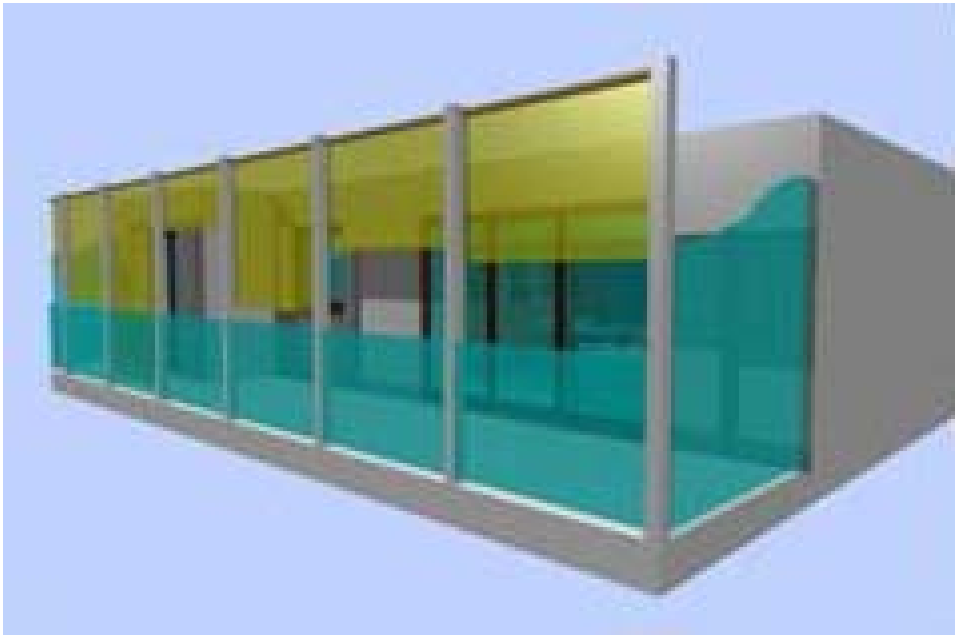
# Pou del Merli settlement
## Spain

## PROJECT SUMMARY

Martorell is in Catalonia, in the province of Barcelona in the region of Baix Llobregat, near to Barcelona (20 km)
Martorell is a first residential area and an industrial town with a population of 22.500 inhabitants and a surface area of 12.9 $km^2$
The main energy source of the region are nuclear electricity (65 %) and natural gas
The climate is Mediterranean, but 30 km from the sea, with some days of the year below 0 °C

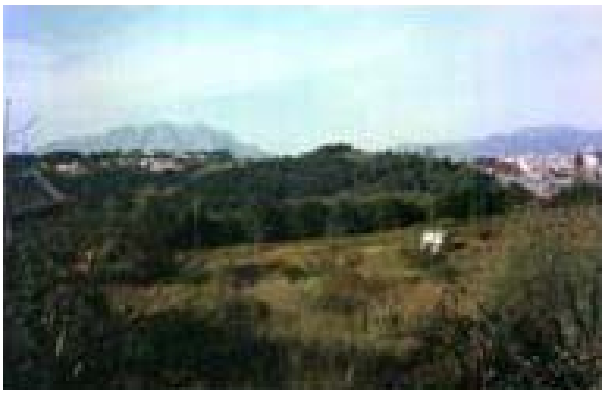
## SUMMARY STATISTICS



# THE SITE

Surrounded for a highway in the south, seat factory in the north, and is projected a new principal road in the west**.** Last area of growth of the town.
Qualified land, not urbanised, so possibility to apply sustainable design.

There is a small pine forest and hillock in the north. The average wind speed of 2 m/s in dominant west direction, 66 % of average relative humidity.



