Work package 2- Historical and recent attitude of stakeholders

Case 2:
Low energy housing (LEH)

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June, 2006

*C*ultural Influences on *R*enewable *E*nergy *A*cceptance and *T*ools for the development of communication strategies to promot*E* ACCEPTANCE among key actor groups

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)

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1. Introduction

This case study describes the introduction of low-energy housing in Finland. Low energy housing refers to a set of technologies and design principles that enable heating energy to be cut by 50%. Low-energy housing is a very important RUE innovation for this country, as space heating amounts to 22% of the total energy consumption in the country. There is a long history of efforts to promote energy-efficient housing in Finland. The case study focuses on the efforts by Motiva, a state-owned company, to promote low-energy housing through a technology procurement competition. The contribution of the project to social acceptance of low energy housing is examined on the basis of earlier research (e.g., Mikkola and Riihimäki, 2002; Savonen, 2004; Halme, 2005). This research has been complemented by reviewing other documents and construction-oriented Internet discussion sites and an interview with a representative of Motiva, the project manager in this case (Aho, 2006).

This case study illustrates issues in market transformation for energy-efficient technologies. But it also describes a technology that has acquired an ambiguous public image, and the successfulness of attempts to shed a prior image and acquire a new, more positive one.

2. Country overview: Energy-efficient housing in the Finnish context

Finland has one of the largest per capita energy consumption levels in the world. Energy consumption per capita is almost double the EU25 average. The country is dependent on imports of coal, oil and natural gas - and in recent years, also electricity. This is partly due to industrial structure, with a large share of heavy industries such as pulp and paper and metals processing, which consume 48% of total primary energy. Geographical factors such as low population density and cold climates are other explanatory factors. Total primary energy consumption has levelled off in recent years, but electricity consumption has continued to grow.

The importance of saving energy and using renewable energy resources has been stressed in the Finnish environmental debate since the 1970s. Industry, in particular, has achieved considerable energy savings, and is generally considered to be highly energy-efficient. Combined heat and power plants have also been adopted extensively. Finland has been one of the leading countries in the use of bioenergy - largely due to the extensive utilization of waste from wood processing. At the same time, the prevailing energy policy has always stressed the importance of providing a cheap and reliable supply of energy. Industry views energy prices as an important competitive factor. Currently, a fifth nuclear power plant is being constructed, and a sixth one is being debated. Electricity has, in fact, been kept relatively cheap in Finland[1] to ensure the competitiveness of the country's heavy industries. One might thus call the energy policy dualistic - emphasizing conservation and renewable sources on the one hand, and cheap and abundant supply on the other. Energy policy has historically been elitist and public participation has been limited (Paldanius, 1993).

Finland has made a commitment to restore carbon dioxide emissions to 1990 levels by 2010. The National Climate Strategy (2001) concludes that about half of the reduction needed can be achieved by promoting energy conservation, by increasing the use of renewable energy and by reducing the emissions of greenhouse gases other than carbon dioxide from combustion. Recent conservation measures have included setting stricter thermal norms for new buildings and promoting efficiency in existing buildings. The other half of emissions reductions will be achieved

[1] Currently, consumer and industry prices for electricity are about 75-77% of the EU25 average (Eurostat, 2006).

in the power generation sector by reducing the use of coal. The strategy was recently revised (MTI, 2005), placing more focus on the diversity of the energy system and indigenous renewable energy sources. The target is to increase the share of renewable energy to at least one third of primary energy consumption by 2025, as compared to 23 per cent in 2003. For energy conservation, the target is to bring about savings of 5% by 2015, compared to the business-as-usual scenario.

The greenhouse gas emission target specified for Finland according to the Kyoto Protocol and the EU burden-sharing agreement means that emissions need to be reduced on average by about 11 million tons per year. This has been viewed as a threat to the competitiveness of energy-intensive industry (MTI, 2005). In order to ensure that jobs stay in Finland, the state has agreed to contribute by acquiring about two million tons of emission reductions per year with the help of the Kyoto flexible mechanisms, and by lowering the electricity tax paid by industry. Thus, much of the conservation pressure is being placed on buildings, traffic, services and ordinary citizens.

As elsewhere in Europe, the population holds a positive attitude to energy conservation (Energy Attitudes, 2004). The demand for more energy conservation efforts instead of building new power plants is accepted by more than one in two (59%). However, conservation is not favoured at any price. The claim borrowed from the nuclear debate, that cheap energy is a bad thing because it undermines energy conservation efforts, is not widely supported (28% agree). A more detailed study commissioned by the MTI (2002) shows that climate change mitigation is becoming one of the key motives for energy conservation. Yet people are not very aware of what the largest sources of CO_2 emissions are. Spontaneous responses (N=1002) to the question "how can you combat climate change personally?" mostly focused on reducing car use (36%). Conserving energy or using renewable energy in space heating was identified by only 10% of the respondents as one way to combat climate change.

