City-zen: New Urban Energy
Menorca 'City-zen Roadshow' REPORT

Martin, C.L.; Keeffe, Greg; Pulselli, Riccardo; Vandevyvere, Han; Broersma, S.; de Ronde, Mats

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NEW URBAN ENERGY

Menorca (Mahón) Roadshow REPORT

DELIVERABLE D9.13

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MAIN COORDINATOR

Name	Sarah Bogaert
Organization	VITO
Address	Boeretang 200, 2400 Mol (Belgium)
Phone	+32 14 33 58 14
E-mail	sarah.bogaert@vito.be

CONSORTIUM PARTNERS

N° DoW	Organization	Acronym	Country
1	Vlaamse instelling voor technologisch onderzoek	VITO	BE
2	Stichting Amsterdamse Economic Board	AIM	NL
3	Universiteit van Amsterdam	UVA	NL
4	Westpoort Warmte B.V.	WPW	NL
5	Alliander	LIAN	NL
6	HESPUL Association	HESP	FR
7	The Queens University of Belfast	QUB	UK
8	Th!nk E	THNK	BE
9	KEMA Nederland BV	KEMA	NL
10	Technische Universiteit Delft	TUD	NL
11	Stichting Waternet	WAT	NL
12	Greenspread Projects BV (subject to reservation, provided acceptance by EU)	GREE	NL
13	Sanquin (subject to reservation, provided acceptance by EU)	SANQ	NL
14	AEB Exploitatie BV	AEBE	NL
15	Daikin Airconditioning Netherlands B.V.	DAIK	NL
16	Siemens Nederland NV	SIEM	NL
17	Universita'degli Studi di Siena	UNIS	IT
18	Ville de Grenoble	MUNG	FR
19	Commissariat a l'Energie Atomique et aux Energies Alternatives	CEA	FR
20	Compagnie de Chauffage Intercommunale de l' Agglomeration Grenobloise	CCIA	FR
21	Gaz Electricite de Grenoble	GEG	FR
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The Menorca Roadshow would not have been possible without the commitment, stamina, diplomacy skills, amenability and passion of one individual. That person, Jesús Cardona, architect and highly respected member of the Institut Menorquí d'Estudis (IME). Jesús' unconditional and continuous support during the preparations for the SWAT Studio and later Roadshow were pivotal in their joint success and far reaching impact in Mahón and across the island. The Roadshow team would like to take this opportunity to thank Jesús and his wonderful colleagues at the IME. We wish them well in their continued efforts to make Menorca a zero energy island, and wish them every success in taking the outcomes of the 'Sustainable Island Menorca' Roadshow to the next level of realization.

The Institut Menorquí d'Estudis would be the home of the SWAT Studio and Roadshow during their co-creative efforts to develop a sustainable island vision. The IME was indeed a home, a place of welcome, friendliness, fun, support, knowledge and experience. All at the Institut, and partnering group, the L'Observatori Socioambiental de Menorca (Obsam) worked relentlessly to ensure that the objectives of the Roadshow were met. In the case of Menorca they would be surpassed. A second special mention goes to David Carreras Marti (Director of Obsam) for his mainstay influence in this regard and offering his vast knowledge of the island, its inhabitants, flora and fauna. Too many people to mention, the Roadshow was simply inspired by the citizens of Menorca and now looks forward to the next Roadshow, aiming for the higher benchmark that has been set by this island and its people.

ABSTRACT

The City-zen Roadshow travels with a team of internationally recognized experts, in the field of energy planning and design to help develop a sustainable agenda for cities and their neighbourhoods. It will visit 10 cities in total over a 4-year period who are seeking expert guidance on how to become more sustainable and wish to move towards energy neutrality. The overall aim of the Roadshow team, known as 'Roadies', is to work closely with people from the hosting city, whether they be city leaders, energy planners, local architect, professionals, academics, students and of course the citizens themselves. The Roadshow spends 5 days in each hosting city to deliver energy and urban design workshops in which all local stakeholders are welcome and encouraged to join and to take ownership of the final outcomes. Outcomes that will allow the cities recourses, both people and energy, to be directed effectively, by highlighting the energy challenges and potentials to be found in their neighbourhoods, and to finally present a sustainable 'City Vision'.

The following report will describe the activities and outcomes of the Roadshow (Sustainable Island Menorca 'Roadshow') that took place at the Institut Menorquí d'Estudis (IME) in Mahón on the island of Menorca, between the 24th & 28th of April 2017.

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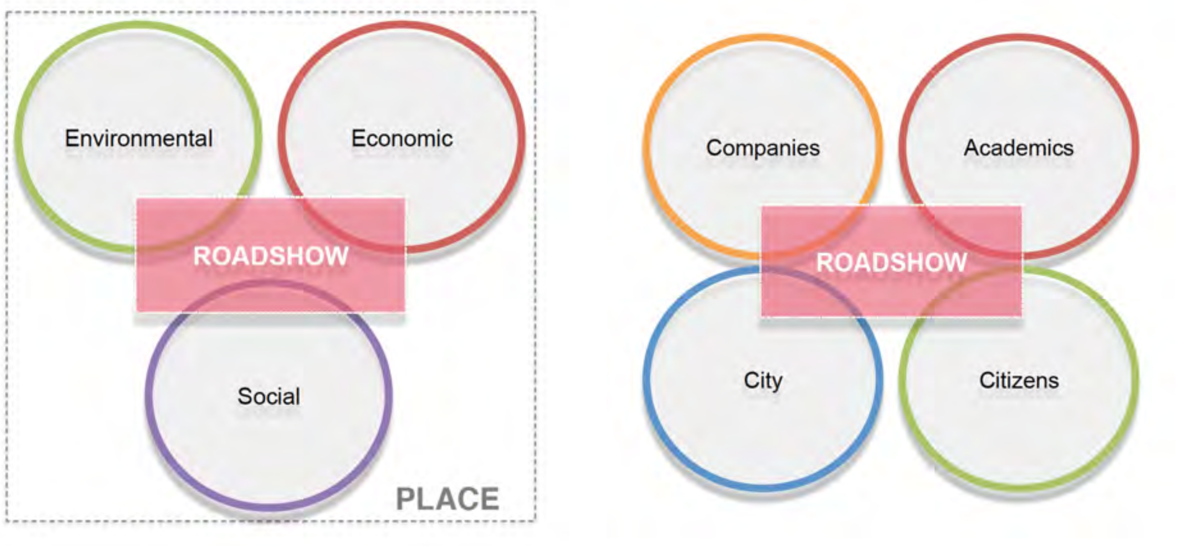
CHAPTER 1 – Introduction

The Roadshow travels with a team of internationally recognized experts in the field of architectural design and energy planning to co-create a sustainable 'City Vision' with city stakeholders. It will visit 10 cities that are seeking expert guidance on how to become zero energy and carbon neutral over a 4-year period. The project has already successfully collaborated with 4 cities, those being Belfast, Izmir and Dubrovnik. The overall aim of the project team, is to work closely with people from each hosting city, whether they be city leaders, neighbourhood associations, energy planners, architects, academics, students and of course most significantly the citizens themselves. The project consists of a 5-Day event model, a culmination of a 3-month preparation, promotion and city relationship-building period. Local stakeholders are welcomed and encouraged to join and to take ownership of the process and the final outcomes. Outcomes that will allow the cities resources, people, knowledge and renewable energy potential to be directed effectively over a realisable timescale that will meet their energy transition. The process starts by identifying a neighbourhood's urban lifestyle and energy challenges. Then, on the final day of the event model, a definitive sustainable 'City Vision' is presented to, and by, the city, which responds to all scales of their built and natural environment. In the case the project presented in this report the scale of inquiry and sustainable solution included the entire island of Menorca.



(a) *(b)*

Fig. 1. (a) The Roadshow investigates Environmental, Economic and Social aspects of each Roadshow city to develop a 'City Vision' that is specifically tailored to respond to place. (b) The Roadshow team brings together all stakeholders, it facilitates this 5-Day event to propose a sustainable 'City Vision' that is 'owned' by the City itself.

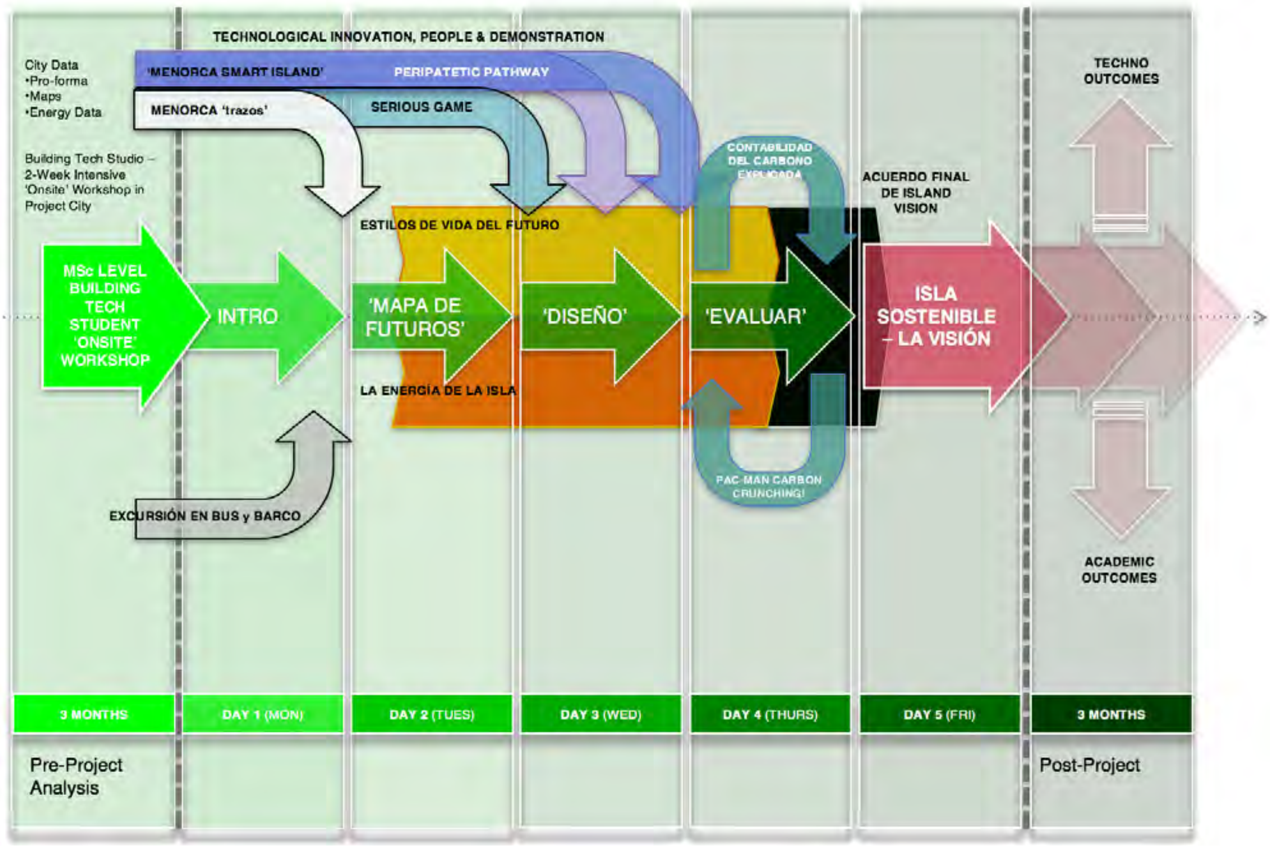


Fig. 2. Menorca Roadshow 5-Day schematic. The outcomes of the MSc Building Technology student 'onsite' workshop (SWAT Studio) being the starting point of the Roadshow 3 months later.

ISLA SOSTENIBLE 'MENORCA' ROADSHOW **LUNES 24 hasta VIERNES 28 ABRIL 2017**

DÍA	Mañana AM / Tarde PM	Hora	ACTIVIDADES	LUGAR / NOTAS
DÍA 1 24/04/17 (LUN) Tema: 'INTRO'	AM	09:00 - 12:00	EXCURSIÓN EN BUS y BARCO (Equipo Roadshow + Invitados)	09:00 – Encuentro en el Institut Menorquí d'Estudis (IME), Camí des Castell, 28. Maó 09:30 – Recogida autobús Snack servido a bordo del barco
		12:00 - 12:30	VUELTA AL IME	
	PM	12:30 - 12:45	¡BIENVENIDA! por Jesús Cardona (Nontropia) & Dr Craig L. Martin (TU Delft)	Lugar: IME
		12:45 - 13:00	ROADSHOW por el Dr. Craig L. Martin, Delft University of Technology (TUD)	
		13:00 - 13:15	ESTILOS DE VIDA DEL FUTURO (Taller 1) por el Prof. Greg Keeffe (QUB)	
		13:15 - 13:30	LA ENERGÍA DE LA ISLA (Taller 2) by Siebe Broesma (TUD)	
		13:30 - 13:45	¿CUESTIONES?	
			COMIDA	
		14:15 - 14:30	TALLER SWAT MAÓ CIUDAD SOSTENIBLE 2017 por el Dr Craig L. Martin (TUD)	Lugar: IME
		14:30 - 16:30	MENORCA 'trazos' Presentaciones de proyectos de sostenibilidad en Menorca (20 minutos por presentación)	
		16:40 - 17:00	Fin del DÍA 1. RESUMEN, APERITIVO Y DEBATE INFORMAL — TODO EL MUNDO BIENVENIDO!	Patio del IME
	PM +	20:00 +	CENA Equipo Roadshow + Invitados	Lugar: CAFÉ MARES Pont des Castell 10-12, Maó
DÍA 2 25/04/17 (MAR) Tema: 'MAPA DE FUTUROS'	AM	09:15 - 09:30	CAFÉ	Lugar: IME
		09:30 - 12:00	'ESTILOS DE VIDA DEL FUTURO' (Taller 1) / 'LA ENERGÍA DE LA ISLA' (Taller 2) PERIODO 1	
			PAUSA	
	PM	12:30 - 14:00	PERIODO 2	Lugar: IME
			PAUSA	
		14:30 - 15:45	PERIODO 3	
			PAUSA	
		16:00 - 16:30	PERIODO 4	
			PAUSA	
		16:40 - 17:00	DÍA 2 'MAPA DE FUTUROS' RESUMEN TALLERES 1 & 2 — TODO EL MUNDO BIENVENIDO!	
	PM +	20:00 +	'DISEÑO BIOCLIMÁTICO' (Col·legi d'Arquitectes) Conferencia del Prof. Greg Keeffe (QUB)	Lugar: Col·legi d'Arquitectes de les Illes Balears, demarcació Menorca. Cós de Gràcia, 38. Maó
DÍA 3 26/04/17 (MIE) Tema: 'DISEÑO'	AM	08:15 - 08:30	CAFÉ	
		08:30 - 12:30	SERIOUS GAME 'Go2Zero' TALLER INTERACTIVO PARA DESCARBONIZAR LA ENERGÍA por Ivo Wenzler (TU Delft/accenture)	Lugar: IME
			PAUSA	
	PM	13:00 - 13:45	'MENORCA SMART ISLAND' Presentación del Departament d'Ocupació i Projecció Econòmica del Consell Insular de Menorca	Lugar: IME
		14:00 - 14:45	COMIDA (PEIXATERIA)	TOUR PERSONAS Y TECNOLOGÍA: 14:00-14:45 COMIDA (Peixateria) 15:00-16:00 TOUR A PIE 16:00-16:30 CONSELL INSULAR (CIM) Visita INSTALACIÓN FOTOVOLTAICA 16:30-17:15 MASTERCLASS (CIM) 17:15-18:00 LLUVIA DE IDEAS (CIM)
		14:00 - 18:00	TOUR PERSONAS Y TECNOLOGÍA Mini-Masterclass 1 'LA CONEXIÓN ENTRE LAS PERSONAS Y LA TECNOLOGÍA' Tour a pie por Maó por el Dr Han Vandevyvere (VITO)	
		16:40 - 17:00	DÍA 3 'DISEÑO' RESUMEN TALLERES 1 & 2 — TODO EL MUNDO BIENVENIDO!	Para interesadas/os que no participen en el Tour Personas y Tecnología
DÍA 4 27/04/17 (JUE) Tema: 'EVALUAR'	AM	09:15 - 09:30	CAFÉ	Lugar: IME
		09:30 - 11:30	CONTABILIDAD DEL CARBONO EXPLICADA Mini-Masterclass 2 por Riccardo Pulselli (University of Sienna)	
			PAUSA	
		11:40 - 12:30		
			PAUSA	
	PM	12:40 - 14:00		Lugar: IME
			PAUSA	
		14:30 - 16:30		
			PAUSA	
		16:40 - 17:00	DÍA 4 'EVALUAR' RESUMEN TALLERES 1 & 2 — TODO EL MUNDO BIENVENIDO!	
DÍA 5 28/04/17 (VIE) Tema: 'VISIÓN'	AM	09:45 - 10:00	CAFÉ	
		10:00 - 10:05 / 10:05 - 10:10	¡BIENVENIDA! Introducción. Instituciones Locales & Jesús Cardona (IME) / Dr Craig L. Martin (TU Delft)	Lugar: CONSELL INSULAR DE MENORCA (CIM) Plaza Biosfera 5, Maó
		10:10 - 11:30	ISLA SOSTENIBLE – LA VISIÓN Presentado por ISLA SOSTENIBLE 'MENORCA' ROADSHOW	Traducción simultánea
		11:00 +	DEBATE FINAL DEL ROADSHOW, APERITIVO Y CLAUSURA	
			FINAL	Menorca IME Contacto: Jesús Cardona (jcardona@nontropia.com) Roadshow Leader: Dr Craig L. Martin (c.l.martin@tudelft.nl)

Fig. 3. Menorca Roadshow 5-Day Timetable.

The following best describes the underlying approach undertaken in Menorca and the project neighbourhood of Mahón. It will include a brief explanation of the 'Sustainable Island Vision' that resulted. City engagement is an exciting and thought-provoking prospect. Many questions arise at the beginning the journey. Making first contact with a prospective project location, conducting preparations, explanations and agreements is far from an exact science. The method of achieving this successfully has evolved city-by-city and is arguably as valuable than the sustainable solutions that are produced at the end. There can be many political, cultural and language obstacles to overcome. The outcomes must have the power to inspire and potentially be realised post-project scope. The first questions are who is 'the City'? What are the city's sustainable expectations, aspirations and current agenda, if they indeed have one at all? What is the current and future calculated energy demand? Where are the urban challenges, are they purely energetic, spatial & social, administrative or a combination of all? Does the 'City' even realize or accept they have challenges, despite its desire to be sustainable?

To answer these questions and many others, the project team began the process of identifying the cities that need and want our collaboration. First contact begins with an educational architecture workshop studio (Known as the SWAT Studio), which occurs in the months leading up to the project. This student-focussed workshop facilitates an extended and detail discussion with city stakeholders. The event model lasts for 5 days and is based on 'themes' that guides the evolution of the vision in which expert input would be delivered at key points throughout. Each event is constructed to relate to individual citizen experiences and knowledge, this giving them confidence in the processes that are them extended later to relate to their street, neighbourhood, district, city and island. The project is not intended to be a one-way stream of information and ideas, instead the process aims to activate, convince, openly invite and encourage 'the City' to be part of the process at any level that they feel comfortable with. The method includes going out of the studio and into the community to engage with various initiatives and to meet and talk with their members no matter what age or background. The project leader selects cities that have diverse climates, urban typologies, economies, cultural backgrounds, this ensures that the project the highly mobile and compact method is fully tested and evolved by different contexts and challenges.

1.1. AIMS

The aim is to develop an event model capable of implementation in all cities to co-create a city's sustainable vision with citizens from all backgrounds. Proposals developed exclusively by the project team, and not by the multidisciplinary city stakeholders, would physically and metaphorically leave with the project, hence a homegrown solution is key. A legacy must remain in which all participatory groups continue to exchange knowledge and speak with a common voice, making any future research bids, beyond the scope of the project more coherent and effective. The project wishes to extend its agenda by strengthening connections and bringing together a global family of project cities, where experiences can be shared together with collaborative research bid proposals across the wider community of Europe.

The most important target group are inhabitants of the neighbourhood, city and wider hinterland of the hosting city. Companies and start-ups in the field of technology and sustainability are encouraged to be active participants during the project. A key objective is to reach 600 students across the EU by visiting local universities, colleges and secondary schools. Students are the future. It has been mutually beneficial idea to combine the energy and enthusiasm of architecture, urban planning and building technology 'SWAT Studio' Master's students with that of the stakeholders and students of each hosting city. The student projects, and more significantly the close relationships that were forged whilst conducting them, lay the foundation on which later to build the later intensive 5-Day project. Promotion, full participation and dissemination contribute significantly to overall success, as a consequence the project and student workshop leader encourages any and all interested groups such as municipalities, neighbourhood associations and universities to grasp the opportunity to do so. Taking the time to discuss what is expected and allay any reservations or doubts they may have. It is not the intention of the event to criticize a cities perceived lack of sustainability, project team specialists are aware of many complex global and local level obstacles toward the energy transition.

Fig. 4. The Menorca 'SWAT Studio'. A MSc's Building Technology 'Onsite' studio (TU Delft, The Netherlands), an educational precursory event that took place 2 months prior to the start of the Menorca Roadshow. During the SWAT Studio the aims and objectives of the Menorca Roadshow would be disseminated on various island media streams. The Mayor of Mahón, Conchi Carreras Pons, came to see the student work and to give feedback. Dr Craig Lee Martin (TU Delft) and Jesús Cardona (IME & Nontropia, Menorca), co-leaders of both the SWAT and Roadshow in Menorca promoted the later Roadshow on local radio, tv and through various sustainability presentations given across the island. An IB3TV (TV Channel for the Balearic Islands) came to film the SWAT Studio. To see the subsequent programme see the link: http://ib3tv.com/20170228_257620-reduir-les-emissions-de-co2-objectiu-del-programa-city-zen-roadshow-de-la-ue.html.

1.2. Objectives

1.2.1 Student Engagement

A Masters level Building Technology student workshop (known as the SWAT Studio), with identical project aims, develop and propose innovative, sustainable, contextually sensitive urban design interventions. A key ambition of the workshop being to demonstrate that, through building interventions at all scales ranging from façade, building, street, neighbourhood and district, that sustainable lifestyles are possible within existing cities. This student-orientated programme is a precursory educational event to the later specialist project. In Mahón at the hosting venue of the Institut Menorquí d'Estudis the studio leader (Dr Craig Lee Martin) and student's forged pre-project relationships with key city stakeholders, allowing project sites to be evaluated and selected. The outputs of each sustainable workshop would be presented on the first onsite day of the project, the workshop making positive connections with academic and municipality leaders and sustainable energy and smart city entrepreneurs.

1.2.2 Process

In Menorca the process began with a collaborative Masters level Building Technology and architecture student workshop 2/3 months prior to the project start. Both the workshop and the project were developed to be intensive by optimizing time, simplifying communication & explanation, and maximising participation. Components (lectures, site excursions, design workshops and mini-masterclasses) within the 5-Day period were strategically timed and citizen focussed at key points to push forward sustainable propositions and to later to evaluate and expand. The outputs, synchronised with specific project team specialisms in energy and urban design, were qualitatively spatial and quantitatively energy focused, and combined to form sustainable City & Island Vision on the final day of the Roadshow.

1.2.3 Daily Activities

In Mahón, daily activities would involve citizens, architects, municipality staff, PhD students, academics and energy consultant's visiting the projects studio base at the Institut Menorquí d'Estudis, a venue donated by the institute and observatory. The 5-Day programme was devised in such a way to encourage participants to 'drop-in' and 'drop-out' so that the project workshop activities and Mini-masterclasses could fit into their professional and family schedules, a strategy that would increase city involvement. PechaKucha style presentations (PechaKucha meaning 'chit-chat' in Japanese, is a format that keeps presentations concise and fast-paced, facilitating multiple-speaker events) informed the participants of what to expect. Menorca's stakeholders also contributed on the day with presentations that outline past, present and future aspirations for their city. Presentations by David Carreras Martí (Director of the OBSAM) and Jesús Cardona (Nontropia & Local Roadshow coordinator/Leader) began the session with critical input that helped identify the environmental context, this would continue for all later project cities.

The project method aims to foster an intensive working environment, yet one, which allows adequate flexibility to ensure maximum participation of stakeholders. It must be respected and appreciated that all stakeholders are likely to have full time jobs and a family life beyond any project, they are not financially supported to attend. Therefore it is one of the roles of the project leader to strike a balance during discussions between conveying the urgency of being part of the process but not to an extent that it distances prospective attendees. Whilst the student workshop is underway on location many preparations and negotiations take place with stakeholders, here various visual descriptors are used to communicate of what is expected during the project.

Photographs of co-creative and intensive scenarios from previous projects in Belfast, Izmir and Dubrovnik are incredibly effective in translating what is to come. Coloured marker pens, rolls of tracing paper, laptops and notebooks are the tools of choice for the project participants. Activities have the same aim, energy neutrality, however each component is enjoyably diverse and offers new perspectives and skills on how to attain it. Whilst two parallel workshops run continually over the week participants sign up to play a Serious Game entitled 'Go2Zero'. Menorca's stakeholders had the chance to 'Role' play, they had playful fun whilst experiencing the cause and effect of energy strategy decisions made at the regional, neighbourhood and family household level.