# PROJECT DESCRIPTION

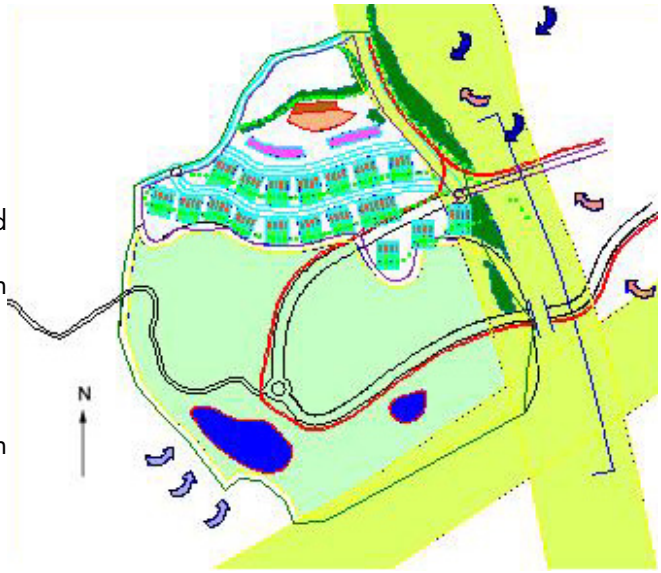
- 120 dwellings, divided in 75 paired houses in file (18 units of 4 houses and 1 unit of 3 houses) in the residential area and 45 social rent flats in 2 block in residential and services area.
- Minimum of 60 % of the land has to be preserved for garden and parks
- Avoiding visual and sonorous impact of highway and road
- Reduction of energy impact of mobility
- Management and sale of the energy produced handled by a company constituted by the regional social housing manager, local authority, a company related with energy field and the users representative
- Providing more data on performance and savings with built-in monitoring systems

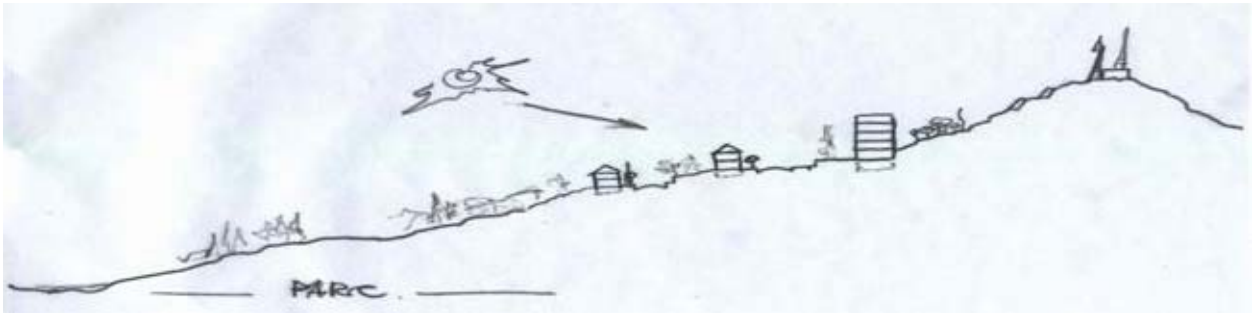
The objective of the project aims to the demonstration of a bioclimatic replicable and competitive cost model of ecological construction; designed, constructed and managed in order to evidence a tendency to zero energy consumption.
The cost of a good conventional heating and/or cooling system or, simply, the cost of compensating for heat losses, forces the users to accept minimal levels of comfort. This project aims to demonstrate and make the users aware that the following can be done at a highly competitive investment cost firstly, large energy savings in the building as a whole, achieved through an intervention involving the application of passive measures with a direct impact on their consumption rates; and, subsequently, the integration of RES systems to improve thermal comfort without conventional energy costs, allowing them to enjoy all the other advantages of these technologies, based on clean energy.