Even though energy conservation is publicly endorsed, favourable attitudes may also partly be socially desirable responses. Underlying these positive attitudes are some much more ambiguous perceptions of energy conservation, which are revealed by qualitative studies (Niva and Uotinen, 1996; Hakala and Hottinen, 1998) and more detailed analyses of factors underlying conservation attitudes (Ranta, 1996). Early energy conservation campaigns during the energy crises gave rise to many problematic beliefs - for example, that energy conservation only leads to price rises, that it means sacrificing personal comfort, and even runs into conflict with health and hygiene. In housing construction, the peak of energy conservation efforts coincided with the introduction of new materials and construction solutions - leading to the (sometimes valid) belief that energy conservation was responsible for indoor air quality problems.

Space heating as a special problem in Finland

Finland is a large and sparsely populated country. Winters are very cold. Space heating is a significant contributor to energy consumption, amounting to about 22% of the total energy consumption, and about 30% of total CO_2 emissions (Statistics Finland, 2005). In urban areas, a wide network of district heating has been constructed, largely utilizing combined heat and power production. District heating is, in fact, the dominant mode of heating: about half of the total housing area is heated with district heating, with direct oil and electricity heating accounting for about 20 per cent each.

Energy-efficiency of buildings is currently regulated in the National Building Code, which includes requirements for the insulation for walls, roofs and windows, as well as for heat recovery from ventilation. These requirements, last amended in 2004, aim to reduce energy consumption by 25-30% as compared with the current status. Improvement of the energy-efficiency of the existing building stock is promoted through renovation and energy subsidies for energy audits, insulation and upgrading of heating and ventilation systems (Ministry of Environment, 2006). The implementation of the Energy Performance in Buildings Directive has started in 2006 and

will be complete by the end of 2009. Key measures include the adoption of an energy performance certificate for buildings (starting 2006). A national energy labelling system for windows has also been introduced at the start of 2006.

Since about 1995 up until the past few years, the role of electrical heating has been growing, as more and more people are constructing detached houses in suburban areas (Ministry of Environment, 2006). Such areas are mushrooming rapidly at a wide radius of the largest cities, and are often not (at least initially) served by the district heating network (Perrels et al., 2006). In general, it is expected that the number of detached homes will grow along with growing income levels, as about 80% of the population would to live in their own house, but only 40% do (Halme et al., 2005). Energy efficiency is thus an important issue especially for detached houses, and its importance is expected to increase in the future.

The technological system of space heating for detached houses is currently undergoing a number of changes. Alongside direct electric heating, geothermal heat pumps have also gained popularity, and a share of about 10% of the heating system market. Wood heating is also regaining popularity, especially in the form of pellets. Direct electric heating is, however, also expected to grow as the popularity of oil heating declines, and households are becoming more comfort-oriented and less technically adept. Households utilizing wood as a primary heating fuel are today also relying more and more on electricity to supplement their heating (Ministry of Environment, 2006). Space heating has thus grown into a significant consumer of electricity, amounting to about 10% of total electricity consumption. It also poses some specific problems in terms of emissions and peak loads on the production network: at peak load periods, space heating consumes about 30 per cent of the electric generation capacity. Reserve power has mostly been generated using condensing coal-fired power plants. Hence, the carbon dioxide emissions for peak electricity consumption are about eight times as large as those for normal load. These considerations have motivated the Ministry of Environment to explore the possibility of introducing a special tax on electric heating (Ministry of Environment, 2006).

3. Summary: The MotiVoittaja project to promote low-energy housing

There have been many experiments and attempts to reduce energy demand in space heating in Finland. Yet homes designed to utilize the full capacity of the technological possibilities (e.g., zero-energy homes) have remained marginal. Most ordinary people have remained suspicious about such solutions, and the confidence and market conditions for their widespread adoption have been lacking. *Low-energy housing* is a relatively recent concept used to refer to housing designs that reduce space heating demand by about 50%. It represents a ‘moderate’ approach to energy-efficient housing that is less extreme than minimum- or zero-energy housing, and is more suitable for the mainstream market in terms of costs, convenience and location options. Motiva, a state-owned company responsible for promoting energy efficiency and renewable energy, launched a project aiming to mainstream and ‘normalize’ the concept of low-energy housing through a technology procurement competition and labelling system (called ‘MotiVoittaja’) targeted at *prefabricated detached homes*. The project was a moderate success: it managed to attract a large number of entries, and contributed to more public interest and debate on energy conservation in space heating. Yet the product concept and label did not become popular, and the definition of low-energy housing remains ambiguous.

4. STEP ONE: Vision of the MotiVoittaja project

Key technologies to reduce heating energy consumption were first introduced during the oil crises, and a number of experimental zero-energy and minimum-energy houses have been built

over the decades. At the same time, more stringent insulation standards and technological developments have reduced the specific consumption (kWh/m^2) of normal houses. Technologies to reduce heating energy requirements sharply have matured, and experiments have provided a better understanding of how they can be combined effectively in different kinds of buildings.

