FROM DEMONSTRATION PROJECTS

TO VOLUME MARKET

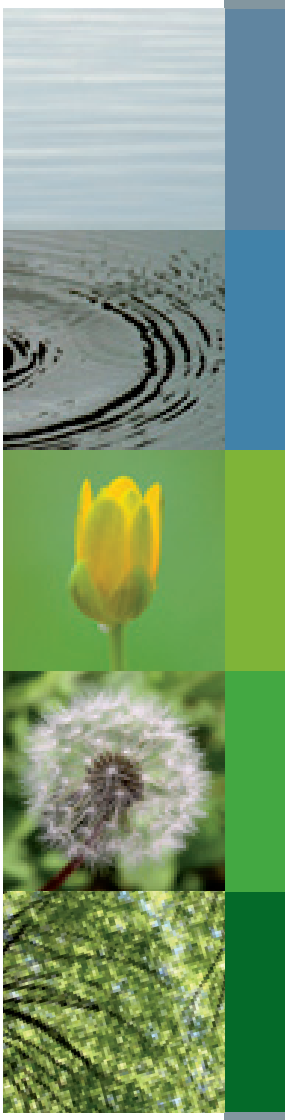
Market development for advanced housing renovation

INTERNATIONAL ENERGY AGENCY
Solar Heating & Cooling Programme

TASK 37: Advanced Housing Renovation with Solar & Conservation

"The greater danger for most of us
is not that our aim is too high and we miss it,
but that it is too low and we reach it"

Michelangelo Di Lodovico Buonarrotisimoni (1475 – 1564)



Contributors

This handbook is produced from material developed in the course of IEA SHC Task 37 Advanced Housing Renovation by Solar and Conservation. The operating agent was Fritjof Salvesen from Norway. This venture brought together some 50 experts from 12 countries. The objective of this task was to develop a solid knowledge base how to renovate housing to a very high energy standard while providing superior comfort and sustainability and to develop strategies which support market penetration of such renovations explicitly directed towards market segments with high renovation and multipliable potentials. The task was divided in four subtasks:

Subtask A: Marketing and Communication Strategies

- Subtask Lead Country: Norway. Lead: Are Rødsjø, The Housing Bank

Subtask B: Advanced Projects Analysis

- Subtask Lead Country: Switzerland. Lead: Robert Hastings, AEU GmbH, CH.

Subtask C: Analysis and Concepts

- Subtask Lead Country: Germany. Lead: Sebastian Herkel, Fraunhofer Institute, Solar Energy Systems

Subtask D: Environmental Impact Assessment (EIA)

- Subtask Lead Country: Belgium. Lead: Sophie Trachte; Architecture et climat, Belgium

For more information: http://www.iea-shc.org/task37

This booklet is produced in Subtask A; Marketing and Communication Strategies. The main authors are:

- Edward Prendergast, moBius consult bv, with financial support from NL Agency, the Netherlands
- Erwin Mlecnik, the Passiefhuis-Platform, Belgium/OTB Delft University of Technology, the Netherlands
- Trond Haavik, the marketing consulting company, SEGEL, Norway
- Are Rødsjø, The Housing Bank, Norway

The editor and co-author is:

- Paul Parker, the University of Waterloo, Canada

The following persons gave significant contributions through meetings and discussions:

- Wouter Hilderson, the Passiefhuis-Platform, Belgium
- Mia Ala-Juusela, the research institute VTT, Finland
- Lynda Amitrano, the company BRANZ, New Zealand

Authors of documents in the appendix are listed in these documents.

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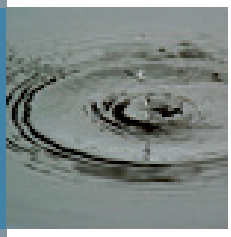
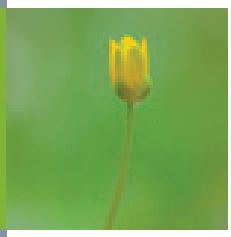


How do we get from demonstration projects to a volume market for very low energy demand in Advanced Housing Renovation? The contributors to this report have been working with this issue for many years. Some worked in both IEA SHC Task 28 Sustainable Housing (2000-2005) and in SHC Task 37 Advanced Housing Renovation with Solar and Conservation. This work resulted in the handbook Business Opportunities in Sustainable Housing (from Task 28) and in this booklet. Building stock analyses from Task 37 show that many countries have a huge theoretical potential for reducing the energy consumed in the existing building stock. The question is: How do we speed up the transition from demonstration projects to volume market? This report looks both at a traditional market development perspective and interventions by public actors. By doing this, the report aims to provide a better understanding of what drives advanced housing renovation, and provides a reference document designed to inform and recommend directions for policy makers and central decision makers.

For successful market development, it is necessary that the right private and public actors cooperate, coordinate their measures and perform them at the right time. Those saying that the market is not ready for this are quite right if they mean the majority of the market. Any new product or service has to be adopted first by the innovators in the introduction phase and thereafter the early adopters in the growth phase before it can reach the early majority in the volume market. This applies to both the supply and demand side. This booklet investigates these three phases through four marketing perspectives: attractiveness, competitiveness, affordability and availability. Separate chapters highlight the driving forces, barriers and critical success factors that are recognised in each phase. This chapter is a short summary of the findings.

To fully exploit the potential of this report it should serve as input for a strategic process carried out by public or private actors which consider taking an active part in developing the market for Advanced Housing Renovation.

Introduction phase



In this phase innovative actors on the supply side have the common goal to realise successful demonstration projects for innovative customers. The most important actors are national authorities, research institutes and innovative companies. Important barriers are lack of knowledge, lack of funding and difficulties in attaining the homeowners' interest. Each actor must contribute to break through these barriers. If this is successful, the innovative homeowner will want to invest in the advanced renovation of his/her home. The demonstration projects should be geographically spread to help the transition to the growth phase and later to the volume phase. In short, recommended measures for these actors are:

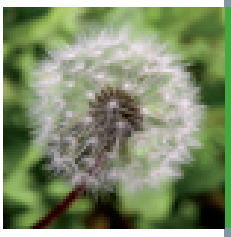
- **Public actors:**
  - Create arenas for the exchange of knowledge for all actors.
  - Promote public awareness.
  - Establish financial support for advanced renovation.
  - Set a national agenda that also includes perspectives for future policies.

- **Research institutes**
  - Participate in international cooperation.
  - Involve good partners from the industry as well as public actors.
  - Present trustworthy facts in an understandable way.

- **Innovative companies**
  - Research in order to learn about the state of the art.
  - Find complimentary partners to increase financial strength.
  - Communicate how the solution fulfils the customers' needs.

Growth phase

The important actors in this phase are national and local authorities, companies and research and educational institutions. In this phase these actors have the common goal to complete successful and attractive projects for early adopter customers. Some of the most important barriers in this phase are lack of cooperation and coordination, lack of knowledge, insufficient quality assurance and that the 'added value' is unclear, both on the supply and demand side. The main actors in this phase must contribute together to break through the barriers. In short, recommended measures for these actors are:



- **National and local authorities**
  - Public buildings as showcases – boosting the demand side.
  - Comprehensive plans for dissemination of advanced renovation including information, education, R&D, quality control and funding.
  - Implement energy labelling and quality assurance systems.

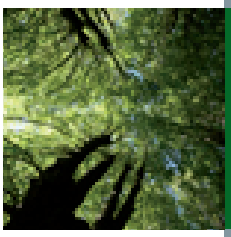
- **Educational institutions**
  - Educational programs at all levels, including professional training and development.

- **Early adopter companies (trendsetters)**
  - Network through the supply chain by creating arenas for all actors to meet.
  - Use demonstration projects as showcases and learning opportunities.
  - Develop 'one stop shops' for complete solutions.
  - Implement tools that create advantages for complete solutions.

Crossing the chasm between the growth phase and the volume phase

The important actors for crossing the gap to the volume phase are national and local authorities, large companies and housing cooperatives. Important barriers are lack of influential and trustworthy forerunners, lack of knowledge of benefits among early majority, difficult decision making processes, legislation and high renovation costs. In short, recommended measures for these actors are:

- **All actors**
  - Market attractive and trustworthy examples of well proven solutions from the growth phase with a main focus on rational arguments.
  - Announce advanced renovation as the standard renovation policy.



- **National and local authorities**
  - Strengthen legislation on required level and performance of renovation.
  - Where necessary, change legislation not to hinder renovation (such as issues on investment and rent).
  - Make the tools and acquired experience available to all actors, for example calculation tools and prescriptions for concepts, technologies, construction details, etc.

- **Companies**
  - Reduce prices to open up new markets and enable large scale production.
  - Implement educational programs for in-house consultants, planners and on site workers
  - Invest in technology clustering as a way to overcome technology dependantlack of skills and competences.

- **Housing cooperatives**
  - Educate project managers/members how to run advanced renovation projects.
  - Initiate large scale affordable advanced (social) housing renovation projects.

Reducing energy use in the building sector is one of the most important and affordable means to mitigate climate change[1]. Technical solutions that substantially reduce the energy demand are currently available as demonstrated by the IEA SHC Task 37 projects. Generally, advanced renovation is progressing, but at a much slower rate than needed. To meet the goals for carbon emission reductions it is necessary to increase both the rate (annual percentage making energy retrofits) and the depth (percent energy savings) of renovations.

[1] IPCC, Intergovernmental Panel on Climate Change, (2007) Summary for policy makers – IPCC WG1 Fourth Assessment Report, Paris. [online], http://www.ipcc.ch, [Consulted: 13 July 2009].

1 Introduction

1.1. Growth, challenges and solutions

Widespread availability of cheap energy was a precondition for the industrial revolution, the rapid growth of modern civilization and a substantial increase in the standard of living. The main source for cheap energy has been fossil fuels: coal, oil, and natural gas. Global greenhouse gas emissions from the use of fossil fuels are now threatening life on Earth as we know it. The global population was 2.5 billion in 1950 and reached 6.8 billion 2009. It is projected to surpass 9 billion people by 2050[2]. Increasing population and economic activity are core drivers of rising demand for energy.

Energy systems contribute 69% of all CO_2 emissions. Global energy demand is expected to rise by nearly 60% over the next 20 years[3], but global emissions must be reduced by at least 50% by 2050, if global warming is to be limited to the target adopted by over 100 countries, a 2°C rise in average temperature[4].

The increased cost of fuel, the liberalisation of energy markets and decreased levels of welfare provision in OECD countries since the 1970s and in the transition countries since the 1990s mean that an increasing number of low-income households cannot afford the costs of heating. In the UK, this problem is known as the 'choice between heating and eating'. Alternatively, it is known as 'fuel poverty' or 'energy poverty. Since it is the most vulnerable, poorer strata of the population that experience the dilemma of 'heating or eating', it is they who face the associated health risks first[5]. Cold and damp houses expose occupants' health to the risk of respiratory, cardiovascular, allergy-related and infectious diseases, psychological stress and cold-related death.[6] "It is estimated that 24,000 older people will perish this winter because they often can't afford adequate heat or from ill health linked to cold, damp living conditions (in UK)."[7] Fuel poverty can lead to energy conservation, but it also threatens public health and welfare, and is therefore not sustainable.

Buildings represent the largest end use of energy globally. The building sector used 38% of global final energy consumption in 2005 and 57% of all electricity. Promoting energy efficiency in the building sector is essential to achieve the mitigation goals of the United Nations Framework Convention on Climate Change and its Protocols (e.g. Kyoto). Reducing energy use in the building sector is one of the most important and affordable means to mitigate climate change[8]. The McKinsey Global Institute[9] has published a comprehensive cost curve for global greenhouse gas reduction measures which states that measures in the building stock are among the most profitable. Advanced renovation can reduce the energy demand to a level where energy for heating is almost not needed. IEA SHC Task 37 demonstration projects highlight energy reductions of 62-95% for space heating and 75% on average for domestic hot water.

2 UN Population Division/DESA, Press release NEW YORK, 11 March 2009

3 IEA, International Energy Agency, (2007) World Energy Outlook.

4 IPCC, Intergovernmental Panel on Climate Change, (2007) Climate Change; Meinshausen, M., N. Meinshausen, W. Hare, S. Raper, K. Frieleri, R. Knutti, D. Frames, M. Allen (2009) Greenhouse gas emission targets for limiting global warming to 2°C, Nature. 458 pp. 1158-62.

5 Wilkinson, P., K. Smith, S. Beevers, C. Tonne, T. Oreszczyn (2007) Energy, energy efficiency, and the built environment, The Lancet. 370 pp. 1175-87.

6 UNECE (2009) GREEN HOMES Towards energy-efficient housing in the United Nations Economic Commission for Europe region.

7 BBC NEWS (29th August 2005) Allan Asher Chief executive, Energywatch.

8 IPCC (2007) Summary for policy makers – IPCC WG1 Fourth Assessment Report, Paris. [online], http://www.ipcc.ch, [Consulted: 13 July 2009].

9 The McKinsey Quarterly (2007) Number 1.

1.2. Government priorities, market development and business opportunities

There are three compelling reasons for policy makers to strive for lower energy use. First, fossil fuels are a limited resource and growing demand is raising the price of fuels; second, burning fossil fuels contributes to climate change; and last, but not least, the energy supply is not considered secure in many countries[10]. Governments are likely to actively support or intervene in market development when it is likely that national goals will not be reached. Several nations and regions have established energy performance policies and regulations. Technical solutions are currently available as demonstrated by the IEA SHC Task 37 projects. Formulating ambition levels and sharpening regulations is feasible and already underway in many countries. However, regulations alone provide no guarantee for the associated market development that is needed.

Generally, Advanced Housing Renovation is progressing, but at a much slower rate than that needed to reach national and international goals within a timeframe that recognises impending fuel constraints and climate change objectives. There are many reasons for this. Products (like Advanced Housing Renovation) that are made to reduce CO_2 emissions have to compete with products where the 'costs' of CO_2 emissions are not taken into account. Work in Task 37 shows that compared to ordinary renovation, Advanced Housing Renovation needs a more holistic approach, higher skill competence and stronger coordination in the planning and renovation process. Furthermore, the building sector, as a whole, is diverse, complex, conservative and characterized by fragmentation. This creates barriers for advanced renovation. Analyses carried out in Subtask A also show barriers according different types of building segments, ownership and decision processes, and national, regional and local energy standards, regulations and funding schemes. On the other hand, advanced renovation and increased renovation rates provide good business opportunities for proactive planners, consultants, building companies and suppliers of building components and materials. So far, only a few companies have recognised and taken advantage of this opportunity[11].

1.3. Scope and target group for this report

This report looks both at a traditional market development perspective and interventions by public actors. By doing this, the report aims to provide a better understanding of what drives Advanced Housing Renovation, and provides a reference document designed to inform and recommend directions for policy makers and central decision makers.

To fully exploit the potential of this report it should serve as input to a strategic process carried out by public or private actors who are considering taking an active part in developing the market for Advanced Housing Renovation.
Main target groups for this report are:

- central government (for establishing policy)
- local governments and local government landlords (housing authorities)
- companies working in the renovation industry (design, installation, component production)
- owners and landlords of housing

[10]Example: The EU imports about 50% of its energy needs and this figure is expected to rise to 65% by 2030. About half of the EU's natural gas imports and 30% of its imported oil come from Russia. Recent disputes between Russia and Ukraine illustrated how vulnerable the supply is to political decisions. Future energy requirements and energy security have thus become a policy priority for the EU.

[11]Example: EuroACE, the European Alliance of Companies for Energy Efficiency in Buildings have been supporting EU proposals for high ambition mandatory targets both for new construction and renovation.

2 Diffusion of Advanced Housing Renovation

2.1. Experiences, potentials and actions

Demonstration projects shows good results
Subtask B: Advanced Projects Analysis of the IEA SHC Task 37 shows that – sometimes innovative - very energy efficient concepts, principles and components have been successfully introduced in the retrofitting of existing buildings. Depending on the building type, realized energy savings vary from 80 to 95%. The heating demand is typically reduced from values between 150 and 280 kWh/m²a to less than 30 kWh/m²a. The projects also show that Advanced Housing Renovation improves living quality and comfort conditions and contributes to sustainable development. In some cases, the Passive House Standard of 15 kWh/m²a is reached for heating demand. As pilot projects in different countries demonstrate, these Passive House retrofits are technically feasible for a range of building types.

The existing building stock offers big potential savings
In general, the Passive House Standard of 15 kWh/m²a, although relatively easy to implement in new construction, is often more difficult to achieve in a cost-efficient way through renovation. Protected building facades, existing thermal bridges and highly valued ornaments are especially difficult to tackle. On the other hand, from the technological point of view, a large group of mass-produced building typologies from the sixties and seventies can be transformed into very energy efficient houses, in limited timeframes and even without creating a lot of nuisance for the (remaining) inhabitants, as shown by IEA ECBCS Annex 50. By recognising and engaging ownership and decision structures, inhabitants and their characteristics, and actual groups of retrofit market players, a huge potential market is available for Advanced Housing Renovation.

Advanced Housing Renovation – clustering of technology groups
The success of these projects lies in their effective combination of conservation measures to reduce energy demand; using renewable energy to cover much of this reduced demand and supplying the remaining heat by highly efficient, compact conventional systems. At the same time, an integrated approach for Advanced Housing Renovation is considered necessary.

The following principles can be translated into specific measures and performance criteria with typical cost and associated technologies, as illustrated by the Intelligent Energy Europe project 'e-retro-fit-kit' and Subtask C : Analysis and Concepts of the IEA SHC Task 37:

- Minimized transmission losses: The building envelope has a very high standard of insulation. Typical insulation thicknesses after renovation are 25-45 cm in roofs and 20-35 cm in walls. Typical windows will be triple-glazed or equivalent. Specific building details will reduce thermal bridges to practically zero.

- Minimized ventilation losses: Heat recovery in the ventilation system can reduce ventilation losses by about 80% while increasing both thermal comfort and air quality. A precondition for heat recovery is a high level of air tightness of the building envelope, minimizing losses from warm air leaking through cracks and crevices.

- Passive and active solar energy: internal heat gains (from people, lights, electrical equipment etc.) and solar radiation are typically taken into account in calculating heating demand[12]. In addition to passive solar gains, active systems like thermal collectors or PV-systems can be used.

[12] Although the internal heat gains can be beneficial in cold periods, they should be avoided in warm periods. Thus energy efficient equipment is necessary to avoid overheating in summer conditions.

- Efficient energy supply: Low energy retrofits have a very low heating demand, but still need a heating system for the coldest winter days and a system providing domestic hot water. This remaining energy demand is typically supplied by very efficient systems like special heat pumps, high efficiency gas boilers or wood pellet furnaces.

- Overheating control: As a very high thermal comfort is one of the main marketing arguments in the development of low energy housing retrofits, overheating control is an important issue. Mainly passive measures like overhangs, shading devices, (e.g. awnings) are used. Measurements in pilot projects have shown that with these measures, passive houses actually suffer less from overheating than regular houses because the thermal insulation keeps the summer heat out.