# BASE CASE

## THE SETTLEMENT

- North and east cold winds in winter
- South wind in summer
- Noise and visual impact of east highway and south road
- Connection between highway and urban planning
- South slope
- Hillock in the north
- Park and garden zone in the south
- Solar collector and management building on the hillock



## INFRA STRUCTURE

### Roads, transport


### District heating and cooling

- 1000 m2 of double glassed solar panels
- Management building including absorption machine, boiler, tanks, etc

### Water

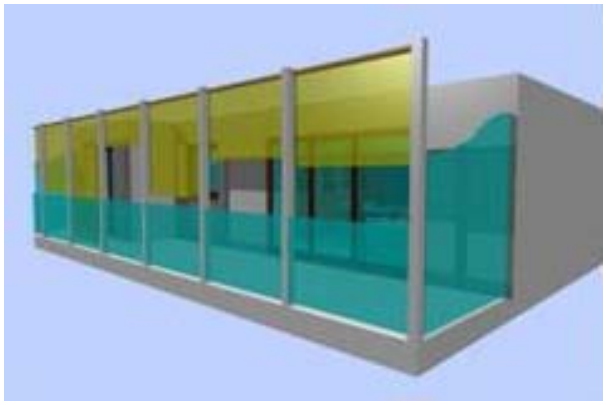
- Evaporative ponds
- Separated drainage water system to rain water reuse and black water treatment

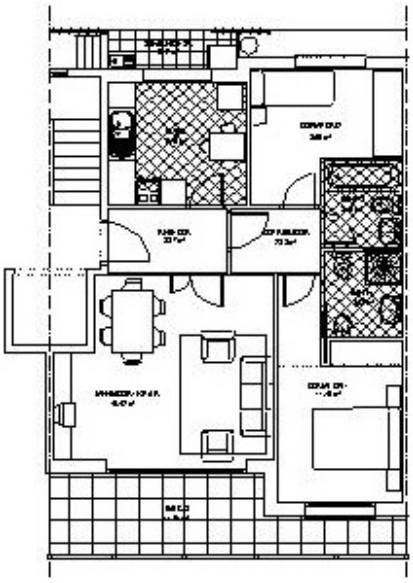
### Services

- Building for management of district heating, water treatment and waste management

## BUILDING DESCRIPTION

- 45 flats of 100 m² (ground floor + 4 floors)
- Building south orientation
- No dwellings with only north façade
- Cross ventilation
- Feng-shui criteria
- Dynamic balconies