1.3. ROADSHOW AT A GLANCE

The following points list 18 keywords that best describe the story and ambitions of the City-zen Roadshow:

1. **ZERO ENERGY** Aims to develop and demonstrate Zero Energy Cities with a central role for citizens.
2. **MOTIVATE & EMPOWER** End-users to a long-term energy saving attitude.
3. **CITIZENS** Placed in the heart of a creative process that develops designs, strategies, guidelines and timelines at all scales of their own cities built environment.
4. **NUMBERS** 4 Cities completed - 3 months prep / city - 5 days onsite / city - All Citizens - 7 International sustainability experts - 6 Cities next.
5. **IMPACT** Healthy lifestyles, environmental comfort, building efficiency, independence from fossil fuel uncertainty. But most of all confidence that sustainability is for all who want it.
6. **TRUST** Citizen's need belief in the process, objectives and solutions, no matter how radical or unfamiliar. Students open the door!
7. **OWNERSHIP** Citizen's take ownership of their built environment without fear of hidden agendas, affiliations or political constraint.
8. **HOMEGROWN** The solutions stay with the people.
9. **WHO IS THE CITY?** Doesn't matter where the ideas come from, as long as they come and begin to be realized.
10. **DISRUPT** Project rocks the status quo to reach zero energy.
11. **GLOCAL** Specialist global expertise combined with local stakeholder energy and knowledge of context and lifestyle.
12. **GRAPHICAL** Use graphical descriptions to get your messages across.
13. **SACRIFICE?** Its not about losing, its about what you gain. Replacing it with something better for your children and community.
14. **TIMETABLE TO SUIT** Schedule to fit stakeholders, not the other way round. Remember, stakeholders are not on the payroll, they have other daily priorities.
15. **INDIVIDUAL PERSPECTIVE** Make sure activities relate to the people and their experiences. These can be expanded later to other scales.
16. **COMPARISONS** To design what is possible is one thing, to show what has been realized or what can occur under the right circumstances is even better.
17. **HIGHLY VISUAL** Outcomes to be colourful representations of the future, before/after scenarios.
18. **BE INSPIRATIONAL** Encourage 'City Vision' participants to take the lead in the next step!

CHAPTER 2 – ROADSHOW COMPONENTS

As an example of how the project approaches each city, the following describes the journey and activities undertaken in Menorca and its capital of Mahón:

2.1. FUTURE NEIGHBOURHOODS (WORKSHOP 1 – DAY 1 TO 5)

Two parallel workshops continue throughout the project week, on arrival stakeholders are guided to select one workshop depending on their interests or specialisms, however migration to each is recommended in order to get a full overview of energy and urban strategies and their implementation. At the end of each day the workshops meet to summarise their findings and to agree on that evenings and the following day objectives.

2.1.1 Background

The aim of 'Future Neighbourhoods' is to inspire people to imagine a more sustainable future, one that embraces the best of new technology in a way that is life enhancing. The workshop encourages freethinking and open-ended discussions about how things should be. It asks stakeholders to imagine new life-styles and then to develop strategies to achieve them. In Mahón (Menorca) the workshop began with an envisioning session about the future, and quickly moved onto designing the infrastructure necessary to achieve these visions. Once the infrastructure was developed a phased strategy would be proposed to achieve these goals. The design element has clear objectives in that it aims to kick-start carbon descent through the development of a series of options for the neighbourhood. The scope was holistic and arguably over challenging for a typical consultancy team to resolve, however this along with all elements of the project offers a service that is currently unmatched.

Zero energy neighbourhoods are places where people live and dwell, it is important to remember this, as it is the actions of people that use energy, thus the environment created not only is a conglomeration of technologies, but also a landscape that encourages behaviours. Behaviour change is crucial for carbon descent and the new neighbourhoods we create will create lifestyles that are sustainable, healthy and happy. It is also important to see the neighbourhood as part of a nested series of environments, each sitting within another, with others within, in turn.

2.1.2 Aim & Objectives

The aim of the Menorca project workshop specifically was to develop strategies at a range of scales that allow a process-based adaptation of the city to carbon neutrality. The scales utilised were: the city, the neighbourhood, and the building. The city scale is important because city form is the basis for the behaviours engendered in the city. Here urban grain can encourage or discourage car usage, can allow safe routes for schoolchildren, and connect the inner city with the countryside. The neighbourhood scale allows us to visualise the commons i.e. the things we share. This may be things such as smart grids, or other networks, but may also be spaces for meeting, playing or growing. Energy storage is most cost-effective at this scale too, as is car share. In addition, density is one of the key factors in making neighbourhoods function, and many behaviours are linked to this such as car usage, local economy etc… The house or building scale is crucial, because here we see many of the technologies for neutrality being employed. Technologies such as PV cells, heat-pumps, shading devices, DHW production all have been developed to work at this scale.

2.1.3 Methodology

The workshop starts with an understanding of city form, historic and future growth, urban grain, climate, eco-system services and density. From these initial studies, an understanding of the city as a holistic super-organism is developed. This bio-climatic understanding allows new insights into current trajectories. Urban design is based on understanding urban trajectories and deflecting or manipulating them, to create new futures in a seamless way. Once a sustainable urban design strategy for the city is developed, we change to the neighbourhood and building scales to look at the issues this strategy creates at the smaller scales. More detail can be developed here, and the solutions become more technological. We then visualise the impact these technological insertions have on the built environment and the lifestyles of the residents.

2.1.4 Experiences & Insights

The City -
Mahon is a historic city. Originally a fortress on the largest natural harbour in the Mediterranean, it has grown up as a series of rings, each developed sequentially. The inner core of the city consists of very narrow streets, which offer good shade in summertime, but have traffic issues. Most streets have been made one way, with very narrow pavements. Car parking is very limited. The middle area of the city, where our neighbourhood resides is surrounded by a ring-strasse that separates the city from its hinterland. The ring road is semi-motorway, with no pedestrian or cycle ways and as such severs the city from the countryside. Since this has been developed more new neighbourhoods and industrial and commercial areas have grown up all around the city in ad-hoc way, further isolating the city from its countryside.

Mobilities -
Car usage is high, but it is not easy to park in the inner ring. People are used to leaving their cars some distance from their house and walking. Many cars are used for very short journeys, as there is little public transport within the city. It mostly services the surrounding villages.

Neighbourhood -
The neighbourhood chosen is of quite high density, consisting of a series of parallel streets of apartment blocks typically 5-6 storeys high, developed in the 1990s. The street space between the blocks has become mainly a car park and there is no people space outside the blocks. This has meant a loss of community, as in the past it was the practice for Menorcans to sit in the street in the evening and talk. This needs remedy. Children too are disenfranchised, having nowhere safe to play, and no easy route to school or green space. There is little in the way of recycling in the neighbourhood.

Buildings -
Developed as private housing in the 1990s, the apartment blocks are rather basic from an energy point of view: there is no insulation, no external solar shading; the secondary roof, or

green roof systems. Technologically the buildings are poor too, there are no renewable systems employed.

2.1.5 Outcomes

The City -
The workshop developed a new strategy plan for the city, which reconnected it to its hinterland, yet still allowed development. This created:

- Re-connection with greenspace.
- Electric bike infrastructure – de-carred space.
- A more people-centred approach to the city.

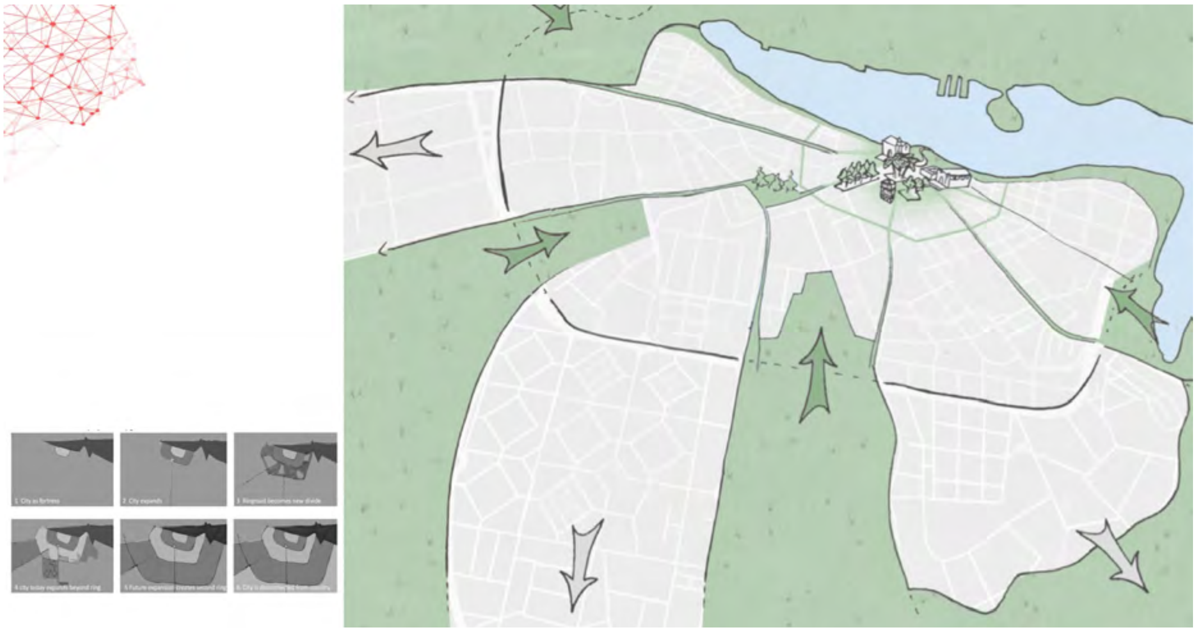


Fig. 5. Menorca project proposition to reconnect Mahón to its hinterland.

The Neighbourhood -
The neighbourhood was re-envisaged as a place for people, where people could share space once owned by the car, the area now offering shade and production in terms of food and energy. The neighbourhood promotes sustainable behaviour and contributes with energy storage, through a reimagining of the public space.

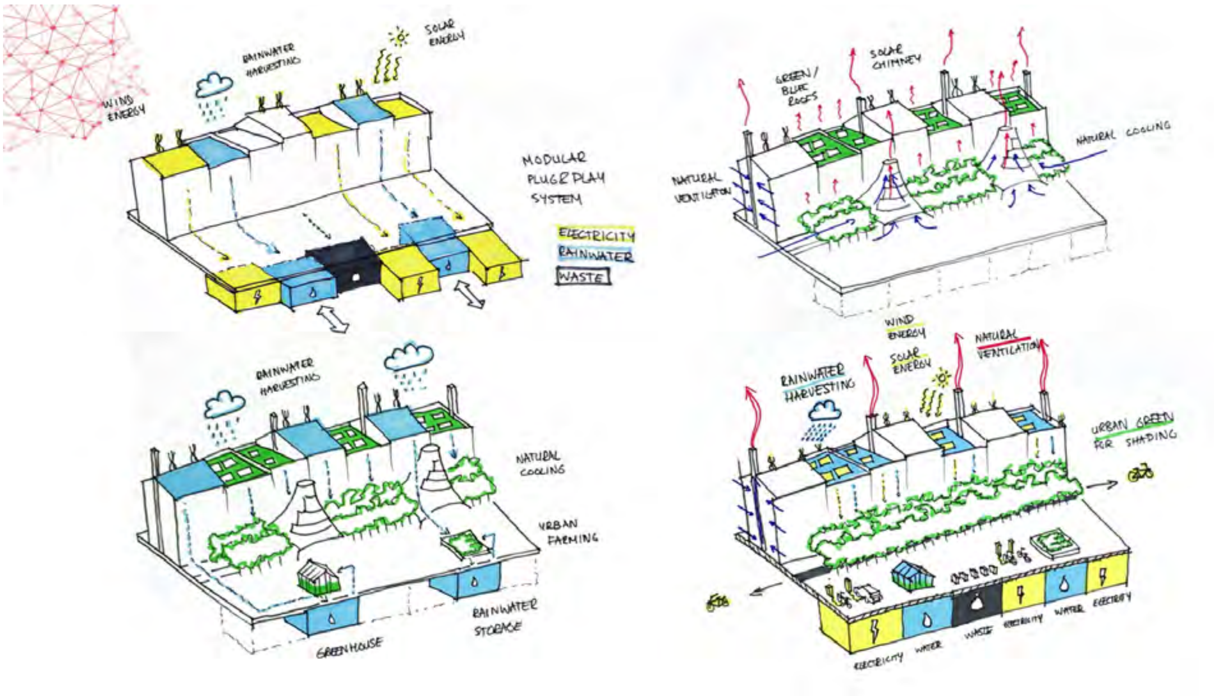


Fig. 6. Intervention of shade, energy + food production, water collection and waste recycling. (All drawings were completed by student workshop 'Facilitators', previously from the MSc Architecture and Building Technology Studio in Menorca).

Building Scale -
A Multi-layered strategy that reduces heat loss and heat gain (in summer) through insulation and shading. Secondly, used renewables to heat and cool the building and produce domestic hot water. Thirdly, developed an energy storage system for heat/coolth and electricity.

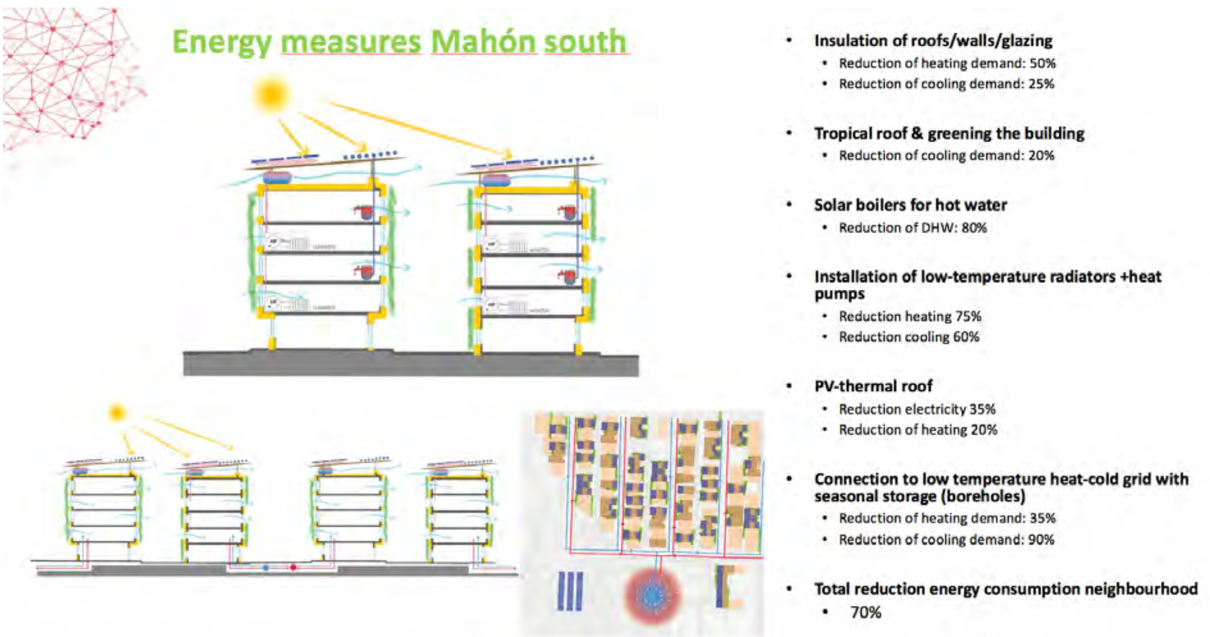


Fig 7. Energy measures at building, street and neighbourhood scale.

Mobilities -

The workshop suggested e-car and e-bike rapid transition over ten years. This is achievable and should be started immediately under the presented timescale. This mobility change, tied with infrastructural change to the narrow streets in the inner city will have a profound effect. The new slow city will be a magnet for tourists and locals alike.

Fig 8. Proposed productive and citizen centred streetscapes. Before and after graphical descriptions demonstrate the many benefits of decarring the urban environment.

Menorca itself is in a great place to make large-scale change. The time-based process for car replacement was a very clear strategy, and we will endeavour to produce this additive methodology to each technological step we develop.

2.2. ENERGY ISLAND (WORKSHOP 2 – DAYS 1 TO 5)

As with previous project cities the aim of 'Energy Island' was to make an Energy Master Plan. For the neighbourhood in Mahón (Menorca) the first steps would be to identify existing and implementable sustainable interventions together with the actions that would lead to a zero energy neighbourhood. The objectives were to map the areas energy demand and potentials. This also involved a social, political, economic and climatical analyse of the region.

The Energy Island workshop represents the energetic-technical part of the energy transition during the Menorca project. To achieve this various methodological steps are taken:

- Step 1: Energy Analysis (Mapping the technical geographical present)
- Step 2: Present planning and trend (Mapping the near future for energy plans)
- Step 3: Society & stakeholder analysis (Mapping the political-legal-social-economic climate)
- Step 4: Scenario for the future (Mapping external influencing variables)
- Step 5: Energy vision with targets and guiding principles
- Step 6: Roadmap with energy interventions and actions

At Menorca the project for the first time was able to not only address a specific neighbourhood (Mahón's south-western neighbourhood), but also the whole island. Of course an energy transition of a neighbourhood is always intertwined with its surrounding city and region. The energy system of an island has very clear borders and with relevant data on primary energy coming into the area and the final use of it (for different functions), the real energy demand of the entire island was be determined. The goal was to define in a first step the real demand in terms of heat, cold, electricity, energy for transport and processes for the residential, non-residential, industrial functions and for transport. And in the next step the sustainable potentials of the island.

Total current energy demand (GWh)						
SECTOR	electricity (appl)	cooling	heating	DHW	cooking	fuel
RESIDENTIAL	119	50	77	33	19	
SERVICES	105	84	38	46	14	
INDUSTRIAL + AGRIC	32			31		
VEHICLES LAND						516
BOATS						214
AIRPLAINES						231
TOTAL (GWh)	256	134	114	110	33	961

Energy efficiency measures for Menorca (GWh)						
ENERGY MEASURE	electricity (appl)	cooling	heating	DHW	cooking	fuel
electricity reduction for appliances (-25%)	64					
modal shift (more public transport and bikes)						258
switch to 50% electric cars/busses/trucks	-43					129
switch to 50% electric bikes	-1,29					129
building retrofit measures ave. 43% red		57	49			
switch to electric boats 100%	-71,3					214
heat pump for heating (COP 4)	-13,8		55			
heat pumps for DHW (COP 2)	-10,5			21		
electric cooking (80%)	-26				26	
heat pump systems for cooling (COP 5)	-15,2	76				
remaining energy demand	373	0	10	89	7	231

Energy PRODUCTION measures for Menorca (GWh)						
ENERGY MEASURE	electricity (appl)	cooling	heating	DHW	cooking	fuel
Wind turbines Mahon (replace 4) (7x3MW)	50					
Wind turbines Ciutadella (7x3MW)	50					
PV-roof canopy 30 km (amorpheus, 15m)	67					
solar boilers 75% of DHW				82		
CHP on biomass for heating city centres + el.	10		10	6		
biogas from foodwaste					7	
PV on roofs (20% all roofs)	120					
10 3MW windturbines	76					
total energy balance with measures	0	0	0	0	0	231

Fig 9. An example of fully configured energy demand and future renewable energy potentials (At all scales). The data interpreted into valuable information leading to design interventions at all city scales in the final sustainable Island Vision.

Crucial information regarding the energy potentials were calculated and collected during the first workshop day, together with the stakeholders. Not only the quantitative information on the potentials but also possible barriers and solutions to how to implement them. Of great relevance to Menorca is that the island is a biosphere reserve, implying that large scale solar power plants and wind parks will not always be possible in certain locations. Based on the maps of suitable locations for wind turbines the maximum amount of 3MW wind turbines was determined to be 71. With a production of around 7,5 GWh per turbine for Menorca region, 60 of those turbines would be able to fulfil the current demand for electricity. From the information obtained during the workshop regarding near future energy plans (step 2), of major importance and concern were the current plans to build a gas network, fed with LNG and imported by sea. Corresponding to the wind potential, it was identified that a solar power plant of an area of around 5 km^2 (60 times the already existent solar parks) would provide the current electricity demand.

With the available information, new energy balances based on sustainable sources and measures of energy reduction were also determined for the entire island. The goal is to define a vision (step 5) with an effective combination of measures that could lead to an energy self-sufficient Menorca (or better: energy neutral since large scale storage was not addressed). During the second workshop day, the combined measures of energy efficiency and energy production that should lead to this were discussed. Further measures provide a large total reduction of demand and because of the shift to electric mobility and use of heat pumps, a large remaining demand of electricity, more easily produced by renewables, remains.

In the final vision various tables showed the energy production measures that provide an energy neutral status for Menorca, although the fuel needed for air traffic was not within the scope of the study as at present air transport has no real alternative sustainable and renewable energy sources available to it. For the electricity production a 50%-50% ratio of solar and wind is taken as guideline, providing the annual most stable production and with that the least demand for electricity storage. Furthermore, the available biomass is used for heating city centres (where energy efficiency measures may be less desirable) and solar collectors largely meet domestic hot water demand. For electricity production by photovoltaic systems, an energy spine or PV-canopy entitled the *‘Espina Energeticá’* was proposed, covering 30 km’s of main road. This way only space already set aside for infrastructure is used. Additional smart measures were integrated with the array such as an electric trolley bus and water collection system.

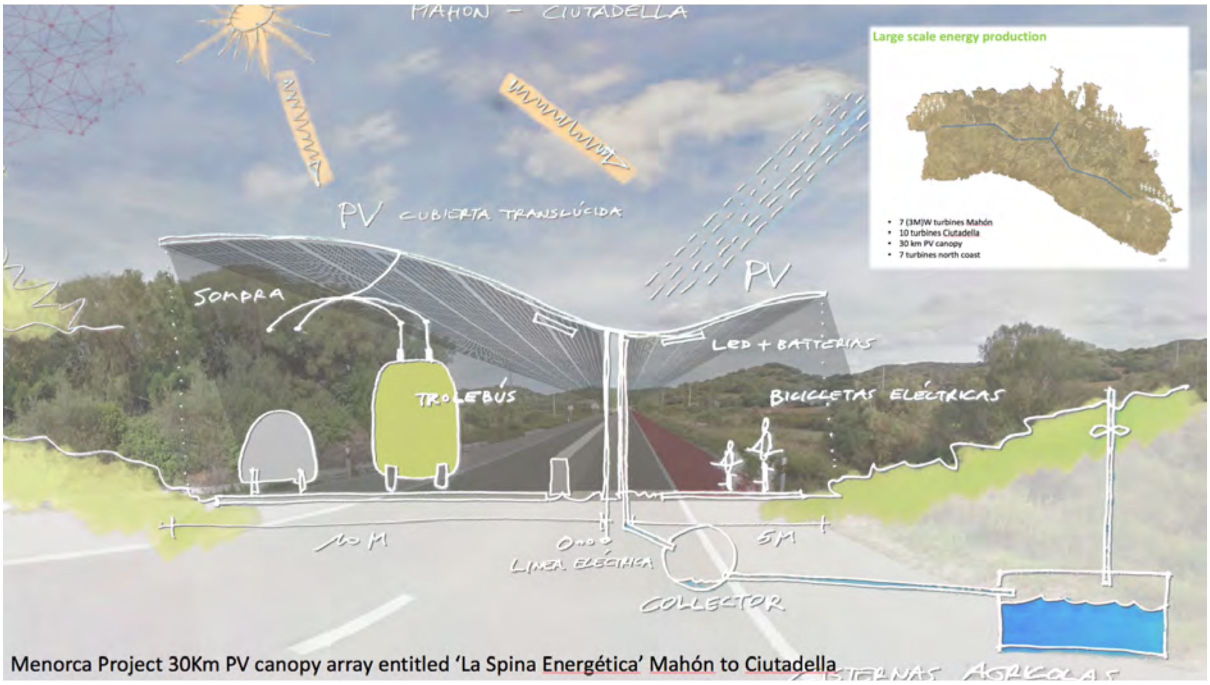


Fig 10. Project design proposal for the ‘Espina Energeticá’, a productive energy and water-gathering canopy shading 30 km’s of main road of the Island. PV farms are already present on the island, however with plans for expansion are under scrutiny due to opposition from various conservation and ecologist groups, this proposal not only negates the need to building on greenfield sites (built on the existing infrastructure) offers renewable energy and alternative mode of renewably powered transportation (Trolebús).

7 consecutive steps were proposed to decarbonize the neighbourhood. This can be seen as a ‘roadmap’ for the area. Although not necessarily everything has to be solved locally, the assignment shows how far the city can get in such a dense area. The neighbourhood itself consists of around 1100 apartments, 16 apartments per building block and around 80 m2 per apartment. The schemes presented illustrated the total energy consumption per block of 16 apartments and what the total remaining energy demand and CO2-emissions are after each step. Specific measures are listed below together with the relative reductions per type of energy:

1. Status quo: The blocks are poorly insulated and naturally ventilated. 6300 kWh of electricity is used per apartment (household) and 2150 kWh of primary energy from a mix of butane, petroleum and biomass (the mix as used for an average Menorca household).

Next steps, taking the new stepped strategy of firstly reducing the demand, next exchanging waste heat if possible and finally producing as much as possible locally sustainably, are consecutively proposed.

2. Insulation of roofs, walls and double glazing
   a. Reduction of heating demand: 50%
   b. Reduction of cooling demand: 25%

3. Tropical roof & greening-up of the building
   a. Reduction of cooling demand: 20%

4. Solar boilers for hot water
   a. Reduction of domestic hot water: 80%

5. Installation of low-temperature radiators and heat pumps (with C.O.P for heating = 4 and cooling = 2,5)
   a. Reduction heating 75%
   b. Reduction cooling 60%

6. PV-thermal roof
   a. Reduction electricity 35%
   b. Reduction of heating 20%

7. Connection to low temperature heat-cold grid with seasonal storage (boreholes)
   a. Reduction of heating demand: 35%
   b. Reduction of cooling demand: 90%

8. Flexible PV canopy
   a. Reduction electricity demand: 49%

Finally, a total carbon reduction of 70% can be met locally with these measures combined. The remaining reduction must come from renewably produced electricity on the island.

2.3. SERIOUS GAME 'GO2ZERO' (WORKSHOP 3 – MORNING)

In Menorca, the serious game session took place in the cellar of an institute belonging to the local government. Around 15 people took part in the session simultaneously, with some stepping out earlier and being replaced by others. The group was relatively diverse in prior knowledge. As the level of proficiency in English also varied strongly within the group, the presence of a translator was a useful interactive addition. The game session itself took about 3.5 hours, and lasted until the following activities were about to begin.

