Report on low-energy building market situation, trends, and influencing factors

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1 EXECUTIVE SUMMARY

Together with NorthPass report “Country-specific market analysis, success factors, marketing approach and market situation”, this study presents information about the market situation of low-energy construction in the eight participating countries in Northern Europe. In this study the situation is explained by defining the attitudes, beliefs and preferences of both builders and real estate experts whereas in the other report the focus is on finding solutions to overcome market barriers and providing marketing approaches for low-energy houses.

In order to examine the attitudes of individual builders and real estate experts, two surveys were compiled. A questionnaire was sent out to individual house owners in all countries inquiring about details of the constructed house as well as about attitudes and beliefs about low-energy construction. Another questionnaire was sent out to different representatives in the construction field in order to find out the experts’ attitudes. The aim was to define the (current and future) state of low-energy construction, the extent of available information, products and expertise and the beliefs related to different aspects of low-energy buildings. These responses were analysed with the help of (and compared to) the findings in “Country-specific market analysis, success factors, marketing approach and market situation”.

According to the builder survey builders in all the eight countries are considerably interested in energy efficient solutions in houses, although extensive measures might not have been implemented yet. Large differences do not seem to exist even across countries with a fairly different market situation for low-energy construction. Also the expert survey provides a positive picture of the situation suggesting that many companies are interested in and know the benefits of low-energy construction.

According to these two surveys, it seems that the trend towards more energy efficient construction is already taking place, to a large extent, but that different measures are needed in order to speed up this development. However, different opinions do exist in regard to how this development should be aided, and these different solutions depend on the distinct social, economic and political environments of the low-energy construction market in each country.
2 INTRODUCTION

This report and the NorthPass report “Country-specific market analysis, success factors, marketing approach, and market situation” serve as background information and offer a framework for the NorthPass report “Scenarios, business models and examples for very low-energy housing markets”.

All the partners of the NorthPass project have participated in this report by providing information about the fundamentals of market potential in their countries, providing examples of success cases and by helping to develop, circulating and compiling the two sets of questionnaires described in this report. The internal national reports were authored by Tõnu Mauring, Helen Hirv (TU), Ole Balslev-Olesen (Cenergia), Mikko Virtanen (VTT), Agris Kamenders, Līga Ieva (RTU), A. Kaklauskas, A. Banaitis (VGTU), Inger Andreesen (SINTEF), Szymon Firlag (NAPE) and Maria Lindblad and Kaisa Svennberg (IVL).
3 **MARKET SURVEY METHODOLOGY**

Market surveys were carried out to create information for market analysis on low-energy buildings. Surveys were compiled from two questionnaires in order to collect the needed data. The first questionnaire was for house builders to find out their willingness to build low-energy houses and the second one for experts to create an image about the real situation and problems in the market. The target groups will be introduced in more details in the following chapters.

Questionnaires were carried out in all participating countries and were similar in each country apart from parts which needed some country based modification. Each country has had their own freedom to decide the way to launch their surveys. The results of the questionnaires were sent to VTT, Finland in excel format and VTT collected the data and placed it into a database called Digium, after which the data was analyzed and reported.

The first questionnaire was directed to constructors of single-family houses to track down their interest to build low-energy houses, which options they had considered/were considering and into which result they had arrived. The target for builder survey was land owners, who had not got the building permission yet and the ones who had got the building permission, but had not started the project yet. For finding the respondents, the help of local authorities, architects, product suppliers, organizations and fairs, were needed. In Finland the addresses of respondents were bought from construction project register company (RPT Docu). Questionnaires in Finland were sent by post and the answers could be delivered in paper or via internet.

The purpose of the expert survey was to find out the estimated amount of low-energy houses, the level of costs, refunding period, the development of business, experiences of the industry and the market situation of very low-energy buildings. The target groups for expert survey were different interest groups such as representatives of the industry, authorities, investigation and organizations. Questionnaires in Finland were submitted via internet with the Digium-program and respondents were reached via email. In other participating countries the questionnaires for experts/market actors could be launched through workshop, symposiums, conferences or emails as in Finland.
4 RESULTS

4.1 Denmark

Results of the builder survey

Nine people responded to the questionnaire directed to single-family house builders in Denmark. Two respondents were in the planning stage of the construction, one respondent had the plans ready, two were currently building the house and four had already finished the construction.

Constructing the house

All respondents had planned the house by themselves. The average living area was 162 square meters and the house was planned for 3 inhabitants, on average. Three respondents had signed a contract with a construction company using a fixed price, three had chosen to use subcontractors and only one had ended up building the house themselves.

The most common heating system was water-based floor heating (in 5 houses). Other mainly chosen systems were open fireplace (3 houses), district heating (2 houses) and a ground heat pump (2 houses). Most of the builders had also considered some on-site renewable energy sources, such as photovoltaic system or a solar heat collector. Half of the respondents believed that indoor conditions are better in a well-insulated, airtight house.

When choosing building materials, a well-known brand, low energy use (or energy label) and nice aesthetics were considered as the most important criteria, and same factors were given importance to also when choosing the heating and ventilation system.

Environmental awareness and information

Danish people seem to be highly aware about low-energy-related buildings concepts: Half of the respondents knew what a low-energy house is and they were interested to build this type of a house. Also the passive house and zero-energy house concepts were familiar to the respondents whereas only few respondents had heard about a plus-energy or a swan-labelled house.

The respondents had experienced that information about constructing a low-energy house (especially regarding investment costs and financing opportunities) was available to some extent but that it was fairly difficult to find.

Most of the respondents had seen advertisements about low-energy houses, and 6 respondents even said that they would choose one if they were currently making a decision about building a house.

Preferences of the builders

In general, Danish builders were willing to pay an additional investment cost in order to build a low-energy house: 3 respondents would accept an extra cost up to 10%, but a few
respondents were willing to pay even more (even more than 20% more than the cost of a standard house) (see figure 2).

Only two builders had an energy performance certificate in their house but approximately half considered the certificate as useful.

When making a decision about the construction project, durability of the house, indoor quality and low energy use were considered as most important criteria. Importance was given also to issues such as safety and aesthetic value of the house and low running, maintenance and repair costs. These same criteria were considered important also when assessing the resale value of a house.

![What is the maximum extra investment cost that you would accept in order to build a low energy house?](image)

Figure 1: Willingness to pay extra for a low-energy house in Denmark

**Results of the expert survey**

The questionnaire sent out to different experts in the construction field received 80 responses. The respondent group consisted mainly of representatives of the building product industry, private contractors, architects, designers, researchers and energy experts or energy consultants.

Most of the respondents agreed on that the energy demand of new buildings has decreased clearly or moderately during the last 10 years while the electricity demand has increased clearly.

**The state of the low-energy construction market**

The experts estimated that of detached and semi-detached houses built in 2009, an average of 10% were very low-energy buildings. In the case of attached houses or blocks of flats the estimated percentage was slightly lower.
The respondents estimated that the number of low-energy construction projects had increased moderately (29% of the respondents), slightly (36%) or clearly (34%) during the last 5 years, and this trend was expected to continue clearly. A third of the respondents also estimated that the additional cost of constructing a low-energy building would be 5-10%, while approximately 20% estimated the costs to be even higher (10-20% more expensive).

More than two-thirds of the respondents had been involved in very low-energy house projects themselves and more than half were planning to recruit employees with specific knowledge about low-energy construction.

More than half of the respondents (64%) had experienced that some Danish construction companies were marketing low-energy houses and almost third thought that it would be possible to get information about energy efficient construction from companies if a customer asked for it. 90% of the respondents thought that required expertise/services are possible to find in Denmark and also that required products are available in the market to some extent, although it might be necessary to know where to look for them.

Perhaps surprisingly, less than half of the respondents were aware of financial support programs available for energy efficient construction, and only few experts thought that this information is easy to access.

**Promoting low-energy construction**

Almost all respondents thought that low-energy construction already was utilized as a positive marketing argument in Denmark. 40% of the respondents estimated that a very energy efficient house would be 5-10% more valuable during the next 10 years and a third though that it would increase the property value with more than 10%.

In Denmark, tax deductions were considered (by 40% of the respondents) as the best mechanism for the state to support low-energy construction. Also grants and tenders received support to some extent. Almost 80% of the respondents also supported the idea of the state as a frontrunner in promoting low-energy construction through public procurement while a fifth thought that the activities of the state would not affect the demand.

Apparently, the extent of low-energy building demonstration projects is not enough in Denmark as two-thirds of the respondents thought that more projects are still needed.

Most important drivers for market penetration of low-energy houses were suggested to be the demand for low-energy construction and National Regulations and authorities favouring low-energy construction (see figure 3 for more details). However, almost all respondents believed that energy-efficient construction would increase also without obligations by law.
Figure 2: Drivers for market penetration of low-energy buildings in Denmark
4.2 Estonia

Results of the builder survey

In Estonia, 13 house builders responded to the questionnaire. Eight respondents had already built a house while 4 were still in the planning stage. Only one was currently building the house. Houses which had already been finished were built between 1958 and 2010.

Constructing the house

As much as 85 per cent of the respondents planned their house individually and only 2 respondents had chosen the model house of a house-building factory. The houses built, planned or which were in building process were designed for four persons on average and the average living area comprised 165 square meters.

Four respondents had chosen the option to build the house using subcontractors, 2 had signed a contract with a construction company fixing the price at the time of the contract and 2 had ended up building the house themselves.

Wood heating was the most common heating system (in 6 houses). Electric floor heating, electric heaters and gas heating were chosen in two to three houses.

One quarter of the respondents had considered solar heat collector as an on-site renewable energy source and 3 respondents had thought about solar electricity. Only 2 respondents had considered wind electricity or some other renewable energy source while five respondents had not considered using any on-site renewable energy source.

The most important criterion when choosing building materials was low energy use or an energy label. Importance was also given to easy installation and maintenance and nice aesthetics. Low energy use and easy installation and maintenance were considered most important also when choosing the heating or ventilation systems.

Almost half of the respondents believed that indoor conditions are better in a well-insulated, airtight house, but five respondents also thought that they are worse or the same compared to a traditional house.

Environmental awareness and information

All respondents were familiar with the concept of low-energy house, and 3 (out of 13) were going to build this type of a house. Also the passive house concept was familiar to all respondents but almost half of the respondents were not interested in this option. The concepts of zero-energy and an energy positive house were less familiar to the respondents although still many had heard about them.

More than two-thirds of the respondents thought that information about the financial support for low energy solutions was difficult and time consuming to find and the same applied to the required additional upfront investments. Approximately a quarter of the respondents considered that there is all kind of information available but only if the customer knew where to ask for it.

According to the respondents, clearly the most difficult issue when carrying out a low-energy construction project is finding required components, material and technology. In general, all these things were considered as fairly difficult to find.
All except two respondents had seen advertisements related to energy-efficient construction but a third did not consider these advertisements as credible.

Preferences of the builders

Most of the respondents were willing to pay an additional fee for building a low-energy house, but only one was willing to pay more than 20 per cent extra compared to a standard house (see figure 4 for more details).

![Figure 3. Willingness to pay extra for building a low-energy house in Estonia](image)

None of the respondents had an energy performance certificate. Still almost two-thirds of the respondents found the information in it useful and 10 respondents thought that the certificate would be useful when reselling the house.

10 out of 13 respondents considered energy-efficient construction as a realistic alternative and 8 thought that living in a low-energy house would be a good way to protect oneself from increases in energy prices. Nobody agreed on the statement that there would be a big variety of existing energy-efficient model house package solutions available.

