ERA-NET Eracobuild project

One Stop Shop - "From demonstration projects towards volume market: innovations for one stop shop in sustainable renovation"

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Project Report WP 3 – Implementation Phase

Innovation in Supply Side Collaboration

Renovation Actor Categories in Partner Countries

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1. Introduction

The overall aim of the "One Stop Shop" project was to facilitate market uptake (volume market) of whole house renovations for single-family houses to very high energy standard while providing superior comfort and sustainability to occupants. Throughout the different studies within the project, the innovation adoption process of the homeowner was defined in different steps: **Information > Persuasion > Decision > Implementation > Confirmation**.

First the homeowner needs to have the knowledge that an energy renovation is a possibility. This information need concerns both the understanding how energy efficient measures may be included in renovations initiated as well as a response to other needs than energy savings. The homeowner needs to be informed using easily recognizable building typologies and innovative technology solutions that reflect the own situation, and by showing experiences from other customers. At this stage of the innovation adoption decision process, **informing actors** play an important role.

Secondly, they need to be persuaded to engage in an integrated energy renovation, taking into account their own concerns for improvement and available budget. Regarding the amount of investment, the prospect of a quality guarantee is needed. They might be referred to **persuading actors** (for example consultants) at this stage.

Then, they need to be able to detect and select **responsible actors** that have shown experience in integrated energy renovation. One responsible contracted actor is needed who the homeowner can consult for every issue. At this stage, project references are important. The responsible actor manages the project and the work of the **implementing actors**. It is important that all solutions are carried out by craftsmen, who are professionals and aware of potential errors and where to be extra careful, when it comes to integrated energy renovation. If the execution of the energy savings and the innovations is poorly done, neither the technical quality nor the energy performance can be assured.

Finally, the homeowner should be referred to **quality assuring actors**. In order to verify whether the result is as expected, the actual effect of the energy savings and the quality of execution should be independently valued. If there is no follow up on the renovation, the negative appreciation will be spread and flaws will not be corrected. If the appreciation by the quality assessor is positive, *the project can be accepted as a reference for all actors involved, and can serve to provide new knowledge, thus closing the learning cycle*.

To realize whole-house renovations more effective supply chain collaboration is needed and collaboration between these different types of actors. Communication channels (such as those intended in the One Stop Shop) can influence each step of the decision-process. *Communication channels (the One Stop Shop) need to guide the homeowner from one actor category to the next*, from relevant actors in one decision phase to actors that are important in the next decision phase, so that the right information can be provided in each decision step.

To explore supply chain collaboration opportunities, most important actor categories were listed for each partner country and some opportunities for their entry in a One Stop Shop development were discussed. This report provides an overview per country which actors might be important for the adoption and diffusion of whole house renovations for single-family houses, in order to understand better how these actors can be related to each step in the client's innovation-decision process and to the idea of the One Stop Shop development.

2. Renovation actors in Belgium

2.1. Informing actors

The information about energy renovation in Belgium (Flanders) is or can be provided by many different actors. As examples can be mentioned:

- Federations like
  - Flemish Building Confederation (VCB) http://www.vcb.be/
  - Bouwunie http://www.bouwunie.be/
  - National Architect's Association (NAV) http://www.nav.be/
- Policy supporting actors like
  - Flemish Energy Agency (VEA) http://www.energiesparen.be/
  - Municipal energy advisers (e.g. RenovaS) http://www.renovas.be/
- Non-profit organizations like
  - Passive House Platform (PHP) http://www.passiefhuisplatform.be/
  - Association of Flemish Environmental Organizations (BBLV) http://www.ecobouwers.be/
- Research organizations like
  - Belgian Building Research Institute (BBRI) http://www.wtcb.be/
  - Flemish Institute for Technological Research (VITO) http://www.vito.be/
  - or specific projects like: Low Energy Housing Retrofit (LEHR) http://www.lehr.be/
- Energy distribution net managers like
  - Eandis http://www.eandis.be/
  - Luminus http://www.luminus.be/
- Manufacturers of products used in energy renovations like
  - Industry consortium Energy Renovation 2020 http://www.renovatie2020.be/
- Companies that offer renovation, planning or execution

Most of the information on integrated energy renovation is only available if the homeowner is actively looking for it and different information sources often prefer to address single renovation measures. A whole house approach to renovation is rarely addressed. The homeowners may or may not be informed about the benefits of an integrated energy renovation when they are planning a renovation. It all depends on which type of company or institute they contact in order to get further advice. The existing Flemish websites have much good information, but do not focus very much on integrated renovation (except the LEHR website), the idea of guiding homeowners during total energy renovations is currently not prominently visible on most sites.

Another way the awareness of the energy use of a house is raised is by the Flemish Energy Performance certificates introduced by VEA in implementation of the European Energy Performance of Buildings Directive. According to the law, a house has to have an Energy Performance Certificate when it is put on the market for sale or rent. Further, the Energy Performance Certificate includes suggestions for improvements to the building. However, these improvements are not often described as an integrated renovation that would bring the house up to today's standard, but more like separate suggestions that each client can follow to do some improvement to the house.

2.2. Persuading actors

Making some changes to the energy performance certificate for houses could be a good way to increase the persuasion to start an integrated energy renovation. However today, it is only information and suggestions on (most obvious) individual measures. There are on-going initiatives[1] if the role of **energy performance advisers** can be redefined using the energy label as a vehicle for motivating homeowners to implement renovation measures.

Financial advisers can be an important target group as well. One way the homeowners could be encouraged is by financial support by the government or banks. Income tax reduction was introduced in Belgium for – next to different individual energy saving measures – reaching an overall low energy performance. For example, substantial income tax reduction was introduced for reaching the passive house standard (also applicable to renovations). However, the new federal government decided from 2012 to delete all federal income tax reductions related to integrated approaches. One can speculate if new incentives will be implemented on the regional level. For the time being, there are subsidies in Flanders for insulation of walls (externally, internally and in the cavity), floor and roof insulation. However, due to the economic stagnation, it is not expected that Flanders will shortly introduce substantial new subsidies. In the Brussels Capital Region, the situation is completely different: there substantial grants have been introduced for low energy renovations, due to good experience with previous grant schemes.

