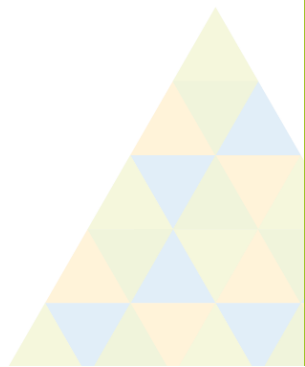



# CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES





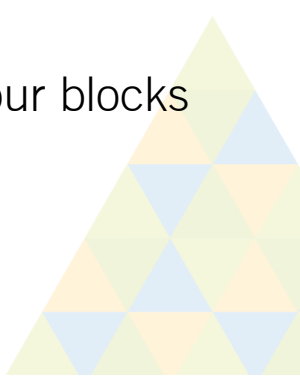
Good morning I am Margarita Arjona partner of the consulting firm "**trinomio construction-efficiency-environment**".

We are a multidisciplinary team led by PMP® and we are based in Seville in (South of Spain).

We manage and develop **low carbon and low environmental impact projects** in three areas:


nZEB & Sustainable Urban Planning  
Energy Efficiency & Climate Change  
Environmental Engineering

Today we are going to use **examples (problem+solutions)** to propose four blocks of measures that are currently being implemented by Spanish Local Administrations.

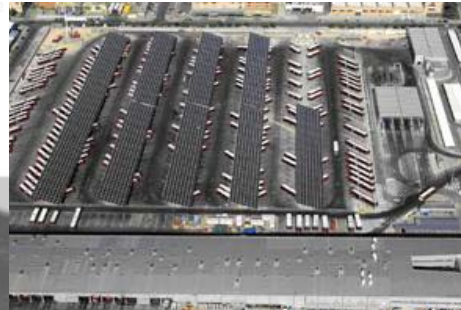
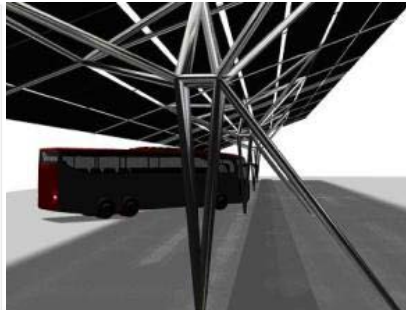
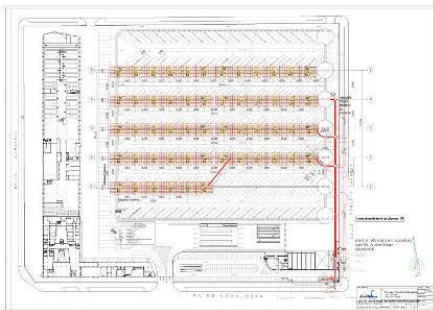




## EXTERNAL ENERGY DEPENDENCE ON FOSSIL FUELS AND HIGH GREENHOUSE GAS EMISSIONS

- ✓ Energy dependence over 70% . 53.5% for EU countries
  - ✓ Imports over 50.000 M€/year
  - ✓ Tariff Deficit of more than 25,000 M€
  - ✓ Inefficiency and high energy prices
  - ✓ Energy Poverty Growth
- 
- ✓ **MOST USED RENEWABLE ENERGIES IN SOUTHERN SPAIN:**
  - ✓ **Solar thermal energy** for DHW production, is increasingly used in homes and residential buildings since 2006 (Building Regulations CTE approval).
- 

- ✓ Most solar cells are made of [cadmium chloride](#), which is very expensive and toxic material. Other materials such as magnesium chloride (harmless and present in the sea) are currently being investigated.
- ✓ **Solar photovoltaic energy. Tussoenergia Project (2008):**
  - ✓ The Sevillian Company called Tussam, manages the city's bus and tram services. Tussam launched Tussoenergia Project:
  - ✓ Solar Photovoltaic Plant of 1.800 Kw.
  - ✓ System of canopies and photovoltaic panels that provide shade for 60.000 m<sup>2</sup> of parking space, as well as generating electricity to discharge to the grid.
  - ✓ It will mean a reduction of 16.537 tons of CO<sub>2</sub> over next 25 years.



