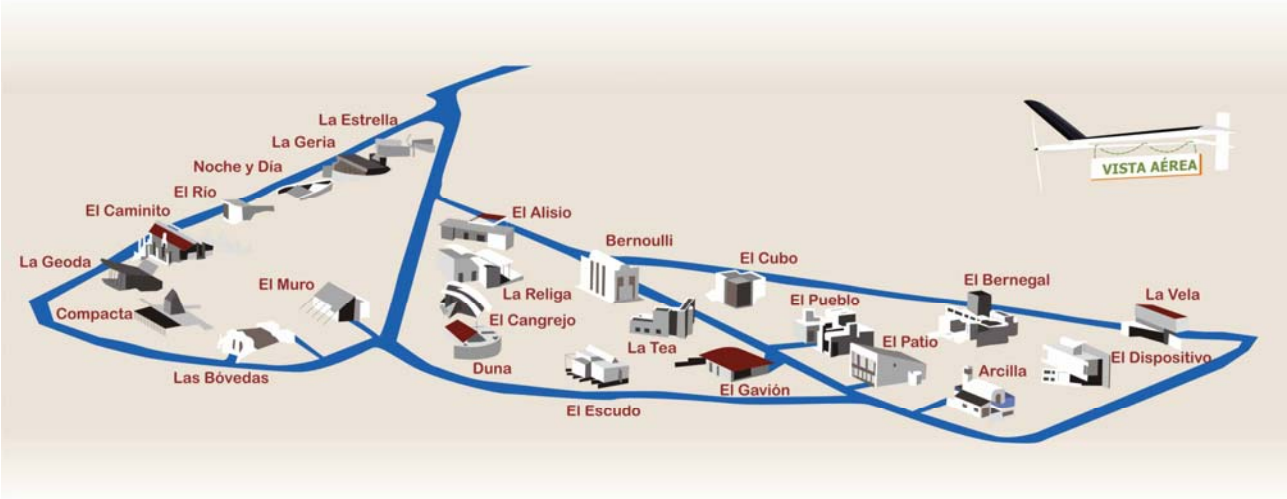
25 Bioclimatic Dwellings for the Island of Tenerife

Village of 25 Bioclimatic Homes for the Island of Tenerife

The housing development of 25 Bioclimatic Homes is situated on land belonging to Tenerife's Instituto Tecnológico y de Energías Renovables, in the south of the island of Tenerife. Their most unusual feature is they have been conceived as a laboratory for different types of bioclimatic techniques and for the integration of renewable energy sources applied to architecture. The homes, which are self sufficient in terms of energy consumption, use photovoltaic and thermal panels and will be monitored for the study of bioclimatic techniques and to determine which are the most efficient. Apart from the technical aspects, the project also aims to disseminate information about these techniques and the integration of renewable energy into architecture to raise awareness among specialists and the general public.

"This is the first Bioclimatic Housing Development with zero CO_2 emissions comprising 25 different models of Bioclimatic Homes that are energetically self-sufficient"



ITER Instituto Tecnológico y de Energías Renovables S.A.

CABILDO TENERIFE

Project History

The project “25 Bioclimatic Homes for the Island of Tenerife” started with an International Tender promoted by the Tenerife Island Government (Cabildo Insular de Tenerife) and Tenerife’s *Instituto Tecnológico y de Energías Renovables* (ITER) with the backing of the International Union of Architects. The aim was to create a laboratory of homes developed in line with the criteria of bioclimatic architecture, adapted to the conditions of the surroundings and capable of being self sufficient in their energy needs. In practice, the results obtained in this laboratory will provide design models for hot climates, which will facilitate reproduction of the technology used and will provide future initiatives of sustainable building with a tried and tested tool which is easy to apply and can be exported to other areas with a similar climate.

This is a major contribution by Tenerife towards research and development for implementing renewable energy in domestic homes and improving the functioning of energy in architecture, which will leave the way open to future opportunities in this field.

This housing development or “village” should give fresh impetus and serve to inspire creative and specific solutions to the challenge of saving and diversifying conventional energy resources and reducing the environmental impact produced by the building industry.