One of the most important policy actions when it comes to energy renovation of single family houses in Flanders is the Energy Renovation 2020 programme, which aims to insulate all roofs, windows and kettles of existing houses by 2020. Although many financial measures relate to the individual measures in this programme, the programme is not expected to lead to integrated renovations achieving very high energy efficiency. In Flanders, it can therefore not be expected that financial support by the regional government will steer the market towards integrated renovation. Solutions to persuade owner-occupiers to do integrated renovations therefore have to be found and developed in the private and/or non-profit sector. However, due to elimination of income tax reduction for low energy performance, also banks decided to delete available green loan schemes for energy renovation.

Institutes like **VEA** engaged in delivering a long-term (2020) roadmap made an inventory of all integrated energy renovations. Certainly VEA could play an important facilitating role. Also, some individual **municipalities** have signed the European Covenant of Majors agreement[2] and could play a facilitating role. Some municipalities also introduced and maintained grants for passive houses. Recently, a **provincial network of sustainable building consultants** was established. In each Flemish province a reference centre can now be contacted for guiding homeowners. The employees in these centres have the task to guide homeowners in their quest for sustainable solutions. The provincial advisors are supported by specific knowledge centres, such as PHP and VIBE (the Flemish Institute for Bio-Ecological Building). Currently **Passiefhuis-Platform vzw (PHP)** is mostly active when it comes to supporting an integrated perspective for energy renovation, while VIBE is more engaged in promoting healthy and bio-ecological construction. PHP is an independent non-profit organization, created in 2002 with the specific purpose of spreading knowledge about highly energy-efficient buildings. The organization is financed through European, national and regional projects, own activities like events, training and certification, and membership fees of mainly

[1] Like the IEE-REQUEST project (http://www.building-request.eu/)
[2] See: http://www.eumayors.eu for an overview

companies[3]. PHP is actively involved in documenting and spreading information about research projects about energy renovations (federal: Low Energy Housing Retrofit, regional: VEA inventory of low energy buildings). PHP is also an actor responsible for certification of passive houses (also renovations), certificates with which homeowners could until now obtain federal income tax reduction. The certification checks the building design and evaluates the building airtightness by means of a blower door test report. This certification activity is expected to continue – maybe in an adapted format – since member companies ask for an approval of achievement and tools for achieving quality assurance.

Further, **energy distribution net managers** – due to their legal obligation to promote rational energy use – will continue to promote overall low energy performance levels with small grants for insulation improvement of roofs, walls, floors and windows, heat pumps, condensation kettles and solar boilers. However, an integrated grant according to overall energy performance level was not yet introduced like for new built constructions. Energy distribution net managers further offer free energy scans for homeowners and have built up a good relationship with the '**energy cutters**' (www.energiesnoeiers.net), a pool of low educated long-term unemployed people who were trained to execute small energy saving measures by means of social economy.

Some municipalities developed local energy action plans and tried to establish neighbourhood contracts to improve districts in a holistic way. Some communities, for example Antwerpen and Schaarbeek, have set up **specific reference centres** or contact points where people are guided free-of-charge in their renovation project with architect's advice. Some even help low-income families with the administration for obtaining financial aid, like discounts for joint purchase, grants provided by energy distribution net managers, monument care grants or specific money for low-income groups. Also, collaboration with social rent offices for executing renovations of private houses was detected as a path worth exploring.

4.3. Responsible actors

Business-as-usual for a small renovation in Belgium means that the homeowner will rarely hire a holistic consultant, project manager or energy expert, but instead decide renovation measures on the advice of the craftsmen consulted to carry out the renovation. **The owner** is thus often responsible and at risk of receiving different advice, which can lead to confusion on whom to trust and on the quality of the advice received. Mostly, homeowners have to educate themselves in all relevant aspects of renovations and have to coordinate themselves all renovation works. This traditional method of renovation, involving multiple actors – usually unfamiliar with deep renovation - rarely leads to quality highly energy-efficient renovations. Individual measures do not lead to integrated renovation because the whole-house approach is not taken from the start into consideration[4]. Phased renovation combining several individual measures over time may be a valid approach combining the overall concept of house renovation and execution as time and financing allow.

In case of substantial renovations, the homeowner might hire an architect to help guide the process, and make the right choices. In fact, Belgian law states that for every renovation that requires a building permit,

[3] Status start 2012 is about 300 members, different actors; architects, engineering bureaus, producers, installers, etc. This is the strength of PHP to have such a pool of companies devoted to energy efficiency.

[4] Individual measures usually create frustration to the homeowner. They need to inform and educate themselves, decide, apply for subsidies, find contractors, take several offers for each measure. This makes the case for integrated renovation and leads to favoring of some homeowners of one responsible central person/ organization.

an architect has to be involved. Architects have also been detected – in the one-stop-shop questionnaire (see WP3.1 report) - as actors which craftsmen would like to collaborate with for highly energy-efficient renovations. However, architects are not often keen to do renovation projects, since – compared to new built construction – their financial benefit is often lower and the workload is often higher. The quality of the advice concerning integrated energy renovation will also depend on the focus of the architect. Some architects have a large knowledge within the area of energy renovation, others less so. The National Association of Architects developed a label '**Energy conscious architect**' (Energiebewuste Architect) which is supported by the Flemish Energy Agency. There is also a listing available of architects that followed a passive house course for architects, installed by PHP.

To increase the market of deep renovation, innovations in supply side are needed. Clustering of architects with preferential craftsmen might be an obvious solution. However, different companies also showed interest to act as responsible coordinator for whole renovations, such as **project managers**, **general contractors** and **turnkey suppliers**. In the neighbouring Netherlands also **consortia of different suppliers** appeared on the market offering whole-house renovation using prefab components and even energy performance guarantee after renovation.

