Energy Policy Dialogues
in the Baltic Sea Region



ENERGY EFFICIENCY IN HOUSING

FRIEDRICH EBERT STIFTUNG

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INTRODUCTION

The process shows: there is light at the end of the tunnel and a green light at the tunnel's entrance

This publication reflects the findings of the Third Baltic Energy Dialogue on Energy Efficiency in Housing organized as an international conference in May 2008 in Tallinn. The First Dialogue brought international experts and politicians to Riga in December 2006 for a critical assessment of nuclear energy in the Baltic region focusing on Ignalina and its implications. The Second Dialogue debated the other extreme, namely the potential for bioenergy in the Baltic Sea Region and it was held in Tallinn in May 2007. The most illustrative contributions to and reflections from the first two Dialogues were published under the title **"Energy Policy Dialogues in the Baltic Sea Region"** by Friedrich Ebert Stiftung in Tallinn.

For this Third Dialogue on Energy Efficiency the organizers were the Tallinn City Government – Department of Environment, the EU project SECURE and the Friedrich Ebert Foundation in the Baltic States. Due to the pragmatic and constructive character of this event we decided to publish the various international lessons learned to solve the ever more urgent scourge of Baltic citizens: Energy Efficiency in Housing. The objectives of this publication are many: to raise awareness, to share experiences, to establish a network and to promote the implementation of solutions in Energy Efficiency in Housing, that means:

- To raise the awareness of civil society, the business community, local and central governmental institutions in terms of energy saving and efficiency in the housing sector;
- To share national and international experiences of energy saving and efficiency;
- To enhance the cooperation and participation of stakeholders (local and state government, the business community and civil society) in the promotion of energy saving;
- To ensure sustainability in energy saving policy formulation and implementation in housing.

The topics discussed in this publication are centered around (1) the identification of gaps and needs in policy instruments, public-civic cooperation, legal regulations (e.g. fiscal tax reform) and monitoring; (2) good and bad lessons learned to ensure sustainable demand and the supply of power, heating and cooling and the provision of housing; (3) what lessons are learned from energy-mix policies and decentralized energy transformation; and (4) funding and returns from particular energy saving concepts.

Civil servants of local, county and national governmental institutions concerned with energy, city development, city planning, building and renovation departments, as well as experts from development agencies, civil society organizations, NGO-s, unions, Home Owners Associations (HOA), the business community, architects, real estate developers, builders from the Baltic Sea Region are the target group for this book.

Changing mentality plus modern technology are the key factors

Energy efficiency might sound like something typical of a stingy and mean person. In fact it isn't. Energy efficiency and saving have economical, social and environmental dimensions. Energy efficiency can be explored as a new economic opportunity for companies which provide design and technological solutions for energy saving and efficiency. From an individual perspective, this economic dimension translates into having the same or better in-door comfort while paying less for it.

With German cooperation, a typical 30-year-old multi-storey apartment block in Riga was renovated using state-of-the-art technologies in insulation and low energy housing and achieved a reduction in heating losses of 60%! No longer leaking energy means keeping more money in one's own pocket instead of paying unnecessarily high bills.[1]

The social dimension to energy saving involves reducing stress on the climate which also affects us and will have a more drastic effect on the environmental conditions for our children. Efficient heating systems reduce green house gas emissions by up to 40%. Further social lessons from the Dialogue were the importance of networking, communication and making agreements between inhabitants of multi-storey buildings, the latter acting as a "lubricant" to help make technical innovations really productive. The environmental aspect of energy saving refers to keeping the environment clean through using less fossil fuels. Cooperation among dwellers not only accelerates the reduction of CO_2 and sulfuric gases but opens the way to using more renewable energy sources for heating and power and also to the introduction of ecological building materials. In the future, in cooperation with the local authorities, more aware citizens will insist on short distance access to public transport in order to consume much less of the precious petroleum and natural gas imported at high cost from abroad.

