Final version of the exploitation and market deployment plan for massive uptake of the BEEM-UP concept around Europe

BEEM-UP

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BEEM-UP

Building Energy Efficiency for Massive market UPtake

Integrated Project

EeB-ENERGY-2010.8.1-2
Demonstration of Energy Efficiency through Retrofitting of Buildings

Deliverable D.6.6: Final version of the exploitation and market deployment plan for massive uptake of the BEEM-UP concept around Europe

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Deliverable description

This document aims to summarise and connect the results of BEEM-UP Work Package (WP) 6, *Exploitation and market replication based on green value*. It shows the most important results of each of the WP activities (referencing to the full document for further information), adding general considerations and main outcomes. Please take into account the references in Chapter 9, which indicates the deliverables of Work Package 6 with more comprehensive analyses and additional explanations.

Executive summary

Buildings account for 40% of Europe's energy consumption, and for one third of its greenhouse gas emissions. Thanks to improvements in technology and increased understanding of climate issues, buildings of the future are now being planned and built to far more rigorous energy efficiency standards than those of the past. These buildings, however efficient, only represent a fraction of the buildings currently in use. In fact, 80% of 2050's buildings are already build. Hence, Europe's goal of meeting climate and energy reduction targets will depend on its ability to reduce energy consumption of these existing buildings. The potential for improvement here is clear, as recognised in the Energy Performance of Buildings Directive, but a feasible method to unlock that potential has thus far not materialised.

Energy efficiency retrofitting can play a vital role in achieving the ambitious European targets, but in order to achieve optimal results, initial efforts must be targeted as effectively as possible. This report argues that the social, public and cooperative housing sector represents the ideal starting point for such an initiative.

Publicly owned SPC housing organisations have the technical ability, the socio-economic objective and the long term investment horizon necessary to carry out large scale energy-efficient renovations. Moreover,, there are good prospects for scalability, both within and outside the sector.

Around 12% of the total European building stock is currently owned by SPC housing organisations – some 27 million dwellings. Prevalence ranges from 3% in southern Europe to around 20% in the north-west and 32% in the Netherlands. Most of these buildings are multi-family residential buildings with a tenant rental structure, thus the impact of each individual renovation is likely to be high.

Best practices established and developed through pilot projects in the sector have high potential for replication. As first mover, the sector could help develop economies of scale and expertise in the private sector to reduce the cost of future renovations and increase adoption elsewhere.

However, considering current refurbishment trends, reaching major energy demand reductions would require developing new adapted contractual models and funding schemes to scale up the energy efficiency measures in the built environment. The challenge of a 75% reduction in greenhouse gas emissions in the residential sector by 2050 cannot be met without a deep reorganization of regulations and governance, which currently prevent investments in high-end energy refurbishment.

The current energy efficiency market practices are limited to the big operators (EE operations are still prohibitive to small business[1]). Hence, the lack of large scale funding of EE measures prevents the scaling up of energy refurbishment in Europe. In general, financial institutions are often reluctant to finance EE projects, being used to provide loans at 70-80% of the market value of assets. They still do not recognize the cash flow generated by energy efficiency projects (i.e. energy savings) as a new "economic asset" to be valued in the financing structure and impose a high-risk lending profile for energy efficiency projects.

[1] Please refer to the "Energy Performance-based Contractual Models" report

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Chapter 1 Framework of the Work Package 6

1.1 WP6 aim and objectives.

The main objective of *WP6 Exploitation and market replication based on green value* is to assess the economic rationale of concrete measures to scale up energy efficient retrofitting across Europe, based on the outcomes and knowledge generated in the 3 building sites. The principal objectives are therefore:

- To analyse market data on energy efficient buildings in relevant European countries.
- To estimate the incremental economic value of the 3 buildings retrofitted in the project.
- To identify clear incentives for investors, developers and building owners to invest in energy efficient retrofitting.
- To set the basis for efficient dissemination of project results (input for WP7 related to dissemination).

1.2 WP6 activities and interrelation.

Work package 6 consists of 5 interrelated tasks;

- Task 6.1 Determination of value increase energy-efficient retrofits (Maastricht University)
- Task 6.2. Energy performance contracting (Acciona / ICE)
- Task 6.3 Building park modelling (Chalmers)
- Task 6.4 Development of replication strategy for Eastern Europe (Chalmers)
- Task 6.5 Elaboration of exploitation plan for massive uptake (Bax & Willems)

The tasks are related in the following way:

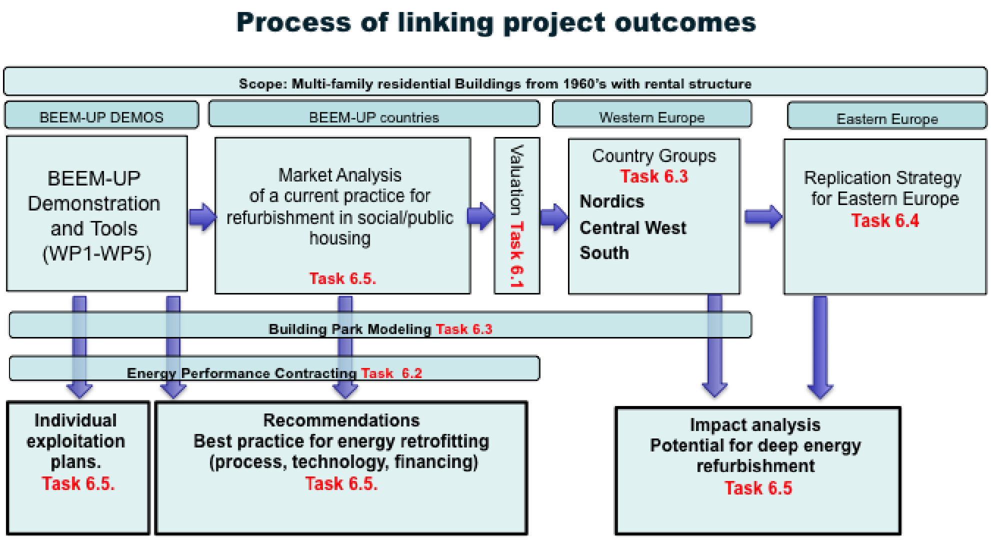


Figure 1: Interlinkage between the individual tasks of Work Package 6

Chapter 2 Value increase due to energy retrofit

2.1 Financial performance of BEEM-UP demonstration sites

Energy *inefficiency* in the built environment is a challenging problem not only at a national but also a European and global level. One of the possible solutions to address this problem is to find an appropriate business model and financial reward system, which would promote the energy efficiency retrofitting at a large scale. As indicated in the pilot cases and demonstration projects, real financial savings can be realized, while adjusting the primary energy demand of buildings.

In the BEEM-UP project, the current primary energy demand in the three demonstration sites in France, Sweden and the Netherlands was 338, 163 (or 216 as per local calculation) and 331 kWh/m^{2}a, respectively, and BEEM-Up's objective is to reduce the primary energy demand for heating in each building project by at least 75%, realizing substantial financial savings for tenants and building owners.

2.2 Energy Savings and Financial Savings

These savings in primary energy demand have the potential for real financial savings. Table 1 below provides a rough estimate of the annual financial savings for tenants and building owners from the change in primary energy demand in the three BEEM-UP demonstration sites. Holding energy prices constant to today's levels and assuming a conservative 90 and 10 percent mix in gas and electricity[2], the three projects will save about €500,000 per annum from their energy-efficiency retrofit investment.

Country	Primary Energy Demand	Annual Cost	BEEM-Up Reduction	BEEM-Up Annual Cost	Annual Savings
France	338	€96,820	85	€24,205	€72,615
Sweden	163	€394,613	41	€32,980	€361,633
the Netherlands	331	€103,012	83	€25,753	€77,259
Total	832	€594,445	208	€82,938	€511,506

Table 1: BEEM-Up Primary Energy Demand Financial Savings

2.3 The Importance for change

Although investments in energy-efficiency are challenging in the social and public sector, there are also many benefits. Achieving the 75 % reduction in primary energy demand leads to decreased energy costs, potentially higher tenant demand, decreased rental income risk and decreased regulatory risk. Not to mention, energy prices in the EU are increasing year over year on average by 3.1 percent for electricity and 3.5 percent for gas.

[2] The assumption about the energy mix does not apply exactly to the regional specifications. It is rather used for simplifying the calculations.

Moreover, energy-efficient building retrofits improve the quality of the structures as well. Vacancy in social housing is very low and the demand is larger than the supply. Tenants are likely to seek out and demand the highest quality units to start out with. Lastly, regulation is increasing year over year with respect to energy-efficiency measures. Housing corporations are potentially able to evade regulations today, but in five years this will not be the case.

2.4 The Return to Energy-Efficiency in Social Housing

It is not common practice in most countries for social/public housing institutions to regularly sell part of their housing stock on the secondary real estate market. However, the Dutch social housing regulators take a different approach and allow – and even stimulate - social housing institutions to sell part of their building stock to maintain a healthy cash flow and foster private home ownership. This provides the unique opportunity to assess the relationship between energy-efficiency and the transaction value of such dwellings.

In cooperation with the Dutch Land Registry, we construct a unique dataset of transactions completed by social housing institutions in the Netherlands. The database of the Land Registry is used to identify these transactions. Combining these transactions with detailed property level information supplied by the National Realtors Association leads to our final sample. We use a total of 44,802 transactions completed in the period from 2003 to the first half of 2013 to investigate the impact of energy labels on the transaction price per square meter. About one third of the dwellings in our sample have an energy label, the other dwellings are used as a control sample. We document that high quality energy labels have a positive impact on the transaction values of social housing dwellings.

- Housing with an A label commands **a 12.1% transaction premium** compared to a G labelled house.
- Housing with a B label commands a **3.4% premium** compared to a G label.