When choosing a construction project the most important criteria were good durability of the house and low running and maintenance costs. When considering the resale value of a house all respondents agreed on that good image of the area and low running and maintenance costs were very important. Good transport connections, vicinity of the necessary services and low energy use of the house were also highly valued.
**Results of the expert survey**

37 responses were received from the questionnaire sent out to real estate experts, the biggest representing group being architects, other designers and representatives of the construction industry.

85% of the respondents thought that energy demand of newly erected buildings had decreased during the last 10 years, and more than half though that the electricity demand had increased or stayed constant.

**The state of the low-energy construction market**

According to the experts, on average 10% of the built detached houses, semi-detached houses, attached houses and blocks of flats in 2009 were very low-energy houses. However, almost all respondents thought that the amount of low-energy construction projects had increased during the last five years and most of the respondents also expected low-energy construction to increase clearly or moderately in the future.

Two-thirds of the respondents had been involved with projects related to low-energy buildings, and half of all respondents had faced more problems in low-energy construction than in traditional one.

Most of the respondents estimated the investment cost of low-energy construction to be 10-20% higher than an investment cost of a traditional building. The selling price for a low-energy building was estimated to be more than 10% higher than for a traditional building, and the price was expected to rise.

As much as 80% of the representatives of companies were offering specific building products for low-energy construction and half of them planned to increase their supply of this type of building products. Two-thirds also were planning to recruit employees with specific knowledge in low-energy construction in the future (see figure 5).

A third of the respondents had already bought or employed low energy construction products while half had not even considered this option.

Around 90% of the respondents had experienced that construction companies were offering low-energy houses but more than half thought that information about them was not provided to a large extent.

Almost all respondents were convinced that in Estonia it is possible to find the required expertise for constructing low-energy houses. Also 91% of the respondents thought that low-energy construction products were available in the market if the customer knew where to look for them.

Half of the respondents felt that they had an easy access to sufficient information about low-energy construction and the other half also thought that information is available but that it is extremely difficult to find. Half of the respondents were not aware of financial support programs available for energy efficient buildings while the other half mainly thought that information about them was available but not easy to find.
Promoting low-energy construction

About three-quarters of the respondents saw low-energy construction as a positive marketing argument. Almost all respondents expected low energy houses to have a green premium in the future and all considered it as more valuable than a traditional one.

According to 80% of the experts, working on energy efficient construction is extremely important because of the company image or for the company’s strategy in the future.

No respondent found the obligatory law necessary for developing the market for low-energy construction. However, almost all respondents were convinced that the demand for low energy buildings by public authorities is important in promoting of low-energy construction.

Additional investment costs were proposed to be covered mostly by tenders, grants or tax deductions. Most of the respondents (89%) also thought that it would be important to build low-energy buildings for demonstration purposes.

Four most important factors driving the market penetration of low-energy buildings were suggest to be the demand for low-energy construction, sufficient availability of financing, wide availability of technology and easiness to find skilled designers and trained building workforce on the market. The European legislation and institutions’ intensions to set targets for low-energy buildings as well as big actors in the market choosing low-energy buildings were considered as the least important factors (see figure 6).
According to your experience, how important are the following factors in driving the increasing market penetration of low-energy construction:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The wide availability of technology</td>
<td>Significant</td>
</tr>
<tr>
<td>Demand for low-energy construction</td>
<td>Moderate</td>
</tr>
<tr>
<td>Favourable attitudes</td>
<td>Moderate</td>
</tr>
<tr>
<td>National Regulations and authorities favour low-energy construction</td>
<td>Significant</td>
</tr>
<tr>
<td>European legislation and institutions set targets for low energy buildings</td>
<td>Significant</td>
</tr>
<tr>
<td>Skilled designers and trained building workforce are easy to find on the market</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sufficient availability of financing</td>
<td>Not significant</td>
</tr>
<tr>
<td>Big actors in the market choose low energy buildings</td>
<td>Not significant</td>
</tr>
<tr>
<td>Sufficient competition and several alternatives for the consumers</td>
<td>Significant</td>
</tr>
<tr>
<td>Public buildings move first and show the private sector what is technologically and financially possible</td>
<td>Moderate</td>
</tr>
<tr>
<td>People are willing to be the pilot users of a new technology</td>
<td>Moderate</td>
</tr>
<tr>
<td>Cities and municipalities adopt ambitious strategies for green buildings</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Figure 5. Drivers for the market penetration of low-energy buildings in Estonia
4.3 Finland

Results of the builder survey

In Finland, altogether 102 responses were received from the questionnaire directed to individual builders. 83% of these respondents were currently building the house, 7% had finished the construction (in 2010), 6% were still planning and 4% were currently starting the construction stage.

Constructing the house

Half of the respondents had chosen a modified model house from a house-building factory and 40% had planned their house individually. Only 10% had chosen the model house of a house-building factory.

Houses were designed for three people, on average, and the living area comprised approximately 157 square meters.

25% chose signing a contract with a construction company fixing the price at the time of the contract. Almost half of the respondents wanted to use subcontractors and the rest 26% had decided to build the house themselves.

Wood heating, ground heat pump (pumping heat from the ground to the heating water network) and electric floor heating were the most common heating systems. Also district heating and exhaust air heat pumps were chosen in many cases.

Almost half of the respondents had considered some on-site renewable energy sources, most commonly solar heat collectors or solar electricity. However, half of the respondents had not even considered using any on-site renewable energy source. Only 39% of the respondents believed that good insulation and airtight house would improve the indoor condition.

A well-known brand and low energy use were considered as most important factors when choosing building materials. Same criteria were given importance to also when choosing the heating and ventilation system for the house.

Environmental awareness and information

The awareness of low-energy house concepts was fairly high among Finnish builders. Almost all respondents had heard about the low-energy house concept and even more than half stated that they would build one. Also the concepts of passive house and zero-energy house were familiar to almost all respondents whereas the respondents were less familiar with the concept of an energy positive house.

Most of the respondents thought that information about the physical characteristics and the designing and the building process of a low energy house were available, but financial support for low energy solutions was more difficult to find.

Achieving real savings in energy costs, finding skilled workers and designers and dealing with investment costs were considered as the most difficult issues when constructing a low-energy building.

About 80% of the respondents had seen advertisements related to energy efficient buildings, but 20% of them thought that they were not credible and 30% were not interested.
Preferences of the builders

Roughly three-quarters of the respondents were willing to spend 5-10% extra for building a low energy house. Only three respondents were willing to pay more than 20% extra compared to the costs of a standard house.

As much as 88% of the respondents had a house with an energy performance certificate (see figure 7), and most respondents found the information in it useful or thought that it would be useful when reselling the house.

![Energy performance certificate](image)

Figure 6. Popularity of an energy performance certificate in Finland

On average, 40% of the respondents considered energy-efficient construction as a realistic alternative and thought that living in an energy-efficient house is a good way to prepare for increases in energy prices. Also, in general the respondents thought that there is enough information about energy-efficiency in buildings.

For roughly 80% of the respondents most important criteria when deciding about a construction project were the aesthetics and comfort of the house and the suitability of the living area. Great importance was also given to the quality of the indoor air and the good durability of the house. Factors such as available tax breaks and subsidies and ecological building materials were considered as least important.
Results of the expert survey

In Finland, 40 people answered to the questionnaire sent out to real estate experts. Most of the expert group represented public authorities, construction industry and building product industry. The rest of the respondents were designers, researchers, consultants or representatives of associations and real estate agencies but no one was from HVAC design, electrical design or architecture.

Half of the respondents believed that heating energy demand of newly erected buildings has decreased moderately while electricity demand has increased.

The state of the low-energy construction market

According to the respondents almost 30% of the built detached or semi-detached houses in 2009 were very low-energy houses, and of attached houses and blocks of flats this percentage was estimated to be 15.

More than half of the respondents forecasted that low-energy construction would increase clearly in the near future.

Almost all respondents expected low-energy houses to have a green premium in the future. Two-thirds of the respondents estimated the investment cost of a low-energy house to be 0-10% higher compared to the investment cost of a traditional one. A fifth estimated the cost to to be 10-20% higher and only 5% believed that it would be more than 20% higher.

Two-thirds of the respondents experienced that construction companies were informing about low-energy houses in a way or another although in some cases the customer would have to ask for the needed information. 65% of the respondents were convinced that the needed expertise was able to find in Finland. Also, 80% of the respondents were convinced that low-energy construction products were available in the market but that they might be difficult to find.

Access to information seems to be a larger problem as less than one fifth of the respondents thought that information regarding low-energy construction was easily available, while the rest thought that sufficient information was either difficult or impossible to find.

More than half of the respondents were not even aware of financial support programs available for energy efficient construction. The other half knew about them, but most thought that information about these possibilities is difficult to find.

Promoting low-energy construction

Almost all Finnish experts considered low-energy construction as a positive marketing argument even though only about 40% had been involved with low-energy construction projects. 85% of the respondents were convinced that working on energy efficient buildings would be important for the company image or the company strategy in the future.

Most of the respondents did not see the obligations by law necessary for the development of low-energy construction market. Most of the expert also believed that constructing low-energy buildings would increase either slightly or moderately. Also, 73% of the respondents found it still important to build low-energy buildings for demonstration purposes.

The additional investment cost is a large hindrance for low-energy construction business. More than half of the respondents believe that tax deductions could help in covering those costs. Only 10% believed that tenders or subsidies would help. Two-thirds of the respondent
saw that the demand of low energy buildings by public authorities can be an important driver in moving the market towards low-energy construction.

According to the respondents, clearly most important drivers in market penetration of low-energy construction are the wide availability of technology and demand for low-energy construction. Also encouraging attitude and national regulations as well as authorities favoring low-energy construction were considered as important drivers (see figure 8 for more details).

![Figure 7. Drivers for the market penetration of low-energy buildings in Finland](image-url)
4.4 Latvia

Results of the builder survey

In Latvia, 16 people responded to the questionnaire directed to private house builders. Half of the responded had already finished the construction (mostly in recent years), 2 were currently building and 6 were in the planning stage.

Constructing the house

12 of the houses were individually planned while four were model houses from a house-building factory. The houses in Latvia were designed for 5 people on average, and the average living space was 206 square meters. In half of the cases, the respondent had ended up building the house themselves, in rest of the cases the builder had decided to sign a contract with a construction company using a fixed price or use a subcontractor.

The respondents had implemented many different heating systems the most common being wood heating, district heating, gas heating and solar heating. Considering renewable energy sources was very popular among the respondents as more than half of them had considered either solar heat collectors or photovoltaic systems.

Natural ventilation was chosen in most cases as the ventilation system. The belief in better indoor condition of a well-insulated, airtight house, was not very strong as only a third thought that it would be better than in a traditional house.

Low-energy building and low price were considered as the most important criteria when choosing building materials for the house. Also a well-known brand, easy installation and maintenance and the nice aesthetics were considered as fairly important. Same factors, especially the low energy use, were given high importance to also when choosing the heating and ventilation system.

Environmental awareness and information

Awareness of different low-energy house concepts was considerably low among Latvian builders: Most respondents had not heard or they knew very little about the concepts of a passive, a zero-energy and an energy-positive house. However, the respondents were more familiar with the concept of low-energy house and a few had even chosen to build one.

Many respondents had experienced that finding skilled workers was the most difficult issue related to low-energy construction. Only few respondents had seen advertisements about low-energy buildings and only one was interested to choose this type of a building (see figure 9).
How easy is it dealing with the following factors when doing low-energy construction

- Finding skilled designers
- Finding skilled workers
- Finding necessary components, materials and technology
- Dealing with sellers attitudes
- Dealing with investment costs
- Achieving real savings in energy costs

n = 13

Figure 8. Easiness to carry out a low-energy construction project in Latvia

Preferences of the builders

Most of the respondents were not willing to pay greater than a 15% additional investment for a low-energy house.