International lessons learned are at hand

All around the Baltic Sea real changes in practice are very hard to invoke. Why is it so difficult to implement changes in energy use in the building and construction sector? The answers given during the long and intensive debates showed that every change in society is a kind of social innovation, the speed and success of which depends on at least 5 factors. If one of those factors is weak or missing, the change in society will not take place or will be extremely slow. The key factors – absolute preconditions for change in society – are seen as:

(1) **motivation** (based on values and world-view);

(2) **know-how** regarding the causes of the problems and their solutions and not wasting resources for mitigating consequences while the underlying causes remain unsolved;

(3) **resources** in terms of fiscal and technological resources to implement the solutions (both mental and technical solutions);

[1] IEMB (Institut für Erhaltung und Modernisierung von Bauwerken e.V. an der TU Berlin): Energie Initiative Riga – ein Kooperationsprojekt der Städte Berlin und Riga zur energetischen Sanierung von Wohngebäuden, 2005, S.6 (see also http://www.iemb.de/moe/moe20/riga.pdf)

(4) **institutions** or an enabling environment, which means adequate and enforced legislation, a proper and working system of incentives for energy saving, trustworthy experts and trained architects, civil servants and home owners; and

(5) **commitment** and faith of opinion leaders, politicians, experts, media-personalities, academics, civil servants and ordinary people to the principle that energy efficiency and saving is the responsibility of every citizen in each of our settlements throughout the world.

We are convinced that the multifold experiences of the international dialogue-partners which we organized for this book will create new thoughts and ideas, motivation and know-how, commitment and faith for energy efficiency and saving in all readers – because we all know that it is high time for change and for the efficient use of energy in our buildings! Editors would like to thank all contributors to this publication!

Ahto Oja and Elmar Römpczyk, editors

Tallinn/Bonn, January 2009

CONTENTS

OBSTACLES TO ENERGY SAVING

Ahto Oja[1]

This book has been published in order to create conditions for stakeholders to remove the obstacles to energy saving in buildings. Therefore, the main obstacles to energy efficiency in the building sector are listed in this chapter which is the summary of the SECURE workshop on 'Overcoming non-technical barriers for energy efficient buildings?' held in May in Tallinn as part of the Third Baltic Energy Dialogue conference. The agenda of the workshop is in annex 1. The group work methodology 'World Cafe' was used. Altogether, 5 working groups were formed with, on average, 10 participants in each group. Two questions were discussed in the working groups: (1) what are the non-technical barriers for energy efficient buildings; and (2) what are the practical solutions to overcome these barriers.

Economy and funding

The pay-back time of investments is not attractive to financial institutions, it is longer in Sweden. The majority of the public doesn't believe that energy saving measures are economically feasible – experts give contradicting data and opinions. The price of energy is still too low – there are almost no incentives to save. The credibility of feasibility studies is low - currently the feasibility studies are not trusted and it is consequently very hard to make long-term financial decisions and to obtain commitments, at least in Estonia. Lack of funding for energy saving projects and the low level of incentives for energy saving are significant obstacles.

Awareness

The public awareness of energy saving issues is low, therefore, environmentally friendly behaviour is not popular. Role models are lacking, high level politicians and other opinion leaders do not set a good personal example in their thinking and acting against energy wasting and over-consumption patterns. People do not care what will happen after 10 years, their radius of thinking is very short term. Prejudices among the political and economical elite that energy saving is not cost-efficient are obstacles for energy saving. The awareness of local self-governments regarding energy saving issues is low. In some places HOAs already demand energy saving solutions, but local self-government doesn't support these initiatives. Education on energy saving issues should start from kindergarten level.

[1] Manager of Mõnus Minek SEES Ltd, which is providing Sustainable Energy and Environmental Solutions.

Knowledge

Adequate knowledge of proper energy saving solutions is insufficient – both public and private experts are not able to ask the right questions and, therefore, effective energy saving solutions are lacking. The lack of knowledge of energy saving technologies and how to build passive houses in Estonia are huge non-technical barriers. Lack of demand for and knowledge and experience of holistic (e.g. polycentric city) planning procedures and actions are also significant barriers.