The goal of the interactive game session is to not only allow citizens to get involved by also those in government and the energy sector to experience their role within a local energy transition. However, the objective of the game is to reduce the amount of CO2 consumed within a residential area. The participants will have to balance this overall objective with achieving their own individual goals. It present's them with realistic obstacles based on realistic limitations and constraints, and the challenges to make decisions and try to overcome obstacles through cooperation with other stakeholders. Through playing the game, the participants will:

- Create insight in the energy demand of residential buildings
- Create insight in a variety of state-of-the-art technologies
- Get to know the roles of key stakeholders in the transition process
- Get to know how to individually reach the role-related, individual objectives
- Recognize and understand the actions of other stakeholders
- Learn how their actions influence other stakeholders
- Learn how to work together to reach collective and individual objectives

The methodology is a tabletop role-playing game, where the participants take on different roles within the energy supply chain. The game revolves around the electricity and heat consumption in a residential area, as well as the CO2 emissions resulting from the consumption. The area is represented through a game board representing the different residences and the network connecting them. Different coloured chips on the board represent consumption and emissions. The following roles are taken within the game:

- Consumers
- Housing corporation
- Technology companies
- Local energy company
- Network operator
- Municipality

Fig 11. Menorca's citizens getting into the game and having 'energetic' role-playing fun whilst learning the implications of energy choices at the large commercial and domestic level.

Each of these groups of stakeholders has their own set of goals to achieve, and means through which these can be achieved. These range from ensuring grid stability to increasing revenues. Participants are challenged to formulate a strategy beforehand, which will influence their decision-making process throughout the game.

The game takes place in a number of rounds. At the start of the round, all financial transactions are handled: everyone pays for their taxes, energy bill and a contribution to the network operator. Afterward, the negotiation phase starts. In this phase, the different stakeholders engage in discussions and make decisions to achieve their own objectives. Consumers and the housing corporation can buy more sustainable technologies to upgrade their houses, or move from grey to green energy contracts. The municipality can decide to increase taxes and give out subsidies. The local energy company can buy large scale renewables in order to avoid having to buy green energy elsewhere for their green energy contracts, etc.

After the negotiation phase is done, the decisions taken by the stakeholders are presented and the results are calculated. Any reductions in electricity or heat use, and the resulting CO_2 reductions, are visualized by removing chips from the game board. In the game, a total of six playable rounds are possible. After each round, new technologies are introduced to represent development. As a result of the round system, players will be confronted with the effect of their decisions and strategies on both the short and long term.

During the game the participants were very enthusiastic and motivated. They appeared to struggle with the complexity at the start – which was the intention. The knowledge of renewable energy technologies also appeared to be relatively low. However, as the game progressed, the participants began to get a better grasp of the possibilities they were offered and the impacts of their decisions. This increased the level of coordination, and the rate at which progress was being made. The participants started out by focusing on small changes that impacted individual households, such as energy saving appliances and solar panels. Their choices mainly revolved around reducing electricity consumption based on technologies they were familiar with. Later in the game, they got a better grasp of the CO_2 emission reduction that large-scale technologies or heat-reducing technologies could achieve. This resulted in a shift of focus, fuelled by the participants playing the municipality introducing effective subsidies that were funded by taxing the more unsustainable households. At this point the participants started encountering the physical limits of the grid, which forced them to work together with the grid operators who had remained relatively uninvolved up until that point. While the choices that were made at that stage were not ideal, all participants seemed to have a good grasp of the relationships and dependencies within the entire ecosystem.

Although the time for debriefing was compact and intensive, the participants were extremely into the game The goals set out for the game with regard to informing and teaching participants was achieved. For future sessions, the game could do with minor ‘bug fixes’. There are small errors in some of the material used (conflicting figures, unclear instructions), and the game could do with more flexibility and depth. If developed further, adding more technologies and tailoring the game to the location at which it is played would be beneficial. It could resonate even more with the participants, and give them a handle on the effects of implementing technologies that are a realistic option in their specific environment.

2.4. ‘PERIPATETIC PATHWAYS’ PEOPLE & TECHOLOGY (MINI-MASTERCLASS 1 DAY 3 – AFTERNOON)

2.4.1 Background

The ‘Peripatetic Pathways’ component and associated masterclass are intended at involving local stakeholders in a deep-diving reflection on both technological and non-technological aspects of the transition to a 100% renewable (energy) system. The methodological background of this exercise is rooted in transition theory, however with a strong eye on the opportunities and challenges that come with technological development.

The initial concept of the masterclass was an open seminar. This format has been used in Belfast, Izmir and Dubrovnik. It was however felt that the format could be made more interactive and effective, both in terms of involving local stakeholders and investigating the project area. Therefore a walking tour through the project area and its thematically relevant surroundings was added to the event. This new approach has been tested during the Menorca project. For reasons of accessibility to local stakeholders, the languages of the tour were Spanish with English as a backup, while the presentation was translated in Spanish. Obviously such linguistic facilitation depends on the available capacities, but in this case an address in the local language could thus be foreseen, lowering the participation barrier.

2.4.2 Experiences & Outcomes

The tour was prepared in close cooperation with a local architect with a passion for climate design and whose been working on sustainability scenarios for the island for over a decade. During preparations the existing energy system was reviewed and an itinerary was worked out in order to maximize the number of interesting locations within the scope of an afternoon’s walk. Discussion themes and points of interaction were identified, such as possibilities for passive climate design, lessons to be learned from historic construction methods, different urban forms with their qualities and challenges, opportunities for building retrofit and renewable energy production, mobility issue and urban living quality.

The group of peripatetic participants consisted of highly skilled and motivated urban actors, young architects and local energy experts. Opportunities were discussed. Menorca has sufficient potential to become energy-independent, but its status as a UNESCO biosphere reserve requires a special approach that reconciles renewable energy production with landscape and nature conservation. A limited heating demand as well as a limited cooling demand in buildings make a perfect case for passive design measures and feasible urban retrofit options towards zero carbon functioning. Many options are available for combining a high urban living quality with sustainable functioning. Higher-level barriers such as the Spanish legislation on PV that strongly discourages investments in the source, the subsidizing of fossil fuels or the natural gas network that is being rolled out on the island by a private company, were extensively debated during the walking investigation. One conclusion on-route is that Menorca would hugely benefit from a living lab status where contra- productive rules are released for the benefit of a 100% renewable energy experiment.

Fig 12. Peripatetic Pathway, A new addition to the project introduced in Menorca. Inspired by the Peripatetic School of philosophy in Ancient Greece developed by Aristotle during his time at the Lyceum. Aristotle observed that educational and intellectual discussions were to be creatively enhanced whilst walking under the shaded colonnades. In Menorca this would be interpreted into a strategically planned route around the urban fabric of Mahón, stopping off at both non-renewable points of discussions and renewable initiatives along the way. Conclusions being fed into the design proposals back at the studio base.

Energy transition efforts need to come in a framework of integrated sustainable urban development. As such, mobility, urban living quality, green in the city and water management were equally discussed. Here again reference was made to historic assets such as irrigation systems and the Arab system of water cisterns that are dispersed across the island. The discussion format extended in such a way that there was no more sufficient time and incentive to hold the masterclass presentation at the end of the afternoon. The presentation was however made available for later consultation by all interested parties. The success of this new 'Peripatetic' approach to the component reiterated the need for the project method to cater directly to individuals and their experiences, not only in the onsite content discussion but also logistically, in how it must continue to timetabled to suit daily lifestyle patterns and cultures.

2.5. ‘PAC-MAN, CARBON CRUNCHING’ – CARBON ACCOUNTING EXPLAINED (MINI-MASTERCLASS 2, DAY 4 – MORNING)

As mentioned previously the project methodology identifies site-specific challenges and sustainable objectives and solutions. As a supporting tool for addressing choices, carbon accounting has been identified within the project format as a driving force, especially when dealing with energy retrofitting of neighbourhoods and other integrated measures. The pathway towards zero energy (totally renewable energy supply) and carbon neutrality starts with Carbon Footprint (CF) assessment as the first step. In particular, during the project, the assessment method is expected to quickly deliver a response, often approximate, but reliable, within the timing of 5-Day event model, a speedy diagnosis being especially vital considering the short-term deadlines of the contemporary age.

In the Menorca case, a simplified CF assessment model was developed from the scale of the island to that of the single household and individual living in Mahón. Results show that the CF of Menorca corresponds to 695,000 t CO_2eq, depending on the greenhouse gas generated by energy use in residential & services, industrial and agricultural sectors (56%), mobility (36%; including maritime and air transport i.e. 17%), waste production and management (7%) and water management (1%). Moreover, the estimate of the carbon uptake by local ecosystems in the island (591,000 t CO_2eq), taking into account different land uses, clearly demonstrates that Menorca is not far from being carbon neutral, thanks in part to a low population density (92,000 inhabitants as a yearly average considering residents and seasonal tourists).

Slides presented during the final day graphically and amusingly represented the Carbon Footprint in the form of forest land that would be needed to absorb an equivalent amount of CO_2 i.e. about 51,500 ha forestland to absorb 695,000 t CO_2eq (avg 1.35 kg CO_2/yr per m^2). Colours showed the contribution of energy use (blue), mobility (purple), waste management (brown) and water management (cyan) and the corresponding area of forestland. Images also showed the Carbon Uptake in Menorca (591,000 t CO_2), also given in area of equivalent forestland (almost 44,000 ha). This result’s coming from the assessment of carbon uptake by woods (20,300 ha) natural area (12,300 ha), pasture (4,500 ha), agriculture (26,800 ha) and wetlands (260 ha) in the whole island. The Carbon Footprint offset in Menorca indicated that local ecosystems can compensate or uptake 85% of the Carbon Footprint.

This significant and exciting finding, even if theoretical suggests the very next step that:
Menorca could potentially be the first carbon neutral island in the Mediterranean.

Nevertheless, a detailed analysis of energy infrastructures (only 3% renewable energy; most of waste is undifferentiated and sent to landfill) and lifestyle of citizens (mobility based on private vehicles) shows that the CF of a single household is 9.4 t CO_2eq, much higher than the average European value (5.6 t CO_2eq). In other words, every family in Menorca would need 0.7 ha of forestland to absorb an equivalent amount of CO_2 and fully compensate its impact. Furthermore, starting from the profile of the household unit, a specific focus on a common neighbourhood in Mahón (3000 inhabitants in 4-5 floors building blocks) showed that the impact of 1100 households is estimated to be more than 10,000 t CO_2eq.

This result looks really unfair, especially considering the high potentiality of the island to implement RES based technologies, and represents the challenge to be faced in the future. The project team provided a first “quick and dirty” scenario to combine potential measures of CF mitigation from the scale of a single household (starting from the citizen behaviour) to that of the neighbourhood and the whole island. In particular, the set of strategic design measures designed by the project team show how the Carbon Footprint of the island can be progressively cut and brought to zero.

These carbon facts, calculations, approximations and equivalences are of course complex and at times seemingly impenetrable, even to specialists who work with them on a daily basis. However, the project takes great care in ensuring that the carbon story is interactively told in first principles and tuned to each participating citizens perspective and carbon usage.

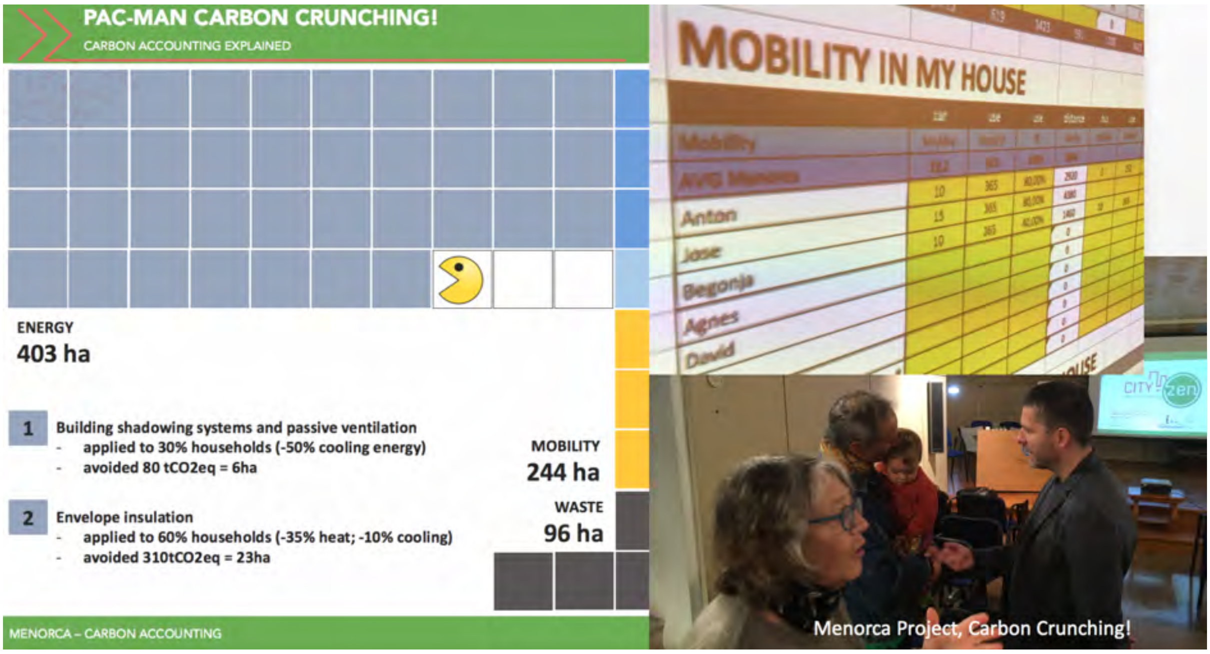


Fig 13. In 'Pac-man, Carbon Crunching!' formal maths and formulae are creatively re-imagined and personally orientated into informally animated visual fun that is easily comparable and understood. Indeed, 'Pac-Man' is a member of the project team too, devouring and crunching the carbon whilst graphically communicating what technological interventions are needed to help him do it.

CHAPTER 3 – SUSTAINABLE ISLAND VISION

3.1. FINAL DAY (CONSELL INSULAR DE MENORCA)

The final day of the Menorca Roadshow took place in Consell Insular de Menorca on the 28th April 2017. The final ‘Sustainable Island Vision’ was presented to an audience comprising Mahón’s Municipality leader’s, the islands Ecologist group, members of the Institut Menorqui d’Estudis, professionals, students and citizens from the Island of Menorca. The Mayor of Mahón together with representatives of the Balearic Islands Council initiated the proceedings by introducing the Roadshow team and welcoming the many participants.

Fig 14. The final presentation (Day 5) of the ‘Sustainable Island Menorca’ Roadshow. The culmination of the 5-Day Roadshow was hosted by the Consell Insular de Menorca. The event was supported by an interpreter service and streamed live by the Consell Insular website, see link: http://www.cime.es/publicacions/verpub.aspx?Id=31665

The final day of the Menorca Roadshow took the form of three integrated presentations. The first, briefly outlining the overall objectives, and specifically the ambitions, format and activities completed during week. The second and third form the major content body of the ‘Island Vision’, the ‘Future Neighbourhoods’ workshop being qualitative in nature, including urban planning intervention proposals at the façade, building and neighbourhood and city scale, together with spatial, social and guidelines. Ending with the ‘Energy Island’ presentation, which is complementary quantitative and focussed on energy strategies, scenarios and carbon offsetting measures at overlapping scales. The full content of the Isla Sostenible Menorca Roadshow presentation is included in the following section.

The project has successfully reached out to, collaborated with, and made meaningful relationships and networks with city stakeholders across Menorca. The work achieved and methods implemented in Belfast, Dubrovnik, Izmir and now in Menorca gaining an internationally wide reputation as being an innovative and societally impactful event model. The project recently became an example of European Commission 'Best Practice'. Building upon previous experiences and looking forward to upcoming visits to Sevilla (Spain), Roeselare (Belgium), Klaipeda (Lithuania) and Catania (Sicily), the EC now extending its reach 2 additional cities, making 10 in total by 2019. Further advances being architecture student 'facilitators' are now financially supported to join each event formally, giving them a unique opportunity to get involved with, and experience, real city design challenges and the skills needed to address them. The key to success has been to identify, reach and gain the trust of city inhabitants and 'decision makers'. To achieve this, an exchange of knowledge, experience and commitment continues to be crucial. As part of the on-going evolution of the project method 'Revisits' will now be planned to guide cities in greater detail on specific aspects of their vision, as well as how best to realise them.

The project has struck the right balance between 'Intensiveness' / 'Fun', 'Specialist' / 'Novice', 'Global' / 'Local', 'Qualitative' / 'Quantitative' and 'Social' / 'Technical'. Each complimentary and diverse component, whether Architecture student workshop, 'Future Neighbourhoods', 'Energy Island', 'Peripatetic Pathway', 'Serious gaming' and 'Pac-man', uniquely citizen orientated and strategically pieced together. The process period is incredibly short, but the architecturally energetic co-created solutions that resulted here in Menorca as well as in Belfast, Izmir and Dubrovnik are for the long-term sustainable, healthy and happy future of their cities, communities and children.

3.2. THE PRESENTATION

The following 'Sustainable Island Vision' presentation (Roadshow findings) was delivered at the Consell Insular de Menorca on the 28th April 2017:

ISLA SOSTENIBLE 'MENORCA' ROADSHOW

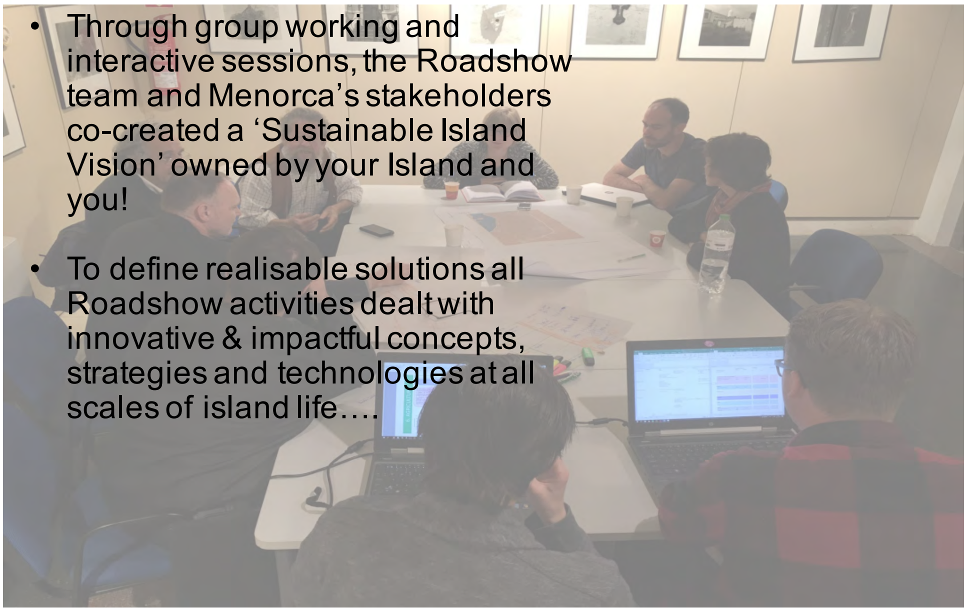
Monday 24th April to Friday 28th April 2017

Hosted by IME – Institut Menorquí d'Estudis

Dr Craig Martin, TU Delft NL.

CITY-zen New urban energy

THE AIM

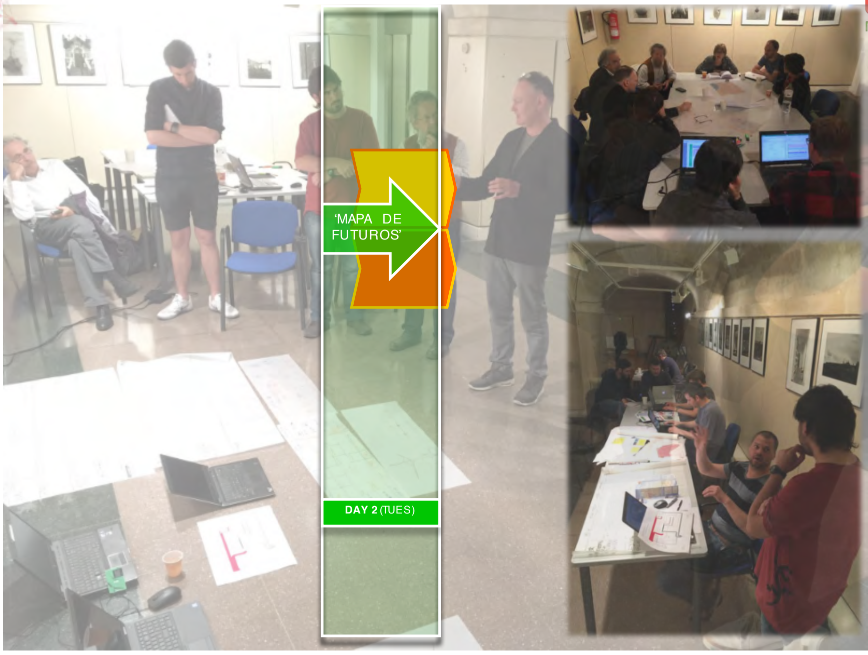


- Through group working and interactive sessions, the Roadshow team and Menorca's stakeholders co-created a 'Sustainable Island Vision' owned by your Island and you!
- To define realisable solutions all Roadshow activities dealt with innovative & impactful concepts, strategies and technologies at all scales of island life….

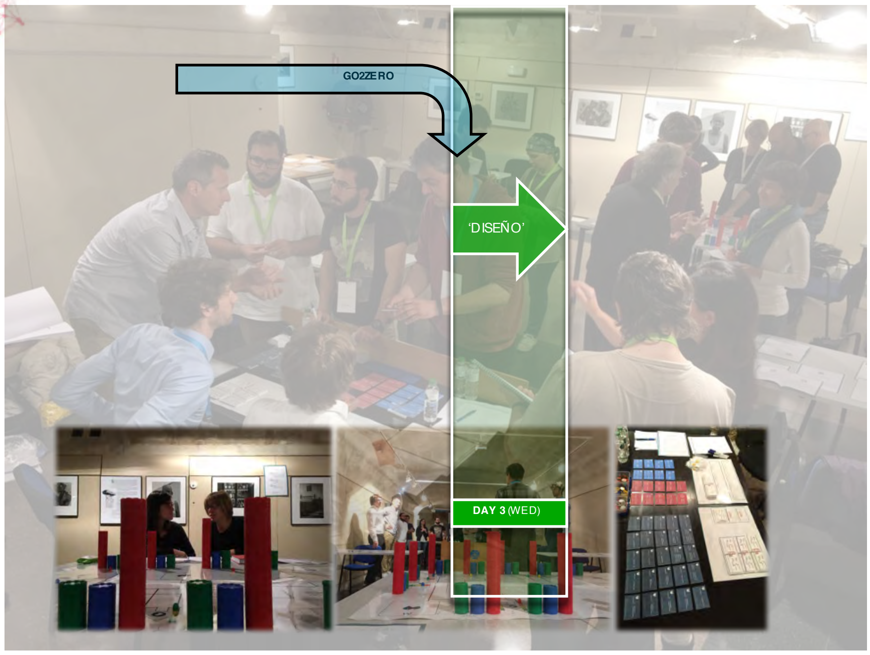
MENORCA 'SWAT' Studio (Feb 2017)

Día 1

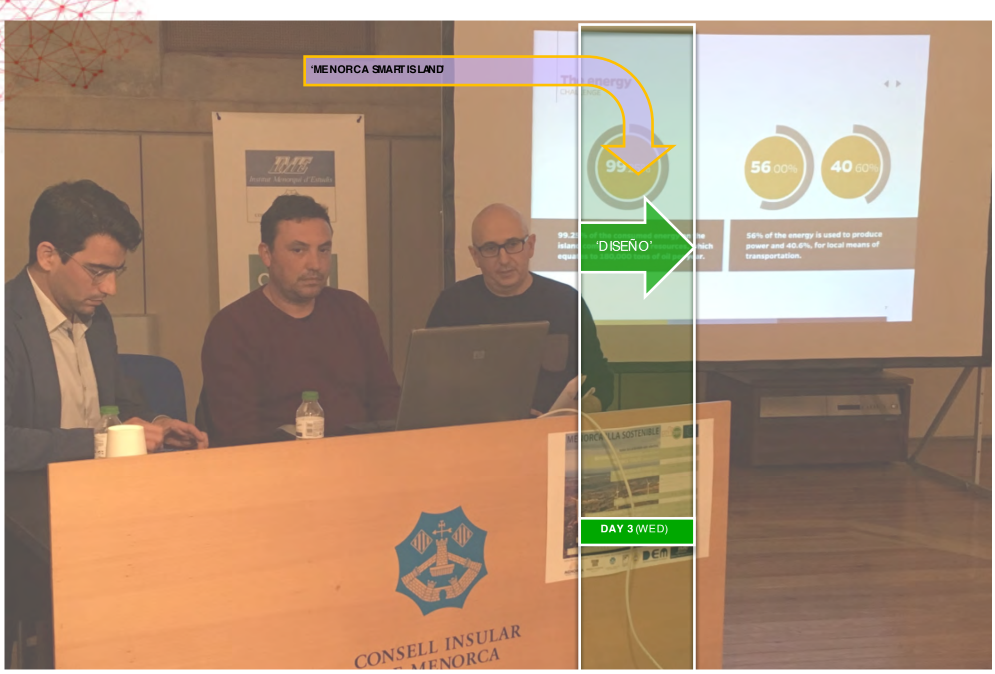
Día 2: 'MAPA DE FUTUROS' TALLERES PARALELOS COMENZAN