# SolarRoof Project: Characterization and implementation of a GIS for improvement the integration of PV panels in urban areas

**Objective:** to evaluate photovoltaic solar on rooftops and urban spaces

**Entity:** CIEMAT and Polytechnic University of Madrid

**Estimated parameters:**

- o Rooftop area available for solar energy
- o Power (Kw)
- o Energy generated per year

**Example: Alpedrete (Madrid):**

Evaluation of 4,053 buildings, 25 municipally-owned buildings

**Results:**

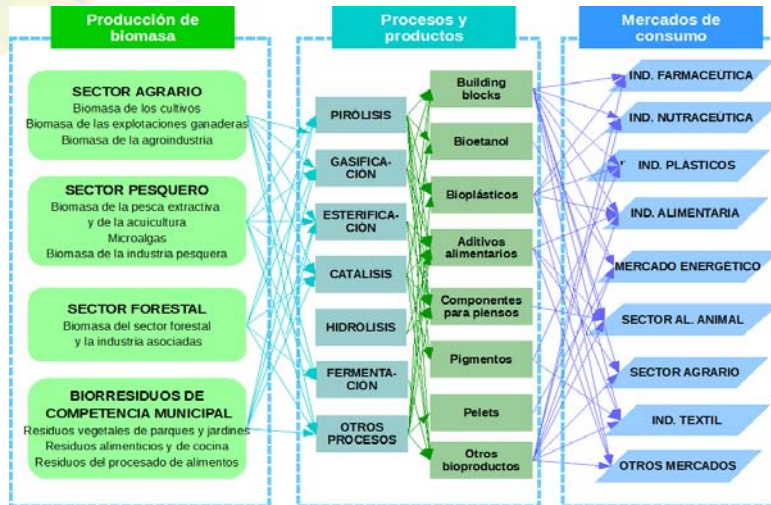
o 92% of buildings have sufficient surface area for solar photovoltaic energy

o 97% of buildings have enough surface area for solar thermal energy



Módulos Fotovoltaicos (Silicio Multicristalino)	
Número de edificios analizados <sup>5</sup>	4.053
Superficie total construida	698.677 m <sup>2</sup>
Número edificios con superficie disponible	3.656
Superficie disponible	186.903 m <sup>2</sup>
Potencia disponible	23 MWp
Energía disponible	33 GWh
Emisiones evitadas de CO <sub>2</sub> <sup>6</sup>	21.417 T
Colectores Solares Térmicos (Placa Plana)	
Número de edificios de viviendas analizados	3.746
Superficie total construida	573.895 m <sup>2</sup>
Número edificios con superficie disponible	3.412
Superficie disponible	135.214 m <sup>2</sup>
Energía disponible	100 GWh
Emisiones evitadas de CO <sub>2</sub> <sup>7</sup>	20.400 T

## Biomass is taking on a key role



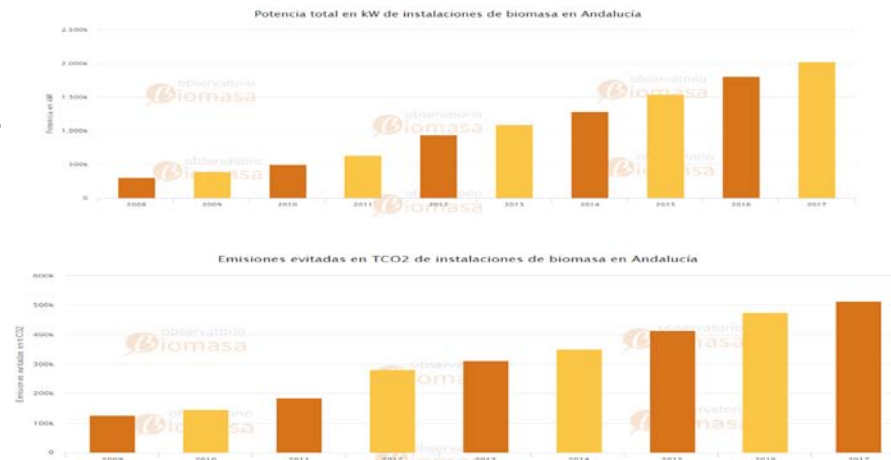
This is why it is being incorporated into the "Bioeconomics Strategies".

The origin of biomass is very diverse: agricultural, forestry, fishing and urban waste.

Biomass can be used for the production of thermal and electrical energy.