Only one respondent had an energy performance certificate, although two-thirds considered the certificate as useful.

When asking about the respondents’ attitudes towards some issues, it appeared that an energy efficient house was considered as a good protector towards changes in energy prices. Many respondents also stated that they consider energy-efficient construction as a realistic alternative.

When choosing a new construction project, most importance was given to the image and suitability of the area and low construction costs, and same factors were valued also when estimating the resale value of a house.
Results of the expert survey

8 experts replied to the questionnaire and they were mostly designers or representatives of construction industry and public authority.
All agreed on that the heating energy demand had decreased while the electricity demand had increased during the last 10 years.

The state of the low-energy construction market

All respondents also estimated that 0-5% of newly constructed detached, semi-detached and attached houses and blocks of flats were very low-energy houses. Only two of the respondents had been involved with a low-energy construction project.
The additional cost of building a low-energy house was estimated to be 10-20% higher than that of a traditional building.
All three companies stated that they provided products suitable for low-energy construction, and two were also planning to recruit employees with specific knowledge about low-energy construction in the future.
The respondents had experienced that in Latvia, some companies do provide information about low-energy construction but usually only if they are asked for it. Seven out of ten respondents were convinced that they could find required expertise and services for low-energy construction if needed.
The experts thought that products for low-energy constructions are available in the market but that it might be necessary to know where to look for them. All experts were also aware about financing programs in Latvia, but some admitted that information about them is difficult to find.

Promoting low-energy construction

Only half of the respondents thought that low-energy construction already is a marketing trend in Latvia. However, half of the respondents estimated the low-energy buildings to have a green premium in the future, and no one estimated the value to be the same as that of a standard building. Almost all respondents thought that working on energy efficiency is important for the company image.
All respondents agreed on that low-energy construction will be a growing trend, at least to some extent, also without the obligation by law.
All experts also thought that there should be more low-energy building demonstration projects in order to promote energy efficiency in buildings. The role of public authorities demanding low-energy buildings was considered as important by almost all respondents.
Only subsidies (7/8 respondents) and tax reductions (1/8) were considered as good mechanisms to support low-energy construction. When considering the factors facilitating the market penetration of very low-energy houses the wide availability of technology, demand for low-energy construction, favourable attitude and national regulations and authorities favouring low-energy construction were given highest importance to (more details in figure 10).
Figure 9. Drivers for the market penetration of low-energy construction according to the experts in Latvia
4.5 Lithuania

Results of the builder survey

The questionnaire sent out to individual builders received 15 responses. Of these respondents 6 had already finished the construction (between 2004 and 2009), 2 were currently building, one had just finished the planning and 6 were currently in the planning stage.

Constructing the house

Only two had chosen a modified model house from a house-building factory while the rest had chosen an individually planned house.

The houses were planned for 4 people on average, and they consisted of an average living space of 178 square metres.

Almost half of the respondents (6 out of 15) had decided to build the house using subcontractors while building the house themselves was another popular alternative (chosen by 5). The rest (3) had decided to sign a contract with a construction company.

The most commonly chosen heating systems were wood heating and a ground heat pump. Other mechanisms were exhaust air pump, gas heating and combined heat and power. Some respondents had considered using on-site renewable energy sources, such as solar heat collectors or a photovoltaic system, but as much as 6 respondents had not considered using any renewable energy source.

The indoor conditions of a well-insulated, airtight house were almost unanimously considered to be better than in a traditional house.

When choosing building materials for the house, low energy use and low price were considered as most important criteria. Same aspects were given high importance to also when choosing the heating and ventilation system for the building, and also the easy installation and maintenance were considered as important.

Environmental awareness and information

It is difficult to draw a conclusion about the availability of information considering low-energy construction. Many builders had experienced difficulties in finding information but approximately the same number of respondents stated that information was easy to find. The respondents agreed only on that it is difficult to find information about the financial support and the potential savings or running costs of a low-energy building (see figure 11 for more details).

Almost half of the respondents had not seen advertisements about energy efficiency in houses. The other half had seen advertisements but had either chosen to build one (20%) or they were not interested (27%).
Preferences of builders

Most of the respondents stated that they would be willing to pay an additional investment fee of 10 or 15% for a low-energy house compared to a standard house, but only two (out of 15) were willing to pay more than an extra investment cost of 20% (see figure 12).

Only a fifth of the respondents had an energy performance certificate in their house but, however, the majority found the information in the certificate useful or thought that the certificate might be useful when reselling the house.

Almost all respondents were considering an energy-efficient building as a realistic alternative. Respondents also agreed on that an energy-efficient house is more ecological than a traditional one and that living in a low-energy building would be a good way to protect oneself from changes in energy prices.

When choosing a construction project low energy use, good indoor quality and the nice and suitable living area of the house were given most importance to. Same factors were considered as important also when evaluating the factors affecting the resale value of a house.
What is maximum extra investment cost that you would accept in order to build a low energy house?

<table>
<thead>
<tr>
<th>Extra Investment Cost</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No extra investment</td>
<td>7%</td>
</tr>
<tr>
<td>Up to 5% of the cost</td>
<td>0%</td>
</tr>
<tr>
<td>Up to 10% of the cost</td>
<td>40%</td>
</tr>
<tr>
<td>Up to 20% of the cost</td>
<td>13%</td>
</tr>
<tr>
<td>Over 20% of the cost</td>
<td>33%</td>
</tr>
</tbody>
</table>

Figure 11. Willingness to pay extra for a low-energy house in Lithuania

Results of the expert survey

12 people responded to the questionnaire directed to experts in the construction field most of whom were designers or representatives of public authority or the building product industry.

All respondents agreed on that the heating energy demand had decreased slightly, moderately or clearly during the last ten years whereas the respondents had different opinions about whether the electricity demand had increased or decreased.

The state of the low-energy construction market

The experts estimated that 5-10% of detached, semi-detached and attached houses and blocks of flats built in 2009 were low-energy buildings, and they forecasted that the amount of low-energy construction projects would increase moderately (5-10% each year) in the future.

Most experts thought that there are some construction companies marketing low-energy houses and some respondents thought that almost all construction companies offer this type of buildings. Almost everyone thought that expertise, services and products are available for constructing a low-energy house. Half of the respondents had already been involved with low-energy construction projects themselves.

Two-thirds of the respondents thought that they have an easy access to sufficient information about low-energy construction and a third also thought that information is available but that it might be difficult to find. Half of the respondents were aware of financial support programs available for energy-efficient construction.

The respondents had differing views on the amount of the extra investment cost that would be required for constructing a low-energy house.
Promoting low-energy construction

11 out of 12 respondents agreed on that low-energy construction already is a market trend in Lithuania and that it can be used as a positive marketing argument.

Almost all representatives of companies believed that working on energy efficient buildings would definitely or maybe be good for the company image or for the company strategy in the future.

Third of the respondents estimated that a low-energy house would be 5-10% more valuable and more than half estimated it to have larger than a 10% premium compared to a traditional building.

Tax deduction was the most commonly suggested financial mechanism. Most experts (67%) thought that the demand by public authorities can be useful for promoting low-energy construction. 11 out of 12 respondents also thought that energy-efficient construction would increase slightly or moderately during the next 10 years also without changes in law.

When choosing the most important drivers in order to promote low-energy construction, national regulations and authorities favouring low-energy construction, demand for low-energy construction, the wide availability of technology and availability of financing were given most importance to (see figure 13).
According to your experience, how important are following factors in driving the increasing market penetration of low-energy construction:

- Significant driver
- Moderate driver
- Not significant

- The wide availability of technology
- Demand for low-energy construction
- Favourable attitudes
- National Regulations and authorities favour low-energy construction
- European legislation and institutions set targets for low energy buildings
- Skilled designers and trained building workforce are easy to find on the market
- Sufficient availability of financing
- Big actors in the market choose low energy buildings
- Sufficient competition and several alternatives for the consumers
- Public buildings move first and show the private sector what is technologically and financially possible
- People are willing to be the pilot users of a new technology
- Cities and municipalities adopt ambitious strategies for green buildings

n = 12

Figure 12. Drivers for market penetration of low-energy buildings in Lithuania
4.6 Norway

Results of the builder survey

In Norway, 13 people responded to the questionnaire sent out to individual builders. Around half of the respondents had already completed the construction while a third was in the planning stage. The rest were either currently building or had finished the planning.

Constructing the house

Two-thirds had chosen an individually planned house, three respondents had chosen a model house from a house-building factory, and two had decided to choose a modified model house from a house-building factory. The houses were planned for 4 persons on average, and the average living area was 123 square metres.

Almost all (8/10) respondents had signed a contract with a construction company using a fixed price while two had ended up building the house themselves.

Most common heating systems were wood heating, electric heaters and electric floor heating. Also district heating and outdoor air heat pump had been chosen in a few houses. 10 out of 13 respondents had not considered using any on-site renewable energy source (solar had been considered in a couple of cases).

Half of the respondents did not have belief in good insulation and airtightness in regard of the indoor conditions of a house.

When choosing building materials easy installation and maintenance, nice aesthetics and a well-known brand were the most important criteria. Low energy use was chosen only as the fifth most important factor. Same factors were given importance to also when choosing the heating or ventilation system although in these cases low energy use was given slightly more importance to.

Environmental awareness and information

Norwegian builders were, on average, fairly unfamiliar with different low-energy house concepts: Most of the respondents had only little information about low-energy and passive houses and many of them had not heard about zero-energy or plus-energy houses. Only few had chosen to build a low-energy house.

All the respondents stated that it is considerably difficult to find information about constructing a low-energy house. Norwegian respondents were sceptical especially when it comes to achieving real savings in energy costs.

Most (9/11) respondents had seen advertisements related to energy efficient buildings but did not think that they were credible.

Preferences of builders

Only three respondents did have an energy performance certificate although half of the respondents did consider the information in the certificate as useful.

The respondents were also not willing to pay extra for a low-energy house: Two-thirds were not willing to pay any additional investment cost, and only few were ready to pay up to 20% more for a low-energy house (see figure 14).
When asked to evaluate different statements related to low-energy houses, many respondents agreed on that an energy-efficient house is a good way to protect oneself against increasing energy prices and that energy-efficient construction is needed in order to prevent the climate change. Nevertheless, remarkably many respondents did not consider energy-efficient construction as a realistic alternative.

When choosing a construction project Norwegian respondents considered the aesthetics and safety of the house, low construction costs and good transportation as the most important factors. Surprisingly, least importance was given to ecological building materials and the low energy use. Good image of the area and the aesthetic value of the house were considered as important factors also when estimating the factors affecting the resale value of a house (see figure 15.)
Figure 14. Important factors when deciding about a construction project in Norway
Results of the expert survey

28 construction field experts responded to the questionnaire. Most of the respondents were designers, private contractors or representatives of public authority or the building product industry.

There were no consensus about whether the heating energy consumption had increased or decreased during the last 10 years but most respondents agreed on that the electricity consumption had increased or stayed constant.

The state of the low-energy construction market

The experts estimated that 5-10% of newly built houses (detached, semi-detached, attached and blocks of flats) were low-energy buildings and they also predicted that the amount of low-energy construction would increase clearly or moderately in the foreseeable future.

Only half of the respondents had so far been personally involved with a low-energy construction project.

Almost half of the respondents estimated the construction of a low-energy house to be 5-10% more expensive but also even higher additional investment costs were suggested.

Four fifth of the respondents had experienced that some Norwegian construction companies were offering low-energy houses, and most respondents also thought that required construction products are available in the market if a person knows where to look for them.