Día 3: SERIOUS GAME

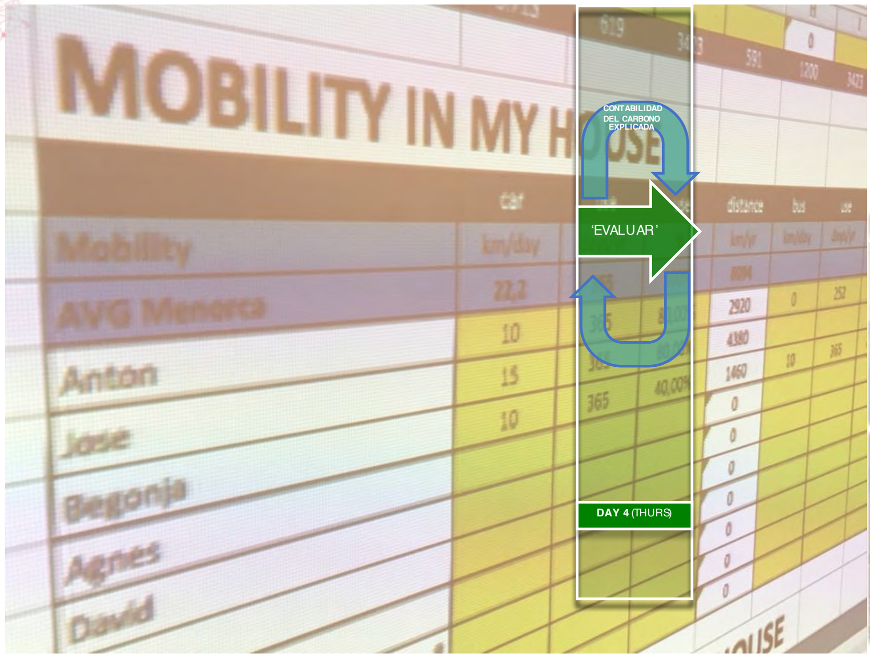


Día 3: MENORCA SMART ISLAND



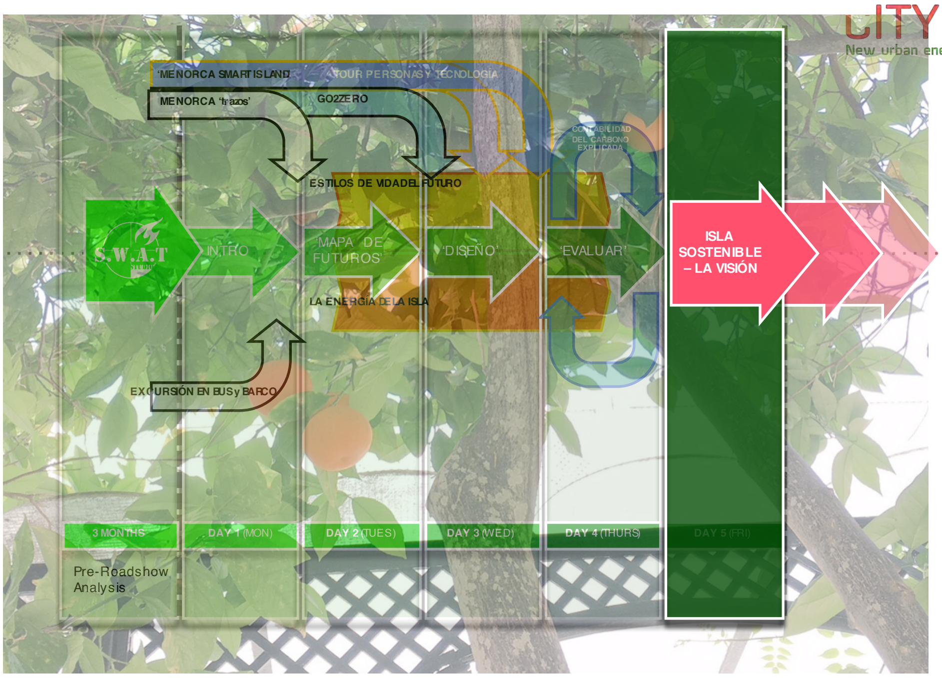
Día 3: TOUR PERSONAS Y TECNOLOGÍA

Día 4: 'EVALUAR' - CONTABILIDAD DEL CARBONO EXPLICADA



Día 5: 'VIE' - ISLA SOSTENIBLE – LA VISIÓN

Día 5: ‘VIE’ - ISLA SOSTENIBLE – LA VISIÓN



Ricardo Pulselli, University of Siena

Ecological Footprint of Menorca is roughly 7 times its area.

Most of this is comprised of

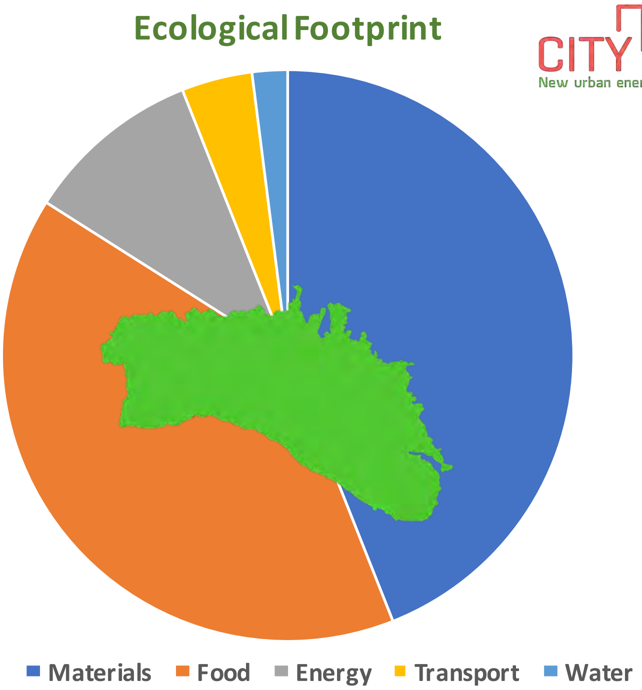
Food
- Generally sourced from elsewhere.
- High levels of waste/foodmiles

Materials
- Poor recycling and re-use
- Non local sources.

Energy
- Mainly Fossil fuels

Transport
- Low public transport
- Little cycling/walking
- High car use

Water
- Limited local supply



ELECTRICITY EMISSION FACTOR

CARBON ACCOUNTING

MENORCA ELECTRICAL GRID

Electricity demand **479 GWh**
Electricity production **411 GWh**

NET IMPORT (14.3%) **69 GWh**
Coal (70%); Nat gas (14%); Oil (4%)

THERMO-ELECTRICITY (82.9%) **397 GWh**
Oil (82.9%) **397 GWh/yr**

RENEWABLE (3%) **13 GWh**
PV (1.6%) **8 GWh/yr**
Wind (1.1%) **5 GWh/yr**

CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

CARBON FOOTPRINT OF MENORCA
CARBON ACCOUNTING

CITY-zen New urban energy

RESIDENTIAL ENERGY	166,122	t CO_2eq/yr
Electricity	198,270	MWh/yr
Petroleum	33,773	MWh/yr
LGP	27,256	MWh/yr
Biomass	7,670	MWh/yr

SERVICES	178,218	t CO_2eq/yr
Electricity	210,371	MWh/yr
Petroleum	43,422	MWh/yr
LGP	28,581	MWh/yr

WASTE MANAGEMENT	51,412	t CO_2eq/yr
Collected quantity	55,265	t/yr
Recicled	10,944	t/yr
Waste to landfill	44,320	t/yr

INDUSTRIAL ENERGY	26,105	t CO_2eq/yr
Electricity	24,267	MWh/yr
Petroleum	19,299	MWh/yr
LGP	3519	MWh/yr
Liquified Natural Gas	8250	MWh/yr

AGRICOLTURE	16,187	t CO_2eq/yr
Electricity	7692	MWh/yr
Petroleum	38,556	MWh/yr
Biomass	0.005	MWh/yr

MOBILITY	129,647	t CO_2eq/yr
Diesel	478,401	MWh/yr

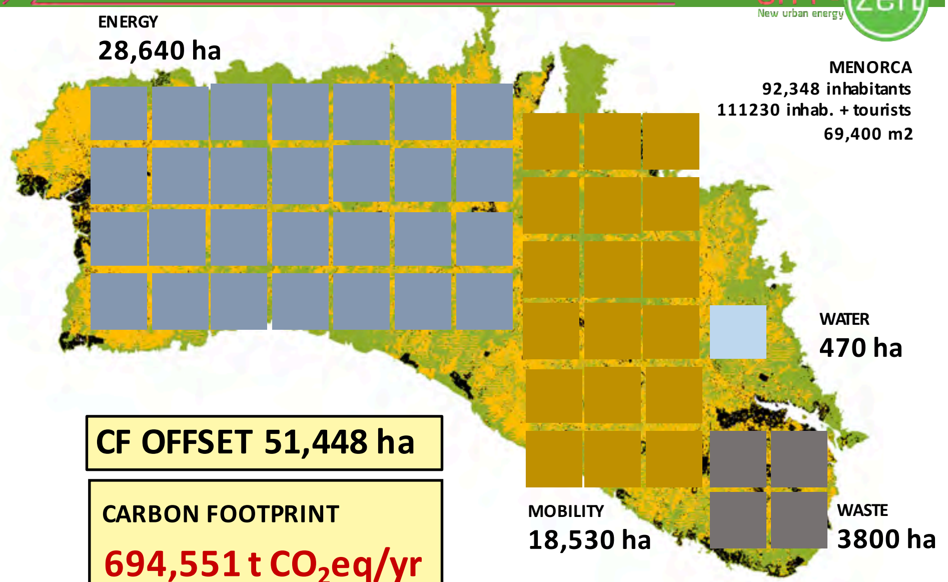
MARITIME & AIR TRANSPORT	120,540	t CO_2eq/yr
Petroleum	444,798	MWh/yr

WATER MANAGEMENT	6319	t CO_2eq/yr
Water use	10,800,000	m^3/yr

CARBON FOOTPRINT
694,551 t CO_2eq/yr

CARBON FOOTPRINT OF MENORCA
CARBON ACCOUNTING

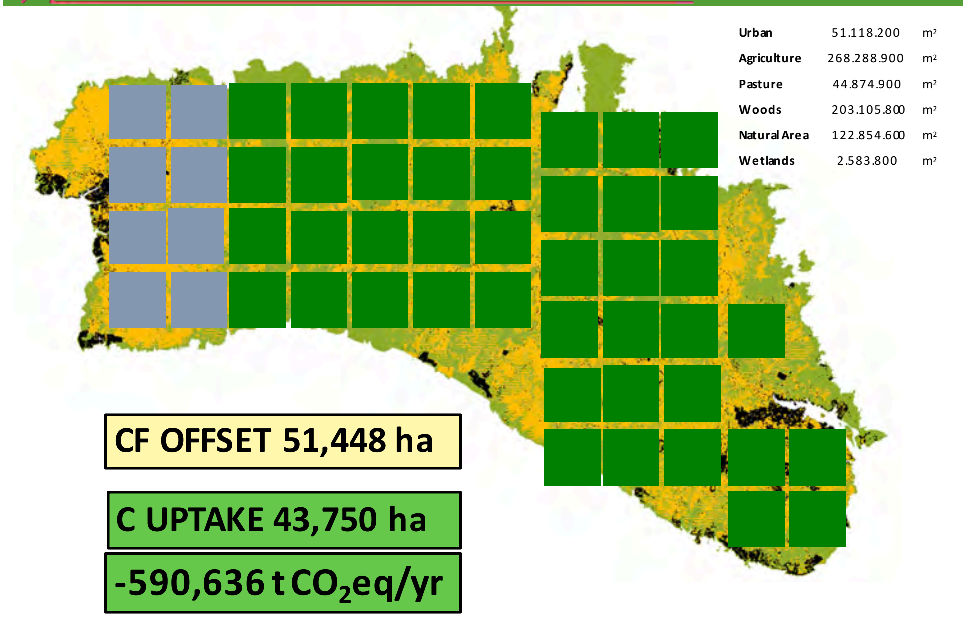
CITY-zen New urban energy



CF OFFSET 51,448 ha

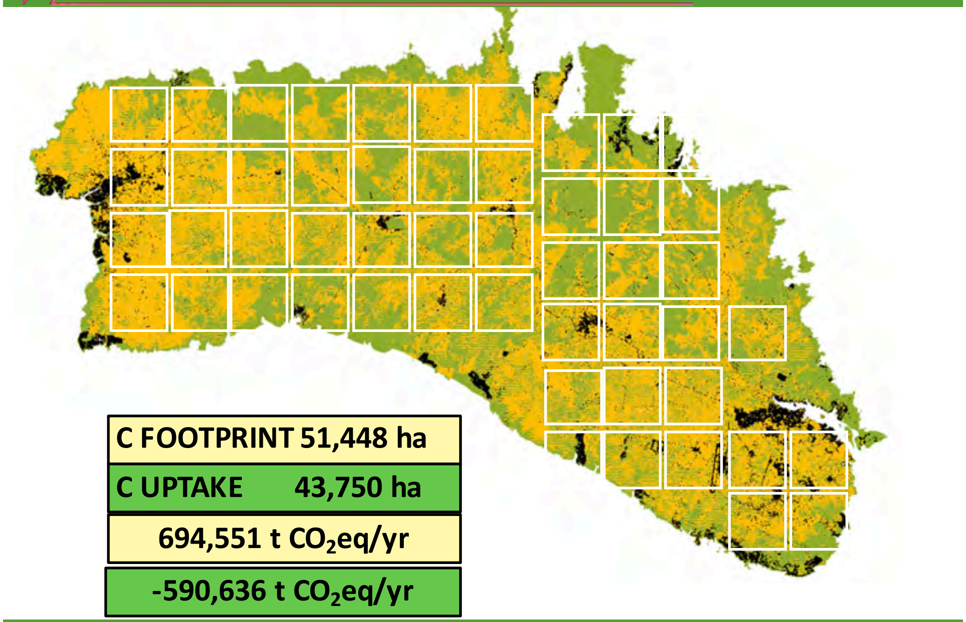
CARBON FOOTPRINT
694,551 t CO_2eq/yr

CARBON FOOTPRINT OFFSET OF MENORCA
CARBON ACCOUNTING



CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

CARBON FOOTPRINT OFFSET OF MENORCA
CARBON ACCOUNTING



CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

CARBON FOOTPRINT per HOUSEHOLD
CARBON ACCOUNTING

CITY-zen New urban energy

MENORCA HOUSEHOLD PROFILING

ENERGY DEMAND	**5186**	kg CO_2eq	**55%**	
Cooling electricity	619	kWh_e/yr		6189kWe/yr
Lighting & appliances	3713	kWh_e/yr		
Heating & DHW (electr)	1857	kWh_e/yr		
Heating & DHW (butane)	253	kWh_h/yr		844kWh/yr
Cooking (butane)	591	kWh_h/yr		
Heating & DHW (oil)	1063	kWh_h/yr		
Heating (biomass)	250	kWh_h/yr		
MOBILITY	**2914**	kg CO_2eq	**31%**	
Distance by car	8094	km/yr		
WASTE MANAGEMENT	**1153**	kg CO_2eq	**12%**	
Collected quantity	496	kg/yr		
Recycled	20	%		
Waste to landfill	0.8	%		
WATER MANAGEMENT	**142**	kg CO_2eq	**2%**	
Water use per inhabitant	97.1	m^3/yr		

5.92 t CO_2eq/yr

5.04 t CO_2eq/yr

5.70 t CO_2eq/yr

5.60 t CO_2eq/yr

CARBON FOOTPRINT

9.40 t CO_2eq/yr

CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

CARBON FOOTPRINT per HOUSEHOLD
CARBON ACCOUNTING

CITY-zen New urban energy

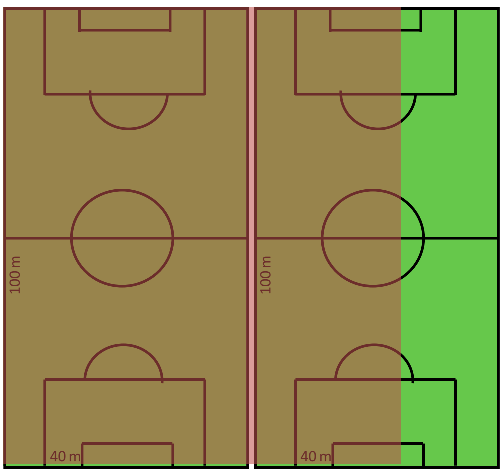
CARBON FOOTPRINT OFFSET
carbon uptake by urban forestry (i.e. 1.35 kg CO_2/m^2)

The carbon footprint of one household is eqivalent to

26,000 km driven by car

The carbon footprint offset of one household is eqivalent to

0.70 ha forestland

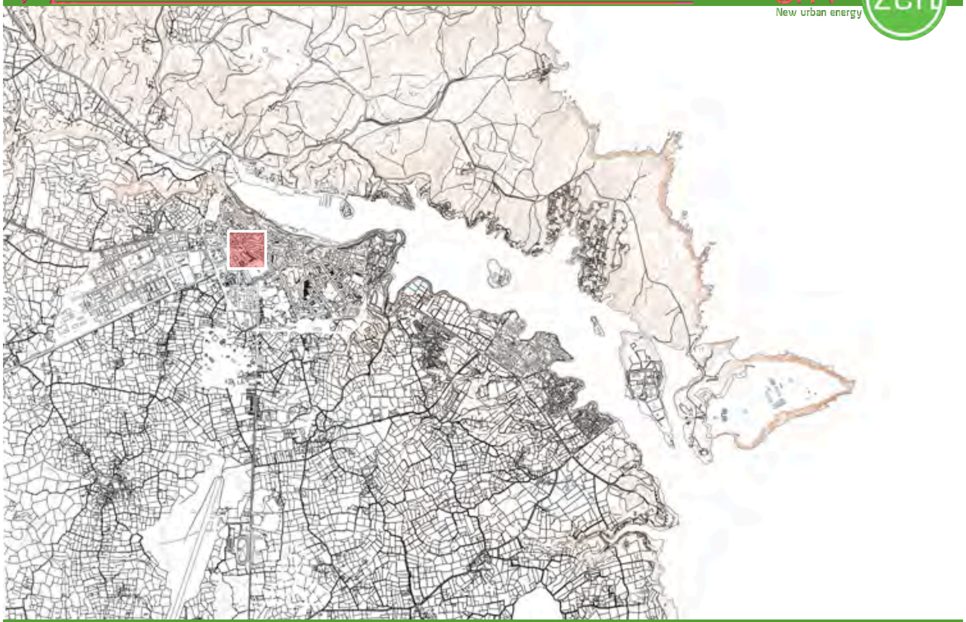


CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

CARBON FOOTPRINT of the NEIGHBOURHOOD

CARBON ACCOUNTING

CITY-zen New urban energy



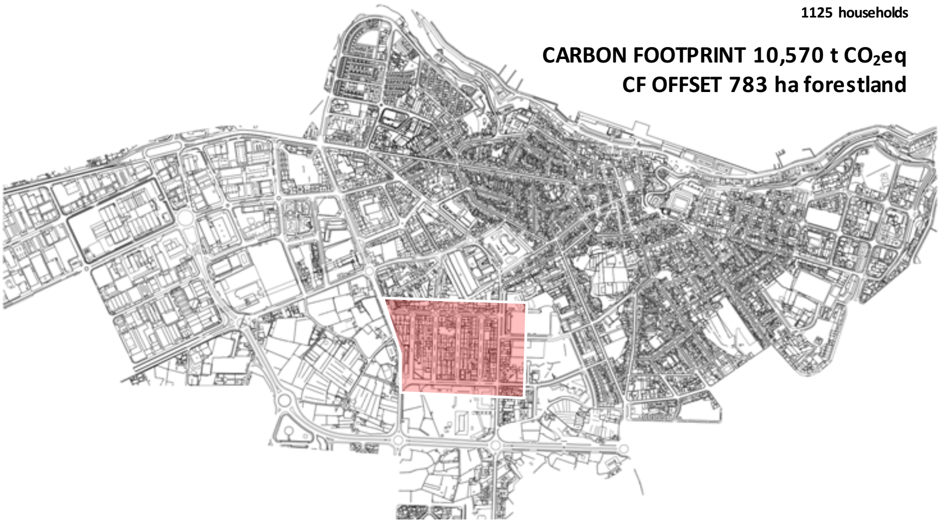
CARBON FOOTPRINT of the NEIGHBOURHOOD

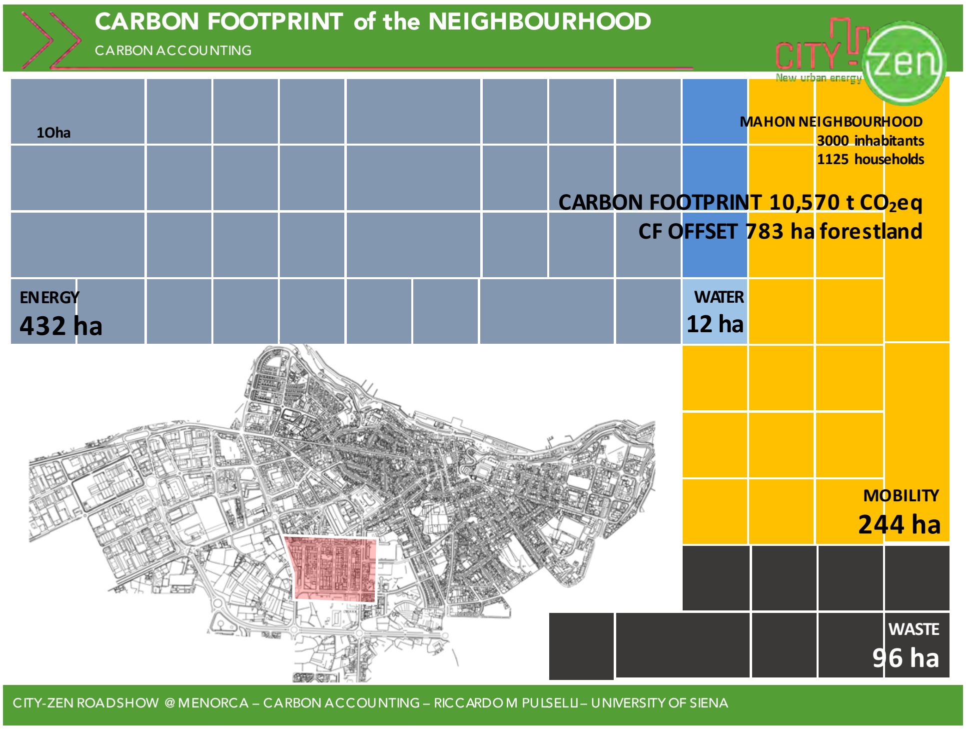
CARBON ACCOUNTING

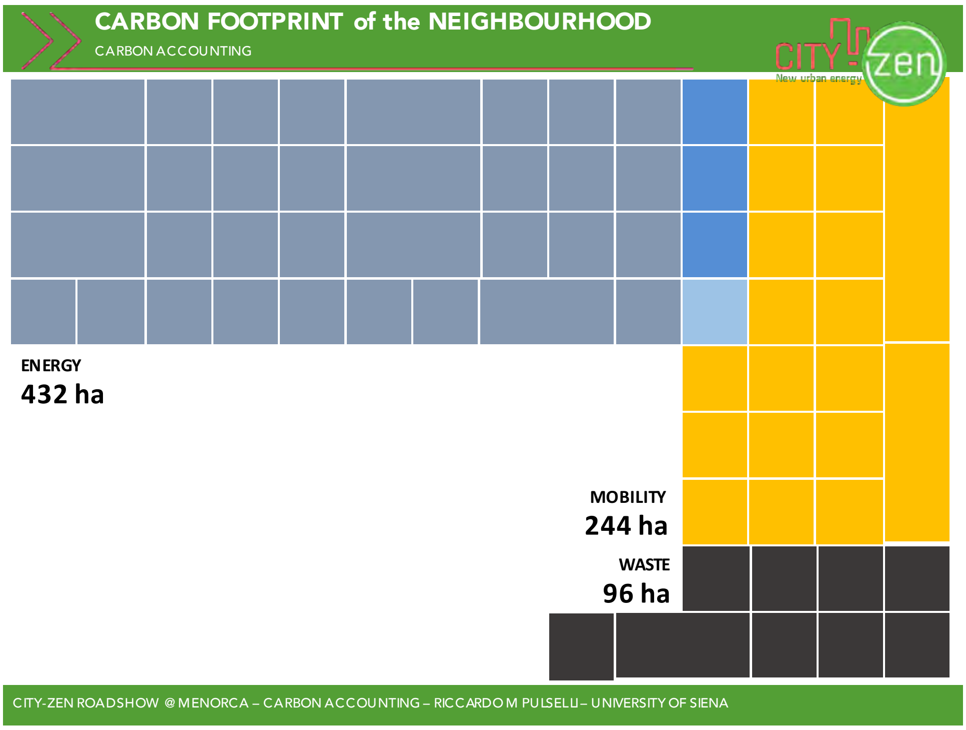
CITY-zen New urban energy

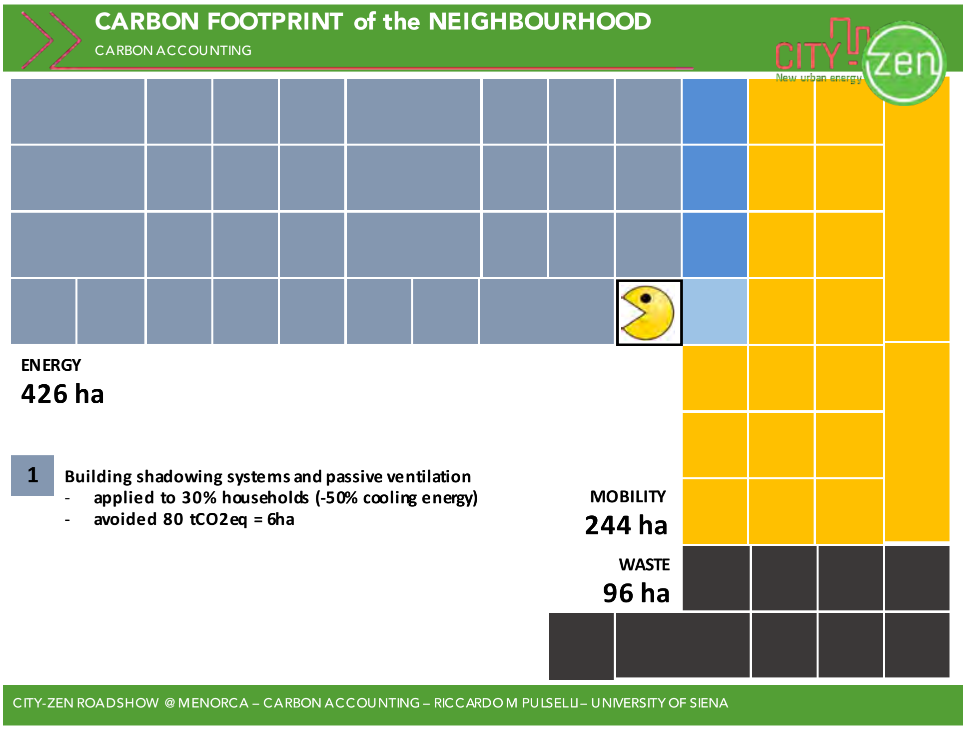
MAHON NEIGHBOURHOOD
3000 inhabitants
1125 households