Yet the cutting-edge designs have not been widely adopted. One reason is lack of knowledge and awareness among homebuilders and construction companies. Another is a lack of financial motives[2]. Due to early unsuccessful experiments, low-energy technologies have also suffered from an ambiguous public image. Lay people still often associate high levels of insulation with mould pollution and respiratory problems. This public perception is encapsulated in the concept of 'bottle houses' - i.e. houses that are too well sealed from their environment (e.g., Hakala and Hottinen, 1998).

Low-energy housing as conceptualized in the project refers to a set of different technologies - i.e., a configurational technology. The technologies employed include increased thermal insulation, low-energy windows, reduced air leakages, recovering heat from exhaust air, extracting energy with heat pumps, passive solar energy and building orientation. A key aspect of low-energy housing is a systems view of designing a house. Design is based on a thorough understanding, control and utilization of the energy flows within a building. Through this design approach, low energy solutions could be reached without large additional investments, and without compromising indoor air quality or comfort.

The MotiVoittaja[3] technology procurement competition aimed to promote the commercialization and entry into the market of this new technology. Technology procurement is a policy instrument aimed at directly stimulating innovation through a targeted acquisition process. An influential buyer or group of buyers formulate the requirements and evaluate the products. Typically, market transformation is further influenced by support activities (e.g., rebates, labelling or awards). Like in many previous technology procurement projects (Westling, 2000), the competition and the award were the most important focus of the MotiVoittaja project. The award was designed to function as a label of endorsement, allowing prospective customers to identify 'certified low-energy houses'.

The vision of the project was to transform the prefabricated housing market by creating a new product concept - the low-energy prefabricated house. This concept would signal a new, more positive image of energy-conserving construction solutions, such as convenience, indoor air quality and affordability. The project managers hoped that such houses would attract a broad range of customers, and would thus help to mainstream low-energy housing. A more general aim was to raise awareness of energy efficiency and its importance as an environmental aspect of housing.

5. STEP TWO: What were the various expectations of the case?

Two organizations were closely involved in the development of the vision. The competition was launched and administered by *Motiva Ltd.* This fully state-owned company focuses on the promotion of energy efficiency and the adoption of renewable energy sources. It started as a project organization in 1993, and was incorporated in 2001, when the Ministry of Trade and Industry purchased its entire stock. Technology procurement is one of its operating modes, along with negotiating energy conservation agreements, administering energy audits, promoting ESCO ser-

[2] For consumers, the share of utility costs of total housing expenditure is relatively small - less than 2%, as compared with 3.4% for the EU15 countries in 2001 (Halme et al., 2005b) - and constructors and construction materials manufacturers lack the selling points for initially more expensive solutions (e.g., additional insulation)

[3] MotiVoittaja is a play on words. It is a combination of the words Motiva and 'voittaja' (winner in Finnish), and also means 'motivator' in Finnish.

vices, serving as an information clearinghouse and generally raising awareness of energy conservation and renewable energy.

The other key partner was the Finnish *national technical research institute, VTT,* which had been intensively involved in developing low-energy housing technology and design concepts with an emphasis user benefits: comfort, healthy indoor climate, simplified heating solutions and reduced lifetime costs. One of the underlying ideas in this concept is that energy-efficiency and indoor air quality are not contradictory goals, but can be simultaneously improved through better management of air and energy flows (Nieminen et al., 2003; Halme et al., 2005). Table 5.1 outlines the expectations of these key partners, as well as some other parties involved a different stages of the project.

Motiva and VTT also tried to take into account the *consumers'* expectations on the basis of previous experiences of problems in adopting low-energy housing (Savonen, 2004; Halme et al., 2005). One was to *reduce the financial risk* involved. The construction process is stressful for consumers- for many, a once-in-a-life investment requiring significant time and financial resources. Few consumers are interested in experimenting with new technologies in this situation - hence, an external 'label of endorsement' by a reliable, unbiased party might increase consumers' confidence in investing in low-energy solutions. *Lack of branding and marketing* was also perceived as an obstacle to low-energy housing (Halme et al., 2005). The underlying belief was that homebuilders are increasingly consumers of ready-made products. The product should be easy to identify and purchase, and it should convey other than energy- and environment-related benefits, such as comfort and healthy living (Halme et al., 2005)

Financial support for the competition was gained from Tekes, the National Technology Development Agency. A *jury* of external experts was invited to determine the winners. The jury included a representative from the VTT (the National Technical Research Centre), Tekes (the National Technology Agency), the Ministry of Environment (in the role of regulator of the built environment), and a regional co-operative bank (Länsi-Uudenmaan Osuuspankki), representing the interest of mortgage-lenders to reduce the financial risk of homeowners. Two organizations represented the user perspective in the jury. One was the National Association for Detached Housing Construction (PRKK ry). The 5000 members of this organization are mainly individual homebuilders and people renovating their houses, and the association serves them by providing training events and advice. The other user representative was the Technical Director of the University of Helsinki, representing an end-user of energy-efficient construction solutions. The jury members participated mainly as experts, but also partly as representatives of the respective interest groups (e.g., users)[4].