Challenges and necessary actions
Subtask B: Advanced Projects Analysis and the marketing stories from Subtask A show that it can be quite a challenge in practice to realize advanced housing retrofit, in particular in view of political, economical, social and technological barriers that hamper the diffusion of energy efficient renovations. But subtask B also demonstrates that very ambitious goals can indeed be met if these barriers are solved. Following in the footsteps of the advances of new construction towards 'better than the passive house standard', a market share of minimum 20% of very energy efficient renovations, appears to be an achievable goal by 2020[13]. However to implement such a vision it is important to:

- Reinforce the political context and energy market conditions.
- Reinforce positive market developments (energy neutral buildings, very low energy renovations, renewable energy with optimized decentralised production).
- Reinforce consumer awareness.

Given our ability to realize the specific goal of energy producing buildings by 2030, the more general goals of increasing competitiveness, environmental protection, meeting EU's Kyoto obligations and security of energy supply can also be achieved.
To realize such a vision it is important to define the appropriate transition paths.

2.2. Methodology - Framework for discussing diffusion of advanced housing renovations

Currently, renovations with advanced energy performance only exist in the demonstration phase. To achieve the diffusion of such projects and associated technologies it is important to make them available in the general market. Unless some government, entrepreneurial or non-profit organisation makes the innovation available at or near the location of the potential adopter, that person or household will not have the option to adopt it in the first place. In the following chapters, we suggest processes by which innovations, and the conditions for adoption, are made available to individuals or households, so that at least the supply aspect of diffusion is covered.

To examine this issue we note that different types of people adopt innovations in different stages and can be attracted by different motives and/or actors. The details have been presented in the scientific literature on 'diffusion of innovation,[14]. Diffusion of innovation can be driven by:

- Communication within a society, i.e. to increase the attractiveness of the innovation[15].
- Improvements made to the innovation itself over time, i.e. to increase the competitiveness of the innovation[16].
- Providing equal access to resources, i.e. to increase the affordability of the innovation[17].
- Providing the innovation near the location of the potential adopter, i.e. to increase the availability of the innovation[18].

To simplify the essence of each perspective, a diffusion analyst can ask four core questions[19] to explain the diffusion of an innovation:

- Is the innovation attractive?
- Is it competitive?
- Is it affordable?
- Is it available?

In the following chapter we will define diffusion phases in order to provide a long-term perspective on the steps to reach the volume market with Advanced Housing Renovation. We use the four questions to guide the analysis of barriers and opportunities in each phase.

Input to the analysis is based on:

- The experiences from the demonstration projects of Subtask A of the IEA SHC Task 37 gathered and structured through two workshops.
- Building stock analyses and marketing stories made by participants in Subtask A
- Input from other reports.
- Output of discussions in several conference calls with participants from Subtask A over a period of 2 years.

In each development phase this report points to driving forces, barriers, key actors and recommend measures that should bring forward the desired change[20]. The measures that are listed give valuable examples of recommendations for actions. However, to fully exploit the potential of the analyses in this report the measures should serve as input to a strategic process carried out by public or private actors to actively develop the market for Advanced Housing Renovation .

For the analysis we note that the impact of commercial firms on technology diffusion is widely recognized to be important.[21] In terms of what empowers an entrepreneur to fulfil the role of innovator and achieve strategic advantage, it is clear that a mix of entrepreneurial vision and will, managerial capacities, know-how and access to resources (capital) is needed to affect change.[22] But entrepreneurs do not operate in a vacuum: policies that are put in place by government can strongly influence their business. A change in institutional conditions may be necessary for realizing the benefits of technological change, but at the same time the technological change, providing an opportunity to increase profits, may be the impetus to innovate a new institutional arrangement.[23]

In this framework it is important to address how government and industry will both be needed to speed up the transition to a low energy built environment.

[13]For example, these strategies are specified in Belgium in the Flanders Region transition area for sustainable living and housing: 'in 2030 energy producing new built construction and energy neutral existing construction'.

[14]See for example the books on this topic by Rogers, E. (1962) Diffusion of Innovation. New York: Free Press, and Brown, L. (1981) Innovation Diffusion: A New Perspective. New York: Methuen.

[15] A Also known as the 'communication perspective', see for example L. Brown (1981).

[16] Also known as the 'economic history' perspective,.

[17] Also known as the 'development'perspective,.

[18] Also known as the 'market infrastructure perspective'.

[19] Miller, D. (2009) Selling Solar, Earthscan, UK, P. 39.

[20] This can be an entrepreneur, a non-profit organisation, a specific change agency, and/or government.

[21] Wilkins, M. (1970) The role of private business in the international diffusion of technology, Journal of Economic History, vol. 30, n°1, pp. 166-188.

[22] Miller, D. (2009) Selling Solar, Earthscan UK, p. 48; Gliedt, T., P. Parker (2010) Dynamic capabilities for strategic green advantage. Global Business and Economics Review.

[23] Brown (1981) p. 189.

2.3. Influencing the demand and supply sides of the market

The basic economic theory of how a market works is explained by the two curves; demand and supply. The demand curve illustrates that demand rises when the price goes down. The supply curve illustrates that supply increases as the price goes up since profits would be higher. If buyers want to purchase more of a product than is available on the market, they will tend to bid the price up. This was the case for insulation in Norway a few years ago, when one of the major suppliers had to reduce their production due to substantial changes in a plant. As a consequence, the price of insulation increased temporarily. Conversely, if more of a product is available than buyers wish to purchase, prices will decline. Overall, there is a tendency toward an equilibrium price at which the quantity demanded equals the quantity supplied.

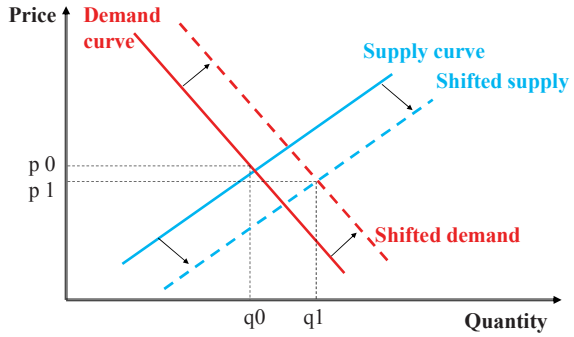


Figure 1:
Supply and Demand Curve Dynamics

We can use insulation materials in buildings as an example. If energy prices increase it will lead to a shift in the demand curve to the right, as more consumers will decide (both as a consequence of the media highlighting the issue and the increased economic returns) to invest in energy saving insulation.

An introduction of new technologies which lead to lower production costs will shift the supply curve down and to the right. Reduced company taxes or other costs (e.g. training of skilled workers) will also contribute to a shift of the supply curve down and to the right.

A combination of measures on both the supply and demand side will be the most effective way to increase the number of products sold as exemplified in the graph above; an increase of the quantity from q0 to q1 and a change in price from p0 to p1.

If we apply some of these general observations to elements for Advanced Housing Renovation, what could initiate a shift in the economic demand and supply sides of the market to result in a higher volume sold?

A shift in demand could be caused by:

- Attractiveness / communication: New information and knowledge to consumers (either by authorities and/or the supply side) through information campaigns, for example:
  - Importance of mitigating climate challenge.
  - How the investment will improve comfort and other non-energy benefits.
- Competitiveness/ economic context / trends:
  - Increased energy prices.
- Affordability: Tax incentives for investment in advanced renovations
  - Incentives or grants given to the homeowner or business for investing in advanced renovations.
- Market infrastructure: Active networks stimulating demand, for example:
  - Make demonstration projects visible to other clients and professionals.

A shift in supply could be caused by:

- Attractiveness / communication: If it becomes clear that a new market is opening up, e.g. increased demand by public housing actors.
- Competitiveness / economic context / trends: New inventions, knowledge or processes that result from R&D which increases knowledge among suppliers about how to produce/install products more efficiently and at a lower cost. Also financial support from authorities for R&D in companies and research institutes will indirectly influence the supply curve.
- Affordability: Incentives or grants on the supply side to companies that invest in developing good quality renovation products or services and lower costs (relatively) of important resources such as labour.
- Market infrastructure: Active networks pushing innovative technologies on the regular building market.

3 Three Phases: From Demonstration to Volume Market

3.1. Introduction

In the next three chapters we will examine the process that a new product, such as Advanced Residential Renovation, goes through before it reaches the volume market.

3.2. Product Life Cycle

It is important to understand that moving from a demonstration to volume market is a dynamic process where involved actors, market segments, driving forces and barriers shift as we move towards increased market penetration. As with any other product or service, both new construction and renovation following the Passive House concept evolves according to the 'Product Life Cycle Curve' illustrated in Figure 2. The speed of this process is influenced by the four perspectives described in the previous chapter.

Before launching the product in the market, it starts with a research and demonstration phase. Pilot projects often attract interest from media and among professionals and other people with a special interest in the subject. It may be seen as the prelude to the introduction phase. In some countries, for instance Austria, the Passive House (for new houses) is already in the growth phase. Advanced Housing Renovation is only in the introduction phase.

The examples in the introduction phase will play an important role as references for the projects to be realized in the growth phase. For authorities and others who want to speed up the rate of Advanced Housing Renovation in the housing sector, it is important to understand the dynamics of market evolution for new innovations. The demonstration projects in the introduction phase play an important role in determining how fast the growth phase will develop.

In the next chapters we will discuss the first three phases of this process:[24]

1. **Demonstration phase and introduction phase**
   - Dominated by innovators who are strongly interested in testing or experiencing technology. In this respect, these actors listen to idealistic and value based arguments.

2. **Growth phase**
   - Dominated by early adopters who appreciate the potential benefits of technology when they see that its benefits match their own needs and desires. This group includes trendsetters who respond to emotion-based arguments.

3. **Volume phase (mature market)**
   - Dominated initially by early majority purchasers who are more resultsoriented, and therefore wait to see if a new technology delivers what it promises. These persons listen to rational arguments and need good examples from relevant trendsetters before they commit to the new technology or concept.

[24] Rogers, E. (1962) Diffusion of Innovations New York:Free Press and P. Kotler(1988) Marketing Management, 6th edition, Prentice-Hall.

These innovators, early adopters and early majority purchasers can be found within each of the major stakeholders involved in this market: building companies and architects, public authorities and homeowners. They are often able to influence the strategies and decision making processes within the organisation based on their position and ability to influence others. When implemented, new solutions will last for many years, and the chosen solution will therefore have long term implications. This means that natural opportunities for doing advanced renovation occur when:

- Ownership changes
- Refurbishment of façade, roof, windows, etc. is needed
- Replacement of the heating system is required
- Improvement of indoor comfort due to moisture, radon, etc. is needed
- An addition (extension) to the house is desired

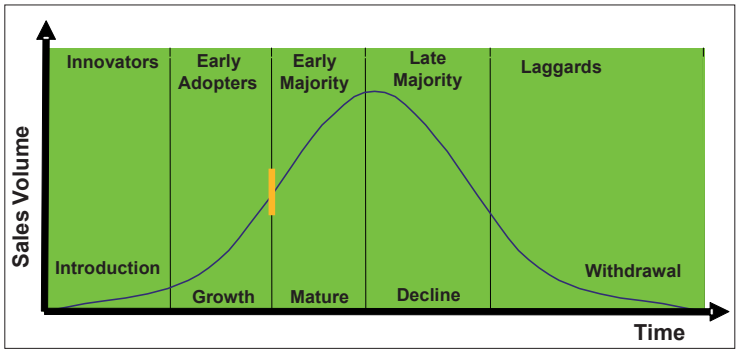


Figure 2:
Product Life Cycle with Major Actors and Phases.

Source: adapted from Rogers, Difusion of Innovation

These 'natural opportunities' will occur in all phases.

To meet the climate challenge it is crucial to speed up the introduction phase or shorten the time until the growth phase and the mature market /volume phase are reached. This process from introduction to withdrawal (when it is replaced by another innovation) is illustrated in Figure 2.

Advanced Housing Renovation is still in the introduction phase of the product life cycle, despite demonstration homes having being established in some countries. Innovators are important actors on both the demand and supply side of the market. Networking between innovators across different organisations is crucial in this phase, and can be facilitated by different types of information platforms (communication).

A major challenge for new disruptive technologies that require a change in industry or consumer choices is to cross the gap between the early adopters who participate in the growth phase and the early majority buyers who participate in the mature market phase (marked with a yellow rectangle in figure 2). The early majority buyers often have very different characteristics and preferences than the early adopters. If the early adopters are not visible or have neutral to negative 'standing' to the early majority, it will be harder to cross the gap. Within the broad early adopters 'segment', there are several sub-segments. The key to cross the gap is to find the sub-segments among early adopters, which are visible and recognized as good examples by sub-segments among the more conservative early majority segment of the market.

In each of the phases we will address the driving forces, barriers and the critical success factors to overcome the barriers

Driving forces are mainly externalities and independent forces which we see to have a positive influence on the market development for advanced renovation.

Barriers are important hindrances to a rapid market development of advanced renovation.

Critical success factors are those factors which have to be in place in order to achieve a defined goal. In our context, the goal is that the described phase evolves in accordance with the theoretical Product Life Cycle Curve.

3.3. Renovation benefits from experiences in new construction

The development of markets for Advanced Housing Renovation for the existing building stock strongly interacts with the market for new advanced houses such as Passive Houses. As construction of new Passive Houses in some countries has already reached the growth phase (blue dot in Figure 3), this provides an important reference for markets for advanced renovation that are still in the introduction phase (yellow rectangle).

Two main benefits from the successful evolution of passive house new construction:

1. The core idea of the low energy concept is already demonstrated through a significant number of new houses.
2. Early adopters in the population have already 'accepted' the idea for new construction. Other early adopters who are not in the position to buy a new house could be well informed by friends and others about the concept, and therefore show interest to apply similar ideas in their old houses.

In countries where both new Passive Houses and Advanced Housing Renovation are in the introduction phase, the advantages identified above are not as strong. The yellow rectangle represents the difficult task to cross the chasm between the growth phase and the start of the volume phase (see chapter 5).

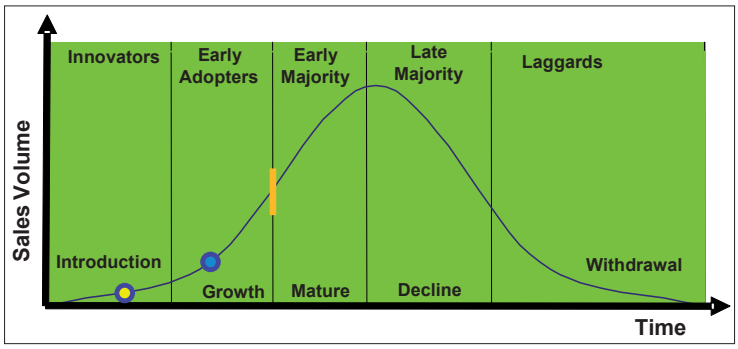


Figure 3:
Product Life Cycle Curve with Passive House Market Positions.

4 Demonstration and Introduction Phase

4.1. From demonstration to introduction

Most products are developed and researched within a closed environment, such as a laboratory. The product will usually be tested on consumers, but within the framework of the laboratory and without giving a great deal of publicity to these tests. Only when a product is fully developed and ready will publicity be generated and the market introduction phase begins.

For some elements of Advanced Housing Renovation the demonstration and research phase develops as described above. For instance, high-performance windows are researched, developed and tested within the laboratory and introduced to the market when fully ready. However, the holistic renovation concept cannot follow this route. There is no laboratory where the retrofit of an apartment building can be researched and tested. The development of the concept has to take place in the 'real world' and will include real inhabitants and is likely to attract a lot of publicity. For this reason it is difficult to make the usual distinction between the research and demonstration phase and the market introduction phase.

Actors
Independent of the type of organisation, key persons in this phase are characterised as 'innovators'. These persons are on the forefront of market development and eager to make use of new inventions. Innovators in key positions play an essential role in this phase of market development. Within their organisations, this type of person can influence the direction of development and decision making.[25]

Innovative organisations (and individuals), influenced by the publicity from the demonstration projects will be a main driving force in the introduction phase. It is important that these innovators have full access to all the necessary information and are able to apply the lessons learned in the demonstration projects to projects in the introduction phase.

Financial aspects
For innovators, one of the main motivations for adopting a new development is related to status or a visionary or idealistic drive. Therefore, at the beginning of the demonstration phase, the payback period is not a crucial factor in the decision, although the price of the investment can be too high to encourage higher purchase rates. To move from the demonstration phase to the introduction phase, financial support can become more important as a bigger group have to be stimulated to carry out advanced housing renovation projects. Financial incentives help to lower the threshold for investment and decrease risk. Later in the introduction phase, financial support will typically decrease, as the number of projects goes up and governments are unable to substantially finance large numbers of projects.

[25] Gliedt, T., T. Berkhout, P. Parker, J. Doucet (2010) Voluntary environmental decision-making in firms: Green electricity purchases and the role of champions. International Journal of Business Environment.

4.2. Driving forces and barriers

Table 4.2.1 presents the most important driving forces, barriers and critical success factors to overcome the barriers in the introduction phase:

Impact on attractiveness

DEMONSTRATION AND INTRODUCTION PHASE

DRIVING FORCES

Publicity about climate change and fossil fuel depletion will motivate innovators to carry out projects. Besides international mass publication[26], also regional and national news-items are important[27].

Publicity around national and international demonstration projects will show innovators what is possible to achieve.

Considering the problems that are likely to arise, there are large potential markets for different kinds of services and products related to sustainable renovation.

The people that are or have been involved in the demonstration projects are important for the multiplication of projects and the dissemination of knowledge.

BARRIERS

There is little knowledge amongst stakeholders about the benefits of living in a low-energy house. There is a lot of information available, but very little is widely known.

Bad examples from demonstration projects or initial user experiences can be a big barrier. They will confirm prejudices in the building sector that it is best to be conservative.

Inconsistent policy from governments will halt market development and can have a devastating effect on business. An example is the sudden stop of subventions on solar cells in the Netherlands in 2003.

Inhabitants of existing buildings are a barrier for the renovation process. Can these people stay in their houses? Do they have to move? Where can they go?

In many projects the 'rebound effect' has been experienced. When the comfort level (e.g. temperature) increases in a house, the behaviour of people changes to offset some of the gains. For example, they set the temperature higher and wear t-shirts indoors during the winter. This can result in substantially less savings than calculations based on the change in technology.

CRITICAL SUCCESS FACTORS TO OVERCOME BARRIERS

A quality-control system like a Passive House Institute, should ensure that there are very few bad examples of demonstration projects.

To overcome information from bad examples, good objective monitoring should be carried out. Facts should counter myths. A bad example can be offset by showing many good examples.

Information should highlight both the energy and non-energy benefits because in this phase users may value environment, health or comfort benefits more than the energy savings.

At the beginning of this phase, projects can be selected where there are (temporarily) no inhabitants, or the inhabitants are sufficiently motivated that they do not mind temporary inconvenience. However, it is important that this does not cause bad publicity. During the introduction phase, methods have to be developed where renovation takes place with a minimum of inconvenience.

Future users should be well-informed about all aspects of their new home, including non-energy benefits. Calculations about projected energy-use should be realistic and based on behavioural studies rather than simply assume ideal technical conditions.

[26] Al Gore An inconvenient truth (2006), The Age of Stupid (2009) .

[27] http://news.bbc.co.uk/2/hi/7817043.stm; energy shortage in Eastern Europe.