The main idea is to reduce power and water costs to a minimum and use renewable energy and treatment plants to supply all the home’s needs (electricity, waters etc.) This is doubly important in an isolated region like the island of Tenerife, which is highly dependent on energy sources from the outside and whose only resources are renewable. The village’s situation within the grounds of a recognised and prestigious research centre like the ITER, which will carry out monitoring of the performance of each of the homes, means very useful data will be obtained for future applications at local and international levels.

The International Tender attracted a total of 397 projects from architects from 38 countries out of which 25 were selected to create the housing development. Four of them were granted awards as the winners of the Tender. The contestant who won first prize was also contracted for the building project of Visitors Centre which informs on the work being carried out at ITER and at the Housing Development.

“The winning house, a project by architect César Ruíz – Larrea, is based on a type of farming construction used on the island of Lanzaroteto protect the crops”

Each of the homes selected for the Housing Development is different in design, materials, techniques to take advantage of the natural resources, architectural integration arquitectónica of themal and photovoltaic solar power etc. This feature makes the Village of 25 Bioclimatic Homes in Tenerife a unique place in the world where the application of very different bioclimatic techniques can be experienced.

Monitoring Scheme

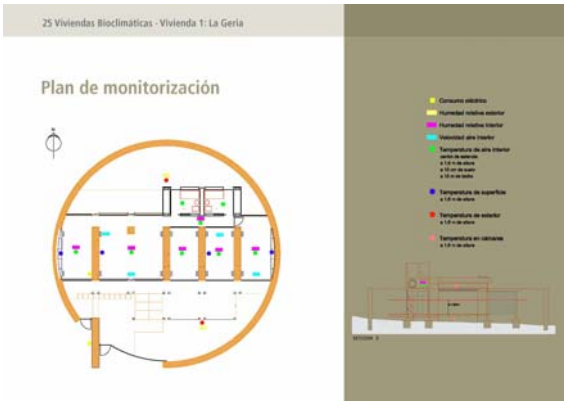
Every house is equipped with sensors and probes to measure certain parameters common to every house -later the data will be processed and compared- and other specifics according to the features of each of the homes (wind speed and direction in air nozzles, temperatures or humidity in specific places etc.). Through monitoring and analysis, the aim is to evaluate the true functioning of each house and this requires that they be lived in. To do this a system of short term stays will be set up.

"Monitoring will allow the study of the different bioclimatic techniques employed and will determine which are the most efficient, making it easy to reproduce them for future sustainable schemes "

Inside the houses we are interested in establishing the level of thermal comfort of the users, which means their levels of satisfaction with the environment around them, taking into account not only the temperature and the humidity but also the air movement and the radiant temperature. To be able to determine the thermal conditions inside the house, the following sensors/probes will be installed in each home: temperature probes at different heights in the house and on both sides of the walls and roofs; humidity probes; air flow meters; people presence sensors; gauges for CO_2 and dust particles.

These probes will be complemented by weather stations, which will register parameters like sun radiation, outside temperature, pressure, humidity and particles, plus registers to measure power consumption and production. All the data will be collected in a concentrator that will process all the information and send it, following a set protocol, to a central computer and eventually, to a computer in the home to process the data from each house.

The central computer will make a global compilation of all the data from each of the homes allowing access to the results either individually or globally, a real time monitoring of the homes' performance and a study of the evolution of the different parameters for a period of time.



Structural Features

Passsive Solar Energy

The homes are thermally insulated to prevent loss of heat or cold and reduce noise from the outside. The main premise is reducing heat loss and taking maximum advantage of useful solar heat.

In the Village of 25 Bioclimatic Homes there are a series of different configurations which allow for better use of passive solar energy: direct (large south facing areas), indirect (walls and roofs for storage), insolated (non integrated into the house, heat is transferred in and out of living area) and dual gain systems (using the advantages of the first three systems).

Additionally, they feature other aspects which help with cooling such as the shape of the house and the outside finish, the materials used, air flow, different orientation depending on sun and wind conditions. etc.

"In the Village of 25 Bioclimatic Homes, different bioclimatic techniques are used to take advantage of passive solar energy to keep the inside at a comfortable temperature and have maximum natural light"

For passive solar cooling, for example an indirect gain system can be applied using storage walls or roofs. For heating, the collection system is exposed to the sun during the day and insulated by night, transferring heat to the house, operating in a reverse way for cooling. Fountains and ponds can also help cooling in some of the homes because they make the surrounding air damp.