An interesting emerging market actor was detected in Belgium. There appear to be private parties that have sufficient capital to start their own chain of '**renovation shops**'. They believe that the increasing energy costs will drive owners anyway to renovate and they want to make it easier for clients to 'shop' renovation measures. For example, turnkey supplier Bostoen – mainly known for its offer of new built passive houses in Flanders – took the initiative in 2012 to install physical stores in different cities where clients can enter to buy renovation measures. So far, they have had good experience with integrated roof renovation (including renewable energy).

The involvement and/or rearrangement of actors for small energy renovations could lead to an important building process innovation, when responsibilities are shifted from small craftsmen to building teams or sole responsible actors which differ from architects. Compare, in traditional renovation, the client, the contractor and/or the architect can be responsible.

4.4. Implementing actors

In general, better supply chain collaboration of implementing actors could be organized in individual projects, involving experienced craftsmen. Ideally, a pool of **acknowledged craftsmen** would be needed, that can show expertise in integrated energy renovation and building team collaboration, for example by having followed a course on integral renovation or by demonstrating their involvement in reference projects. In this framework, there is a strong need to educate individual craftsmen with the specificities of deep renovation. A workshop organized by BBRI in the framework of One Stop Shop project also detected specific needs such as interaction of implementing actors with each other's activities to avoid energy conflicts and quality decrease. The Flemish contractor federation VCB acknowledges the need for specific training and plans are being made to develop a course for craftsmen. Another Flemish contractor federation (Bouwunie) already launched a course supporting the development of a pool of 'energy conscious contractors'. The contractors learn more about how the building should be constructed in order for the energy consumption to be as low as wanted/possible. The awareness of the important elements is the first step towards constructing it correctly.

There are a number of local initiatives with the purpose of improving the knowledge about sustainable construction among craftsmen. For example, in the Brussels Capital Region the **Cluster Eco-construction** has this goal and there is also the IEE project BUILD UP Skills - Belgium. In Flanders, appropriate education is currently limited, but it is acknowledged that such course can provide necessary knowledge and give new possibilities for branding the craftsmen as specialists in the area of energy renovations and increase their job options. In talks with municipal agencies, the need for a **public list** of experienced actors was confirmed, since it can be used to refer to in project calls. PHP intends to establish and publish a first list of contractors involved in exemplary renovation projects at the end of the One Stop Shop project. In november 2012, a course will be organized in collaboration with VCB and BBRI.

4.5. Quality assuring actors

Quality assurance is a key issue when one wants to convince owner-occupants to hand-out a whole renovation to a single responsible player. Especially for deep energy renovation, the homeowner needs to be sure that executing actors can be trusted. Key trust issues are cost guarantee, timing and effectively established energy performance of the project. Therefore, it is envisioned that **cost managers** and **energy performance verifiers** should play a role in integrated energy renovation. In the end, it is the project result that counts and **project certification** is detected to be an interesting option to distinguish good demonstration projects. In comparison, an actor certification scheme does not exist in Flanders and some barriers were detected regarding risks, insurances, liability and guarantees.

There are currently no demands in the Belgian building regulations stating that the actual quality of a building should be documented or verified, after a renovation has been carried out. In Flanders, PHP is willing to develop a project certificate for renovations based on its passive house labelling experience. It is recommended that the energy saving effect of the renovation should always be documented through calculations before the actual renovation is started, using adequate certification tools that can also estimate energy performance in more detail when very low energy consumption is the goal. After renovation, key quality issues - such as thermal insulation, energy consumption of fixed equipment, building airtightness, and ventilation quality – should be checked ‘as built’.

3. Renovation actors in Denmark

3.1. Informing actors

The information about energy renovation in Denmark can be provided by many different parts, as long as the homeowners themselves are looking for it. As examples can be mentioned:

- Organizations like
  - Go' Energi http://www.goenergi.dk/
  - Bolius, http://www.bolius.dk/
  - Energibolig.dk, http://www.energibolig.dk/
  - Energihjem.dk, http://www.energihjem.dk/
  - Realkredit Danmark, Kloge m^2, http://www.klogem2.dk/renoverings-zone
- Research institutions and projects like
  - SBi, http://www.sbi.dk/
  - DTU www.dtu.dk
  - Projekt Lavenergi http://projektlavenergi.dk/
- Manufacturers of products used in energy renovations like
  - rockwool, http://www.rockwool.dk/r%C3%A5d+og+vejledning/lavenergiguiden/energirenovering
  - Exhausto, http://www.exhausto.dk/energirenovering
- Companies that work with renovation, planning or execution like
  - KlimaEnergiByg http://www.klimaenergibyg.dk/
  - Arkitema http://www.arkitema.dk/Energi.aspx
  - BygEnergi http://www.bygenergi.dk/
  - Renovi http://www.renovi.dk/

However most of this information is only available if the house-owner is actively looking for it. They may or may not be informed about the benefits of energy renovation when they are planning a necessary renovation, like a new roof when the old one needs to be replaced. It all depends on which type of company they contact in order to get the new roof.

One of the most important sources of information when it comes to energy renovation of single-family houses in Denmark is Go' Energi. Go' Energi is an **independent public organization**, created in 2010 with the purpose of promoting effective use of energy, both in households, government and private industry. The organization is financed through the electrical bill: they get 0,6 øre/kWh (0,006 DKK/kWh). Their focus is to plan the activities as to achieve the largest reduction in energy use within their funding (1).

Among their activities Go' Energi is running a campaign to raise the awareness of the possible energy savings in buildings. With this campaign they inform people about benefits when changing windows, optimizing heating systems and improving the insulation of a house (2). The website of Go' Energi has much good information, but they do not focus very much on the benefits of making more than one improvement at a time, e.g. changing the windows while insulating the wall and the roof. It is mentioned that there can be a benefit in making the energy saving measures when the house has to be renovated anyway, but the idea of total energy renovations is not prominent on the site (3).

Another way the awareness of the energy use of a house is raised is by the system 'Energimærkning' (Energy label). Therefore, **label providers** could be important informing actors. According to the law, a house has to have an energy label made when it is set for sale, and it will then be valid for 5 years. The Energy label reflects the energy use of the house on a scale from A to G (A being the best, with the lowest energy use) and it contains suggestions for improvements to the building. However, these improvements are not often seen as a total renovation that would bring the house up to today's standard, but more like separate suggestions that each can make some improvement to the house (4).