This implies that the average home with a G label in our sample would sell for €17,900 more when improved to an A label, and for €5,000 more when upgraded to a B label. The findings documented here indicate that if a G-labelled dwelling were transacted as an A-labelled dwelling the transaction price per square meter would increase by €200. Transforming a C-labelled dwelling to achieve an A label would yield an increase in transaction price per square meter of €209. The estimated costs of energy-efficient retrofits per square meter for the BEEM-UP demonstration sites are in most cases lower at around €190 per square meter. These results indicate that although it may be difficult for social housing institutions to recoup their investments in energy-efficient improvements directly through increased rents are lowered energy bills, they may be able to recover the investment, at least in part, at the time of sale.[3]

[3] Fort he full report please refer to the Deliverable 6.2

Chapter 3 Energy performance contracting

3.1 Financial tools applicable to EPCs

While discussing and categorizing financing schemes for comprehensive energy-efficient refurbishments, particular attention should be paid to:

- Distinguishing which financial scheme is most suitable to which EPC project model (Efficient Energy Supply Contracting, Efficient Works/Equipment Optimization or both[4]),
- Differentiating the “superiority” and “complementarity” of the tools against each other. It should be explicit that most of the instruments (e.g. equity financing, forfeiting, subordinated debt) are often complementary to the main financing scheme (e.g. debt financing).

We have clarified and classified most common and all-encompassing financing instruments that could be applied to EPCs in the BEEM-UP pilot sites’ contexts. Six financing tools illustrated in the figure below have been analysed in terms of their contribution to deep energy refurbishment practices.

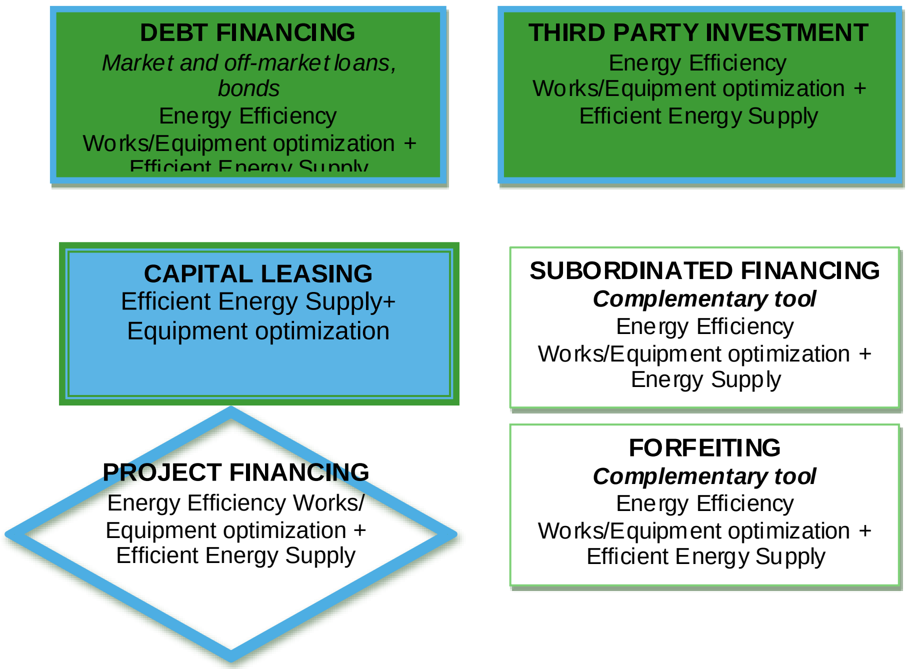


Figure 2. Main categories of financial tools under EPCs

These tools have been distinguished based on their functionality, debt usage, and superiority/complementarily criteria. For example conventional debt-financing and third party investments represent on-balance sheet financing tools, while in case of capital leasing and project financing the debt/leased equipment does not appear as debt on the balance sheet of an ESCO/BO.

[4] See ICE (2012), “Energy Performance-based Contractual Models” report under the Beem-Up project

Criteria	DEBT FINANCING	CAPITAL LEASING	PROJECT FINANCING	THIRD PARTY INVESTMENT	SUBORDINATED FINANCING *(complementary tool)*	FORFEITING *(complementary tool)*
EPC models	*-BO investment model* *-ESCO investment model* *-SPV model* *-TPOI model*	*-BO investment model* *-ESCO investment model* *-SPV model* *-TPOI model*	*-SPV model*	*-TPIO model*	*-BO investment model* *-ESCO investment Model* *-TPIO model*	*-ESCO Investment model* *-SPV model* *-TPIO model*
Types of services	*EE Works/ Equipment optimization + EE Supply*	*EE Supply + Equipment optimization*	*EE Works/ Equipment optimization + EE Supply*	*EE Works/ Equipment optimization + EE Supply*	*EE Works/ Equipment optimization + EE Supply*	*EE Works/ Equipment optimization + EE Supply*
Type of funds to be mobilized	*Commercial/ Public subsidized loans*	*Commercial financing*	*Private investment / Commercial financing / Public subsidized loans*	*Private investment / Commercial financing / Public subsidized loans*	*Commercial financing*	*Commercial financing*
Debt	*BO/ESCO on balance sheet financing*	*BO/ESCO on balance sheet financing*	*SPV on balance sheet or BO/ESCO off balance sheet financing*	*TPIO on balance sheet financing*	*BO/ESCO on balance sheet financing*	*BO on balance sheet financing*
Projects scale	*All types of projects*	*All types of projects*	*Large scale projects*	*Large scale projects*	*All types of projects*	*All types of projects*
Advantages	-simplicity, less legal and administrative burden compared to other types of financing -loans can be repaid by anticipated energy savings -subsidized loans availability for EE	-attractive alternative to the simple borrowing: preserves existing credit lines, maximizes access to new credit (equipment shown on the balance sheet as an asset, only lease payments as a debt)	-leveraged funding of EE projects: facilitates lending at scale, i.e. pools of buildings, very large multi-building projects -EE project is evaluated based on its own merits: no burden on BO/ESCO balance sheets	-"credit ratings" may be high due to the nature of the TPIO -allows to raise capital and debt at low cost	*-flexible way to raise capital,* *-may improve ESCO/BO's equity position.* *-part of the "equity cushion", facilitating the loans attribution* *-lowers the overall cost of capital*	*-ceded "payments" can give more security for the financial institution* *-can serve as additional collateral.*
Limits	-burdening of the balance sheet downgrades of the equity-to-assets ratio -interest payments do not always coincide with the anticipated cash	-equipment financing (CHP, SP..) and not a standalone tool for comprehensive energy refurbishment projects -regulations are	-steep setup costs -expertise challenges, requires significant financial knowledge and capacity on the part of the ESCOs/BOs.	-first pilot projects are ongoing, but financial architecture is not yet well conceived	*-costs more than senior bank debt* *-comes as a complementary tool*	*-typically high interest rates due to the fact that the forfeiter takes the risk*

Table 2. Analysis of the financial tools under EPCs

In addition to the traditional bank loans, and subsidies and alternative financing mechanisms, special attention has to be paid to the opportunities of the European funds to be mobilized in order to contribute to the viability of the large rehabilitation projects.

3.2 Financial simulation of technical solutions and alternative business models: Delft pilot site

We compute cash-flows simulation for a 30 years project lifetime, by considering a general inflation of 2% and a 5% energy-price rate.

Delft site's 2 dwellings, 155.4 m^2	Status Quo	Maintenance scenario	BEEM-UP scenario		
			(SHO internal)	(SHO/ESCO)	(TPI)
Technical solution					
Envelope (type/insulation)	Cavity wall moistened (4cm stone wool); pitched timber roof (no ins.); suspended floor (no ins.)	Repellent walls; maintenance roof (no ins.), maintenance floor (no ins.)	Repellent walls; insulation between rafters; reflecting foil at susp. Floor		
Windows	single glazing /double glazing, different frames	wooden frames with H++glass	wooden frames with H++glass		
Heating systems	old central boiler	maintenance existing system	condensing boiler		
Sanitary Hot Water	old central DHW	maintenance existing system	central DHW + solar		
Ventilation system	window ventilation	window ventilation	window ventilation		
Prefeasibility studies costs, €		**5 378**	**9 214**	**9 214**	**9 214**
Investment costs, of which		**33 147**	**59 031**	**59 031**	**59 031**
Construction cost, €		*26 647*	*40 586*	*40 586*	*40 586*
Equipment and technical installations, €		*6 500*	*18 445*	*18 445*	*18 445*
Financial scheme – *SHO debt cost*		40% (the rest on equity) of the investment cost (construction + equipment), at 3,5% interest rate and 30 years	40% (the rest on equity) of the investment cost (construction + equipment), at 3,5% interest rate and 30 years	40% (the rest on equity) of the construction cost, at 3,5% interest rate and 30 years	
Financial scheme – *Third Party Investment service cost*				ESCO is financing the equipment: 10% return on its equity (30%) and 5,5% interest rate for its debt service (70%), on 20 years	A TPI operator is financing all project costs (prefeasibility, investment, equipment): 10% return on its equity (30%) and 5,5% interest rate for its debt service (70%), on 20 years
Rent, €/year	**9 324** (60€/m^2)	**10 878** (70€/m^2)	**12 432** (80€/m^2)	**12 432** (80€/m^2)	**12 432** (80€/m^2)
Internal O&M cost, €/year	**2 500**	**2 500**	**2 500**	**2 500**	**2 500**
External Maintenance costs, €/year	**100**	**100**	**100**	**100**	**100**
Energy efficiency services cost (M&V,…), €/year				**550**	**550**
Electricity consumption, kWh/year	**3 212**	**2 922**	**2 809**	**2 809**	**2 809**
Gas consumption, kWh/year	**51 915**	**33 945**	**14 792**	**14 792**	**14 792**

Our financial simulations indicate that the BEEM-UP technical solution is the most costly scenario for the building owner in the short and the medium term. Cumulative cash-flows for the SHO (Social Housing Organisations) from this scenario exceed those from the alternative technical solutions (less ambitious in terms of energy performance) only by the end of the project lifetime (by 2029-2030), due to the increased cash flows. Under the current conditions of accessing bank credits and financing projects, investment models involving ESCO/TPIO (Third Party Investment Operator) are not attractive for SHOs in the Netherlands. Financial simulations suggest however some interest in third-party investment models in the following cases: (i) emergence of TPIO able to mobilize low cost financing (citizens' savings, public funds…) and/or (ii) weak debt capacity of SHOs willing to scale up energy retrofitting in a short period of time.