Almost all experts estimated that they have access to information about low-energy construction to a sufficient extent although two-thirds thought that this information might be difficult to find. Almost 80% of the respondents were also aware about financial support programs available in Norway although more than half of these respondents thought that this information is not easy to find.

Promoting low-energy construction

Four-fifths of the respondents thought that low-energy construction already was a marketing trend in Norway. Nevertheless, all respondents did not think that low-energy houses have a green premium.

72% of the representatives of companies thought that working on energy efficient buildings would definitely be useful for the company image.

Almost everyone (79%) agreed on that there is still a need to carry out more low-energy house demonstration projects.

Grants were by far the most popular financial mechanism in order to support low-energy construction. The role of public authority was considered as very important in Norway: 76% of the respondents thought that public authority can promote low-energy construction through energy efficient public procurement.

Most respondents also thought that the development towards increasing low-energy construction would take place also without changes in law.

Most important drivers for the increase in low-energy construction were suggested to be the demand for low-energy construction, availability of technology, national regulations, initiatives by cities and municipalities and big actors in the market choosing green buildings (see figure16).
According to your experience, how important are the following factors in driving the increasing market penetration of low-energy construction?

<table>
<thead>
<tr>
<th>Factor</th>
<th>Significant Driver</th>
<th>Moderate Driver</th>
<th>Not Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>The wide availability of technology</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Demand for low-energy construction</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Favourable attitudes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Regulations and authorities favour low-energy construction</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>European legislation and institutions set targets for low energy buildings</td>
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<tr>
<td>Skilled designers and trained building workforce are easy to find on the market</td>
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<tr>
<td>Sufficient availability of financing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big actors in the market choose low energy buildings</td>
<td></td>
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<tr>
<td>Sufficient competition and several alternatives for the consumers</td>
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<tr>
<td>Public buildings move first and show the private sector what is technologically and financially possible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>People are willing to be the pilot users of a new technology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cities and municipalities adopt ambitious strategies for green buildings</td>
<td></td>
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</tbody>
</table>

n = 29

Figure 15. Drivers for the market penetration of low-energy buildings in Norway
4.7 Poland

Results of the builder survey

In Poland altogether 39 individual house builders responded to the questionnaire. Half of the respondents were only planning to build a house whereas a third had already finished the construction (between years 1997 and 2010). The rest had either finished the plans or they were in the construction stage.

Constructing the house

41% of the respondents had chosen a modified model house from a house-building factory and another 41% had chosen an individually planned house. The rest had chosen a model house of a house-building factory. The houses were on average designed for four persons and the living area was approximately 174 square meters.

Half of the builders had chosen to use subcontractors when building the house and a third had ended up signing a contract with a construction company using a fixed price. Only two builders had decided to build the house themselves.

The most commonly chosen heating systems were biomass boilers and gas boilers. Also electric heater and solar heating were fairly common heating systems. Surprisingly many of the builders had considered using some on-site renewable energy resource. Almost half of the respondents had considered solar heat collectors and also solar and wind electricity received a lot of popularity, and only a fifth had not considered using any renewable energy resource.

Two-thirds of the respondents thought that indoor conditions are better in a well-insulated, airtight, house. When choosing building materials low energy use, low price and a well-known brand were considered as the most important factors. Same criteria were considered to be important also when choosing the heating and ventilation system for the house. Environmental friendliness was not given high importance to.

Environmental awareness and information

Surprisingly many respondents had heard about different low-energy house concepts, and more than half were also planning to build a low-energy or a passive house. The builders were familiar also with the concept of zero-energy house although not as many had heard about a plus-energy house.

Some of the respondents thought that there is much information available about low-energy related issues but most builders also thought that this information is fairly difficult to find. The respondents also thought that achieving real savings in energy costs was fairly easy whereas finding skilled workers in order to construct a low-energy house was considerably difficult (see figure 17).

Only half of the respondents had seen advertisements related to energy efficient construction but these respondents did not think that the advertisements were reliable.
Preferences of builders

Even if interest in low-energy construction seems to be high in Poland builders were not interested in paying high amounts in order to build one: a third was not willing to pay any extra investment cost for a low-energy house and none of the builders were willing to pay more than 20% extra. Anyhow, some respondents were willing to pay up to 5, 10, 15 or 20% more than for a standard house. Also, when asking about attitudes towards low-energy construction, not outstandingly many were considering energy efficient construction as a realistic alternative.

One fourth of the builders had an energy performance certificate in their house and more than half thought that the information that the certificate provides is useful or that the certificate would be useful when reselling the house.

When deciding about a construction project the aesthetics and comfort of the house, safety and durability of the house and available tax breaks or subsidies were considered as most important factors. Least importance was given to low energy use and indoor air quality.

Results of the expert survey

In Poland 58 experts responded to the questionnaire. Two biggest representative groups were designers and construction industry (private contractors). The rest of the respondents were representatives of national or European associations, real estate agents, construction physics researchers or consultants.

Two-thirds of the respondents thought that heating energy demand of newly erected buildings has decreased during the last 10 years while electricity demand has increased.
The state of the low-energy construction market

According to the expert survey, on average 15% of the newly built detached or semi-detached houses were very low-energy houses and from attached houses and blocks of flats the percentage was estimated to be 10%. More than half of the respondents forecasted that the amount of low-energy buildings would increase 5-10% per year and quarter of the respondents believed in higher than a 10% growth.

Roughly 70% of the respondents had faced more problems with low-energy construction than with the traditional one. Only fifth found no difference between those two construction types.

As much as 90% of the experts thought that construction companies are marketing low-energy houses but half of these respondents noted that information is available only if the customer asked for it (see figure 18.) Even more respondents were convinced that in Poland it is possible to find the required expertise and services in order to build a low-energy house. Also roughly 80% were sure that low-energy construction products were available in the market although they might not be easy to find.

![Figure 17. Availability of (information of) low-energy houses in Poland according to real estate experts](image)

In Poland more than 30% of the respondents believed that information about low-energy construction is easily available, but two-thirds thought that sufficient information is available but extremely difficult to find. More than half of the experts were aware of financial support programs available for energy efficient buildings in Poland although most of them thought that it is difficult to find information about them.

Most of the respondents estimated that the cost of constructing a low-energy house would be 10-20% higher than the cost of a traditional building. The experts also estimated that the
selling price would be higher than the selling price of a traditional house, and that the price would continue increasing in the future.

Promoting low-energy construction

As much as 82% of the experts saw that the demand of low energy buildings by public authorities can be an important driver in promoting low-energy construction.

In Poland, almost all respondents considered low-energy construction as a positive marketing argument even though only about one fifth had been involved with a low-energy construction project. Almost all respondents expected low energy houses to have a green premium.

The experts suggested that additional investment costs should be covered by subsidies or tax deductions. Most respondents did not see the obligatory law necessary in order to speed up the low-energy construction.

64% of the respondents thought that working on energy efficient buildings might be important for the company image. Also, 80% of the respondents found it important to build more low-energy buildings for demonstration purposes.

According to respondents the two clearly most important factors driving the market penetration of low-energy houses are availability of financing and the national regulations and authorities favoring low-energy construction. Also the wide availability of technology and demand for low-energy construction were seen as important drivers (see figure 19).
According to your experience, how important are following factors in driving the increasing market penetration of low-energy construction?

- The wide availability of technology
- Demand for low-energy construction
- Favourable attitudes
- National Regulations and authorities favour low-energy construction
- European legislation and institutions set targets for low energy buildings
- Skilled designers and trained building workforce are easy to find on the market
- Sufficient availability of financing
- Big actors in the market choose low energy buildings
- Sufficient competition and several alternatives for the consumers
- Public buildings move first and show the private sector what is technologically and financially possible
- People are willing to be the pilot users of a new technology
- Cities and municipalities adopt ambitious strategies for green buildings

Figure 18. Drivers for market penetration of low-energy buildings in Poland
4.8 Sweden

Results of the builder survey

In Sweden, responses were received from 16 people, of whom 10 were currently building the house, 4 had already finished the construction and one was in the planning stage.

Constructing the house

3 respondents had chosen a model house of a house-building factory, 6 had chosen the option of a modified house of a house-building factory and 5 had decided to plan their house individually. 5 respondents had chosen to sign a contract with a construction company with a fixed price, 6 had decided to build the house using a subcontractor and 4 of the respondents had ended up building the house themselves.

The houses were designed for 3 people, on average, comprising an average living area of 163 square meters.

Electric floor heating was the most commonly chosen heating system, wood heating coming next and ground heat pumps and outdoor air heat pumps being the third favored ways. Four respondents had considered installing a solar heat collector.

Two-thirds of the respondents thought that well-insulated, air-tight house, would provide better indoor conditions.

Swedish respondents appeared to be considerably environmentally aware when choosing building materials and heating and ventilation systems: most of the respondents thought that choosing low-energy or energy-labeled products is very important in all these areas. A well-known brand, good quality and the aesthetics were considered as the next important criteria.

Environmental awareness and information

The awareness about the passive, low (mini)-energy and plus-energy house concepts was surprisingly low, and most of the respondents had not heard or did not know much about them. Almost all respondents also thought that it was difficult to find information related to low-energy houses.

Almost half of the respondents had seen advertisement related to low-energy construction and a couple of respondents also had chosen to build one.
Figure 19. Important factors when deciding about a construction project in Sweden
Preferences of builders
Swedish respondents were not interested in paying a premium for a low-energy house; only five were willing to pay less than 10% more and only 2 people willing to pay more than a 20% premium.

More than two-thirds of the respondents considered the energy performance certificate as useful and two-thirds had already acquired one.

Many of the respondents thought that living in an energy-efficient building is a good way to prepare for increases in energy prices, and many respondents also stated that they are considering energy-efficient construction as a realistic option.

When asking about the criteria related to choosing a construction project, the aesthetics of the house, the living area, indoor air quality and low running, maintenance costs were given most importance to. Almost two-thirds of the respondents also gave large importance to the low energy use and the good image of the area (see figure 20).

Also when defining the factors affecting the resale value of a house, the aesthetics value and comfort, good image of the area, a suitable living area and low energy consumption were given most importance to.

Results of the expert survey

20 construction field experts responded to the questionnaire, most of whom were public authorities, private contractors, designers or researchers.

Four fifths of the respondents thought that the energy demand had decreased moderately or slightly during the past 10 years while most respondents estimated that the electricity demand had increased or stayed constant.

The state of the low-energy construction market

Four-fifths estimated that of detached and semi-detached houses built in 2009, 0-10 per cent were very low-energy houses, and the same applies for attached houses and blocks of flats. The amount of low-energy construction was considered to have been increasing moderately or slightly during the past five years by three fourth of the respondents. 9 out of 20 respondents had personally been involved in a low-energy house construction project.

More than half of the respondents though that some (or all) construction companies already were informing about low-energy houses while only a couple respondents thought that they did not. 19 out of 20 respondents believed that required expertise would be possible to find in the country if needed and also that required products were available in the market (although a customer might need to know exactly where to look for them). Almost all respondents also expected that companies would increase their supply of low-energy products in the near future with 10-30%.

Half of the respondents were aware about financial support programs available for energy efficient buildings in Sweden but no one thought that information about them is easy to find.

Most of the respondents also thought that information about low-energy construction is not very easy to find in general, although only one respondent thought that this kind of information is not possible to access.
Four-fifths of the respondents estimated that the additional cost of constructing low-energy buildings would be 0-15% more compared to the cost of a traditional one.

Promoting low-energy construction

Almost all respondents thought that low-energy construction already is a marketing trend in Sweden and this trend was expected to continue to a large extent with low-energy construction becoming more general and also more valuable.