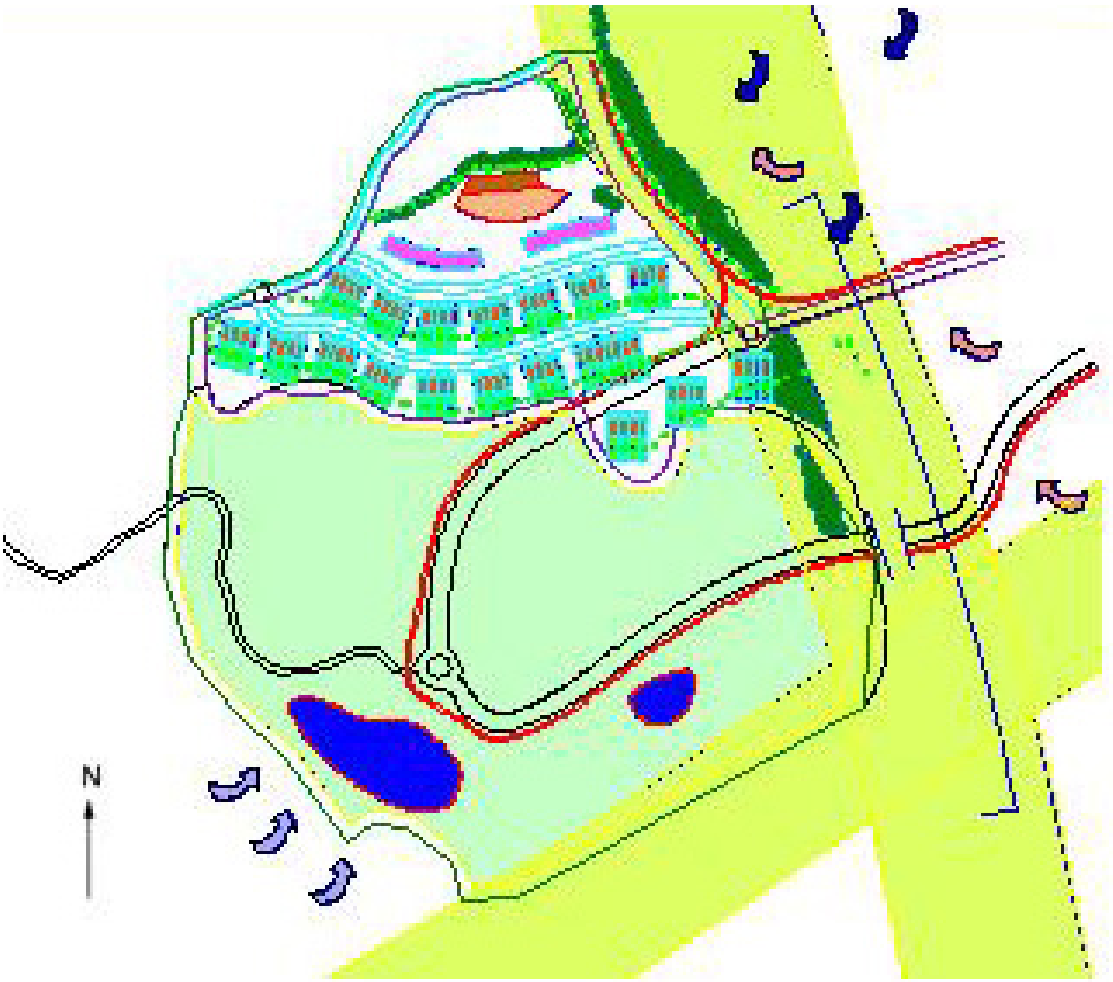
**Paired houses**

- 75 paired houses of 150 m² (ground floor + first floor)
- Cross ventilation
- 6 metres span
- Caduceus trees (south) and perennials in north

# SCENARIO

## MICROCLIMATE IMPROVEMENTS

- Caduceus trees in south orientation to avoid solar gains in summer and take profit in winter
- Perennial trees in north and east to avoid noise and winter winds
- Use of ponds and trees to refresh the air in summer
- South slope orientation
- Dynamic shading balconies
- Reduction of transit



## BUILDING ENVELOPE

### passive heating

Thermal brick to avoid thermal bridges and improve thermal mass of the building

Insulation
19 mm thickness 0,90 W/m$^2$·°C
24 mm 0.73 W/m$^2$·°C
29 mm 0.60 W/m$^2$·°C

Thermal storage
19 mm 241 kJ/m$^2$·°C
24 mm 271 kJ/m$^2$·°C
29 mm 311 kJ/m$^2$·°C

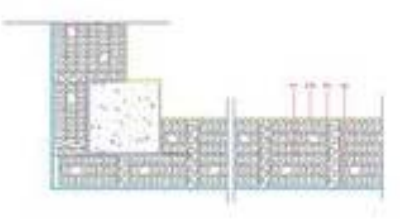
### Passive cooling

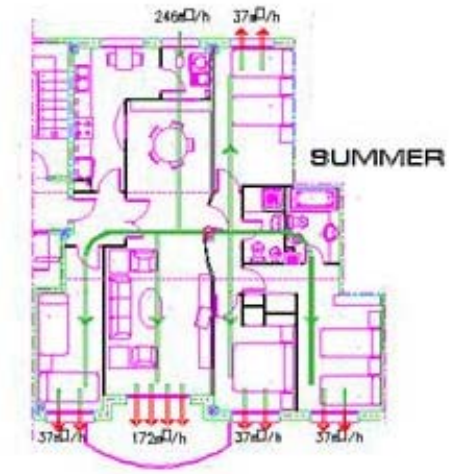
Solar acoustic ventilation window (heating and refrigeration passive) SAV

