Factor 4

A sustainable energy strategy for social housings in Europe

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The Factor 4 project (IEE 2005)

Objectives of the project :

- **To work out an economic and operational tool for social owners in order to favour the integration of energy and GEG challenges in the management plan of their building stock**
- **To recommend technical and non-technical actions to implement energy efficient planning in a comprehensive way between the short term possibilities and the long term issues (reduction of GEG by a factor 4 before 2050).**

Partners :

Association SUDEN (coordinator)

La Calade, HTC (France)

Cenergia (Denmark)

Ricerca e Progetto (Italy)

Promotors Association for Local Development (Romania)

Social owners partners :

Moulins Habitat, and Logicil - groupe CMH, SAGECO – groupe Caisse d'Epargne, Maison Girondine, OPAC 38, UNILOGI... and USH (France)

Volkswohnung (Germany)

KAB (Denmark)

Soc. Coop. ABITA (Italy)

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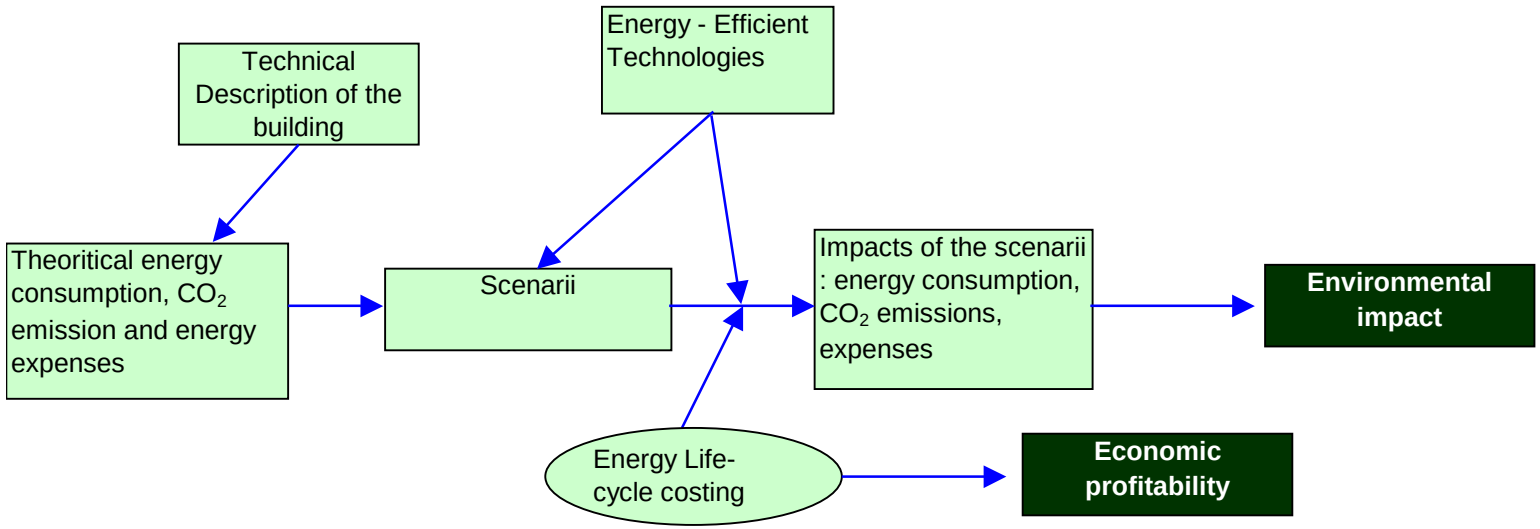
The energy retrofitting of existing social housings : a crucial issue for decreasing GEG emissions

	Social Housing Stock (million dwellings)		Energy consumption (GWh)	CO2 emissions (mio. Ton)
	2004/2005	« 2050 »	2004	2004
France	4.3	2.7 to 3.0	56 000	11.8 *(20 % of the building stock)*
Germany	1.9	1.4	ongoing	
Italy	0.92	0.92	10 500	2.2 *(30 % of rental housings)*
Denmark	0.51	0.50	4 600	0.6 *(15 % of the building stock)*