About financial mechanisms, almost half of the respondents considered tax reductions as the most important means, while other suggested mechanisms were for example grants and tenders. The possibility of public authorities to promote low-energy construction by demanding them was seen as an important means as well by most of the respondents (see figure 21 for more details). On the other hand, respondents thought that low-energy construction becoming more general should happen market-led.

More than four fifth considered working on low-energy buildings to be important for the company image, and approximately three fourth also thought that more demonstration projects are needed in order to promote low-energy houses.
Figure 20. Drivers for market penetration of low-energy buildings in Sweden
5 DISCUSSION

5.1 Denmark

As noted in NorthPass report "Country-specific market analysis, success factors, marketing approach and market situation”, the path towards increasing low-energy construction in Denmark is already clear. Regulations have been introduced and they are revised every five years and therefore it is useless to construct other buildings than those which are filling the tight energy-efficiency requirements. The question is related to how, and with the help of which mechanisms, this anticipated development should be obtained.

Because of the very low number of respondents, reliable conclusions about builders’ preferences are difficult to be drawn. However, according to the respondents and also findings in "Country-specific market analysis, success factors, marketing approach and market situation” it seems that environmental awareness among the Danish is considerably high. Quite a few builders were familiar with different low-energy house concepts and were planning to build one, and many were also willing to pay extra (up to 10 or even 20%) for a low-energy house.

The survey directed to real estate experts also gives some valuable information about the market situation of low-energy houses in Denmark. The experts estimated that approximately 10% of houses built in 2009 were low-energy houses and they also forecasted that the amount of low-energy construction would increase with a 5-10% rate per year.

The experts assessed the situation of low-energy construction to be considerably good with sufficient amount of expertise, services and products available in the market. However, they also thought that information might not always be easy to access and surprisingly few were aware of financial programs for low-energy construction available in the country. As noted also in "Country-specific market analysis, success factors, marketing approach and market situation”, there apparently exists a problem with disseminating information and coordination of knowledge which needs to be addressed.

The experts are well aware about the opportunities that low-energy construction can provide: companies might use it as a positive marketing argument and owners could benefit in the form of increasing property value. When assessing the drivers that would help low-energy houses entering the market, demand for low-energy construction and National Regulations and authorities favouring low-energy construction were suggested as the most important ones.

In Denmark the state has taken a considerably active role in promoting very low-energy construction and this is highly supported by the real estate experts. Almost 80% of the respondents were in favour of the idea of the state being a forerunner in promoting low-energy through public procurement. Nevertheless, almost all respondents also believed that energy-efficient construction would increase without obligations by law.

According to the builder and expert surveys, and "Country-specific market analysis, success factors, marketing approach and market situation”, the market for sustainable construction looks promising. The market penetration of low-energy buildings can be facilitated by activities by the state but changes are expected to take place also market-led without obligation by law. The level of know-how and availability of information are relatively high although improvements in the dissemination of information and cooperation between different actors are needed.
5.2 Estonia

Despite high energy prices and a few attempts by the government to promote energy efficiency in buildings the interest in energy conservation still remains low. As noted in "Country-specific market analysis, success factors, marketing approach and market situation", high prices and lack of information about the benefits of low-energy buildings still constitute a major barrier for the growing energy efficiency in residential buildings. Most of the builders who responded to the questionnaire thought that information about low-energy construction was fairly difficult to find and that finding required components, material and technology was clearly the most difficult issue. Also half of the experts had experienced that sufficient information was difficult to find and they were not aware of financial support programs available for energy efficient buildings.

According to the builder survey, interest in low-energy construction does not seem to be at a fairly low level as stated in "Country-specific market analysis, success factors, marketing approach and market situation". The respondents were very interested in low energy use when choosing building materials and heating and ventilation systems. Many builders were familiar with different low-energy house concepts and were also willing to pay an additional fee for constructing a low-energy house (although less than 20% more than the cost of a standard house). The experts, on the other hand, estimated that the investment cost of low-energy construction would be 10-20% higher than the investment cost of a traditional building and therefore the supply should be able to meet the demand at a suitable price.

So far, only one low-energy building has been constructed in Estonia and hence, the real estate experts seem to believe that the low-energy construction is in a better state than it actually is (estimating low-energy buildings to constitute 10% of all buildings built in 2009). Most of the experts in the survey also agreed on that more demonstration projects are needed in order to promote low-energy construction.

Even if, as presented in "Country-specific market analysis, success factors, marketing approach and market situation", designers and engineers are considerably old fashioned in Estonia and not willing to learn about new technologies, it still seems that low-energy houses have entered the market to some extent. About three-quarters of the experts who responded to the questionnaire stated that low-energy construction is a positive marketing argument in Estonia, and almost all builders had already seen advertisements related to energy efficient construction. Almost all experts believed that the required products and expertise for constructing low-energy houses are available to a sufficient extent in the Estonian market and most experts also believed that working on energy efficient construction is extremely important for the company image or for company strategy in the future.

In Estonia, some actions have been implemented by the state in order to promote low-energy construction, and state is also trying to serve as an example itself with energy saving procedures. Experts who responded to the questionnaire seemed to be in favour of this, thinking that the demand for low-energy buildings can be increased by public procurement. However, no respondents found the obligatory law necessary for developing the market for low-energy construction. Demand for low-energy construction, availability of financing and the wide availability of technology were also suggested as important drivers in order to help the market penetration of low-energy buildings.

It seems difficult to depict the current state of low-energy construction market in Estonia as the level of knowledge about low-energy construction seems to be very uneven. It seems that products, information and financing possibilities are available to some extent but that they are
difficult to find. On the other hand, house builders seem to be fairly aware of energy efficiency issues and different actors seem to have understood the benefits of low-energy construction. A large problem in Estonia is related to the fact that old blocks of flats from the Soviet-era constitute a very large share of the building stock and therefore favoring low-energy detached and semi-detached houses does not solve the entire problem. Larger projects need to be implemented in order to enhance the energy efficiency in these old buildings, which are in poor condition, and bring about real improvements.

5.3 Finland

The market situation for low-energy buildings in Finland seems to be fairly good: According to the expert survey, almost 30% of the detached and semi-detached houses built in 2009 were very low-energy houses and this number was estimated to increase clearly in the future. Large construction companies such as YIT and VVO have already committed to carry out all new construction projects according to low-energy requirements, and there are legal obligations in order to improve the energy efficiency of buildings.

As stated also in "Country-specific market analysis, success factors, marketing approach and market situation", the level of environmental awareness in Finland is considerably high. Also the awareness of low-energy house concepts was fairly good among Finnish builders; almost all respondents had heard about different low-energy house concepts and almost half of the respondents considered energy-efficient construction as a realistic alternative. Almost half of the respondents had also considered some on-site renewable energy source and as much as 88% of the builders responding to the questionnaire had a house with an energy performance certificate.

Roughly three-quarters of the builders were willing to spend 5-10% extra for constructing a low-energy house. According to the expert survey the additional investment costs for constructing a passive house is only 5-10% and therefore there should not be a problem with the supply and demand meeting at a feasible price.

As noted in "Country-specific market analysis, success factors, marketing approach and market situation", a major barrier for implementing better energy efficiency in buildings is the scattered field of expertise and information. For an individual constructor it is difficult to obtain information about the building materials and techniques related to passive house buildings. This is slightly contradictory to the builder survey as most of the respondents had experienced that information about the physical characteristics and the designing and building process of a low energy house were available. Also according to the expert survey the needed expertise and low-energy construction products are available in the market but that they might be difficult to find.

The benefits of low-energy construction are becoming more clear and almost all Finnish experts considered low-energy construction to be positive marketing argument. 85% of the respondents were convinced that working on energy efficient buildings would be important for the company image. About 80% of the house builders had seen advertisements related to energy efficient construction.

Several low-energy houses have been constructed and information about them is disseminated through different channels (for example the Finnish Housing Fair) but more demonstration projects are still needed, according to most experts. The state supports energy efficiency improvements, low-CO$_2$ investments and the use of renewable sources in residential buildings by several means. It is perhaps surprising that still more than half of the real estate experts
who responded to the survey were not aware of any financial support by the state. More than half of the responded experts believe that tax deductions could help in covering the additional costs.

Information campaigns have been launched in order to increase the awareness of people. Two-thirds of the experts saw that the demand of low energy buildings by public authorities can be an important driver in moving the construction towards higher energy efficiency. Nevertheless, most of the respondents did not see the obligatory law necessary for the development of low-energy construction market but they thought that changes would take place anyhow.

Overall, the low-energy housing market looks fairly good in Finland with both individual builders as well as different actors in the construction fields sharing an interest in it. The problems related to dissemination of information and the dispersity of expertise have been noticed and solutions are tried to be found.

5.4 Latvia

As stated in "Country-specific market analysis, success factors, marketing approach and market situation", sustainable lifestyles are increasingly appreciated in Latvia and an interest in low-energy construction clearly exists among individual buyers/builders and real estate professionals. This trend could also be seen in the surveys of this study. Considering renewable energy sources as an alternative was very popular among the builders who responded to the questionnaire as more than half of them had considered introducing solar heat collectors or photovoltaic systems. Many respondents also stated that they consider energy-efficient construction as a realistic alternative and low energy consumption and low price were considered to be the most important criteria when choosing building materials for the house.

Despite the increasing interest, the experts do not estimate the market situation for low-energy houses to be very good: according to the experts, only 0-5% of newly constructed detached, semi-detached, attached houses or blocks of flats were very low-energy houses. The additional cost of building a low-energy house was estimated to be 10-20% higher than that of a traditional building. This might be problematic as most of the respondents were not willing to pay greater additional investment cost than 15% for a low-energy house.

Even if the individual builders seemed to be fairly interested in sustainable construction, awareness about different low-energy house concepts was still considerably low among Latvian builders. Also, implementing low-energy measures seemed to be difficult and many respondents had experienced that especially finding skilled workers was the most difficult issue related to low-energy construction. Only few house builders had seen advertisements about energy efficient construction.

Also in "Country-specific market analysis, success factors, marketing approach and market situation" it was noted that several components and solutions required when constructing a low-energy building (such as good windows, high efficiency recuperation systems and good doors) do not exist or are hard to find in the Latvian market. Nevertheless, the situation does not seem as bad according to the expert survey as the experts thought that products for low-energy constructions are available in the market but that it might be necessary to know where to look for them. Most experts were also convinced that they could find required expertise and services for low-energy construction if needed and they were all also aware about financing programs in Latvia.
The belief in the higher value of a low-energy house compared to a standard one seemed to be high: half of the respondents estimated that low-energy buildings will hold a green premium in the future. Also, almost all respondents thought that working on energy efficiency would be important for the company image. Nevertheless, only half of the experts thought that low-energy construction already is a marketing trend in Latvia.

Only few very low-energy buildings have been constructed in Latvia so far and also profound studies about these project are missing. This seems to be a problem also considering that all experts thought that there should be more low-energy building demonstration projects in order to promote energy efficiency in buildings. Also, the role of public authorities demanding low-energy buildings was considered as important by almost all respondents.

The implementation of the EPBD started only in 2009 and today the energy performance certificate of a building is necessary when the building is being sold or rented. Also the new construction law does include requirements about energy efficiency. These changes will undoubtedly lead into enhanced energy efficiency of buildings but all experts agreed on that low-energy construction will be a growing trend, at least to some extent, also without the obligation by law. Subsidies (7/8 respondents) was suggested to be the most popular mechanism to support low-energy construction.

