

### CARTUJAQANAT Recovering the street life in a climate changing world

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### CARTUJAQANAT: Recovering the street life in a climate changing world





The project <u>UIA03-301</u>-CartujaQanat "Recovering the street life in a climate changing world" is co-financed by the European Regional Development Fund through the Urban Innovative Actions Initiative







### **C**<sup>(3)</sup>**NAMA2O22**

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# Situación Planteada: El problema

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#### The situation....





Source: https://showyourstripes.inf





### The Objetive....

Development of technologies, tools and indicators that allow the development of measures related to the socially effective use of public space.

- For the redesign of transit and stay areas in the urban environment when they are going to be undertaken in the same rehabilitation or restoration actions.
- In such a way that the periods of use are substantially extended by means of a microclimatic treatment.
- Using solutions based on environmental heat sources and sinks.

Increase people's feeling of comfort, adapting the temperature of the air, in open and public spaces, using technologies that do not consume much energy.

### CartujaQanat: Recovering life on the street in a climate changing world

#### **Basic Idea**

Creation of an urban ecosystem pilot for adaptation to climate change

#### Objectives

Accelerate urban transformation, using the city as a social dynamizer, improving it, achieving a comfortable temperature for life abroad and involving public and private agents as well as the citizen in this transformation in a revolutionary Governance System.

### Call

Urban Innovative Actions Programme

#### Status

Finished

#### **Expected Results**

Solutions for microclimatic improvement and new business models. Construction of zones with comfortable room temperature

#### **Duration**

48 months (01/11/2018 - 01/10/2022)



Budget: 4.998.884,40 €





**Funding from CE** 80% (3.999.107,52 €)



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### CartujaQanat: Where.....



#### **URBAN HEAT SINKS**

In climate control applications we call HEAT SINKS those solid, liquid or gaseous media are at a lower temperature at conditioning temperature in summer.

Large-scale heat sinks that found in the urban environment are the vegetation (parks) and bodies of water (Rivers AND lakes).







#### **URBAN HEAT SINKS**

Most of the thermal stress in the urban space during the summer comes from solar radiation. Getting conditions of comfort in the public space is based on:

- 1. Control of solar radiation through elements of shade that they do not overheat.
- 2. Reduced temperatures of surrounding surfaces occupants below body temperature.
- 3. Air temperature reduction (only when the other two strategies have been implemented).





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### URBAN HEAT SINKS at CARTUJAQANAT

At the scale of the CartujaQanat project, cooling technologies are used associated with environmental sinks:

- The sky at night (radiation cooling)
- Outside air during the day (direct evaporative cooling)
- Outdoor air at night (cooling by convection / evaporation)
- Vegetation
- The terrain (conductive cooling)

### **5 NATURAL HEAT SINKS**

#### **URBAN HEAT SINKS: Radiation cooling**

On an annual basis, the planet's radiant balance is neutral.

That is, all the short-length radiation of wave received from the sun is dissipated by radiation long wave-length into outer space.

Outer space (heaven) is therefore a heat sink the same way that the sun is a source of heat







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### **URBAN HEAT SINKS: Evaporative cooling**

### SMALL

### "BIG" DROPS



## THEY EVAPORATE COMPLETELY AND COOL THE AIR

THEY DO NOT EVAPORATE COMPLETELY AND COOL THE WATER

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#### **URBAN HEAT SINKS: Evaporative cooling**



### **URBAN HEAT SINKS: Vegetation**

- Solar radiation is mostly absorbed in the leaves, so the reflected radiation is very small (low albedo).
- The evaporation of water from leaves (evapotranspiration) prevents the heating of these and as a consequence of the surrounding turn.
- Rainwater is absorbed into the ground. Subsequently, the Water evaporates from the soil and mainly from the leaves.











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### **URBAN HEAT SINKS: Vegetation**







#### **URBAN HEAT SINKS: Conductive cooling**

The effect of inertia dampens and delays the heat wave so that there is a depth at which the temperature remains constant and equal to the annual average of the ambient air.