Manufacturers of prefabricated houses were selected as the target group because of their growing market share. According to the current estimate, their share of the detached house market was about 68 per cent in 2005 (PTT, 2006). There are about 40 producers on the market, producing about 10 000 houses annually (Nordic Ecolabel, 2005)[5]. The most popular form of setting up a prefabricated house is for consumers to do part of the work themselves or have it done by contractors, but turnkey constructions are also gaining popularity (Halme et al., 2005).

The winners of the competition were promised the right to use the MotiVoittaja label in their marketing. The winners would also be entered into a product record allowing homebuilders to identify the best solutions from an unbiased source. In addition, Motiva made a commitment to assemble a purchaser group and facilitate the winning manufacturers' negotiations with them.

[4] A special group of technical experts was also involved in conducting a technical evaluation of the submissions. A calculation program developed by the VTT research centre was distributed to the participating companies, which were instructed to use this program in calculating the energy consumption and costs of their designs.

[5] The industry is fragmented among a great many small players with annual turnovers (2002) ranging from less than € 2 million to 46 million (PTT, 2003).

The participating companies had quite different expectations. Some were very serious about their submissions, and looked forward to including a new energy-efficient model in their product range. Others were merely experimenting with solutions that might become important or even compulsory in the future. They saw the project as an investment in gaining competencies they would need later on. Participating companies were also motivated by a desire to learn more about energy issues and to demonstrate their own expertise in the field (Savonen, 2004).

Table 5.1 *Actors and expectations involved in the MotiVoittaja project*

Actor	Expectation	Speaking for 'publics'
Motiva	Mainstream low-energy housing through a technology procurement competition and label of endorsement	National climate strategy: energy-efficiency and environment Consumer concerns (in general) + future, convenience-oriented consumers (especially) Concerns of prefabricated housing manufacturers
VTT	Promote low-energy housing as a 'systemic design' concept of controlled energy flows Commercialize advanced design concept	Energy-efficient technology Quality construction Key consumer and market concerns identified in earlier studies
Tekes (National Technology Agency)	Promote Finnish technological know-how Boost innovativeness and quality in the construction sector (especially SMEs)	National competitiveness Technological prowess Socially responsible technology
Other jury members	Represent their respective interests and expertise in the jury	Quality of built environment Homebuilders Housing financiers Energy technology and construction solution users
Companies participating in the competition	Gain new competencies Benchmark and display their own capabilities Create new product concepts Gain market share	Owners, managers and employees of the companies

6. STEP THREE: Understanding 'participatory' decision-making: negotiation expectations

The competition was published at the beginning of April 2000 and closed in December 2000. The winners were announced in May 2001. Expectations were negotiated at a variety of stages: in setting up the criteria, in selecting the winning models, in assembling the initial purchaser group, and in communicating about the project in the media and in direct communications (e.g., fairs).

Planning, criteria-setting and selecting the winning entries was conducted by experts: the project managers, the expert evaluators and the jury involved in the competition. Mostly, these parties shared similar views on the project. Negotiations concerned mainly the level of ambition and the stringency with which the criteria should be applied. During the competition, participants and would-be participants also addressed some questions to the jury (Aho et al., 2001). These questions took issue with some of the criteria, especially ones that were not clearly defined (e.g., implementability). The focus on turnkey constructions was also questioned, as this is not the dominant mode of delivery.

Even though the project was not very participatory, the project managers made an effort to address some of the consumers' (perceived) concerns related to low-energy housing, namely costs, convenience and indoor air quality. They were included in the award criteria, which consisted of the following items (for more details, see Tekes, 2006):

- Specified space requirements that should accommodate a family of four.
- Indoor air quality and emissions from construction materials.
- Energy efficiency[6] and carbon dioxide emissions from energy consumption.
- Water consumption.
- Costs: There was no set cost level, but participants were required to calculate the construction and operating costs of the designs, and both construction and lifetime costs were taken into account in the evaluation.
- Commercial scale: The submissions should be realistic and implementable on a commercial scale. Companies submitting an entry were required to be capable of delivering at least five houses for the initial buyer group during 2002.
- Convenience: Suppliers should be prepared to deliver the winning construction as a turnkey solution (i.e., full delivery including foundations, construction and finishing).

