

LIFE ReNatural NZEB

Recycled and Natural Materials and Products to develop nearly zero energy buildings with low carbon footprint

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LIFE ReNatural NZEB

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COORDINATING BENEFICIARY



ASSOCIATED BENEFICIARY





LIFE17 ENV/ES/000329 - LIFE ReNaturalNZEB

Recycled and Natural Materials and Products to develop Nearly Zero Energy Buildings with low carbon footprint

Proyecto cofinanciado con la
Contribución del Programa LIFE
de la Unión Europea

Project co-funded with the
contribution of the LIFE Programme
of the European Union



CONSTRUCTION AND REHABILITATION EXPERIENCES

GENERAL LOCATION

Recycled and Natural Materials and Products to develop Nearly Zero Energy Buildings with low carbon footprint

The map shows the locations of four projects in Spain: Mérida, Ribera del Fresno, Badajoz, and La Bazana. Each location is marked with a green dot and connected to a corresponding photograph of the project. The photographs show various stages of construction and rehabilitation, including aerial views of residential blocks, modern social housing units, and public buildings.

- Rehabilitation of a residential block of 16 social houses in Mérida**
- Construction of 3 social houses in Ribera del Fresno**
- Rehabilitation of 4 social houses in Badajoz**
- Rehabilitation of 1 public building in La Bazana**

CONSTRUCTION AND REHABILITATION EXPERIENCES

INSULATING MATERIALS

<https://www.liferenatural.com/es/documentación/material-publicado>



Cork insulation ($\lambda=0,040 - 0,045$ W/mk)



Cellulose insulation ($\lambda=0,022 - 0,035$ W/mk)



Kenaf insulation ($\lambda=0,036 - 0,039$ W/mk)



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CONSTRUCTION AND REHABILITATION EXPERIENCES

Rehabilitation of 4 social houses in Badajoz

MATERIALS AND CONSTRUCTION SYSTEMS



Final state of the building



Original state of the building



Original state of the building



Wood carpentry



Cork insulation on the façade



Kenaf insulation on the roof

CONSTRUCTION AND REHABILITATION EXPERIENCES

Rehabilitation of a residential block of 16 social houses in Mérida

MATERIALS AND CONSTRUCTION SYSTEMS



Original state of the building



Wood carpentry - Cellulose insulation on the roof and underneath floor



Cork insulation ($\lambda=0,040$ W/mk) on the façade

CONSTRUCTION AND REHABILITATION EXPERIENCES

Rehabilitation of a public building in La Bazana

MATERIALS AND CONSTRUCTION SYSTEMS



Original state of the building



Kenaf insulation on the façade



Inside image



Cork insulation on the roof





CONSTRUCTION AND REHABILITATION EXPERIENCES

3 social houses in Ribera del Fresno

TARGETS AND LOCATION

Targets

We have to develop 3 model houses of nearly zero energy building with low carbon footprint and low cost using green and circular economy criteria. We also have to achieve an **80%** reduction in energy demand during all the time the building is useable.

The decreased embedded energy and CO2 emissions has to be more than **60%** and more than **20%** of weight reduction comparing with the current construction standard. This model will suppose only **25%** more expensive than the nowadays building average costs.

Location



3 Semi-detached houses



CONSTRUCTION AND REHABILITATION EXPERIENCES

3 social houses in Ribera del Fresno

TYPES OF HOUSES

House 1 will be considered a "Model house" and it will be built with conventional technology



House 2 and 3 will be "experimental houses" and will be built with sustainable technologies

The dividing façades will be built adiabatic, so they don't allow the transfer of heat from one side to another and their exposure to the outside environment does not interfere with the results.

The three houses will be monitored to compare temperatures, consumption, humidity, etc.