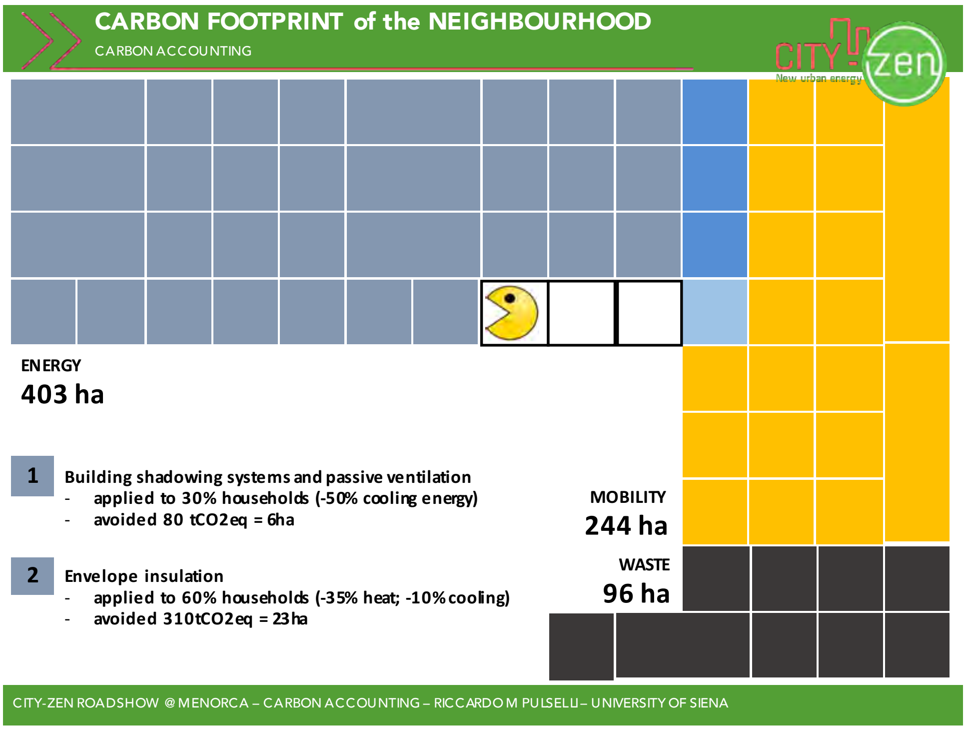
CARBON FOOTPRINT 10,570 t CO_2eq
CF OFFSET 783 ha forestland




CARBON FOOTPRINT of the NEIGHBOURHOOD
CARBON ACCOUNTING
CITY zen
New urban energy
1Oha
MAHON NEIGHBOURHOOD
3000 inhabitants
1125 households
CARBON FOOTPRINT 10,570 t CO_2eq
CF OFFSET 783 ha forestland
ENERGY
432 ha
WATER
12 ha
MOBILITY
244 ha
WASTE
96 ha
CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

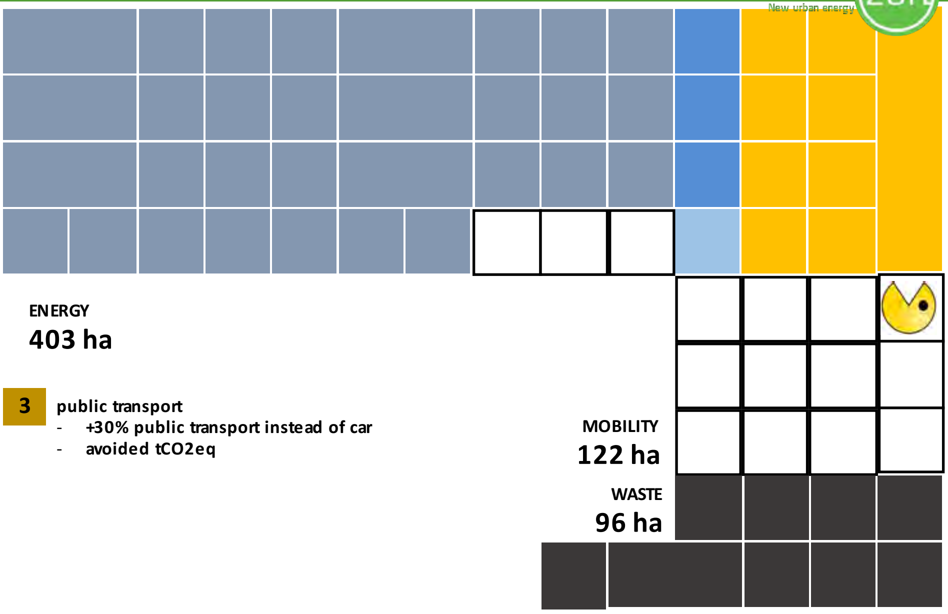

CARBON FOOTPRINT of the NEIGHBOURHOOD
CARBON ACCOUNTING
CITY zen
New urban energy
ENERGY
432 ha
MOBILITY
244 ha
WASTE
96 ha
CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA


CARBON FOOTPRINT of the NEIGHBOURHOOD
CARBON ACCOUNTING
CITY zen
New urban energy
ENERGY
426 ha
1
Building shadowing systems and passive ventilation
- applied to 30% households (-50% cooling energy)
- avoided 80 tCO2eq = 6ha
MOBILITY
244 ha
WASTE
96 ha
CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA


CARBON FOOTPRINT of the NEIGHBOURHOOD
CARBON ACCOUNTING
CITY zen
New urban energy
ENERGY
403 ha
1
Building shadowing systems and passive ventilation
- applied to 30% households (-50% cooling energy)
- avoided 80 tCO2eq = 6ha
2
Envelope insulation
- applied to 60% households (-35% heat; -10% cooling)
- avoided 310tCO2eq = 23ha
MOBILITY
244 ha
WASTE
96 ha
CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

CARBON FOOTPRINT of the NEIGHBOURHOOD

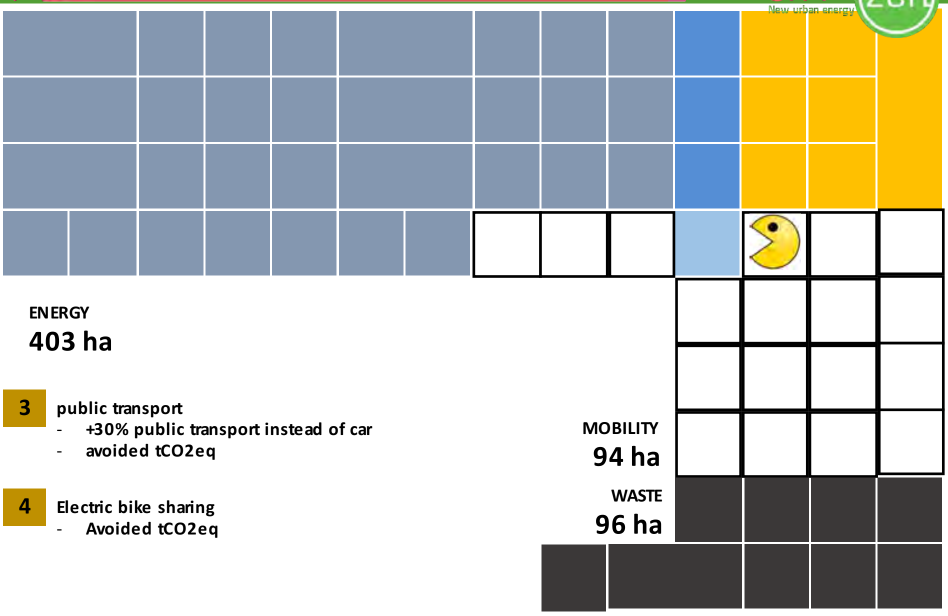
CARBON ACCOUNTING



3 public transport
- +30% public transport instead of car
- avoided tCO2eq

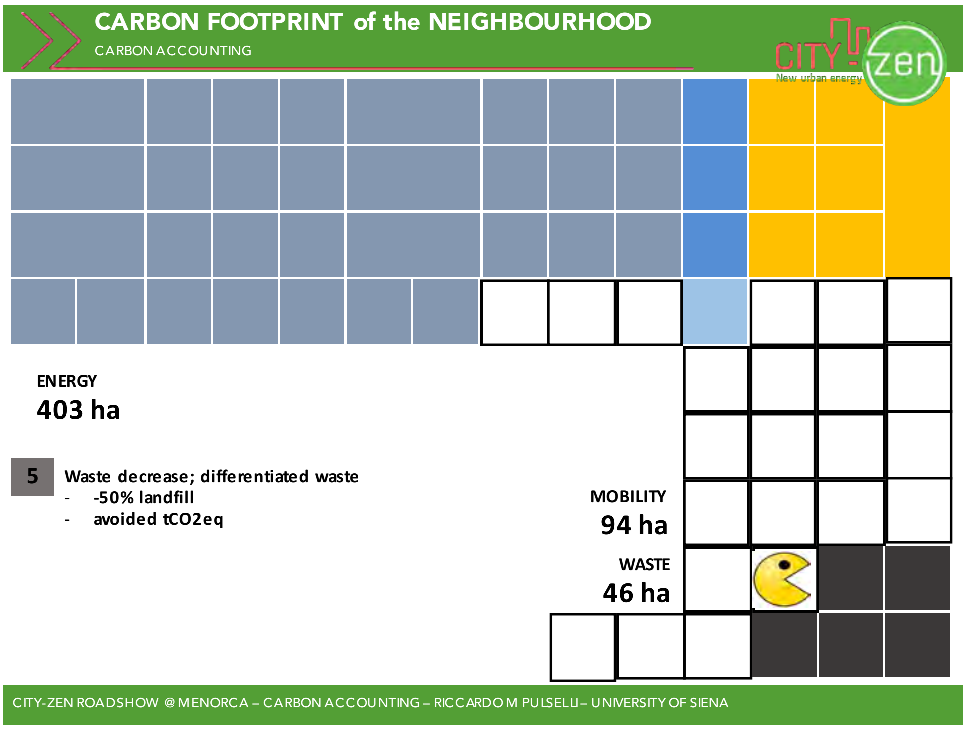
CARBON FOOTPRINT of the NEIGHBOURHOOD

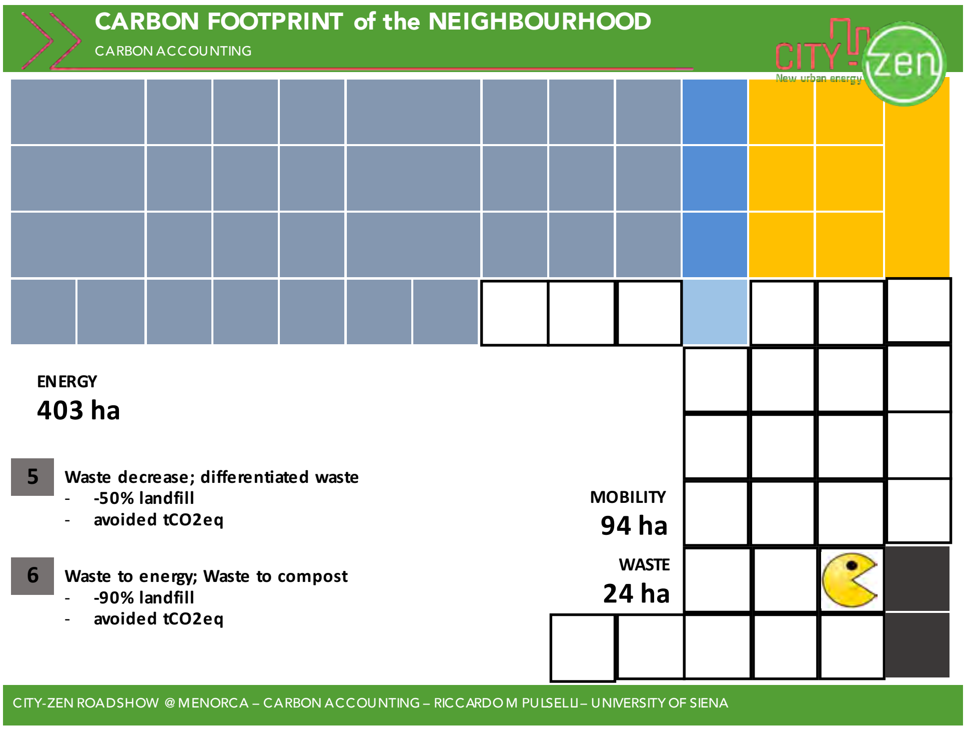
CARBON ACCOUNTING



3 public transport
- +30% public transport instead of car
- avoided tCO2eq

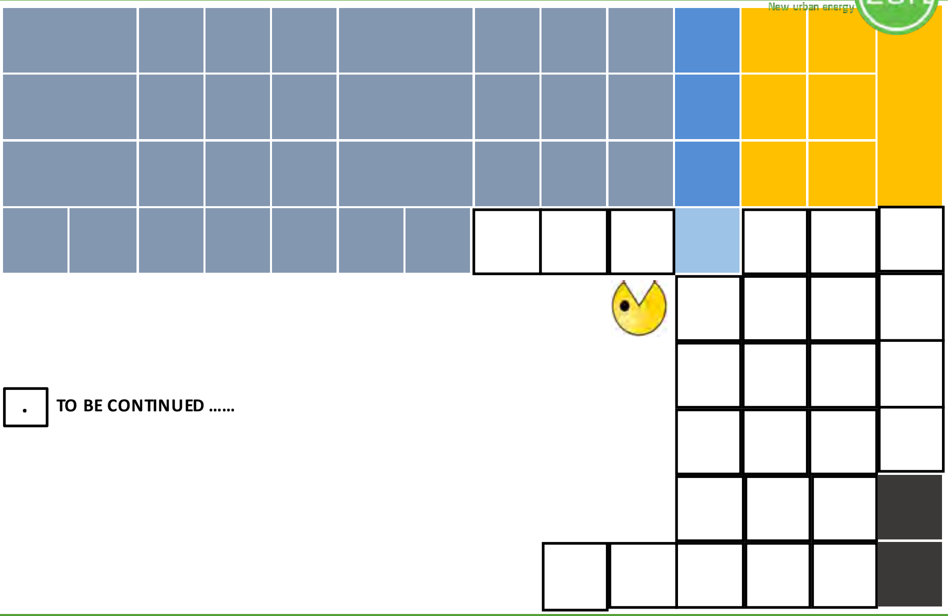
4 Electric bike sharing
- Avoided tCO2eq


CARBON FOOTPRINT of the NEIGHBOURHOOD
CARBON ACCOUNTING
CITY-zen
New urban energy
ENERGY
403 ha
5
Waste decrease; differentiated waste
- -50% landfill
- avoided tCO2eq
MOBILITY
94 ha
WASTE
46 ha
CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA


CARBON FOOTPRINT of the NEIGHBOURHOOD
CARBON ACCOUNTING
CITY-zen
New urban energy
ENERGY
403 ha
5
Waste decrease; differentiated waste
- -50% landfill
- avoided tCO2eq
6
Waste to energy; Waste to compost
- -90% landfill
- avoided tCO2eq
MOBILITY
94 ha
WASTE
24 ha
CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

CARBON FOOTPRINT of the NEIGHBOURHOOD

CARBON ACCOUNTING



TO BE CONTINUED ......

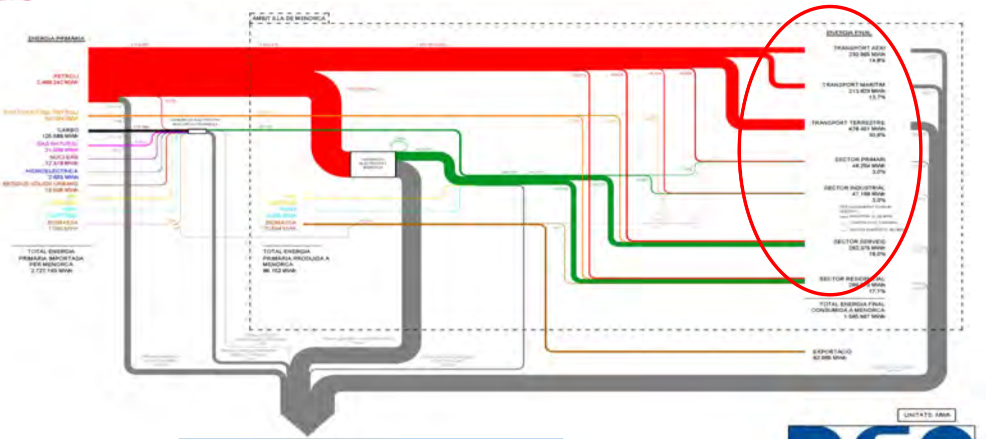
CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

Energy interventions

Siebe Broersma TU Delft

The current energy system, demand & potentials

The current energy system & energy use



Defining the real energy demand

RESIDENTIAL energy use and demand

total RESIDENTIAL energy use	total (MWh)	per hh (kWh)	demand for	electricity (appl)	cooling	heating	DHW	cooking
			*avarage household **USE** for:*					
electricity	198000	6188	electric + cool + heat+ DHW	3713	619	1238	619	
butan etc	27000	844	heating + DHW +cooking			169	84	591
Petroleum	34000	1063	heating +DHW			744	319	
biomassa	8000	250	heating			250		
total	267000	8344	total	3713	619	2400	1022	591

avarage household DEMAND for:

		electricity (appl)	cooling	heating	DHW	cooking
COP airco	2,5	3713	1547	2400	1022	591

TOTAL RESIDENTIAL ENEGRY DEMAND for:

	electricity (appl)	cooling	heating	DHW	cooking	total
(MWh)	118800	49500	76800	32700	18900	296700
calculated:	40	17	26	11	6	100 %

consumption for demand type

educated guess:	RESIDENT	SERVICE
electricity for:		
electricity (appl)	60%	50%
el heating	20%	5%
el cooling	10%	40%
el DHW	10%	5%
butan for		
cooking	70%	
DHW	10%	
heating	20%	
petroleum for		
heating	70%	50%
DHW	30%	50%
biomassa for		
heating	100%	
LPG for		
heating		20%
cooking		30%
DHW		50%

energy use and demand SERVICES

ENEGRY DEMAND from services for:

SERVICES energy use	total (MWh)	demand for	electricity (appl)	cooling	heating	DHW	cooking	total
electricity	210000	electric + cool + heat+ DHW	105000	84000	10500	10500		
Petroleum	43000	heating +DHW			21500	21500		
LPG	28000	heating +DHW+cooking			5600	14000	14000	
total	281000	total	105000	84000	37600	46000	14000	286600
			37	29	13	16	5	100 %

INDUSTRIAL energy use and demand

INDUSTRIAL energy use	total (MWh)	demand for	electricity (appl)	cooling	heating	DHW	cooking	total
electricity	24000	electricity	24000					
Petroleum	31000	processes with hot water				31000		
		total	24000	0	0	31000	0	55000
			44	0	0	56	0	100 %

Energy use and demand for VEHICLES and ARGRICULTURE

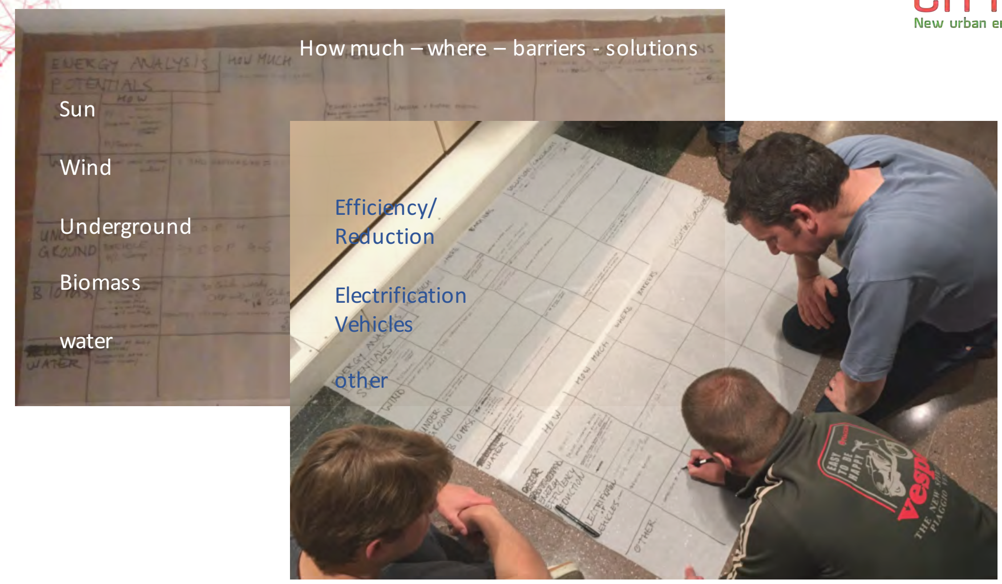
demand by	fuel vehicles	electricity
airplains	231000	
boats	214000	
vehicles land	478000	
agricultural	38000	8000
total (MWh)	961000	8000
total (GWh)	787	8

1st step towards a zero energy island: proper energy accounting!
Know your energy demand!

Starting point: the current demand

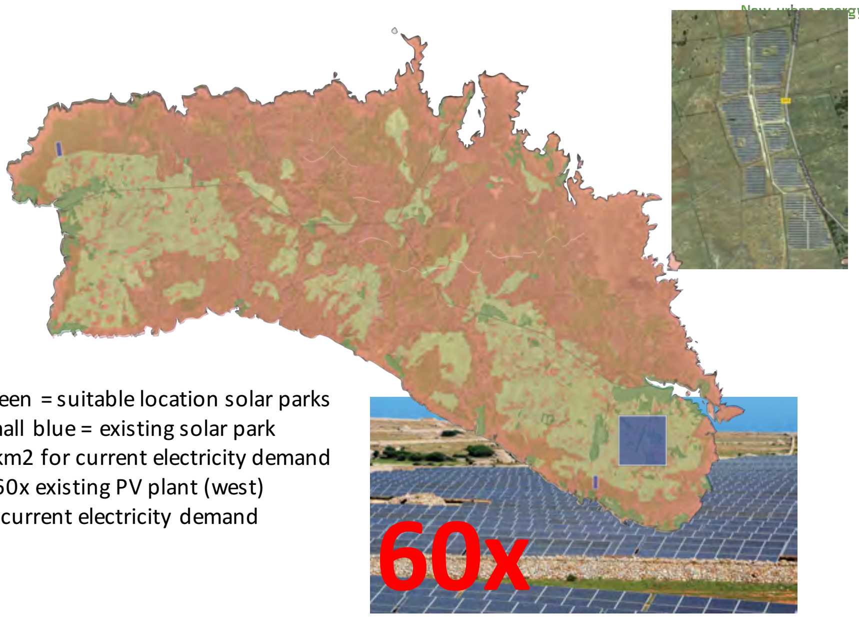
Total current energy demand (GWh)						
SECTOR	electricity (appl)	cooling	heating	DHW	cooking	fuel
RESIDENTIAL	119	50	77	33	19	
SERVICES	105	84	38	46	14	
INDUSTRIAL + AGRIC	32			31		
VEHICLES LAND						516
BOATS						214
AIRPLAINES						231
TOTAL (GWh)	**256**	**134**	**114**	**110**	**33**	**961**

Energy potential analyses



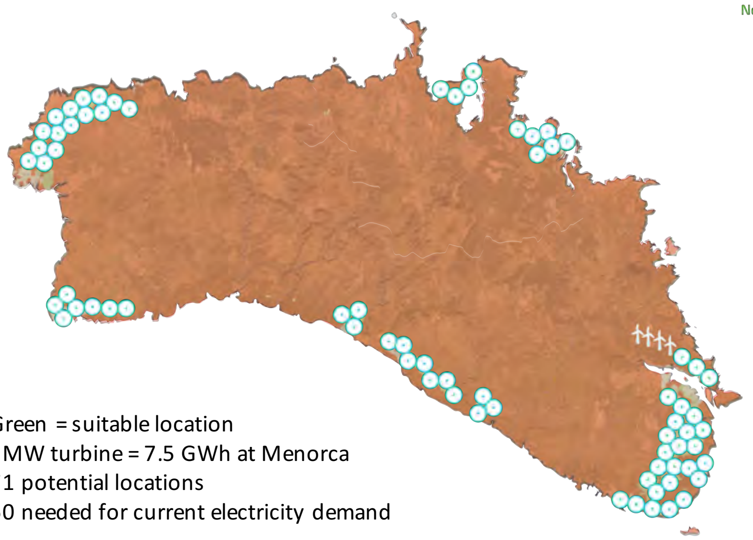
What are the local energy potentials…and barriers?