Assembling an initial purchaser group. Gaining market commitment from initial purchasers is an important part of technology procurement projects. In this case, purchasers would mainly be private consumers, so assembling the group was a complex task. Prospective buyers were contacted through the National Association for Detached Housing Construction at training seminars and by advertising in the association's newsletter. Finally, a buyer group of 40 families was gathered. Yet the buyers turned out to be quite reluctant to make binding contracts with the manufacturers - they merely agreed to give priority to the awarded models. In the end, some were not satisfied with the standard awarded models, and requested so many modifications that the houses were no longer exactly the same. Others 'dropped out' for various reason, such as financial problems or other changes of plans.

Communications. Most of the communication on the project followed a top-down model. Communications were directed at the trade and daily press and other media. One important form of communication was constituted by participation in the Housing Fair events. This is an annual event that creates a new model housing development and illustrates novel technologies through demonstration constructions. These events are visited by approximately 150,000 visitors each year, including both experts and ordinary people. After the event, the houses are sold to 'normal' families, and the fairgrounds are turned into a 'normal' residential area.

The most important initial buyers were also purchasers of Housing Fair houses. This was in connection with the Housing Fair in the town of Kotka (in Southeast Finland) in 2002. Three different awarded models were constructed for the Housing Fair, and were actually sold before the fair. The families who moved into these houses became the most important showcases for the MotiVoittaja concept - so much so, actually, that they became quite annoyed with all the publicity, and decided to stop giving interviews. Their houses, the energy efficiency solutions, their construction costs and annual energy bills, as well as interviews about their family life are still on display on the Motiva website, offering at least some personal peer experiences for other potential homebuilders.

The project thus gained a lot of visibility at the Housing Fairs, and relatively much attention in the media. The media coverage was quite favourable, focusing on low-energy housing as a modern and future-oriented approach. The 'unofficial' communication ongoing on Internet dis-

[6] A maximum electricity consumption of 135 kWh/gross m^2 and maximum heating power requirement of 45 W/gross m^2, maximum CO_2 emissions of 32 kg/gross m^2.

cussion forums reveals a more mixed reception[7]. Such sites are an important source of knowledge for a growing number of homebuilders. The 'experts' on these sites are often professionals or seasoned self-builders. Both positive and negative discussions can be found about low-energy housing. The sites reveal very divergent opinions on what 'low-energy housing' means, and much debate about real-life heating costs (as opposed to calculations based on technical performance). There is also some competition between contrasting concepts of ecological housing: one being based on traditional, vernacular construction methods and natural materials, and other 'modern' one involving well-sealed structures and highly controlled air and energy flows. Some of the proponents of 'traditional' ecological housing oppose tightly-sealed and 'smart' low-energy homes. Homebuilders are also faced with a confusing array of heating and insulation options and combinations. One recurring topic seems to be whether to invest in geothermal heat pumps or increased insulation. This line of discussion implies that the 'systemic design' idea represented by researchers at the VTT has not been adopted by the consumers - people consider different technologies as separate issues. Overall, however, the discussion on low-energy housing seems to be increasing, and more and more discussants are telling about their own personal experiences.

Market: By stimulating a market for 'mainstream' low-energy housing, the project attempted to align itself with the (perceived) interests of ordinary homebuilders, and especially the growing group of middle-class people who rely extensively on ready-made market offerings. This group would also include people concerned about the environment and about future energy costs, and the project tried to serve up low-energy housing as a solution to both concerns. Yet homebuilders are, in fact, a quite variegated group of consumers. They typically consider a number of different heating and construction options (Mikkola and Riihimäki, 2004) and balance a wide range of different requirements. Prefabricated houses are also not an ordinary industrial product. They are sold in small quantities (an average of 250 houses yearly per manufacturer), and even 'standard' models are often modified and tailored extensively. This is somewhat problematic when considering energy efficiency from a 'systemic design' perspective: modifications should not interfere with the planned and controlled energy flows.

The consumer segment that the design competition attempted to target does clearly exist, but is perhaps not as easy to enrol as believed. A survey conducted half a year after the competition was resolved (Mikkola and Riihimäki, 2002) showed that homebuilders do value energy efficiency - 40% of the respondents (N=229) reported it being an important criterion when selecting a prefabricated house. Some of the respondents (8%) had never heard of low-energy housing, and about half had heard of it, but stated that they knew very little about it. A relatively large share (14%) had considered low-energy housing, but decided otherwise. Nine percent of the respondents stated that they planned on building a low-energy home - which does show a clear growth pattern.

The consumer survey also revealed that interest in energy conservation and ecological solutions is growing among homebuilders. Homebuilders feel, however, that there is not much reliable information on the topic, and they are confused by the different concepts. The attempt to equate low-energy housing with ecological housing has not been too successful: only 39% of the respondents believed that an ecological house consumes less energy than a normal detached house. Less than half believed that one can halve a building's energy demand with small additional construction investments (Mikkola and Riihimäki, 2002).

[7] 139 discussion threads in the Suomi 24.fi forum and 53 discussion threads in the Rakentaja.fi forum were examined, identified by using the search terms 'low-energy housing' and 'MotiVoittaja'. The review also includes newspaper articles linked by discussants (e.g., HS, 2004; HS, 2005).

