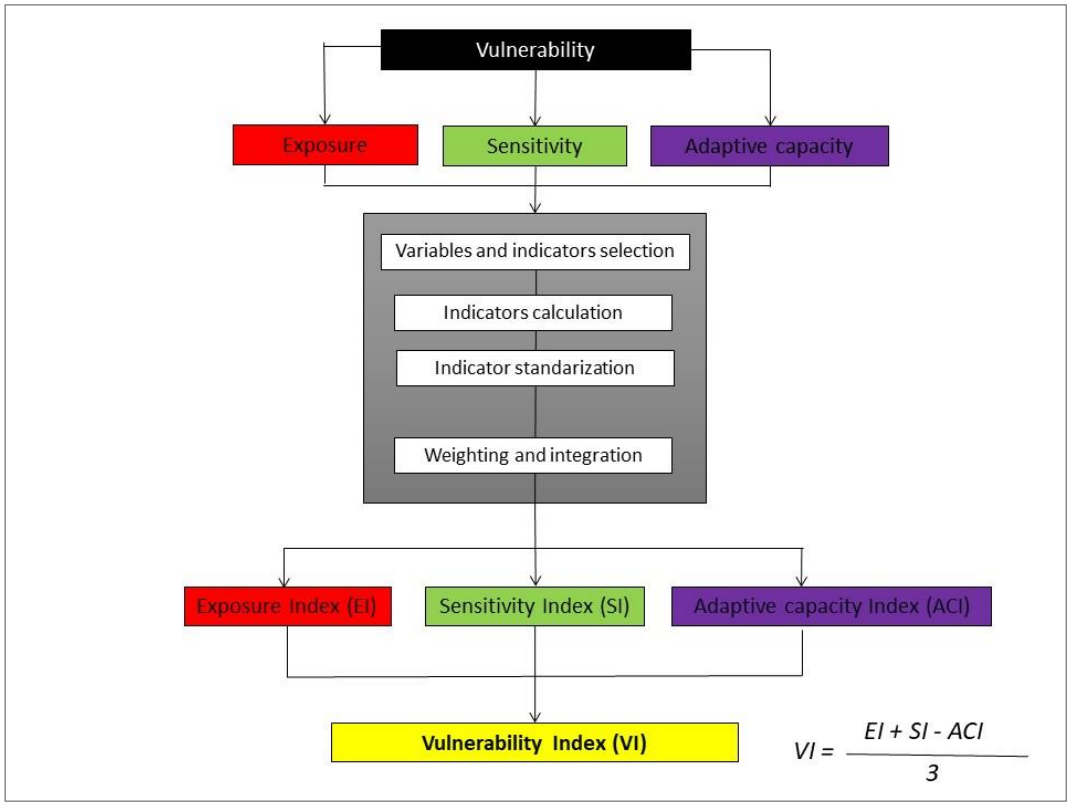


Figure 24 - Methodological proposal to assess vulnerability.

Each group selected a case study (Southern Harbour district, Group 1 and Northern Harbour district, Group 2) for which they calculated the Vulnerability Index (VI) by following a series of steps included above. Starting from the indices of each Vulnerability Index (Exposure, Sensitivity, and Adaptive Capacity) calculated, it was analysed how the VI is structured, that is, how each of the components influences the final determination of the value of the VI. This allows a first approach to the causes that generate vulnerability. To do this, the relative weight of each of the indices in the final value of vulnerability was calculated according to the following equations and then they are represented in the vulnerability structure triangle (Figure 25-26). Once each group had calculated the index for their case study, the results were shared and the index values for each district compared.

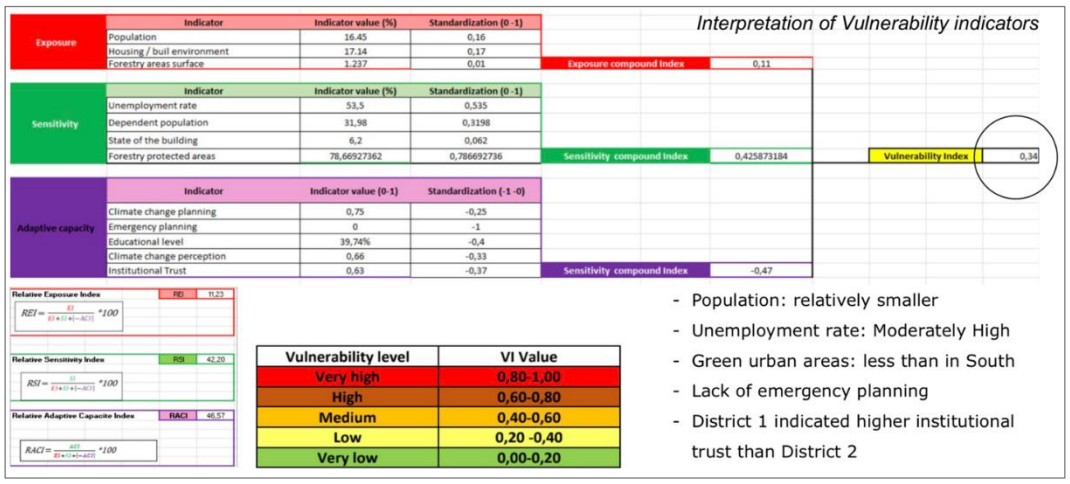


Figure 25 - Group 1 results.

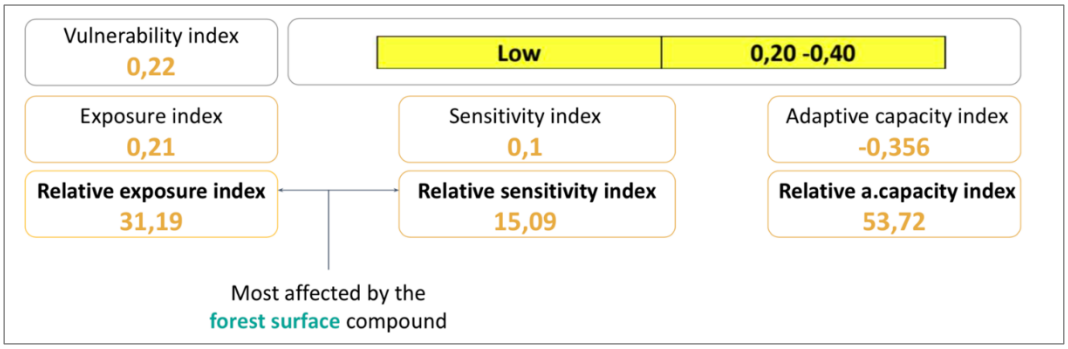


Figure 26 - Group 2 results.

Results

After the afternoon's work, students fixed the summary of their reasoning and conclusions on a map and PowerPoint presentation that was presented on the last day of the workshop with the vulnerability index and the triangle results (Figure 27), and with the following main conclusions:

- Sensitivity and lack of adaptive capacity are the main component of vulnerability for Valletta (>33).
- Vulnerability is dynamic as it could change between two closely related districts (0.34 low in district 1 to 0.15 very low in district 2).
- Valletta district 1 has lower exposure than Rome or Florence (IT, Tuscany region) but has similar sensitivity as Viterbo (IT, Lazio Region) in the global context.
- We will only be able to deal with the risks posed by climate change if we understand what makes us vulnerable.
- A Vulnerability Structure Triangle Results from previous workshops (Siena, Rome, and Seville) have also been included for comparative proposes (Figure 28).

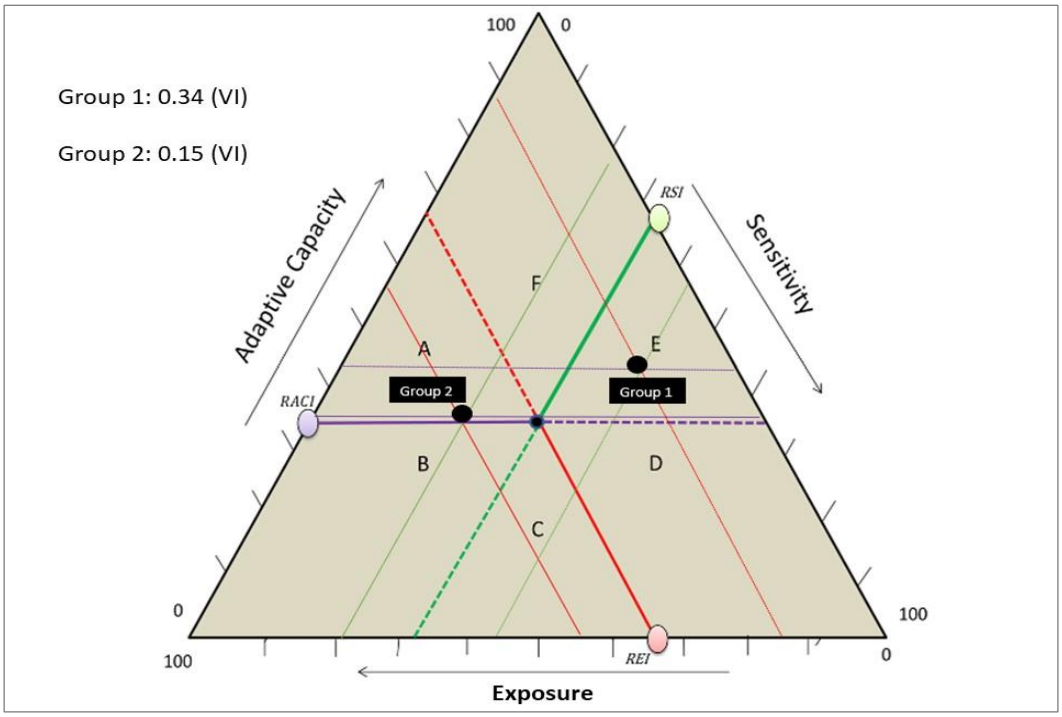


Figure 27 - Vulnerability Structure Triangle Results.