3.2. Persuading actors

One way the house-owners are encouraged to renovate is by economical **support by the government**. Today there is a scheme called Bolig Job ordning (Resident Job scheme). This scheme gives you a reduction in taxes, reducing the price of the work done by about 33%, with a maximum of 15.000 DKK pr. Adult in the household. This scheme was supposed to run until the end of 2013, but with the change of government in Denmark, the scheme will be closed by the end of 2012 (5).

Instead a new green support scheme has been developed, called '*Grøn støtteordning*'. This scheme will be running for 2013-2014, and has 500 mio. DKK each year. The goal is to make it more attractive to commence an energy renovation by supporting energy efficient windows and doors replacing the old, more insulation in roof and exterior walls, better heating systems, heat exchangers for the ventilation and more (6).

However, some feel that the amount of money for the house-owners is too small, as there might only be a few thousand in it for each house. This is a very small amount compared to the investment of an energy renovation, and might not be sufficient to convince any house owners to start a renovation, they weren't already planning (7).

Making some changes to the energy label for houses could be a good way to increase the persuasion to start energy renovation. However today, it is only information and suggestions.

One way the government is trying to promote efficient energy renovations is by setting demands for renovations in the building regulations (BR10, 7.4.1 and 7.3.2). Here it is stated that improvements towards a lower energy use should always be implemented in connection with alterations or modifications to the building envelope, excepting solutions that would create moisture problems or solutions that are not economically feasible. Small alterations like painting or fixing a hole in the roof is not covered by this rule, and protected historical buildings are also excluded.

The Danish building regulations also contain demands for the insulation of the building envelope, in connection to renovation. As examples can be mentioned exterior walls 0,20 W/m^2K (BR10 for new houses 0,30 W/m^2K), floor towards ground 0,12 W/m^2K (New house 0,20 W/m^2K) and roof constructions 0,15 W/m^2K (new house 0,20 W/m^2K). As these numbers show, the demands in connection with alterations or modifications to the building envelope are actually stricter than the minimum demands for new buildings. By makings these rules, it is ensured that the buildings will be gradually upgraded to achieve lower energy consumption (8).

Beside national measures to ensure energy renovation, **municipalities** all over the country are trying to promote it in their own ways. One example is Skive municipality, who has developed a project inspired by the Tupperware business model. They are making home parties, where house-owners who are thinking about energy renovation can meet companies that provide services like energy evaluation of the dwelling, architectural options, economical calculations, funding options, coordination of renovation work, discount through joint purchase and turnkey solutions. The host of the 'my new home-party' gets the project planning of their renovation for free, and has to find ten other house-owners interested in energy renovation in order to host the party. Through this method, the municipality is hoping to inspire many house-owners to renovate (9).

3.3. Responsible actors

Once the motivation for starting a renovation process is there, it is useful with guidance, resulting in the right choices. However, the guidance the house-owners receive depends heavily on the adviser they choose, and there are a number of different people who provide some kind of guidance on the subject of renovation.

In the case of a small renovation, the **house-owner** will rarely hire a consultant, but instead decide based on the advice of the craftsmen hired to carry out the renovation. In the case of an energy renovation, the homeowner may choose a **craftsman, who is educated as energy adviser** (energivejleder). An energy adviser has taken a three-day course, learning how to advise about potential for energy savings in buildings, beyond their own profession, but within the two areas of installations or the building envelope. The goal of the education is to give house-owners and small businesses access to craftsmen who, based on the state of the whole house, can guide as to which improvements would be most efficient (10).

In case of larger renovations, the house-owner might hire an energy consultant (Energikonsulent) to help guide the process, and make the right choices (11). **Energy consultants** are either engineers (ingeniør eller maskinmester), architects or building constructors (bygningskonstruktør), who have at least three years of documented experience with relevant consulting on buildings and energy, in order to get the title. Besides advising on energy renovations, energy consultants are the only ones who can make an energy label (energimærke) for a house (12).

Beside the specialized advisers on energy renovations, people can choose to hire an **architect** to plan and lead the renovation. If this is the case, the quality of the advice concerning energy measures, will to a large extent depend on, what the focus of this architect is. Some architects has a large knowledge within the area of energy renovation, others less so (13).

3.4. Implementing actors

In order for an energy renovation to be effective, it is of large importance that the solutions are implemented in an appropriate manor. If the connections are not made correctly, the constructions will be leaky, and thermal bridges will cause the building to lose heat.

Some **craftsmen have taken a course** to earn the title as energy adviser. These have learned more about how the building should be constructed in order for the energy consumption to be as low as wanted/possible. The awareness of the important elements is the first step towards constructing it right.

There are a number of local initiatives with the purpose of improving the knowledge about energy renovations among craftsman. One can be found on the island Bornholm, where it is a declared goal to make the island free of the use of fossil fuels by 2014 through the project 'bright green island'. Here a new continuing education has been started, with the purpose of giving craftsmen working with installations or the building envelope further knowledge about energy renovations and sustainable buildings. The education consists of a 5 week course, and gives the title **Green craftsman** (Grøn Håndværker). The education is popular, as it besides knowledge, gives new possibilities for branding the craftsmen as specialists in the area of energy renovations and increased their job options (14) (15) (16) (17).

3.5. Quality assuring actors

There are no demands in the Danish building regulations stating that the actual energy use of the building should be documented, after a renovation has been carried out. The effect of the renovation must always be documented through calculations before the actual renovation is started, but there are no demands that this should be tested once the house is finished

One concept that includes subsequent documentation of the energy use, is ESCO, where a company helps estimate the potential energy saving, carry out the renovation, measures the result of the renovation, and splits the profit with the customer. This system, however, is not yet addressed towards the single family house-owners in a large scale. A few projects are trying to shape the method in order to engage house-owners, like the **ESCO light** project in Middelfart municipality (18).