Even if there does exist a clear interest in low-energy construction among individual house builders in Latvia, a large problem relates to the existing housing stock, most of which (71%) was built in the period of 1945-1990. These buildings are in need of large refurbishment projects which will be expensive and time-consuming to carry out. On the other hand, high energy bills (heating accounts for 65-80% of the total energy consumption) also serve as an incentive for making energy efficient improvements. People in Latvia want better living conditions and better houses and these requirements are compatible with the features of low-energy buildings.

The number of individual builders who responded to the questionnaire was fairly low but some conclusions can still carefully be drawn: The high number of people who want to have an individually planned house and also build it themselves might lower the possibility to implement energy efficient solutions as the builders stated that information about low-energy construction was fairly difficult to find. Better low-energy building concepts and easy solutions would be important in order to increase the interest of people. A positive thing, as stated in "Country-specific market analysis, success factors, marketing approach and market situation", is that during a period of low activity, there is more time to learn and search for new market niches. Therefore the poor economic situation in the country might offer an excellent opportunity to introduce better low-energy products to the market.

5.5 Lithuania

The situation in Lithuania is very similar to the situation in Latvia. Most of the house builders had chosen an individually planned house and building the house themselves was a popular choice. In the future, construction of single-family houses will probably grow, the demand for semi-detached houses in the suburbs will increase and better living conditions will also be demanded. 66% of the population is living in blocks of flats constructed between 1960s and 1990s and these buildings are in a remarkable need for renovation.

The individual builders seem to hold an interest in sustainable construction: Some respondents had considered using on-site renewable energy sources, such as solar heat collectors or a photovoltaic system. When choosing building materials for the house, low
energy use and low price were considered as most important criteria. Also when deciding about a construction project low energy use, good indoor quality and the nice and suitable living area of the house were considered as most important criteria. Almost all respondents were considering an energy-efficient building as a realistic alternative and most were willing to pay an additional investment fee of 10 or 15%. Still, almost half of the builders had not seen advertisements about energy efficiency in houses and only a fifth had an energy performance certificate in their house.

So far, only few passive houses have been built in Lithuania. It seems that the real estate experts do not have a realistic picture about the situation as they estimated that 5-10% of new buildings constructed in 2009 were low-energy buildings. They also forecasted that the amount of low-energy construction projects is going to increase moderately and this might be more realistic.

As informed in "Country-specific market analysis, success factors, marketing approach and market situation", several measures have been introduced in order to promote low-energy construction in Lithuania. The EPBD was implemented in 2007 and 2009, and now, an energy performance certificate is mandatory for all new buildings and when the existing buildings are rented or sold. Different programs have been introduced to aid renovation projects. Several large projects have been planned and for example the Lithuanian Housing Strategy aims at renovating 70% of the multi-apartment buildings by 2020. Also disseminating information is an important objective, and several seminars, workshops and communication campaigns have been organised in order to increase the level of information among municipalities, specialists, professionals of the building sector and the general public.

Almost all experts believed that expertise, services and products are available for constructing a low-energy house. Two-thirds of the respondents thought that they have an easy access to sufficient information about low-energy construction. The builders, on the other hand, were sharing different views on how difficult it is to find information about low-energy construction but most of them agreed on that it is difficult to find information about the financial support and the potential savings or running costs of a low-energy building.

11 out of 12 respondents agreed on that low-energy construction already is a market trend in Lithuania and thought that it can be used as a positive marketing argument. More than half of the respondents also thought that working on energy efficient buildings could benefit the company image.

When choosing the most important drivers promoting low-energy construction, the experts gave most importance to national regulations and authorities favouring low-energy construction, demand for low-energy construction, wide availability of technology and availability of financing. Also, 11 out of 12 respondents thought that energy-efficient construction would increase slightly or moderately during the next 10 years also without changes in the law.

Nevertheless, as stated in "Country-specific market analysis, success factors, marketing approach and market situation", because there is a lack of data and a legal definition of the concept of low-energy buildings, Lithuanian citizens must turn to the experiences of other countries. It is evident that accessible information and knowledge as well as state support are needed to promote low-energy construction.

Because of the low number of responses conclusions about the market situation of low-energy construction is difficult to be made based on the surveys but some market trends can still be observed. Individual builders already seem to be interested in low-energy construction to some extent although the level of knowledge does not seem to be as high as in some other countries. Belief in low-energy construction seems to be even higher among real estate experts. It is also possible to forecast that energy efficient construction will increase in the
future because of the growing interest as well as the measures implemented by the state and obligations by law.

5.6 Norway

As stated in "Country-specific market analysis, success factors, marketing approach and market situation", environmental awareness among Norwegian people is considerably high. According to a study conducted by the Norwegian association of housing suppliers\(^1\), 30\% of the housing buyers chose energy-efficiency measures which exceeded the conventional standard. This is surprising when contemplating the results of the questionnaires; according to the survey, Norwegian individual builders did not seem to be remarkably interested in low-energy construction. Half of the respondents did not have much belief in good insulation and airtightness regarding the indoor conditions of a house, and when choosing building products, low energy use was chosen only as the fifth most important factor. According to the survey, Norwegian builders were on average fairly unfamiliar with different low-energy house concept and only few had chosen to build a low-energy house. Only very few respondents did have an energy performance certificate and two-thirds were not willing to pay any additional investment cost. Most (9/11) respondents had seen advertisements related to energy efficient buildings but did not think that they were credible.

Even if these results imply that the market situation for low-energy houses would be considerably bad, the unofficial estimations about the amount of low-energy houses (10\% of new buildings) are more promising. Also the real experts who answered this survey estimated that approximately 5-10\% of the newly built houses were low-energy buildings, and they also predicted that the amount of low-energy construction would increase clearly or moderately in the foreseeable future.

The government has tried to encourage low-energy construction by providing financial aid from different sources. Measures implemented by the Norwegian Government, for example the requirement of energy labelling, have also had a considerably large impact on promotion of energy efficient construction. Pilot building programs have also had an important input in disseminating information about low-energy buildings although almost all experts agreed on that more low-energy house demonstration projects are still needed.

The experiences of individual builders seem to differ from the experiences of the real estate experts’ experiences to some extent. The builder survey implies that it would be considerably difficult to find information about low-energy construction whereas almost all experts estimated that they have access to information to a sufficient extent although two-thirds thought that this information might be difficult to find. Four fifth of the experts also had experienced that some Norwegian construction companies were offering low-energy houses and most of them were also aware about financial support programs available in Norway.

Four fifths of the experts thought that low-energy construction already was a marketing trend in Norway and 72\% also thought that working on energy efficient buildings would definitely be useful for the company image. Nevertheless, all respondents did not think that low-energy houses have a green premium.

The role of public authority was considered as very important as the state could promote low-energy construction with its own procurement. Nevertheless, most real estate experts also

\(^1\) http://www.boligprodusentene.no.
thought that development towards low-energy construction would take place without obligations by law.

The results of this study seem fairly surprising regarding the long tradition of high environmental awareness of Norwegian people. The low interest in and knowledge of low-energy construction, can probably be explained by the low number of builders responding to the questionnaire, who did not constitute a representative sample. Some differences can also be noticed between the attitudes of individual builders and real estate experts which strengthens the perception about distorted results. It can be suggested that, as stated in "Country-specific market analysis, success factors, marketing approach and market situation", the development of low-energy construction market in Norway would be very similar to other Nordic countries with similar kind of political, social and economic environment.

5.7 Poland

A remarkable feature of the Polish housing market is that there is a large lack of supply. The housing stock in Poland is relatively young but the quality of construction is fairly poor. There is also a large amount of concrete-made buildings built during the communist era, and these buildings will need to be refurbished or replaced. Large improvements in energy-efficiency of these buildings have taken place since 1996, and the improvements have been remarkable especially since 2000.

Surprisingly many builders had considered using some on-site renewable energy source, mostly solar heat collectors and also solar and wind electricity. Interest in energy efficiency seems to be high also when choosing building materials; low energy use, low price and a well-known brand were considered to be the most important factors. Many of the respondents had heard about different low-energy house concepts, although only few considered energy efficient construction as a realistic alternative. Some thought that there is much information available about low-energy construction although most builders though that this information is fairly difficult to find. Only half of the respondents had seen advertisements related to energy efficient construction and only one fourth of the builders had an energy performance certificate in their house.

Similar perceptions about low-energy construction seemed to exist also among real estate experts. They estimated that, on average, 10-15% of the newly built buildings were very low-energy houses. As much as 90% of the experts thought that construction companies are marketing low-energy houses although most noted that information might be difficult to find. This same applies for the required expertise, services and products; the experts estimated that they are available in the market but it might be difficult to find them. It was presented also in "Country-specific market analysis, success factors, marketing approach and market situation" that the required technologies and products do exist in the market to a large extent. There are also companies specialized in designing and constructing low-energy and very low-energy buildings as well as energy consultants who can help in transforming a standard building to a more energy efficient one.

More than half of the experts were aware of financial support programs available for energy efficient construction in Poland. Most of the experts estimated that the costs of constructing a low-energy house would be 10-20% higher than the costs of a traditional building. This might be problematic as the builder survey revealed that the individual builders are not interested to pay high amounts in order to build an energy efficient building, to a large extent.
Unfortunately so far no government programs have been introduced to promote the construction of energy-efficient buildings. However, Lipincy Domy serves as an excellent example as a company specialised in passive and energy-efficient construction. It constructed a low-energy house to demonstrate the benefits of this type of construction and showed that market penetration can also take place without activities by the state.

In Poland, almost all respondents considered low-energy construction as a positive marketing argument and almost all respondents also expected low energy houses to have a green premium. Most respondents did not see the obligations by law necessary in order to speed up the increase of low-energy construction although four fifth of the experts believed that the demand of low energy buildings by public authorities can be an important driver in promoting low-energy construction.

According to the two surveys as well as the results of "Country-specific market analysis, success factors, marketing approach and market situation", the situation in Poland seems to be to a large extent similar to the situation in the Baltic states. In all these countries the old blocks of flats are in need of renovation. Even if individual builders seem to be increasingly interested in energy efficient solutions and the market penetration of low-energy single family houses is already on its way, also larger projects are needed in order to obtain development on a national level. Despite some similarities with the Baltic states, in Poland, the situation is slightly different because in Poland the state has not taken an active role. Therefore the pressure to convert construction towards improved energy efficiency is mainly on private companies.

### 5.8 Sweden

As informed in "Country-specific market analysis, success factors, marketing approach and market situation", Sweden has a long tradition in environmental awareness, although differences in the environmental awareness exist between income groups, housing forms and generations. In 2009 there were around 400 passive houses in Sweden and the number has continued to grow. Passive houses are mainly owned by the municipalities but also private owners hold an increasing interest in energy-efficient solutions. Also the fact that blocks of flats are usually owned by large private owners makes it easier to carry out extensive renovation projects in order to improve energy efficiency in these buildings.

As in other Nordic countries, also in Sweden, the state has taken a very active role in moving construction towards a more energy efficient direction. Several policy measures have been introduced in order to improve energy efficiency of buildings and for example the biggest step towards implementing EPBD was taken in 2006. An information and communication campaign been launched by the state, which tries to improve the level of knowledge of the general public and owners of single family houses as well as real estate agencies and housing companies. Also the passive house centre in Ålingsås has tried to provide information from one source and, thereby, facilitate the implementation of energy efficient measures. Good low-energy building examples already exist in Sweden and therefore it is surprising that approximately three-quarters of the experts thought that more demonstration projects are needed.

Most Swedish respondents appeared to be considerably environmentally aware when choosing building materials and heating and ventilation systems and they thought that choosing low-energy or energy-labeled products is very important. On the other hand, the awareness about the passive house and low-energy house concepts was surprisingly low and Swedish respondents were also not interested in paying a premium for a low-energy house.