Table 4.2.1

Driving forces and barriers in the Demonstration and Introduction phase

Impact on competitiveness

DEMONSTRATION AND INTRODUCTION PHASE

DRIVING FORCES

Innovative companies actively stimulate projects, in particular energy experts and architects who want to use their expertise and suppliers who want to sell their products. They will therefore be an important driving force in the introduction phase of the product life cycle.

BARRIERS

To successfully move into the growth phase, it is necessary that important actors have a long term Initial investment costs are generally high in comparison to traditional renovation costs. A strong focus on cost savings relative to investment costs (pay-back period) may not be persuasive at this stage.

In the introduction phase, knowledge still has to be developed. Existing knowledge from other countries is typically not readily available or accepted. There is a lack of knowledge regarding the concept of seeing the house as a whole when retrofitting.

CRITICAL SUCCESS FACTORS TO OVERCOME BARRIERS

To successfully move into the growth phase, it is necessary that important actors have a long term vision and strategy. Such vision and strategy should counter short term thinking about pay-back periods and higher investment costs. This long term strategy should entail guidelines on how to work in real projects. An example for this is a checklist developed by the Housing Bank in Norway (Husbanken) for housing corporations to select successful projects.

Tailor-made documentation and information for all actors in the market has to be available. The information can come from international networks and demonstration projects. In the demonstration phase, it is therefore important that the (relatively) few demonstration projects are documented in a consistent manner for further dissemination of experience and lessons learned. This may be part of the requirements for receiving subsidies or low interest loans.

Government is a main actor in the introduction phase. The attitude of the government, as shown through its policies, is a main driving force, as this demonstrates to stakeholders what long-term vision is held and therefore what types of legislative measures can be expected. The policy statements of the government should be backed up by their actions. Specifically, it should be expected that government leads by implementing policy in their own renovation projects. If government is clear in their support for low-energy renovation, it is important for companies to gain experience in this field, because there is a big market potential and capacity needs to rise quickly.

Impact on affordability

DRIVING FORCES

High (rising) energy prices. The prospect of increasing energy prices lowers pay-back periods substantially.

National and regional production of building elements or services related to advanced renovation lowers the price and increases demand.

BARRIERS

High initial costs of technologies and lack of knowledge about implementing low-energy housing create both technical and management related barriers to the advanced renovation process.

CRITICAL SUCCESS FACTORS TO OVERCOME BARRIERS

Temporary subsidies for buyers can increase affordability and the rate of adoption in this phase[28]. Tax reductions and special construction financing arrangements can increase affordability and demand. Subsidies should only lower the additional costs of advanced renovations. Otherwise, the subvention becomes a barrier in later phases, when bigger numbers cannot be maintained.

Even limited amounts of money available for incentives could act as a driving force, as parties will compete to be eligible for the demonstration projects.

[28] See the REEP marketing story in Appendix A where incentives rapidly stimulated an increase in renovation rates.

Impact on availability

DRIVING FORCES

Higher standards for new housing will be a driving force for the renovation market. Prices of high-quality components will go down, knowledge and experience in the building industry will improve, and the expectations of homeowners and end-users will rise.

There is a huge market potential in the field of low-energy retrofit.

BARRIERS

The building industry does not easily accept changes. For innovators within companies and innovative companies, it can be a problem to find parties to utilise innovative techniques. Seeing the house as a whole integrated system is a major change to the traditional renovation method.

Energy-use and CO_2-emissions are not major factors in the private real estate market. The end-user also has little knowledge about the non-energy benefits of high-performance housing. Therefore, there is little demand for low-energy housing and no effective demand on the building industry to provide such housing if there is no 'pull' for the product by end-users.

In retrofit projects the decision making process is often complicated, which can involve the professional owner (housing corporation), municipality and the tenant. In all phases, this will be a barrier, as all parties have to agree on the retrofit. The type of majority needed (from simple majority to consensus) will depend on the voting rights of tenants and the type of ownership and building governance.

Some government regulations have been experienced as obstacles. An example is not allowing the increase in the brut space or footprint of houses that they need when adding more insulation on outer walls. Another example is not allowing changes to the brick façade of a building, thereby making outer-wall insulation virtually impossible.

Within the building market there can be a lack of expertise for the design and implementation/ construction of low-energy housing.

CRITICAL SUCCESS FACTORS TO OVERCOME BARRIERS

Information about successful projects will increase acceptance and demand for advanced renovation.

Big real estate owners, i.e. the government, should create demand in the market for high ambition levels in renovation. Many projects are able to achieve an 80% reduction in energy consumption[29].

An innovation platform can have different forms and the role it plays will depend on the form and the housing market. A platform where possible actors in demonstration projects meet can be an important driving force in the market. The actors inform each other about projects and problems and exchange knowledge. The platform can facilitate the start of projects. The actors in the platform have a common goal and can, as a group, also form a strong lobby group for changes in legislation. Examples of innovation platforms are the passiefhuisplatform in Belgium and PeGo in the Netherlands.

Government regulations that create barriers for advanced renovation should be adjusted. An example of these barriers is the link between rent benefits and gross floor area in Scandinavian countries. This results in the lowering of benefits when outside insulation is applied. Another example is the prevailing precondition in the Netherlands (usually set by municipalities) for brick facades, making the use of outside insulation difficult.

Training programs have to be set up to train professionals for advanced renovation. In this phase of market development, there is a strong risk of a lack of knowledge on the construction site. Special training should be set-up.

29 http://www.iea-shc.org/task37/

4.3. Recommendations for the key actors

National and local authorities

Attractiveness:

- Supply information to both the demand side and the supply side on the benefits of advanced retrofit in general and good demonstration projects in particular.
- Information on bad examples also has to be dissimulated including the reasons for the problems.
- Set up or stimulate the setting up of a quality control system.

Competitiveness:

- Have a consistent and long term vision about sustainable retrofit. Besides a consistent policy for stimulating the market, also a consistent policy for the public building stock is essential. If all governmental levels are clear in their message for advanced renovation, it is important for companies to gain experience in this field, especially because there is a big market potential and capacity needs to rise quickly.

Affordability:

- During the introduction phase, some subsidies will continue to overcome high initial costs for specific products or techniques. Small subsidies will also stimulate projects, by providing justification and status. Public funding agencies are the government's extended arm into the market. By using this tool effectively, government can directly influence both the direction and speed of market development.

Availability:

- Arguably the most important role for governments in this phase is the establishment of innovation platforms for advanced renovation. Connecting actors in the market is a key aspect for market development both in this phase, and in later phases.
- Government regulations should be adapted to not form a barrier for low-energy housing, especially advanced renovation.

Research Institutes

Attractiveness:

- Research the benefits of advanced renovation in general and good demonstration projects in particular. Disseminate the knowledge gained in pilot projects to the market.
- Research the experiences in other countries and adapt the lessons learnt to the national situation.
- Research bad examples and disseminate the reasons for the problems.

Competitiveness:

- Make customised documentation and information for all actors in the market.

Affordability:

- Research institutes can, in some countries, form an important link between projects and subvention programs. Both the research institute and companies participating in the projects can benefit (financially) from such cooperation.

Availability:

- Make training programs for different actors in the building industry. In this phase, the priority should be to increase the knowledge on the building site.

Innovative companies

Attractiveness:

- Market the direct and indirect benefits of advanced renovation to potential customers. The target group for the companies are innovators.
- Exercise good quality control on all aspects of the building process, to avoid problems in later phases and to effectively learn from the projects.
- Inform end-users of all aspects of the end-product.

Competitiveness:

- Make a long-term vision for the marketing of the product (related to) advanced renovation.
- Realise fruitful partnerships with supplementary companies and customers.

Affordability:

- In many countries, companies can cover research and development risks with government subsidies and/or tax-reduction programs.

Availability:

- Ensure that there is enough knowledge in all elements of the production chain to ensure that products will pass all necessary quality control checks.

Innovative housing corporations

Attractiveness:

- Exercise good quality control on all aspects of the construction process.
- Inform end-users on all aspects of advanced housing renovation, both before and after implementation.

Competitiveness:

- Make a long-term vision that incorporates social responsibilities (e.g. energy poverty) as possible direct economic aspects of rising energy prices. Ensure that building budgets, knowledge and ambition levels do not contradict.

Affordability:

- In many countries subventions for demonstration programs are available.

Availability:

- Make partnerships with different actors in the building industry, such as building and consulting companies.

5 Growth phase

5.1. Entering the growth phase

As the Product Life Cycle curve in chapter 3 illustrates, the growth phase is where substantial changes in sales volume take place. The initiation and the speed of this phase depend on several factors, which will be discussed in this chapter. A prerequisite for getting this phase started is that the introduction phase, described in the previous chapter has been completed successfully, i.e. the product/service has been introduced to the market in a way that makes the 'early adopters' curious and interested. The growth phase achieves increased growth when the benefits of the product/service are recognised by a broader segment of the public. Demand continues to grow as the 'early majority' decide to purchase Advanced Housing Renovation and the volume phase of the market is reached (see chapter 5).

5.2. Important actors

Independent of the type of organisation we are talking about (public or private), the key persons within each are typically 'early adopters'. These persons are visionary and searching for opportunities to take advantage of new inventions for their own benefits and to advance their organisation. The companies most likely to realize such ambitions are those which already are positioned among the 'quality leaders'. This has been seen in the development of new high energy efficiency houses. An example of this is Anliker in Switzerland.[30]
Based on the analysis in section 4.3 we will follow these steps to identify the important target groups:

- Find organisations, companies and homeowners that possess resources enabling them to play a role in the diffusion of this new innovation.
- Find the segments within each organisation with key persons who are early adopters. These persons are expected to have a strong standing within the organisation so that they will be able to influence important decision making.

The selected target group must also serve as good models for others, so they can be the trendsetters in the marketplace.

5.3. Driving forces and barriers

Table 4.3.1 illustrates the most important driving forces, barriers and critical success factors to overcome the barriers:

30 Aabrekk S., Haavik T. et al. (2006) Business Opportunities in Sustainable Housing, Trondheim, pp. 19-31.

Impact on attractiveness

DRIVING FORCES

Demand from the first early adopters among private homeowners:
Searching for better living standards, increased comfort, better indoor climate and increased value of the house.

High standards in new housing:
Publicity and knowledge about high standards in new housing increases the desire to achieve similar standards in old housing.

Media
Local media recognise and stimulate interest in local projects. The Canadian project, REEP[31], shows the importance of the strategic use of local press.

Creating new jobs:
For authorities in several countries an additional motivation is that retrofit projects are labour intensive and have a positive effect on reducing the unemployment rate. The creation of jobs is identified as a driving force in Canada, NZ and NL.

Creating a positive image:
Some local authorities promote advanced renovation to position their communities as modern cities that receptive to new ideas and innovations. Old housing can be shown to achieve advanced housing standards such as Passive House Standards.

BARRIERS

Inconsistent policies:
Policies that are frequently changed create uncertainty among residents and firms.

Limited knowledge among consumers results in a weak demand side:
What is unknown means high risk for most people. Bad myths and lack of accurate information about advanced renovations are also barriers.

Bad examples or inconsistent quality:
A negative experience in one project creates a good story for the media.

CRITICAL SUCCESS FACTORS TO OVERCOME BARRIERS

Master plans:
Consistent national policies should be implemented over a number of years to be consistent with the long term vision and reinforced at the regional level.

Informing homeowners:
To boost the sale of a product or service, you have both to 'push' your distribution channel and 'pull' the demand side by marketing activities. The latter should be done by both the authorities (on a general level) and the industry itself (on a specific level). National and lower governments are essential in stimulating the demand side. The experience of end users can be used effectively in promoting projects. Correct information is very important. The chance of misperceptions with such an invisible, difficult measure is high. Therefore, it is crucial to invest in innovative marketing of sustainable retrofitting. With demonstration projects, publicity is easily generated at the moment that a project is started and / or completed. When entering the growth phase the projects will generate less attention by themselves, with the exemption of the local level, where it still is considered to be news. The problems that occur in projects will, however, be more attractive as a news item even on a national level. Therefore, it is important to define a communication plan, which includes a plan for how to act in case of negative press.

Quality control and certification:
There is a need to establish a common understanding and reference for what level of performance is expected by all involved professionals. Such a mechanism should be controlled by a neutral body. The lack of trust in some institutes has been a major obstacle in some cases (e.g. EPBD in the Netherlands). The existence of strong, independent quality assurance institutes is seen as necessary.

A critical factor, is to establish certification systems for both evaluators and certification standards. According to Mlecnik, Kaan and Hodgson[32], this must be incorporated with national legislation, Passive House Standard and the EPBD (in Europe).

[31] Aabrekk S., Haavik T. et al (2006) Business Opportunities in Sustainable Housing, Trondheim, pp. 33-49.

[32] Mlecnik, E., H. Kaan, G. Hodgson (2008) Certification of Passive Houses: a Western European Overview, PLE 2008 – 25th Conference on Passive and Low Energy Architecture, Dublin, 22-24 October 2008.

Impact on competitiveness

DRIVING FORCES

Demand from the public sector:
Demand from the public sector is a key driving force. When municipalities and regional as well as national authorities actively ask for advanced renovations in their own projects, they form a strong demand side opportunity for the suppliers in the building industry. In this way, they create an interesting market for early adopter companies.

Early adopter companies seeking profitable business:
As the first movers demonstrate that they see business potential in Advanced Housing Renovation through their actions in the market, they create 'waves' among additional actors in this business. Competition between companies leads to marketing campaigns in which each actor actively promotes the advantages of his or her particular solution.

BARRIERS

The building industry:
The majority of the building industry is conservative, and invests little in R&D compared to other businesses. Similarly, universities and architects are mentioned as barriers when they only teach traditional approaches.

Costs versus quality:
The cost of demonstration projects (which form the reference prices) are mentioned as an important barrier to broader adoption in the growth phase.

Low energy prices:
In some countries, the cost of energy, in particular electricity, is not perceived as high. Therefore, saving energy costs is not a very big issue. This is especially the case for Norway and Canada.

CRITICAL SUCCESS FACTORS TO OVERCOME BARRIERS

Legislation and certification:
The building codes are in general low in relation to high performance housing. Increasing the requirements of the building code is necessary. Stronger demands in new housing can also have a spin-off effect on the renovation market. The possibility of strong legislation establishing higher energy performance in the renovation market should be investigated.

Announced stepwise enforcement of national building codes and legislation:
This stepwise improvement combined with project competitions and demonstration projects are strong driving forces that set the agenda and establish a strong demand for information and education. Energy labelling system and certificates will make it possible to compare different solutions and buildings regarding energy requirements.

Product labels and energy certificates:
The attention that product labels get among suppliers and consumers in the market, leads to a focus on and recognition of different quality levels of renovation. It also gives a common understanding and reference for the concept of Advanced Housing Renovation. An improved energy performance certificate or official rating for the house documents a better quality than before and increases the value of the house.

Focus on the early adopters as a target group:
In order to take advantage of the potential force among the early adopters (architects, construction companies, universities or municipalities), it is necessary to identify those who are ready to play a role in the development of the market. It is therefore necessary to realise that you are not going to move the 'whole market' in the growth phase. The quicker the major actors realise this, the less time and costs they waste on the laggards among the various actors.
Public authorities on all levels who are early adopters can play an important role to boost the market.

Increase tax on energy:
Higher taxes on energy will give a clear signal to the market that there are negative effects of high energy consumption, which society has to recognise and can internalise through higher energy prices. This initiative will also have direct impact on the households' decisions, meaning that they will change behaviours regarding energy consumption.

Impact on affordability

DRIVING FORCES

Existence of cost efficient demonstration projects:

As the supply side has developed attractive concepts (packages) which have both non-energy benefits as well as being cost efficient investments for the homeowner, this becomes an important driving force.

Focus on how to overcome fuel poverty:

Low income groups are vulnerable to higher energy prices. Creative policies are required to address energy affordability. Senior citizens are especially vulnerable to future rises in energy costs because of their fixed pensions.

BARRIERS

Still relatively high costs:

- Lack of knowledge about how to carry through Advanced Housing Renovation leads to high costs in renovation projects.

One sided focus on payback period of the higher investment cost:

A common mistake within the building industry is to focus on the payback period of the 'extra' investment in the high performance solutions. This leads the homeowner to consider the price as the primary buying argument.

Another cost issue related to tenants is that the rent often includes the energy cost. In multi-family houses, this price system does not show the real energy consumption in each flat.

Subsidies:

National authorities should understand the use of subsidies and their influence on the market. A market may become 'addicted' to subsidies. As a result, sales may drop dramatically when the subsidy program is halted.

MEASURES TO OVERCOME BARRIERS

Focus on the 'added value':

Instead of focusing on the payback period of the additional investment, attention should be directed towards the non-energy benefits achieved through sustainable renovation. Earlier studies (Skumatz et al. 2000)[33] have shown that consumers appreciate the non-energy benefits much more than the pure cost savings. By highlighting such information, the homeowner discovers other values in advanced renovation. This also supports the attractiveness mentioned above as well as the willingness to pay a higher price.

Subsidies, Subvention programs, tax deductions, etc:

In some countries we have seen that public funding can boost selected market segments. This was the case for heat pumps in Norway. However, the challenge is how to sustain the market after such financing programs are halted. Therefore the policy made before a new subsidy program is launched should include plans for how and when to phase out or end the program. The quantity of retrofit projects in the growth phase makes it impossible for (most) governments to sustain substantial subsidies. A good alternative is to fund early adopter companies to invest in developing good solutions to bring to the market and reduce the relative importance of this support as the market grows.

[33] Skumatz, L., C. Dickerson, B. Coates (2000) Non-Energy Benefits in the Residential and Non-Residential Sectors – Innovative Measurements and Results for Participant Benefits, ACEEE Summer Study, Monterey, US, pp. 8.353-8.364.

Impact on availability

DRIVING FORCES

Pan national agreements and legislations:
International agreements such as the United Nations' Framework Convention on Climate Change, the Kyoto Protocol and international conferences for cooperation among nations around the world, are an underlying force for motivating initiatives to develop sustainable solutions on all levels – including within the residential renovation business.

Better standards for new housing:
Higher standards for new housing will be a driving force for the renovation market. Prices of high-quality components will go down, knowledge and experience in the building industry will improve, as the expectations of homeowners and end-users will rise.

BARRIERS

Legislation, certification and standards:
Certificates, labelling and calculation programs that are not perceived as trustworthy.
Attitudes in the building sector that building codes are a maximum quality level.
Regulatory offices that are too slow to improve energy performance requirements in the building code.

Lack of regional and pan regional cooperation and coordination:
Although, there is some international cooperation, there are also challenges to concrete action plans. This includes a lack of harmonisation and compatibility among different national standards and legislation.

Lack of professional sales channels for holistic and complete renovation package:
A 'one stop shop' for holistic and complete delivery of retrofit materials and services is missing, especially for the single family house market. Today, the homeowner has to compose and coordinate the right package for his/her house. As each renovation in the small house market represents only a small sales value, bigger construction companies might see this as a less interesting business opportunity.

Lack of educating / capacity training of professionals due to too few actors are involved in education:
Lack of knowledge and skills among the people that will have to design and build the high-performance buildings is seen as a major problem for the growth phase. It is critical that dissemination of knowledge is well developed on all levels. Training of all professions among the craftsmen is a major challenge. EU calls for such programs have received little interest from potential suppliers of such training[34].