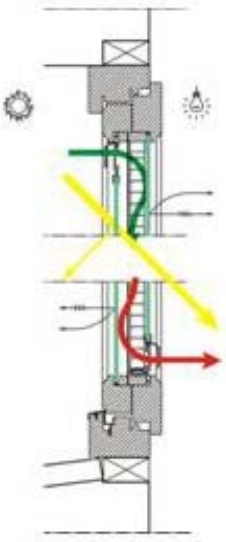
The ventilation system will direct during winter periods the hot air from the south facade and force it to cross the dwellings expulsing the air to the north façade, the summer procedures will be of the same characteristics but in the opposite way, forcing the cool air from the north façade (protected by the shadow of the building) and expulsing the air through the South façade

## DHW

If the solar thermal panels are not centralized double glassed panel 0.762-1.51X





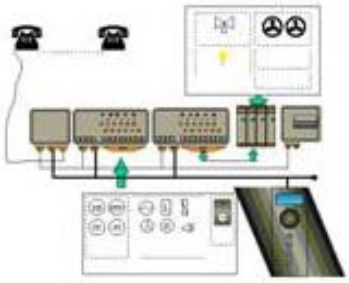



**DEEMAND SITE MANAGEMENT**

- SAV control system
- Individual energy charging

central computer system in which residents will be able to monitor their energy consumption via the internet, and will save money if the indoor temperature is less than consigna temperature and pay more it it is higher

**Domotic system**



**BUILDING INTEGRATED TECHNOLOGIES**

**SAV system**
Ventilation, heating, cooling, noise and thermal insulation

**DHW**
If the solar thermal panels are not centralized double glassed panel 0.762-1.51X

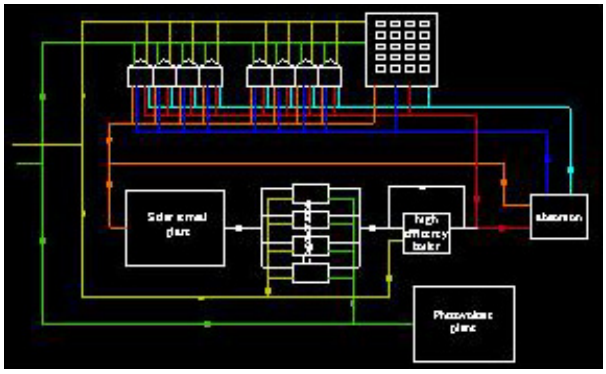
**Pv system** connected to grid and stand alone for common uses (100 kWp). If the solar pv panels are not centralised

## DISTRICT HEATING AND COOLING

### OPTION A – Centralised system

Heat is produced by:
- Solar thermal plant of 1000 $m^2$.
- 4 microcogeneration of 70 kW
- High efficient boiler of 2 MW

Cooling is generated by an absorption machine
All the system is the management and service building




## ENVIRONMENTAL IMPROVEMENTS/ SUSTAINABLE BUILDING

### Recycled and ecological materials and water saving technologies

Ecological paints and varnishes
Construction without PVC
- Drainage system
- Wiring protection
- Socket

Ecological wood
Reuse of materials for urban furniture
Reuse of rainwater
Low consumption tubs and WC tanks

## SOCIAL IMPROVEMENTS

Although until now sectors like social housing have lagged behind in these new technologies, and confidence and awareness lacking, the practical demonstration of the economic feasibility of the incorporation of passive elements and RES in these different European countries will accomplish:

· Acceptance of the technologies: To overcome lack of confidence among the sectors involved in social housing construction and renovation, users, management companies, etc.