Source : Factor 4, IEE 2005

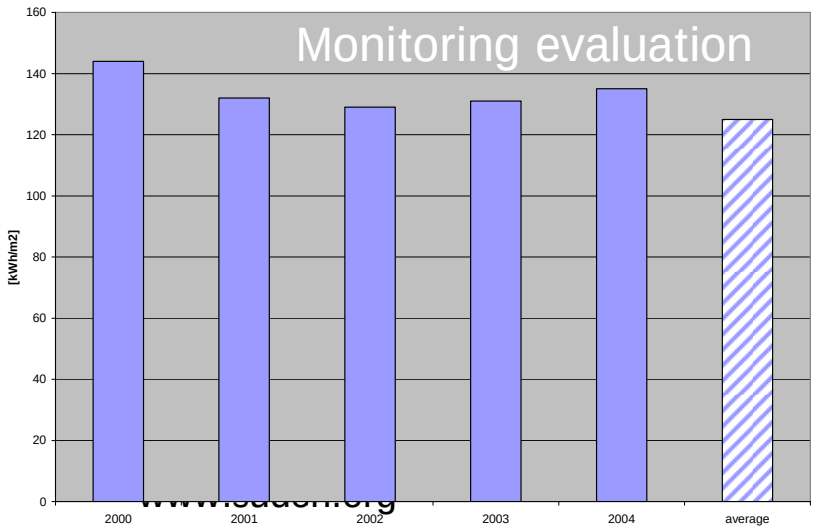
The energy retrofitting of existing social housings : Economical and environmental analysis



The modelling of economic and environmental impacts of energy – efficient projects : ASCOT model in Denmark, SEC model (Sustainable Energy Cost) in France and Italy, EPBD in Germany (?)

The energy analysis of a building (ASCOT and SEC models)

Project ID	**DK1 - Kildevænget**	
Year of construction	1958	
Size of the buiding project (treated floor area)	35136	m²
Number of dwellings	450	
Number of floor levels	3	
Building category	Others	
Central- or individual heating	Central heating system	
Internal distribution	Insufficient insulation	
Energy resource (Fuel type)	District heating	
Efficiency of the heat production	95%	
Reference, electricity	30	kWh/m²
Reference, water inclusive hot water	1.00	m³/m²
Reference consumption hot water	30%	
Weather data		
Station	DK, Copenhagen	
Building characteristics		
Wall, U-Value	0.60	W/m²K
Roof, U-Value	0.40	W/m²K
Floor, U-Value	0.40	W/m²K
Window, U-Value	3.10	W/m²K
Data for new heating system		
Central- or individual heating	Central heating system	
Heating supply system	District heating	
Efficiency of the heat production	95%	
Economic data		
Investment of reference project	0.00	euro/m2
Set aside (maintenance)	2.5%	%
Expected economic lifetime	30.00	years
Discount rate	5.0%	
Tax of interest	0.0%	
Inflation of energy	2.5%	
Inflation of maintenance	2.0%	



Economic analysis for energy efficient technologies

Heating	
Passive solar heat design	☐
Ventilation with heat recovery	☑
Airtightness	☑
Energy savings through water saving	
Energy savings / tenant behaviour	☑
Energy efficient windows, U-value=1,4	☐
Super energy efficient windows, U=1,1	☑
Cold bridges, 50% improvement	☑
Additional insulation, 100mm valls	☑
Additional insulation, 100mm roof	☑
Additional insulation, 100mm floor	☑
Improved distribution (insul.+BEMS)	☑
New heating system	☐
Active solar heat, DHW	☑
Sum of chosen initiatives	
Water	
General water conservation initiatives	☑
Water conservation / tenant behaviour	☑
Collection of rainwater	☑
Local bypass of rainwater	☐
Sum of chosen initiatives	
Electricity (lightning)	
Energy efficient lighting	☑
Electricity savings through ventilation	☑
Electricity savings / tenant behaviour	☑
Hard white goods - Grade A	☑
Roofed clothes drying yards	☑
Daylight optimisation	☑
Photovoltage, 5 sqm per dwellings	☑
Sum of chosen initiatives	
Total	☐