According to data from National Observatory of Biomass Boilers (AVEBIOM):

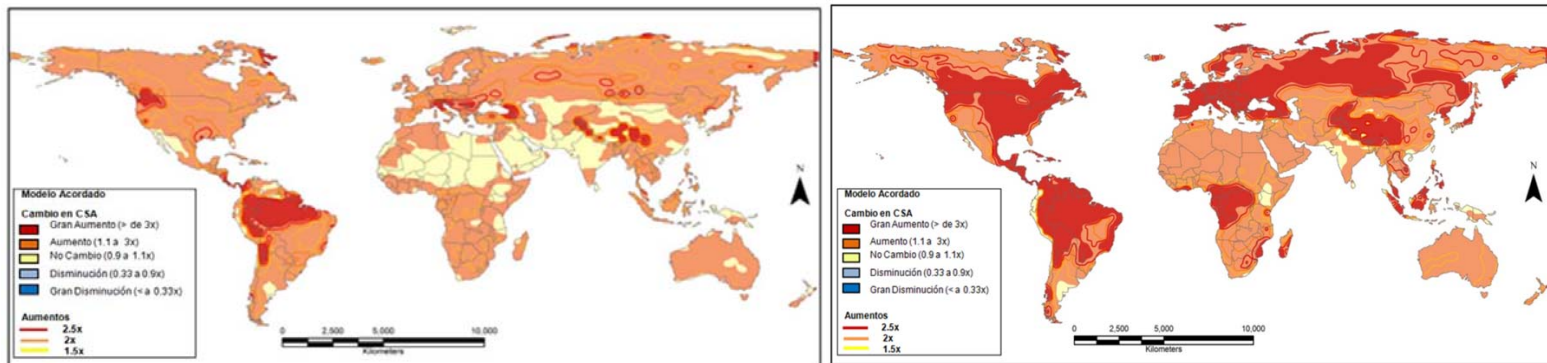
The use of biomass for production of heating is increasingly frequent in Spain.



## Forest biomass

Forest biomass has the following benefits related to climate change mitigation strategies:

- ✓ **Forest mass act as carbon sinks**
- ✓ **Forest management reduces the risk of fire.** This is very important because they will increase:
  - Fire season (number of months)
  - Frequency and intensity of fires
  - Burnt surface area



Fuente: "El Cambio Climático y los Incendios Forestales" (2012) William J. de Groot, Michael D. Flannigan, y Brian J. Stocks

In Southern Spain, forest biomass heating could be promoted even more because:

- ✓ **There is a very large area of forest mass.**
- ✓ **Part of the mountains are property of councils.**
- ✓ **There is a close relationship between councils and citizens.**



## Example: Soria

- Spanish largest grid system (18 MW and 28 km of pipelines)
- Biomass consumption: 16,000 t/year
- Capacity: 150 Tn
- Current customers: 8,000/ Potential customers: 16,000
- Users: homeowners associations, schools, hospitals, nursing homes, sports and public buildings



### El district heating urbano con biomasa más extenso de España

4 de junio de 2020 10:30 AM 11 de junio de 2020 11:12



La red de calor urbano con biomasa más extensa de España hasta la fecha tiene 18 MW y 28 km de tuberías y está en Soria. El district heating que consume 16.000 t/año de biomasa y cubre 2ª fase alcanzará a finales de 2020. Ha recibido un premio ENERGA 2019 y se ha conectado en un momento a centros de otros municipios.

HEMS - ACTUALIDAD SUCESOS PORTADA

### Alcalá de Henares contará con un sistema de District Heating híbrido biomasa y termosolar en 2021

Lucía Gila - 17/06/2020



## Example: Alcalá de Henares (Madrid)

- Future District Heating (**biomass and solar thermal**) in 2021
- Socio-economic and environmental benefits:
  - Reduction of 32,000 tons of CO2 per year
  - 25% savings on energy bills
  - Creation of 50 permanent and more than 100 temporary jobs during the construction work





# District Heating in Small Councils from Southern Spain

## Huétor Tajar (Granada)

- Current population (2017): 10.236 residents
- Installed power: 750 KW
- Biomass: olive stone
- Service: DHW heated swimming pool and heating in municipally-owned buildings



## Monterrubio de la Serena (Badajoz)

- Current population (2017): 2.463 inhabitants
- Main economic activity: Agricultural industry
- Installed power: 375 KW
- Biomass: local olive stone
- Service: DHW heated swimming pool and heating in municipally-owned buildings
- Economic saving: 14.000€/year
- Reduction of CO2 emissions/year: 55,31 tons



## EXPECTED IMPACTS OF CHANGES IN PRECIPITATION AND TEMPERATURE PATTERNS. DESERTIFICATION

- 1) Decrease in water resources
- 2) Increase in drought
- 3) Heat islands in cities