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18. **Middelfart Kommune.** ESCO-light - Energibesparelser for klima, komfort og konkurrence evne. *middelfart.dk.* [Online] 9. december 2011. [Citeret: 12. december 11.] http://www.middelfart.dk/Om%20kommunen/Den%20gr%C3%B8nne%20v%C3%A6kstkommune/Esco%20light.

4. Renovation actors in Finland

4.1. Informing actors

The information about energy renovation in Finland is or can be provided by many different actors. As examples can be mentioned:

- Federations like
  - Finnish House Owners' Association http://www.omakotiliitto.fi/en
  - Allergy and Asthma Federation http://www.allergia.fi/
- Policy supporting actors like
  - Renovation portal provided by the Finnish Ministry of the Environment, tools, guidance and information for apartment buildings and single-family houses http://www.korjaustieto.fi/
  - The Consumer Agency safeguards and strengthens the position of the consumer in society also in housing renovations http://www.kuluttajavirasto.fi/
  - Motiva Ltd is a state-owned expert company promoting efficient and sustainable use of energy and materials, http://www.motiva.fi/
- Non-profit organizations like
  - Sitra - The Finnish Innovation Fund, the activities promote and stimulate new business models that aim for sustainable well-being http://www.sitra.fi/en
- Research organizations like
  - VTT Technical Research Centre of Finland http://www.vtt.fi/
  - TTS – Työtehoseura is a research, development and training institute, and provides information on energy and eco efficient housing http://www.tts.fi/
- Energy companies like
  - Helsingin Energia as one of the largest energy companies in Finland, Helsingin Energia supplies electric energy to about 400,000 customers in Finland and covers more than 90 percent of the heat demand of the capital city with district heat. Helsingin Energia produces and sells district cooling, which is considerably expanding in Helsinki. Among the services provided by Helsingin Energia are the design, projecting and maintenance of energy production and distribution systems. Helsingin Energia is also responsible for the outdoor lighting systems in Helsinki. https://www.helen.fi/index_eng.html
  - Fortum's activities cover the generation, distribution and sales of electricity and heat as well as related expert services. http://www.fortum.com/countries/fi/yksityisasiakkaat/services-in-english/pages/default.aspx
- Manufacturers of products used in energy renovations like
  - Domus manufacturing energy-efficient windows http://www.domus.fi/
  - Enervent specializes in air handling and heat recovery products for homes and buildings. http://www.enervent.fi/main.asp?menuid=10000&langid=3&countryid=900
  - Thermia, a heat pump manufacturer, http://www.thermia.fi/
  - Paroc, an insulation manufacturer http://www.paroc.fi/channels/fi/
- Companies that offer renovation, planning or execution
  - K-Rauta hardware store chain www.k-rauta.fi

- Rautia hardware store chain www.rautia.fi
- Senera, a package energy renovation provider http://www.senera.fi/Energiaremontti_on_avain_viihtyisaan_ja_energiataloudelliseen_asumiseen

The Finnish House Owner Association gives all sorts of information and guidance to house-owners. Their role in information sharing on energy renovations could also be significant.

The Finnish Asthma and Allergy Association could also have a role when health related issues of energy renovations are considered. However, one should be careful not to overestimate the mould issues in this respect.

4.2. Persuading actors

Research on energy renovations has been done for years and there are products developed based on those research results. Now the real challenge is to get the people to buy these products and develop services and business models that utilize those products. It is also important to share the newest research results. VTT is a strong **R&D actor** in Finland. There are also technical universities that work in the area.

The central **government** authority in charge of developing and directing both land use and planning and building activities is the Ministry of the Environment (http://www.ymparisto.fi/default.asp?node=4778&lan=en).

On the regional level there are 13 **Regional Environment Centres** subordinated to the Ministry. The centres steer the building activities within the area covered by a local authority. The local (municipal) authorities are independently responsible for drafting and approving master plans and local detailed plans. The statutory functions regarding building control are the charge of a committee appointed by the local authority. The local authority must have a building inspector who advises in and supervises building issues. (http://www.ymparisto.fi/default.asp?node=4778&lan=en)

In Finland, there are not requirements for the level of energy retrofitting. The total energy consumption for new houses is currently between 130-240 kWh/m^{2}year and the energy efficient level is between 90-160 kWh/m^{2}year (Halme et al. 2005[5]). The energy rating of new buildings is based on the calculated energy consumption. Existing buildings are rated according to their actual energy consumption. The energy rating (*Figure 1*) classifies the buildings on an efficiency scale ranging from A (high energy efficiency) to G (poor efficiency). New buildings constructed in accordance with the requirements of the Building Regulations 2007 will typically fall in energy class D. (Haakana 2007[6], 2008[7])

[5] Halme, M., Nieminen, J., Nykänen, E., Sarvaranta, L. & Savonen, A. 2005. Business from Sustainability. Drivers for Energy Efficient Housing. Espoo: VTT Building and Transport. 61 p. + app. 1 p.
[6] Haakana, Maarit. 2007. Implementation of the EPBD in Finland: Status May 2007.
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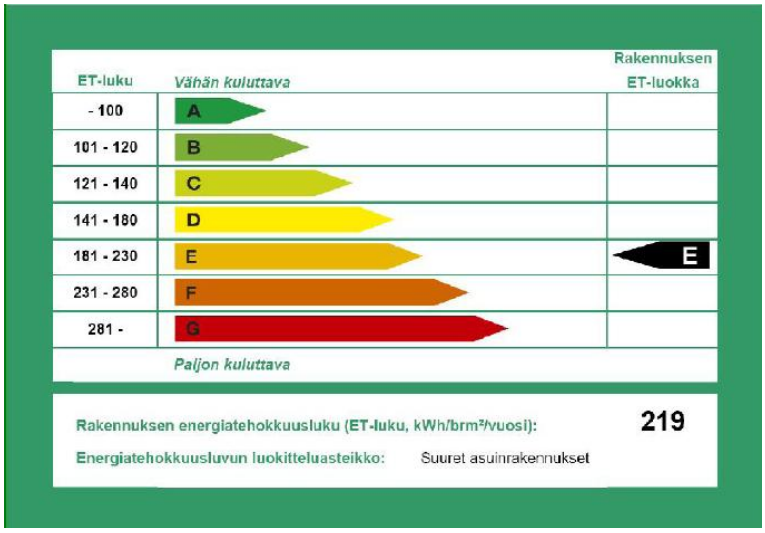

Figure 1. The energy ratings in Finland. (Ministry of Environment. 2009[8].)