In Seville, at depths greater than 3m, the ground temperature remains below 25°C throughout the year. That level can be used at low temperature to cool air. The problem is that after a short time the land around the duct becomes saturated (its temperature increases) and the efficiency to transmission from the air is drastically reduced.





#### **ANCIENT QANATS**

Hydrogeological infrastructures of Persian origin dating back to 1 millennium BC. Based on the use of water and the conduction through drainage galleries to maintain naturally stable temperatures.







#### CARTUJA QANATS





The Qanats used are 40m long and are insulated thermally from the outside using low-grade fillers conductivity and a treatment with vegetation of the surface.

140 m3 of water (70m3 per Qanat) allow cooling 48,600 m3 /h of air using buried and submerged ducts







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#### CARTUJA QANAT LAYOUT

The tempered island is designed as an open space with a certain linearity that incorporates a series of vertical, horizontal and furniture elements that serve as a link between the access to the square through the Leonardo Da Vinci street wall and the Amphitheater. The objective is to create a tempered microclimate based on innovative bioclimatic technologies developed and tested in this project.

The amphitheater is a space used during the period of the EXPO'92 as a show kiosk. has shape semicircular approximately 28m in diameter and has capacity for 200 people. It is located in a depression with respect to the level of the avenue to Minimize the intake of outside air. The confinement complete with a diametrical wall closes the stage and the cypresses that surround the area of stands.



The ZOCO is a newly created space in the shape rectangular of 750 m<sup>2</sup>. can be partitioned into subspaces according to multiple patterns to allow the simultaneous performance of different activities. It is located 2 m in depression with respect to the level of the avenue to minimize the entry of outside air. The confinement is completed with barriers semitransparent in the two main dimensions.

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#### CARTUJA QANAT: Amphitheater

The air is cooled using water from the attached pond and from the Qanats. This air is distributed through the front of the stage and the steps of the stands. The shape of the space and its level of confinement makes it possible to create a lake of low-temperature air in the area where the occupants are located.







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### CARTUJA QANAT: Tempered Island

- 1. VERTICAL and wet barriers
- 2. DRAINAGE PAVEMENTS
- 3. URBAN FURNITURE
- 4. SEMI-TRANSPARENT COLD COVER
- 5. PHOTOVOLTAIC INSTALLATION









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B B C NEWS MUNDO

Alejandra Martins

BBC News Mundo

8 noviembre 2022

ABCdesevilla Sevilla

La ciudad de España que usa

técnicas de hace 3.000 años

para bajar la temperatura y

combatir el cambio climático

#### **CARTUJA QANAT: Disemination**





Seville Replicates Ancient Canal System To Fight Heatwaves







Así es el Cartuja Qanat, la nueva plaza climatizada sobre el antiguo auditorio de la Expo 92

El alcalde de Sevilla ha presentado este lunes el nuevo proyecto de mejora climática de los espacios públicos urbanos

<u>La Cartuja se reinventa para el futuro sin olvidar el legado de la Expo</u>



Principales noticias

8 horas

2 horas

El gobierno de Polonia asegura que un "misil de fabricación rusa" cayó en su territorio y mató a dos personas

La NASA lanza su cohete más potente

jamás construido para volver a la Luna 4 horas "Yo supe antes que nadie de la llegada

del hombre a la Luna": un español de la

NASA relata los peligros y emociones que se vivieron en el histórico momento

No te lo pierdas

Refugios contra el calor con técnicas de la antigua Persia

Un proyecto piloto busca mitigar el calor en zonas urbanas adaptando técnicas que ya se usaban en Persia hace 3.000 años. Puedos ver más noticias en Espacio Protegido y el programa completo en CanalSur Más.



TOPICS



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### CARTUJA QANAT



### PROTAGONIZA LA TRANSF©RMACIÓN

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## ¡Gracias!

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