CRITICAL SUCCESS FACTORS TO OVERCOME BARRIERS

Increased national and international cooperation between public and private actors:
It is crucial to create systems and networks for multiplying the Advanced Housing Renovation solutions throughout all regions in all countries. Even though new Passive Houses in southern Germany are in the growth phase, the same is not the case for the northern part of the country.

Educating and training:
The whole educational system needs to be able to educate the new techniques to the different actors. Besides training the future professionals, the existing professionals also need to be trained. Post-graduate or professional education for architects is important, as they are a key actor. Also the training of the existing craftsman is necessary, as is building up the right knowledge among real estate, project development and facility management professionals. Besides educational programs for these stakeholders, different information platforms will need to be set up, such as websites, newsletters and articles in magazines.

Knowledge among key actors:
Key market players as well as local authorities must possess knowledge about applied sustainable solutions. Social housing agencies also need specialised information.

Create a 'One stop shop':
A complete solution approach is required that makes it easy to understand, produce, obtain, sell and use advanced performance products. This could involve a 'one stop shop' offering complete renovation solutions (from planning to implementation and financing). A joint Nordic project[35] will develop complete renovation concepts for approaching the single family homeowner and make it easier to define tailor-made solutions for each house.

34 Gordon Sutherland (2009) Promoting lower energy homes: support from the Intelligent Energy Europe Programme. The Nordic Passive House Conference 2009, Gothenburg. Project Officer, Executive Agency for Competitiveness and Innovation (European Commission)

35 http://successfamilies.vtt.fi/

5.4. Recommendations for the key actors

National and local authorities

*The authorities on all levels have an important role in increasing the **attractiveness** through:*

- Broad information campaigns in order to 'teach' people about the issue and give specific examples of how to act. Such activities could be done in close cooperation with NGOs and homeowner associations.

*National authorities can influence the **competitiveness** of sustainable retrofitting through:*

- Announcement of enforcement of building codes and legislation.
- Implementing trustworthy quality control mechanisms combined with a certification system which gives objective measures for the comparison of the quality of different houses.
- Sustainable retrofitting of public buildings or parts of towns can in itself represent an interesting market potential, and through this motivate private companies to develop their concepts and solutions in this business.
- In countries with low energy prices, increased taxes on energy and/or greenhouse gas emissions will improve the relative competitiveness of Advanced Housing Renovation.

*As it is a goal to reach a broader public, it is necessary to make sustainability **affordable:***

- Subvention-programs to early adopter companies and/or households and/or tax deductions for sustainable retrofitting. Public funding has two main effects:
  - Balance the additional investment to what is perceived as the value of the increased comfort level.
  - An objective body is signalling that this is a rational investment.
- Support to develop education and network cooperation.

*National cross departmental programs can increase **availability** of relevant competence:*

- Implement education and training programs.
- Support international networks for exchange of knowledge.

Companies

In order to succeed in developing Advanced Housing Renovation into profitable business, the early adopter companies (within the building industry as well as complimentary businesses) have to use this phase to take a leading and visible position in the market, so they may harvest from it when later entering the volume phase.

*In order to increase the **attractiveness** of their concept they need to:*

- Market innovative sustainable retrofitting, by using good and relevant examples. The innovators from the previous phase play the role as confirmers towards the early adopters that the solutions are effective and durable. Therefore, it is important that persons used as examples must be trustworthy and recognised as relevant examples in the eyes of the early adopters. Early adopters among consumers must understand the concept and find it attractive enough to take on extra investment costs when they are in the buying process. For increased multiplication of the sustainable solutions chosen by the early adopters, these persons must be visible and serve as good examples for the broader public.
- Build credibility through alliances with research institutes and technical universities.

*Demonstrate that the concept is **affordable** for a larger number of households:*

- Focus more on the added value of non-energy benefits than the pure energy cost saving, such as climate change mitigation, or improved health, air or environmental quality. The early adopters are more sensitive to non-financial arguments.

*Communicate how the concept is **competitive** compared to traditional solutions:*

- Execute educational programs for on site workers.
- Focus on the early adopters as a target group, as this is where a match between costs and willingness to pay a higher price can be found.
- Highlight that the residents will get a 'new' high quality house instead of only a repaired old house.

*Improve **availability** for the single family homeowners:*

- Develop good conceptualisation and new business models for advanced renovation (example: 'one stop shops' or new 'shopping counters').
- Create complementary products such as lower interest loans from banks for low energy houses or Advanced Housing Renovation.
- Create consulting services from utility companies to encourage conservation.
- Rent high performance equipment from utility companies.

Research and educational institutions

The growth phase needs support from professional education. This can be universities or other public institutions or private institutes and at all levels. Their attention towards Advanced Housing Renovation increases the *attractiveness* of the topic, in particular among students. This means that the ordinary system for education and training must have integrated sustainable building solutions in their programs in order to increase the competitiveness in implementation of advanced housing renovation solutions. In addition, post education programs must be well established and made *available* regionally so that experienced professionals from the carpenter to the engineer, may be updated on the 'Passive House' or 'sustainable building' in an *affordable* way for local companies. For the higher educated, this may include postgraduate programs.

6 Crossing the chasm between the growth phase and the volume phase

6.1. Introduction

The volume phase is where the product has to be attractive to a large proportion of customers and suppliers (early and late majority) to make sales numbers reach the top. At the start of this phase, competence, production capacity and marketing for Advanced Housing Renovation must be in place in all regions. During the phase, the concept of advanced renovation must become well known among consumers so that the demand side is well established as a basis for profitable business for the companies involved.

6.2. Crossing the chasm

To meet the goal of reducing global greenhouse gas emissions by more than one percent per year (for a reduction of over 50 percent by 2050) it is necessary to reach the volume phase fast. Analyses from Task 37 show that the renovation rate needs to be higher and the depth of renovation needs to be deeper. This requires not only changing the normal practice of the industry, but also increasing the capacity and size of the industry to increase the total sales of advanced renovation. In others words there have to be shifts in the supply and demand curves as illustrated in chapter 2.

Early adopters (growth phase) are normally focused on quality. In a successful growth phase, attractiveness has been proven to a broader customer base. Still there are strong barriers to overcome and measures to be taken in affordability, competitiveness and availability. Crossing the chasm between the growth phase and the start of the volume phase is seen as a difficult challenge that includes the need to scale up from niche suppliers to volume builders and to reach new customer segments that find other benefits and selling points attractive. This also implies a need for a changed focus in communication channels.
The early majority (volume phase) has an interest in technology, but is driven by practicality. They will wait and see if a technology delivers on its promises. They will not adopt just because they have been exposed to program information. Also, they want to reference (talk with, work with, know about) others among the early majority, not just innovators and early adopters, before they buy. Thus, getting the early majority on board requires different transformation efforts and a different level of effort than attracting the innovators and early adopters.

For a fast transition to take place, it is important that the early adopters in the growth phase function as guiding lights for the actors in the early majority phase, both on the supply and demand side. Examples may come from cities or regions that have achieved higher performance levels. These market leaders can be the examples for others to follow.

6.3. Important actors

For a product like Advanced Housing Renovation to reach the volume phase, a broader scope of public and private actors on the national, regional and local level are important. These are actors that are involved in advanced renovation as a volume product. Some of these will already play an important role concerning complementary products and services in the volume market, e.g. utilities, hardware stores, banks. In addition, some of the leading innovative firms will increase capacity and reduce costs either individually or through mergers or collaboration with large market players to ensure economic viability. Also other companies in the building industry that see advanced renovation as a business opportunity with a strong future will enter the market. These are companies that focus on quantity.

6.4. Driving forces and barriers

So far advanced, high ambition renovation has not reached the volume phase in any country. Hence there are no real experiences of successful ways to reach these phases for comprehensive renovations. Still there are many experiences where individual innovative products have entered the market and gained market dominance, such as high performance windows. Assumptions, conclusions and recommendations in this document are based on experiences from

- renovation projects with both high and ordinary ambitions
- new construction projects with high ambitions
- trends in legislation, government may take leadership by requiring higher standards
- market theory and experiences from other types of products

Impact on attractiveness

CROSSING THE CHASM BETWEEN THE GROWTH PHASE AND THE VOLUME PHASE

DRIVING FORCES

- Less energy dependency both for governments and consumers.
- Success stories from the growth phase for different target groups.
- Improvement of architecture in renovation and city development.
- Influence from neighbour markets.
- Real estate sector marketing both energy benefits and non-energy benefits of Advanced Housing Renovation.
- Fear of rising energy prices and reduction in living standard.
- Fear of social downward spirals in old not renovated buildings.

BARRIERS

- Companies in the housing renovation sector traditionally are focused on selling single standard products/ services and are marketing 'stand alone' solutions as the best. Promotion of substitutes with mediocre energy performance, but with a lower price and the same selling points: environment, comfort etc.Lack of quality assessment resulting in projects with bad results.

MEASURES TO OVERCOME BARRIERS

- Marketing good examples from the introduction and growth phase with a focus on rational arguments.
- Promote holistic solutions and warn against 'light' non-holistic renovations.
- Public authorities agree on supporting and using one labelling/certification and energy performance standard at the national level.
- Promote updated information on energy price trends, and consequences for private economy.
- Inform residents about risks for social downward spirals in old not renovated buildings.
- Promote the benefits related to energy independence.

Table 6.3.1
Driving forces and barriers in the Volume phase

6.5. Speeding up market development also creates barriers

There is already much information and many campaigns about international and national goals for decreased energy use and reduced greenhouse gas emissions from the building stock. Some countries have announced stepwise enforced building codes, some are discussing legislation that supports energy efficiency in the existing building stock and some road maps and scenarios to a zero carbon future have been made. This highlights business opportunities for innovative actors in the introduction and growth phase but can also represent big challenges and threats to more conservative companies or organisations that currently dominate the volume market. These companies are very important for reaching the volume phase. If these actors counter act against the process of enforcing the building code this could create serious barriers to reaching climate and energy goals in the housing sector in time.

Impact on competitiveness

CROSSING THE CHASM BETWEEN THE GROWTH PHASE AND THE VOLUME PHASE

DRIVING FORCES

- Expected rising energy prices.
- National cross political agreements on high ambition levels for renovation.
- Outlook to high profits for companies.
- More foreign and domestic companies entering the Advanced Housing Renovation market.
- Banks and insurance companies promoting and giving better offers to low energy solutions.
- Real estate agents, project developers and investors focus on high energy performance.

BARRIERS

- Difficult decision processes in different types of ownership structures (public, cooperative, etc.).
- Different and inconsistent quality / energy labels which make it difficult to compare and chose the right products.
- Lobby activity from laggards among big companies to lower national or regional ambition levels and to delay the process of changing building codes and legislation.

MEASURES TO OVERCOME BARRIERS

- Authorities agrees on a long term ambition level and time schedule.
- Public actors (like municipalities), and housing cooperatives announce Advanced Housing Renovation as their policy in their own building stock.
- Public quality certification that certifies companies for advanced renovation.
- Communication that focuses on rising energy prices in the near future.
- Promotion of and support to successful actors from the growth phase, that are motivated to reach the volume market with further competence development, trade negotiation and resource acquisition for up scaling.

Impact on affordability

DRIVING FORCES

- Banks and insurance companies support low energy solutions.
- Increased competition lowers prices.
- Authorities focus on large scale housing renovation.

BARRIERS

- Low energy prices in some countries.
- Recent 'light' renovations that make new investments unprofitable.
- Large numbers of households with low income.
- Single actors have no power to negotiate prices.
- Strategic housing stock policy based on 'light' renovations and regular maintenance schemes make large investments largely unavailable.
- Lack of savings for major renovation among housing cooperatives and homeowners.
- Those who have to invest are not the ones that profit, due to different kinds of legislation affecting owners and tenants.

MEASURES TO OVERCOME BARRIERS

- Raising energy taxation if energy prices are low.
- Change in legislation according to support renovation, investment and rent.
- Public and private financial bodies supporting advanced renovation.
- Housing associations promote saving policies for advanced renovation among their members.
- Public actors (like municipalities) and housing cooperatives implement advanced renovation as their policy in their own housing stock.
- Organized groups of single actors negotiate lower costs.
- Specific measures for low income groups. For example, in Belgium, some low income groups cannot deduct energy saving investment from taxes because they do not pay any taxes: a special law now creates opportunities.

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Impact on availability

DRIVING FORCES

- Geographically widespread establishment of 'one stop shops' or Integrate 'one stop shops' in traditional shopping venues, for example, large DIY (do it yourself) or hardware stores.

BARRIERS

- Early adopters want to maximise the profit in luxury niche markets before thinking of entering the volume market.
- The building sector is labour intensive. Big changes in products or new products mean change in skills and traditions for many individual workers and demands enhanced post education. There are few incitements for increasing competence among construction site workers. When a decision for change is taken the process of educating all workers is expensive and long lasting as identified in the growth phase.
- Companies with large investments in production technology need a market of a certain size before investing in new production lines, but can change fast when the decision for change is taken.
- Lack of competence and capacity for advanced renovation at an increased renovation rate in the building sector.

MEASURES TO OVERCOME BARRIERS

- Make Advanced Housing Renovation an integrated issue in regular education provided by schools and universities.
- National educational programs that qualify on site workers for Advanced Housing Renovation.
- Geographically widespread education programs towards deliverers include quality education of local technology and service providers for public offers.
- Making the tools and acquired experience available to all actors, for example standard per formance based contracts, calculation procedures, commissioning procedures, prescriptions for technologies and services for public offers.
- Companies execute educational programs for in-house consultants, planners and on site workers.
- Technology clustering might be a way for companies to overcome technology dependant lack of skills and competences.

6.6. Recommendations for the key actors

All actors

Attractiveness

- Market good examples from the introduction and growth phase with a main focus on rational arguments
- Promote holistic solutions and warn against 'light' non-holistic renovations.
- Focus on quality control in the planning and building process.
- Promote updated information on energy price trends, and consequences for the private economy.
- Inform residents about risks for social downward spirals in old not renovated buildings.
- Promote non-energy benefits such as energy independence and energy security.

Competitiveness

- Public and private actors (like municipalities), Housing Cooperatives and others announce advanced renovation as their policy in their own building stock.
- Communicate rising energy price trends.

National and municipal authorities

Attractiveness

- Public authorities support and use a standard labelling/certification and energy performance standard on a national level.

Competitiveness

- Authorities agree on a long term ambition level and time schedule.
- If necessary, change legislation affecting renovation, investment and rent.
- Strengthen legislation on renovation. The EPBD (Energy performance of buildings directive) (and national regulations in some countries) demands a certain energy performance when buildings undergo a major renovation. This tool can be strengthened and linked to stepwise enforcing of the building codes.
- National financing bodies announcing priority to good holistic and complete solutions and warn against 'light' non-holistic renovations.
- Support successful actors from the growth phase, that are motivated to reach volume market with further competence development, trade negotiation and resource acquisition for up scaling.Help organized groups of single actors negotiate costs.

Affordability

- Local authorities make advanced renovation as their main policy in their own building stock and warn against 'light' non-holistic renovations.
- Raise energy taxation if energy prices are low.
- Specific measures for low income groups. For example, in Belgium, some low income groups can not deduct energy saving investment from taxes because they don't pay any taxes: a special law now creates opportunities for this benefit.

Availability

- Introduce national and regional programs and action plans that include the most important public and private actors.
- Make tools and acquired experience available to all actors, for example standard performance based contracts, calculation procedures, commissioning procedures, prescriptions, etc.

Companies

Attractiveness

- Market good examples and benefits of advanced renovation.
- Promote holistic solutions and warn against 'light' non-holistic renovations.

Competitiveness

- Make advanced renovation as the main business activity.
- Investment in technology clustering might be a suitable way for companies to overcome technology dependant lack of skills and competences.

Affordability

- Consider reducing prices to open up new markets and enable large scale production.

Availability

- Utility companies, contractors or others establish widespread 'one-stop shops' with full service concepts including analyses, planning, renovation and finance.
- Geographically widespread education programs of deliverers include quality education of local technology and service providers.
- Execute educational programs for in-house consultants, planners and on site workers.

Housing cooperatives

Attractiveness

- Make the cooperatives more attractive than others by carrying through advanced renovation.
- Promote good examples and focus on running costs and non-energy benefits.
- Inform residents and associations about risks for social downward spirals in old not renovated buildings.
- Warn against too strong focus on maintenance and 'light' non-holistic renovations.
- Educate members on how to run their own Advanced Housing Renovation projects.

Competitiveness

- Implement advanced renovation as their main policy for renovation.

Affordability

- Implement long term rent and saving policies.
- Large scale affordable advanced social housing renovation creates lower prices.
- Negotiate prices by acting as a group.

Availability

Make advanced renovation their main renovation policy.

Appendix

Now House™ Markets Zero Energy Retrofits in Canada

The first Now House Project in mid-construction, Topham Park, Toronto 2007-2008

INTRODUCTION

The Now House Project has been developed as a transferable retrofit process to demonstrate what is 'now' possible with current technologies and transferable knowledge practices, to achieve low or near zero energy performance for a standard house type. It is conceived as a community initiative, promoting an orderly process of stepwise energy reductions for low to medium income homeowners, in Ontario and across Canada.

The project focuses on retrofits to existing wartime homes (circa 1940s). The first Now House, a typical representative of such housing, is located in Topham Park, Toronto. It is a modest, 1 ½ storey, detached, wartime bungalow (139 m^2) (see Brochure). Retrofitting this house allowed a range of realistic retrofit interventions to be demonstrated to the public. At the same time, it explored how local communities could be collaboratively nurtured as the mobilizing actor, in moving standard homes towards deeper energy retrofits.

The Now House Project began as a design proposal for the 2006 Canada Mortgage and Housing Corporation (CMHC) 'Net Zero Energy Healthy Home Project' design competition, (later re-branded as Equilibrium Sustainable Housing Initiative). This competition sought the design and construction of zero energy demonstration homes across Canada, and offering a unique potential to measure the performance of zero energy housing under real-world conditions on a national scale.

There were 72 entries from across Canada. After an intensive selection process, the design team, Work Worth Doing, was selected as one of 12 winning teams. Their Now House proposal advanced the urgent need for energy reductions through retrofits to existing buildings (all others proposed new-build zero energy homes). The winning teams had to spearhead the dissemination of housing that was healthy, affordable, sustainable and zero or near zero energy. By January 2010, the Now House was one of only six Equilibrium projects completed.

1. INFORMATION GATHERING

As part of the competition, design teams were required to carry out an Integrated Design Process. The Now House project team invited the who's who of Toronto's sustainable design community which allowed initial interdisciplinary exploration for appropriate solutions. The outcome produced a model that acted as the basis for the initial Now House Project.

The projects follow these phases:

Phase One: Represented socio-technical-economic research, with an emphasis on early community engagement through neighbourhood events, development of communication plans with key messages and an attitudinal and demographic profile of the neighbourhood.

Phase Two: Incorporated an Integrated Design Charrette for technical evaluation and community involvement to steer the design direction of each subsequent Now House. This included baseline energy audits, condition reports, development of future scenarios through facilitated and collaborative discussions and consensus on an integrated design solutions, all summarised in a Charrette Report.

