

9. NATIONAL STUDIES: WHAT IS A PASSIVE HOUSE IN ... SPAIN?

FACTOR 10 - TOWARDS A 90% CO₂-REDUCTION IN MEDITERRANEAN BUILDINGS, NEW AND RETROFIT

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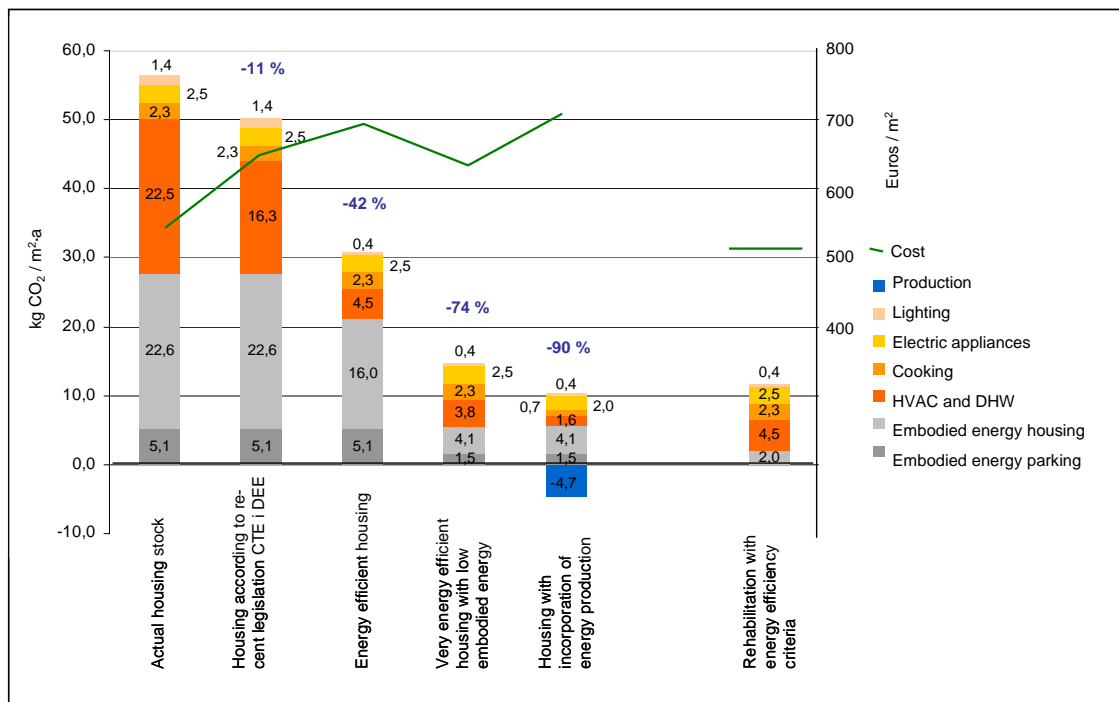
ABSTRACT

The research developed for the exhibition on Sustainable Building Design in the frame of the stand of the Catalan Government's Department of Environment and Housing at the construction fair CONSTRUMAT in May 2007 in Barcelona demonstrated the feasibility to decrease the life-cycle CO₂-emissions in Mediterranean housing by 90% at a reasonable cost.

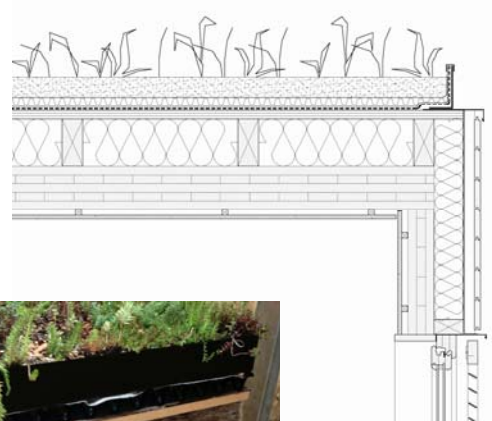
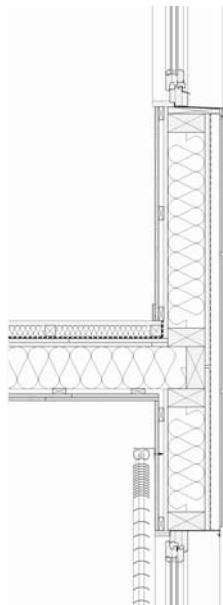
The study determines five different construction models for new built housing as well as one example for retrofit and compares the associated life-cycle CO₂-emissions to the actual building pool. The main results for the studied typologies are:

- Actual housing stock: Buildings built previous to the recently approved building codes.
- Housing according to recent legislation, CTE/DEE: The transposition of the European Building Performance Directive to Spanish legislation as well as the Catalan Decree on Energy Efficiency in Buildings (both 2006) decrease the CO₂-emissions by around 11%, focusing exclusively on the operational phase of the building: quality of envelope, lighting efficiency, introduction of solar thermal for DHW, etc.
- Energy efficient housing: Further decrease of the building's energy demand, increase of energy efficiency of the installations and selection of building materials with less environmental impact may decrease the emissions up to 42%, considering only local construction technologies and a cost increase inferior to 5%.
- Very energy efficient housing with low embodied energy: Further reduction (up to 74%) is only achieved by switching over to materials with less environmental impact for structural elements and façades, as for example wood products with its additional CO₂-storage capacity. In this way, the use of high embodied energy materials, mainly steel and concrete, as well as the building's weight and therefore the amount of material to be used in foundations get reduced, even more if building parts with high energy implication, as underground parking areas, are avoided. It is obvious, that this change requires not only a reconsideration of existing building codes and the elimination of administrative barriers, but also innovation and open minds to introduce not yet established building technologies into Mediterranean Countries.
- Housing with incorporation of energy production: Finally, a 90% CO₂-reduction is achieved by further demand reduction, but mainly by an increased use of renewable energy systems, especially for DHW, heating and electricity production.

To give maximum visibility to the exhibition and to underline the feasibility of the proposed building technologies, a number of 1:1 façade and roof compositions have been constructed and compared in terms of thermal transmittance, weight, embodied emissions and cost.



0,37 W/m²K
 56,00 Kg/m²
 10,09 kg CO₂/m²
 160,72 €/m²



0,22 W/m²K
 159,87 Kg/m²
 -39,76 kg CO₂/m²
 188,89 €/m²

Very energy efficient housing with low embodied energy

Ventilated façade, wooden structure and boards,
 insulation material: wool.

Green roof, massive wooden structure,
 wooden boards, insulation material: wool.

CONCLUSION

Factor 10. A 90% decrease of the overall life-cycle CO₂-emissions in Mediterranean housing is feasible at a reasonable cost, introducing low environmental impact materials and consequent use of renewable energy technologies. An increasing number of housing promotions is introducing sustainable building design criteria, but nevertheless lots of barriers on legal and administrative level are still to be removed and minds to be opened.