Another notable feature in the Housing Development is a variety of systems used for máximum natural light, which mean that it enters directly into the home's interior spaces (Core system) or areas adjacent to the house's exterior (Perimeter system). The use of raised windows, sunshades, skylights and side lighting also reduce power costs.

Environmental Impact

The layout and orientation of every house has been carefully studied so it blends into the surroundings. Special care has been taken to create a microclimate around the homes. Many designs are based on local architecture.

The native vegetation has been greatly respected and it has thrived due to appropriate watering. The plants are mainly different species of the Euphorbia cactus and other endemic shrubs.

The garden in every house corresponds to the design requirements outlined in the original Project submitted for the tender although under no circumstances will any plants species be used which may be harmful to the environment.

"The homes are integrated into the landscape, creating a micro climate around the houses. The gardens greatly respect the native vegetation of Euphorbia, shubs and and cactii helping it to thrive due to correct watering"

Energy & Water Saving

The domestic appliances are perfectly adapted to the needs of residents (capacity, power, etc.) and are in the classification level of the European's Union's "Energy Label".

The main energy savings for lighting come from the design of each home oriented to take maximum advantage of natural light and low consumption light bulbs, which use 80% less power than conventional ones. Photoelectric and people sensors can switch off unecessary lights producing savings between 10 and 80%.

Fort the most rational use of water, the taps in the houses have ventilators and reducers of the water flow; cisterns with interruption of discharge or double push-button. And there are other examples of more unusual water saving systems such as a dry bath or systems of double water flow, which means the water can be re-used for other purposes.

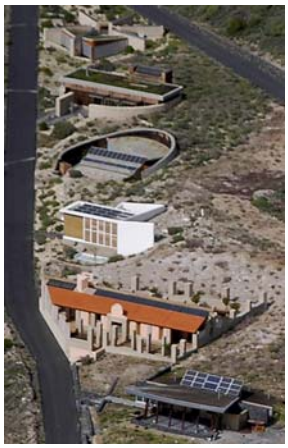
"As well as the energy savings through bioclimatic techniques, energy efficient household appliances, energy saving light bulbs and other devices like movement detectors and reduced flow taps guarantee a major reduction in water and power costs"

Power supply

Every house features photovoltaic systems integrated into the roof, façade or building elements to generate electricity. All the homes are connected to a common network to make optimum use of the dual concept of production–consumption which means that they manage to produce a similar amount of power as they normally consume which favours stability in the system and avoids the limitations of an isolated network.

A small wind turbine will be integrated into one of the houses basically to reduce transmission of vibration and acoustic impact and generate the maximum amount of power within the scale of small wind turbines.

"These houses, which are self sufficient in power supply, are a clear example of the integration of renewable energy into building and they show the different options designed to make use of natural resources to produce electricity"



The Development of 25 Bioclimatic Homes is a clear example of the integration of renewable energy sources into building and it shows the different options designed to make use of natural resources to produce electricity: curtain walls and glass roofs with glass-glass photovoltaic panels (made on site) and photovoltaic panels as shadow elements to control solar radiation incidental to the houses.

Water supply

A desalination plant using reverse osmosis and a purifying system supply the village's needs for water consumption and irrigation via three distribution networks.

For domestic hot water supply, low temperature active solar power systems have been installed in each home, which use a solar power collector. These have been integrated into every single house and adapted to their different design.

"The installation of solar power collectors in every home will supply all their hot water needs thanks to the sun's power"

Use of the Development

To make this experience accessible to scientists, experts or any other interested parties, the houses will be available to rent. This temporary occupation of the homes means real information will be collated with regard to the different parameters being monitored under the scheme. It will also include the remarks and feelings of the tenants, which will be used as applied data for the project. Additionally, periodically Open Door Days will be staged with guided tours to the houses.

"One of the main goals is to divulge bioclimatic techniques and integration of renewable power in architecture to specialists and the general public"

The Visitors Centre, built by the tender winner, César Ruíz-Larrea, displays information about the project and other departments at the Institute. It will provide information about the experience and the results of the monitoring scheme for the houses. As well it will be the centre for conferences or congresses on renewable energy and bioclimatism. Finally it will also give logistical support to the temporary residents staying at the houses.