24/11/2011
However, as much as two-thirds had already acquired an energy performance certificate. Maybe surprisingly, less than half of the respondents had seen advertisement related to low-energy construction.

Real estate experts who responded to the questionnaire seemed to be slightly more optimistic about the state of the low-energy construction market. Almost all experts thought that low-energy construction already is a marketing trend and they believed that working on low-energy buildings would be important for the company image. More than half of the respondents though that some (or all) construction companies already were informing about low-energy houses and almost all respondents believed that required expertise and products would be possible to find in the country if needed. However, most respondents also thought that information about low-energy construction is not very easy to find and only half of the respondents were aware about financial support programs available for energy efficient buildings.

When considering financial mechanisms, almost half of the respondents thought that tax reductions are the most important means, but also grants and tenders were suggested as suitable mechanisms. The possibility of public authorities to increase the demand of low-energy buildings through public procurement was seen as an important means but some respondents also thought that low-energy construction should become standard also without the involvement of the public sector.

The results of the surveys and the information provided in "Country-specific market analysis, success factors, marketing approach and market situation" seem to differ from each other to some extent, probably because of the low number of people responding to the questionnaire. Even if the builder survey suggests that there is only a low interest in low-energy construction, measures taken by the state show that development towards more energy efficient construction is already taking place.
6 CONCLUSION

It is surprising how similar the results of the two surveys directed to individual builders and real estate experts were in all the eight countries. Regardless of the market situation of low-energy houses in each country, the interest of builders seem to be fairly similar across northern Europe. This study does not even reveal any major differences between the Nordic countries, in which people are traditionally considered as highly aware of environmental issues, and other countries of the study, in which low-energy construction has not yet achieved a similar stage. No remarkable differences can be perceived neither between the builders’ attitudes nor the experts’ perceptions in different countries.

According to the survey, there seems to exist a considerably strong interest in low-energy construction among individual builders in most of the eight countries. In general, the individual house builders were interested in the opportunity to construct a house according to low-energy standards, even if extensive measures might not have been implemented yet. In most countries, respondents were also slightly interested in the energy performance certificate and believed that it would be useful, although differences remain. For example in Finland, surprisingly many of the respondents already did have an energy performance certificate in their houses whereas, in some other countries, the certificate had not obtained similar popularity yet (see figure 21).

![Figure 21. Popularity of the energy performance certificate.](image)

Many of the respondents in all countries stated that they would be willing to pay an extra investment cost for low-energy buildings but in many cases the amount was not remarkably high and it might not reach the actual extra investment costs estimated by the experts (see figure 22). Differences between the availability of information among the eight countries do exist, to certain extent, but in most countries the individual builders had experienced that information, products and services regarding low-energy construction do exist but that they might be difficult to find. In many countries more demonstration projects are wanted and
according to a previous study the demonstration projects need to be impartially and reliably performance monitored, documented and evaluated.

Figure 22. Willingness to pay extra in order to build a low-energy house.

Also the real estate experts were somewhat optimistic about the situation of low-energy building market in their countries. According to the survey it seems that products and services as well as information are available to a certain extent, but that this information might be difficult to access.

Figure 23. Do companies inform about/ provide low-energy houses?

The future trend for low-energy construction seems clear: there is a strong belief in the increase of low-energy construction among the experts, and most of the respondents also
foresaw that low-energy buildings will be more valuable in the future. The experts did share different views on how to reach this development regarding different financial measures, for example. However, in most countries the experts strongly favoured measures by the authorities although the respondents also believed that the development towards enhanced energy efficiency in construction would take place also without obligations by law.

It is possible that in some countries, the low number of people responding to the questionnaire distorted the results to some extent. The number of respondents varied a lot across countries and therefore it is not possible to draw many trustworthy conclusions of these responds. Also, some of the results of this study are not compatible with the information presented in "Country-specific market analysis, success factors, marketing approach and market situation" and this fact might increase doubts about the validity of the surveys. However, some trends are still possible to be outlined from the surveys, which can help to evaluate the current situation as well as predict future development of low-energy construction.
7 APPENDIXES

7.1 Questionnaire for the individual builders

QUESTIONNAIRE FOR PRIVATE INDIVIDUALS BUILDING A SINGLE FAMILY HOUSE

Please answer the following questions. This questionnaire is intended for surveying opinions and views of private individuals building a single family house in North European countries. The results will be used in IEE NorthPass-project, which aims at promoting the very low-energy house concept to the North European building market. Please see information about the project at www.northpass.eu

If you are still planning your house, please choose the most likely alternative at this moment. If you are already building the house, you can answer according to the choices you have made.

For your information: Low-energy construction means building houses which use less energy than traditionally constructed houses, in example … Here will be the national, country-specific terms used for very low-energy houses from D2.

1. Please tell the phase of your building process, circle the alternative that best describes your situation:
   a) we are still planning
   b) the plans are ready
   c) we are building the house
   d) we have built a house, it was completed year ____________

2. How is your house designed?
   a) it is a standard house of a house-building factory
   b) it is a modified standard house of a house-building factory
   c) our house has been individually planned

3. What is the size of the house you are planning / building / have built, and how many persons it is it designed for?
   The living area is _______ m²
   The amount of inhabitants is ___ persons.
4. The outer wall structure is mainly

a) wood frame (other than log)   e) block (cellular concrete or expanded clay)

b) log                            f) steel structure

c) concrete                        g) other, please specify _________________________

d) brick                            h) I am not sure / I do not know

5. Which construction alternatives have you planned and which will you probably choose? *(This question can be modified in each country to represent typical national solutions)*. Please tick the alternatives to the table.

<table>
<thead>
<tr>
<th></th>
<th>I consider or I have considered</th>
<th>I'll choose or I have chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Turnkey construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) I will have the house built with subcontracts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) I will mainly build the house myself</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Why have you chosen this alternative?

____________________________________________________________________________________

6. Which heating energy source will you choose / have chosen and which heating energy sources have you considered? If you have considered several heating energy sources, or have chosen a combination of different heating energy sources, please tick all the alternatives you have considered or chosen. Please put your chosen heating energy sources in the order of importance: the primary heating energy source is 1, the secondary heating energy source is 2, etc. *(This question can be modified according to each country)*

<table>
<thead>
<tr>
<th>Heating energy source</th>
<th>I'm considering / have considered</th>
<th>Will choose / have chosen</th>
<th>Order of importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood heating (including wood chips, wood pellets)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical heating:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>direct electrical heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>indirect electrical heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ground heat pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>outdoor air heat pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>exhaust air heat pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar heating</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Gas heating:
- conventional boiler
- condensing boiler
- Combined heat and power / CHP
- Other, please specify

Why have you chosen this/these heating energy source(s)?

________________________________________________________________

7. Which heat distribution system will you choose / have chosen and which heat distribution systems have you considered? If you have considered several heat distribution systems, please tick all the considered alternatives. Please put your chosen heat distribution systems in the order of importance: the primary heat distribution system is 1, the secondary heat distribution system is 2, etc.

<table>
<thead>
<tr>
<th>Heat distribution system</th>
<th>I'm considering / have considered</th>
<th>Will choose / have chosen</th>
<th>Order of importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water-circulated radiators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water-circulated floor heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric heaters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric ceiling heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric floor heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fireplace heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other, please specify?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Why have you chosen this/these heat distribution system(s)?

________________________________________________________________

8. Which on site renewable energy sources have you considered?

- a) wind electricity
- b) solar electricity (photovoltaic system)
- c) solar heat collector
- d) bio gas
- e) other, please specify ___________________
- f) none
9. Which ventilation system will you choose / have chosen?
   a) natural ventilation
   b) mechanical exhaust ventilation
   c) mechanical exhaust and supply ventilation
   d) mechanical exhaust and supply ventilation with heat recovery
   e) other, please specify ______________________________________
   f) I do not know / I am not sure

10. Do you believe, that indoor conditions are better in a well insulated, airtight house?
   a) no, they are worse than in a traditional house
   b) they are same than in a traditional house
   c) they are slightly better than in a traditional house
   d) they are clearly better than in a traditional house
   e) I don’t know

11. Please circle the importance of following selection criteria when you are choosing / have chosen building materials, heating systems and ventilation systems?

<table>
<thead>
<tr>
<th></th>
<th>10 A BUILDING MATERIALS</th>
<th>10 B HEATING SYSTEMS</th>
<th>10 C VENTILATION SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-known brand</td>
<td>Very important: 5</td>
<td>Quite important: 4</td>
<td>Can't say: 3</td>
</tr>
<tr>
<td></td>
<td>Slightly important: 2</td>
<td>Not important: 1</td>
<td></td>
</tr>
<tr>
<td>Good quality</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Local/national product</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Warranty</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Low energy use</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Environmentally friendly</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Energy-labelled</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Eco-labelled</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Low price</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Easy installation</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Easy maintenance</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Good looking</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
<tr>
<td>Own experience</td>
<td></td>
<td>Preferred: 5</td>
<td></td>
</tr>
</tbody>
</table>
12. Please fill in the table about low-energy house types

<table>
<thead>
<tr>
<th>Country-specific low-energy building solution, e.g. low-energy house</th>
<th>I have never heard about it</th>
<th>I have a little information about it</th>
<th>I know what it is, but I’m not interested in building one</th>
<th>I know what it is, and I have considered it but decided not to build it</th>
<th>I will build this type of house</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country-specific low-energy building solution, e.g. passive house or very low-energy house</td>
<td></td>
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<tr>
<td>Zero-energy house</td>
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<tr>
<td>Energy positive house</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

13. Have you received information about the following factors concerning low-energy houses?

<table>
<thead>
<tr>
<th>Physical characteristics of a low energy house</th>
<th>Only when I asked for it</th>
<th>It was difficult and time-consuming to find information</th>
</tr>
</thead>
<tbody>
<tr>
<td>The designing and building process of a low energy house</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The financial support available for low energy solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The additional upfront investment needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The potential savings on running costs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14. According to your experience, how easy is dealing with the following factors when doing low-energy construction:

<table>
<thead>
<tr>
<th>Easy</th>
<th>Requires some effort</th>
<th>Difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Finding skilled designers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b Finding skilled workers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c Finding necessary components, materials and technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d Finding information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e Dealing with sellers attitudes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f Dealing with investment costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g Achieving real savings in energy costs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. Have you seen advertising, where houses have been marketed especially based on their energy-efficiency?
   a) No
   b) Yes, but they are not credible
   c) Yes, but I’m not interested
   d) Yes, and I will choose one
   e) Yes, and I would choose one if I were interested about standard houses

16. Please answer following statements concerning energy-efficient construction.

<table>
<thead>
<tr>
<th>Statement</th>
<th>I totally agree</th>
<th>I quite agree</th>
<th>I can not say</th>
<th>I quite disagree</th>
<th>I totally disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is a big variety of existing standard house package solutions available</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>An energy-efficient house does not look different or have visibly different features than a traditional house</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>I consider energy-efficient construction as a realistic alternative</td>
<td></td>
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<tr>
<td>Energy-efficient construction is environmentalistic daydreaming</td>
<td></td>
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<td></td>
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<tr>
<td>There is not enough information available about energy-efficiency of buildings</td>
<td></td>
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<tr>
<td>Energy-efficient buildings should be marked with an “environmentally friendly” label</td>
<td></td>
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<tr>
<td>Energy-efficient house is more ecological than a traditional house</td>
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<tr>
<td>It is possible to halve the heating demand of a house with a small additional investment (less than 5% of investment costs)</td>
<td></td>
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<tr>
<td>Energy-efficient houses have a good reputation</td>
<td></td>
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<tr>
<td>Energy-efficient construction is needed for the prevention of climate change</td>
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<tr>
<td>Energy-efficient house has a better indoor environment</td>
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<tr>
<td>Living in an energy-efficient house is a good way to be prepared to increases in energy prices</td>
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</tr>
</tbody>
</table>
17. Which of the following factors have importance in decision of a construction project and choice of the building type? Please tick also, how much importance this factor has to you. Tick the final column if this factor will be/is fulfilled in your house. All rows will have 1-2 tick marks.