AUMENTO DE LA TEMPERATURA MÁXIMA ( °C )	AUMENTO DE DURACIÓN OLAS DE CALOR (DÍAS)	CAMBIO DE PRECIPITACIONES (%)	AUMENTO DE LA TEMPERATURA MÍNIMA EN (°C)
Entre 2,5 y 5,5	Entre 5 Y 25	Entre -5 y -15	Entre 2 y 4,5

Regionalised Climate Projections to 2080 for Andalusia in AR5 Stages (RCP 8.5, 6.0 and 4.5), AEMET (Spanish Weather Agency)



Considering the mains problems of lack of water resources and increase in drought

WHAT CAN WE DO IN URBAN GREEN AREAS ?



# Xerogardening

## ➤ Definition:

Water efficient gardening (Burés S.). It does not consist on the exclusive use of cactus or other succulent plants over cobbled land (Sánchez Lorenzo).

There are a large number of plant species to incorporate.

## ➤ Origin:

It was born in the second half of 20th century in the USA, after a drought period in California, Texas, Arizona and Florida in the USA.



## ➤ Principles (7)

Established by the National Xeriscape Council of the USA:

Proper planning and design

Soil study

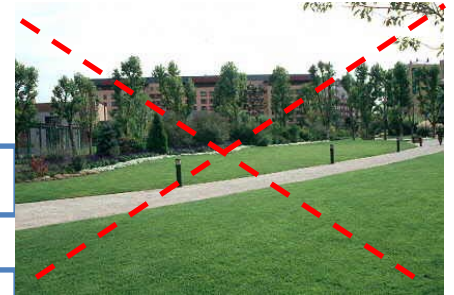
**Selection of plant species**

**Reduction of grass areas**

Efficient irrigation systems

**Soil protection by mulching**

Proper maintenance





## Example of xero-gardening: Mijas Public Green Areas

- **Problem:** High lawn water consumption
- **Objective:** Progressive grass removal and implementation of xero-gardening
- **Replicated example:** Fuerteventura (Canary Islands), one of the Spanish Councils with more know-how



**AYUNTAMIENTO DE MIJAS**

<b>Tu Ayuntamiento</b> Información sobre el Consistorio	<b>Trámites</b> Realiza todo tipo de Trámites Municipales	<b>Participación</b> Participación Ciudadana	<b>Servicios</b> Servicios Municipales	<b>Transparencia</b> Índices de Transparencia	<b>Sede Electrónica</b> Gestiones 24 hrs. con Certificado Digital
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<b>Conoce Mijas</b>	<b>Fomento del Empleo</b>	<b>Atención Ciudadana</b>
<b>Deportes</b>	<b>Educación</b>	<b>Extranjeros</b>
<b>Juventud</b>	<b>Cultura</b>	<b>Urbanismo</b>

Mijas apuesta por la progresiva implantación de la xerojardinería como solución sostenible



Xerojardinería

<b>Otros enlaces de interés</b>
<a href="#">Noticias</a>
<a href="#">Transportes</a>
<a href="#">Certificado Digital</a>
<a href="#">Patrimonio Histórico</a>
<a href="#">Subasta Pública</a>
<a href="#">Pago de Impuestos</a>
<a href="#">Teléfonos de Interés</a>
<a href="#">Otras webs de Interés</a>
<a href="#">Renta Social Básica</a>
<a href="#">Normativas</a>
<a href="#">Video Acta</a>
<a href="#">Perfil del contratante</a>
<a href="#">Ocio, diversión y actividades</a>
<a href="#">Festividades</a>



## Example of xero-gardening: “The Garden of Cigarettes” Seville (Nuun Consulting)



“...Rafael Lario (one of the architects):

*It has been designed as an environmentally friendly space with proposals that contribute to its better maintenance:*

*xero-gardening*

*study of water circuits to make the most of water resources*

(Source: Culture of Seville)

# R+D+i Project "Sustainable Plant Barriers for Acoustic Mitigation and CO2 Compensation in Transport Routes with Telematic Monitoring"

➤ **Holder:** Construction Agency of Andalusian Civil Works and Housing Department

➤ **Research entity:** University of Almeria  
(16/04/12 to 01/07/14)

➤ **Regulations:** Environmental and Energy Sustainability Objectives of Andalusian Transport and Infrastructure Network