Illustration of the four house types used in the Four Houses; Four Cities project, May 2009

Phase Three: Involved local production of drawings and permits, tendering and execution. The important aspect that has grown out of this phase has been the knowledge transfer and experiential learning component aimed at trades people, local builders, and home owners with the aim of changing attitudes towards deep energy retrofit techniques.

Phase Four: Included many forms of communications — open house tours, community events and exit surveys measuring the public's response to the demonstration home were undertaken throughout each phase of implementation. This practice has been continued in all subsequent Now House projects.
Lack of retrofit demonstration homes with near net zero energy performance limits the dissemination of tactile information to the public. The Now House addresses this issue, firstly, through presenting an integrated design for a whole house that can be explored by the public during open houses, secondly, by committing to a

synchronized communication and engagement plan. All exhibitions, media releases and local news coverage are coordinated to promote the success story so that the project becomes assimilated by the community.

Phase Five: Post retrofit energy and water consumption and solar production is monitored to compare modeled with actual performance.

Since its completion in 2008, the Now House concept has been expanded through two current projects; the 'Now House Your Home: Four Houses, Four Cities' initiative, partially funded through the Ontario Power Authority (OPA) as part of the Ontario Energy Conservation Week, and the 'Now House Windsor 5', which was carried out for the Ontario community-housing corporation in Windsor, Ontario.

These two projects provide an additional eight Now House demonstration houses, in various neighbourhoods across South Western Ontario.

POLITICAL FACTORS

- General public groundswell support for green initiatives in Ontario.
- Federal/ Provincial energy programs provide financial incentives to encourage energy retrofits (e.g. EnerGuide for Houses, ecoENERGY for Houses).
- Canada Mortgage and Housing Corporation and the Ontario Power Authority support demonstration projects and their promotion.
- Municipalities are encouraged to promote Integrated Community Sustainability Planning.

ECONOMICAL FACTORS

- Renovation programs align with Government investment in infrastructure redevelopment.
- Some communities hit hard by the economic contraction (e.g. Windsor: has the highest unemployment rate among Canadian cities) thus retraining programs are sought after.
- Feed-in-tariff programs provide an economic incentive for use of solar PV in OntarioAvailability of subsidised home energy audits in some provinces (e.g. ecoENERGY).

Technology is not the only source of innovation. Local children involved with one of the many Now House community events — Now House front porch can be seen in center-background of photograph.

SOCIAL FACTORS

- Public is unaware of deep energy reduction retrofits.
- As a grassroots initiative, trust at community level is very important for forming partnerships to increase support for near zero energy retrofits.
- Neighbourhoods close to urban centers are being renewed.
- The community population is diverse with immigrants from many countries.
- General need for re-skilling of trades' workforce, deep energy retrofits offers a potential complementary skill set.

TECHNOLOGICAL FACTORS

- Sustainable building practices were not common practice with trades nor taught in colleges.
- Current energy performance of wartime homes is significantly below average Canadian rating.
- Growing desire by municipalities to see actions such as energy mapping and community energy plans.
- Environmental factors often not considered in tandem with energy improvements.
- Housing sector seen as a major area for reducing CO_2 emissions
- Building Codes are modest in terms of energy conservation.
- New national building code will require all new housing to match an energy rating score of 80 by 2012, but does not affect existing homes.
- Most energy reduction projects are demonstrated through new build projects — there is a need for retrofits to existing homes.

THE MARKET ARENA

It is estimated that approximately one million houses of similar construction standard to wartime homes are still standing across Canada. The slogan, "One small house. One million opportunities", frames the conceptual scale of the Now House retrofit model market potential while highlighting that innovation will be required, if projects are to be successful.

Scale is a significant issue to address, as there can be a reduced impact, if there are a limited number of homes to be converted or a lack of work to attract adequately trained personnel. This occurred with the Windsor 5 project where increasing complexity in budgets and a diversity of knowledge for achieving near zero energy homes demonstrated the need for a full time project manager.

It was clear from research by the Now House team, that regardless of its size, such projects can provide needed economic stimulus and local jobs. This influenced both the design of the communications process as well as the building project. This proved to be the case in Now House Windsor 5 project, included hiring fifteen companies in the local area and providing orientation and knowledge transfer abut zero energy retrofits.

The wartime-style house was chosen intentionally to provide sustainable building practices to mid and low income groups. All other EQuilibrium house projects are demonstrating more expensive solutions with new houses. If the case for a demonstration home is presented properly in a community, people want to belong to the project and this leads to increased partnerships for funding and general support within the community.

TECHNICAL ANALYSIS

All selected houses for Now House retrofitting scored relatively low ratings when initially audited for their energy performance. This is typical for 60-year-old wartime homes. This type of house is moderately built, has little or no insulation and tends to have very high air changes. Mean baseline scores for all the sample Now Houses were measured at a 35 EGH rating[1], while the national average score

[1] EGH = EnerGuide for Houses/ecoENERGY is Canada's national home energy efficiency performance rating system and managed by Natural Resources Canada. The linear 100 point scale is standardised with 100 indicating that no net commercial energy is required. An 80 indicates an R-2000 standard of building performance.

for a typical house is 62 EGH; post-renovation ratings averaged 85 EGH — if renewable energy technologies were employed the rating is higher. The original test-case Now House initially scored 68 EGH (192 kWh/m^2), after deep energy retrofits the post-retrofit audit increased to 84 EGH, after renewable technologies were installed it achieved a final score of 94 EGH (38 kWh/m^2) (see Brochure 310).

To achieve the goal of a near zero energy retrofit, the Now House process has had to offer an adaptable template of tasks for the homeowner to consider. This required an emphasis on a stepwise set of actions, highlighting the order in which the improvements should be made. Strong presentation themes, access to products and availability of knowledgeable personnel during open house tours to answer questions increased the educational component.

Summarised SWOT — analysis
Implementation of sustainable goals in the Now House projects are summarised as follows:

STRENGTHS

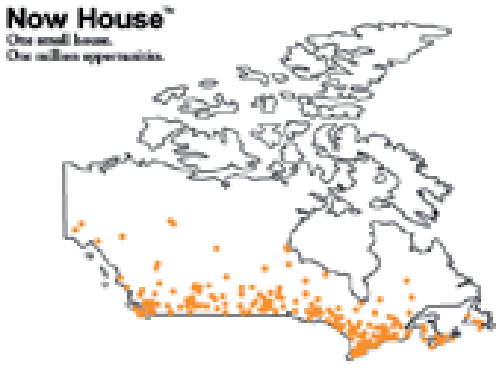
- High interest factor in using an older, existing house — it makes a good story.
- The wartime house type suits a replicable model for a demonstration project.
- Concept of sustainable practices is being taken to mid and low income groups.
- There is a component of local history that makes people want to belong to a caring process for wartime homes.
- The Work Worth Doing — Now House team has design and communication strengths.
- Well documented process.

WEAKNESSES

- Some reinvention had to occur with each demonstration house.
- The list of actions was not automatically transferable between projects and needed some adjustment.
- Each home retrofit was in a new locale and meant new contractors, which involved re-skilling.
- Need a certain volume of retrofits to bring costs down.
- Need volume of work to attract trained people.
- Skilled trades do not currently exist for such retrofits.

OPPORTUNITIES

- The stated ambition of one million houses provides an identified market.
- If energy efficient types of retrofits are known when finances are being planned, they can be included in the mortgage.
- There is a synergistic impact- all houses require retrofit works so conducting energy audits before any work identifies energy saving opportunities.



This map of Canada indicates the many urban centers in which wartime homes can be found.

THREATS

- Funding of demonstration homes requires partnerships.
- Scaling the process faces several barriers related to lack of adequately trained trades.
- All houses achieved net zero energy cost (revenue from PV electiricty sales exceed energy purchase costs) but getting to net zero energy use is much more expensive.

3. GOAL

The goal has been to dramatically reduce the amount of energy used by existing houses in Canada by retrofitting them to net zero energy use.
The success of the Now House Project was dependent on clearly understood social goals. There was no point in communicating achievable technical goals (e.g. attaining a net zero performance), if the public did not understand this information. This insight shaped the process for how Now House projects were introduced in each of the four communities in which they worked.
The goal was to bring design thinking and design processes to a host of social and environmental challenges arising from home energy retrofits so that near or net zero energy performance could be promoted and eventually achieved as a community aspiration.

4. STRATEGIES

Now House Windsor 5 demonstration house provides visitors with exhibitions about the retrofit process applied to the five houses.

Strategies have constantly evolved to adjust to the requirements of different community projects. Essentially three main strategies shape the process for the project:

Now House public involvement: Starts with seeking early engagement with the community. This is achieved through social events focusing on energy saving or conservation campaigns, children's educational programs and displays on the historical facts of wartime homes.

An external space (e.g. a neighbourhood park) often provided the best means of engaging the community. Community building relationships were important. Rather than trying to build new networks, locating people who were already socially connected allowed for greater dissemination of messages (such as the local baseball league in Topham Park and the Canadian Auto Workers (CAW) union in Windsor).

Partnership development: Was essential for funding much of the expected work. While sponsorship varied, main industry partners generally provided discounted costs rather than funding essential materials. Appliances have been sponsored or discounted. The importance of the OPA and CMHC was central to funding knowledge transfer, post-retrofit monitoring, and skills training as part of the process for retrofitting the houses.

Clear communication of the success story: Meant that understanding where people in the community got their information from was important. Thus communicating and building relationships with media and ensuring media coverage plays an essential role in Now House projects.

5. THE ACTIONS TAKEN

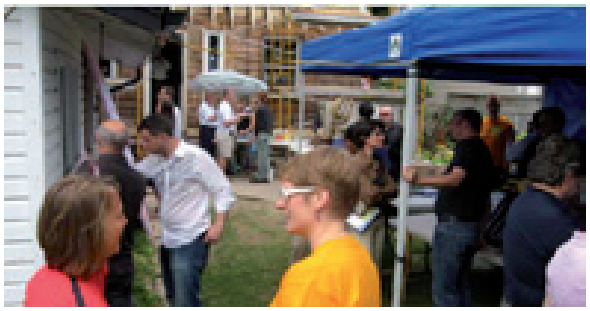
The main objectives have been:

- Rather than raising awareness by pushing the message to achieve net zero energy homes and buildings, the focus is on doing and showing by example.
- To ensure that adequate engagement with the community occured from the earliest opportunity.
- To develop a communication plan with key messages.
- Variation in neighbourhoods meant that the team had to learn as they progressed through each project.
- Promote a stepwise order for retrofit actions to the house as a whole system and demonstrate this.
- Seek partners and funding for carrying out the demonstration homes.
- Carry out exit surveys during open house demonstration events.
- Implement monitoring programs to ensure measurement and evaluation.

6. RESULTS AND LESSONS LEARNED

Since the launch of the initial Now House in Toronto in September 2008, the team has worked in the neighbourhood to encourage additional deep energy retrofits. The Topham Eco Team evolved from this work and with support of Now House team have succeeded in initiating a cooperative to purchase solar panels among local residents. Their initial target was 10 further homes with deep energy reductions; to date, they have completed two homes.

In 2009, Now House completed five deep energy retrofits for the Bridgeview



Now House mid-construction open house invites visitors to view retrofit changes prior to completion when many changes will no longer be visible.

community in Windsor, Ontario, to demonstrate five different approaches for five post-war bungalow retrofits. The goal is to monitor and evaluate the performance characteristics of each retrofit approach to determine the most cost effective interventions that could be applied to an additional125 wartime bungalows in the community housing portfolio of Windsor.

Some of these demonstration houses are expected to achieve a positive net cash income through a feed-in-tariff (FIT) rebate program provided through the OPA as part of the 2009 Ontario Green Energy Act. This project presented an upgraded base model that achieved 62% energy reductions for comparison with a further two that achieved net zero energy cost (fitted with 2.1 kWp PV system plus solar thermal), another two received deeper conservation measures than the base model upgrades.

Four houses received deep energy upgrades as part of the Energy Conservation Week in May 2009. The locations of the homes were: Kitchener, Windsor, Toronto and Ottawa.
The Now House initiative is also being expanded to other zero energy retrofit projects in St. Catherine's and Hamilton (Ontario), Vancouver (British Columbia) and a zero energy housing project in Mexico.

AUTHOR

Shane ONeill
University of Waterloo
shane@webgate.net

Lorraine Gauthier
The Now House Project Inc.
lorraine@workworthdoing.com

Paul Parker
University of Waterloo
pparker@uwaterloo.ca

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Engaging Residents in Energy Evaluations and Retrofits: REEP, Waterloo Region, Canada

REEP House for Sustainable Living

Introduction

The Residential Energy Efficiency Project (REEP) began as a university-community partnership in 1999. The Faculty of Environment at the University of Waterloo and the Elora Centre for Environmental Excellence received funding from the federal government's Climate Action Fund to create a project that identified barriers to action and systematically encouraged broad participation in residential energy evaluations and energy retrofits to reduce energy consumption and greenhouse gas emissions.

The federal government's EnerGuide for Houses program was the evaluation service delivered in the project. The core strategy of community engagement through participation in dozens of community events and delivering specialized public information workshops enabled the project to recruit approximately 1000 participants from the local community each year. By the second year of operation it accounted for 10% of the national total of evaluations. This success in initial recruitment was reported in IEA SHC task 28 report (Kennedy and Parker 2006).

The REEP project is 10 years old, has survived the cancellation of its initial core program, rebounded with the new ecoENERGY program to double its annual number of participants, documented increased numbers of households taking retrofit action and launched a new demonstration project (the REEP House) to encourage deeper retrofits (double or triple the energy savings of an average retrofit).

An environmental not-for-profit organization, Waterloo Region Green Solutions, was established in 2006 to be the local member of Green Communities Canada (the national association that holds the federal government contract for green communities to deliver energy evaluations) and to manage REEP along with new projects.

REEP's success reflects the national trend of increased participation as the government refined its program and the provincial government matched the value of financial incentives to stimulate more action.

1. Information gathering

- Surveys were conducted to identify barriers to taking action and the lack of information and lack of finances were identified as key.
- Trust was also identified as a barrier as business sources of information were perceived as promoting their own product as a solution. The partnership of university, not-for-profit organization and local utilities was designed in part to address the trust issue as these third party sources of information are perceived as less biased.
- Extensive building data were collected during a two hour inspection of each house.
- Socio-economic data were extracted from census files.

2. Analysis

First we look at the factors that indirectly influenced the energy evaluation and retrofit market.

Political factors

- After launching the EnerGuide for Houses (EGH) program in 1998, the federal government cut its support for these energy evaluations in 2006 when the party in power changed.
- Local governments responded to the federal government's cancellation of the energy evaluation program by passing a resolution at the Federation of Canadian Municipalities to call for its continuation
- The federal government introduced a revised and renamed program, ecoENERGY for Houses. Solar thermal installations were added to the list of renovations receiving an incentive.
- Provincial governments supported energy efficiency as part of their climate change initiatives.
- Ontario, Canada's largest province, called for the creation of a culture of conservation (especially to reduce electricity consumption, to ease the risk of shortages and to cut the use of coal-fired generation).
- some provinces (Newfoundland Labrador, Nova Scotia, Ontario and Saskatchewan) matched the federal financial incentives to increase participation rates and to avoid the duplication that would have resulted if they created a similar separate program
- Building codes were upgraded in several provinces
- After the federal government cut its financial support for conducting evaluations, the Ontario government decided to pay up to 50% of the cost ($150 maximum)
- Retrofit loans were made available in some provinces and territories (British Columbia, Manitoba, Yukon)

Economic factors

- Relatively low energy prices ($0.05-$0.10 / kWh commodity price or $0.08 - $0.12 / kWh delivered price).
- Strong purchasing power as the Canadian dollar fluctuated near the value of the US dollar
- housing demand and prices increase because of population growth and a strong economy (especially in the oil producing province, Alberta)
- The incentive for solar thermal installations increased 125% in 2009 ($1250 from the federal government).
- The stimulus program to address the 2009 recession included a 25% increase in federal ecoENERGY incentives. Also up to $1250 in tax reimbursements is available for residential renovations (not restricted to energy retrofits)

Social factors

- Income is high on average, but the gap between rich and poor is growing.
- Some provinces support low income energy retrofits (Quebec and Saskatchewan)
- Federal low income energy retrofit program cancelled after a small pilot

- Education level is high on average
- Population growth is driven by immigration and First Nations
- Diverse ethnic and linguistic mix requires translation of materials and culturally sensitive service providers

Technological factors

- Lack of public knowledge on ambitious energy saving solutions (net zero energy healthy houses are promoted by a small federal program by Canada Mortgage and Housing Corporation)
- Stress on green technologies, rather than on energy conservation
- New building code only affects new houses
- Research conducted by National Research Council, Natural Resources Canada and University partnerships
- Ontario Centre of Excellence supports university-industry partnerships for energy technologies.
- Some media focus more on 'smart homes' and solar homes rather than deep retrofits

The market arena

The growth in demand for energy evaluations following the government's re-introduction of the program in 2007 created opportunities for more businesses to enter the market. Existing home inspectors offered evaluations as a related service. Some individuals and new firms specialized in energy evaluations.

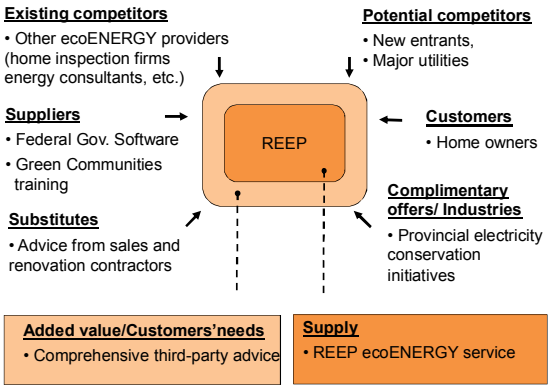
The major gas and electricity utilities could diversify their energy services and enter the market.

Potential competitors include a popular reality TV star who has a show on home renovations and has identified the region as an ideal location for a reality TV show on home evaluations.

The reputation of the REEP service held by customers enabled referrals to remain the most common source of people learning about the service.

On the supply side, the federal government provides the required software and Green Communities Canada has the delivery contract with the federal government.

Figure: 6-force model (Grove)



Technical analysis

Evaluators easily find recommendations to reduce energy consumption by 30-40 percent in typical pre-1980 dwellings. Homeowners often implement two-thirds of the recommendations to achieve a 27% savings. The technical potential for savings is greater than the achieved savings with opportunities to encourage both the evaluator and homeowner to look deeper.

Old houses with un-insulated walls and large air leakage (drafts) provide a prime opportunity to demonstrate deeper retrofits. The REEP House project uses two side-by-side century homes to demonstrate how energy consumption can be cut by 58% with a package of retrofits priced at $30,000 (20,000 Euros) in the 30/50 House (Brochure 320). The second house demonstrates energy savings of 85% with renewable energy used to achieve near net zero energy performance. It highlights actions for deep retrofits and the Leadership in Energy and Environmental Design (LEED) Platinum for Homes building standard and certification process.