Yearly consumptions and savings per m²	Reference	Sustainable	Savings
Heat used for domestic hot water [kWh]	14.0	5.6	59.6%
Space heating	91.9	14.1	84.7%
Losses in distribution	20.0	5.0	75.0%
Losses in production	6.6	1.3	80.4%
Heating and hot water [kWh/m²]	132.5	26.0	80.4%
Electricity [kWh/m²]	30.0	19.5	35.0%
Water inclusive hot water [m³/m²]	1.00	0.38	62.0%
Consumption hot water [m³/m²]	0.30	0.11	62.0%
Yearly emission [kg]			
CO2	1,397,424	656,926	53.0%
SO2	3,087	1,931	37.5%
Nox	6,313	3,047	51.7%
Damages of air pollutants in euro per year			16132

Yearly running costs	Reference	Sustainable
heat	329,081	64,612
water	161,204	61,258
electricity	290,926	189,102
Extra maintenance		164,294
Total yearly running costs	781,211	479,265

Economy	
Investment in standard project	0
Additional investment	6,509,530
Total	6,509,530
Total per dwellings	14,466
Total per sqm. Treated floor area	185
Investment per kg CO2 reduction	8.79
Simple Payback Time, years	21.6
Net Present Value	83,958
Profitable investment	

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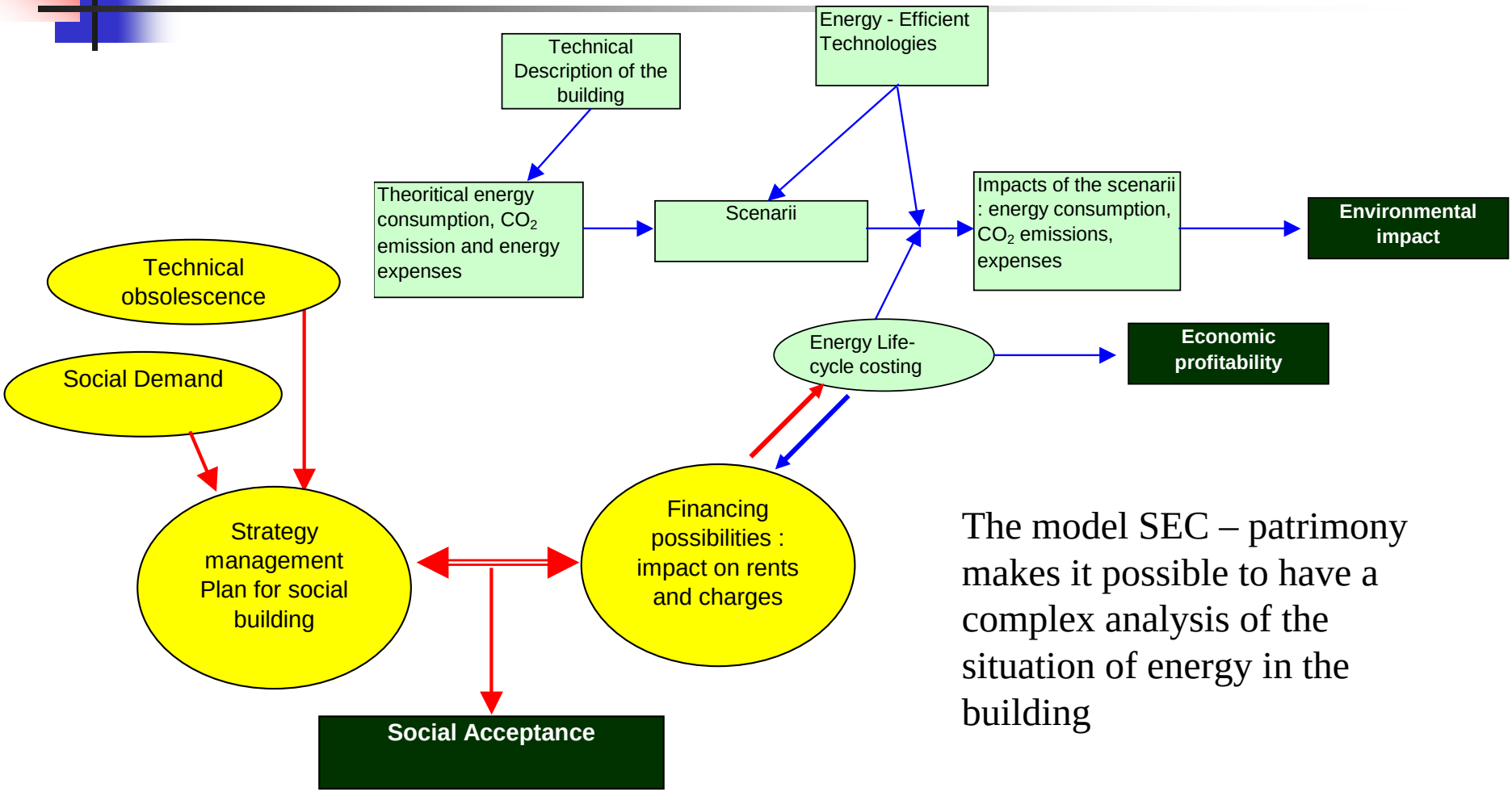
The energy retrofitting of existing social housings : Social impact and sustainability