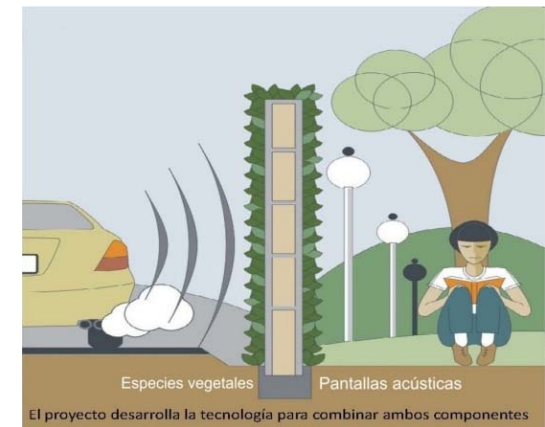
➤ **Main project data**  
"Three-dimensional structure of a sustainable green roof"  
(Patent of the University of Almeria P20091772)

Urban road network and close to habited areas

Hydroponic cultivation and xero-Gardening

Recycled materials (circular economy)

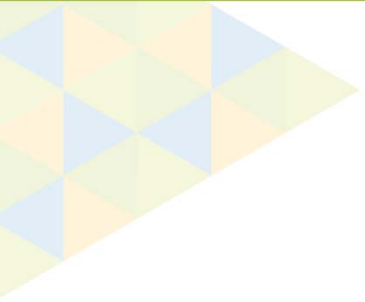
Intelligent irrigation system



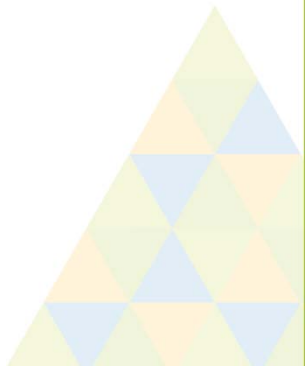
## ➤ Benefits:

- CO<sub>2</sub> capture: 10-40 gr m<sup>2</sup>/day
- Improves air quality (reduces dust and solid particles of road traffic)
- Improving the quality of urban landscape
- Improved acoustic comfort





WHAT OTHER ACTIONS ARE USEFUL?



# Water reuse for garden irrigation and road cleaning in Chiclana de la Frontera (Cádiz)

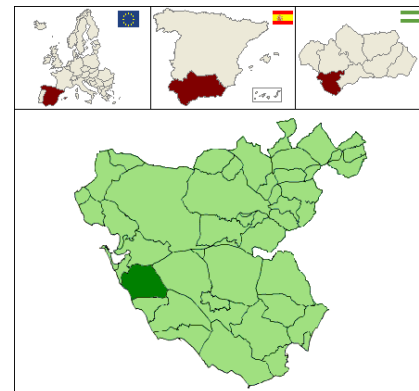
The city of Chiclana has two treatment plants: El Torno and La Barrosa.

**Natural Chiclana** it's a municipally-owned company dedicated to water management, waste management and environmental care.

- It is working on the modernization and continuous improvement of the wastewater treatment processes of both WWTPs.
- The treatments carried out in both plants allow the water to be reused for other uses in compliance with regulations (ROYAL DECREE 1620/2007)
- Currently, the "LA BARROSA" WWTP is used for the following purposes:
  - Irrigation of golf courses of the Sancti Petri tourist area
  - Irrigation of parks and gardens
  - Street cleaning



EDAR LA BARROSA





## Water reuse for farming and urban use in the Vega Baja region (Alicante)

EDUARDO DE GEA • Alicante 12 AGO. 2018 08:24



Panorámica de la depuradora de Rojales, una de las afectadas. / EL MUNDO

12/08/18: "Approval of tertiary treatment for all the treatment plants in the La Vega Baja Region (Alicante) to combat drought"

The **scarcity and poor quality of water** used in **agriculture** in **Southern Alicante Region** has been constant since decades.

Among the measures approved is the **adaptation of the wastewater treatment plants (WWTP)** for **tertiary water treatment**.