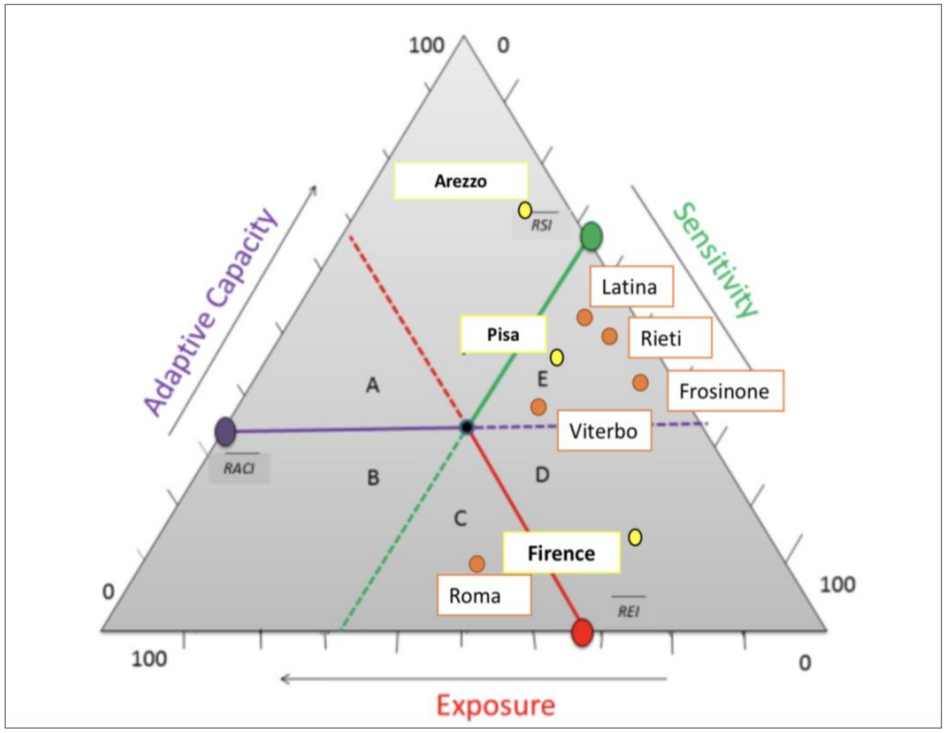


Figure 28 - Vulnerability Structure Triangle Results from previous workshops.

The vulnerability structure triangle does not represent the values acquired by the components but the relative weight that each of the components (regardless of whether their relationship with vulnerability is direct or inverse) has in the final determination of the VI. To calculate the Relative Exposure, Sensitivity and Adaptive Capacity Relative Indices use the following equations.

Some of the conclusions regarding a vulnerability that can be extracted from the on the results of the workshop are:

- Vulnerability is multifaceted (social, environmental, institutional, economic, physical).
- Vulnerability is dynamic (temporal and spatial changes).
- Vulnerability assessment is Hazard and context (territorial scale, availability of data, etc.) specific.
- There is still a long way to go and many challenges in which to continue advancing in these methodologies.
- Only by knowing what makes us vulnerable will we be able to cope with the risks posed by climate change.

UNISI

The UNISI presentations consisted of the explanation of the Urban Carbon Accounting Methodology for the City of Valletta to the students. The proposed methodology is the same as that used for the Siena, Rome, and Seville Workshops, with some modifications to better adapt it to the Intensive Course, which was the first project experience carried out in presence.

On the first day of the Course (Monday, July 11th), the UNISI contribution consisted of two presentations by Dr. Matteo Maccanti and Dr. Michela Marchi. The first one illustrated the methodology, data collection, and processing, calculation of Valletta's Carbon Footprint, quantification of the virtual forest equivalent necessary to absorb the emissions of the study area, selection of the theoretically most suitable mitigation measures, calculation of their emission reduction effect on Valletta's total budget.

The second presentation detailed the Excel file that the students had to work on, and it explained step by step what the first part of the exercise they had to do consisted of.

After the explanations, students were asked, as "homework", to carry out the first part of the exercise (i.e., calculating Valletta's Carbon Footprint and quantifying the virtual forest equivalent) before the afternoon of Wednesday, July 20th, which was dedicated to the UNISI-coordinated exercise, so that they would have more time to devote to the second part of the exercise and focus on mitigation measures.

The main notions recounted in the presentations were then reminded and summarized to the students on three other occasions: during the wrap-up on the last day of the first week (Friday, July 15th), in the presentation on the first day of the in-person workshop (Monday, July 18th), and Wednesday afternoon, at the beginning of the co-working session run by UNISI.

In addition, a Google Drive folder was shared with the students where the Excel file for the exercise and a PDF copy of the presentations given by Drs. Maccanti and Marchi were uploaded. In this way, the students had all the material they needed to go over the topics and fill in any doubts (for this purpose, the two UNISI teachers also made themselves available to give further explanations either by e-mail during the online week, or directly verbally in the second week of the workshop).

Some of the information developed for the UNISI presentation are illustrated below:

1. Description of the study area analysed (Figure 29);
2. Main sources of emissions analysed (Figure 30);
3. Calculation of Valletta's Carbon Footprint (the results are expressed in t of CO_2eq and shown in Figure 31);
4. Carbon Footprint evaluation by individual household (Figure 32 - allowing comparison with an average European household and that studied during the Siena, Rome and Sevilla Workshops);

5. Hectares of equivalent virtual forest that would be required for the absorption of GHG emissions emitted in the study area (Figure 33, which also provides information regarding the emissions liability to be given to each emission sources, and activity sectors analysed).

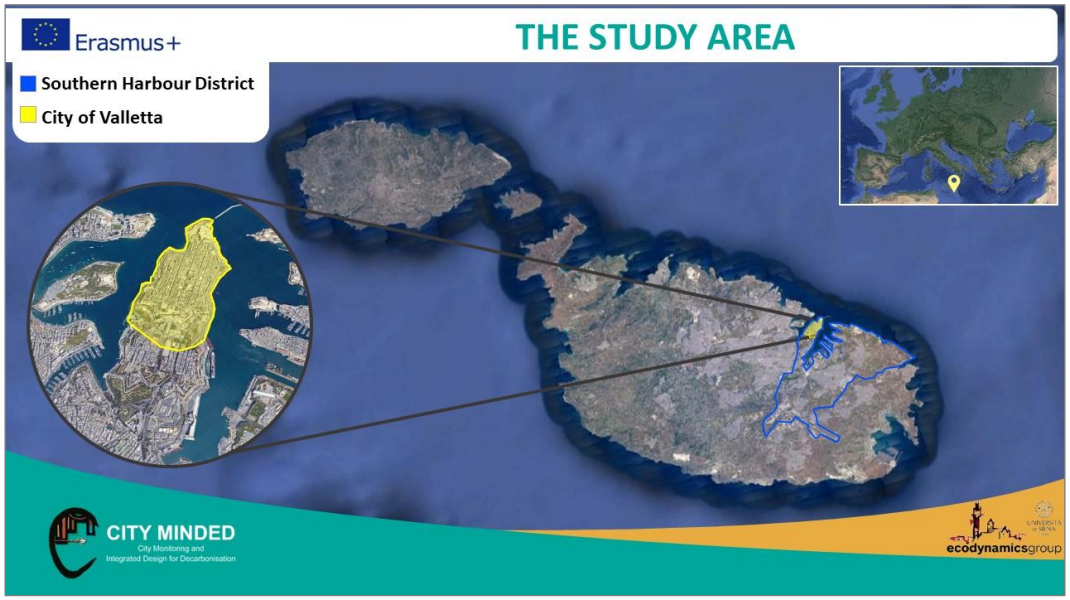


Figure 29 - The study area: the City of Valletta.

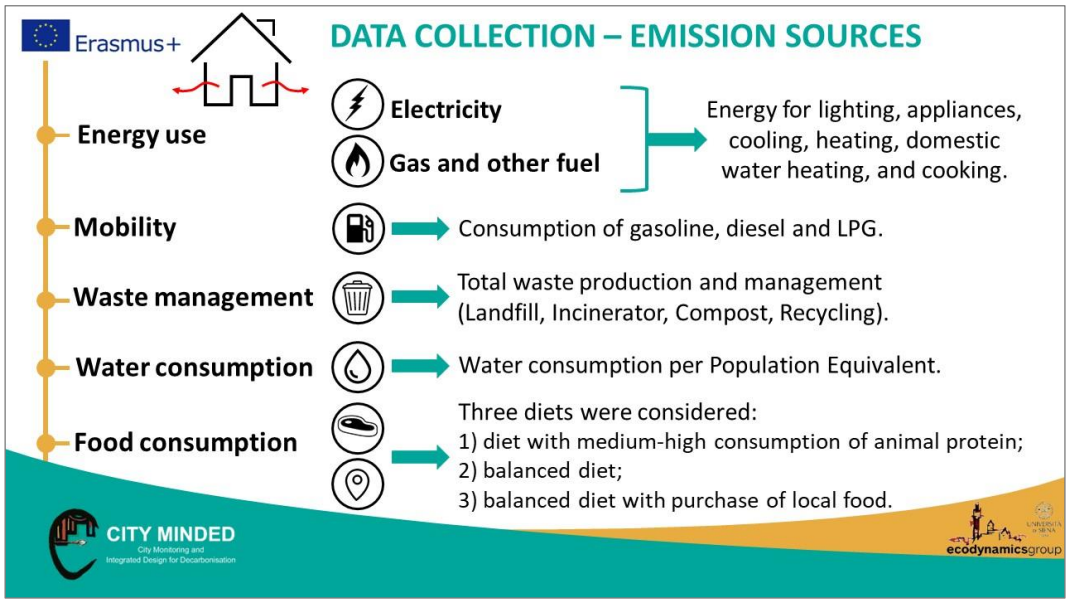


Figure 30 - The emission sources analysed for the Carbon Footprint evaluation.