Summarised SWOT analysis:
REEP faces a dynamic operating environment

Strengths
- Experienced and trusted staff with 10 year track record
- Strong partnerships
- Quality evaluators with training and independent checks

Weaknesses
- Limited number of evaluators to respond to rapid growth in demand
- Wait times for appointments grows to over one month
- Training and examination standards effectively reduce the number of available evaluators. Both computer skills and knowledge of building science are required and training takes time.

Opportunities
- Large proportion of the housing stock remains to be upgraded
- A complementary solar assessment procedure and report was developed

Threats
- Competition from other energy evaluation service providers
- As demand has grown, more service providers have entered the market (home inspection companies, independent firms, etc.)
- Federal incentive program is expected to finish in 2011.

3. Goal

Mission Statement: empowering communities towards healthier homes and sustainable living.

Goal: positive environmental action for:
- sustainable resource use
- energy conservation and efficiency
  (e.g. action plan – 1000 houses/year)
- renewable energy applications

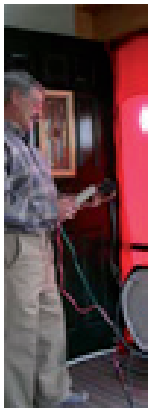
4. Strategies

We achieve our goal through:
- innovative programs and services
- public education and outreach
- collaborative research
- community partnerships

Introduction phase:
- Use GIS (geographic information system) analysis of census data to identify neighbourhoods with the greatest potential to gain from participation in the program.
- Pre-1970 construction
- High ownership level
- High education level
- Above average income
- Test recruitment approaches
- Utility bill inserts
- Community events
- Leaflets/fliers
- News reports

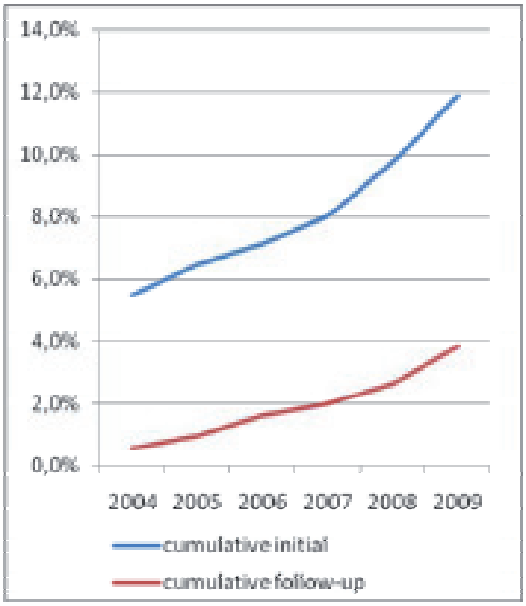
Strategies for broadening the energy evaluation and retrofit market:
- Use multiple messages to match multiple motivations held by people:
- Comfort, savings, environment
- Create a new social norm through social marketing

5. The actions taken



In targeted neighbourhoods, pamphlets were distributed door-to-door to encourage participation and to test various designs and messages.
Partnerships with local utilities allowed inserts to be sent to each home with their utility bill.
Public outreach and participation in community events contributed to increased brand recognition.
The marketing message was based on a triple motivation: comfort, savings and environment.
More evaluators and office staff were hired.

6. Results and lessons learned



Percent of Low Rise Housing Stock in Waterloo Region Evaluated by REEP

REEP has undertaken energy evaluations of 12% of all low rise housing built in Waterloo Region prior to 1991. The participation rate in some neighbourhoods is double this average.

REEP has grown and diversified over time. It conducts twice as many residential energy evaluations and follow-up evaluations to measure the energy savings achieved as it did five years ago. The project also promotes deeper retrofits to encourage homeowners to go beyond the 27% savings achieved on average.

REEP expanded its initial success with the innovators (first 1-2% of households) to provide energy evaluations to the early adopters (5-15% of households) and is reaching the early majority (17-50% of households) in some neighbourhoods.

The number one source of clients continues to be referrals. This highlights the importance of providing a third party service that is valued and trusted. The not-for-profit nature of the organization is viewed positively (no profit to be gained from sales of a particular product) and the partnership with the university, local government and local utilities increases the trust factor.

The price of the service has increased over time to $350, but the incentives provided to those who take action overcome this financial barrier.

Incentives from the federal government encouraged early adopters to participate in the program. Changing incentives from performance-based to action-based increased customer satisfaction as they had a clearer expectation of the size of incentive payment they would receive for a particular action. The doubling of incentives with matching provincial incentives further increased demand. (The increased focus on financial incentives also resulted in much more staff time being spent on explaining and clarifying the incentives and payment timelines.)

Demand for evaluations continued to grow through the 2008-2009 recession. Incentives were increased by a further 25% for a limited period.

Personal referral continues to be the most important source of participants as people listen to the advice of their family, friends or neighbours.

Partnerships with contractors who install equipment generated many referrals, but in some cases they have turned to service agents with shorter wait lists. Adequate staffing and prompt service delivery are important to maintain good relations and satisfied customers.

Outreach continues to play an important role as it is believed that people must hear about the program and its benefits from multiple sources.

Achieved savings in one household serves as the evidence for others to also take action, discover their energy rating, receive a plan for retrofits, invest time and money in the renovations, and finally, await the incentive cheque to reimburse some of the costs. This spiral process of innovation diffusion enables each street or neighbourhood to move from an introductory to volume phase where most people are aware and consider participation. A new social norm is being created.

Overall, the project has evaluated over 11,000 households in Waterloo Region and documented annual savings from 3000 households equalling 10,000 tonnes of CO2 emissions and $2.3 million in annual energy cost savings. An estimated $30 million was spent on retrofits and incentives of $4 million were paid by government to home owners. The incentives leveraged homeowner investment and stimulated higher participation rates.

Author

Paul Parker
Professor, University of Waterloo
pparker@uwaterloo.ca

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Social housing block Sterrenveld

Introduction

Between 1959 and 1963, the social housing company *Mijn Huisje* (My Little Home) constructed the *Ban Eik* estate in Wezembeek-Oppem, close to Brussels. The project combined 150 single family houses and 320 apartments, a primary school, a shop and the offices of *Mijn Huisje*. In the spirit of the garden city, it offered a lot of open green space and playroom for children, and together with it's central district heating system, the project was seen as an example for the social housing of the future.

After thirty years, the situation had changed drastically. The *Ban Eik* estate was worn out, lacked comfort and did not apply to current health and safety standards. The dilapidation caused vandalism and insecurity, people moved out and were replaced by those who could not afford a better place, including illegal immigrants, drug abusers, …

While renting prices had to be lowered, the outdated district heating coped with high distribution losses and leakages, resulting in high maintenance and energy costs while struggling to deliver the needed heating and DHW.

At the start of the nineties, *Mijn Huisje* was integrated into the social housing company *Volkswoningbouw Sint-Pieters Leeuw*. The Ban Eik estate was given a second chance, and a plan was made to
After tackling the most urgent repairs, a progressive refurbishment of the estate was planned, gradually disconnecting the houses from the outdated district heating system. The single family houses got new windows, the bathroom was upgraded, the electrical system rewired and each house got its own condensing gas boiler.
The municipality of Wezembeek-Oppem redesigned the public areas, and new public functions were planned, like a new shopping space and, after the removal of

the district heating plant, a community centre and new office spaces for the social housing company.

Where the single family houses were in a relatively good state and easy to renovate, the opposite was true for the apartment blocks. Here, a thorough renovation was needed. Three options were considered: demolition, light renovation and thorough renovation. Since a new building code had limited the building height, demolition would strongly reduce the number of apartments to be rebuilt. Light renovation would only slightly improve the comfort standard, and not solve the social problems. So the social housing company opted for a thorough renovation, hiring the architects Quirynen & Jacobs, as well as the technical engineering firm Roelandts Cornelis Rys.

The first two apartment blocks were renovated in the years that followed. This meant the buildings were completely redone, adding insulation and outside terraces, renewing the flooring, walls, installations, etc. But the volume, typology, circulation and technical shafts were kept unchanged.

The last apartment block to be renovated was *Sterrenveld*. Here, the refurbishment would be more radical, changing the whole floor plan and organization of the block, adding freestanding winter gardens and including different renewables.

In Flanders, the VMSW (Flemish Organization for Social Housing), is an externalized institution, with the purpose to stimulate, support and finance the local social housing companies. It forms the link between the government and the local field. Towards the social housing companies, VMSW promotes high quality and sustainable solutions via its EDSW principles (Ecological and Sustainable Social Housing).

In May 2000, the VMSW (then still called VHM) called the social housing companies to translate their vision and ideas about sustainable development in a project. *Sterrenveld* was one of 3 pilot projects that were selected.

1. Information gathering

In the call for proposals, the VMSW asked the participants to give an answer to the following questions:

- Why is this a sustainable project?
- How does the project shape the relationship between the individual, the building and its surrounding?
- How will the project reach out as a pilot project?
- How do the cost-benefits of the pilot relate to a standard project?

On the scale of the *Sterreveld* project, the design team had already completed the refurbishment of the other 3 apartment blocks, Bloemenveld, Zwaluwveld and Zonnenveld. The last one, Zonnenveld, was completely identical to *Sterreveld*, and became an important source of information and comparison.

2. Analysis

First we look at the factors that indirectly influenced the VMSW market.

Political factors

- As a support and knowledge base, the VMSW strongly supports sustainable construction
- The spike in energy prices has triggered measures to reduce the impact for the poorest people
- Media and politics focus on energy production (nuclear power plant and/or windmill)
- *Sterreveld*: the merger of Mijn Huisje into Volkshuisvesting created a new climate

Economical factors
- Relatively small scale of the social housing market with only 6% of total built volume
- High demand for social housing and long waiting lists
- Rent price is linked to the amount invested

Social factors
- Dilapidated state of the buildings triggers neglect by the residents
- Lack of social control facilitates violence and vandalism
- A majority of the tenants are outcasts (illegal immigrants, drug abusers, …)
- High demand for social housing and long waiting lists

Technological factors
- Lack of knowledge on ambitious energy saving solutions
- Stress on green technologies, rather than on energy conservation
- No existing examples

The market arena

Through the 6-forces model, we try to analyze what the VMSW wanted to offer to the social housing companies and their clients who would participate in the call for pilot projects. The model illustrates the forces to use in their advantage or to overcome.

The core business of the VMSW is to support housing companies in Flanders in building up and maintaining their social housing portfolio. Through the EDSW program, they focused on sustainable development.

The motivation of the social housing companies and their clients are intertwined, and lie in a strong improvement of the living conditions in *Sterreveld*. High comfort and an integrated design including improvement of the social aspects of housing result in a high living quality for the tenants and a higher rent for the social housing company. Insulation and renewables lower the energy costs of the tenants and the running costs of the social housing company.

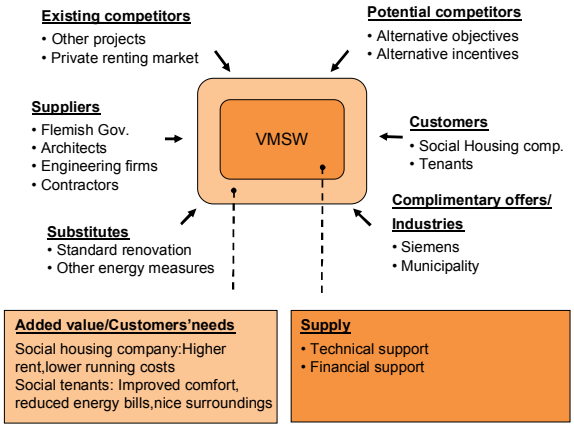

Figure: 6-force model (Grove).

On the supplier side, the design team played an important role in achieving these goals right from the start, since their first challenge was to get the project selected as a pilot.
On the other hand, the supplier side for the refurbishment itself included an important barrier as well, in the party of the contractor. Invitations to tenders for public works are strictly regulated, so it became a challenge to select those contractors that had some experience in low energy building, or at least were interested in learning about it.

The competitor side became a strong driver for the project, since 13 projects competed and only 3 were selected. As for the tenants, the private renting market would be the alternative to social housing, but offer less quality for often higher prices.
Potential competitors could be seen in alternative objectives, like for instance leaving the holistic view on sustainability and focusing on renewables only, or the installment of other incentives or pilot programs.

In the design of the *Sterreveld* project, a mix of solar and conservation was made, with an emphasis on renewables. When the project was designed, very low energy or passive building had not yet produced the examples that would prove the importance of high levels of insulation and air tightness. This lack in hierarchy of measures meant a lot of alternative strategies were possible. Zonnenveld, the twin building of *Sterreveld*, was close and tangible evidence of another substitution. Zonnenveld's refurbishment improved living conditions, including adding insulation, but without changing the structure, nor adding all the renewable techniques.
Complimentary actors did not play a big role at the start of the project, but their importance has grown towards the end, mostly through Siemens and their technical engineer who set up the monitoring system, and fine-tuned the whole technical installation. Even after he changed employers, he kept monitoring and improving the installation, giving tours and working on informing the tenants.

Technical analysis
The apartment blocks were build in the early sixties, using mainly cheap materials, single paned windows and no insulation at all. As part of the whole estate, they were connected to a central district heating system. After forty years, the buildings were completely worn out. No renovations had been done before, so the building was worn out.

Energy consumption
- Before (calculated): 150 kWh/m².a
- After (calculated): 55 kWh/m².a

Real energy consumptions probably were much lower than calculated, and continue to be so after the renovation. Comparison to Zonnenveld has shown that the social tenants want to reduce their heating bills as much as possible. This can be clearly seen in the use of the ventilation system. Since Zonnenveld is less ambitious, it uses ventilation system C with integrated intakes above the windows. This results in a noticeable draft of cold air when ventilated, what is translated by the tenants as energy loss. The result is that almost all ventilation intakes have been taped close by the tenants. As for the system D of *Sterrenveld*, blowing preheated air through the heat recovery, almost no air inlets are taped. Here though, the fact that nobody turns their heating on (the exhaust air before the heat recovery can be as low as 17°C) provides the heating boiler from working inefficient. If all tenants would put the heating on 20°C, the gain in efficiency would probably result in an equal or even slightly lower energy consumption. The basis for the apartment block was a concrete slab construction with good free height and column rhythm, allowing for a radical adaptation of the floor plans.

Summarised SWOT-analysis
The position of the VMSW to be able to implement these sustainable goals in the pilot projects can be summarised as follows:

Strengths
- Trusted partner for the social housing companies
- In depth knowledge of the decision making processes in the social housing companies
- Open, challenging format of the call for pilot projects
- Well defined structure, used to go further than the national standards
- Well elaborated basic structure for incorporating ecological and sustainable measures in social housing projects
- Financial support through the Flemish government

Weaknesses
- Limited experience with sustainable renovation projects
- Quality of the result of the call for projects depends on the quality and number of the competitors

Opportunities
- Very poor quality before the renovation, making an intervention unavoidable
- Merger with the *Volkshuisvesting*, improving management standards and providing new oxygen
- Strong financial incentive, not only in subsidy if selected as a pilot, but mainly in the very low rent before renovation
- Introduction of the EPBD for new construction
- Cooperation with the municipality

Threats
- Lack of monitoring of the measures after refurbishment and lack of fine-tuning the installations.
- Lack of quality control on the contractor (and subcontractors)

3. Goal

The goal of the VMSW through the pilot projects was:
- To elaborate and reinforce their ambitions for an ecological and sustainable social housing
- To test and monitor different sustainable approaches and techniques
- To demonstrate sustainable strategies and techniques, so that other projects can learn from the examples

The goal of the social housing company in the *Ban Eik* estate in general and the *Sterreveld* refurbishment in particular was:
- To revitalise the neighbourhood
- To improve living quality
- To reduce neglect and vandalism
- To reduce running costs
- To lift the rent up to a normal level, allowing for a normal payback time of their original investments

4. Strategies

The strategies for the introduction of sustainable construction by the VMSW were:
- Develop, accomplish and communicate good pilots in new construction as well as retrofitting.
- Stimulate the development of competence and experience within the VMSW as well as outside
- Test and illustrate their EDSW program.

For the social housing company, the strategic choices were:
- Partaking in the call for pilots, thus developing new strategies and ideas
- A holistic approach to revitalise the neighbourhood
- A thorough retrofit, making it necessary for tenants to leave the building (and not returning)
- Monitoring the results

5. The actions taken

These actions were taken in order to realize the strategies:
- A call for pilots was organized in 2002, out of 13 project, 3 were selected, two new constructions and one retrofit.
- Follow-up of the design and construction by the technical support services of the VMSW
- Information about the pilot projects was incorporated into presentations, dissemination and training of interested parties, inside the VMSW but also outside
- Implementation of a monitoring system, and appointment of a person responsible for monitoring and optimization
- Initiatives to inform the tenants of the properties of the building have been postponed, but are planned
- Collaboration with the municipality, who will refurbish the public infrastructure, creating green spaces and circulation.

6. Results and lessons learned

As a whole, the renovation was a success. The estate has been revitalized and social problems have diminished.

The main problems on the level of *Sterrenveld* were situated in the lack of building quality. Since the poor state of the apartment blocks before retrofit were caused by cheap materials and bad building quality, this highlights a general problem in the construction sector. Striving towards very low building costs attracts inexperienced or foreign subcontractors. A lack of common technical ground, and even common language, make the information stream and quality assessment very difficult.

A very important part of the good result obtained, was funded on the close and productive collaboration between the different design teams. The architects Quirynen & Jacobs, the technical engineering firm Roelandts Cornelis Rys, the Sustainable technology engineer from Siemens worked closely together to realize an integrated design.

As for the most important lesson to be learned from the pilot projects, the multiplication effect they will or will not generate, it is still to early to evaluate. Was is certain though, and very important too, is the will the VMSW has expressed through these pilot projects to invest in new and better construction standards, and explore new possibilities. A next step has already been the ongoing renovation of a small group of terraced social houses towards passive house standard.

Author

Wouter Hilderson
Technical advisor, Passiefhuis-Platform
wouter.hilderson@passiefhuisplatform.be

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The city of The Hague - Renovating inner city housing

Introduction

The city of The Hague is on of the mayor cities of The Netherlands. In total it consists of about half a million inhabitants in about 250.000 dwellings. The city has formulated a high ambition for CO_2-emission reduction. The ambition being that the city will have zero CO_2-emissions in 2050. To achieve this goal, the municipality is setting up many different energy-saving projects.

Two big projects that are being developed are concerned with the distribution of sustainably produced heat, both for new housing and for the existing stock. In one project heat is produced using a heat pump from the stored heat in sea water. In another project, geothermal heat is collected at a depth of 2 km under the city. About 4.000 houses, both new and existing will be connected to the distribution network.

One of the big issues in achieving the formulated ambition, is the energy use of the existing building stock. A large amount of energy is still used for the heating of older buildings. For the municipality it is impossible to finance retrofitting all the houses in the municipality. The logical conclusion is that home owners have to be persuaded to retrofit their own housing.

To start up a pilot project the city has been looking at a specific area in The Hague. The area is called Rustenburg-Oostbroek. In this area already for a couple of years a project has been running for the improvement and enlargement of dwellings, called “vergroot je woning”.

The area is located near the city centre. It was designed by the famous Dutch architect Berlage in the beginning of the 20th century. The area is located next to the "Transvaalwijk", which is an area that has undergone extensive restructuring (demolishing and new construction) in the last couple of years. Rustenburg-Oostbroek., like Transvaal, has inhabitants in the low-income category. However, here most inhabitants (60%) are owner occupants. This makes restructuring a lot more difficult. Furthermore research from 2001 has shown that most inhabitants are against this type of upgrading and want their neighbourhood to stay as it is.