CONSTRUCTION AND REHABILITATION EXPERIENCES

3 social houses in Ribera del Fresno

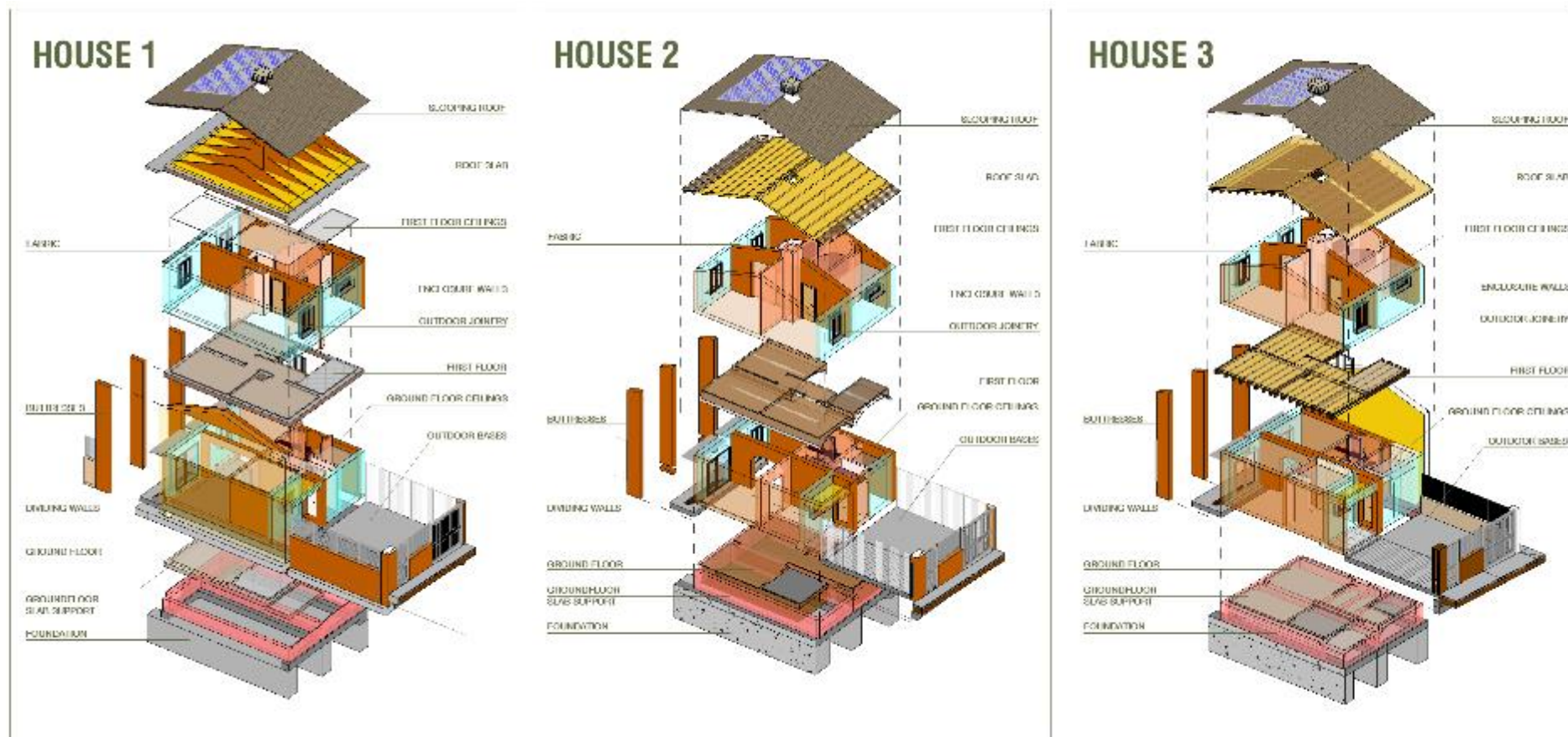
MATERIALS AND CONSTRUCTION SYSTEMS



These materials are low cost and are manufactured in small brick-sized pieces. They can be placed together using lime or plaster mortar. Timbrel vaults can be constructed safely using these materials without formworks because they are self-supporting and lightweight.

LIFE ReNatural NZEB 3 social houses in Ribera del Fresno (Badajoz)

CONSTRUCTION SYSTEMS

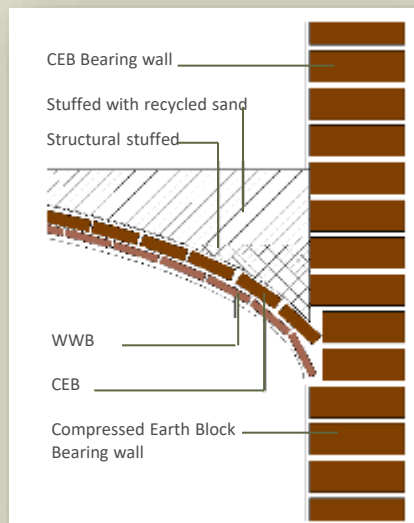


LIFE ReNatural NZEB 3 social houses in Ribera del Fresno (Badajoz)

VAULTS

INVESTIGATION CARRIED OUT BY MANUEL FORTEA

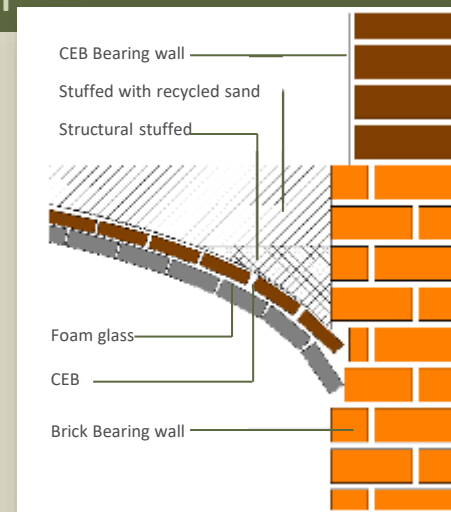
HOUSE 2_ FIRST FLOOR



STUFFED VAULT: WWB + CEB

- **Mineralised fir wood bound with Portland cement (WWB)**
22,5*10*2 cm / Plaster mortar
- **Compressed earth blocks (CEB)**
Blocks of 20*10*2 cm / Clay mortar