On the tenant' side, the BEEM-UP technical solution appears to be interesting in the short-midterm, by allowing cutting both total cumulative expenses and in particular the share of energy consumption cost in the total charges: from 53% in the Status Quo and 40% in the Maintenance scenario, to only 25% at the end of the project in the BEEM-UP scenario. These results are sensitive to energy prices; the BEEM-UP technical solution is increasingly beneficial for tenants and is becoming more urgent with increasing energy prices.

3.3 Recommendations

Policy and Regulatory levers:

1. Legally define and classify the contracts for comprehensive energy-efficient retrofit projects.
2. Allow recoupment of energy savings from tenants and/or increase of the rent.
3. Establish supportive regulations for the emergence of guarantee funds and EE risk insurance under EPC projects.

Market practices:

4. Adopt appropriate contractual model.
5. Enhance evaluation of the EE projects' bankability.

Public actors' involvement:

6. Guide BOs/ESCOs and facilitate access to available financial schemes for comprehensive energy refurbishment.
7. Create specialized institutions to boost EE practices.

Please refer to the deliverable 6.3 LEGAL FEASIBILITY OF ENERGY PERFORMANCE CONTRACTING IN FUTURE for the comprehensive overview of recommendations on the topic of financial models and instruments.

Chapter 4 Building Park modelling

An Excel-based Building stock model (BSM), developed at ETH Zurich has been expanded and adapted to meet the goals of the BEEM-UP project. Therefore data for residential buildings in EU27+6 countries has been collected and incorporated into the model. The building stock model is used for the assessment of energy and greenhouse gas emission reduction potential, when applying the ambitious refurbishment measures of the case study sites within the BEEM-UP project to the residential European building stock.[5]

Typically a country's building stock is categorised in a number of construction periods or building cohorts (e.g. grouped by year of construction 1961 to 1975). Buildings from identical construction periods and style usually show similar characteristics in size, building envelope quality, etc. For modelling purposes, each cohort is represented by an archetype building, from which it is assumed that it is representative for its cohort. This archetype building then serves as a model building for calculating space heat and hot water demand

The BEEM-UP model in general is designed to analyse the energy saving potential within the existing building stock in European countries. The analysis is based on the experiences and results from the three BEEM-UP pilot sites. The model provides outputs on three levels; cohort, country or European level. Analyses of single buildings and optimal refurbishment choices can be established using the tool developed in Deliverable 1 of the BEEM-UP project, however this is not incorporated in the BEEM-UP model.[6]

4.1 Building park model and its results

The report at hand presents the model outputs of four selected cases. The cases provide the main results for the three scenarios, based on the BEEM-UP pilot sites, and for an alternative choice of energy mix.

	Refurbishment scenario[8]	**Energy mix** (cf. table 5)	**Heating system**
Case I	SE Alingsås - Pilot (scenario #2)	EU average energy mix	Default selection
Case II	NL Delft - Improve Envelope and Floor (scenario #4)	EU average energy mix	Default selection
Case III	FR Paris - High Performance Insulation (scenario #5)	EU average energy mix	Default selection
Case IV	SE Alingsås - Pilot (scenario #2)	EU improved energy mix	Default selection

Table 2. Chosen settings of the four presented result cases.

The first three cases are calculated by using the EU average energy mix for SH and DHW. Therefore, the differences in energy demand reductions between the refurbishment scenarios can be seen. Further, the impact of the refurbishment scenarios on final energy consumption and GHG emissions is displayed. The results are not influenced by changing the energy mix, but solely by the refurbishment measures[7]. The GHG emissions are then

[5] The BEEM-UP BSM tool is available for download on the project website (http://www.beem-up.eu).
[6] While the model covers different technological aspects, it does not incorporate political and economic factors.
[7] Note: The analysis with the EU average energy mix is suitable on a European level. To analyze effects on a cohort or country level the „renovated energy mixes" should be defined generally (<control> sheet) according to the analyzed cohort / country or individually (<th.fact.calc> sheet) per cohort / country,

calculated based on the shown final energy consumption (including conversion losses for electricity and auxiliary system's electricity demand).

The following subsections show the BEEM-UP model results for all 259 implemented model cohorts of the 27 countries for multi-family housing. The figure below shows the BEEM-UP model selection share of the European floor area.

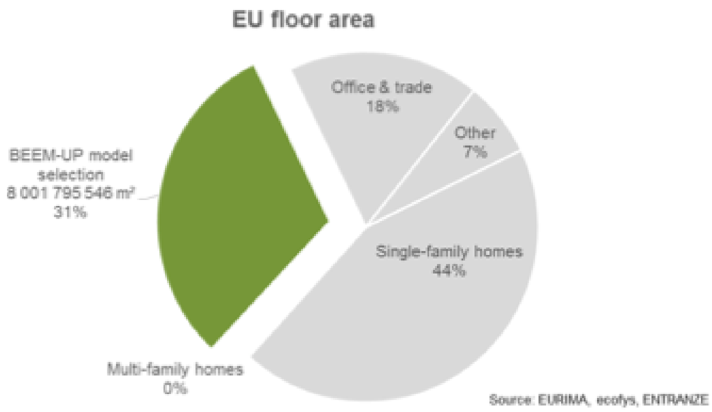


Figure 3. EU floor area share of the BEEM-UP model selection

	Building Status Quo	Building Renovated	Reduction Potential
Total floor area		8 001 795 546 m^2	
Energy Demand	TWh/a	TWh/a	Δ
Space heat	1 305	297	77,2%
Domestic hot water	350	224	36,1%
Total	1 655	521	68,5%
Final Energy Consumption	TWh/a	TWh/a	Δ
Space heat	1 665	384	76,9%
Domestic hot water	397	242	39,2%
Total	2 062	626	69,6%
Greenhouse gas emissions	Mtons CO_2-eq/a	Mtons CO_2-eq/a	Δ
Space heat	474	116	75,5%
Domestic hot water	130	80	38,7%
Total	605	196	67,6%

Table 3. Total results with the Alingsås pilot site

depending on the goal of the analysis.

		Building Status Quo	Building Renovated	Reduction Potential
Total floor area			8 001 795 546 m^2	
Energy Demand		TWh/a	TWh/a	Δ
	Space heat	1 305	576	55,9%
	Domestic hot water	350	224	36,1%
	Total	1 655	799	51,7%
Final Energy Consumption		TWh/a	TWh/a	Δ
	Space heat	1 665	704	57,7%
	Domestic hot water	397	242	39,2%
	Total	2 062	946	54,1%
Greenhouse gas emissions		Mtons CO_2-eq/a	Mtons CO_2-eq/a	Δ
	Space heat	474	204	57,1%
	Domestic hot water	130	80	38,7%
	Total	605	284	53,1%

Table 4. Total results with the Delft pilot site

		Building Status Quo	Building Renovated	Reduction Potential
Total floor area			8 001 795 546 m^2	
Energy Demand		TWh/a	TWh/a	Δ
	Space heat	1 305	457	65,0%
	Domestic hot water	350	224	36,1%
	Total	1 655	681	58,9%
Final Energy Consumption		TWh/a	TWh/a	Δ
	Space heat	1 665	568	65,9%
	Domestic hot water	397	242	39,2%
	Total	2 062	810	60,7%
Greenhouse gas emissions		Mtons CO_2-eq/a	Mtons CO_2-eq/a	Δ
	Space heat	474	166	65,0%
	Domestic hot water	130	80	38,7%
	Total	605	246	59,3%

Table 5. Total results with the Paris pilot site

It should be noted that the shown savings are based on an ideal refurbishment transferability of 100%. This implies that refurbishments are successfully applied to all treated buildings without any limitation. This is done in order to quantify the overall refurbishment potential of the EU MFH stock. By considering factors, such as monumental protection, economic restrictions, minor renovations, etc. this potential will be mitigated.

Chapter 5 Replication strategy for Eastern Europe

Three BEEM-UP pilot sites are certainly flagship projects, but it is obvious at the same time that such ambitious measures are not applicable to the entire European building stock. As stated in the EURIMA report *Building renovation in Europe - what are the choices?* "…[the] increased building renovation with a high level of energy efficiency faces various barriers for implementation, such as the need for upfront financing, investor/user conflict, necessary capacity building etc." (Boermans et al. 2012, p. 11). The various barriers are our primary area of analysis in this report with a specific focus on building refurbishment in Eastern Europe.

5.1 Rationale behind energy efficiency in Eastern Europe

While there are plenty of studies available on success stories and lessons learned in Northern and Western Europe, there has been significantly less published on refurbishment experiences and/or more theoretical studies in Eastern Europe, a region with ca. 3.566 Mio. m^2 of heated floor area which is around 13% of the entire European Building stock (Boermans et al. 2012, p. 16).

ETH Zurich (until June 2012) and Chalmers University (from July 2012 onwards) took the lead to develop a strategy for replication of the BEEM-UP concept from the three pilot sites in Northern and Western Europe to Eastern Europe. A methodological approach has been developed (see chapter 2) and applied to seven Eastern European countries (see chapter 3). In cooperation with knowledge carriers in these seven countries and based on intensive desk research, main barriers have been identified which BEEM-UP would need to overcome to successfully replicate the concept in Eastern Europe. The study provides an overview of the identified bottlenecks for each of the investigated countries and finally, provides a proposal for a strategy on how to achieve a meaningful exploitation potential under the country specific circumstances observed for the Eastern European countries as a whole.