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BIOCLIMATIC HOUSES

LA GERIA

Dedicated to Loyola de Palacio del Valle Lersundi
Architects: César Ruíz-Larrea Cangas, Enrique Álvarez-Sala Walther, Carlos Rubio Carvajal, Javier Neila González, Alberto Monedero Frías y Gonzalo Ortega Barnuevo
Country: Spain
First prize

EL CAMINITO

Dedicated to Georges Peri
Architects: Natasha Pulitzer, Sergio Los, Enrico Cozza, Alberto Miotto, Cristina Boghetto, Sergio Lot, Annamaria Bertazzon y Salvatore Pandolfo
Country: Italy
Second prize

LA ESTRELLA

Dedicated to Robert Hill
Architects: Marta Puig Adroer y Sergi Serra Casals
Country: Spain
Third prize

EL CUBO

Dedicated to Werner Bloss
Architects: Luc E. G. Eeckhout y Jean Pierre Van Den Broeke
Country: Belgium
Third prize

CASA BERNOULLI

Dedicated to Leopoldo Guimarâes
Architect: Neil G. Swift
Country: United Kingdom

EL ALISIO

Dedicated to Roger Van Overstraeten
Architects: Madelaine Fava, Daniel Fauré y Gaëlle Breton
Country: France

EL MURO

Dedicated to Wolfang Palz
Architects: José Luis Rodríguez Gil y Javier Rueda Descalzo
Country: Spain

El GAVIÓN

Dedicated to Karl-Heinz Wehnert
Architects: Dan Burr, Brian Hemsworth y Mark Richard
Country: France

LA GEODA

Dedicated to Gerard Wrixon
Architects: Eduardo Vadillo Ruiz y Joaquín López Vaamonde
Country: Spain

LA TEA

Dedicated to Jos Beurskens
Architect: Anne Mathilde Petri
Country: Dinamarca

LAS BÓVEDAS

Dedicated to Melim Mendes
Architect: Jaime Navascues Lacourly
Country: Spain

COMPACTA

Dedicated to Adán Martín Menis
Architects: Fernando de Retes Aparicio, Miguel A. Valverde Alarcón, Isabel García Laloma y Manuel Ródenas
Country: Spain

EL RÍO

Dedicated to Joachim Luther
Arquitecto: Morel Cedric
País: France

EL PUEBLO

Dedicated to Anthony Lewis
Architects: Kaarina Löfström y Markku Kolehmainen
Country: Finland

NOCHE Y DÍA

Dedicated to Hermann Scheer
Architects: Pablo Mosquera Arancibia y Francisco J. Fernández. Pareja
Country: Spain

LA VELA

Dedicated to Rafael Martín Moyano
Architects: Joel Rutten y Kriti Siderakis
Country: France

EL BERNEGAL

Dedicated to Arthouros Zervos
Architects: B. Sánchez-Montañés Macías, José Pérez de Lama Halcón y A. Luis Ballesteros Rodríguez
Country: Spain

EL DISPOSITIVO

Dedicated to Erik Lundtang Petersen
Architect: Pablo La Roche, Ignacio de Oteiza y Francisco Mustieles
Country: Venezuela

EL ESCUDO

Dedicated to Werner Kleinkauf
Architect: Alfonso Fernández Castro
Country: Spain

LA RELIGA

Dedicated to Giuliano Grassi
Architects: Nahim Dagdug, Nora Esquivel, José M. Rosales, Jorge León y Fernando Ramírez
Country: Mexico

EL PATIO

Dedicated to Francisco González Reyes
Architect: Ángel Díaz Domínguez
Country: Spain

ARCILLA

Dedicated to Jürgen Schmid
Architects: Harry Bent, Anneli Lyytikkä y Katriina Bent
Country: Finland

DUNA

Dedicated to Antonio Luque López
Architects: Ángel Luis García Palmas, Nylian González Anzola y Natalia Bernárdez García
Country: Spain

EL CANGREJO

Dedicated to Peter Helm
Architects: David Dobereiner y Dan Chin
Country: USA