1. Information gathering

Many sources have been used for information gathering. Besides the extensive documentation of the council, for a great deal available on the website, the database about the population build-up of The Hague, many interviews have been held with different kinds of stakeholders, both local and in the field of renovation and communication:

- "Vergroot je woning"
- Real estate agents in the area
- Main utility company in area
- "Aardewerk" company specialized in communication to low-income and/or not-Dutch speaking inhabitants
- "Wonen++" project leader of (original) program of innovative retrofitting project by the province of Groningen
- "Wonen++" commercial spin-off by company Ecostream
- Different branches of the council

2. Analysis

Important factors which indirectly influence the market are listed :

Political factors

- local government has a high "green" ambition level
- National government; Christian-Left majority in government is "green"
- Minister announcing higher standards for new buildings, wants standards for renovation.
- National government has made money available for energy-retrofitting projects.
- EPBD-legislation (energy labelling of buildings) implemented on 1 January 2008.
- Government campaign for healthier living conditions
- International wave of "green" awareness (Al Gore c.s.)

Economical factors

- Neighbourhood of lower and middle income
- macro-economic developments are not good, unclear what the effect is in the neighbourhood itself
- energy prices are rising.
- interest rates are rising
- green mortgage available, cheaper than regular mortgage.
- banks are profiling themselves as "green"
- rumours about subsidy-programs

Social factors

- Low-income area
- Area is not yet "bad"
- 50% Dutch origin, 15% Moroccan, 15% Surinam, 10% Turkish
- 45 % 1-pers no child, 25% 2-pers no child, 25% 2-pers w child, 5% 1 pers w child
- 50% age 20-44
- 10% lived there all their life, 25% moved there in 1990-1999, 55% no later than 2000
- 55% voted left(ish), 15% voted far right (xenophobic)

Technological factors

- normal practise, installations & construction, is much better than level in neighbourhood.
- specifically for neighbourhood special roof-top extensions have been developed.

3. Technical analysis

There are about 8.000 dwellings in the area. About 1000 of them are one family terraced houses. The other 7.000 dwellings are small apartments in three story terraced buildings. The houses are small. The one family houses are about 100 m^2, the apartments are mostly 60-70 m^2.

The houses in the area are in a very variable condition, some have been modernized somewhat, but most are energetically not in a very good state. Energetic improvements are difficult, because of the lack of room inside and the protected view of the façade. Most of the houses do not have ground insulation, other than a crawling space. None of the houses have roof-insulation.

The installations vary widely, but are for the most part below “normal practice”. Some houses still have individual gas heaters. None have solar stills or PV.

4. Market segmentation

It was realized early on that this area had many disadvantages when it came to the renovation process. However the council is of the opinion that also these kinds of areas need to improve substantially if the city’s goal for energy savings is to be reached. Furthermore, it is of great importance that the area does not deteriorate to the point that retrofitting is no longer a viable option. Furthermore, research had shown that many inhabitants of the area feel a strong binding with the neighbourhood.

Within the area three groups of people where identified for targeting in the project.

- Starters / movers

For them it is a “natural moment” for improving their house. It is widely acknowledged that this group is most likely to improve their home. They are already thinking about financing and getting a mortgage. Furthermore they are targetable through real estate agent, banks and EPBD-agents

- People that have shown interest in “enlarge home”

For them too it is a “natural moment” for improving their house. They are also already thinking about financing and getting a mortgage. Furthermore they are directly accessible through shop in area

- Families with children

This target group was chosen partly because of political reasons. The council wants to help these people. They have a lot to gain for their children in sense of health and comfort. As a group they are well accessible through different channels, such as Schools, Health care and Community centres. Furthermore, they have in general a large network in the area, so that targeting them can have a secondary effect on other groups.

The market arena

With the 6-force model an analysis was made of the market situation. The main issue was to identify the different stakeholders and their possible role in the project. From the start it was identified that the role of the council was difficult. They are the initiator of the project, but are not a supplier. Furthermore, the council in other roles

are also important stakeholders in the neighbourhood. Especially for the inhabitants the council is not identified as different parties. The customers can be identified in different groups. As stated before three target groups were identified: new owners, people interested in “vergroot je woning” and families with children. Three discussion evenings were organised with members of each target group. From the discussions several conclusions could be made:

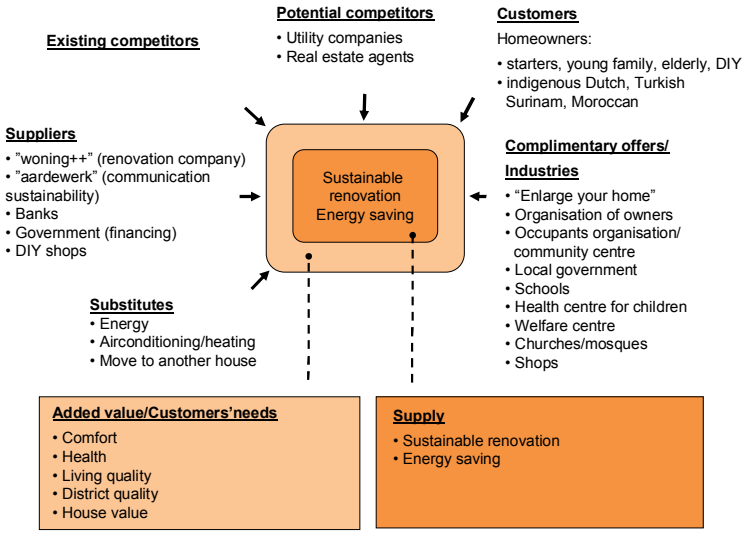
- Many people have invested in improving their homes but for most of them energy-issues have not been very important. Comfort issues have been the main reason for energy-saving measures.
- There were little differences between motivations of different target groups to improve their homes. Only on health issues did families with children show slightly more concern.
- There is uncertainty about where the area is going and what the council is planning.
- The council is seen as an unreliable force in the market that often promises more that it can deliver.
- More cooperation between people in the neighbourhood could have a positive effect on renovation. The council could organise/facilitate such cooperation.

Potential competitors could play an important role in the project. Therefore early on these groups were analyzed. There are two main (groups of) potential competitors, real estate agents and utility companies.

- Real estate agents
  interviews were held with the important real estate agents in the area. The main conclusions are:
  - Some improvements are done (almost) standard when a house is bought.
  - Financing is the main obstacle for most people in the area.
  - The council does not have a good policy. It is unclear what they want and what they (intend to) do.
- Utility companies
  A meeting was held with a representative of the main utility company in the area. They were willing to cooperate, but it was difficult to do something concrete in a project on this (small) scale.

Within the supplementary industries, many indications showed that cooperation with different actors is possible. Promising school projects were identified that can be used in the area.

Figure: 6-force model (Grove)



5. Summarized SWOT-analysis

Based on the analyses presented above and others a SWOT-analysis was presented.

Strengths
- availability of "shop" in area
- extensive network through council / Pressure can be applied on organisation through council
- lot of knowledge about the neighbourhood
- lower exploitation costs
- better comfort
- better health
- houses increase in value

Weaknesses
- council is bureaucratic and slow
- is council trusted?
- different aspects need to be covered
- organising different parties
- makes a mess
- expensive (in relation to income)
- initial costs

Opportunities
- high mutation rate; 20% (threat?)
- 10% of lived-here-all-their-life in area
- 30% family with children
- increasing energy prices
- increasing energy awareness
- subsidy programme announced (threat?)
- energy labelling of housing
- possible partners
- home-extension programme
- utility companies
- schools
- health / welfare centre
    - organisation of sustainable renovation won prize recently → now commercially organised
- green mortgages available

Threats
- low-income target group
- energy awareness relatively small
- most houses in a small
- organisation of owners, making decision making difficult (probably not a threat)
- (bad) DIY

3. Goal

The overall vision of The Hague:
- zero CO2-emissions in 2050
- improve the area of Rustenburg-Oostbroek

For the pilot project the goals were:
- within two years have at least one energy saving measure in 100 houses and two measures in another 100 houses
- learn from this pilot project how to achieve better results

4. Strategies

After the analysis a marketing plan was made for the promotion of sustainable renovation in the area. The main steps in the strategy are:

1. Project has to be organised by a small organisation in the neighbourhood. The council itself is not able to successfully adapt to changes in the market situation. Furthermore, council is not perceived positively by many stakeholders.
2. The organisation should target the different stakeholders directly and concrete. Social networks should be used as a marketing tool.
3. The knowledge and workmanship within the area about DIY should be utilised. Knowledge about energy-issues has to be improved within these groups.

4. A technical solution has to be made for the insulation of the rooftops. Here also the possibilities of subsidies should be explored, because of difficulty in ownership.
5. For financing of renovation projects a revolving fund should be set up, to lower the financial threshold.

6. The actions taken

The city of the Hague recognizes that the issue of renovation cannot be done “on the side”. The have initiated a project organization with the specific goal to realize energy-renovation in existing buildings. The project organization is to be funded from resources made available to combat the economic crisis.

The project in Rustenburg-Oostbroek has been put on hold.

7. Results and lessons learned

A large scale project to market renovation to owner-occupants has to be run by a dedicated organisation.

The project itself yielded several potentially successful strategies. However, so far they have not been put in action. Therefore it is not possible to conclude whether or not they are successful.

Author Edward Prendergast
moBius consult
www.moBiusconsult.nl

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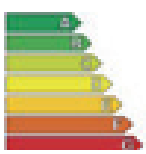
Myhrerenga Housing Cooperative – renovation project

Introduction

This is a report of the decision making process for a high ambition renovation project, which started construction in February 2010.

Myhrerenga Housing Cooperative is located in Skedsmo, 15 km north of Oslo. The cooperative owns 7 identical 3 storey high blocks with 168 flats and unheated cellar. The Housing Cooperative consists of 1-bedrooms (55 m²) and 2-bedrooms (68m²) apartments. The buildings were built in 1968-1970

The Norwegian research institute Sintef Byggforsk concluded after an examination of the building that energy-efficiency rating corresponded to an “f” in the new energy labelling system.



Sintef Byggforsk summarized the technical issues as these:

- Monotone and weary façades
- Windows in bad condition (some are rotten)
- Complaints about poor indoor climate, draft problems and cold floors
- Extremely high energy consumption; 275-300 kWh/m² per year ”overall" energy consumption. Few years earlier it was as high as 400 kWh/m² but had been reduced by several measures (see point 2. Analysis – Key actors).
- The residents want larger balconies
- Moisture problems with existing balconies

The housing cooperative has an administration and service agreement with USBL which is a housing cooperative company in Oslo.

USBL is managing approx 26.500 homes owned by 566 housing co-operatives.

It requires a 2/3 majority at the General Assembly of the respective housing co-operative to decide upon a renovation project.

USBL was invited to participate in the EKSBO Project, which is a sub project to the Norwegian participation in IEA SHC Task 37.

The technical director in USBL launched the idea of an advanced renovation project to the board of Myhrerenga Housing Cooperative. In USBL there was an internal scepticism regarding the feasibility of convincing a big housing cooperative to go for a high ambition renovation project.

The main steps in the process were:

- The housing cooperative had been talking about the façades for long time.
- 2007: offer for renovating the façades
- Fall 2007: 3 options were presented for the occupants
- Waited 1 year for specified suggestions and calculations.
- Several work meetings
- Distribution of the final proposal to occupants
- 29th of January 2009: General Assembly
- Conclusion: Mandate to board 63,4 mill NOK (approx. EUR 8 mill) +/-15% The decision implies an ambition close to the Passive House standard.

1. Information gathering

The obvious need for renovation of the façades of the buildings initiated an internal process in the housing cooperative to find good renovation solutions. In this work they were assisted by the technical department at USBL.

The Norwegian Housing Bank contacted USBL in order to find potential high ambition demonstration projects. This idea was presented to the board of Myhrerenga Housing Cooperative.

2. Analysis

Important factors which indirectly influence this market (PEST-Analysis):

Political factors

- Norwegian authorities are encouraging sustainable solutions – also incentives
- Media focuses more on how to increase supply of more energy rather than on saving

Economical factors

- General strong purchase power
- Relatively low energy prices
- From overheated Norwegian economy to international financial crisis, which could change from “sellers” market to “buyers market”

Social factors

- The residents were a mixture of young and mature persons:
  - Starters; 20-30 years
  - Divorced, older singles; 50-70 years

Technological factors

- Still little knowledge about sustainable solutions
- Sintef Byggforsk is the main actor with competence in this field

- New building code to be implemented only for new houses
- Few existing examples of advanced renovation.

The key actors

1. The board of Myhrerenga

The board was well respected among the inhabitants in the cooperative. During the last years it was decided and implemented several cost savings measures. To be mentioned:

- Trading on utility services
- Closed down fridge room in the basement
- Closed down washing room
- Measurement system

The chairman and a second person in the board possessed both technical and organising skills.

2. The residents

The people living in the housing cooperative may be seen as the customers of the board. The people living in Myhrerenga are either “starters” with no kids or “mature” single people. The majority has not lived there for a long time.

Their basic need is a warm cosy home for a reasonable price, and the board’s job is to handle all types of issues in a housing cooperative.

As each resident owns their share in the cooperative they also have an interest in increasing the value of the buildings, and in this particular case to reduce energy costs. Some also pay attention to non energy benefits, such as better indoor climate and comfort.

3. Key suppliers

USBL is the main supplier of services to the Myhrerenga Housing Cooperative. It is long term relationship, and includes mainly management services and

planning of maintenance. In this project the technical department was involved in the analysis of the buildings (part of the maintenance planning) and project management.

Sintef Byggforsk was hired to the project as the specialist regarding good renovation measures to achieve a high energy efficiency performance.

Sintef Byggforsk had experience from a decision making process in a housing cooperative in Lillehammer, which concluded not to go for an advanced renovation solution. This gave important knowledge about possible pitfalls in how to communicate the message.

The Norwegian Housing Bank and Enova (Norwegian Energy Efficiency Body) contributed with a beneficial financing package. The Norwegian Housing Bank also played a role as an informer at the start of the decision making process in the housing cooperative.

Arkitektskap AS was chosen as designers of the buildings and the outdoor area.

Summarised SWOT-analysis

Based on the analysis presented above in addition to other relevant analysis, we can summarise the initial status into a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) seen from Myhrerenga Housing Cooperative:

Strengths

- The rent had been increased more than necessary according to existing payment obligations. As a consequence the cooperative had built some equity for new investments.

- A high proportion of occupants had lived there for a shorter time, and had therefore other references for quality of dwellings.
- An active and impatient board, with sufficient knowledge to understand the benefits of advanced renovation.
- The board had a good standing among the residents, due to earlier implemented cost savings measures.

Weaknesses

- Buildings in a very poor condition (in respect to the renovation project this could also be seen as a ”Strength”).
- The two board members who were the key actors had moved out before the decision of renovation was to be made.

Opportunities

- As this would be the first pilot of advanced renovation of multi storey dwellings in Norway, extensive financial incentives from authorities could be expected.
- Also special financial terms from important building systems and components suppliers could be expected.
- Significant energy saving potential could result in reduced energy costs.
- Significant improvement in quality of indoor climate, comfort and temperature. It would also eliminate existing draught and moisture problems. It would upgrade the quality of the buildings above the new building code.
- Increased living space and balconies.
- Increased aesthetics
- Increase attractiveness and value of flats
- Increased interest in media for sustainable solutions, such as “house of future”

Threats

- Renovation costs could be too high
- Based on experiences from planned similar project in Lillehammer, the decision making process with the requirement of 2/3 majority could stop the project.
- Relatively low energy prices

3. Goal

For the pilot project at Myhrerenga the goals were:

- To realise a renovation project towards the Passive House standard.
- Through reduced energy costs, grants and sound financing the rent should not be higher than by a traditional renovation.

4. Strategies

These strategic choices were made for the launching of the idea to go for advanced renovation project at Myhrerenga:

1. The two board members, who initially played a very important role, remained as board members until the decision was made although they had moved out from their apartments in the cooperative.
2. An integrated decision making process with strong involvement of the residents.

3. Building credibility by using the best technical expertise in Norway.
4. Design of a very good financing of the project.
5. Communicate the message that the net cost per month should not be higher than by traditional renovation. It was presented only two options; advanced renovation and ordinary façade renovation.

Both types of renovation will also lead to tax deductions, which are not included in the figures above. Before renovation the rent was:

2-bedrooms NOK 3200,-(EUR 400,- /m)

1-bedrooms NOK 2700,-(EUR 340,- /m)

The board estimated that the renovation would increase the value of a 2 bed-rooms flat from NOK 1,4 mill to NOK 2 mill.

5. Results and lessons learned

Results

In January 29th 2010, the General Assembly decided to give a mandate to the board to realise the project within a frame of 63,4 mill NOK (approx. EUR 8 mill) +/- 15 %.

The total construction cost including supervision, enlargement of balconies and drainage work is now estimated to NOK 74,5 million. In February 2010 the construction started.

The calculated net rent compared with a traditional façade renovation is as follows (source: Sintef Byggforsk):

(NOK)	1-bedrooms	2-bedrooms
Trad. Ren.	3.510	4.390
Adv. Ren.	3.190	3.990

The reason why the rent is estimated to be lower for the advanced alternative than a traditional façade renovation is due to:

- Grant from Enova: NOK 6,4 mill
- Lower rent from Norwegian Housing Bank (4,7%) compared with ordinary bank (5,7).
- Reduced energy costs (based on energy price 0,1 Euro/kWh)

Lessons learned

- As the majority of the residents had not lived in the apartments for a very long time, they "knew" what to expect from a good apartment. In other words they were not used to and would not accept to live in such poor buildings.
- Due to the rent policy the cooperative had saved some own funding for the project, and had established a rent level which made the additional increase less dramatic (approx. 20%).
- The board as a team:
  - "We are very complimentary"
  - "We challenge each other"
- Smart moves:
  - Chairman of the board is not directly involved
  - Always presentation for the board and challenging questions
  - Always positive atmosphere at the resident meetings
  - Make alliances with the critical persons
  - Presented only two options to choose between.

- Mr. Tor Helge Dokka from Sintef Byggforsk gave the idea credibility. He had in depth knowledge about the technical challenges, while at same time he communicated and acted in a manner enabling ordinary people to easily understanding his message.

In summary the main reason for the positive decision, was that it did not imply higher rent than they would have had to pay for an urgent needing façade renovation.

Author

Trond Haavik, Segel AS,

Pb 284, 6771 Nordfjordeid, Norway

www.segel.no

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Tor Helge Dokka, Sintef Byggforsk; and Michael Klinski; The first apartment house renovation with Passive House components in Norway, Paper to the Passive House Conference in Dresden May, 2010.

The information in this document is gathered through interviews of:

- The board of Myhrerenga Borettslag
- Key technical persons at USBL
- Key persons at Sintef Byggforsk

Hammerseng Housing Cooperative – renovation project

Introduction

Hammerseng Housing Cooperative is located in Lillehammer, Norway. The cooperative owns 2 buildings with 32 terraced flats.