Solar power potential



- Green = suitable location solar parks
- Small blue = existing solar park
- 5 km2 for current electricity demand
- = 60x existing PV plant (west) for current electricity demand

Wind potential



- Green = suitable location
- 3MW turbine = 7.5 GWh at Menorca
- 71 potential locations
- 60 needed for current electricity demand

Taking energy measures in a smart way

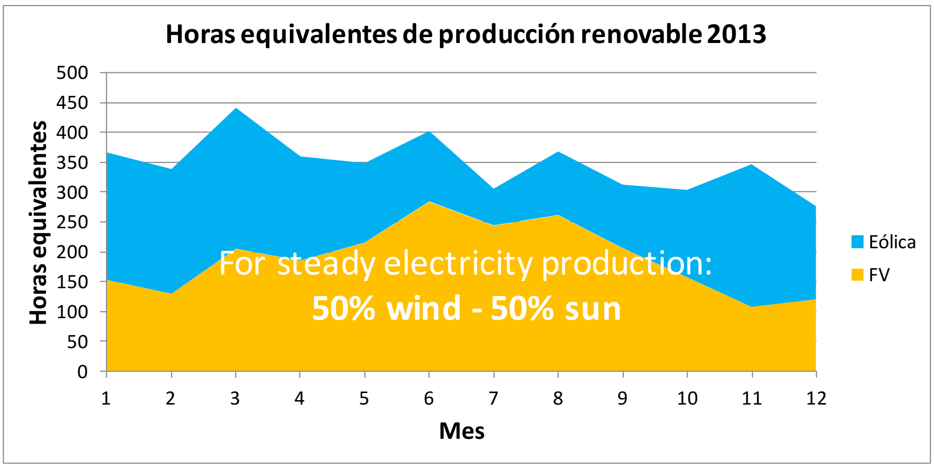
Our New Stepped Strategy (for different scale levels)

1. **Reduce** the energy demand
   - Urban planning & design
   - Architectural design
   - Passive, smart & bioclimatic design
   - Using local characteristics, vernacularity

2. **Reuse** waste energy
   - Attune supply and demand
   - Exchange surpluses with shortages
   - Cascade heat
   - Store energy

3. **Produce** renewable energy
   - Sun
   - Wind
   - Water
   - Air
   - Soil
   - Biomass

Solar and wind power



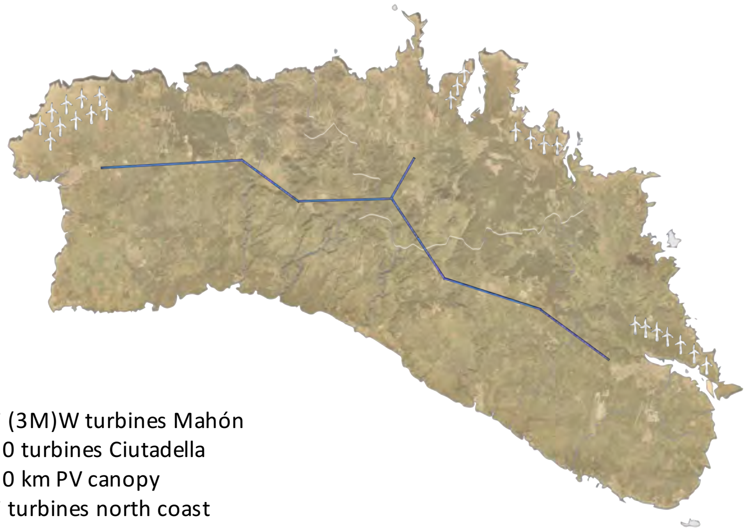
Energy efficiency & sustainable production

Total current energy demand (GWh)						
SECTOR	electricity (appl)	cooling	heating	DHW	cooking	fuel
RESIDENTIAL	119	50	77	33	19	
SERVICES	105	84	38	46	14	
INDUSTRIAL + AGRIC	32			31		
VEHICLES LAND						516
BOATS						214
AIRPLAINES						231
TOTAL (GWh)	256	134	114	110	33	961

Energy efficiency measures for Menorca (GWh)						
ENERGY MEASURE	electricity (appl)	cooling	heating	DHW	cooking	fuel
electricity reduction for appliances (-25%)	64					
modal shift (more public transport and bikes)						258
switch to 50% electric cars/busses/trucks	-43					129
switch to 50% electric bikes	-1,29					129
building retrofit measures ave. 43% red		57	49			
switch to electric boats 100%	-71,3					214
heat pump for heating (COP 4)	-13,8		55			
heat pumps for DHW (COP 2)	-10,5			21		
electric cooking (80%)	-26				26	
heat pump systems for cooling (COP 5)	-15,2	76				
remaining energy demand	373	0	10	89	7	231

Energy PRODUCTION measures for Menorca (GWh)						
ENERGY MEASURE	electricity (appl)	cooling	heating	DHW	cooking	fuel
Wind turbines Mahon (replace 4) (7x3MW)	50					
Wind turbines Ciutadella (7x3MW)	50					
PV-roof canopy 30 km (amorpheus, 15m)	67					
solar boilers 75% of DHW				82		
CHP on biomass for heating city centres + el.	10		10	6		
biogas from foodwaste					7	
PV on roofs (20% all roofs)	120					
10 3MW windturbines	76					
total energy balance with measures	0	0	0	0	0	231

Large scale energy production



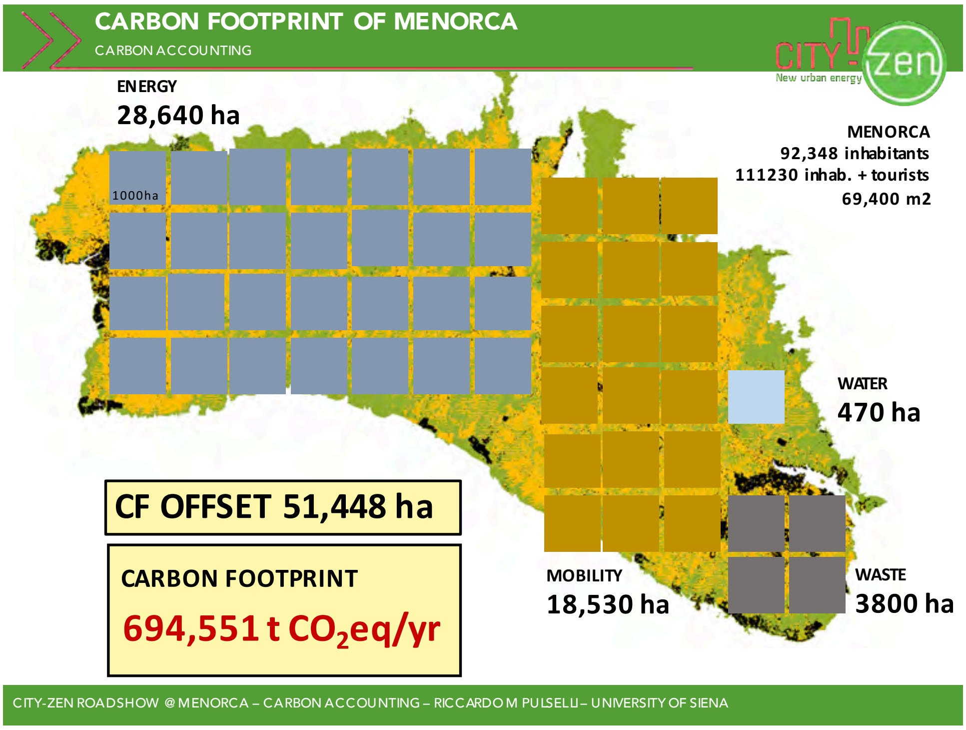
- 7 (3M)W turbines Mahón
- 10 turbines Ciutadella
- 30 km PV canopy
- 7 turbines north coast

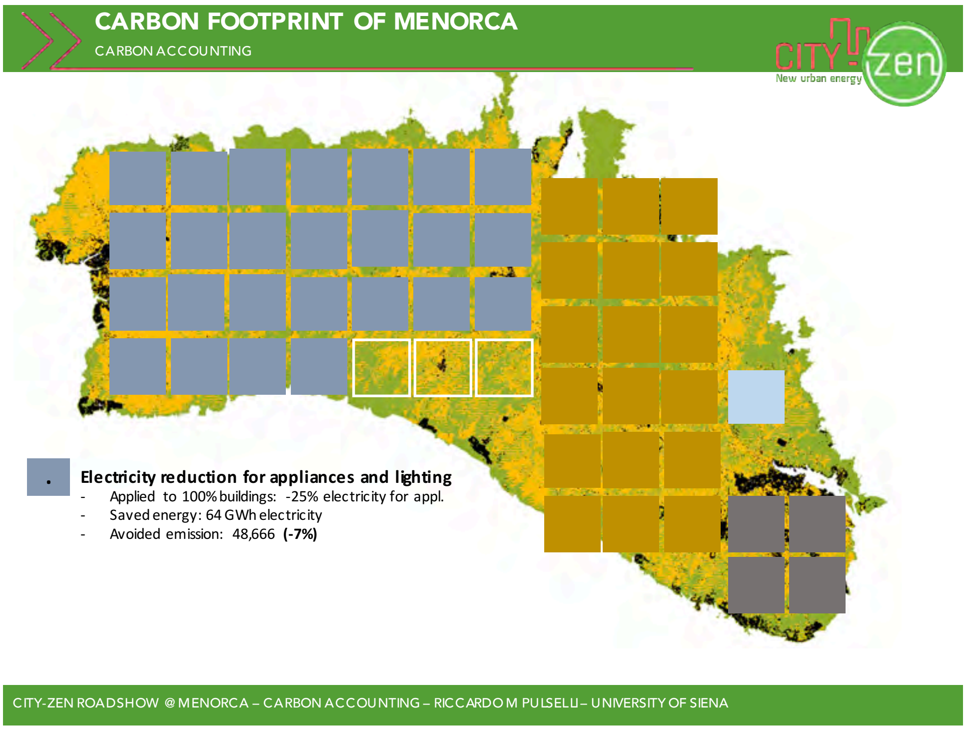
CITY zen
New urban energy

CITY zen
New urban energy

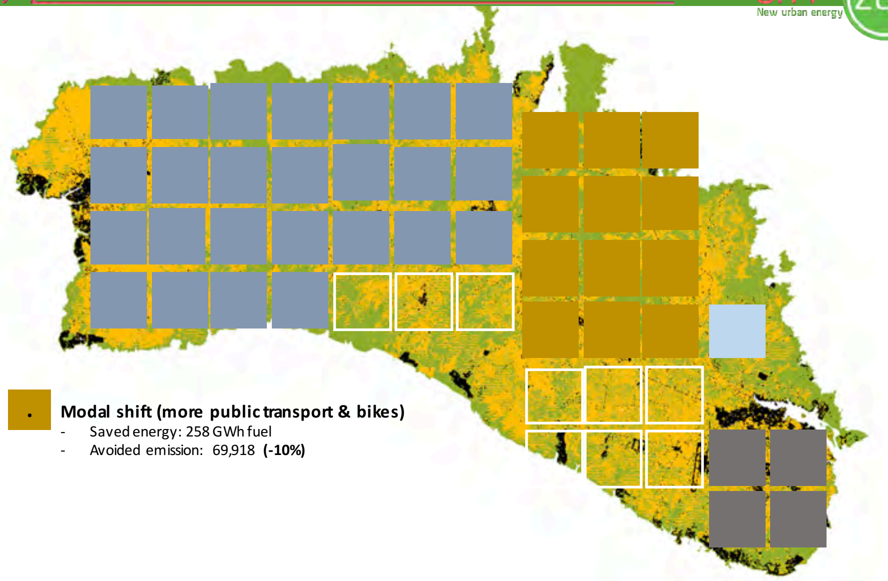
CITY-zen
New urban energy

CITY-zen
New urban energy


CARBON FOOTPRINT OF MENORCA
CARBON ACCOUNTING
CITY-zen
New urban energy
ENERGY
28,640 ha
1000ha
MENORCA
92,348 inhabitants
111230 inhab. + tourists
69,400 m2
WATER
470 ha
CF OFFSET 51,448 ha
CARBON FOOTPRINT
694,551 t CO_2eq/yr
MOBILITY
18,530 ha
WASTE
3800 ha
CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

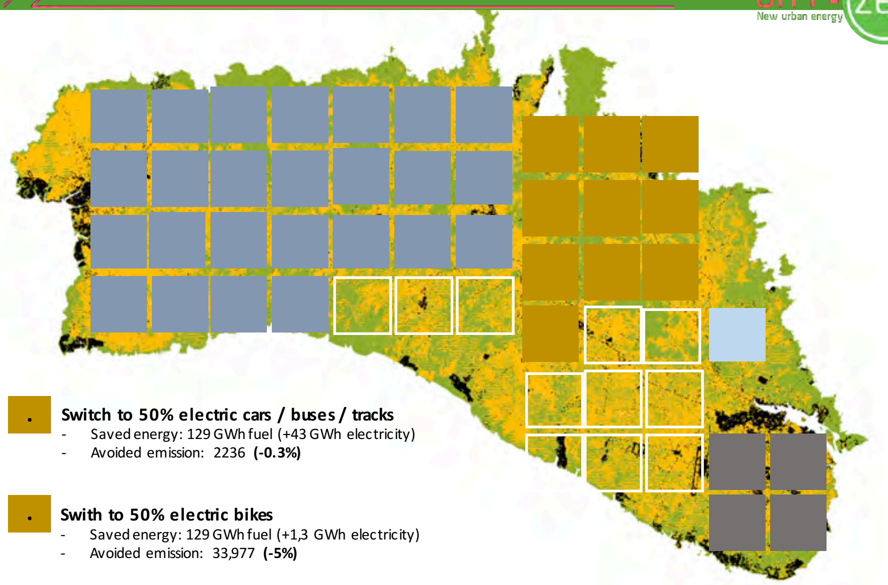

CARBON FOOTPRINT OF MENORCA
CARBON ACCOUNTING
CITY-zen
New urban energy
Electricity reduction for appliances and lighting
- Applied to 100% buildings: -25% electricity for appl.
- Saved energy: 64 GWh electricity
- Avoided emission: 48,666 (-7%)
CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

CARBON FOOTPRINT OF MENORCA
CARBON ACCOUNTING



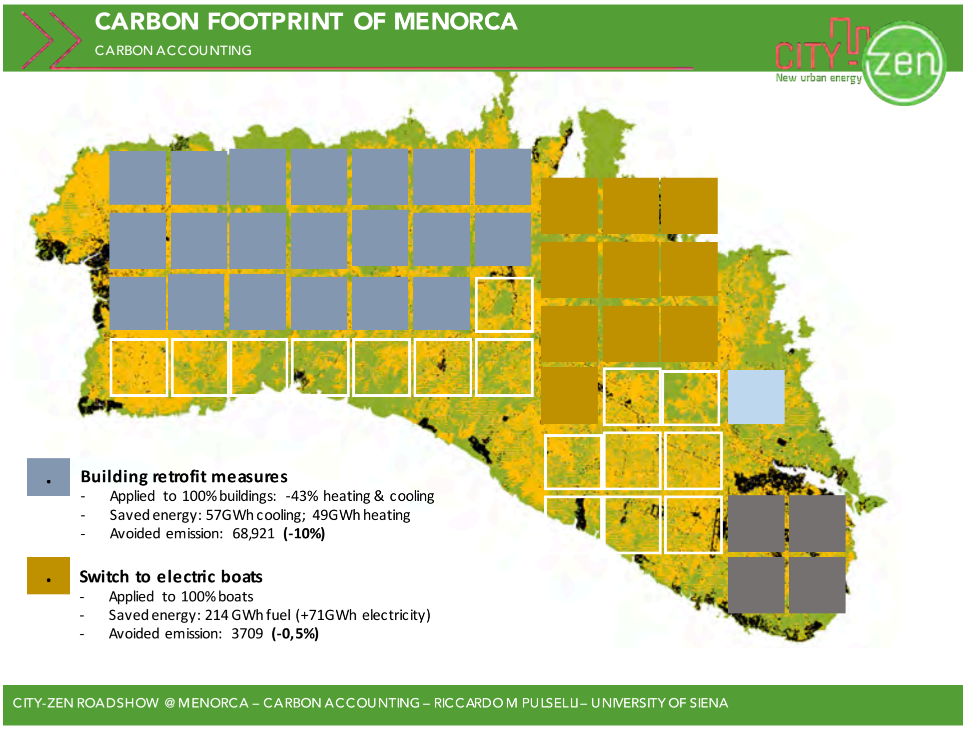
Modal shift (more public transport & bikes)
- Saved energy: 258 GWh fuel
- Avoided emission: 69,918 **(-10%)**

CARBON FOOTPRINT OF MENORCA
CARBON ACCOUNTING



Switch to 50% electric cars / buses / tracks
- Saved energy: 129 GWh fuel (+43 GWh electricity)
- Avoided emission: 2236 **(-0.3%)**

Swith to 50% electric bikes
- Saved energy: 129 GWh fuel (+1,3 GWh electricity)
- Avoided emission: 33,977 **(-5%)**



Cost of Retrofit – orders of magnitude.

Each household pays 1000 Euro per year for energy.

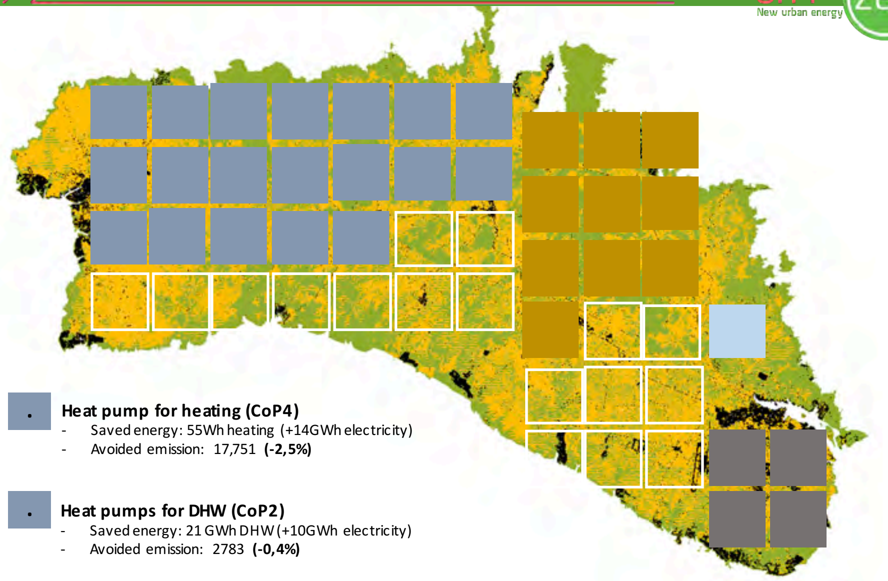
Energy retrofit operation on all permanent residential units in Menorca
In **historic centres**, allowing **20%** of reduction in energy use
In all other places **deeper retrofit** allowing **50%** reduction in energy use.

We estimate *average* retrofitting costs as follows:

10.000 Euro for an apartment;
25.000 Euro for a terraced house;
30.000 Euro for a freestanding house.
Total Cost for 600 million Euro
Saving each household €420 pa
Payback 27 years if 5% fuel inflation
The payback time is very **sensitive** to rising energy prices, behaviour of occupants and other factors influencing energy use & costs.

CARBON FOOTPRINT OF MENORCA

CARBON ACCOUNTING



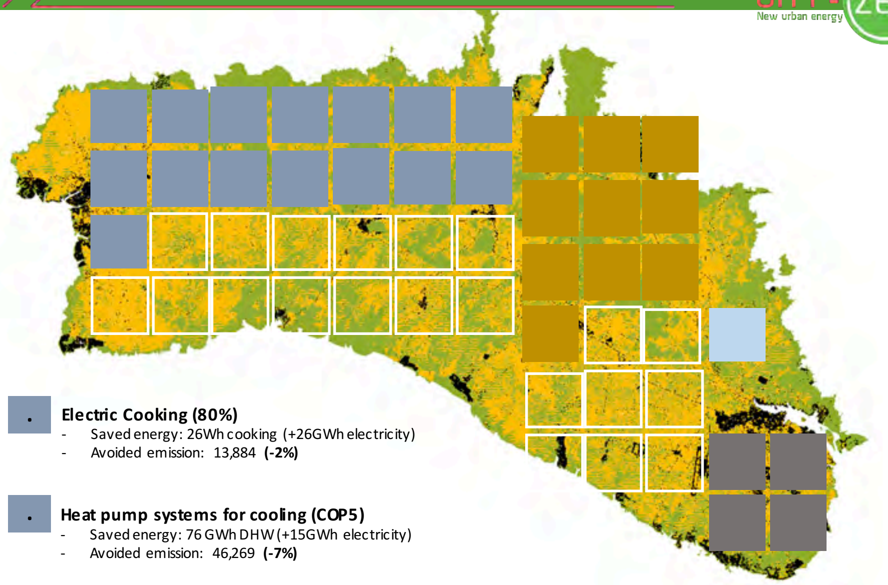
Heat pump for heating (CoP4)
- Saved energy: 55Wh heating (+14GWh electricity)
- Avoided emission: 17,751 **(-2,5%)**

Heat pumps for DHW (CoP2)
- Saved energy: 21 GWh DHW (+10GWh electricity)
- Avoided emission: 2783 **(-0,4%)**

CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

CARBON FOOTPRINT OF MENORCA

CARBON ACCOUNTING



Electric Cooking (80%)
- Saved energy: 26Wh cooking (+26GWh electricity)
- Avoided emission: 13,884 **(-2%)**

Heat pump systems for cooling (COP5)
- Saved energy: 76 GWh DHW (+15GWh electricity)
- Avoided emission: 46,269 **(-7%)**

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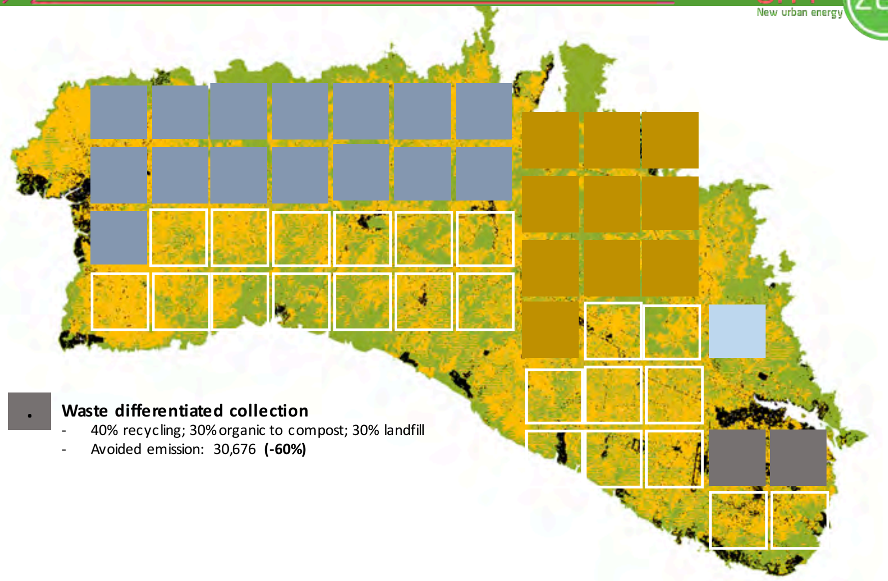
CARBON FOOTPRINT OF MENORCA

CARBON ACCOUNTING



Waste differentiated collection
- 40% recycling; 30% organic to compost; 30% landfill
- Avoided emission: 30,676 **(-60%)**

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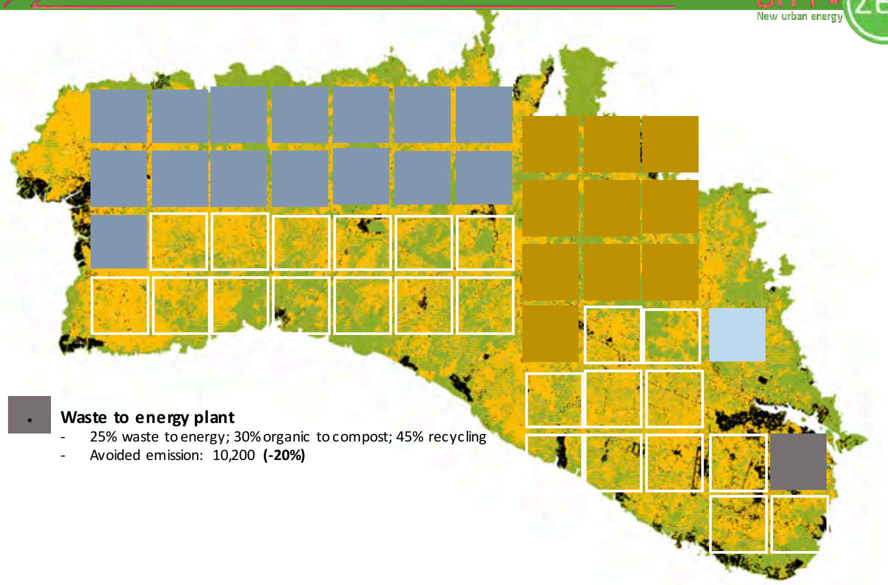
CARBON FOOTPRINT OF MENORCA

CARBON ACCOUNTING



Waste to energy plant
- 25% waste to energy; 30% organic to compost; 45% recycling
- Avoided emission: 10,200 **(-20%)**