Behaviour

The strength of old habits is stronger than the motivation to implement new behavioural models. Negative and sceptical attitudes towards new and innovative technologies and solutions occur in Sweden and elsewhere. Old habits and technologies are preferred, for example, belief in the saying 'it has been always made **this** way' just because these seem safer (with lower risk of failure). Values change very slowly – how to sell, for instance, energy saving solutions or the passive house concept as something valuable and "sexy" is the main question. Different ethnic groups with different cultural backgrounds have different levels of knowledge and values – which makes joint decisions for whole multi-flat HOAs very difficult. Different age groups prefer different things (e.g. colder or warmer in-door temperatures). The level of motivation to change well established habits to more energy saving habits is low.

Institutions

Good, positive, effective and working practical examples – so-called "energy efficient demo-houses" are missing or are not publicly acknowledged. Technology transfer is inadequate and slow. ESCOs are missing in Estonia. Architects are not involved from the very beginning and the objectives and solutions in terms of energy saving are not clearly stated. The green public procurement procedures and standardization are missing.

The institutional capability of the public and private sectors to jointly implement energy saving measures is insufficient. The cooperation between partners is poor. Knowledge transfer would be more efficient and costs would be lower if partners would cooperate. Lack of good and trustworthy experts is one of the main barriers. Architects are not trained to offer energy saving solutions. The high number of home owners in Home Owners Associations (HOAs) makes decision-making slow. The personal problems of leaders of HOAs – some of whom do not train themselves and also prevent others from getting new knowledge and experiences. State policies, strategies and action plans with proper funding systems for energy saving are inadequate. The supply side of heating has a monopoly and consumers do not have possibilities to influence the price of heat, and, if consumption is not measured on a per flat basis (e.g. using MESA), then it does not encourage energy saving. The objectives of heat and electricity producers are contradictory – on one hand they need to produce and sell more energy (heat and electricity) and, on the other hand, they talk about energy saving which is not economically profitable for energy companies which have a monopoly in the region or in the sector. Fair competition is missing from the district heating system in Estonia. An adequate and comprehensive Strategy for Renewable Energy is missing in most countries and state level strategy for energy saving is missing as well.

The non-technical barriers to energy saving are listed in the next section. The knowledge, skills, experiences and solutions for energy efficiency in buildings in the Baltic Sea region will be described in the following sections of this book divided into technical, economical, policy and public awareness issues. Solutions are shortly listed in the concluding chapter.

OVERVIEW OF NON-TECHNICAL BARRIERS TO ENERGY SAVING IN ESTONIA

Ahto Oja[2]

The objective of this chapter is to introduce non-technical barriers to energy efficiency in buildings in the public, private and residential housing sectors in Estonia. A semi-structured questionnaire was used in the face to face interviews and over the phone in September – October 2008. The following persons were interviewed: Mr. Meelis Linnamägi, head of development of Valga City Government, Valgamaa; Mr. Tõnu Mauring, head of the Core Laboratory of Energy Efficient Buildings of the Institute of Technology, University of Tartu; Mr. Ragnar Kuusk, head of the Home Owners' Assocoation of Sütiste tee in Tallinn; Mr. Juhan Peedimaa, CEO of printing and publishing house Ecoprint Ltd. in Tartu; Mr. Andrus Ilumets, owner and director of a real estate company and forest management company of Hiiumaa Island; Mr. Mihkel Pukk, developer of Kiisa Culture Centre, Harjumaa. The results are presented in the following parts of this chapter.

Legal

The contract didn't differ from the previous contracts for building. Standardized contracts were used and did not impose more or less strain on the contractors. There is no need to change contracts as such – what is different is the technical (explanatory) annex of projects – all details are described in a technical annex and the content of it can easily be adopted and used for future building contracts. The guarantee time of the implemented systems in relation to systems that were previously used for building did not differ from its usual two years. The technical annex for a passive house project needs to be very exact, if possible also providing information about materials and, to those dealing with this technology and these materials, instructions regarding undertaking operations in the right order and the use of all equipment.

[2] Manager of Mõnus Minek SEES Ltd, which is providing Sustainable Energy and Environmental Solutions.