<table>
<thead>
<tr>
<th>Importance in decision of a construction project:</th>
<th>Great importance</th>
<th>Some importance</th>
<th>No importance</th>
<th>My house has this feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The area has a good image</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>b. Good public transport connections</td>
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<td></td>
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<tr>
<td>c. Good transport connections</td>
<td></td>
<td></td>
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<tr>
<td>d. Necessary services are nearby</td>
<td></td>
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<tr>
<td>e. The site is well suitable for construction</td>
<td></td>
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<tr>
<td>f. The permitted building volume of the site is sufficient</td>
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<tr>
<td>g. Low construction costs</td>
<td></td>
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<tr>
<td>h. The house is easy to design</td>
<td></td>
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<tr>
<td>i. The house is easy to build</td>
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<tr>
<td>j. The house has a suitable living area</td>
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<tr>
<td>k. The house is good-looking</td>
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<tr>
<td>l. The house has good durability</td>
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<tr>
<td>m. House is built with ecological building materials</td>
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<tr>
<td>n. House is safe to use (easy stairs, easy to remove snow from the roof, etc.)</td>
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<tr>
<td>o. Fire-safety</td>
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<tr>
<td>p. Break-in safety</td>
<td></td>
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<tr>
<td>q. The house is comfortable</td>
<td></td>
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<td></td>
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<tr>
<td>r. Low running, maintenance and repair costs</td>
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<tr>
<td>s. Low energy use</td>
<td></td>
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<tr>
<td>t. Easy maintenance of heating and ventilation systems</td>
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<tr>
<td>u. The premises satisfy well the individual needs</td>
<td></td>
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<tr>
<td>v. The house in convertible to changing demands (e.g. a new baby, children leaving home)</td>
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<tr>
<td>x. The house is suitable for remote work</td>
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<tr>
<td>y. The indoor air has a good quality</td>
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<tr>
<td>z. The rooms are soundproof</td>
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<tr>
<td>à. Available tax breaks, subsidies, etc.</td>
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</tr>
</tbody>
</table>
18. Which of the following factors have importance to the future resale value of the house? Please tick the alternative, which best suits your opinion.

<table>
<thead>
<tr>
<th>Importance on resale value:</th>
<th>Great positive influence</th>
<th>Small positive influence</th>
<th>No influence</th>
<th>Negative influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>a  The area has a good image</td>
<td></td>
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<td>m  Fire-safety</td>
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<td>n  Break-in safety</td>
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<td>o  The house is comfortable</td>
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<tr>
<td>p  Low running, maintenance and repair costs</td>
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<tr>
<td>q  Low energy use</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>r  Easy maintenance of heating and ventilation systems</td>
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<td></td>
<td></td>
<td></td>
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<td>s  The premises satisfy well the individual needs</td>
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<td>t  The house in convertible to changing demands (e.g. a new baby, children leaving home)</td>
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<td>v  The indoor air has a good quality</td>
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</tr>
<tr>
<td>x  The rooms are soundproof</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>y  Available tax breaks, subsidies, etc.</td>
<td></td>
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</tbody>
</table>

Thank you for your answers!
7.2 Questionnaire for the experts

Please answer the following questions. This questionnaire is intended for surveying opinions and views of construction experts in North European countries. The results will be used in IEE NorthPass-project, which aims at promoting the very low-energy house concept to the North European building market. Please see information about the project at www.northpass.eu

Please answer the questions based on your best estimate, it is not necessary to look up specific information or numbers. You can safely fill out the questionnaire quickly without spending too much time on considering a single question.

For your information: Low-energy construction means building houses which use less energy than conventionally constructed houses, for example … Here will be the national, country-specific terms used for very low-energy houses

Please circle the alternative that best describes your view:

1. Which expert group do you represent?
   a) public authority
   b) private builder
   c) commercial real estate owner / real estate agent
   d) construction industry
   e) building product industry
   f) designer
      [ ] HVAC or automation designer
      [ ] RES system designer
      [ ] architect
      [ ] structural design
   g) national association
   h) European association
   i) project manager
   j) other, please specify: _______

2. How has the heating energy demand of newly erected buildings changed in your country during the last 10 years?
   a) Increased
   b) Stayed constant
   c) Decreased slightly (less than 10 %)
   d) Decreased moderately (10–30 %)
   e) Decreased clearly (over 30 %)
3. How has the electricity demand of newly erected buildings changed in your country during the last 10 years?
   a) Increased
   b) Stayed constant
   c) Decreased slightly (less than 10 %)
   d) Decreased moderately (10–30 %)
   e) Decreased clearly (over 30 %)

4. There were X dwellings built in (your country) year 2009. From these dwellings xx were in detached or semi-detached houses and yy in attached houses or blocks of flats (this data will be filled by VTT). According to your estimation, how many of these dwellings were built as very low-energy houses?

   Detached or semi-detached houses
   a) 0–5 %
   b) 5–10 %
   c) 10–20 %
   d) 20–50 %
   e) over 50 %

   Attached houses or blocks of flats
   a) 0–5 %
   b) 5–10 %
   c) 10–20 %
   d) 20–50 %
   e) over 50 %

5. How has the amount of low-energy construction projects developed during the last five years?
   a) Decreased
   b) Stayed constant
   c) Increased slightly (0–5 %/a)
   d) Increased moderately (5–10 %/a)
   e) Increased clearly (over 10 %/a)
6. How do you expect the amount of low-energy construction projects to develop in the foreseeable future?
   a) Decrease
   b) Stay constant
   c) Increase slightly (0–5 % in a yearly basis)
   d) Increase moderately (5–10 % in a yearly basis)
   e) Increase clearly (over 10 % in a yearly basis)

7. According to your experience, how have the low-energy construction projects in general succeeded in your country?
   a) they have succeeded better than traditional construction projects
   b) they have succeeded as well as traditional construction projects
   c) they have not succeeded as well as traditional construction projects

   Why?________________________________________________________________________________________________
   __________________________________________________________________________________________

8. Have you personally been involved in construction projects of very low-energy houses? If you have, in how many projects?
   a) I have not been involved
   b) Yes, amount of construction projects? ________
      have you faced specific problems in such projects? Please specify:
      ______________________________________________________________________________________
      ______________________________________________________________________________________

9. Is low-energy construction already a marketing trend in your country, meaning that it is often used as a positive marketing argument?
   a) Yes
   b) No

10. Do you expect low energy houses to have a green premium ("bonus") in the future and if so, how much more valuable you think a very energy efficient house will become in the next decade?
    a) no significant difference compared to traditional buildings
    b) 0 – 5 % more valuable
    c) 5 – 10 % more valuable
    d) > 10 % more valuable
11. Do you believe that the way of constructing regular buildings in your country will develop to a more energy-efficient direction during next 10 years, even if the concept of low-energy buildings does not become obligatory by law?
   a) No, not without the right legislative framework
   b) Yes, slightly (less than 10 % smaller space heating energy use than today)
   c) Yes, moderately (10–30 % smaller space heating energy use than today)
   d) Yes, clearly (over 30 % smaller space heating energy use than today)

In question 12 please answer either the questions for companies doing business in the construction sector or the questions for other actors, depending on which you represent.

**Companies:**

12a.1 Do you offer building products specifically for low-energy construction?
   a) Yes
   b) No

12a.2. Do you plan to increase your supply of building products for low-energy construction?
   a) Yes
   b) No

12a.3 Do you have the right expertise and knowledge to construct low energy buildings?
   a) Yes
   b) No

12a.4 Do you plan to recruit employees with specific knowledge in the field of low energy in the future?
   a) Yes
   b) No

**Other actors:**

12b.1 According to your experience, do construction companies in your country inform about and offer low-energy houses?
   a) no
   b) if they are asked for it
   c) some construction companies market low-energy houses
   d) almost all construction companies market low-energy houses

12b.2 In your country, are you able to obtain the expertise required / services needed to build such houses?
   a) Yes
   b) No
12b.3. Are there low-energy construction products available in the market for an independent builder (building for own use)?
   a) no
   b) yes, if you know where to look for them
   c) they are easily available

12b.4. How much do you believe that the companies will increase their supply of low-energy construction products in the near future?
   a) they will not increase the supply
   b) less than 10 %
   c) between 10 – 30 %
   d) between 30 - 50 %
   e) over 50 %

13. Is there enough information available about low-energy construction?
   a) no
   b) yes, if you know where to look for it
   c) it is easily available

14. Are you aware of financial support programmes (grants, tenders, subsidies) available for energy efficient buildings?
   a) no
   b) yes, but it is not easy to find information about them
   c) yes, and the information is easily available

15. Have you already considered buying/employing low energy construction products and, if not, what are the reasons that prevented you?
   a) yes, definitely
   b) maybe
   b) no, because ____________________________________________________

16. Do you think that working on energy efficient buildings will be important for the image of your company or for your company strategy in the future?
   a) yes, definitely
   b) maybe
   c) no
17. What is the typical investment cost of a traditional residential building in your country?

**Detached and semi-detached houses:** __________ € / net floor area

**Attached houses and blocks of flats:** __________ € / net floor area

18. Please estimate the investment cost of low-energy construction compared to the investment cost of traditional construction?

a) lower than traditional construction

b) same that traditional construction

c) 0-5% additional upfront investment costs

d) 5-10% additional upfront investment costs

e) 10-15% additional upfront investment costs

f) 15-20% additional upfront investment costs

g) over 20% additional upfront investment costs

19. Please fill in the table about low-energy construction products and services:

<table>
<thead>
<tr>
<th></th>
<th>more than 10% lower</th>
<th>5 - 10% lower</th>
<th>less than 5% lower</th>
<th>no change</th>
<th>less than 5% higher</th>
<th>5 - 10% higher</th>
<th>more than 10% higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>How has the cost of low-energy construction services / products changed during last 5 years?</td>
<td></td>
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<tr>
<td>How do you estimate the cost level of low-energy construction services / products to change in the future?</td>
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<tr>
<td>How much does the selling price of a very low-energy house/dwelling differ from the selling price of a traditional house/dwelling?</td>
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<tr>
<td>How do you estimate the selling price of a very low-energy house/dwelling to develop in the future when compared to a traditional house?</td>
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</tbody>
</table>
20. According to your experience, how important are following factors in driving the increasing market penetration of low-energy construction:

<table>
<thead>
<tr>
<th>Driver</th>
<th>Significant driver</th>
<th>Moderate driver</th>
<th>Not significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>The wide availability of technology</td>
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<tr>
<td>Demand for low-energy construction</td>
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<tr>
<td>Favourable attitudes</td>
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<tr>
<td>National Regulations and authorities favour low-energy construction</td>
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<tr>
<td>European legislation and institutions …</td>
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<tr>
<td>Skilled designers and labourers are available</td>
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<tr>
<td>Sufficient availability of financing</td>
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<tr>
<td>Big actors in the market prefer / go for low energy buildings</td>
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<td>Sufficient competition and several alternatives for the consumers</td>
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<td>Public buildings move first and show the private sector what is technologically and financially possible</td>
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<td>People are willing to be the pilot users of a new technology</td>
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<td>Cities and municipalities adopt ambitious strategies for green buildings</td>
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<td>Other reasons, please specify: ________________________________</td>
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Thank you for your answers!