Table 6.1 *Forms of participation in the MotiVoittaja project*

Type	Organizers	Involvement	Purpose
Planning, criteria-setting and selecting the winning entries	Motiva	Representatives of expert and stakeholder groups: VTT, Tekes, Ministry of Environment, detached housing association, housing finance, expert end-user	Represent expertise and interests from different positions (technology development, finance and regulation, market players and end-users)
Assembling the initial purchaser group	Motiva	40 households (some of whom dropped out later)	Create market Spread knowledge through peer experience
Formal communications	Motiva	media representatives > media users Housing Fairs > exhibitors and visitors	Media: diffuse information Audiences: learn about new construction technologies and designs
Informal communications	Self-organized, facilitated by Internet discussion sites	Homebuilders Professionals	Exchange views and experiences about construction issues
Market	Manufacturers Motiva	Consumers	Build a house (low-energy or not)

The interests of Motiva (energy conservation), technology developers and promoters, and the manufacturers of prefabricated homes were aligned by combining new technology into an existing product, the prefabricated detached home. This focus largely determined the types of activities conducted in the project, and also limited the actors involved to market actors (manufacturers and citizens as consumers) and building experts. By linking themselves closely to the manufacturers' market strategies, Motiva created one sort of alliance: it teamed up with the (growing market segment of) turnkey and prefabricated customers, it positioned itself toward the high end of the market, and it emphasized the modernity and normality of low-energy housing. Thus, selecting an energy-efficient home was positioned as a private matter of personal commitment to reduce CO_2 emissions and save money in the long term. The aim was to mainstream low-energy housing by showing how it can be included in perfectly normal prefabricated housing constructions. The houses look (and are supposed to look) exactly the same as other houses, so in that way too, only the owners and the manufacturers know about the low-energy features (see Figure 6.1).

Figure 6.1 *Example of one awarded design (Tyrsky by Suomen Kodikastalot) and its location in a new residential area in Kotka (the town centre is visible on the horizon)*

At the same time, making a commitment to this type of alliance severed some other options:

- It was not, for example, possible to place a lot of emphasis on the differences between low-energy homes and standard homes in communications (this would not have been acceptable to the manufacturers, with a number of 'standard' models[8]).
- Because the project was a marketing effort, any attempts to create social pressure toward homebuilders were also out of the question. Thus, people who are not building their own house were not included in the target group, even though homebuilders' investment in low-energy solutions would be in the interests of every environmentally-conscious citizen.
- Visible proponents of 'traditional' vernacular-style ecological housing were not involved, because they represent a different approach to ecological building, and would not be likely proponents of prefabricated designs.
- By making a commitment to a competition-based project, co-operation and networking among the housing manufacturers was precluded (Halme et al., 2005; Savonen, 2004). As an alternative approach, Halme et al. (2005) have suggested developing an open concept that various small businesses could utilize in network-based development projects.

These unavailable alliances were most probably unavoidable and logical 'costs' of setting up a commercially-oriented, mainstreaming technology procurement project. Yet there are some other groups that would probably have 'fit' in the alliance actually created. For example, local planning or building authorities were not involved, even though they can (and sometimes do) specify energy and environmental requirements for new developments. A stronger commitment by the financial sector might also have been helpful. A representative of a mortgage bank was involved in the jury, and the idea of an additional loan for energy efficiency investments was discussed, but it was considered too novel at the time[9].

7. STEP FOUR: From visions to actualities

The initial response, i.e., the number of entries into the competition, was positive. There were 20 entries into the competition - i.e., almost half of all manufacturers entered a design, including three of the ten largest manufacturers. Eight of the entries were considered by the jury to merit being awarded with the MotiVoittaja label. The total energy consumption of the awarded de-

[8] In fact, some manufacturers make an effort to blur the difference in their communications, and prefer to present low-energy as a feature than can be linked to any model the sell. This is probably quite true, but it undermines the labelling-effect.

[9] Homebuilding projects are usually financed with a mortgage, and it is typical to take out the maximum loan and build the largest home that one can afford. If banks were to offer an extended loan for the extra cost of low-energy solutions, this might promote their adoption, and would also certainly increase consumers' trust in the calculated payback periods of their investments.

signs ranged from about 60 kWh/m^2 to 130 kWh/m^2, but was at least 35% less than average (Aho et al., 2001). One design, with the lowest specific energy consumption, was given a special commendation. In spite of the differences, all eight designs were promoted equally. Furthermore, the right to use the MotiVoittaja label was awarded retroactively to two other designs that were submitted later, but met the criteria. The winning designs were very similar in appearance and overall design to the standard type of prefabricated house offered in the market. Motiva and the jury were quite happy with the cost level achieved: the construction costs varied from € 1300 to 2000 per m^2 of living area.