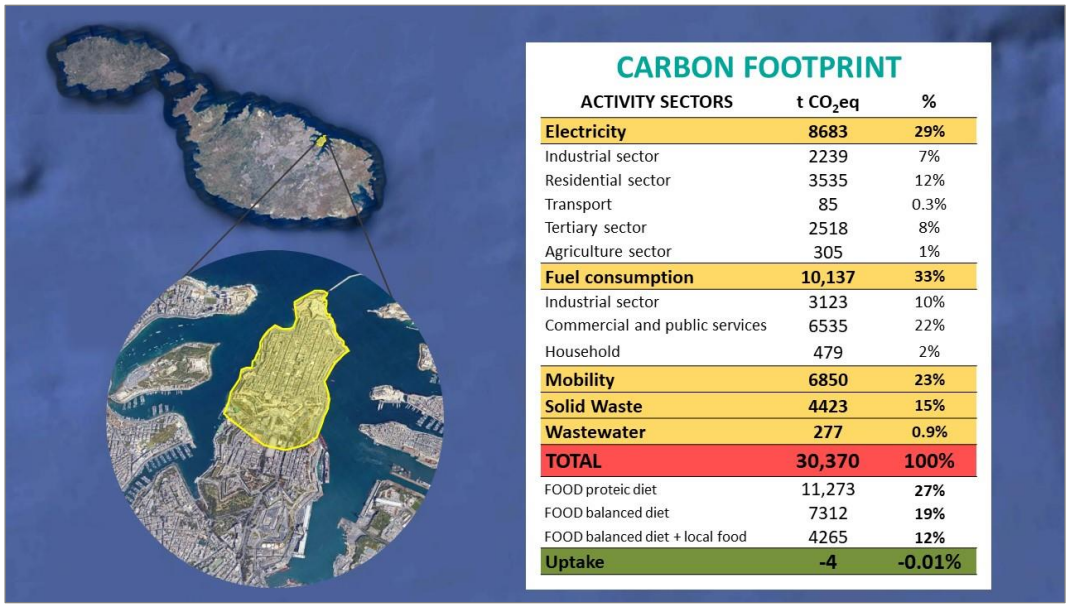


Figure 31 - Total Carbon Footprint of the City of Valletta.

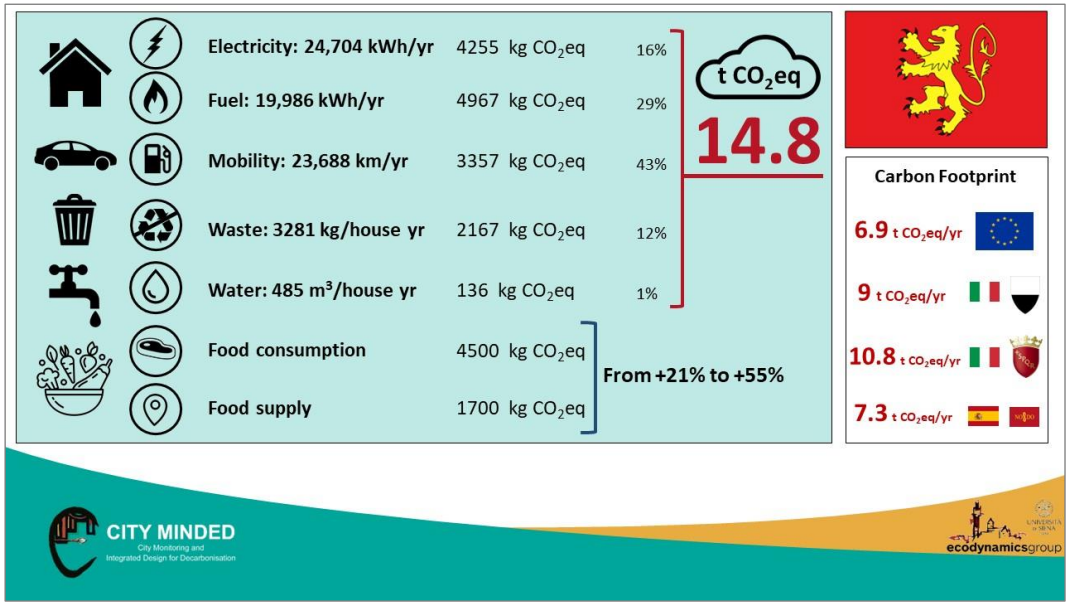


Figure 32 - Total Carbon Footprint for a typical household in Valletta.

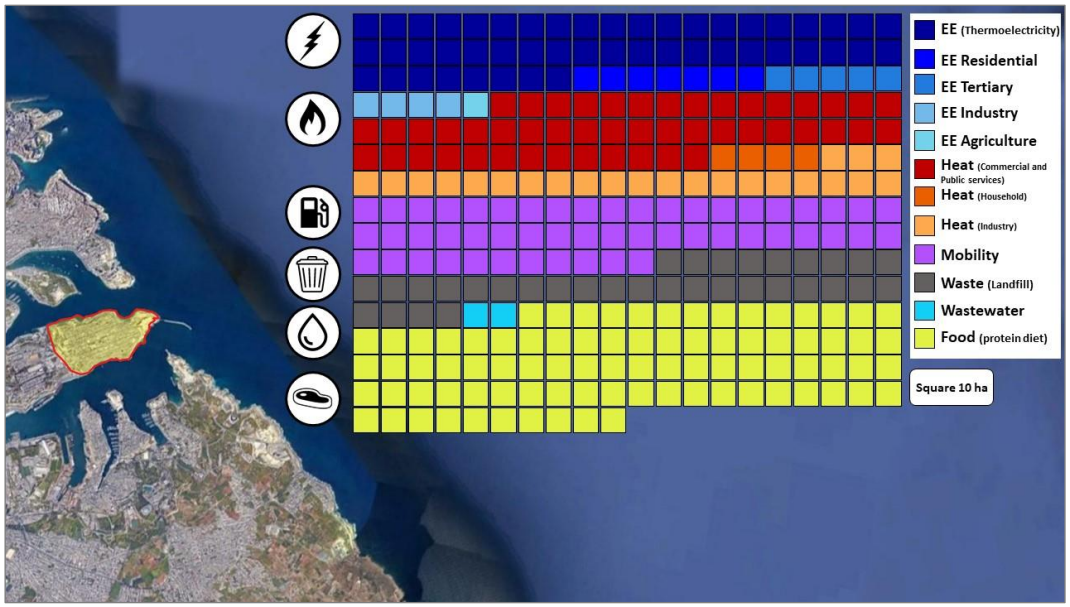


Figure 33 - Scaled representation of the equivalent virtual forest that would be required to absorb gas emissions from the City of Valletta.

Then, after explaining the methodology, its applications, results, and some graphical ways to show the numbers obtained, possible mitigation actions to reduce emissions were illustrated. These are structured based on different spatial scales (household, building, building block, street, neighbourhood, city) and different time scales (short-, medium-, and long-term measures, with time scales of 10, 20, and 30 years). In addition to the solutions presented in the other workshops (see, for example, Table 3 - Seville Workshop) described in detail in Pulselli et al. (2019), on this occasion, since it was the study of an urban area within an island, two other solutions for generating electricity from renewable resources were presented: Floating Wind Turbines (based on productivity level and technologies proposed in Pulselli et al., 2022a) Wave Energy Converters (based on what was proposed in Pulselli et al., 2022b and Franzitta et al., 2016).

In the end, a dynamic representation of the "decarbonisation" plan for city by 'crunching' the virtual forestland was carried out (Figure 34).

