

Título	BIOCLIMATIC ARCHITECTURE AND SOLAR COOLING
Acronym	ARFRISOL
Call	MEC/MICINN
Duration	2005-2011
Partners and collaborators	Dragados, Ciemat, Seis, Ceder, F.Barredo, Acciona, Atersa, FCC, Gamesa, Isofoton, OHL, UAL, Uniovi, Unisolar
Speciality	Building – Upgrading – Building prefabricated systems – Building facilities
Application to work sites	Upgrading of the CEDER (Renewable Energies Development Centre) offices building, Cubo de la Solana, Soria

PROJECT OBJECTIVES

The main objective of the R&D Project ARFRISOL is to adapt and implement bioclimatic architecture and solar energy generation measures into singular public buildings. Specific buildings around Spain have been chosen in this project as demonstration prototypes in which different energy efficiency improving measures are to be implemented considering the different climatologic conditions affecting each building. Reductions of around 80-90% in energy consumption and CO2 emissions are expected as a result of these implementations.

DESCRIPTION

In order to comply with the planned objectives, several buildings located in different areas of Spain with different climates (Asturias, Almería, Madrid and Soria) have been built/renovated within the project ARFRISOL. These buildings, considered as project results demonstrators, have been monitored to evaluate their energy performance during their design and operation phase. This monitoring process has allowed to prove and quantify significant reductions both in energy consumption and CO2 emissions. The demonstration buildings are showed in the figures below:



- 1. ED70 CIEMAT building (Madrid)
- 2. Fundación Barredo building (Asturias) .
- 3. Solar Platform building (Almería)
- 4. CIESOL building, University of Almería.

Figure 1 Demonstration buildings built and monitored in ARFRISOL



Figure 2 Demonstration building retrofitted by DRAGADOS (CEDER building, Cubo de la Solana, Soria)

ACHIEVED RESULTS

Main achieved result is the validation and quantification of the energy savings derived from the use of passive solar strategies based exclusively on the adaptation of the architectural and constructive design to the climatological conditions of each building's location. The table below shows a summary of the main figures regarding energy savings and construction overcosts of the five buildings, according to calculations done by the project coordinator CIEMAT (Research Centre for Energy, Environment and Technology) and published in the final report of ARFRISOL.

Building	Built m ²	Cost €/m ²	Passive systems demand reduction (%)	Active systems savings (%)	Biomass (%)	Total savings (%)	Final energy demand (KWh/M ² -yr)		Overcosts of passive systems (%)	Overcosts of active systems (%)	Total overcost (%)
							Heating	Cooling			
SP2 CIESOL	1072	1059	40	56	.....	96	13,96	9,49	3,95	10,89	14,84
SP3 CIEMAT	2047	2635	51	43	.....	94	8,33	35,23	1,39	8,60	9,99
SP4 PSA	1115	2260	62	34	.....	96	13,40	23,04	2,21	15,54	17,75
SP5 Fund. Barredo	1250	3045	59	19	22	100	17,34	14,60	6,06	7,61	13,67
SP6 CEDER	1366	2577	40	34	26	100	42,21	13,07	9,51	7,32	16,83

According to these data, these demonstration buildings need from 0% to 6% as much conventional energy as similar buildings, erected in the same locations and built using traditional construction methods.