4.3. Responsible actors

Even though there are similarities in single family houses, still a renovation concept is always building-specific. One has to consider case by case what the best renovation solutions for a particular house are. It is essential that the owner has enough information available for the choice. This includes that there is information on the conditions of the house.

Basically every commercial activity aims towards a profit as big as possible. So, if considered from a point of view of a single family house owner, some company may suggest a solution which is not the most sustainable for this house. Still there are not strong conflicting interests.

4.4. Implementing actors

National regulations

In Finland, the "Land Use and Building Act" defines the permits required for building activities and other action (http://www.finlex.fi/en/laki/kaannokset/1999/19990132). In section 125, there are stated the requirements for building permits also for repair works:

- "A building permit is also required for repair and alteration work which is **comparable to building construction, and for extending a building or increasing its gross floor area**."
- "A building permit is required for repair and alteration work to a building other than that referred to above, **if it is obvious that the work may affect the safety or health conditions of those using the building**."
- "A building permit is required **to substantially alter the intended use of a building or part thereof**."

[8] Ministry of Environment. 2009. Guidance notes for the energy certificate. The energy certificate of building and the establishment of the energy rating. 12.1.2009.

Instead of a building permit, an action permit is required to erect or locate a structure or installation that cannot be considered a building, or to alter the outward appearance or layout of a building. In "Land Use and Building Decree" (http://www.finlex.fi/en/laki/kaannokset/1999/en19990895.pdf), there are mentioned at least the following cases which are relevant for repair works:

- "for the construction of a … largish antenna, wind power station or largish lighting column or corresponding structure (separate equipment)"
- "to alter the elevation, roof shape, roofing or its colour, material or colour of exterior cladding, to install an awning that affects the streetscape, or to alter the fenestration (elevation action)"
- "to combine or divide residential apartments (arrangement of an apartment)"

The house-owner is not allowed to make electrical installations herself/himself. A hot work permit is also required in some cases. An installation of equipment including refrigerants often needs an authorization. In addition, installations of a district heating station or an oil-fired boiler need an authorized installer.

Complete service package

All the time more and more complete service providers come to the market. This shows that there is need and room for complete service packages in the market, even though many single family house owners still want to do most of the repairs by themselves. Most of these providers are local SME companies. Their core business is in selling some product or construction work to single family houses or inhabitants of apartment buildings. The service package vary a lot but they always include some part(s) of the core business – some companies basically only want to sell devices, equipment, products or building material; some have a wider scope and they first at least try to give information on reasonable choices for a particular house.

Traditional first line services

Constructors and Carpenters

In Finland, there are some big construction companies (NCC, Skanska, YIT). Typically, they are not interested in the single family houses. At the moment, only SME constructors are involved in single family houses. The renovation business is increasing which may have impacts to the markets.

Plumbers

In Finland, plumbers are purely involved in plumbing installations, i.e., installations of water and sewage pipes, taps, WC seats, floor heating pipes, water radiators and water heating pipes. Plumbers are not involved in improving the indoor conditions or environments. Most parts of the visible bathroom or kitchen renovations are done by constructors. However, some pipe manufacturers sell their products as services that improve the indoor conditions (floor heating and water radiator heating).

Electric installation companies

A licensed installer is required for electric installations. So, because they are called in anyway, they would have a chance to offer wider services.

Retail stores

The retail stores meat the do-it-yourself-customers. Often they just sell products or material but sometimes there is also other service available such as construction recommendations or visualisation services (like in IKEA's web pages). So, it could be a logical complement to include energy renovation advice as well. K-Rauta and Rautia hardware store chains launched their energy renovation services for single-family houses on winter 2012.

Interior studios

In Finland, interior studios or visualisation services have been used for years for example with kitchen and bathroom renovations. Nowadays these services are in some form also available in the www. The energy renovation services are more challenging by means of visualisation, because an energy renovated house may look similar to a non-energy renovated house. The energy renovation visualisations also often need more expertise (such as expertise to interpret cold bridges or air leaks) than pure interior visualisations.

Utility companies

Companies providing electricity, water or heat have existing customer connections to single family house owners. Their core business is to sell as much as possible. They still often provide information on saving the energy as well.

Companies providing water or district heating are typically municipality owned. The electricity markets are open in Finland. So you can buy your electricity from any firm but you still need to pay also for transferring the electricity (i.e., using the electricity networks). One may also pay extra for wind electricity.

Banks and insurance companies

The banking and insurance businesses in Finland have been integrated into each other. The biggest banks in Finland nowadays are Nordea, OP, Sampo, Aktia and Tapiola. In addition, there are some chains of stores which offer bank accounts as well (like S-pankki). These accounts are usually connected to the customer programs.

The big banks offer financing for renovations but it is unlikely that they would offer renovation solutions themselves. The retail stores already offer products and material for renovations. So, for them it would be natural to offer service packages too.

Industry

Façade industry

The facades of Finnish single family houses are usually made of wooden panelling, bricks or stones. The building facades are seldom changed in Finland. Typically the facades are retrofitted only if there is a clear problem that needs to be fixed.

Insulation industry

The role of the insulation industry is remarkable because they have a chance to minimize the heating demand of a house. Many of the companies (like Paroc and SPU Systems) quite openly offer solutions and products for energy renovations. Because the internal extra insulations increase the humidity burden of a wall, feasibility of different structural solutions must be considered house by house[9]. So, it is essential that these companies also offer services that support decision making in these cases.

Prefabricated products and elements

Prefabricated production is a clear and extremely important trend for the whole Finnish construction industry. It will dramatically reduce the time used for construction work at the construction site. In case of renovation, this diminishes nuisances for living. For piping renovations, there are currently several efforts in Finland that utilize prefabricated modular products. At the first stage, many of them are aimed for apartment buildings but it is obvious that sooner or later prefabricated products are offered also for single family houses.