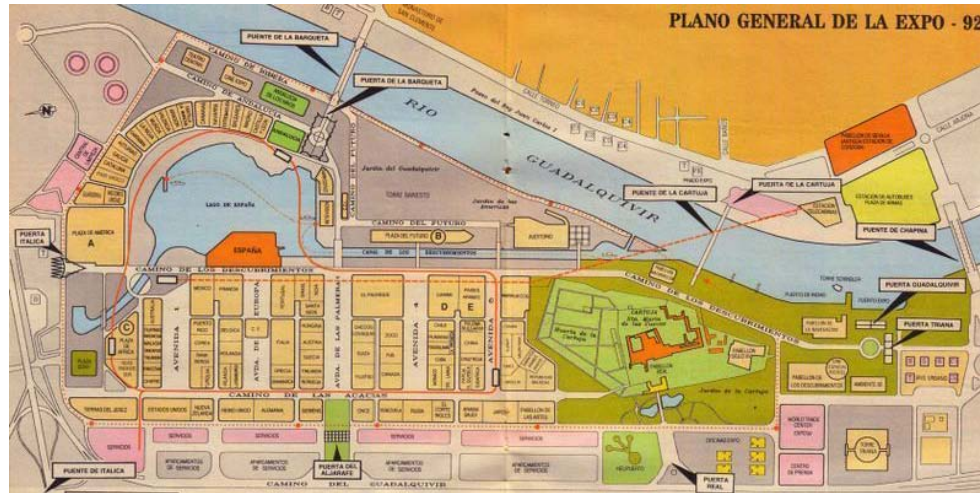




WHAT CAN WE DO TO MITIGATE HEAT ISLANDS IN CITIES OF WARM CLIMATES?



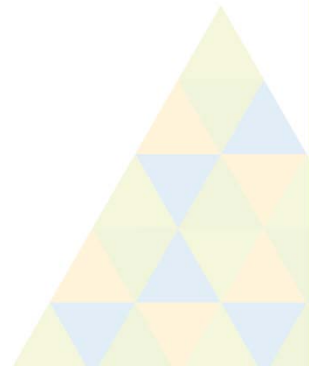
## Green areas and water in public spaces. 1992 Sevillian Universal Exhibition



It was held on **Cartuja Island**, and it is an **example of microclimate in public spaces that looked for the well-being of visitors during the hottest months of the year.**

Servando Álvarez's team of engineers studied the best way to combat the sun and heat by applying: **age-old passive air conditioning techniques** and **state-of-the-art technology.** They were inspired by the Andalusian Arab Courtyards.

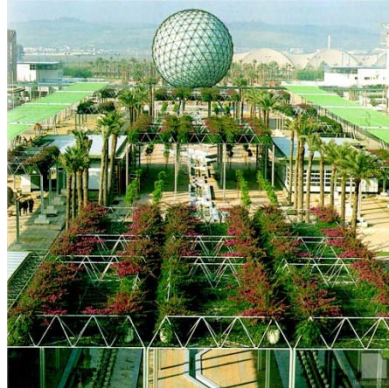
Examples of Andalusian Arab patios  
(Alhambra, Royal Alcaceres of Seville,  
Cordoban Courtyards)





## What did they actually do?

- The air currents were conveniently contained by street furniture. They studied and created air circulation maps of Cartuja Island.
- They blocked solar radiation in certain areas through green canopies. In these shaded areas the soil is as cold as the forest floor.