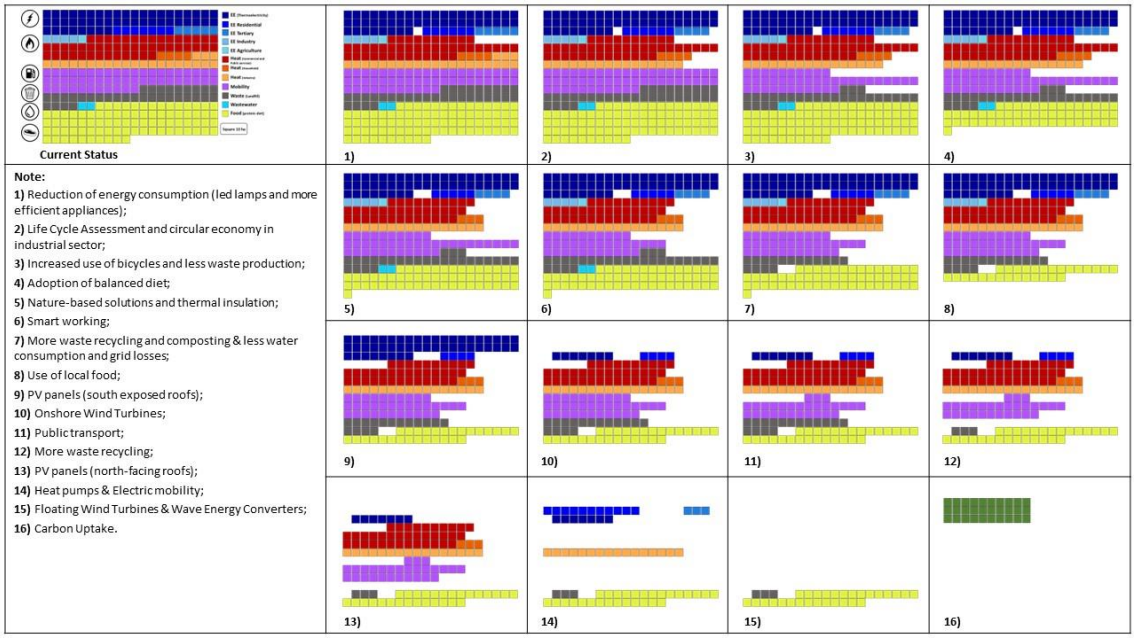


Figure 34 - Carbon Footprint mitigation scenario for City of Valletta.

Co-working session

On the afternoon of Wednesday, July 20, the Co-Working session coordinated by the two teachers from the University of Siena was held at the Valletta Design Cluster.
The exercise proposed had the following aims:

a) Quantifying the Carbon Footprint (CF) of the City of Valletta;
b) Quantifying the virtual equivalent forest area needed to absorb GHG emissions;
c) Discussing potential policies (brainstorming);
d) Simulating the CF mitigation of the City.

The co-working session began with a short presentation given by Dr. Maccanti to summarize to the students the theoretical part covered in the first week's lecture, the methodology, and the equation

they will have to apply for the various calculations required. In the end, students were shown the planned timetable for the various steps into which the exercise was divided (Figure 35).

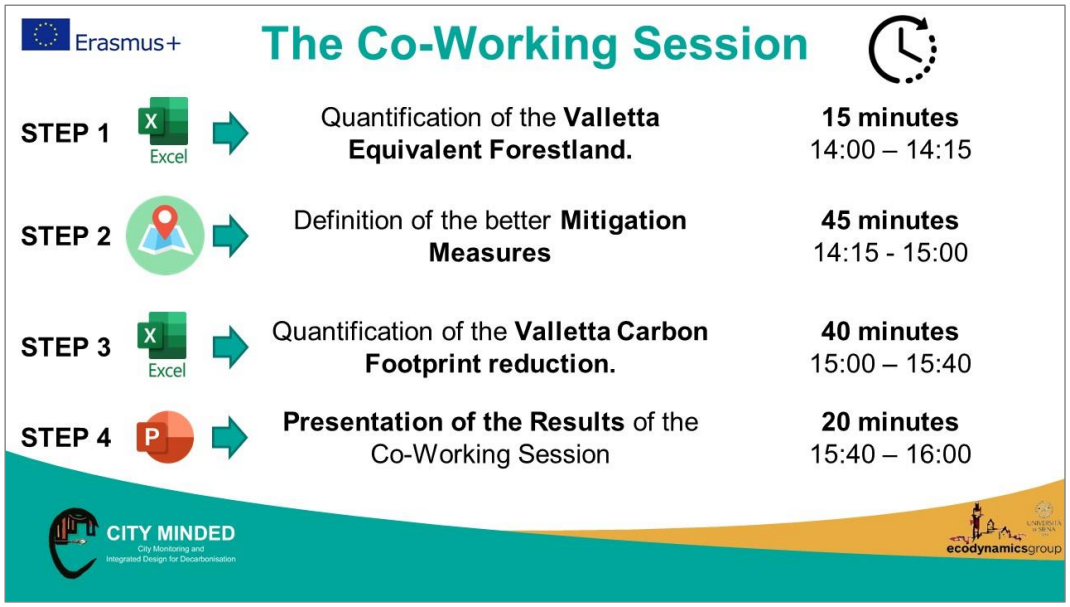


Figure 35 - The time schedule for the UNISI co-working session.

The first part of the exercise (quantification of CF and virtual equivalent forest) was conducted individually, or in self-organized groups, the days before the co-working session. Therefore, students were divided into the two groups defined on the first day of the Workshop and were asked to present their results of the CF calculation and forest hectares. Some of the errors the students made were corrected, after which all the time available was devoted to mapping work and identifying the best mitigation measures for the study area.

The students started to think of mitigation measures based on the work and maps carried out the previous day in the co-working session coordinated by UNIROMA3 (see Figures 19 a-d as an example). The planned timelines were not met; the class started earlier and ended after the scheduled time (the lesson, therefore, lasted about three hours instead of two) because students spent a lot of time identifying the best solutions to apply in Valletta and calculating their mitigation effects on the total CF.

Students debated the best solutions, discussed, each presenting proposals and suggestions based on their knowledge, documented real-world virtuous examples, and debated with teachers from UNISI and other partners, resulting in choral work, a kind of small think tank, concrete, and tangible expression of a scientifically based cultural enhancement process, instant planning of the city of the future.

Results

At the conclusion of the afternoon's work, students fixed the summary of their reasoning and conclusions on a map and PowerPoint presentation, and one representative from each group carried out a brief final presentation.

Both groups met and exceeded the Carbon Neutrality goal for the city of Valletta as they focused heavily on the implementation of renewable energy facilities (particularly PV panels and wind turbines, both onshore and offshore floating). The solutions, however, also range in other areas, such as increasing urban greenery, reducing energy waste through the use of LED bulbs and more efficient household appliances, and optimizing cycles through increased recycling and reuse of processing waste (e.g., for the production of biogas and biodiesel), changing individual diets by reducing meat consumption (imagining, for example, the gradual increasing inclusion of products derived from insects), and much more (the Figures 36-43 show some of the results and mitigation measures identified by the students).

INPUT	UNIT	Activity data		CF
				t CO_2eq
Population		5,859		
Electricity (INDUSTRIAL)	MWh_e	2,171		565
Electricity (RESIDENTIAL)	MWh_e	3,428		893
Electricity (TRANSPORT)	MWh_e	83		22
Electricity (TERTIARY)	Mwhe	2,442		636
Electricity (AGRICULTURE)	MWh_e	296		77
Thermoelectricity (Natural gas)	m^3 natural gas	3,357,852		6,490
Fuel (INDUSTRY SECTOR)	MWh_{th}	12,227		3,123
Fuel (COMMERCIAL AND PUBLIC SERVICES)	MWh_{th}	25,527		6,535
Fuel (HOUSEHOLDS)	MWh_{th}	3,032		479
*of which **Water heating***	MWh_{th}	*779*		*123*
*of which **Cooking***	MWh_{th}	*455*		*72*
*of which **Air Conditioning***	MWh_{th}	*376*		*59*
*of which **Electrical appliances and lighting***	MWh_{th}	*840*		*133*
*of which **Space heating per dwelling***	MWh_{th}	*582*		*92*
Fuel MOBILITY	MWh_{th}	26,013		6,850
*of which **Cars***	MWh_{th}	*15,816*		*4,165*
*of which **Bus***	MWh_{th}	*2,471*		*651*
*of which **Motorcycles***	MWh_{th}	*234*		*62*
*of which **Trucks and light vehicles***	MWh_{th}	*6,009*		*1,582*
*of which **Rail***	MWh_{th}	*0*		*0.00*
*of which **Water (ships and ferries)***	MWh_{th}	*1,405*		*370*
*of which **local airport (private airplanes)***	MWh_{th}	*78*		*21*
Waste (LANDFILL)	t waste	5,993		4,423
Waste (INCINERATOR)	t waste	0		0.17
Water	m^3 water	989,754		277
FOOD proteic diet				11,273

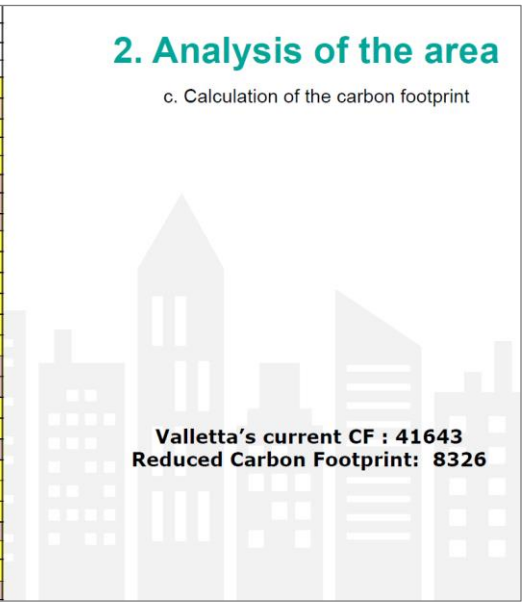


Figure 36 - Group 1: Carbon Footprint results and mitigation effects for the City of Valletta.