Doors and windows manufacturers

Renovation or replacement of windows often plays in important role in energy renovations. It is among the most common energy renovation solutions done in single family houses. The better U-value also decreases the heating demand of the house. Also the doors have similar effects but because their share of the building shell is quite small the influence is not so significant. In Finland, there are several energy-efficient windows available but there is a lack of energy-efficient doors in the market. There are signs that there are already customers who are asking for these products. Some door and window manufacturers also offer their products as part of a complete service package.

Ventilation suppliers

If ventilation is renovated from a natural to a mechanical system, a heat recovery is typically added as well. There are several ventilation suppliers in Finland and they are also a strong in the energy renovation markets. Some of these companies are also enclosed in complete service packages.

Heating system suppliers

The most typical primary heating sources of the Finnish single family houses are electricity, oil and district heating. Ground heat pumps, pellets etc. have a small market share. Fireplaces and air heat pumps are typically utilized as an additional heating source. Still especially the role of fireplaces is remarkable.

4.5. Quality assuring actors

Different kinds of energy consults mainly in engineering offices can provide energy certificates for single-family houses in Finland. Most of the Finnish architects do not have building energy knowledge, so they do not have a role here. Perhaps, an energy certificate after the renovation should show reduced energy consumptions however they are still not a guarantee of the quality of the renovation.

[9] Lindeman, V., Huvi, K. & Immonen, K. 1991. Ulkoseinien lisäeristäminen sisäpuolelta. Espoo: Valtion teknillinen tutkimuskeskus. 89 s. (ETRR-tutkimusohjelma. Raportti 6). ISBN 951-47-4424-1 (in Finnish)

It is a crucial issue that all the installers have good skills and they do the work in a reliable way. So, the service provider can trust that the work is well done which on the other hand is an important part of the quality.

Inspecta is a leading provider of inspection, testing, certification and technical consultancy services in Northern Europe (http://www.inspecta.com/). One of their service sectors is real estate. They already provide many services which are relevant for energy renovations as well (http://www.inspecta.com/en/Our-Services/Technical-Consultancy/Building-services/). So, they could perhaps be interested in quality assuring functions as well.

5. Renovation actors in Norway

5.1. Informing actors

As in the other countries there are several actors providing information about energy efficient renovation:

- Public bodies like:
  - Enova http://www.enova.no/
  - Husbanken http://husbanken.no/english/
  - Norwegian Water Resources and Energy Directorate's Energy label system http://energimerking.no/
  - The municipality of Oslo has its own energy efficiency agency http://www.enoketaten.oslo.kommune.no/
- Research and educational institutions and research projects like:
  - Sintef Byggforsk http://www.sintef.no/home/Building-and-Infrastructure/
  - Norwegian University of Science and Technology, NTNU http://www.ntnu.edu/
  - Project Zero Emission Buildings http://www.sintef.no/Projectweb/ZEB/
  - Lavenergiprogrammet is a cooperation between national public actors and federations representing different parts of the building industry. http://lavenergiprogrammet.no/
- Manufacturers of products used in energy renovations like:
  - Glava http://www.glava.no/
  - Rockwool http://www.rockwool.no/
  - Norsk Celluloseisolasjon http://isofiber.no/
- Companies that work with renovation, planning and execution like:
  - Bolig Enøk http://www.boligenok.no/
  - Entelligens http://entelligens.no/
  - Energirådhuset http://www.energiradhuset.no/
  - Byggmakker Ski http://www.skibygg.no/tips-og-raad/energi/velkommen-til-ski-byggs-enoeksenter
  - Some of the service companies for housing cooperatives (which mainly consists of multi-family houses) also involve to a less extent in renovation of single family houses. Example of this is Obos with head office in Oslo. http://www.obos.no
- Organisations like:
  - Federation of Norwegian Building Industries http://www.bnl.no/
  - Norwegian Society for the Conservation of Nature http://naturvernforbundet.no/miljovennlig_hverdag/hvordan_fa_et_klimavennlig_hjem/
  - Bellona http://bellona.org/
  - The Norwegian House Owner Association http://www.huseierne.no/
  - Grønn Hverdag (green everyday) http://www.gronnhverdag.no/

In the websites of the big organizations/institutions the house-owner has to use their search engines to find the sections of the web sites with information about energy efficient housing.

Due to the fact that many renovation projects are started due to other needs such as repairing an ugly façade, leaky roof, etc, or even due to change in ownership, there are also other actors which could play an important information role.

ENOVA is public body reporting directly to the Ministry of Petroleum and Energy and does national information campaigns through mass media. They also operate a call service where private persons may get advice of how to proceed if you want implement energy efficiency measures. Their activities increase the general interest among the the population for energy efficiency in buildings. A survey executed by BNL confirms this (source: http://www.bnl.no/article.php?articleID=1822&categoryID=301 consulted 23.02.12). We believe that ENOVA could focus more on holistic solutions.

5.2. Persuading actors

ENOVA also offer subsidies of 20 % limited to NOK 10.000,- (approx €1350 per measure) to energy efficiency measures to replace oil burner with biomass system or connecting to district heating system, installation of heat pump (not air to air), pellets stoves and solar collectors.

The Norwegian State Housing Bank (Husbanken) may offer allow interest loan up to 100% of the renovation costs. The total mortgage loans (including existing from private banks) may however not exceed the market value of the house.

In Oslo house-owners may also apply the municipality for grants similar to those measures also supported by ENOVA (but you cannot get from both to the same project). In addition the Oslo Municipality offer grants to insulation, ventilation heat recovery and electric control systems.

Some few saving banks have offered better interest rates on energy efficient houses, but as there has been very little demand for such loans, it is currently not promoted (ref interview with Sparebanken Sogn og Fjordane). They see however a potential in this as the market evolves.

New incentive likely to come in Norway is “White Certificates”. This is a proposal which is now currently discussed between the Government and federations representing the industry. The utility network supplier is mentioned as possible to operate such system.