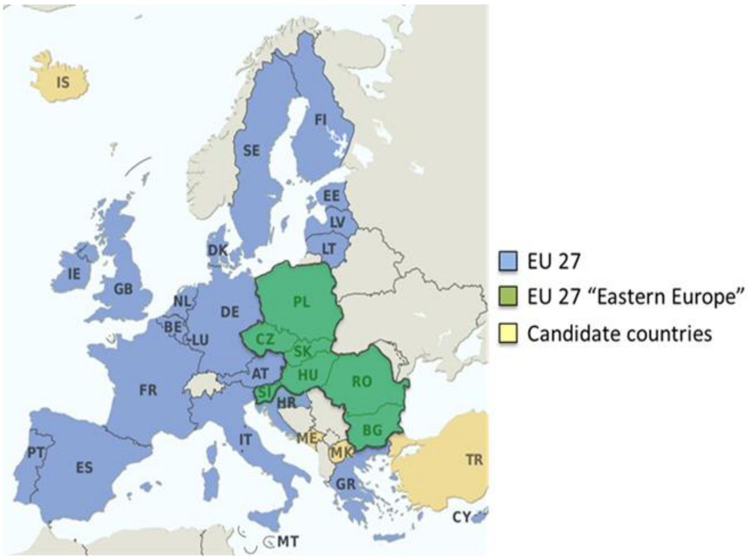


Figure 4: Target countries in Eastern Europe (visualized in green).

5.2 Main conclusions of the analysis of the EE countries

Themes the project countries have in common:

- An urgent need of investments in energy efficiency and renewable energy sources.
- Socialist history of similar length (40-50 years), impact and consequences.
- Challenges of sustainable development receive similar level of attention in the project countries.
- Political activities aiming to conform to the European Union sustainable development directive.

Economics aspects:

- Most of the reviewed countries have a per capita GDP above the world's average
    - Bulgaria and Romania are still well below that indicator.
- All of the project countries depend significantly on energy imports.
- The project countries can be characterized by a process of deregulation and liberalization of their energy markets with electricity markets having the highest degree of progress; gas and heat markets are lagging.
- Large hydropower stations and wood are major contributors to renewable energy generation, while other renewable energy sources have a negligible share.

Societal aspect:

Some influential features of the project countries' societies can be noticed, which mainly stem from their socialist pasts:

- Relatively low overall confidence in political institutions resulting in suspicion towards the attempts of the government to introduce new approaches for sustainable development.
- Heritage of socialist, multifamily, high-rise residential buildings that are characterized by similar architecture, construction techniques, and present level of maintenance.
- A large share of buildings constructed mainly between the 1960s-90's, characterized by a growing need for retrofitting.
- Predominantly individual ownership of residences, which inhibits to a great extent the development of a unified, large-scale approach to managing common building areas and dealing with problems of retrofitting and EE.
- Financial difficulties due to predominantly low income levels.

Political aspects:

- Main policy driver related to energy use in buildings is the EPBD, implemented in 2002 and recast in 2010 with more ambitious provisions. This is the main convention through which requirements for certification (EPC), inspections, training or renovations are introduced in member states. Europe attempts to make use of EPBD as a unified platform for coordinating energy efficient policies. However, this will not be achievable as long as EU legislation only partially covers the field of building renovation.
- Available financial programmes are a significant part of the politics towards increasing building energy performance. Though an extensive amount of financial

schemes are reported, their implementation has so far achieved "business–as usual" results. Very few financial instruments provide enough funding for deep renovations.

The identified common themes described above help to define certain barriers to investments in EE projects. These barriers can be divided into three main categories: institutional, economic, and capacitive.

Institutional barriers.

The lack of a transparent and trustworthy organizational system is a major issue in the project countries. Cooperation is lacking among the different ministries and agencies involved in energy policies at both the national and local level. This is the result of stronger involvement with and allegiance to the policies of parties they belong to, rather than to the national policies. Sudden disruptions due to regulatory instability and discontinuity caused by frequent and uncoordinated updates of current policies bring a sense of chaos. Such a chaotic atmosphere consequently produces a feeling of apathy, lack of concern and suspicion towards new political initiatives. People tend to expect innovations to have an unsuccessful outcome or at least to be introduced with a lot of unpredictable mistakes. As a result, involvement with new initiatives by default is regarded as too risky. Research shows that there exists a lack of secondary legislation and operational instructions, tools, standards, and procedures necessary to implement primary legislation. Even more burdening are the numerous bureaucratic obstacles placed on new projects, such as non-transparent administrative and authorization procedures.

There is lack of public procurement guidelines for the acquisition of energy efficient equipment and the request of provision of energy services to public entities, and there is inefficient or limited use of public tendering processes for energy efficiency and renewable energy projects. In addition, unresolved property issues in multi-residential apartment buildings and the significant fragmentation of land ownership limit profoundly the feasibility of energy efficiency investments in the housing sector at the scale of the individual resident.

Economic barriers.

A number of economic policy approaches currently used in the project countries need to be reviewed and improved.

Traditional routes of state intervention in price formation have been through creating artificially low tariffs for final customers and cross subsidies between customer segments. Such incentives limit the profitability of energy efficiency projects and create an unfavourable investment climate.

Environmental costs of the energy supply are often not taken into account, and this inhibits evolution towards more responsible behaviour of the final customer. Most of the major energy companies are publicly owned, causing an unresolvable conflict of interest between profitability and pursuit of political benefits through popular, social pricing policy.

The funding system also still requires a lot of development. Availability of public funds is insufficient, and the developed premium tariffs are often not operational and of a limited nature since they apply only to certain technologies or have restrictive requirements. EE funds, if they are operational, have limited resources. Alternative measures such as dedicated credit lines providing soft loans, tax exemptions, or support schemes for third-party financing are often not in place.

Banks themselves do not contribute to mitigating the problem - they apply high interest rates to medium and long term loans and restrictive requirements for collateral.

As a consequence of all these economic barriers, the size of the energy efficiency and renewable energy projects remains rather small. This results in high evaluation and transaction costs per project.

Capacitive barriers.

Inefficiency in policy and the economy result in a lack of awareness and interest in energy efficiency issues in the societies of the project countries. Sustainable development is still regarded as a rather exotic domain, foreign to the very initial concerns of everyday life. Consequently, a societal lack of interest diminishes the value of sustainable development as an issue in political strategies.

A lack of professional skills is reported with all stakeholders involved in identification, development, financing and implementation of energy efficiency and renewable energy projects:

- Policy level: insufficient political commitment to implement the necessary policy reforms and lack of qualified human resources among local authorities who are to realize the identified projects.
- Economic level: Lack of experience within commercial banks in financing energy efficiency and renewable energy projects and lack of knowledge for possible economic benefits arising from energy efficiency and renewable energy projects.
- Societal level: Lack of training and educational opportunities for conducting energy audits.
- Failure to identify attractive project opportunities and preparing bankable project proposals.
- Consumer level: Energy is regarded more as a public service than a valuable good, which is difficult to change unless this implies a tangible improvement of the living standard.

Chapter 6 Exploitation plan for massive market uptake

6.1 Introduction

Large-scale energy refurbishment has a vital role to play in Europe's transition to a low-carbon economy. When we consider that the energy demand from buildings accounts for 40% of Europe's total, and that 80% of 2050's buildings have already been constructed, it is obvious that improving the energy performance of existing building stock should be high on the EU's sustainability agenda.

The question then is where and how to make such improvements. Residential buildings make up a large majority of Europe's building stock, and over one in ten of these fall into the Social, Public and Cooperative (SPC) housing category. Moreover, these often belong to publically owned organisations with the technical capacity, the socio-economic objective and the long-term investment horizon needed to carry out energy renovations on the necessary scale.

To assess the ability of SPC housing organisations to achieve both their own objectives for 2020 and those of European policy, we have completed the first cross-European analysis of trends and projections in the sector. The study offers quantified insights into expected reductions in energy consumption, and recommends policy actions to accelerate progress to the desired level. The survey covers 16 of 24 EU countries, accounting for approximately 60% of the total SPC housing stock of 27 million dwellings.

6.2 Quantifying the issue

A substantial part of SPC building stock is constructed prior to 1960. Such buildings have, on average, an energy efficiency label of E or F (although definitions do vary by country). The current average refurbishment rate across countries surveyed is 1.19% per year. These buildings are generally upgraded to a C label at an average cost of €32.250 per dwelling**,** with the sector currently investing around €10,4 billion each year.

Towards 2020 an increase in activity is expected. The renovation rate is currently expected to rise to 1.39% and the average investment to €36.200**.** Annual investment is expected to increase to €13,6 billion.

As recently demonstrated by the BEEM-UP project, energy demand reduction to a much higher standard is both feasible and cost-effective. However, a demand reduction of more than 65% has been shown to cost some €70.000 per dwelling on average.

If the sector is to meet 2020 targets and achieve a 20% energy demand reduction in line with European policy objectives, an even greater funding gap must be addressed. In order to attain this figure using current best practices, an additional total investment of €180,6 billion will be needed for the period 2014-2020.

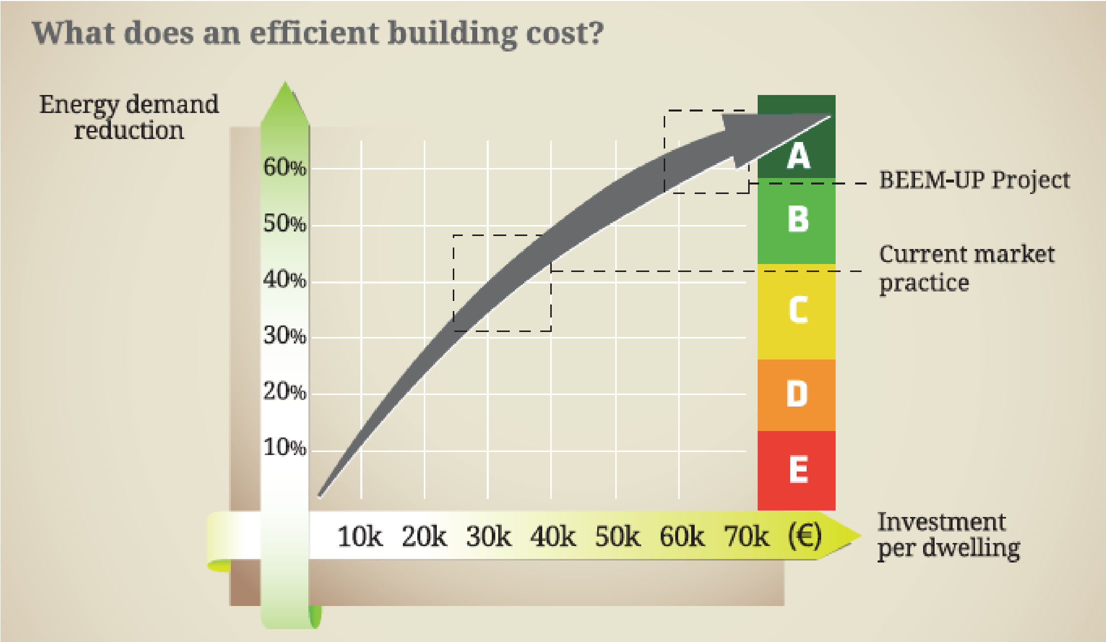


Figure 5. Cost of energy efficiency in residential building. BEEM-UP project vs. current market practices.