Four of the 10 companies awarded the label actually offered their winning design for sale, and three are still selling the product in 2006[10]. So for many of the participants, participation was more of a learning and public image exercise, but a few linked it more closely to their mainstream business. Also some of the subcontractors and suppliers (e.g. providers of insulation material) have utilized the competition in their marketing and communications.

The housing manufacturers were somewhat disappointed: they had expected a more enthusiastic market response to their new models, and more deals with the initial buyer group (Mikkola and Riihimäki, 2002; Aho, 2006). They would have liked Motiva to invest more in marketing the MotiVoittaja label also after the results of the competition were published. As small companies, they considered themselves unable to invest sufficiently in marketing and awareness-building. They believed that consumers were cautious about low-energy models for fear that they involve complex technologies that are difficult to operate. Their impression was also that consumers only focus on initial investment costs, and fail to grasp the importance of total lifetime costs. They were also aware of the fact that consumers are not very trustful of manufacturers' promotional materials: they thus called for third-party calculations of consumption figures and costs[11].

MotiVoittaja did not turn out to be a branding success. The vision of creating a new label or brand that would storm the market and transform it were, thus, somewhat over-ambitious. Project managers themselves were of the opinion that more efforts should have been placed in communications after the competition. Communication and marketing efforts were limited because the project had depleted its budget. The idea of launching the MotiVoittaja label as a kind of impartial seal of approval did not really work - the has quite low visibility today[12]. The project also largely failed to promote commercial models marketed specifically as low-energy housing and to establish a specific set of criteria for this type of housing. Three companies still utilize it in their communications, but less in the context of labelling specific models or designs, and more as a general endorsement. On the other hand, a few manufacturers have adopted energy efficiency as a profiling factor and selling point for their product range.

Yet in general, one can conclude that the target of raising awareness of low-energy housing and mainstreaming the concept were actually fairly successful - even though it is difficult to isolate the contribution of the project to the overall development in this area. The idea of houses with about 50% less energy consumption has been adopted quite widely, but there is still a lot of debate about the effectiveness of different solutions to meet this aim[13]. The aim of launching a consistent concept - a sort of definition for ecological housing - was only partly successful. There are many (partly contradictory) perspectives on the topic. For example, there is now also a Nordic Ecolabel for detached houses - with somewhat different criteria from the MotiVoittaja

[10] Two as a designated model, and one as an optional element that can be added to all standard models.

[11] A calculation program has been added to the Motiva website, but it is not very easy to find, and has not been widely publicized.

[12] The limited success of the MotiVoittaja labelling system is not a big surprise, as there are similar systems in operation in other Nordic Countries, and none of them have been especially successful (Nordic Ecolabelling, 2005).

[13] The term low-energy was recognized by the respondents of the Mikkola and Riihimäki (2002) survey, and it features quite prominently in the Interent discussion forums. Yet people are uncertain of what it means exactly (in technical terms), and actually use it to refer to quite different solutions (e.g., insulation, ventilation vs. geothermal heating and wood as a supplementary fuel).

label (Nordic Ecolabelling, 2006). The consumer surveys and Internet discussions also show that there is still a lot of confusion about the concept, and that energy-efficiency is not automatically equated with ecological housing.

There are some *project design factors* that influenced the outcome of the project. Even though the project tried to address consumer concerns, it failed in fully aligning with the homebuilder's perspective (Halme et al., 2005). From the homebuilder's perspective, there are many factors that speak for the need for third-party labelling, but also make it difficult to create a labelling system that is perceived of as sufficiently credible. The Finnish construction industry in general, and manufacturers of prefabricated houses especially, lack a good reputation. Manufacturers of detached houses are small companies, with a high turnover rate in the industry. Superimposing a labelling system on this type of turbulent market is not an easy task. Labelling systems are also socially embedded, and require a certain level of confidence (cf. Luhmann, 1986) in the overall system in which they are located. Motiva was a well-situated player in this sense, but the company's own reputation was only just building up at the time[14] (early 2001) when the label was launched. A broader coalition of different types of advocates might have reinforced Motiva's message.

The initial buyer group was an important element in the project design, but also a risk factor[15]. Having peer experiences available is one important credibility factor (cf. Zucker, 1988), and in this respect the project was not fully successful, as few of the initial buyers agreed to serve as peer exemplars. The design concept advocated by the project was also somewhat vulnerable to problems in application. Although the project managers were open to alternative solutions to reduce energy consumption in the competition entries, they assumed that a prefabricated house when installed is identical to the design of that house. But homebuilders like to tailor their prefabricated houses. This type of tailoring interferes with the design-based low-energy housing concept, which is based on a tight design control. This was one of the factors that made it difficult to align the initial buyer group to the project's objectives - some of the initial buyers made such a large number of changes in their house that the low-energy characteristics were lost (Aho, 2006).