The Norwegian research institute Sintef concluded after an examination of the building that energy-efficiency rating corresponded to an "f" in the new energy labeling system. The occupants felt these issues:

- Draft from windows, doors, walls
- Cold winters and warm Summers
- The façade is ugly
- The terrace floor needs to be renovated

The housing cooperative has an administration and service agreement with LOBB, which is the housing cooperative company in Lillehammer. LOBB has the management contracts for approximately 2400 homes owned by 99 housing co-operatives.

It requires a 2/3 majority at the General Assembly of the respective housing co-operative to decide to go for a renovation project.

LOBB was invited to participate in the EKSBO Project, which is a sub project to the Norwegian participation in IEA SHC Task 37. The technical department considered which of the housing cooperatives had highest energy efficiency saving potential, and concluded to offer the board of Hammerseng Housing Cooperative to be a pilot for advanced renovation. For LOBB this was seen as part of their overall strategy in increased focus on sustainable renovation in their building portfolio.
The former Managing director of LOBB was informed about the EKSBO project through his personal contacts in the Norwegian State Housing Bank. The director

introduced the idea of participating in the EKSBO project to his technical department, which consists of two persons. Both became positive to the idea, and their interest grew as they increased their knowledge in the subject through participation at study trips and conferences.

When the former director resigned, and a new started, they continued to develop the idea, integrated as part of the overall strategy for LOBB.

The main steps in the process were:

- 25.10.06: LOBB inspection of buildings together with the board in Hammerseng
- Autumn 2006: LOBB considered which housing cooperatives to be targeted
- 18.01.07: Invitation to be a pilot as part of IEA
- 3.02.07: The board of Hammerseng accepted the invitation
- 30.3.07: Evaluation and a renovation plan – Step 1 (subsidized)
- 22.05.07: The General Assembly decided to merge renovation plans for 2008 and 2009 and to include façade, roof, windows and doors
- June 2007: Personal interviews of the owners
- October 2007: Contract signed between LOBB and the board of Hammerseng to execute evaluation and develop alternative renovation solutions by the technical research institute Sintef.
- 15.11.07: Presentation for the board by LOBB, Segel, Housing Bank and Sintef
- 5.12.07: Information meeting for the owners by LOBB, Housing Bank and Sintef
- 21.2.08: General Assembly decided to go for “light” renovation project.

In addition to this, LOBB worked with their strategies on a general level:

- 13.11.07: Internal strategy workshop in LOBB (analysis and ambition level)
- 28.3.08: Internal Strategy workshop, focused on learning from Hammerseng and definition of strategies for the business area “Renovation”.

1. Information gathering

LOBB as initiator of this specific project made mainly these types of information gathering:

- Maintenance reports for each of the housing cooperatives.
- Know how from the EKSBO Project about technical issues and decision making processes (including participation at the Passive house conference in Bregenz).
- Knowledge among employees in LOBB about the occupants in many of the housing cooperatives.
- When the pilot was chosen, The Norwegian State Housing Bank and a student from the Norwegian Technical University visited and interviewed most of the inhabitants.
- Information about income level among occupants was gathered from public sites on the internet.

2. Analysis

Important factors which indirectly influence LOBB’s market (PEST-Analysis):

Political factors

- Norwegian authorities are encouraging sustainable solutions – also incentives
- Environmental plan for the municipality

- Media focuses more on how to increase supply of more energy rather than on saving

Economical factors

- General strong purchase power
- Relatively low energy prices
- Overheated Norwegian economy
- High pressure in the building market
- Media focuses on how to recruit and integrate immigrants to the market

Social factors

- Net fortune medium +
- High education level
- Age 60+
- No kids
- Media focuses on how to cope with the elderly wave

Technological factors

- Lack of competence about sustainable solutions
- Research mainly by Sintef
- Increased focus by tech. Universities.
- New building code to be implemented only for new houses
- Some media focus on"future homes".
- Few existing examples

Market segmentation

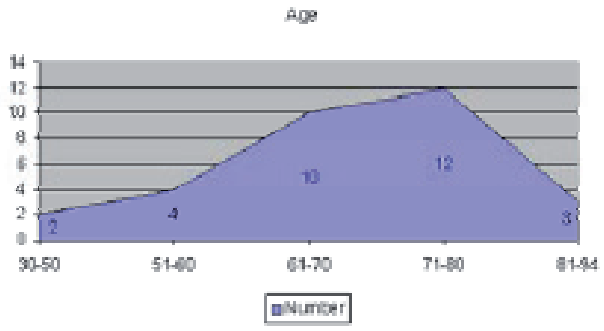
Before the Hammerseng Housing Cooperation was elected as pilot, LOBB segmented the market mainly by the technical condition of the buildings.

Housing cooperatives established in the seventies and earlier, and which were lagging behind with their maintenance were considered as most likely to be interested in high ambition renovation.

They considered persons with higher education to be more interested due to better financial situation as well as concern for the environment. However, they did not have detailed information about the persons' background so they could only define this from their impression which was founded on their local insight.

As Hammerseng was chosen as the pilot, most of the occupants were interviewed (in person on site) by the Norwegian State Housing Bank and a student from the Norwegian Technical University. Among other information, they found that most had higher education. Several were retired teachers. The households were constituted by 1 or 2 persons without children.

The distribution of age was like this:



The initial hypothesis was that this group should have an income which is above average (i.e. financially good situation).

After checking the financial facts among the occupants (which is public information in Norway), it was stated that:

- 9 of the 22 voting households had two incomes.
- The vast majority of the owners had incomes which were lower than the Norwegian average. In fact, some had rather low income.

The market arena

Through the 6-forces model, LOBB discussed what they tried to offer in respect to the customers' real needs. The model

illustrates which forces they have to manoeuvre together with (and some against) in order to design solutions which fulfil the needs of the customers.

The core business of LOBB is to serve housing cooperatives in the region of Lillehammer with management services and technical consulting and planning regarding buildings and outdoor areas. As part of their participation in the EKSBO project they increased the focus on sustainability in renovation projects.
The motivation of the customers (which drives them) is what they feel as their "pains".The interactive process between LOBB and their customers are directly influenced by the other actors (i.e. forces) on the arena. Foremost, the supplier-side through the EKSBO project is actively motivating both LOBB and the customers to aim for high ambition level.

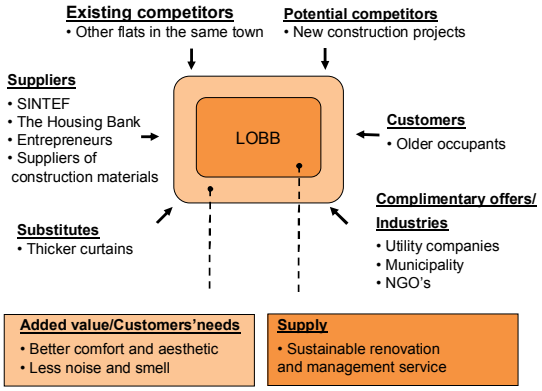


Figure: 6-force model (Grove).

The competitor-side in this case plays as a driver as it reminds about the options; either to move to a better existing flat or to join a new project. The challenging question for each occupant is therefore, if he wants the existing flat should be updated and competitive to modern flats, or to remain cheap and simple. If more than 1/3 choose the latter options, it is likely that some of the other will move over to more attractive flats.

In the Hammerseng Housing Cooperation several of the occupants did several individual means to cope with the bad insulation, such as using thicker curtains during the cold winter, and by lowering the temperature in some of the rooms. As a consequence, their energy bill was not too scary for them.
In this case, complimentary actors did not play an important role. The municipality of Lillehammer was considered to have common interest with LOBB, as the project included many older persons who could probably extend the time before they had to move into elderly homes.

Technical analysis
The 2 blocks of flats belonging to Hammerseng Housing Cooperation were built in 1971/72. In 1995 it was made additional 5 cm insulation in the end wall. In the early 80's it was added 5-6 cm insulation in the roof. The current condition is somewhat "worn" and renovation of the facade is anyway needed.
Energy consumption before renovation:

- Calculated: 267 kWh/m2
- Real: ~ 125 kWh/m2 (due to low indoor temp and individual saving measures). In addition to heating by wood stoves

Sintef's classified the building as category F in the new energy labelling system (A-G, where A is best).
The occupants felt these issues:

- Draft from windows, doors, walls
- Cold winters and warm summers
- The façade is ugly
- The terrace floor needs renovation

Based on this, such options for ambitions were presented for renovation:

- Ordinary: level E (current F)
  - New rent: NOK 4.932
- Medium: level C (as new build. code)
  - New rent: NOK 6.030
- High: level B
  - New rent: NOK 6.348

Current rent per month for a 97 m2 flat is NOK 2.643,-

Summarised SWOT-analysis
Based on the analyses presented above and some others, LOBB summarised their current strategic position:

Strengths
- Financially strong
- Well experienced with project management
- Broad professional skills
- Participation in Eksbo (network with interested suppliers)
- Good knowledge about the occupants as well as about the buildings
- In depth knowledge about decision making processes in housing cooperatives
- Good reputation

Weaknesses
- Limited experience with sustainable renovation projects.
- LOBB failed in launching a passive house project for new houses, and serves as a bad reference.
- Scarce capacity in following up development projects.
- Lack of QA-system

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Opportunities
- Financial incentives from authorities
- General strong economy
- Cooperation with the municipality
- Work through the boards in the housing cooperatives to
- By creating the first success, it will be easier to get new started
- Focus on reduced energy costs (in general) and improved quality
- Increase attractiveness and value of flats
- New building code (for new buildings)
- Increased access to knowledge about sustainable solutions
- Increased interest in media for sustainable solutions, such as “house of future”
- Better aesthetic
- Less moisture and draught
- Better indoor temperature

Threats
- Limited willingness to pay higher rent (rent was very low)
- Competition from new projects
- Unpredictable decision making process
- Focus on simplification may result in minimum solutions
- Relatively low energy prices
- High pressure in the construction business

3. Goal

LOBB’s overall vision is to:

“Improve the everyday for our members”

Regarding the existing building stock;
- LOBB has ambitions to improve the quality of older buildings to the level of new buildings.
- LOBB will have at minimum 2 such renovation projects ongoing.

For the pilot project at Hammerseng the goals were:
- To convince the general assembly to at least go for the medium ambition level.
- To accomplish a successful renovation project.

4. Strategies

LOBB’s strategies for the renovation business:

1. Develop, accomplish and communicate good pilots in retrofitting.
2. Development of competence and training within LOBB through use actively use of networks.

3. Good decision making processes for the housing cooperatives.

For the pilot at Hammerseng these strategic choices were made:

1. Tailor-made proposals adjusted to the occupants desires. Three options were designed and presented.
2. The extra cost of planning (related to the ordinary option) was funded by the Norwegian Housing Bank. The additional cost of insulation, etc for the ambitious option was partly sponsored by suppliers.
3. An integrated decision making process with strong involvement of the occupants – but through the board of the housing cooperative.
4. Build credibility by use of the best technical expertise in Norway.
5. Use the positive image of being an international pilot to create pride among the occupants.

5. The actions taken

These actions were taken in order to realize the strategies:

1. The two technical key persons increased their knowledge in the subject by participating in EKSBO, excursions and conferences.
2. Workshop together with the board of Hammerseng where facts about technical solutions were presented by Sintef, and Segel presented challenges in similar decision making processes.
3. Information meeting for the occupants.
4. A student from the Norwegian Technical University and a representative (sociologist) from the Norwegian State Housing Bank interviewed the occupants, focusing on their needs and wishes.
5. The final proposals (three options) were designed as a result of technical analysis and the interviews of the occupants. These were presented for decision at the general assembly.

6. Results and lessons learned

Only 5 of 22 voted yes for an ambitious renovation.

17 voted for a smaller renovation project (maintenance plan for two next years).

Distribution of the votes:

- 4 of those voted yes had highest income
- The fifth had an medium+ income
- None of the occupants with the lowest income were positive.
- Age does not seem to differ their attitudes
- Only one of the single family households was positive
- Two of four board members voted against.

Lessons learned

- Financial situation is the most important barrier for this segment.
- As older people they had lived modest without high comfort.
- Due to low energy consumption, the energy savings would not be substantial. The sales arguments left were comfort and nicer look.
- A very high percentage increase of the rent “terrified” the occupants. Some of the wealthier persons sympathised with the poorer.
- An indication that couples are more positive than singles.
- Segmentation criteria:
  - Building: High potential for energy efficiency
  - Persons: Late majority/Laggards

- Situation:
  - Lived in the same flats for long time, therefore not that eager to renovate as newcomers.
  - However; should be a "time-window" for renovation due to the ugly façade.
- The process:
  - The board members did not agree about ambition level.
  - The chairman was very positive, but was not too communicative (in the two meetings he had hired an other person (external) to lead them).
  - The two positive board members were not representative for the majority of the owners.
  - All occupants expressed that the information presented by LOBB and Sintef were extensive and good.

Lessons learned seen by the key persons at LOBB

- Payback time should not be used as the convincing argument
- Important to analyse the real energy consumption today instead of estimated " normal consumption" based on average national figures. As these occupants consumed far less than normal due to individual measures (example lowering temperature), they did not find the theoretical energy (cost) savings to be realistic.
- Communication is perhaps the biggest challenge, as it is needed 2/3 majority for a positive decision. All actors must be convincing in their arguing for a high ambition level. This includes LOBB's own key persons, all board members as well as external experts. We could all have been more enthusiastic, including more involvement from other parts of LOBB's organisation. It is easier to communicate pure aesthetic issues than functions.
- The amount of subsidies from ENOVA and The Norwegian State Housing Bank to the project was vague. Subsidies could have been used as a sales argument if they were more specific.
- LOBB's organization has learned a lot about passive means in renovation of existing buildings as well as decision making processes. This knowledge is now used in planning of new retrofitting projects in accordance with LOBBs overall strategy, which is still valid.

Author

Trond Haavik, Segel AS,

Pb 284, 6771 Nordfjordeid, Norway

www.segel.no

References

Trine Dyrstad Pettersen, Sintef Byggforsk; Energiøkonomisk analyse av mulige tiltakspakker i forbindelse med rehabilitering av Hammerseng borettslag (Energy efficiency analysis of possible renovation packages for Hammerseng Cooperative, 2007.

More info about LOBB:

http://www.lobb.no/

Appendix B:
IEA Solar Heating and Cooling Programme

IEA Solar Heating and Cooling Programme

The *International Energy Agency* (IEA) is an autonomous body within the framework of the Organization for Economic Co-operation and Development (OECD) based in Paris. Established in 1974 after the first "oil shock," the IEA is committed to carrying out a comprehensive program of energy cooperation among its members and the Commission of the European Communities.

The IEA provides a legal framework, through IEA Implementing Agreements such as the *Solar Heating and Cooling Agreement*, for international collaboration in energy technology research and development (R&D) and deployment. This IEA experience has proved that such collaboration contributes significantly to faster technological progress, while reducing costs; to eliminating technological risks and duplication of efforts; and to creating numerous other benefits, such as swifter expansion of the knowledge base and easier harmonization of standards.

The *Solar Heating and Cooling Programme* was one of the first IEA Implementing Agreements to be established. Since 1977, its members have been collaborating to advance active solar and passive solar and their application in buildings and other areas, such as agriculture and industry. Current members are:

Australia	Finland	Portugal
Austria	France	Spain
Belgium	Italy	Sweden
Canada	Mexico	Switzerland
Denmark	Netherlands	United States
European Commission	New Zealand	
Germany	Norway	

A total of 44 Tasks have been initiated, 33 of which have been completed. Each Task is managed by an Operating Agent from one of the participating countries. Overall control of the program rests with an Executive Committee comprised of one representative from each contracting party to the Implementing Agreement. In addition to the Task work, a number of special activities—Memorandum of Understanding with solar thermal trade organizations, statistics collection and analysis, conferences and workshops—have been undertaken.

To find Solar Heating and Cooling Programme publications and learn more about the Programme visit www.iea-shc.org or contact the SHC Secretariat, Pamela Murphy, e-mail: pmurphy@kmgrp.net.

April 2010

Current Tasks & Working Group:

Task 36	*Solar Resource Knowledge Management*
Task 37	*Advanced Housing Renovation with Solar & Conservation*
Task 38	*Solar Thermal Cooling and Air Conditioning*
Task 39	*Polymeric Materials for Solar Thermal Applications*
Task 40	*Towards Net Zero Energy Solar Buildings*
Task 41	*Solar Energy and Architecture*
Task 42	*Compact Thermal Energy Storage*
Task 43	*Rating and Certification Procedures*
Task 44	*Solar and Heat Pump Systems*

Completed Tasks:

Task 1	*Investigation of the Performance of Solar Heating and Cooling Systems*
Task 2	*Coordination of Solar Heating and Cooling R&D*
Task 3	*Performance Testing of Solar Collectors*
Task 4	*Development of an Insolation Handbook and Instrument Package*
Task 5	*Use of Existing Meteorological Information for Solar Energy Application*
Task 6	*Performance of Solar Systems Using Evacuated Collectors*
Task 7	*Central Solar Heating Plants with Seasonal Storage*
Task 8	*Passive and Hybrid Solar Low Energy Buildings*
Task 9	*Solar Radiation and Pyranometry Studies*
Task 10	*Solar Materials R&D*
Task 11	*Passive and Hybrid Solar Commercial Buildings*
Task 12	*Building Energy Analysis and Design Tools for Solar Applications*
Task 13	*Advanced Solar Low Energy Buildings*
Task 14	*Advanced Active Solar Energy Systems*
Task 16	*Photovoltaics in Buildings*
Task 17	*Measuring and Modeling Spectral Radiation*
Task 18	*Advanced Glazing and Associated Materials for Solar and Building Applications*
Task 19	*Solar Air Systems*
Task 20	*Solar Energy in Building Renovation*
Task 21	*Daylight in Buildings*
Task 22	*Building Energy Analysis Tools*
Task 23	*Optimization of Solar Energy Use in Large Buildings*
Task 24	*Solar Procurement*
Task 25	*Solar Assisted Air Conditioning of Buildings*
Task 26	*Solar Combisystems*
Task 27	*Performance of Solar Facade Components*
Task 28	*Solar Sustainable Housing*
Task 29	*Solar Crop Drying*
Task 31	*Daylighting Buildings in the 21st Century*
Task 32	*Advanced Storage Concepts for Solar and Low Energy Buildings*
Task 33	*Solar Heat for Industrial Processes*
Task 34	*Testing and Validation of Building Energy Simulation Tools*
Task 35	*PV/Thermal Solar Systems*

Completed Working Groups:

CSHPSS, ISOLDE, Materials in Solar Thermal Collectors, Evaluation of Task 13 Houses, and Daylight Research

April 2010

This handbook is produced from material developed in the course of IEA SHC Task 37 Advanced Housing Renovation by Solar and Conservation. This venture brought together some 50 experts from 12 countries.
The operating agent was Fritjof Salvesen from Norway.

The objectives of this task was:

To develop a solid knowledge base how to renovate housing to a very high energy standard while providing superior comfort and sustainability
To develop strategies which support market penetration of such renovations explicitly directed towards market segments with high renovation and multipliable potentials.

For more information:
http://www.iea-shc.org/task37

Skipnes Kommunikasjon