The main partners are usually local government (Valga City Government, Kiisa, Tartu, etc.) and the Energy Efficient Building Core Laboratory of the Institute of Technology of the University of Tartu[3] was the main competence centre for the design of passive house standard renovation of most of the buildings in Estonia. Other partners include supervisory bodies for construction quality on behalf of the client, funding agencies (EU ERDF via Enterprise Estonia, Swedbank, SEB Bank), and contractors or building companies.

Common public procurement procedure was applied: 5-6 bidders made their offers, the best offer in terms of quality and price was selected. The positive experience was that all partners were responsible, especially the building companies. All case studies were similar in the sense that the subcontractors involved were some of the first companies implementing the passive house standard in their region and they were interested to get good and positive references out of this process. Most of the subcontractors succeeded in achieving this.

The responsibilities between different actors are managed as in standard building contracts. The business agreements did not differ in comparison to traditional building contracts. The building technical designs need to be good ones and need to state all the required details During the implementation process, some solved the problems, questions, choices via negotiation. It is impossible to foresee all obstacles, most important is trust, a positive attitude towards innovative technology and a problem-solving orientation. The number of architects and companies who are able to design passive houses has increased.

Our experience is that it is impossible in Estonia to include energy efficiency requirements within the planning procedure – public opinion is not yet ready to accept this. Thus, currently in Estonia, the planning procedure and plans do not have limiting nor additional requirements or any impact on energy efficiency.

An amendment to the city development plan was made in the case of Valga City. The city will have one pilot passive house project which has also been the base for Valga's kindergarten project. As in other cases, a few problems occurred at the beginning of the process, but, through proper persuasion with well justified arguments, these were overcome. The city had made an energy audit for 40-flat multifamily houses in Valga, which proved very clearly that a bigger investment and complex renovation solution would have a better payback period and economic indicators. Local government can't adopt stricter rules than the state. Estonia cannot follow the Nordic examples where local Governments own quite a lot of housing stock and thus can implement energy renovation projects in its own property, this is not the case in Estonia.

Once local government wants to implement energy efficiency in buildings, it is worth including such an activity to the city development plan. Private owners and developers are free to implement energy efficient building criteria. The price of district heating has risen three times in Tallinn, which is quite an incentive for refurbishment.

The directive on energy performance of buildings will be in force from the 1st of January 2009 and thus did not have an impact on the case study projects as most of those were implemented before. Estonian economic and energy efficiency indicators are far below those stated in the directive.

[3] http://www.tuit.ut.ee/eeb

The motive and first initiative to start energy saving pilot projects were closely dependent on the leadership of key persons, so-called energy efficiency pioneers in Estonia. This was the case in Valga city, where the key person was Meelis Linnamägi, head of the development department of Valga City Government. The personal interest of Meelis towards energy efficient building lead to an information search on the internet, of the literature and to his participation in energy saving conferences and training, mainly abroad. A similar path of development was observed in all case studies. Positive, practical working examples of passive houses were the most convincing argument to those who don't believe in it. To introduce new working habits to the workers of the kindergarten, hotel and printing house, relevant training will be provided.

Financial

Life-cycle cost is only used by the most aware and knowledgeable companies. In the observed cases, the overall investment cost of the building was calculated in a classical manner. The difference in investment costs compared to the traditional building was usually 10-20% higher.

The pay off time was not calculated in the case of Valga, as the project was funded from EU ERDF and LG's own budget (5 MEEK, €310 000). The pay off period in other cases was usually 5-10 years depending on the agreement with the lending company. The sudden increase in the energy price has decreased the pay off period in some cases. In Valga district heating is still cheap and thus life cycle costs were not calculated. According to the energy audit the energy consumption was 240 MWh before the renovation in Valga. The estimated energy consumption after the project is 20 MWh with around €10000 per year as the energy saving effect.

None of the implemented systems had tax incentives in Estonia. The suggestion was made that public procurement procedure should include green public procurement criteria e.g. the application of environmental management systems (ISO 14000 series or EMAS), preferring local and ecological building material, energy efficiency indicators, etc. Concerning energy price, district heating still has the best price in most cases.

The energy price affects the user's habits in everyday activities. The market for energy saving devices and technologies will grow very rapidly in the near future. For industry, the price of oil shale based electricity is still too low to make real changes happen. On the other hand, some of the big companies have started to complain that their business plans will suffer because of increasing electricity prices in Estonia.