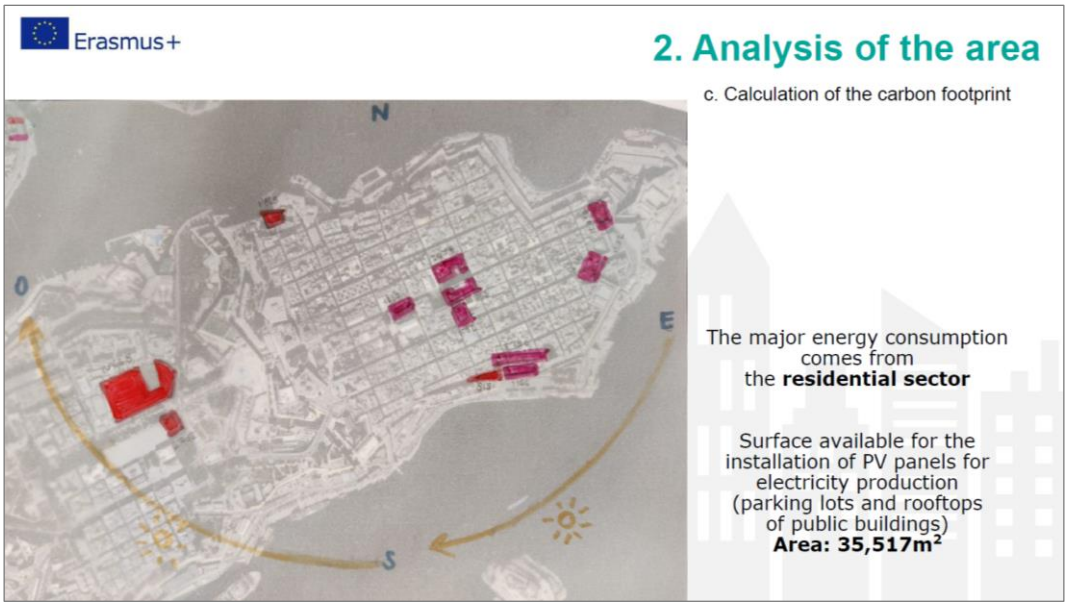


Figure 37 - Group 1: Map of the City of Valletta with areas for the installation of PV panels highlighted.

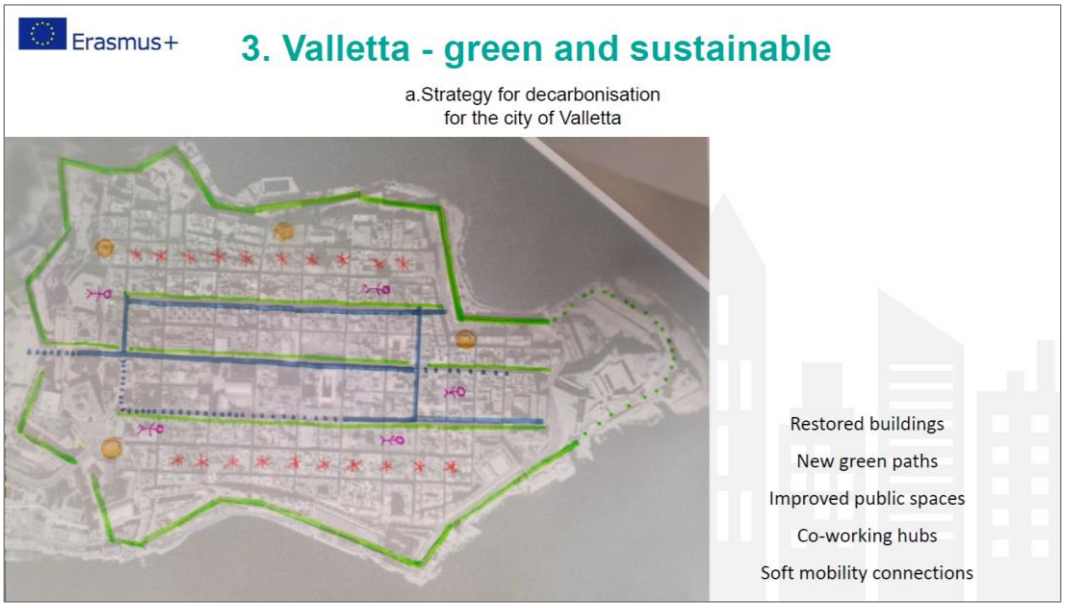


Figure 38 - Group 1: Strategy for the decarbonisation of the City of Valletta.

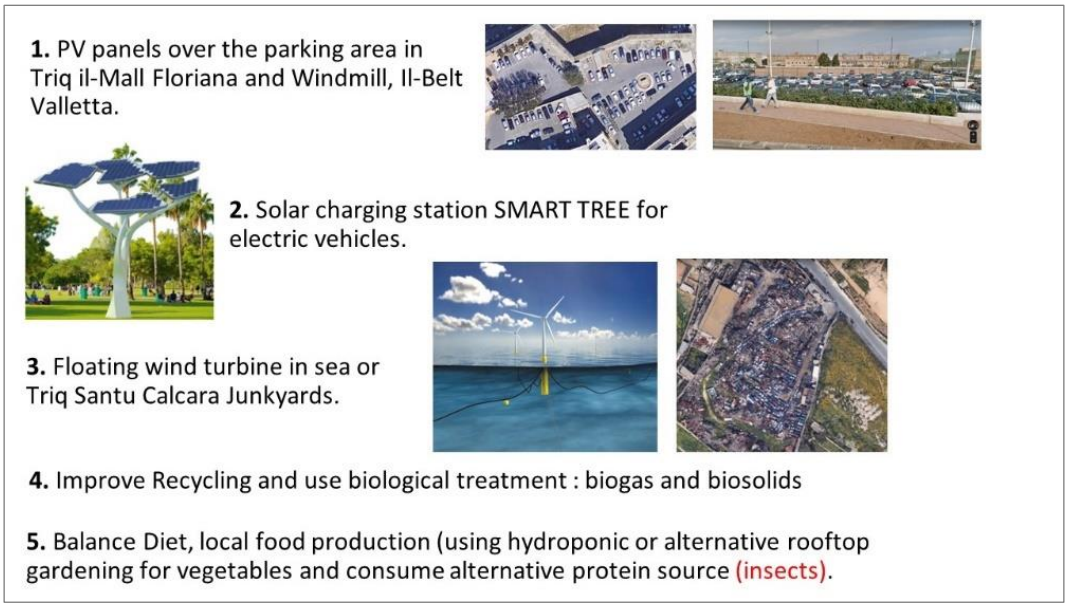


Figure 39 - Group 1: Examples of GHG mitigation solutions.

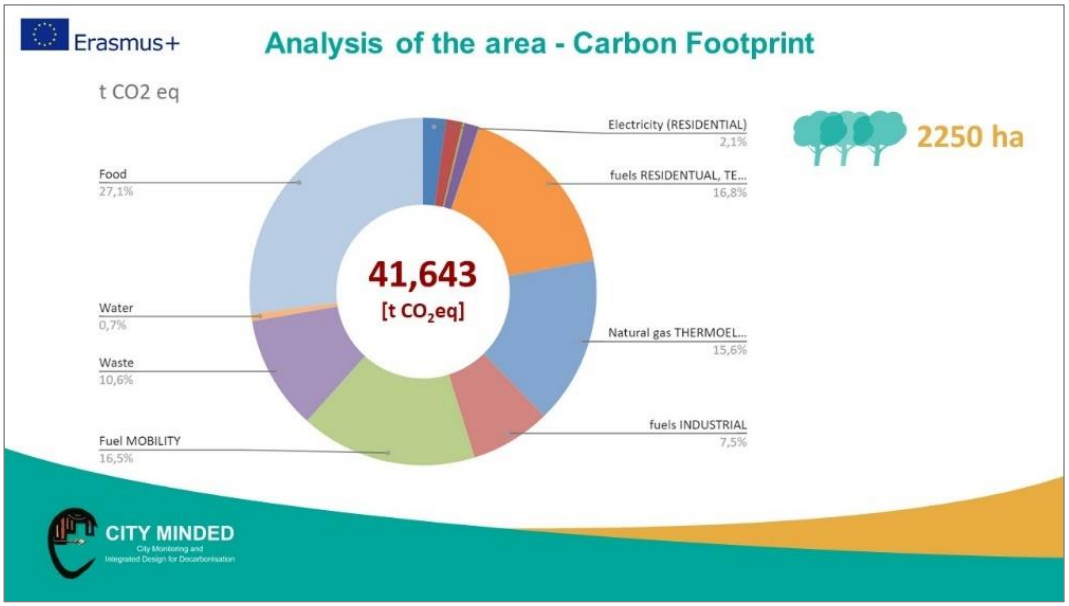


Figure 40 - Group 2: Carbon Footprint results for the City of Valletta.

Figure 41 – Group: traffic modifications and the increase and development of urban green areas.