The model SEC – patrimony makes it possible to have a complex analysis of the situation of energy in the building

The SEC – Patrimony model

Equipement	présence dans le bâtiment	Année de remplacement
	1 pour oui	année
1 - INTERIEURS DES LOGEMENTS		
Chauffe eau / chauffe bain		
Convecteur gaz		
Chauffage électrique		
Canalisations radiateurs	1	2008
Electricité	1	2008
Meuble évier	1	2008
Sanitaire équipement porcelaine	1	2008
Carrelage sol	0	
Revêtement de sol PVC	1	2008
Sanitaires / canalisations	1	2008
Tableau électrique	0	
Ventilation mécanique contrôlée	1	2008
2 - PARTIES COMMUNES		
Eclairage		
Electricité	1	2008
Faux plafonds		
Interphonie, contrôle d'accès	1	2008
Portes palières		
Portes locaux techniques		
Portes des caves		
Portes intérieures		
Peinture	1	2008
Carrelage sol		
Revêtement de sol PVC		
Tableau électrique	1	2008
Ventilation mécanique contrôlée		
Vide ordure		
3 - CLOS ET COUVERT		
Couverture Tuile collectif		
Descente eau pluviale		
Couverture Tuile		
Etanchéité terrasse multicouche	1	2008
Fermeture volets		
Garde corps		
Imperméab./peinture/traitement/ravalement	1	2008
reprise maçonnerie façades	1	2008
menuiseries alu collectif		
menuiseries maison individuelle		
menuiseries PVC collectif		
Porte entrée immeuble	1	2008
portes garage individuel		
Porte entrée logement individuel		
Peinture		
Etanchéité terrasse MI		
4 - GROS EQUIPEMENT SUR CONTRAT		
Ascenseurs - cabines		
Ascenseurs - motoréducteur		
Ascenseurs - opérateur		
Ascenseurs - serrure		
Ascenseurs - variation fréquence		
Porte parkings		
Chauffage - Colonnes	1	2008
Production chauffage collectif		
Chauffage - réseau enterré		
Chauffage - sous station		