Figure 6. Size of the SPC sector and a financial gap for reaching 2020 targets.

6.3 Conclusions and policy implications

This report asserts that a financial gap of approximately €180.6 billion must be closed in order for the SPC housing sector to reach 2020 targets for energy efficiency. It concludes that the sector has an important role to fulfill in the European economy, and should, due to the following characteristics, be considered as central to a number of policy actions.

- SPC housing providers each manage a considerable housing stock (often more than 20,000 dwellings) compared to private landlords, which creates a leverage of individual investment decisions and a great scope for replication.
- The housing stock is managed in the long term (30-50 years), therefore there are strong incentives to reduce future operational and maintenance costs.
- The majority of SPC housing stock has a rental structure with controlled rent levels, which means that rent cannot be raised after a renovation. This imposes constraints on both return on investments and possible business models.
- The sector, with 12% of European building stock, provides housing for a great number of low-income families and disadvantaged people. It significantly raises the living standard of these groups and provides positive externalities in areas including health and productivity.

From various European projects and the daily experience of affordable housing providers, it can be said that some ingredients are missing to trigger the ecological transition in the affordable housing sector:

Creation of a European Housing Fund.

There is a compelling need for a European entity to facilitate the financing of major investments in retrofitting of houses. A European Housing Fund could combine the financial capacities of major European banking institutions in order to finance those investments with a long-term strategic importance to European society. Such an entity would be capable of providing low interests loans for major renovation projects in the SCP Housing sector. A European Housing Fund could also provide grants for technical support of investments' execution. Involvement of such an institution could have strategic value in setting up the necessary structures to encourage further investment from the private sector.

Currently, housing companies have still little experience in implementing long-term renovation plans and managing major retrofitting projects. Experience of the ELENA grant programme across Europe provides evidence that a technical support grant can mobilise major renovation projects with a leverage of more than 50 over the financial grant.

A new technical support programme for the period 2014-2020 would greatly contribute to the acceleration of investment programmes in building renovation.

Facilitation of applied research and standardisation.

Three lines of research have been identified as beneficial for the fostering of energy-retrofitting projects.

- The continuation of applied research to develop low-cost technologies for the improvement of energy efficiency and renewable energies in housing, including a focus on pre- fabricated modules aimed at deep renovation of affordable dwellings within a short period of time.
- Standardisation of the appraisal of green investments, including a credible evaluation of external benefits related to energy retrofitting.
- Training of both housing professionals and tenants in order to enhance their ability to benefit from the energy transition, to include financial engineering and major retrofitting project management.

Chapter 7 Conclusions

7.1 Main conclusions of the Work Package 6

- The BEEM-UP project demonstrates that reducing energy demand by more than 75% through deep energy refurbishment is indeed feasible in the long term.

- Dutch social housing with a high-energy performance achieves a substantial transaction premium in the range of 3.4% - 12.1%

- The average home with a G label in the Dutch sample would sell for €17,900 more when improved to an A label and for €5,000 more when upgraded to a B label

- Social and public housing institutions have difficulty to recoup their investments in energy-efficient improvements directly through increased rents and lower energy bills. However, they may be able to recover the investment, at least in part, at the time of sale.

- The current refurbishment rate across studied countries stands at 1.19% each year, this number is expected to rise slightly to 1.39% in 2020.

- Housing companies (social and public) in Europe spend on average €32,250 per dwelling for a major refurbishment. This will increase to €36,200 towards 2020.

- The current size of the market for SPC housing refurbishment is estimated to be €10.4 billion, this number is expected to increase to €13.6 billion.

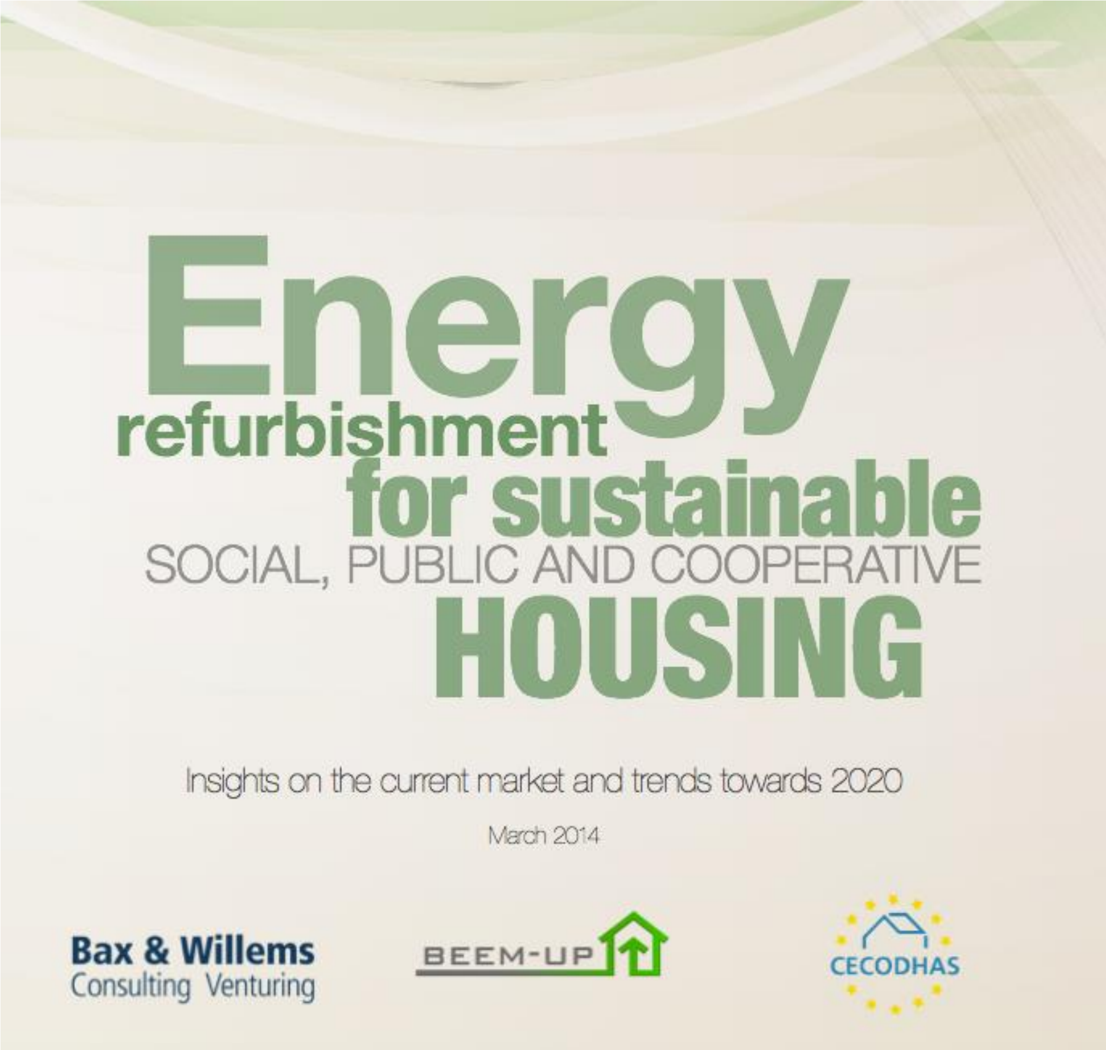
- The total annual investment needed to reach EU 2020 targets is estimated to be €37.8 billion.

- In order to meet the 20% target by 2020, at least 2% of the SPC housing stock needs to be refurbished each year achieving an average reduction in energy demand of 65%.

- At the current level of average expenditure per refurbishment, a reduction in energy demand of around 40% can be expected – enough to raise an E or F-rated building to roughly a C label.