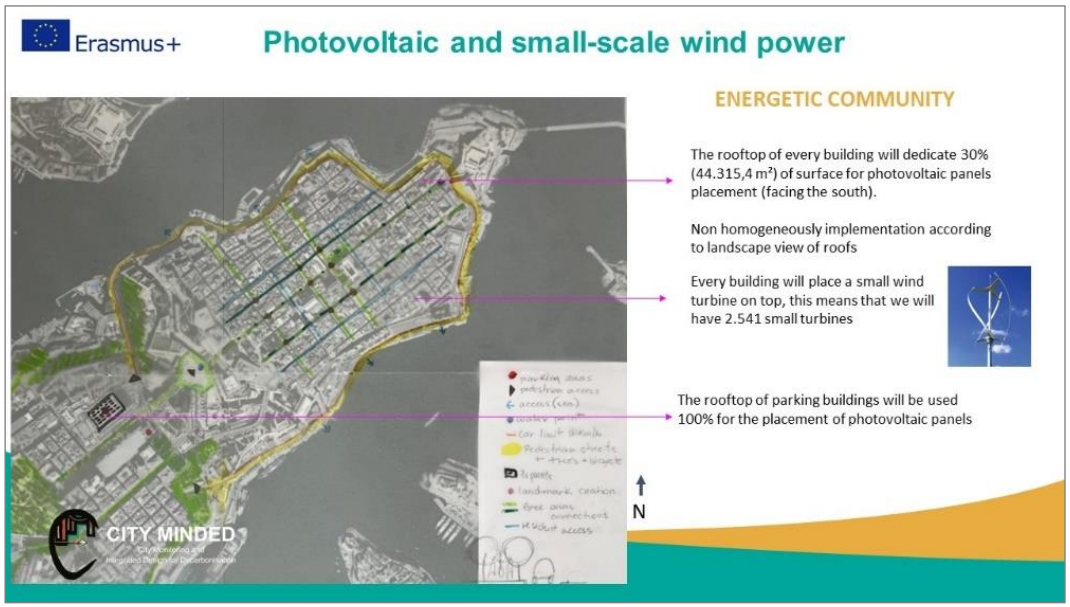


Figure 42 - Group 2: areas for PV panels and small vertical-axes wind turbines (energetic community implementation).

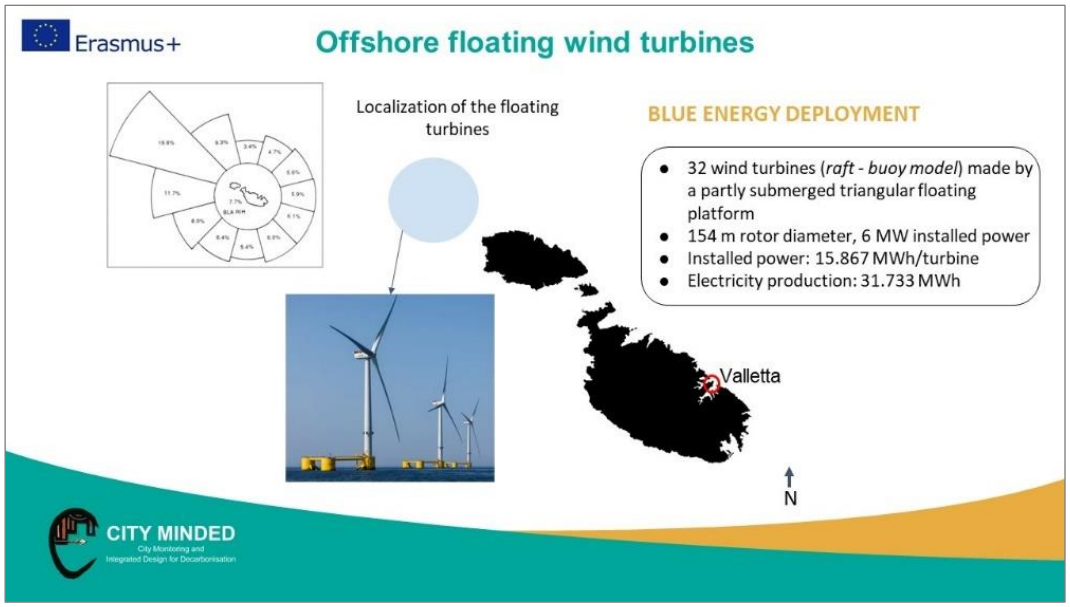


Figure 43 - Group 2: Map of the Malta archipelago with the location for a hypothetical floating wind farm.

IRENA/MIEMA

Training session

The intensive course was divided into two parts, and it was the first occasion to hold the sessions in the presence of the students and the teachers. The training session was held in online mode, and it was the opportunity to present to the students and teachers the developed methodology related to the improvement of energy efficiency and boosting the use of renewable energy technologies in target urban areas. As in the previous three workshops, the first part of the session was related to sharing knowledge about energy efficiency, detecting potential problems, and identifying solutions that will be analysed during the co-working session. The analysed and proposed energy efficiency measures will then act as an integral part of the urban decarbonisation roadmap for the City of Valletta. The first session was divided into five chapters, and it was slightly modified and adapted by considering the current situation in the energy sector and the peculiarities related to climate change and urban sustainability. The session started with the presentation of the working group, the second chapter was focused on current EU initiatives focused on achieving carbon neutrality by 2050, and the third one was related to the topic of energy efficiency in the active service of the city decarbonisation process by analysing all the specifics of the City of Valetta and describing possible energy efficiency measures which can be conducted to achieve better energy performance of the buildings, and the last two chapters were related to the energy refurbishment of heritage buildings and how to finance the renovations and investments in new technologies.

The first thematic chapter of the session was related to the analysis and presentation of actual EU initiatives aiming to achieve that Europe becomes the first carbon-neutral continent by 2050. Climate Change and urban sustainability is possibly the biggest challenge of our times and an opportunity to build a new economic model. With that in mind, European Union has adopted a comprehensive set of regulations and initiatives with the main one, the European Green Deal which represents an overarching strategy aiming at making Europe the first climate-neutral continent in the world by 2050. The goal of the European Green Deal is the transformation of the EU into a modern, resource-efficient, and competitive economy, by ensuring no net emissions of greenhouse gases by 2050, ensuring economic growth decoupled from resource use, and taking care that no person and no place is left behind (see Figure 44).

Figure 44 - European Green Deal objectives. Source: European Commission.

The second initiative which was presented to the students and the teachers was the "Fit for 55 package" (Figure 45) which represents a set of proposals to revise and update EU legislation and to put in place new initiatives to ensure that EU policies are in line with the climate goals. The "Fit for 55" refers to the EU's target of reducing net greenhouse gas emissions by at least 55% by 2030.

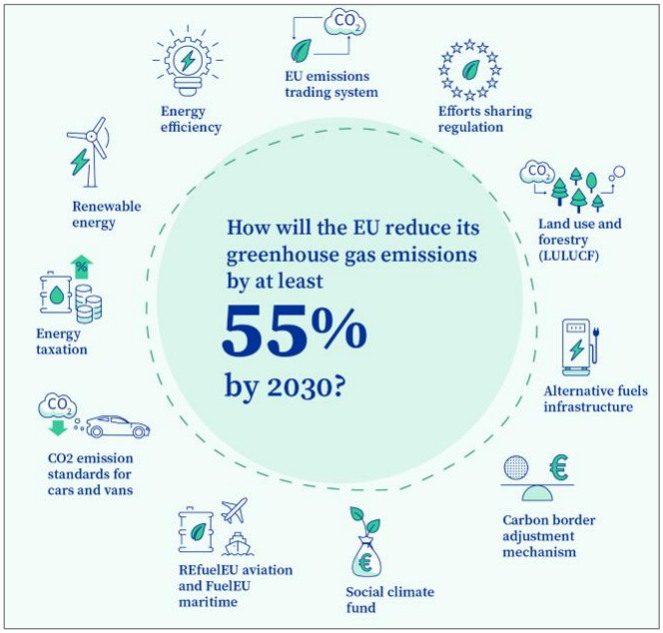


Figure 45 - Fit for 55 areas of intervention. Source: European Council.

The last and the most actual initiative which was presented to the students and teachers were the "REPower EU" which is the latest strategy of the EU made as a response to the hardships and global energy market disruption caused by Russia's invasion of Ukraine. The REPowerEU is a plan for saving and producing clean energy by speeding up the green transition and spurring massive investment in renewable energy and diversifying energy supplies.

The third chapter of the session was related to the topic of energy efficiency, its definition, why is important, and what energy efficiency measures can be conducted on the level of the City of Valletta by targeting the improvement of its building stock. The improvement of energy efficiency brings a variety of benefits, it affects the reduction of Greenhouse Gas emissions, reduces the demand for

energy imports, and lowers the costs on a household and economy-wide level. Energy efficiency measures are focusing on the sectors with the greatest potential for energy savings, buildings, industry, transport, and energy supply sectors. As in the previous workshops, the focus of the session was on how to achieve energy-efficient buildings, and in the case of the Intensive course, it was related to the City of Valletta. 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 greenhouse gas emissions. As regards the analysis of Valletta's building stock, considering that it is a World Heritage City with a high density of historic buildings and monuments it has a lot of conservation constraints that have to be taken into account before planning adequate energy efficiency measures. The main detected issues during the analysis were the following: decline in residential population, overall decay of the general environment, excessive vehicular traffic, degradation of buildings, obsolete infrastructure, social problems, and collateral effects of tourism and commercial activity. The analysis of the building stock showed that the refurbishment and repurposing of the buildings must be carefully regulated but the positive aspects were detected such as strong interest among private individuals as well as businesses to invest in the conservation and reuse of historic buildings. Possible energy efficiency measures were proposed in five typical categories aiming to reduce the heating demand, cooling demand, the energy requirements for ventilation, energy use for lighting, and energy used for heating water.

The last chapter of the session related to energy efficiency was the presentation of possible financing schemes which could make it easier to finance the renovations and investments in new and green technologies. On the national level, a financing scheme called "Grants for the Restoration and Finishing of Privately Owned Residential Properties 2021-2024" was detected and presented to the students and teachers.

The second part of the thematic area related to energy focused on the integration of renewable energy systems within buildings located in 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 turbines, and combined heat and power plants were presented as different types of renewable technologies that can be used within the urban scenario for the generation of clean energy by integrating the systems within existing buildings. Several best practices from Malta and other European countries about 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. 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. The presentation was focused on the context of the city of Valletta, highlighting challenges related to

the integration of RES during the historic value of the buildings and laws specifying how interventions can be implemented.