HOUSE 3_ GROUND FLOOR SLAB SUPPORT



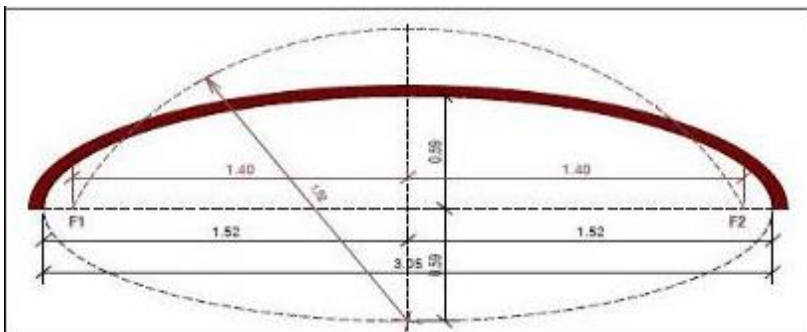
STUFFED VAULT: FGB+ CEB

- **Blocks of foam glass (FGB)**
Blocks of 20*10*5 cm / Plaster mortar
- **Compressed earth blocks (CEB)**
Blocks of 20*10*4 cm / Clay mortar

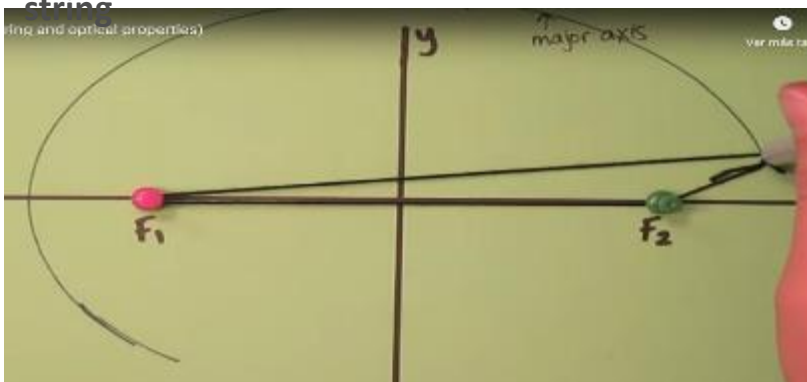
LIFE ReNatural NZEB 3 social houses in Ribera del Fresno (Badajoz)

DESING AND ESSAYS

INVESTIGATION CARRIED OUT BY MANUEL FORTEA



Design and drawing the ellipse with string



Essays





LIFE ReNatural NZEB 3 social houses in Ribera del Fresno (Badajoz)

TARGETS and RESULTS

MAIN TARGET

Develop an NZEB building model with a low carbon footprint and low cost, using green and circular economy criteria, and introducing sustainable building technologies and materials.

-80%

80% reduction in energy demand during all the time the building is useable,
In addition, it is required that the houses be NZEB, so the heating/cooling demand must be <15kwh/m² year.

RESULTS:

Prototype´s heating and cooling demand:

HOUSE 1: 14,72 / 6,99 kwh/m²year HOUSE 2: 8,05 / 12,28 kwh/m²year
HOUSE 3: 6,48 / 11,81 kwh/m²year



- 20%

20% reduction in the weight of the building, compared to the current construction standard.

The use of BTC in vertical structural elements and vaults increases the weight of the building, but on the other hand, it does not require transportation.



- 60%

60% reduction in embedded energy and CO2 emissions

We still do not have final data but based on the trials carried out, we believe that this objective will be achieved.



+25%

Cost at most 25% more expensive than the current average for a home with the same characteristics.

The reference cost is set by house 1, which is built with traditional construction systems.
The increases in cost regarding house 1 are: HOUSE 2: 21% HOUSE 3: 25%



LIFE ReNatural NZEB 3 social houses in Ribera del Fresno (Badajoz)

WORKS EXECUTION



Execution of vault with foam glass and CEB



Vault pattern drawing



Execution of walls and arches with CEB



Wooden lintels

LIFE ReNatural NZEB 3 social houses in Ribera del Fresno (Badajoz)

WORKS EXECUTION



Execution of vault with wood wool
board and CEB



Interior of the finished vaults



CONSTRUCTION AND REHABILITATION EXPERIENCES

3 social houses in Ribera del Fresno

CONCLUSIONS REGARDING SUSTAINABLE MASONRY STRUCTURES

1. The materials used have a low carbon footprint.



2. Easily and rapidly built with little additional equipment.

3. Have been demonstrated, both by tests and by implementation, to be highly resistant.



4. They are ideal for low-rise buildings.



THANK YOU!



More info at:

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LIFE ReNatural NZEB – KEY MESSAGE

Greater circularity and more efficient use of local natural and recycled materials present new rehabilitation opportunities