Chapter 8 Annexes

Public report 6.5 - Energy refurbishment for sustainable social, public and cooperative housing. Insights on the current market and trends towards 2020. March 2014 - BEEM-UP, CECODHAS



Chapter 9 References

[1] DELIVERABLE 6.2 ESTIMATION OF THE ECONOMIC OUTCOMES OF THE PARIS, ALINGSÅS AND DELFT SITES

[2] DELIVERABLE 6.3 LEGAL FEASIBILITY OF ENERGY PERFORMANCE CONTRACTING IN FUTURE

[3] DELIVERABLE 6.4 ADAPTED TOOL FOR BUILDING PARK MODELLING IN EU COUNTRIES

[4] DELIVERABLE 6.5 ENERGETIC REFURBISHMENT REPLICATION STRATEGY FOR EASTERN EUROPEAN COUNTRIES

[5] BASTIAANSSE R., DIJOL J., ZIETARA P,. ENERGY REFURBISHMENT FOR SUSTAINABLE SOCIAL, PUBLIC AND COOPERATIVE HOUSING. INSIGHTS ON THE CURRENT MARKET AND TRENDS TOWARDS 2020. MARCH 2014 - BEEM-UP, CECODHAS HOUSING EUROPE

Energy refurbishment for sustainable SOCIAL, PUBLIC AND COOPERATIVE HOUSING

Insights on the current market and trends towards 2020

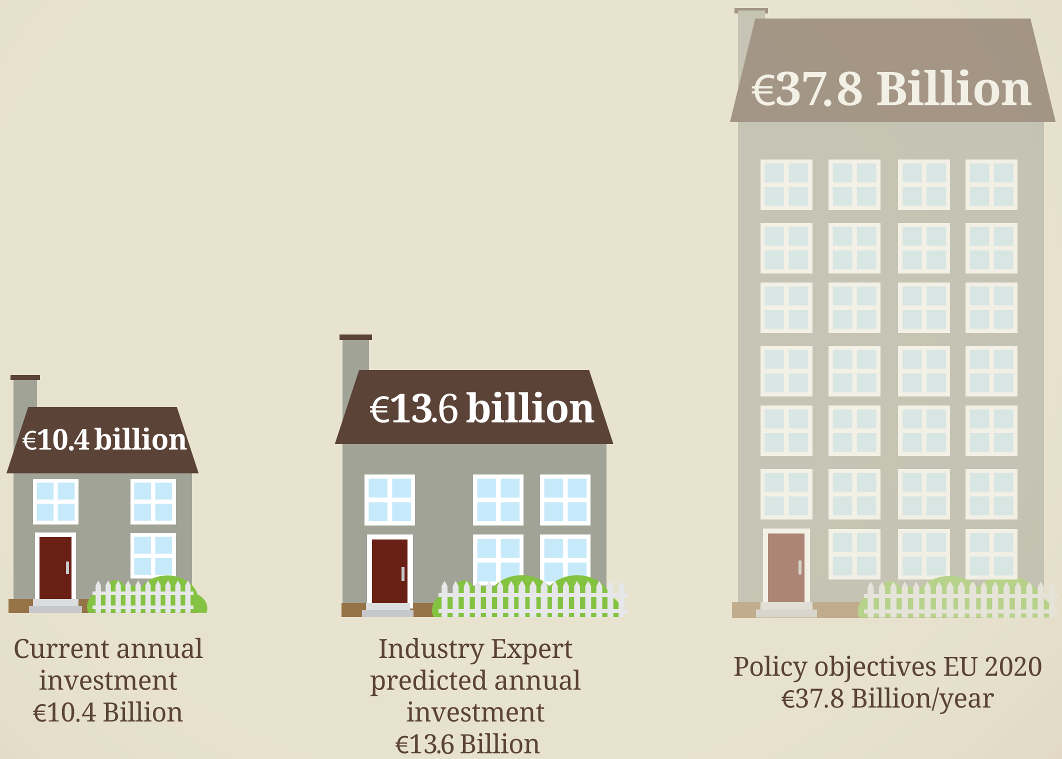
March 2014

Bax & Willems Consulting Venturing

BEEM-UP

CECODHAS

Current, predicted and recommended annual investment in social, public and cooperative housing retrofit



Estimated Funding Gap Over 7 years
€180.6 Billion

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Executive summary

About this report

Large-scale energy refurbishment has a vital role to play in Europe's transition to a low-carbon economy. If we consider that energy demand from buildings accounts for 40% of Europe's total, and that 80% of 2050's buildings have already been constructed[1], it stands to reason that improving the energy performance of existing building stock should be high on the EU's sustainability agenda.

The question then, is where and how to make such improvements. Residential buildings make up a large majority of Europe's building stock, and over one in ten of these fall into the Social, Public and Cooperative (SPC) housing category. Moreover, these often belong to publicly owned organisations with the technical capacity, the socio-economic drive and the long-term investment horizons needed to carry out energy renovations on the necessary scale.

To assess the ability of SPC housing organisations to achieve both their own objectives for 2020 and those of European policy, we have completed the first cross-European analysis of trends and projections in the sector. The study offers quantified insights into expected reductions in energy consumption, and recommends policy actions to accelerate progress to the desired level. The survey covers 16 of 24 EU countries, between them accounting for around 60% of the total SPC housing stock of 27 million dwellings.

Quantifying the issue

A substantial part of SPC building stock was constructed prior to 1960. Such buildings have, on average, an energy efficiency labelling of E or F (although definitions do vary by country). The current average refurbishment rate across countries surveyed is 1.19% per year. These buildings are generally upgraded to a C label at an average cost of **€32,250 per dwelling,** with the sector currently investing around **€10.4 billion** each year.

Looking towards 2020, an increase in activity is expected. The renovation rate is currently expected to rise to 1.39% and the average investment to **€36,200 per dwelling,** Annual investment is expected to rise to **€13.6 billion**.

As recently demonstrated by the BEEM-UP project, energy demand reduction to a much higher standard is both feasible and cost-effective. However, a demand reduction of more than 65% has been shown to cost in the region of **€70k per dwelling on average.**

If the sector is to meet 2020 targets and achieve a 20% energy demand reduction in line with European policy objectives, an even greater funding gap must be addressed. In order to attain this figure using current best practices, an additional total investment of **€180.6 billion** will be needed for the period 2014-2020.

1 http://www.eui.eu/Projects/THINK/Documents/Thinktopic/THINKTopic72012.pdf

The tip of an iceberg

Buildings account for 40% of Europe's energy consumption, and for one third of its greenhouse gas emissions. Thanks to improvements in technology and increased understanding of climate issues, buildings of the future are now being planned and built to far more rigorous energy efficiency standards than those of the past. These buildings, however efficient, represent but a fraction of those currently in use. In fact, 80% of 2050's buildings are already standing today.

To a large extent then, Europe's hopes of meeting climate and energy security targets will depend on its ability to reduce energy consumption of these existing buildings. The potential for improvement here is clear, as recognised in the Energy Performance of Buildings Directive, but a feasible method of unlocking that potential has not thus far materialised.

A social solution

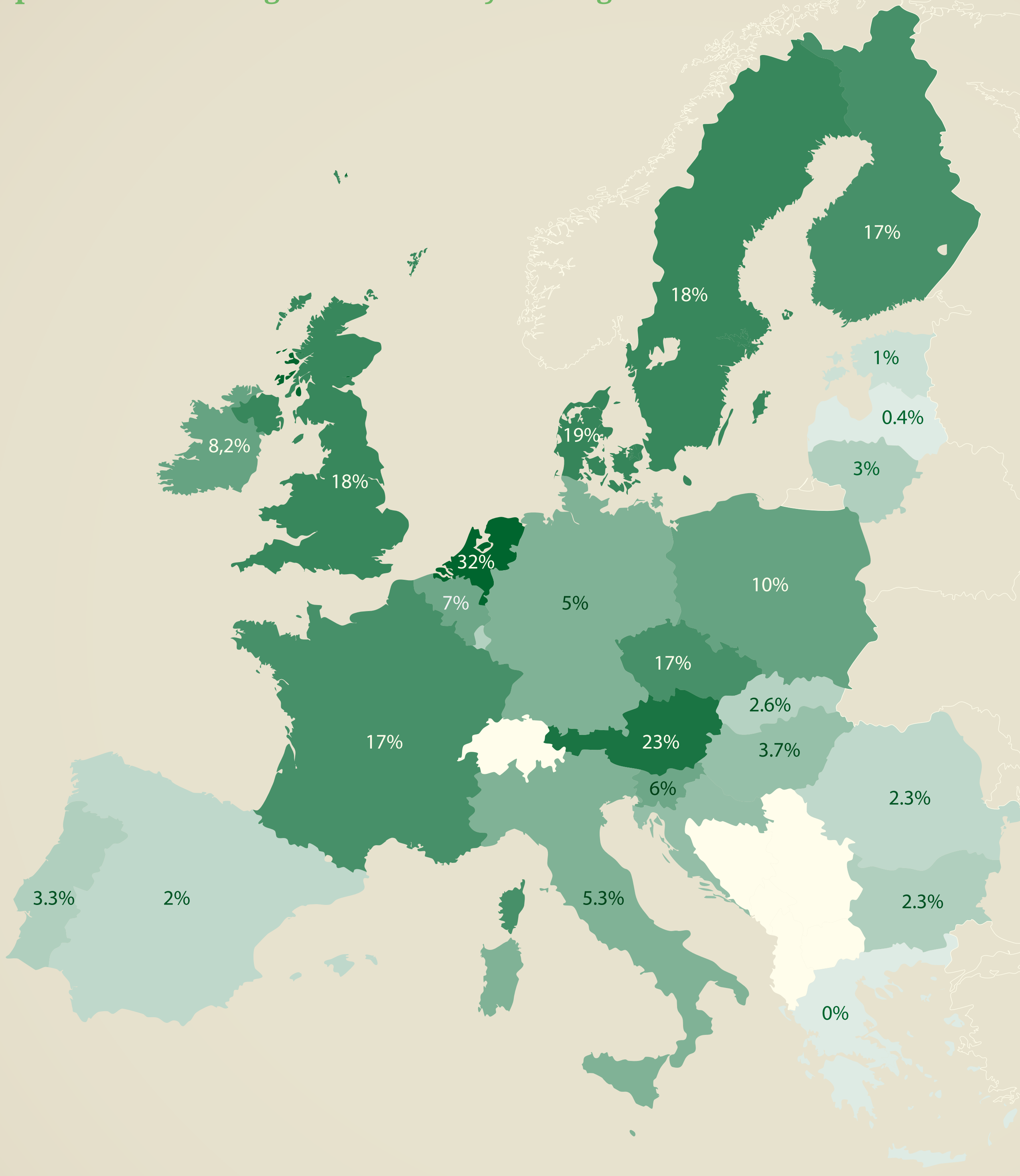
It stands to reason then, that energy efficiency retrofitting could play a vital role in achieving ambitious European targets, but in order to achieve optimal results, initial efforts must be targeted as effectively as possible. This report will argue that the social, public and cooperative housing sector represents the ideal starting point for such an initiative.

Publicly owned SPC housing organisations have the technical ability, the socio-economic drive and the long term investment horizons necessary to carry out energy renovations. What's more, there are good prospects for scalability, both within and outside of the sector.