Co-working session

The exercise with the students was finally the occasion to test the methodology in a real environment. The students and teachers were divided into two groups and the exercises were divided into four main tasks, each following and complementing the previous one. The first group has selected the building of the Valletta Design Cluster. The first task was to identify the measures already implemented for energy efficiency and renewable energy in/on the building. The second task was to propose additional measures to maximise the energy performance, the third one was to identify challenges and mitigation measures for the implementation of the proposed measures and the last task was to propose an implementation timeline (short, medium, long term). The second group had to select a building/group of buildings in the City of Valletta and then identify aspects of the area which have a bad energy performance and what would be the main energy consumers. Then the group should propose measures to maximise the energy performance (EE + RES) and identify challenges and mitigation measures for the implementation. The last task was to propose an implementation timeline (short-, medium-, and long-term) for the proposed measures.

The first Group started their exercise with a walk around the building to identify the implemented measures on/in the building. As the implemented measurers, the group identified the rooftop garden, green wall within the main courtyard, solar electricity panels panel on the canopy, good use of natural light (glass walkways), efficient use of space (module rooms + external corridor), use of adaptive and resistant materials (wood and steel), use of LED lights and restored existing cisterns (Figure 46).

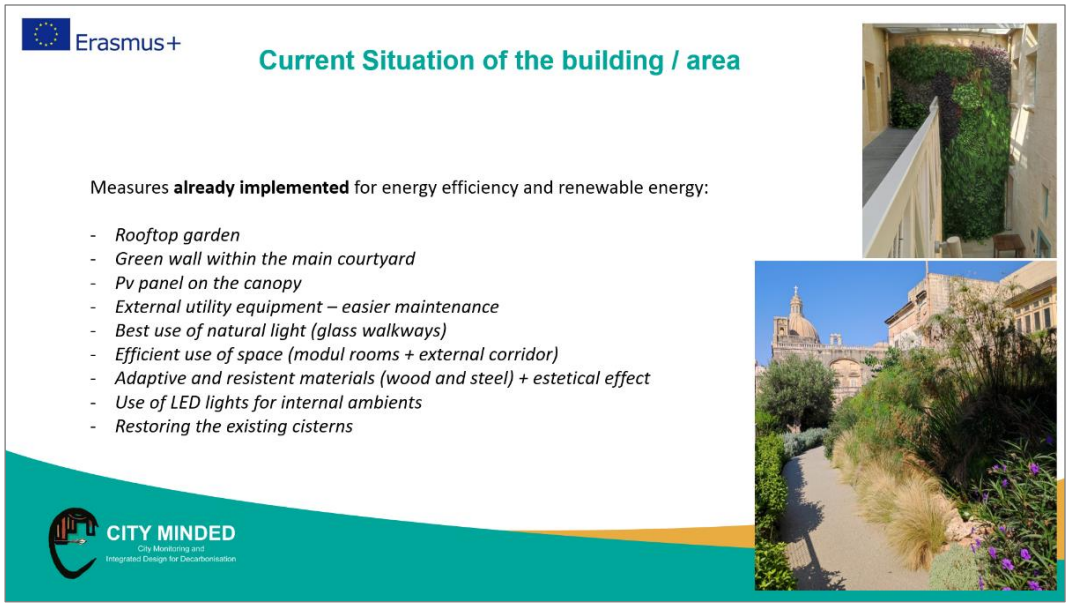


Figure 46 - Identified and implemented measures on the Valletta Design Cluster – Group 1.

Following the analysis of implemented measures, the group proposed several solutions to improve the energy efficiency of the building and maximise the use of renewables (Figure 47). The proposals included the following: increase the number of PV panels, movable PV canopy to increase the efficiency of solar retention, install sensors for the lights and water taps in the building, limit air condition temperature, ensure shadow (lighter tents) in roof garden to improve usability, improve air circulation to reduce the greenhouse effect, improve accessibility for person with reduced mobility and provide a key map of the building. The identified challenges by the group were the establishment of the maintenance plan, how to ensure regular checks for PV and service equipment, and the conservation rules.

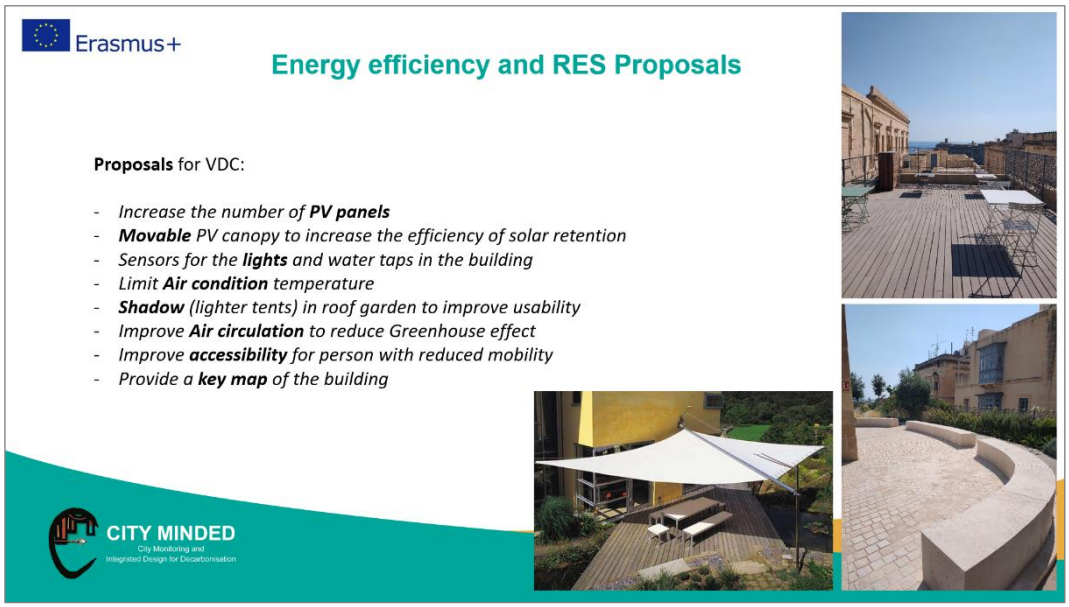


Figure 47 - Proposals for the improvement of the Valletta Design Cluster – Group 1.

The second group started their exercise with an on-site visit to the target area. The group selected for their exercise a group of buildings located in *Triq San Duminku* in the historical centre of Valletta (Figure 48).

Figure 48 - Target area chosen by the Group 2.

The Group has analysed the buildings in several ways. First, they have done a walk around the building and took notes about the visible interventions or weaknesses. Then the Group interviewed several users and flat owners to collect valuable inputs regarding the energy performance of the buildings, interventions made and what are the challenges that the owners are facing, particularly in terms of energy consumption and living comfort. The detected are shown on Figure 49.

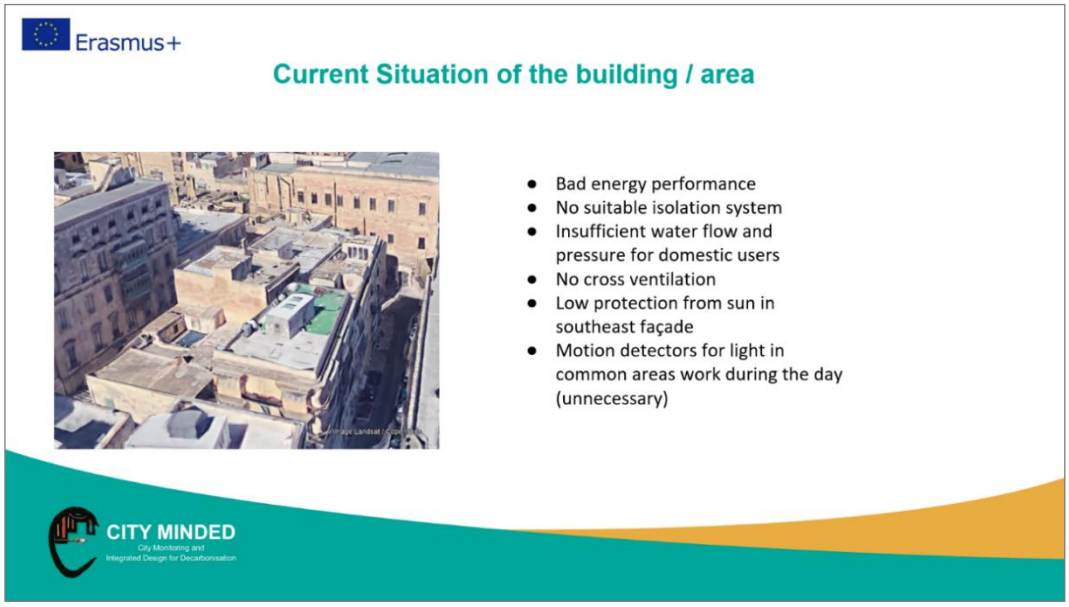


Figure 49 - The analysis of the selected area

Following the analysis of the area, the group proposed the following energy efficiency measures and renewable energy systems as shown on Figures 50 and 51:

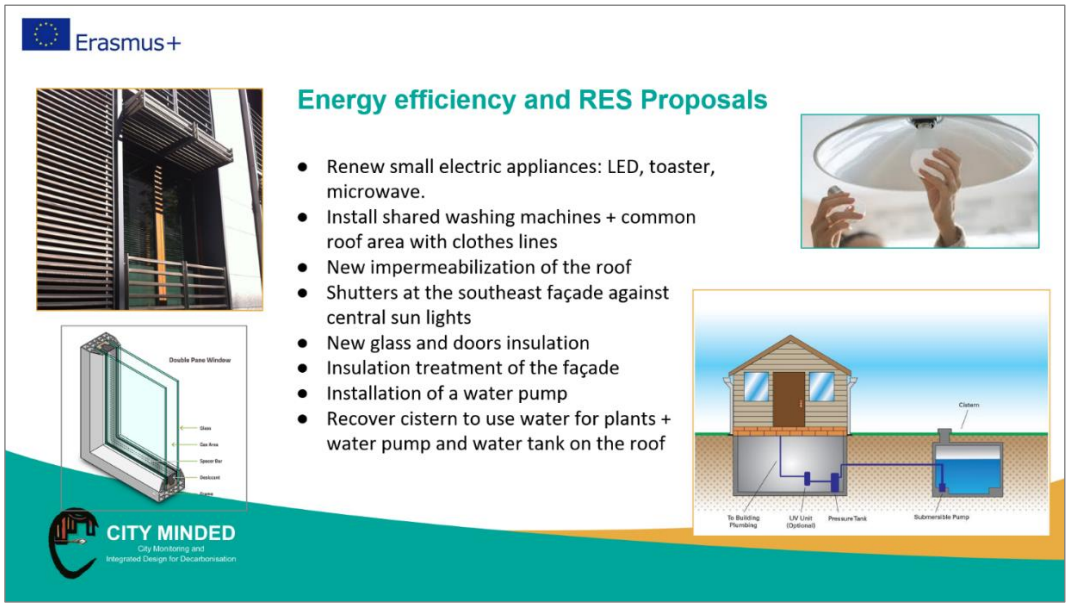


Figure 50 - The proposed solutions by Group 2.

Figure 51 - The proposed solutions by Group 2.

The Group identified the absence of common areas, heritage regulation, and accessibility as the main challenges of the area. As the mitigation measures, the Group proposed the organisation of common areas on the roofs, the use of roofs for the installation of renewables, and the use of glass PV cells if possible. As regards accessibility, the Group proposed the installation of a common wood ramp to avoid steps at the entrance of the block, and the adaptation of stairs and access from the street to the roof for people with accessibility problems.

As the common conclusion after the presentation of the results by both groups, it was concluded that the developed methodology worked very smoothly in the real condition and that the workshops in presence give more opportunity to produce tangible results than the online ones. Nevertheless, the developed methodology can work in both conditions, and this is for sure an added value to the project. The work between the students and teachers from different Universities and with different levels of knowledge has provided significant proposals for the energy efficiency improvement of the target area and Valletta in general, which then can be used by stakeholders and practitioners to prepare actions aiming at achieving carbon neutrality in the upcoming years.

9. The Teacher's Toolkit

The Toolkit is an instrument that complements the Modular Course (O4) and has been conceived mainly to valorise the experience gained by the project Consortium in virtual teaching during the COVID-19 Pandemic and to increase the replicability of the City Minded experience. It has the purpose to help teachers and tutors in academic institutions or other organisations that want to use the City Minded methodology for teaching decarbonisation. The toolkit is by no means an exhaustive methodology but is supposed to provide the prospective tutor with the right tools to prepare and carry out training and co-working sessions on the various topics covered within the project.

Therefore, it includes:

- Instructions for the implementation of both training and co-working sessions on the 4 decarbonisation-related topics addressed by the project, including data and materials to be used;
- A set of tools that can be used to implement the sessions (templates, graphic tools, etc.) and to assess their results (evaluation questionnaire for participants, evaluation grid to verify the learners' acquired knowledge);
- Practical examples taken from the City Minded workshops.

To ease consultation, the Toolkit is structured in five sections:

1) General guidelines on training sessions;
2) Step-by-step general organization of co-working sessions;
3) Exercises factsheets;
4) Examples;
5) Annexes.

Each section and each Exercise factsheet are conceived as a stand-alone document and can be downloaded separately from the project e-learning platform. Each document schematically provides clear and synthetic information; the teacher can refer to other project Outputs for additional detail. A description of the five sections is provided in the following.

9.1 General guidelines on training sessions

This section provides indications on training sessions, based on the City Minded workshops experience. For each training session, the objectives and structure are specified, including the number, title, and duration of lectures. The contents of the lectures are not specified since teachers are expected to exploit the corresponding materials of the Modular Course.

9.2 Step-by-step general organization of co-working sessions

This section aims at guiding teachers in the organization of co-working sessions, both online and in person. For each topic, it suggests the optimal tutor-to-learner ratio for online and in-person

workshops and the tested structure of the sessions, specifying the different phases to go through, their contents, and duration.

9.3 Exercises factsheets

Each factsheet displays:

- A clear and synthetic description of a single exercise, specifying its title, the topic addressed and the didactic objectives it is expected to achieve (in other words, what students are expected to learn/produce during the exercise), as well as the conceptual linkages with other Modules of the City Minded Course, highlighting the interdisciplinary nature of the project;
- The structure of the exercise, including implementation phases, procedure and timing for each phase, and pointing out the differences between online and in-person mode;
- A table, listing and synthetically describing data, materials, and equipment needed for the implementation of the exercise, and providing also notes on the possible sources to get data and information, as well as on the different options in online and in-person sessions;
- An evaluation grid to assess the knowledge acquired by learners, and the quality of the outputs they produced during the exercise. The possible rating foresees 5 to 6 degrees (on a scale from 0 to 5 scores), according to which level the learner has succeeded in processing, integrating, and putting into practice the information received during the training sessions.

9.4 Example

This section collects sample materials and outputs taken from the project workshops, which can be useful for teachers to understand the minimum level of detail to be reached during the exercises. Of course, according to their expertise, on the time available, and on the level and background of the involved learners, teachers can go beyond the examples provided and produce more refined outputs.

9.5 Annexes

The Annexes section collects both the materials to be used in exercises (tables, templates, etc.) and the evaluation questionnaire model to be submitted to learners to assess their degree of satisfaction, their perception of the knowledge and skills they acquired during the workshop, etc.

10. Conclusion

The purpose of this document “Methodology and Guidelines” was to explain as clearly as possible the experience that took place during the City Decarbonisation Itinerant Workshops of the Erasmus+ City Minded project.

After an initial framing of the Project and its objectives, the explanation focused on the creation of a detailed guideline on what is the best way to carry out a workshop such as those performed in the project, trying to distinguish the peculiarities and cautions to be kept in mind for both an online and live performance. Next, the project partners were introduced, as the Methodology itself mirrors their knowledge and expertise.
The document then goes into detail about the Methodology, its purposes, characteristics, structure, and components provided by each project partner. The final part of this Document shows all the different applications of the Methodology, focusing on two experiences in particular: the third City Decarbonisation Itinerant Workshop, the last and most comprehensive example of the online applications (held in Seville), and the study of the City of Valletta carried out as part of the Malta Intensive Course, the only project experience carried out in presence.

The Pandemic from COVID-19 that began when the City Minded project was just getting started, put a strain on the initial structure that had been planned. In fact, at least 3 individual 5-day workshops and a 15-day Intensive Course were planned, all of which were to be conducted in presence in different locations between Italy, Spain, and Malta. The restrictions that followed the Pandemic forced a complete revaluation and restructuring of what was planned, trying to find the most engaging and interesting ways possible for students to have remote experiences that mimicked face-to-face group work. This was concretized, for example, by trying to make the teachers' presentations dynamic, light-hearted, and interactive, by dividing students into small groups for co-working sessions, and by providing students with materials that would help them understand the topics covered and carry out the planned exercises.
This was a complex challenge that we believe, at least in part, we overcame, as feedback from students who participated in the various experiences was always very positive, both regarding the interest and clarity of the topics covered and the cultural and personal background they gained. All the feedback, advice, criticism, and any difficulties encountered during the workshops have allowed both training and co-working sessions to be shaped to the best of their ability, in a process of continuous growth and improvement.
A remote experience can never be comparable to a "traditional" face-to-face meeting, where proximity, contact, glances, and nonverbal communication go a long way toward enriching and embellishing each other's knowledge and fostering non-traditional learning built primarily from experimentation and application of notions that otherwise remain purely theoretical.
All the work that has been carried out in defining and optimizing the presented Methodology has constantly had as a reference the main subject of the project: the students. They were the privileged recipients of the work that the partners carried out and they were the protagonists of the experiences fulfilled during the project.

The goal was in fact to make tools, methodologies, and knowledge in many cases complex and the result of years of study, accessible and understandable (without trivializing them) to students belonging to different disciplines and study courses, with backgrounds often far from the subject of the City Minded Workshops. At the end of the various experiences, the reports and presentations that were requested from the students had the purpose of making them spokespersons of the skills learned during the training and co-working sessions.

The other protagonist of the work that was carried out were the regional districts, cities, and neighbourhoods under study. Urban areas are in fact (and will increasingly be) the privileged places for understanding and rectifying human behaviour, being real hotspots, directly or indirectly, of the main forms of pollution on the Earth, first, the Greenhouse Gas emissions and the resulting Climate Change.

City Minded fully embodies the challenges that humanity will have to face in building a different future. At the basis of every action is knowledge, which cannot be the prerogative of a few people, but must be disseminated, shared, accessible, and understood by all, especially by the younger generations. And, in addition to the knowledge, there must be conscious actions that aim at changing and improving the places in which we live: our cities, our neighbourhoods, our homes.

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