Institutional

The builders and construction companies need training on passive house and energy efficient building technologies. The air tightness of construction seems to be the biggest bottleneck at the moment. The building materials, such as air tight tapes, mastics, and other equipment are not easily available in the Estonian market.

Heat pumps, air recovery systems, solar heating systems are available in the market while solar panels for electricity are not. Renewable energy technologies for housing, in terms of price and quality, are not available. The first positive reactions to the market are visible in Estonian society with a building construction company Kodumajatehas AS having started mass production of energy saving element-houses. The best sources to find good technical solutions are training events, study tours, visits to exhibitions, the Internet, technical journals, research institutions and yellow pages. Conventional technological solution systems that improve energy performance of buildings are most common in the market, but heat recovery, renewable energy systems and ecological building materials should be better represented. Despite that, the experiences from case study projects will be used as guiding principles and there is still a long way to go towards standard methods. Some of the results of the Valga pilot project can be used and implemented as standard methods in future, but the precondition is that the client must be aware and must know what he wants.

The main barrier for energy saving building, housing and renovation is the lack of motivation, public awareness, knowledge and specialists. The producers and traders of specific materials and equipment are not well represented in Estonia. Funding is also a critical issue, since energy efficient buildings cost more, without additional support from the EU or from the state (KredEx), it is hardly possible to finance the project from its own sources or with a loan.

The main modes of communication are common ICT tools: phone, internet, email and Skype. In more complicated cases, core working groups had meetings every week where, at a minimum, the client, the contractor and a supervisor participated, other partners participated according to the agenda and needs, e.g. Core laboratory of University or suppliers of materials and equipment.

The dialogues were managed well between partners, the most common communication methods proved to be most efficient and successful, such as well prepared face-to-face meetings. When everybody knew the problem and offered solutions and all plans were on the table and visible for all, everybody concentrated on the topic. All partners were equally involved and willing to contribute in all cases studied in Estonia.

The users were usually not involved in the project design phase but were trained afterwards to behave according to the new standards. The workers of the kindergarten were convinced by a technology expert that in-door environment would be best in this type of building: fresh air, equal heating of all space, etc.

Social

Social planning was successful in the case of the kindergarten: workers expressed their wish to have soundproof interior walls which will now be made. The multifamily residential house had problems with social planning, some families supported the refurbishment, but others didn't. Only after some positive practical energy saving was proved, most of the inhabitants started to support further refurbishment.

The buildings were supplied with energy from a public energy source, an individual one, and a combination. District heating is still an option in many cases, but in a few cases, an individual energy supply was used, e.g. in the case of the printing house and cultural centre. Sun heating systems will be installed in many cases, which will also be used for heating water. The main resource used for electricity supply is fossil fuel (oil shale). Some wind and bioenergy systems are also installed in Estonia. It is too early to assess the main weaknesses in using an individual energy supply.

The energy performance is usually measured on site and includes electricity, heat and water use. In some cases, the individual heating consumption system MESA was used. The head of the HOA is responsible for the measurements. There are some plans to automate the collection of all measurements via the web to one server and make it publicly available on-line. The energy performance changed significantly after the first measurement with the MESA system in a residential house.

The user behaviour patterns influence the energy performance of buildings in all areas and at all levels. The training of tenants will be crucially important, to avoid the opening of windows in summer time in a passive house.

The concept of direct sunlight shades was changed in the Valga case, as it was doubted, that the kindergarten workers would open and close sun shades with engines properly, thus a stable wooden shadow stage was designed and used instead.

Motives, knowledge and available solutions influence and change the user's behaviour most. The objective of all the case studies has been to raise public awareness on energy efficiency. Any differences in use patterns depending on different cultural, social or generational aspects of users were not observed.

The implemented measures had significant positive effects on the in-door environments, comfort and living standard. One can influence the user behaviour in order to improve the comfort via training, public awareness campaigns and working pilots, with on-line web-based energy consumption measurements.