Around 12% of the total European building stock is currently owned by SPC housing organisations – some 27 million dwellings. Prevalence ranges from 3% in southern Europe to around 20% in the north-west and 32% in the Netherlands. Most of these buildings are multi-family residential buildings with a tenant rental structure, thus the impact of each individual renovation is likely to be high.

Best practices established and developed through work in the sector have high potential for replication. As first mover, the sector could help develop economies of scale and expertise in the private sector to reduce the cost of future work and increase adoption elsewhere.

Proportion of building stock owned by SPC organisations



Source: www.housingeurope.eu

The market for SPC housing refurbishment

Estimates of current and projected refurbishment rates from twelve European countries provide some insight into the market for renovation in Europe. Defined as the ratio of major renovations to overall housing stock, current refurbishment rate across studied countries stands at **1.19% each year.**

Insights into refurbishment plans from companies in the SPC housing sector indicate that this number is expected to rise slightly to **1.39%** in the run up to 2020, representing an **additional 54,000 buildings** each year.

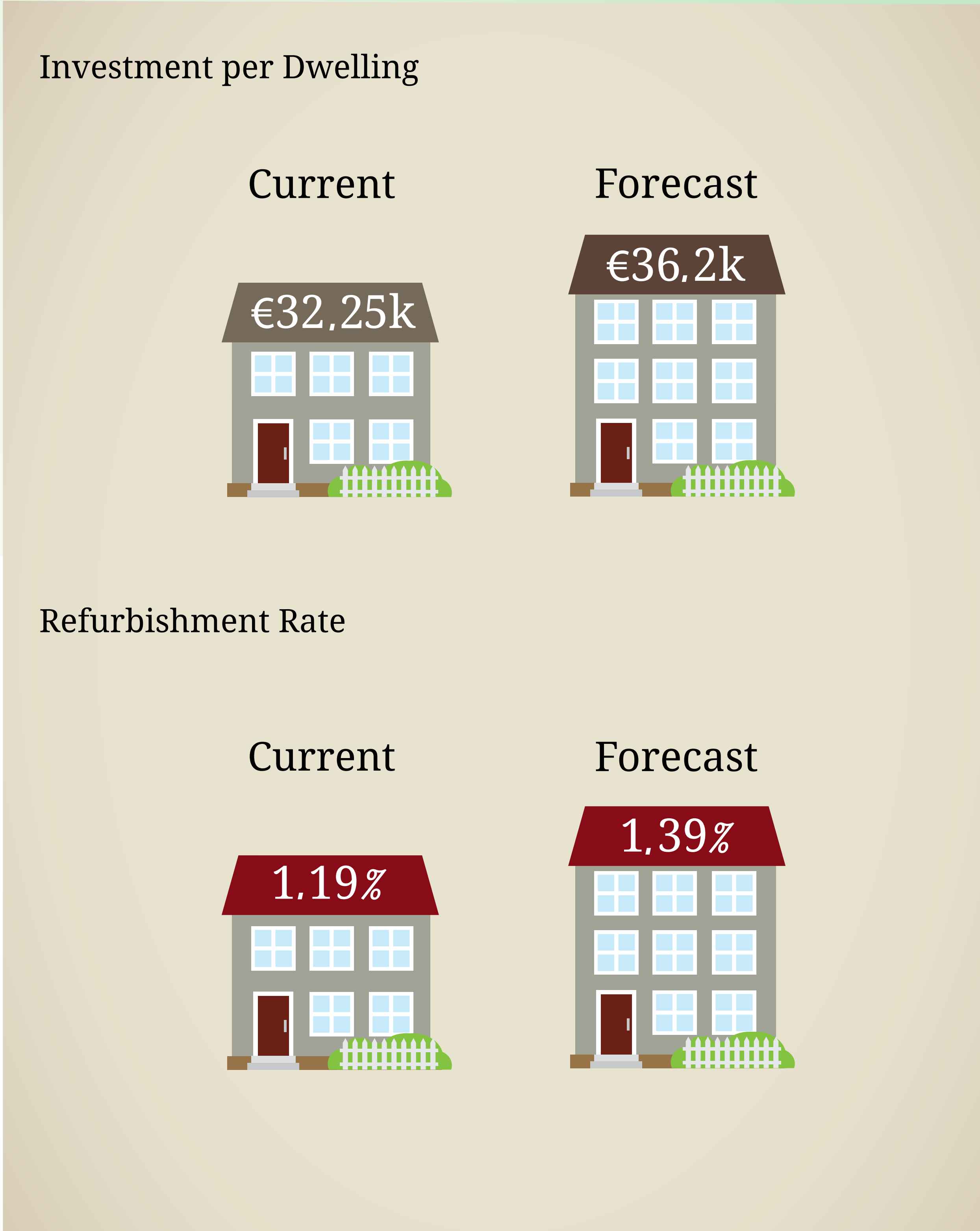
Projected increases remain small, due largely to the limited financial resources of SPC housing companies. Increased awareness of sustainable development, long-term planning and housing portfolio optimisation, whilst encouraging future development, has done relatively little to offset the problem.

Similarly, the average spend per refurbishment is expected to rise slightly across 14 surveyed countries. Aggregation of data shows that housing companies in Europe spend on average **€32,250 per dwelling** for a major refurbishment. We estimate that as we head towards 2020, this will rise to **€36,200.**

This expected growth can be explained in part by ambitious long term refurbishment plans, though public funding expectations also play a key role: some of the federations we spoke to expect subsidies to become available in coming years and have factored this into their projections, raising expected average investments. A second upward pressure results from the higher costs associated with hard-to-treat properties that have thus far not been renovated but will need to be in coming years.

Sizing it up

Based on the above indicators, the current size of the market for SPC housing refurbishment is estimated to be **€10.4 billion.** Projected increases in both refurbishment rates and average investments indicate that this figure will rise to **€13.6 billion.**



The cost of efficiency

2020 targets call for a reduction of energy consumption by 20% across the sector. At the predicted rate of expenditure, the Social, Public and Cooperative housing market will not meet this requirement until the year 2029.

Considering its size and the quality of its building stock, the sector has the potential to make major contributions to European sustainability objectives. The data clearly shows, however, that current predictions suggest that a reduction in energy demand of just 15% is expected by 2020 (with respect to the baseline period of 1990).

In order to meet the 20% target by 2020, at least 2% of SPC housing stock would need to be refurbished each year to achieve an average reduction in energy demand of 65%.

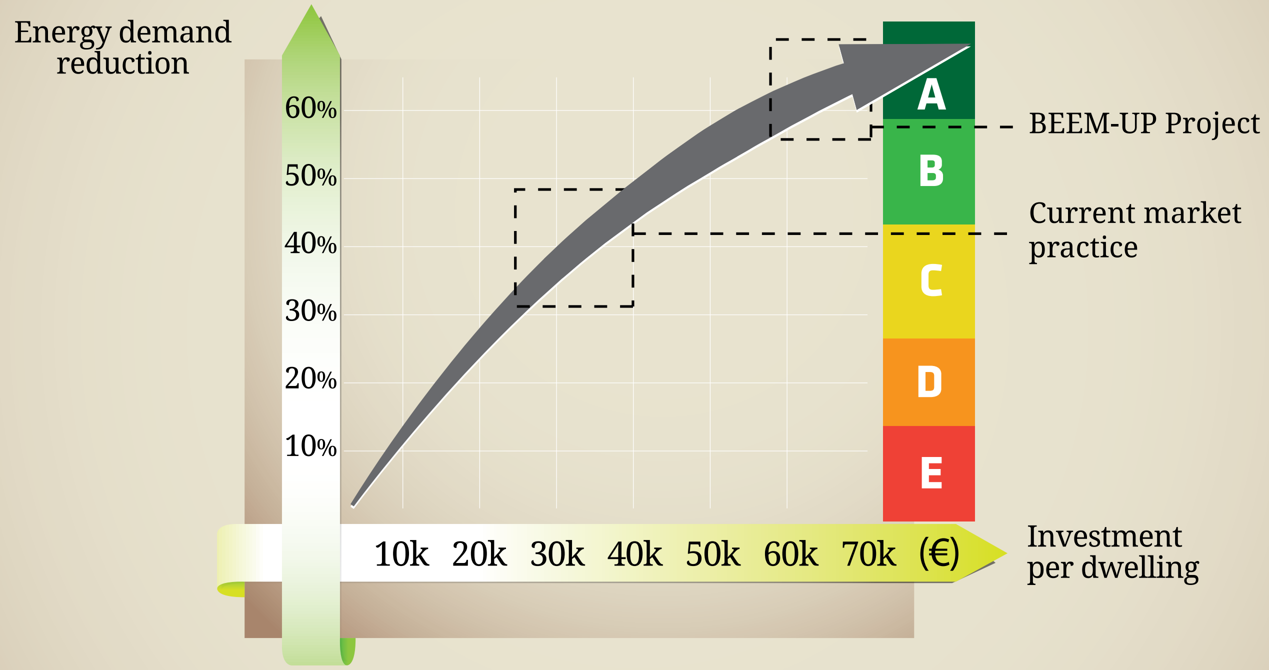
Bridging the funding gap

Survey data shows that the average energy performance of social, public and cooperative housing due for renovation in Europe sits at an energy efficiency label of E or F. At the current level of average expenditure per refurbishment, a reduction in energy demand of around 40% can be expected – **enough to raise an E or F-rated building to roughly a C label.**

Recent results from the BEEM-UP project[2] demonstrate that reducing energy demand by more than 70% through deep energy refurbishment is indeed feasible in the long term[3]. In most cases, such an energy saving would be enough to reach an energy efficiency label close to A.

[2] The BEEM-UP project demonstrates the economic, social and technical feasibility of deep energy retrofitting in social and public housing. The project includes 340 dwellings in across three northwest European countries: France, Sweden and The Netherlands.
[3] http://bwcv.es/assets/2013/12/4/BEEM-UP_-_Building_Energy_Efficiency_for_Massive_Market_Uptake.pdf

What does an efficient building cost?