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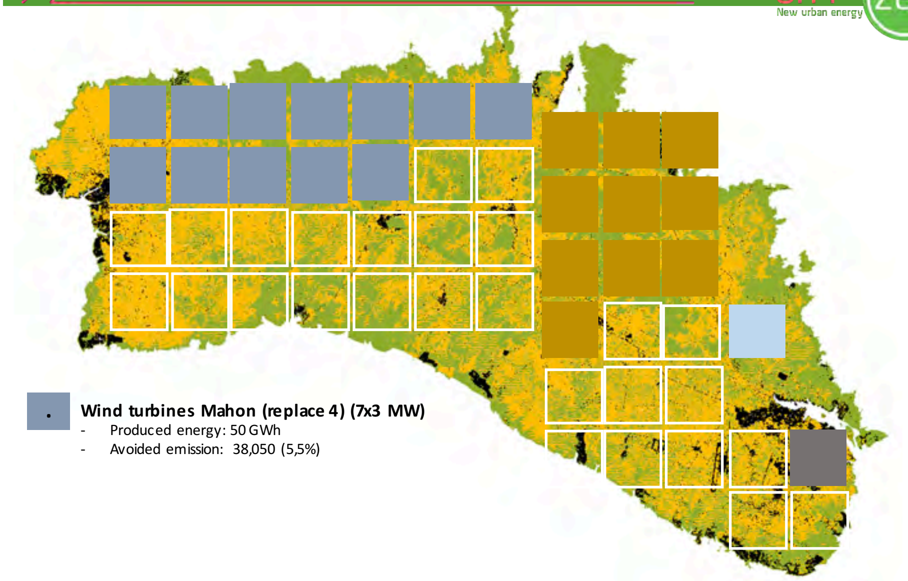
CARBON FOOTPRINT OF MENORCA

CARBON ACCOUNTING



Wind turbines Mahon (replace 4) (7x3 MW)

- Produced energy: 50 GWh
- Avoided emission: 38,050 (5,5%)

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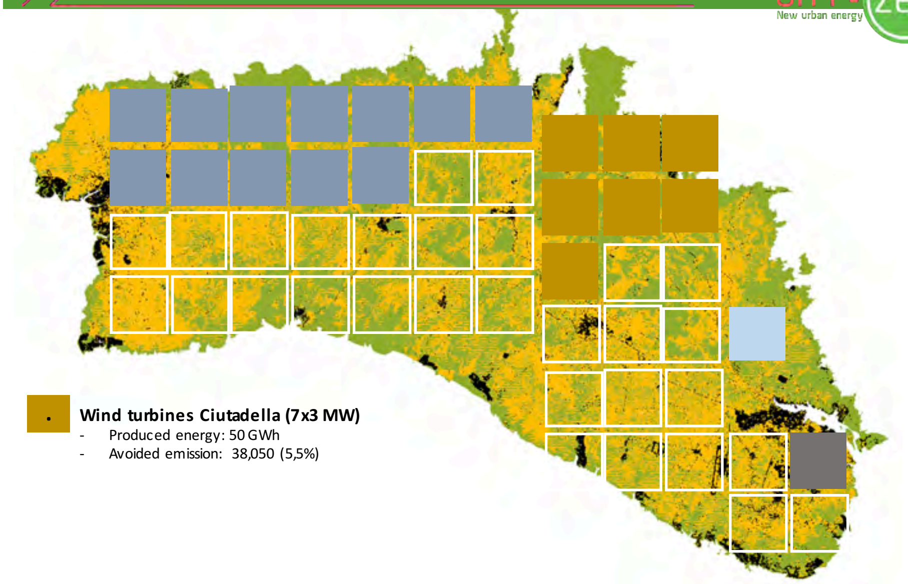
CARBON FOOTPRINT OF MENORCA

CARBON ACCOUNTING



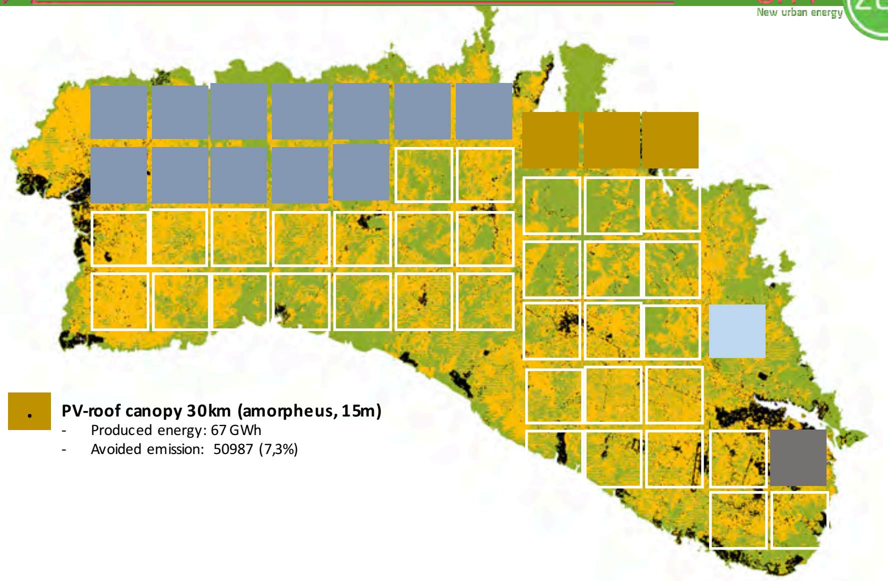
Wind turbines Ciutadella (7x3 MW)

- Produced energy: 50 GWh
- Avoided emission: 38,050 (5,5%)

CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

CARBON FOOTPRINT OF MENORCA

CARBON ACCOUNTING



PV-roof canopy 30km (amorpheus, 15m)
- Produced energy: 67 GWh
- Avoided emission: 50987 (7,3%)

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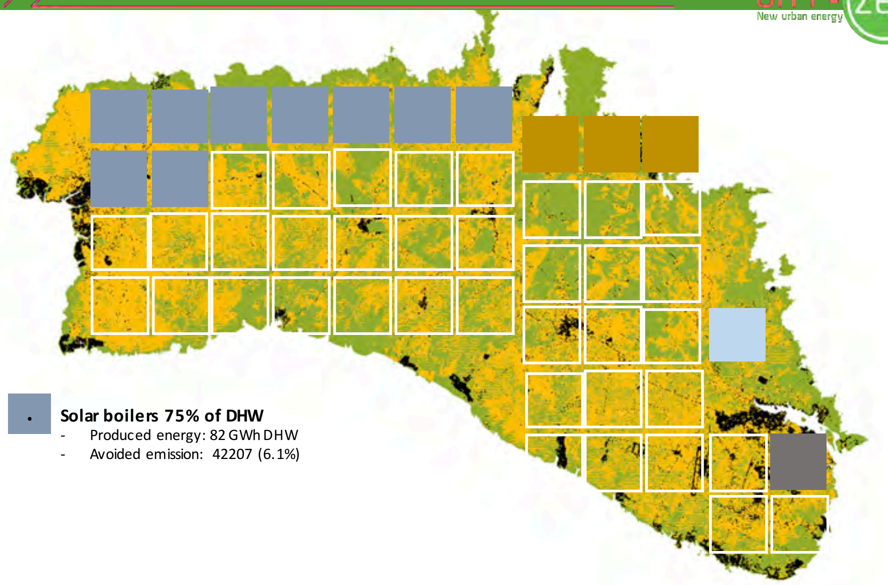
CARBON ACCOUNTING



Solar boilers 75% of DHW
- Produced energy: 82 GWh DHW
- Avoided emission: 42207 (6.1%)

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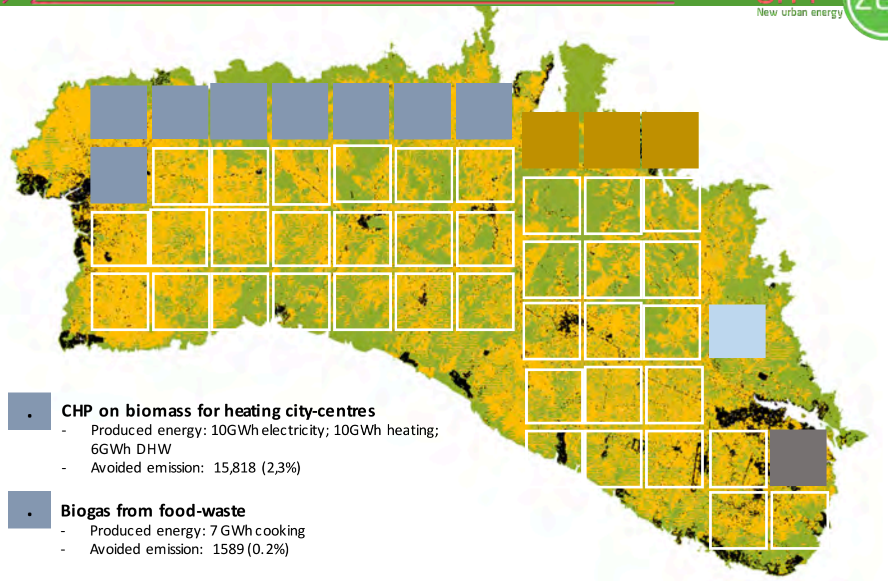
CARBON FOOTPRINT OF MENORCA

CARBON ACCOUNTING

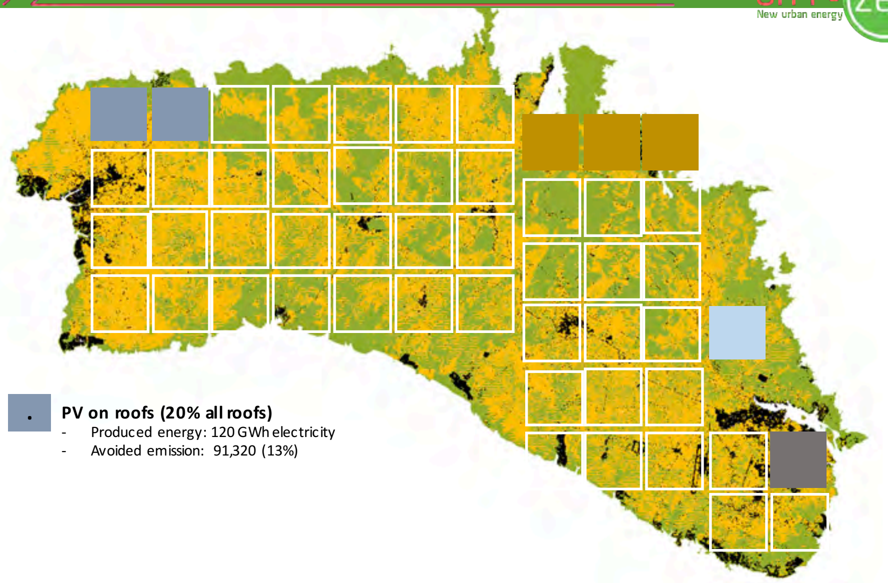


CHP on biomass for heating city-centres
- Produced energy: 10GWh electricity; 10GWh heating; 6GWh DHW
- Avoided emission: 15,818 (2,3%)

Biogas from food-waste
- Produced energy: 7 GWh cooking
- Avoided emission: 1589 (0.2%)

CARBON FOOTPRINT OF MENORCA

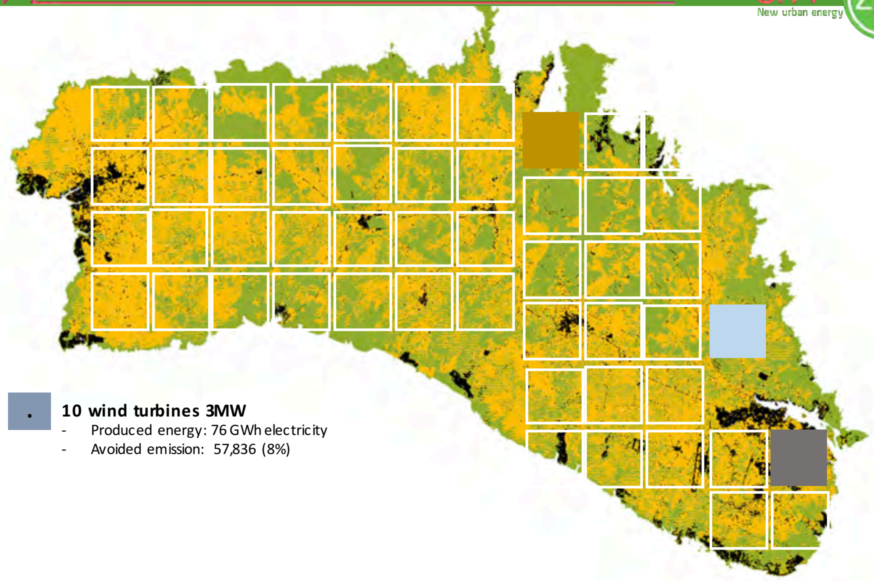
CARBON ACCOUNTING



PV on roofs (20% all roofs)
- Produced energy: 120 GWh electricity
- Avoided emission: 91,320 (13%)

CARBON FOOTPRINT OF MENORCA

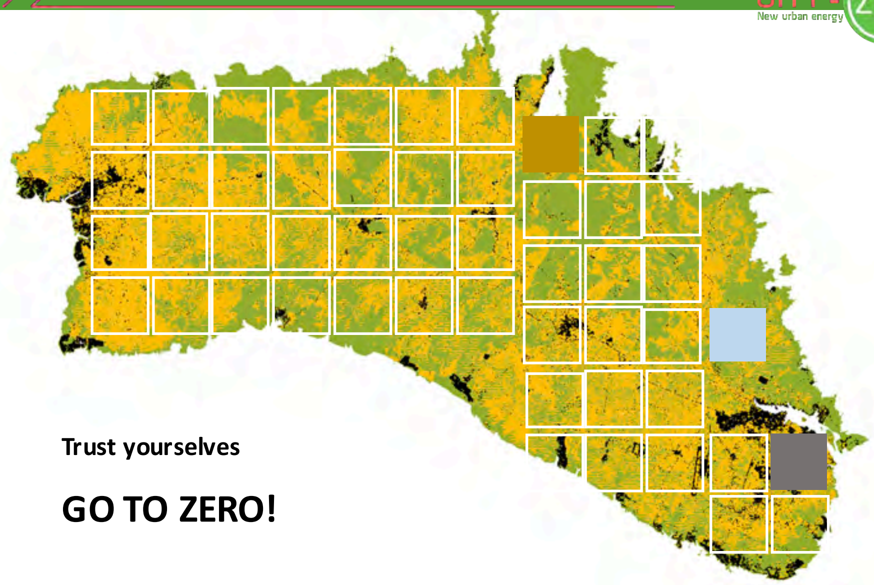
CARBON ACCOUNTING



10 wind turbines 3MW
- Produced energy: 76 GWh electricity
- Avoided emission: 57,836 (8%)

CARBON FOOTPRINT OF MENORCA

CARBON ACCOUNTING



Trust yourselves

GO TO ZERO!

CITY-ZEN ROADSHOW @ MENORCA – CARBON ACCOUNTING – RICCARDO M PULSELLI – UNIVERSITY OF SIENA

Urban Vision

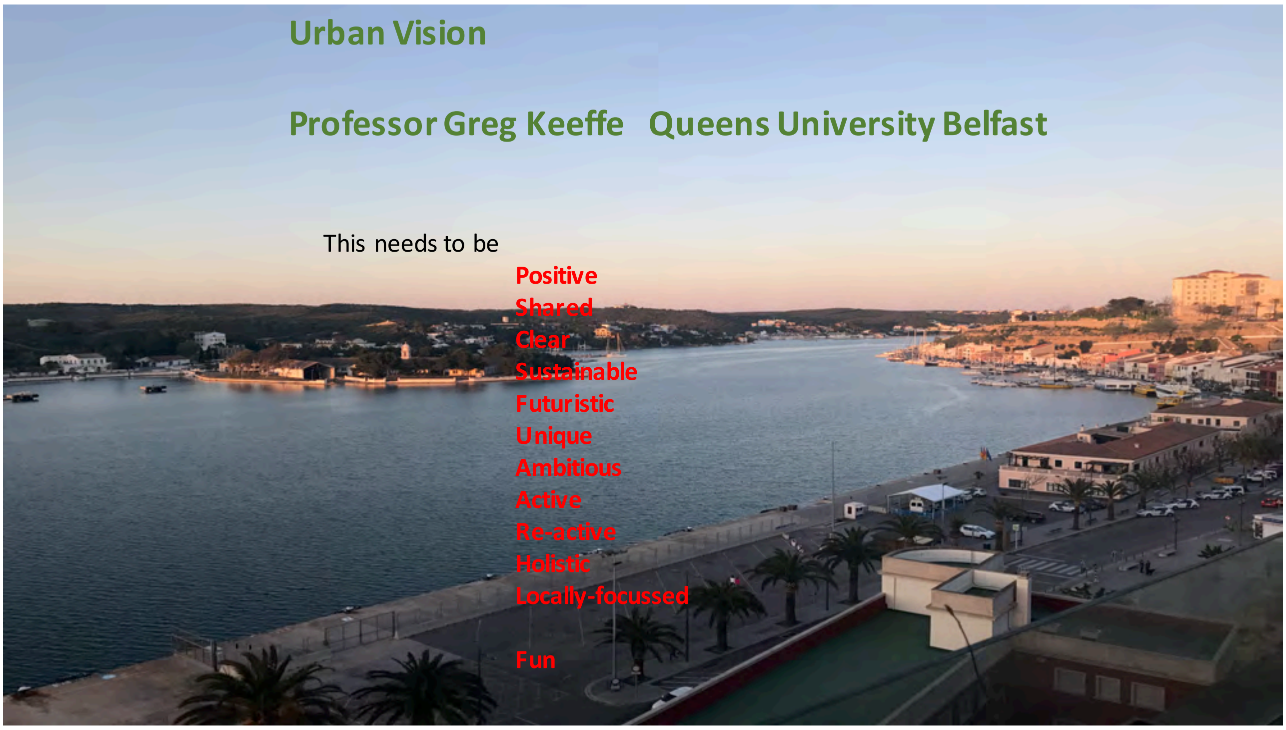
Professor Greg Keeffe Queens University Belfast

The vision

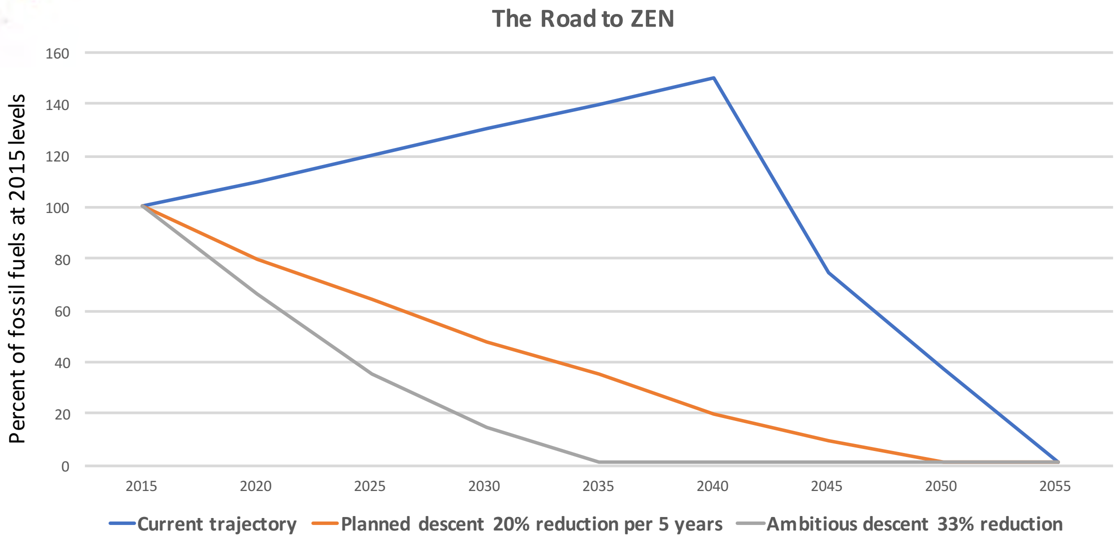
This needs to be

Positive
Shared
Clear
Sustainable
Futuristic
Unique
Ambitious
Active
Re-active
Holistic
Locally-focussed

Fun



Speed of Implementation



The city vision:

Mahon a slow city,

Confident in its future

Connected to its environment.

Car free

Sustainably powered

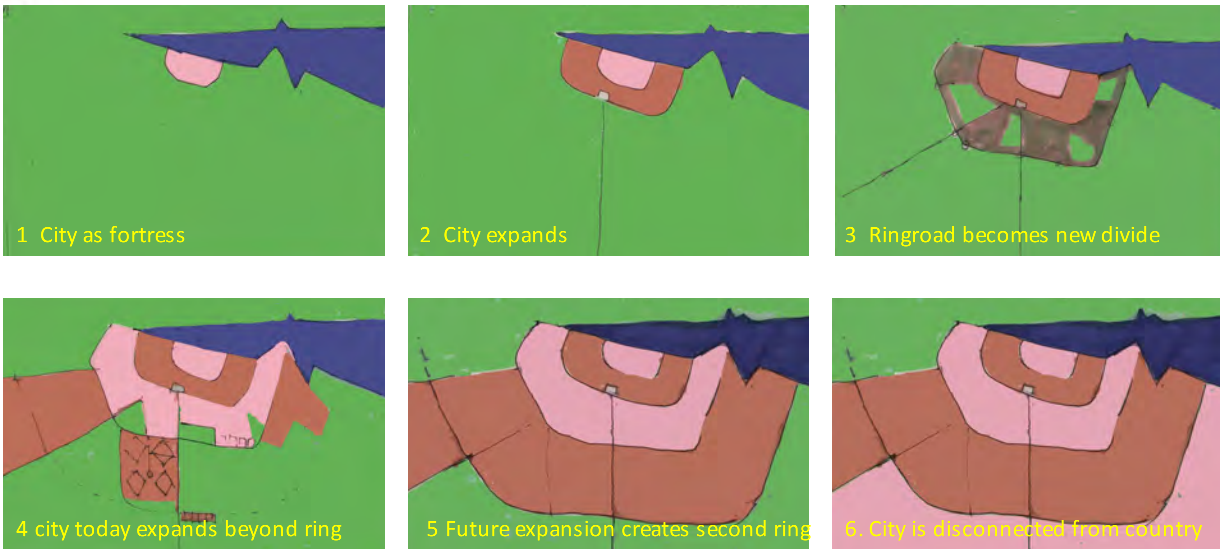
Locally focused

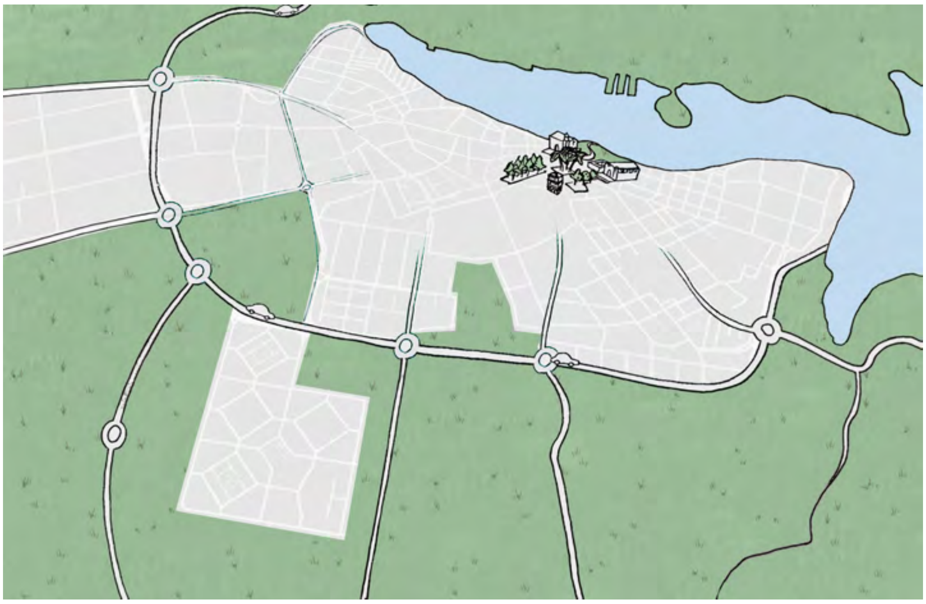
Child and older people-friendly

Biologically connected

A destination for sustainable tourism

Mahon: Historic and projected city growth





CITY-zen
New urban energy

CITY-zen
New urban energy

Long term vision –city

(Re) Connect the city with the rural landscape

Create and Protect green corridors.

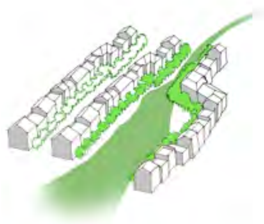
Remove cars from city centre

Create green and shaded routes inside the city for bicycles and pedestrians.

De-engineer the ring road

Allow city to grow in a structured way

new public spaces created with car parking under.