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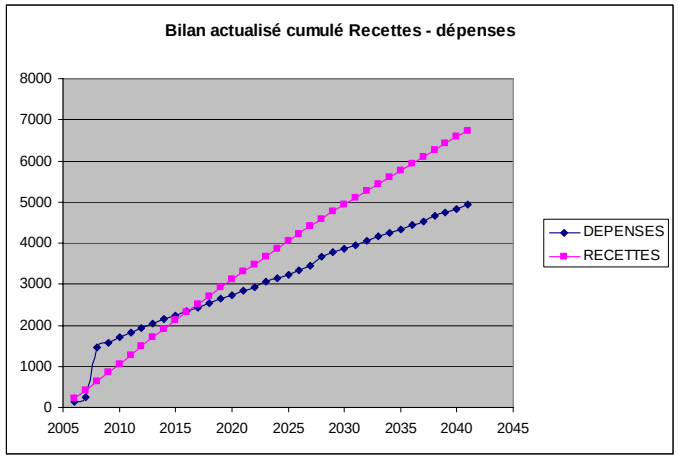
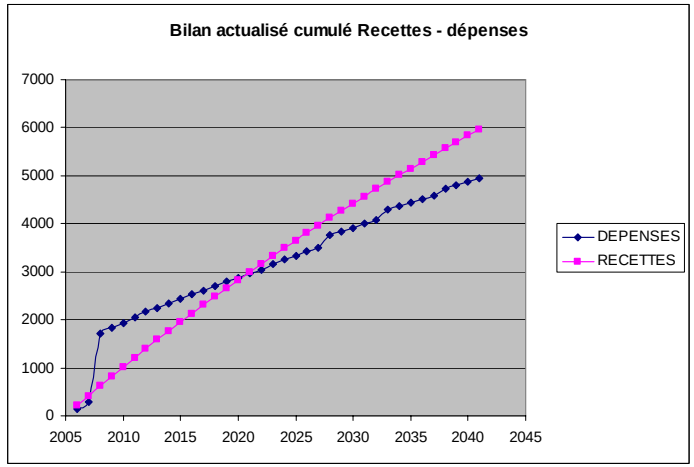
The energy analysis of a building





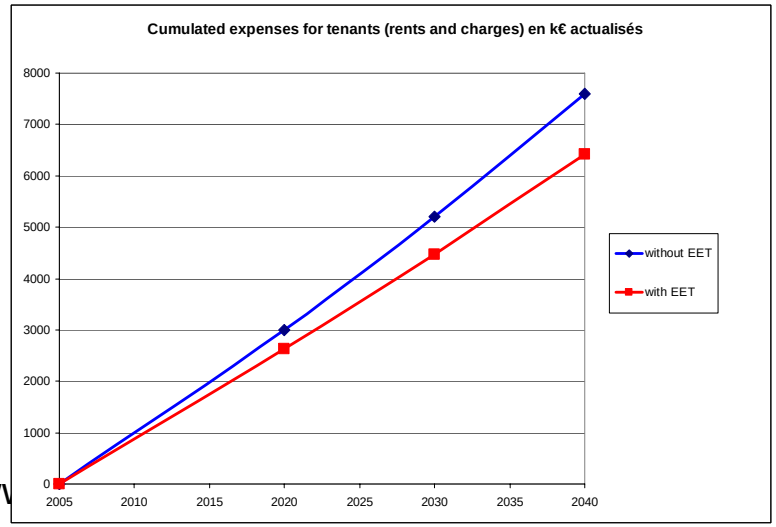
Energy Efficient Technologies (EET) project :

- Roof insulation

- High yield boiler

-Solar hot water

- High perfomance windows



The shared LCC in the new construction : the SET – SHE model (SHE project, www.she.coop)

Shared Life-Cycle Costing :

- Direct Cost = investment + operating cost
- Externalities : GEG, acoustic pollution, location of the building / services and equipment...
- Shared cost between the different stakeholders
- Qualitative indicators for a global approach

5 Italian cooperatives, 3 social owners in France, Portugal and Denmark

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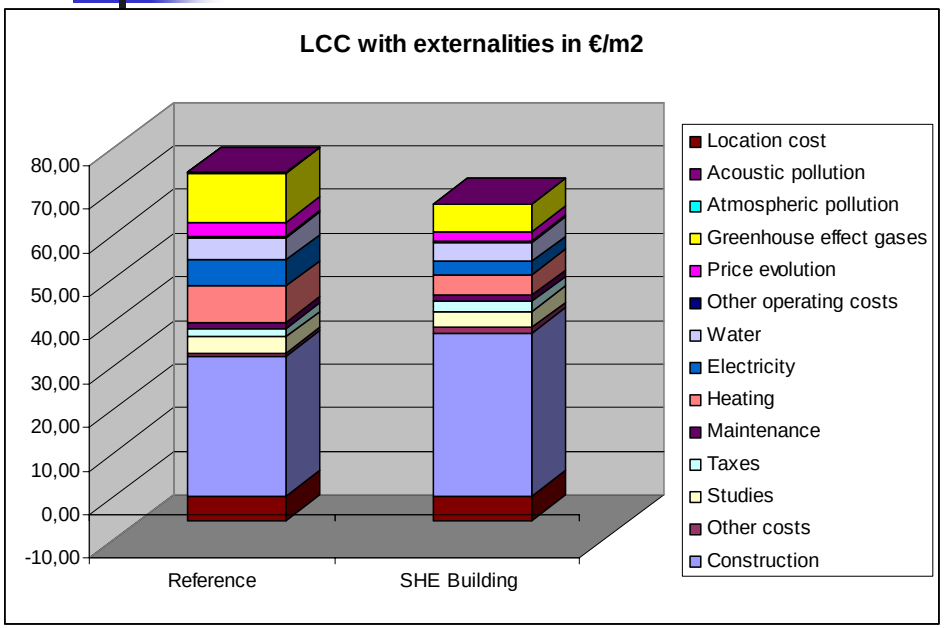