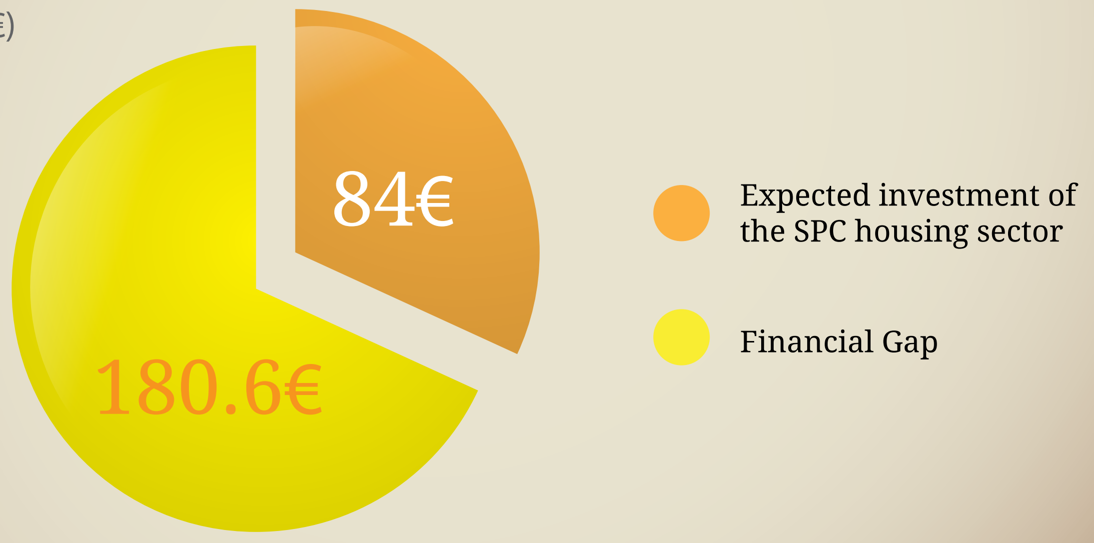
B&W elaboration based on data from the BEEM-UP project

Taking the discussed costs and refurbishment rates into account, we estimate the total annual investment needed to reach EU 2020 targets to be **€37.8 billion annually**. The SPC Housing sector is expected to spend an average of **€12 billion** annually, representing a yearly gap of **€25.8 billion** on average.

For the period 2014-2020 this represents a total gap of €180.6 billion.

Investment required to reach EU 2020 targets for energy demand reduction

(Billion €)



Weighing the impact

The benefits of social housing renovation extend far beyond sustainability. Besides the huge potential for CO_2 reduction, expected outcome of increased renovation across Europe include accelerated economic growth and the creation of new jobs.

Higher employment

According to latest figures on construction sector labour intensity[4], each €115,600 of turnover is assigned to one permanent job. The current expected investment in SPC should create an additional 103,806 jobs by 2020. Taking into account that one job created in the construction industry is expected to create two more jobs in the economy, this rate of investment predicts the creation of 311,418 jobs across Europe[5].

In the specified 2020 scenario, an annual investment of €37.8 billion would contribute an additional 980,968 jobs.

Reduced CO2 emissions

Buildings account for 40% of Europe's total energy demand. Given that residential buildings constitute 75% of total building stock, and that SPC housing accounts for 12% of these, we estimate that the sector consumes 63.3m tonnes of oil equivalent (TOE)[6].

Under current refurbishment plans, the Social, Public and Cooperative Housing sector will achieve a 3.9% reduction in energy demand by 2020 (with 2013 as a baseline). This translates to a saving of approximately 6.15 million tonnes of CO2 (2.49t CO_2/TOE)[7]. Given the price of CO2 under the EU Emissions Trading Scheme (€16.50 per tonne[8]), we estimate a saving of **€101.5 million**.

Under the second scenario, with the sector meeting the 2020 target of 20% energy demand reduction, the estimated saving is valued at **€239.5 million.**

[4] http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Construction_statistics_-_NACE_Rev._2
[5] http://www.efbww.org/default.asp?Issue=CONSTR
[6] http://epp.eurostat.ec.europa.eu/statistics_explained/index.php?title=File:Gross_inland_consumption_of_primary_energy,_2000-2010_(million_tonnes_of_oil_equivalent).png&filetimestamp=20121012130325
[7] http://www.energy.eu/publications/KOAE09001_002.pdf
[8] http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2030_update_2009.pdf

Improved public health

Renovation of residential buildings has a real impact on the health of residents. Retrofitted energy efficiency measures not only improve temperature regulation, but also the indoor climate. People in industrialised countries spend up to 90% of their time in buildings[9], and improvements to these environments can yield a number of indirect benefits, from lower incidence of disease and lower mortality rates, to higher productivity and an improved quality of life. Consequently, fewer hospital visits and workplace absences translate to public budget savings.[10]

[9] Höppe, P. Different aspects of assessing indoor and outdoor thermal comfort. 34 (2002)
[10] http://www.renovate-europe.eu/uploads/Multiple%20benefits%20of%20EE%20renovations%20in%20buildings%20-%20Full%20report%20and%20appendix.pdf

Policy implications

This report asserts that a financial gap of approximately €180.6 billion must be closed in order for the SPC housing sector to reach 2020 targets for energy efficiency. It concludes that the sector has an important role to play in the European economy, and should, due to the following characteristics, be considered a central focus of a number of policy actions.

- SPC housing providers each manage a considerable housing stock (often more than 20,000 dwellings) compared to private landlords, which creates a leverage of individual investment decisions and a great deal of scope for replication.

- Housing stock is managed in the long term (30-50 years), thus there are strong incentives to reduce future operational and maintenance costs.

- The majority of SPC housing stock has a rental structure with controlled rent levels, which means that rent cannot be raised after a renovation. This imposes constraints on both return on investments and possible business models.

- The sector, with 12% of European building stock, provides housing for a great number of low-income families and disadvantaged people. It significantly raises the living standard of these groups and provides positive externalities in areas including health and productivity.

What can be done?

From various European projects and the daily experience of affordable housing providers, it can be said that some ingredients are missing to trigger the ecological transition in the affordable housing sector:

Creation of a European Housing Fund

There is a compelling need for a European entity to facilitate the financing of major investments in retrofitting of houses. A European Housing Fund could combine the financial capacities of major European banking institutions in order to finance those investments with a long-term strategic importance to European society. Such an entity would be capable of providing low interests loans for major renovation projects in the SCP Housing sector. A European Housing Fund could also provide grants for technical support of investments' execution. Involvement of such an institution could have strategic value in setting up the necessary structures to encourage further investment from the private sector.

At present, housing companies have still little experience in implementing long-term renovation plans and managing major retrofitting projects. Experience of the ELENA grant programme across Europe provides evidence that a technical support grant can mobilise major renovation projects with a leverage of more than 50 over the financial grant.

A new technical support programme for the period 2014-2020 would greatly contribute to the acceleration of investment programmes in building renovation.

Facilitation of applied research and standardisation

Three lines of research have been identified as beneficial for the fostering of energy-retrofitting projects.

- The continuation of applied research to develop low-cost technologies for the improvement of energy efficiency and renewable energies in housing, including a focus on prefabricated modules aimed at deep renovation of affordable dwellings within a short period of time.

- Standardisation of the appraisal of green value investments, including a credible evaluation of external benefits related to energy retrofitting.

- Training of both housing professionals and tenants in order to enhance their ability to benefit from the energy transition, to include financial engineering and major retrofitting project management.

Further considerations

Appropriate legislation is needed to allow the development of low carbon market finance. This may be achieved through, for instance, the standardisation of Energy Performance Contracts and the transfer of receivables (energy savings which represent guaranteed cash flows) into asset portfolios of investors, or as underlying assets for bonds.

Indeed the emission of specific bonds based on the securitisation of the future energy savings could be envisaged since bond emission would enable to raise funds at lower cost than through a usual loan, and thus to offer ESCOs better refinancing conditions. However, the emission of bonds requires a critical size and homogeneity of assets, which can only be reached in a mature market.

Annex 1: Methodology

This survey is based on a questionnaire and telephone interviews with 16 of the 24 members of the Energy Experts working group of CECODHAS Housing Europe. The working group members represent national SCP housing federations in Europe.

The survey reflects best estimates by experts at time of interview. The data provided should not, however, be considered reflective of the formal positions of participating experts, nor the organisations they represent.

The following organisations participated in the survey:

Organisation	Country
EKYL	Estonia
GdW	Germany
NABCo	Ireland
LegaCoop Abitanti	Italy
NBBL	Norway
AVS	Spain
Riksbyggen	Sweden
BHA	Bulgaria
VMSW	Belgium
USH	France
Federcasa	Italy
AEDES	The Netherlands
ZRSMRP	Poland
SFHA	Scotland
GdV	Austria
NHF	UK

This survey and accompanying report has been the result of collaboration between Bax & Willems S.L., the industry-led BEEM-UP project, and CECODHAS Housing Europe.

Bax & Willems
Consulting Venturing

Bax & Willems is a specialised consultancy firm with extensive experience in market studies and analysis. For more than 25 years, the firm has designed and implemented Open Innovation strategies for large industrial corporations as well as smaller high-tech companies, research institutes and governments.

Energy efficiency in the construction sector is one of Bax &Willems' key areas of expertise.

www.baxwillems.eu

BEEM-UP

The BEEM-UP Project is one of the largest European projects (FP7). It demonstrates the economic, social and technical feasibility of deep energy retrofitting in social and public housing. The project takes an integral approach to overcome barriers through three ambitious retrofitting pilots located in Sweden, the Netherlands and France.

BEEM-UP aims to retrofit 340 dwellings with an average heating energy demand reduction of 75%. The overall objective is to explore innovative building and energy management approaches, which could be replicable on a larger scale.

www.beem-up.eu

CECODHAS

CECODHAS Housing Europe is the European Federation of Public, Cooperative & Social Housing - a network of 45 national and regional federations, which together represent about 41,400 public, voluntary and cooperative housing providers in 19 countries.

www.housingeurope.eu