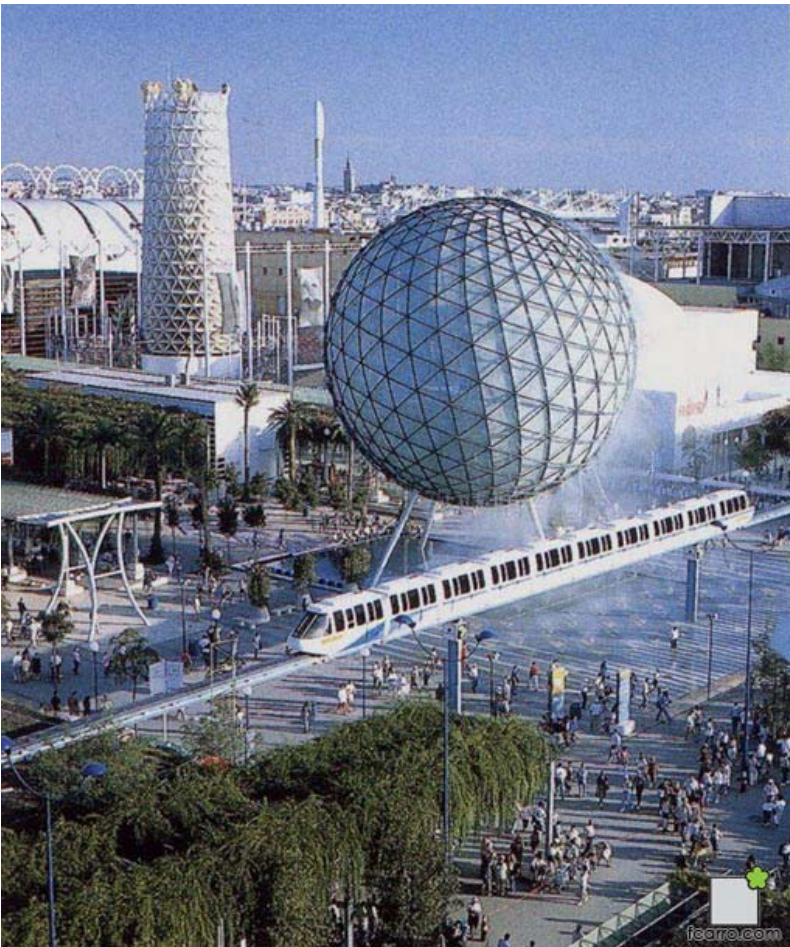


- They cooled surfaces with walls of water.





- They cooled air by evaporative cooling systems (Expo sphere, cold towers, water sheets)






## OLD AND ENERGY INEFFICIENT SPANISH RESIDENTIAL PARK

In the European Union, buildings consume 40% of final energy and emit 36% of carbon dioxide emissions.

Almost 58% Spanish Buildings were built before the first regulation with energy efficiency criteria in Spain (1980). Approximately 21% are over 50 years old.

### nZEB. Passivhaus and EnerPHit

- ✓ Standard Passivhaus has already been explained in previous webinars.
  - ✓ Passive House is for new buildings and EnerPHit is for building renovations.
  - ✓ Both are a perfect complement to LEED and BREEAM certifications in ENERGY AREA.
- 



## nZEB . Passivhaus in Spanish Urban Planning:

Villamediana de Iregua (La Rioja) approved on 17/June/2013 the first Spanish Urban Planning that includes the Passivhaus Standard:

All public buildings must be constructed according to the Passivhaus Standard

10% new developments must be passivahus. As an incentive, the buildability has been increased to compensate the extra cost.

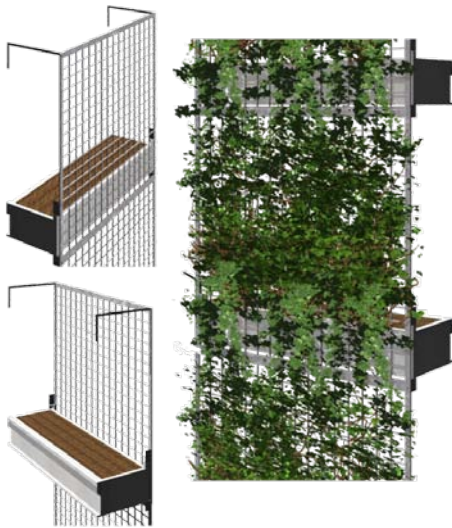


Municipal Library

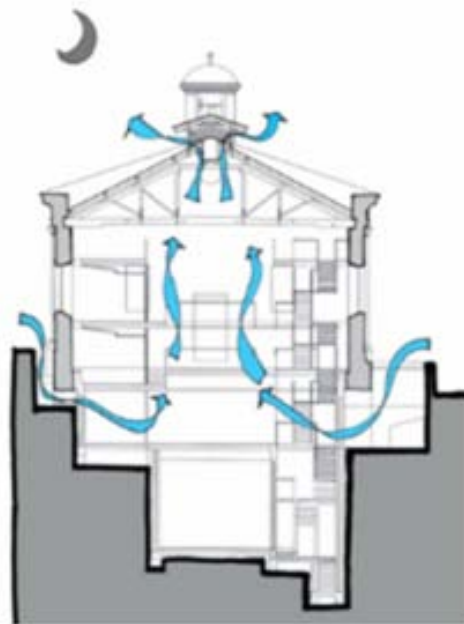
## Passivhaus and EnerPHit in warm climates

In warm climates such as Andalusia (Southern Spain), the need for cooling is very important during the summer. Some of the most commonly used passive techniques are:

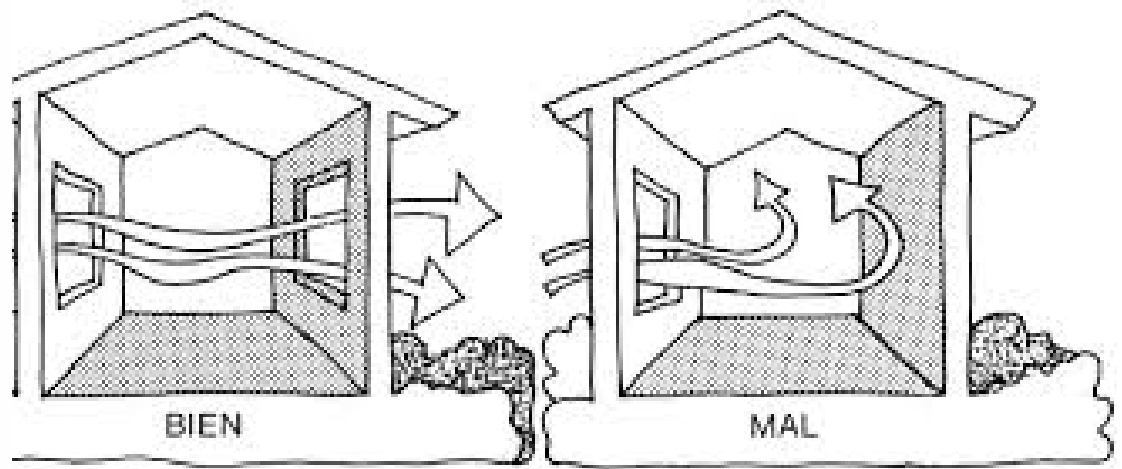
**Solar control.** To achieve good solar control, it is very important to design the holes and sun protection elements according to their orientation.



**Natural cross ventilation.** It is caused by the current of air that enters and leaves through opposite openings during the cooler hours of the day and night. Improves air quality and reduces indoor temperature.



summer night cooling  
strategy using convective  
night ventilation





## UNSUSTAINABLE PRODUCTION MODEL

The fight against climate change and strategies for the circular economy are closely linked.

The need for cities to implement innovation and sustainable strategies to combat global warming and preserve natural resources was outlined at the Paris Summit (2015), with the signature of the [Call to Cities for the Circular Economy](#).

To promote the circular economy, administrations now have a powerful tool at their disposal: **green public procurement (GPP)/sustainable public procurement (SPP)**

In this new contracting model, Life Cycle Analysis plays a key role.





*"GPP is an important tool for achieving environmental policy objectives related to climate change, resource use, sustainable consumption and production, especially in Europe because of its high public spending". (Green Procurement! Handbook on Green Public Procurement, European Commission, 3rd edition page 4)*



# GREEN PROJECTS: SUPPORT FOR PUBLIC PROCUREMENT OF INNOVATIVE AND SUSTAINABLE ENERGY SOLUTIONS



## The Project:

- o Initiative under the EU's Horizon 2020 Programme
- o International Consortium made up of 14 entities from eight European countries
- o Linked to the Covenant of Mayors

## Main objective and pilot projects:

- o Train public authorities and workers in the application of GPP/SPP, **with special focus on energy-consuming products and services.**
- o CO2 emissions have been reduced **more than 6400 Tn** through GPP pilot experiences.

## "Supply of Green Electricity to the Regional Government of Cadiz" (Southern Spain)

 <p>País-Región: <b>Provincia de Cádiz, España</b></p> <p>Ahorro de energía/reducción de CO<sub>2</sub>: <b>137.666 €/año; 1.127</b></p>	<p>En 2013, la central de contratación de la Diputación provincial de Cádiz, con la asistencia técnica de la Agencia provincial de la Energía como Unidad de Gestión Energética, desarrolló diferentes acciones para adaptar los suministros de electricidad de los edificios de la Diputación de Cádiz a los nuevos requerimientos legales.</p> <p>Estas acciones estaban encaminadas a conseguir varias mejoras como:</p> <ul style="list-style-type: none"><li>❖ Nuevo contrato de suministro de electricidad en el mercado libre.</li><li>❖ Modificación de potencias eléctricas y adaptaciones de requisitos técnicos.</li><li>❖ Cambio de titularidad y cancelaciones de contratos de suministro que ya no pertenecían a su gestión.</li></ul> <p>Como resultado de estas acciones, el coste de la electricidad disminuyó en 83.332 €/año.</p> <p>Tras una primera fase de actualización del suministro de electricidad de los edificios de la Diputación de</p>
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THANK YOU VERY MUCH FOR YOUR TIME AND ATTENTION



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