Today it is not requested to file an application if a house-owner wants to upgrade his house as long as he is not going to change the façade. However, if single measures are taken as for example installing a new window, this must fulfil the new building code (Tek10).

5.3. Responsible actors

Only in cases where the house-owner faces the reality that a very substantial renovation is needed he may consider to consult an architect or a building engineer (often work in same company). As the Norwegian University of Science and Technology for some years has run post training programs for planning and designing of passive houses targeted towards such companies, the competence of this issue is gradually increasing.

Beside this, one normally consults directly with a local carpenter/small entrepreneur company which is then asked to execute the work. The competence about holistic energy efficient renovations is still limited among many of these companies. In Norway there are some more than 3000 such companies, of which about 2500 with only one employee. The advice given by many of these one man companies is therefore only to "repair" the existing failures of the house. In fact, very often good opportunities for upgrading are missed.

The Norwegian House Owner Association (172.000 members per 1.1.2011) has in cooperation with suppliers of respective craft for several years promoted different audits like: testing the electricity system, the roof test and the piping test. The association could see an interest in offering a more complete energy audit of the house.

An example of how this may be improved in the future is now being demonstrated by Bolig Enøk which is offering a service where they take on the responsibility for the complete process for the single family house owner.

For some years back the Norwegian utility companies were obliged to have energy efficiency information centres with the scope to inform customers how they could save energy. By the establishment of ENOVA this obligation was ended. Most of the centres were closed, but some managed to establish a commercial service which today is mainly directed towards non-residential buildings. As part of our research project we launched the idea of a One Stop Shop service towards single family house owners for the company Enøksenteret. They seriously considered the idea but concluded that it was too early. As they possess the right skill, they will probably enter this market at a later stage.

5.4. Implementing actors

In order to secure good quality in implementation of solutions there is a great need of training for craftsmen in Norway. So far the relevant training in energy efficient buildings has been obtained through building of new very energy efficient buildings such as passive houses. Craftsmen with such experience already a good understanding of the concept. Autumn 2011 "Lavenergiprogrammet" started a course for craftsmen in energy efficiency renovation. The course is now offered in different cities.

The Norwegian Energy performance certificate (EPC) is pure WEB based where the homeowner himself put in key info about the building and the system conclude an energy certificate. If he sells or rents out the house such certificate is obligatory. The seller of the house is the legal responsible for the correctness of the certificate based on the input given.

5.5. Quality assuring actors

There is no special quality assuring mechanism for renovation of houses. The warrant period for buildings is in Norway today only 5 years. There has been made proposal of prolonging this to 10 years as in Sweden and Denmark, but is not accepted by the majority in the Parliament.

6. Conclusion

The following Table 1 provides an overview of the detected actors and possible actors in various countries for the development of supply chain collaboration in One Stop Shop initiatives.

	Belgium	Denmark	Finland	Norway
Informing actors	Various; label providers	Various; independent public organization, label providers	Various; House-owner association	Various; ENOVA
Persuading actors	Energy performance advisers, financial advisers, Flemish Energy Agency, municipalities, provincial network sustainable building, Passiefhuis-Platform, energy distribution managers, 'energy cutters', reference centres	Government, municipalities (Tupperware-model)	R&D actor, government, Regional Environment Centres	ENOVA, Norwegian State Housing Bank, municipality, savings bank, utility network supplier
Responsible actors	Homeowner, contractor, architect, project manager, consortium, renovation shop, turnkey supplier	Homeowner, educated craftsmen (energy adviser), energy consultants, architect	Traditional	House-owner, architect, building engineer, carpenter, small entrepreneur, house-owner association, Bolig Enøk, Enøksenteret
Implementing actors	Craftsmen; acknowledged craftsmen (public list), eco-cluster	Craftsmen (energy adviser or 'Green craftsman')	Complete service package providers, traditional first line services, industry	Trained craftsmen
Quality assuring actors	Cost managers, energy performance verifiers, project certifiers	ESCO light	Energy consultants, service providers, Inspecta	(warranty)

Table 1: Detected (possible) actors in various countries for the development of supply chain collaboration in One Stop Shop initiatives.

In conclusion, it can be stated that there are differences as well as similarities between countries how responsibilities and actions are covered by various actor categories. In general, the supply chain is very fragmented and various types of actors are not well connected in partner countries. Actors rarely offer integrated renovation as a service or product and innovative service providers have to find pathways to compete with traditional actors. There is still a lot to learn from innovative supply chain collaboration forms in various countries.

There are many (innovation) opportunities for strengthening supply chain collaboration.

A first opportunity is to stimulate collaboration of responsible actors in working together with complementary implementing actors. Typically, project managers could merge with contractors involved in construction operations and with actors delivering different installations.

A second opportunity for collaboration lies in strengthening ties with consulting actors. Typically, these can include architects, engineers, quality assessors, whole building commissioning agents, interior design advisors, and so on.

An opportunity is also observed for collaboration of responsible actors with informing actors. In partner countries there exist many actors that voluntarily inform and advice the house-owner. Typically, these informing actors include organizations of house-owners, non-profit organizations, energy agencies,

material suppliers, banks, DIY stores, and so on. They have an influential role on many potential customers and can offer an entrance for the client to find responsible actors. Some of these informing actors may also act as consulting in a later stage, possibly providing a direct link to responsible actors.

Another opportunity observed is that in partner countries quality assessment schemes are still largely missing for housing renovation. Only in exceptional cases some actors also offer quality assurance services. However, introducing such quality assessment schemes could increase customer confidence for choosing integrated housing renovation. It could also stimulate collaboration of responsible actors with persuading actors.

Different partner countries stressed the role of policy actors influencing volume market development. Typically, these are policy makers, grant providers, and so on. While their role is important to stimulate integrated housing renovation, it is highly unlikely that such actors will directly collaborate with contractors to develop market infrastructure. However, federations could lobby for influencing customer demand by providing neutral information about the benefits of integrated housing renovation to policy actors. To achieve such goal, they would preferably work together with trusted informing actors to generate neutral information.