- · Replicability: So that in the future an ever greater number of publicly-owned social housing management companies and other governmental organisations throughout Europe, to which the application of RES has heretofore been alien, take a strong, active interest in adopting this new model of sustainable construction and renovation

- · Cost reduction and technical enhancement: Apart from the fact that this demonstration includes very low base prices, given the large market in this sector with the huge volume of social housing being built constantly all over Europe, competition among builders and among manufacturers will rise with increasing pace, thus driving down market prices and further raising the interest of technical experts in developing better technologies, thus improving return periods of and the quality of investments

- · Jobs: An increase in the number of RES specialists, teaching users about the technologies involved and promoting their training through workshops and courses, and fostering the creation of more specialised enterprises in the sector and creating more jobs, including for the users themselves

- Simplify building design and construction processes by providing better practice strategies, in terms of both quality and cost efficiency.

## PROJECT MANAGEMENT

The project management is focused in:

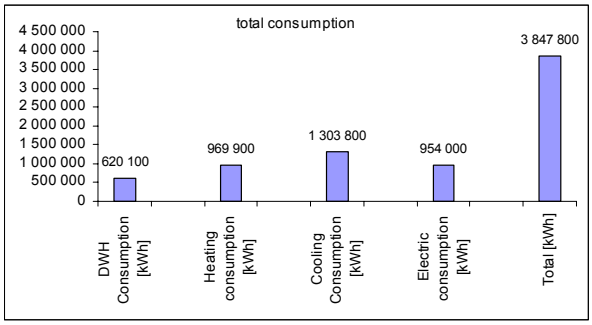
- The impact during the construction of a building on a specific location, and its integration in the environment
- The performance of the building throughout its life, analysed from the point of view of the influence of its architectural design
- The energy consumption of the building throughout its lifetime, analysed from the point of view of the energy-related features
- The environmental impact of the materials during their manufacture, use and recycling or disposal
- Construction measures: measures to reduce noise pollution, water-saving measures, minimisation and selective collection of waste

In order to ensure that local people can actually use the system to save energy and money an information programme will be launched in which 50 local residents will be employed on an hourly basis to be trained an then to train their neighbours in energy saving and other environmental advice. Each household will be equipped with a small energy saving toolbox with information and simple equipment to promote a change of behaviour. After the project period the energy advisors will have the opportunity to continue their role in exchange for reduction in their rent

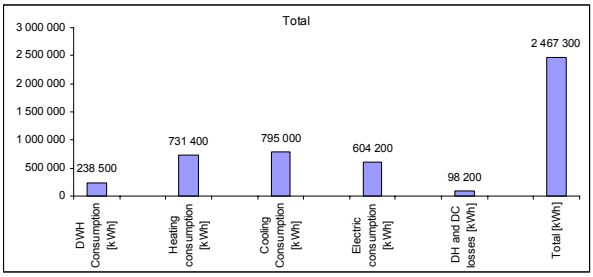
## EVALUATION - BASE CASE

Total energy consumption per year

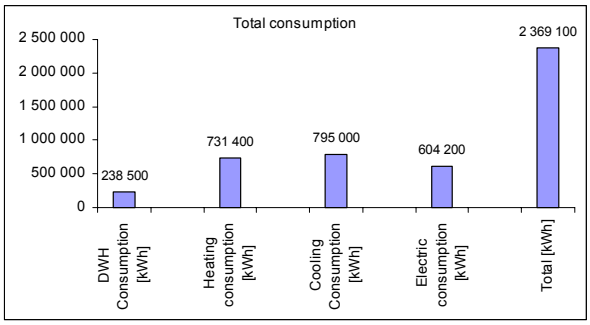
Base case without bioclimatic design




Centralized system




Semi-centralized system




## SUMMARY RESULTS

- Incorporate bioclimatic solutions at market competitive cost
- Management and sale of the energy produced handled by a company constituted by the regional social housing manager, local authority, a company related with energy field and the users representative
- New jobs creation
- To provide proof to verify that this solutions are replicable in other urbanisations
- Importance of good practices manuals
- Stimulate the construction sector

Energy saving per year