SUSTAINABLE DESIGN ECONOMIC AND ENVIRONMENTAL LIFE CYCLE ASSESSMENT MODEL

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The research goal is the definition of an **economic-environmental efficiency factor** for building design. It will be a useful tool both for designers –to guide choices- and clients –as first control device.

The factor, named **€CO**, integrates the economic aspect into an environmental evaluation model. It is based on life cycle at the scale of the technical component (building envelope).

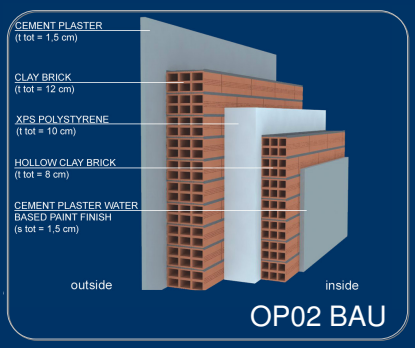
Materials & Methods

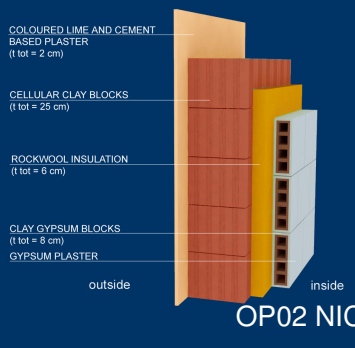
$$€CO = (X_{LCC} * \eta_{LCC}) + (X_{GWP} * \eta_{GWP}) + (X_{CED} * \eta_{CED})$$

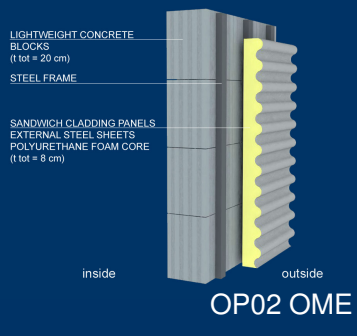
X_{LCC} = Economic Performance
X_{GWP} = Environmental Performance (Global Warming Potential)
X_{CED} = Environmental Performance (Cumulative Energy Demand)

η_{LCC} = Weight of LCC
η_{GWP} = Weight of GWP
η_{CED} = Weight of CED

Defining the €CO factor is a step toward the integration of Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) in evaluating building projects.



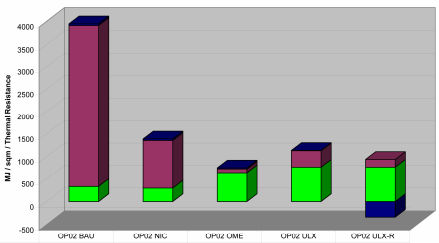




Results

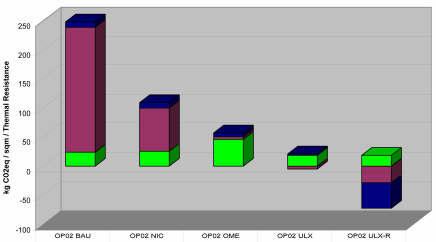
ENVIRONMENTAL IMPACTS "from cradle to grave"

IMPACT ASSESSMENT
CED (Cumulative energy demand)



	OP02 BAU	OP02 NIC	OP02 OME	OP02 ULX	OP02 ULX-R
CED End of life	35,3	35,1	24,2	8,7	-338
CED Use	3580	1060	85	363	173
CED Production	328	293	638	763	763

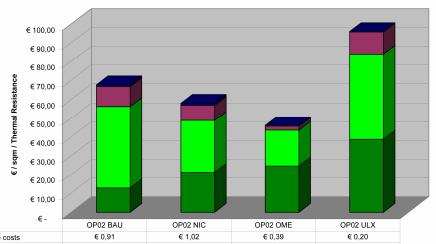
IMPACT ASSESSMENT
GWP100 (greenhouse effect)



	OP02 BAU	OP02 NIC	OP02 OME	OP02 ULX	OP02 ULX-R
GWP End of life	9,31	9,26	6,39	2,3	-43
GWP Use	215	74,4	4,36	-4,81	-29,6
GWP Production	23,6	25,2	45,3	18,3	18,3

ECONOMIC IMPACTS "from cradle to grave"

IMPACT ASSESSMENT
LCC (Life Cycle Costs)

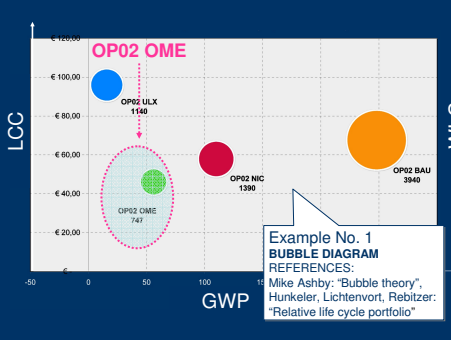


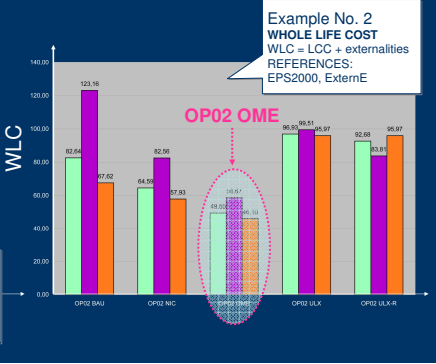
	OP02 BAU	OP02 NIC	OP02 OME	OP02 ULX
End of life costs	€ 0,91	€ 1,02	€ 0,39	€ 0,20
Use and Maintenance costs	€ 10,50	€ 8,11	€ 2,12	€ 11,80
Installation costs	€ 43,59	€ 27,84	€ 19,07	€ 45,28
Purchase costs	€ 12,62	€ 21,16	€ 24,52	€ 38,70

Discussions & Conclusions

In order to verify and validate the outcome, different methods -derived from published international researches- have been applied to evaluate the same building envelopes.

Comparing the results obtained through €CO with other methods, it is possible to affirm that the scale of values is substantially unaltered (examples: see pictures below).





CED MJ / F.U. + GWP kg CO_2eq / F.U. + LCC € / F.U

€CO

Economic-Environmental Efficiency Factor