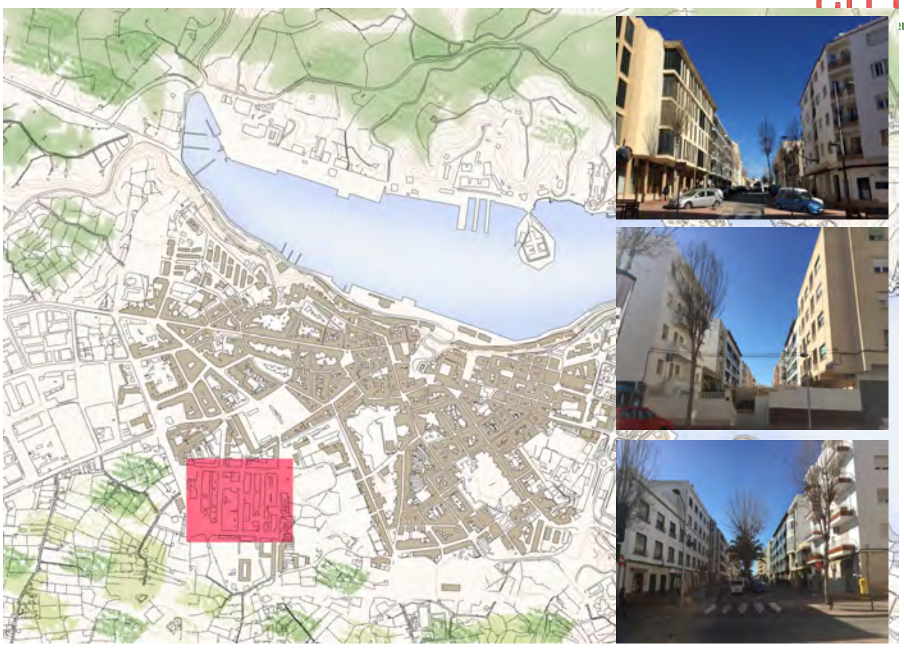


Rural space directly
accessed from the city

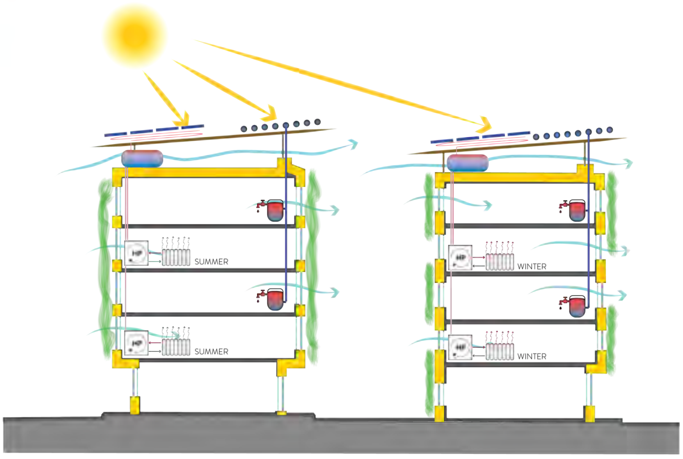
Car domination

Bicycle routes for the city

Energy strategy Mahón south

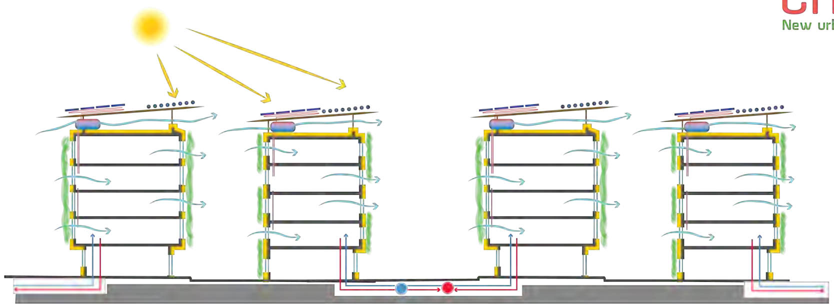


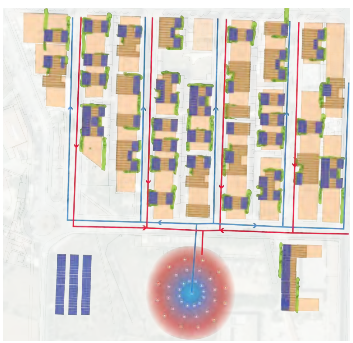
Energy measures Mahón south



- **Insulation of roofs/walls/glazing**
  - Reduction of heating demand: 50%
  - Reduction of cooling demand: 25%
- **Tropical roof & greening the building**
  - Reduction of cooling demand: 20%
- **Solar boilers for hot water**
  - Reduction of DHW: 80%
- **Installation of low-temperature radiators +heat pumps**
  - Reduction heating 75%
  - Reduction cooling 60%
- **PV-thermal roof**
  - Reduction electricity 35%
  - Reduction of heating 20%

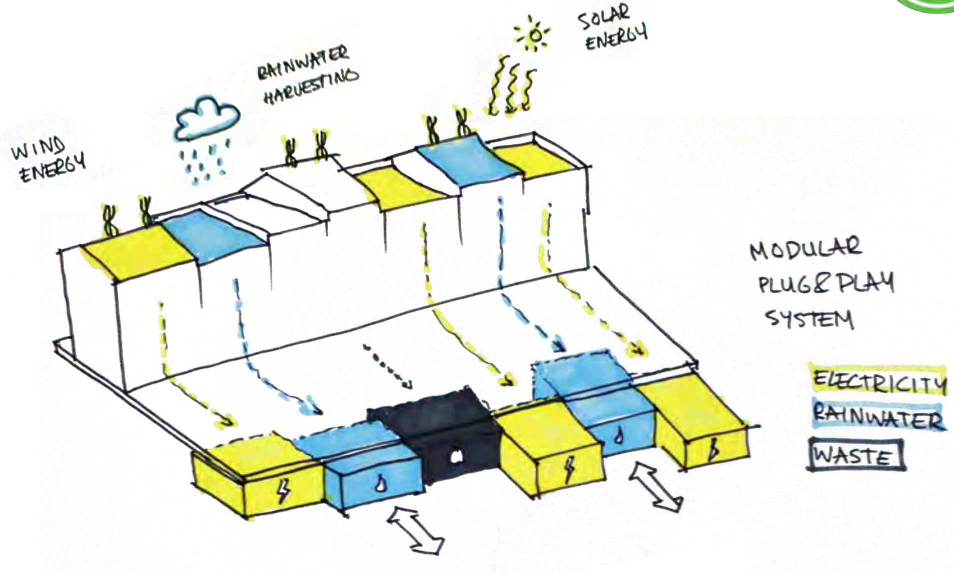
Energy measures



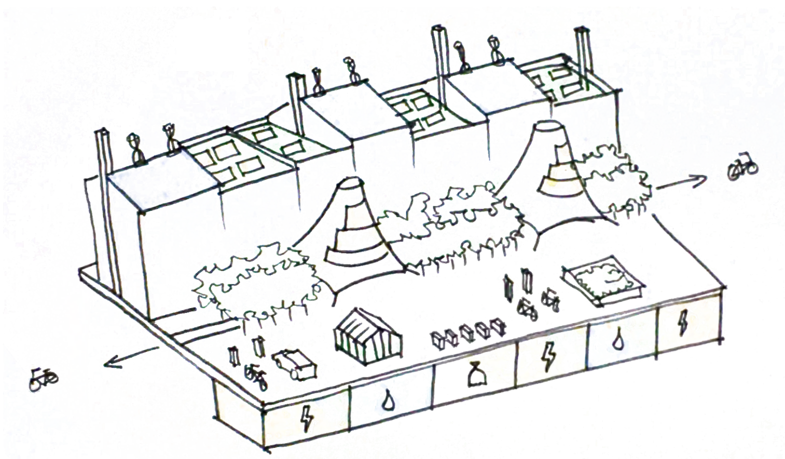


- **Connection to low temperature heat-cold grid with seasonal storage (boreholes)**
  - Reduction of heating demand: 35%
  - Reduction of cooling demand: 90%
- **Total reduction energy consumption neighbourhood**
  - 70%

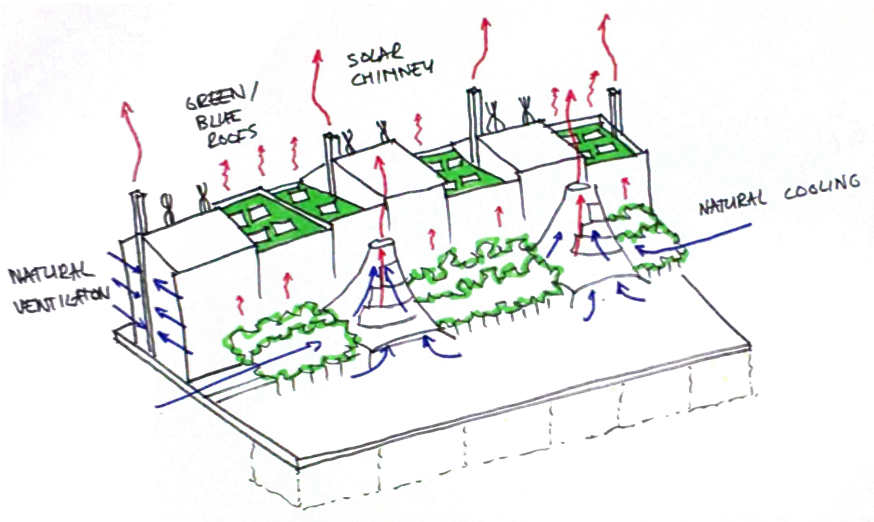
CITY-zen New urban energy



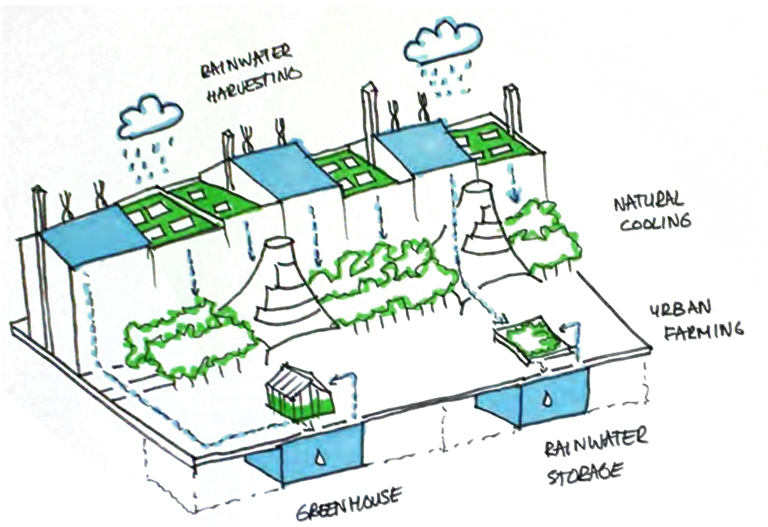
CITY-zen New urban energy



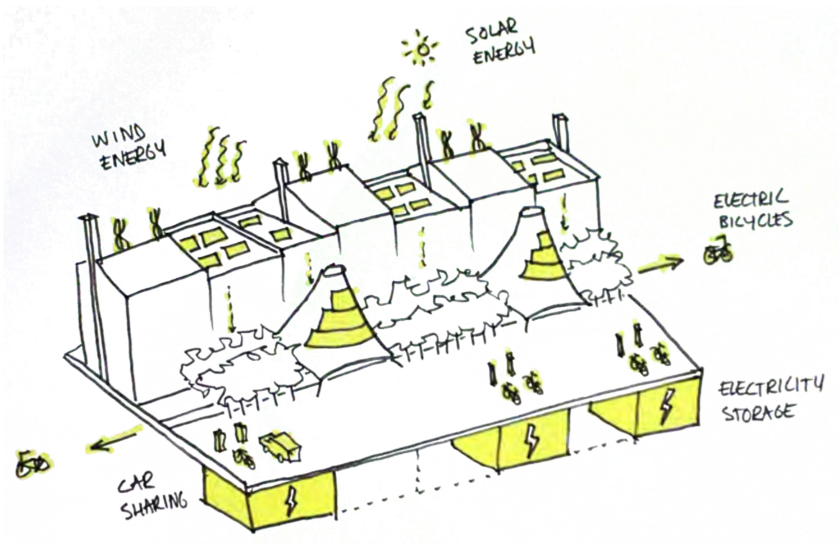
CITY-zen New urban energy



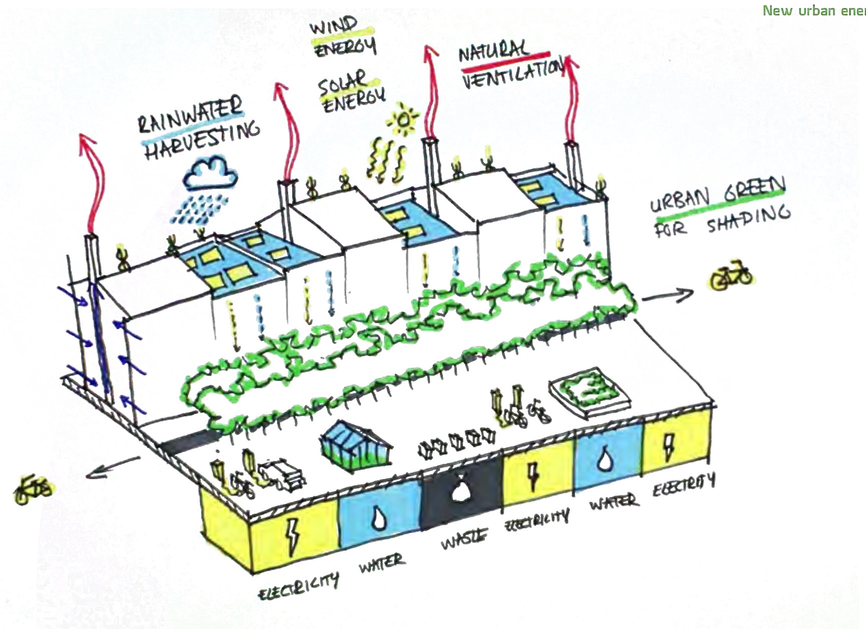
CITY-zen New urban energy



CITY-zen New urban energy



CITY-zen New urban energy

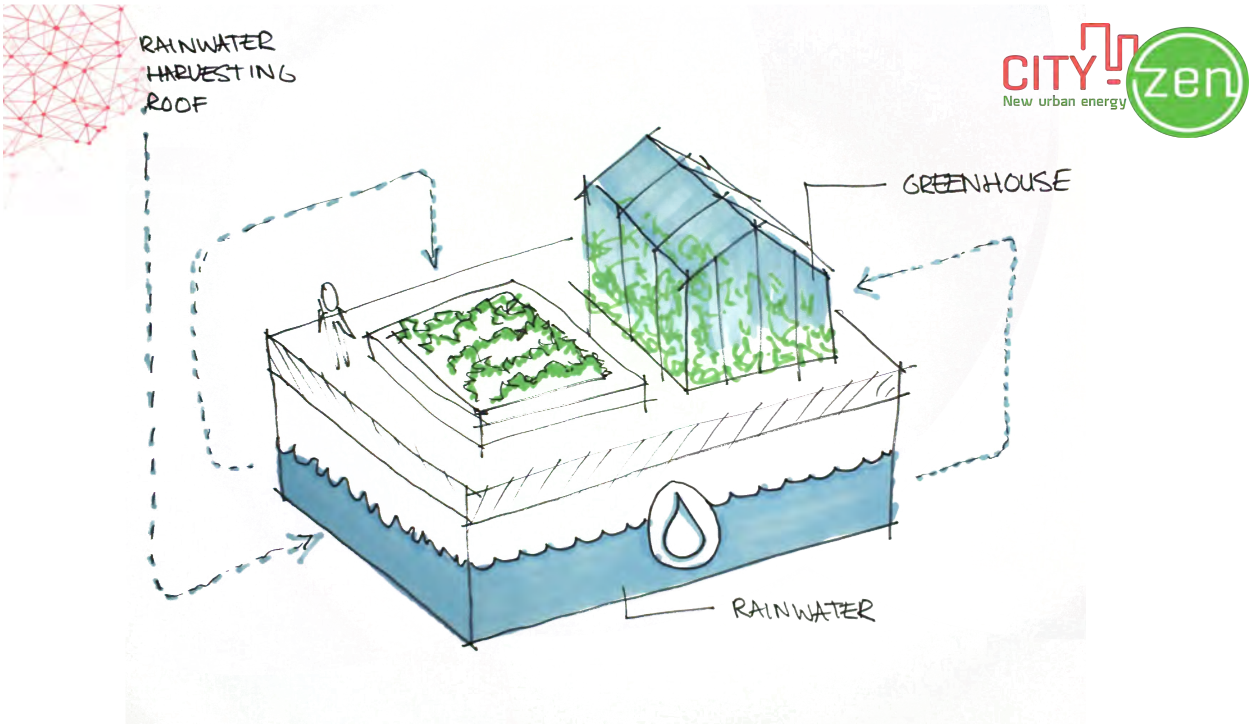


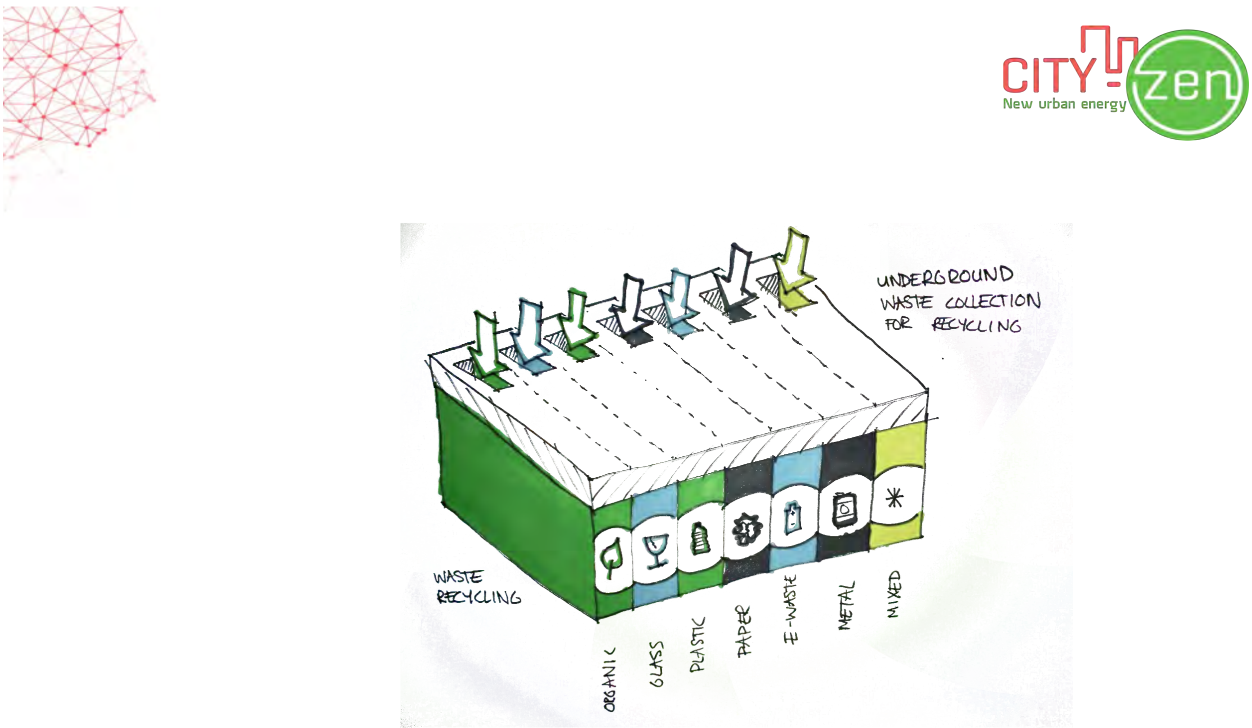
CITY zen
New urban energy

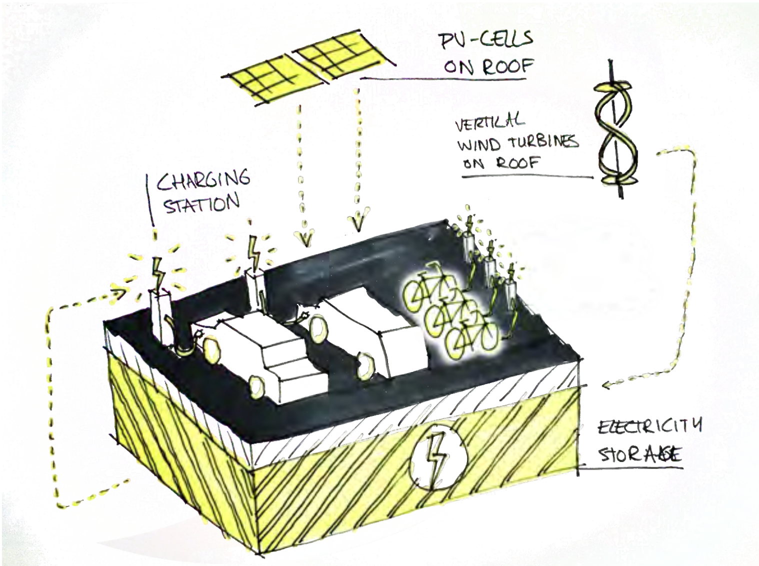
CITY zen
New urban energy

Passive cooling strategy for apartment blocks using ground cooling and solar chimneys

Option 2b. Ground cooling with solar assisted extract

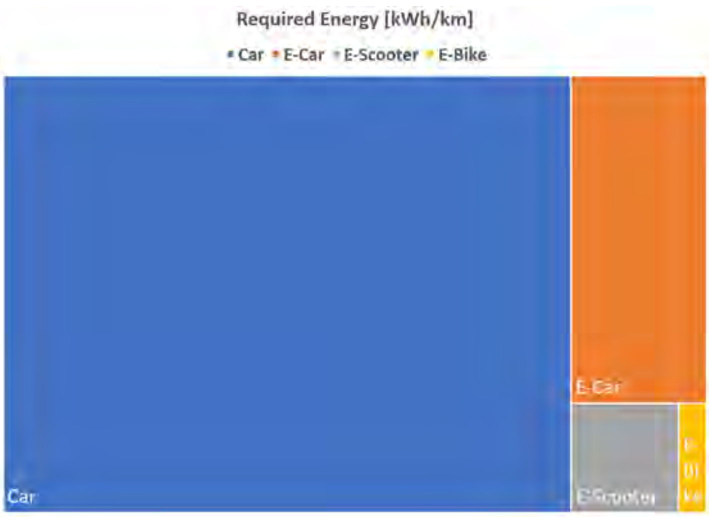

RAINWATER
HARVESTING
ROOF
GREENHOUSE
RAINWATER


UNDERGROUND
WASTE COLLECTION
FOR RECYCLING
WASTE
RECYCLING
ORGANIC
GLASS
PLASTIC
PAPER
E-WASTE
METAL
MIXED



Electric mobility

Not all vehicles are equal



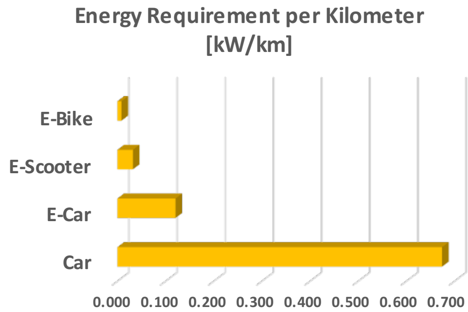
Issues & Solutions

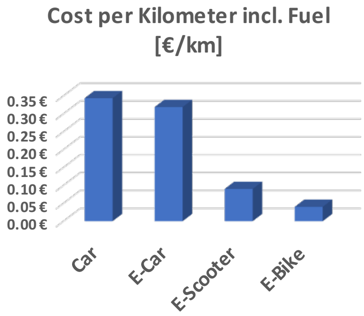
Cars are used for short distances

Use E-Bikes / E-Scooters

High EV Investment cost

Use Leasing (incl. fuel)

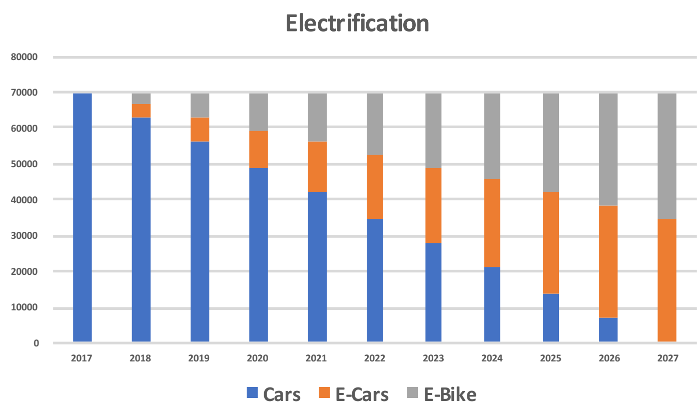




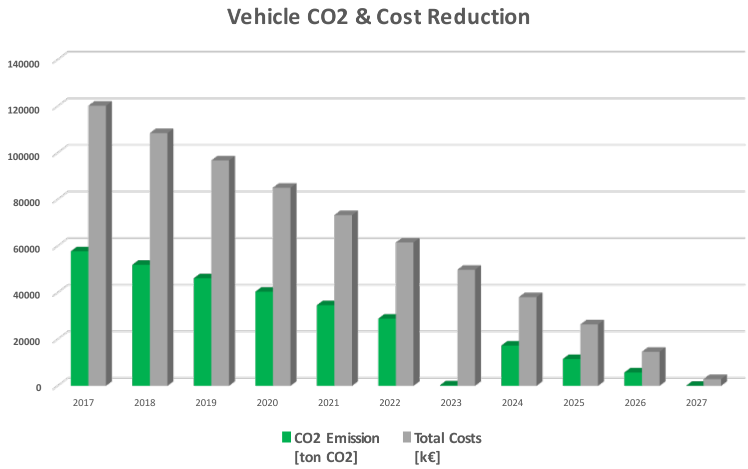
Electric mobility

Every year: replace 10% of cars by electric vehicles

50% E-Bikes & 50% E-Cars



Electric Mobility



Cost of Renewable energy

Residential PV Installation (< 10kWp) : 1,012 € / kWh
= Revenue for local installers

Industrial PV Installation (> 10kWp) : 0,812 € / kWh

E-Cars (leased): 0,32 € / km

E-Bikes (leased): 0,04 € / km

Wind turbines

Large scale 1,230 € /kWh


Conclusions
CITY-zen
New urban energy
Shared vision for the island
Holistic
Ambitious
Confident
Be pro-active
Begin today
Have a development plan for the city re urban design
Local focus.
Use the expertise you have
Invest in local businesses
No more Fossil fuel investment
Spend monies on energy conservation
Develop expertise in passive heating and cooling
Invest in renewables
Develop smart grids
If in doubt, cover roofs with Photovoltaics!!


Zero energy Menorca
CITY-zen
New urban energy
Set yourselves up as living laboratory as soon as you can.
Make your own Roadmap
Start immediately
You can do it!!


ISLA
SOSTENIBLE
'MENORCA'
ROADSHOW
(24th – 28th Apr)
CITY-zen
New urban energy
Muchas gracias!
For more information please contact:
Dr Craig L. Martin (c.l.martin@tudelft.nl) Roadshow Leader
Jesús Cardona(jcardona@nontropia.com) Menorca Roadshow Coordinator
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RESERVA DE BIOSFERA
MENORCA TALAIÒTI
CONSELL INSULAR
DE MENORCA