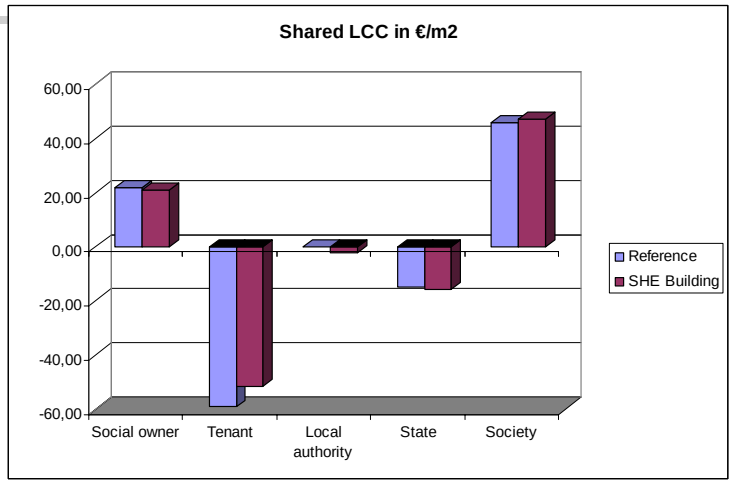

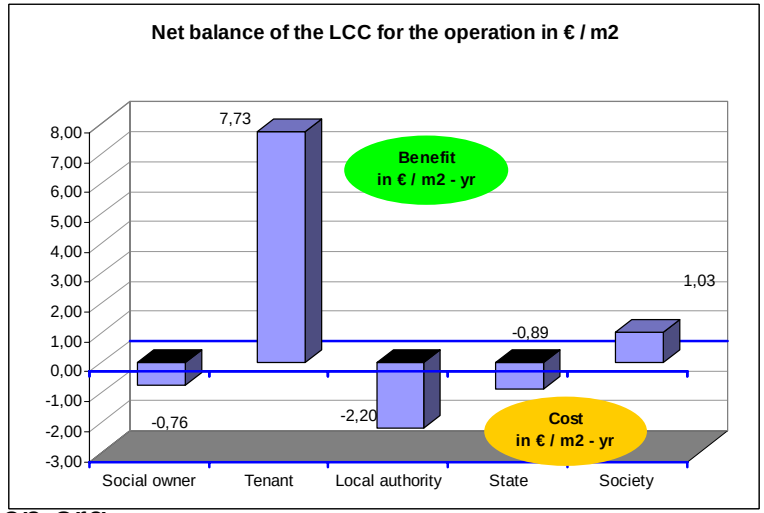

OPAC 38 Project :

construction of 40 dwellings

Conclusion
the Factor 4 objectives

- To work out **operational** models, **adapted** to each national context, **easy to use** by social owners in order to make themselves (able to) take into account energy efficiency and GEG emissions **in their strategic management plan for their whole building stock**
- These models should be also **decision aid tools** for each building retrofitting when necessary
- Factor 4 and its models are also an help for the implementation of integrated strategies and new ways of working **towards urban sustainability**, in synergy and coherency with other tools (SET-SHE, the European Directive about eco-design...) or approaches (HQE2R)