Some factors that influenced the level of successfulness of the project relate to *local context*. The local context of the study was the market of prefabricated housing manufacturers, i.e., the whole of Finland - with a special emphasis on growing residential areas, mostly located in the South. What is specific about this context is the (still relatively) low price of energy vis-à-vis construction costs. Home-owners still only pay about € 1500 per year for their heating, whereas construction costs can easily amount to € 20,000. So the payback period for energy-efficiency investments is still fairly long, especially from the perspective of a growing family with a tight budget. The local context also includes the timing of the project. At the time of the competition (2000-2001), there was much less urgency about energy-efficiency than there is now. After the debate about a special tax on direct electric heating and with the rising price of oil, the general atmosphere has become much more responsive. It was probably a good idea to launch an awareness campaign early on, yet the project managers failed to convince the housing manufacturers or the homebuilders about how important space heating would become.

Another landscape-level factor relates to the role of consumers and SMEs in energy policy. They have usually 'got the short end of the stick' in public policy decisions, while large industry has always been protected. Hence, the public opinion on energy conservation is slightly ambivalent. Consumers and SMEs do not view themselves as active players in the energy field, and some are slightly suspicious about advice offered by 'the establishment'.

[14] In a survey of municipal technical experts in 2002, 60% of the respondents knew about Motiva and its activities. It can thus be inferred that even fewer consumers had heard of Motiva at that time.

[15] Assembling a consumer-based buyer group is a very complex task in technology procurement, and is thus seldom attempted (e.g. Westling, 2000).

8. Lessons learned

This case study illustrates a special type of social acceptance, i.e., *market and consumer* acceptance, which however, hinges partly (if not solely) on public acceptance and perceptions of the risks and benefits of the technology. A broader reading of the case study can thus be one of a technology attempting to break into the awareness of the general public, and simultaneously shed some of the negative images related to its early applications.

Motiva, as the project manager, is clearly an intermediary organization. Its aim is to promote energy conservation, and its ability to do so depends on its skills in articulating options and demand, creating awareness of possible futures, aligning actors and possibilities, building networks and supporting learning processes (cf. Van Lente et al., 2003). This case study shows that it also has to make (explicit or implicit) choices between different types of possible networks and alignments, and these choices are important for the course that the project takes.

The successful features of the project (mainstreaming, awareness-raising, improved image) highlight the following issues:

- The importance of a close understanding of factors constraining the adoption of the technology. These were addressed by considering the key concerns and obstacles of homebuilders (and consequently, manufacturers). Issues such as impartiality, branding, affordability and indoor air quality were taken into consideration when designing the project and the competition criteria. These considerations were based on previous research and analysis, but also involvement of representatives of (some) key stakeholder groups in the governance of the competition.
- Engaging market actors in experimentation is a good way to raise general awareness. The competition served to engage a good share of companies in the industry. This, in itself, further signaled the normality and emerging 'mainstreamness' of the technology. Although the activities involved (competition, labelling, Housing Fairs) were quite specific, their greatest contribution was to an overall rising awareness.

Less successful features of the project (limited market transformation, failure of the branding and labeling strategy, remaining ambiguity in public image) also provide some lessons:

- Lack of concerted efforts (or powerful players). In this project, market transformation would have probably required a more concerted commitment by a broader stakeholder community (e.g. banks, eco-people, authorities) as well as those supporting the project (e.g., Tekes and MTI as owner of Motiva). The limited 'authority' of Motiva at the time of the competition was also an obstructing factor - today, the label might work better.
- Low level of existing awareness. At the time of the project, the problem to which the label aimed to be a solution (i.e., large energy consumption and costs) was not perceived strongly in the market. Thus the advice that the label provided was not in great demand. In fact, the project served to create this awareness, and a further similar project might build on its results more successfully.
- Flexibility and adaptability. The project was quite dependent on a few 'cornerstones' to fully achieve its goals. These include the design-based low-energy housing concept and the initial buyer group. Both were basically sound ideas, but they turned out to be difficult to implement and combine with existing market practices. The project was forced to make do with a very small group of buyers, and the design concept has in practice been diluted and fragmented. This does not make the project a failure, but shows that some initial goals had to be modified.
- Economic and political context. The project aimed to target market players on the basis of their financial motive (sell more houses, save money in the long term). This motive, however, was not very strong, as the price of energy is still relatively low. Even though expectations about rising prices are growing, they are partly undermined by speculations about new investments in cheap energy (i.e., nuclear power). In general, consumers and SMEs are not

accustomed to being active players in the energy field, as they have been relegated to the role of 'target groups' for decades.

- Timing in terms of landscape developments. Many of the issues contributing today to the attractiveness of low-energy housing were only on the horizon in 2000 (e.g., energy labelling of buildings), or were still well below it (e.g., special tax proposal). They had not yet filtered into the awareness of ordinary market players. Building a convincing image of the future is a key success factor for such future-oriented projects, but not easy to achieve.

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