The main non-technical barrier has been a mental one, the decision makers are very suspicious. Is it hard, will it give such a saving as promised, will it be economically feasible? Also, inhabitants of residential buildings were sceptical at the beginning as was the funding agency. The suggestions for future projects include to explain, convince, calculate, improve and show that these technological energy efficiency solutions work, that these are healthy, economically feasible and eco-friendly.

Editors hope, that the following chapters will give to readers the motivation, the will and the knowledge to make change happen first in our own mentality and secondly, in practice, getting energy efficiency in buildings as normal and self-understandable as breeding oxygen in every second of our life.

1. TECHNICAL ASPECTS OF ENERGY SAVING

1.1 Energy saving opportunities as sector of economy.

Marek Strandberg[4]

The economy of saving energy in housing should be one of the branches of economy but that is often ignored in Estonia today. Energy conservation is a branch of economy - it is also dependent on the use of money, while it is related to money flows, it is a branch of economy. One can quite often ask "what does this 'green' housing look like?". It means to us that it has a small ecological footprint and also offers comfort to the residents, it doesn't mean that this impact has been achieved by reducing comfort.

The planning of residential areas is also very important. This means that we have to plan for energy production as well and the whole energy system should be looked at differently. There are already quite mistaken presumptions in the notion that energy consumption would grow and that we have to produce more or obtain more energy, but we have to know what the energy consumption is (in figures) right now. The ideas should be implemented already in planning housing, transport and other things – this is an inter-related topic and if we neglect this, then the result will be that our energy system has been planned to be quite expensive and difficult to handle. The topics on saving of energy and passive houses will be introduced later in this chapter. .

Now the question: why nothing is done to achieve energy saving? The human being is a conservative being and, looking at the development of technology, we can see that some changes in technology take place over lengthy periods of time. Despite the fact that the knowledge is already present, it quite often takes hundreds of years. If we are looking at the steam engine, then the first was invented in 1755 and within 100 years, the efficiency was improved quite regularly and we can see how the steam engines were replaced by more powerful engines using different technologies. Each step in the development involved terrific pain in changing mentality. And then the overall goal is "mobility" as we can see in the way in which cars have developed. In the Estonian situation, we have more cars than children as of today. So how cars have been developed and other processes can be detected in the living environment as well. How different living spaces and residential areas have changed.

There are pros and cons to every type of house during different development phases, but our reality of today is like living in private house or in multifamily house in Estonia. Housing technologies are becoming more hybrid in nature. Low energy consumption or hybrid technology use and maximum use of solar energy have been enhanced and also the heat has been caught through ventilation pipes as well. And, if we are talking about contemporary building and construction technology like passive houses and so on where the energy consumption is extremely low,

[4] Member of Parliament of Estonia, First Spokesman of the Estonian Green Party

then we are talking about hybrid technology that already starts in the design phase. In the 21st century the construction of buildings and residential areas is totally different from a couple of hundred years ago. The first picture in peoples' minds is that I have a log house close to the forest and I am heating my log house with firewood. But the annual energy consumption of such a house is 200kWh/m^2. So such a traditional building (that was traditional some 100 years ago) is definitely not similar to the energy conserving house.

Technology barriers

The technology barriers in cities are focusing on fossil fuels and we have to understand that the risks are growing. If we do not have fossil fuel supplies any more then our living conditions and our comfort would be drastically reduced. But hybrid buildings or passive housing can exploit natural energy resources. It is also creating and introducing a new mentality and a new living speed. Today, we have quite simple choices: the media tells us what to buy and what is left over as waste that will go to the toilet or to the garbage bins. Today we have very little space for solar energy or hybrid technology. Our today's environment produces people who are wasting everything that they get their hands on. If we want to reduce the ecological footprint then the only way to achieve that is to change those spheres - the nature of the spheres that surround such people.

The energy, mobility, work - should we opt for distant or home work more depends on how we build our houses, how we build our roads and plan the traffic and what we do with the waste. This is quite an old problem. If a machine is transforming energy and doing some work then part of this energy becomes an entropy. And it is not possible to handle this entropy or inconvenience that is also felt through the climate changes that those technological aids that we have right now entail. We have to learn to save those resources around us and at the same time maintain the level of comfort.

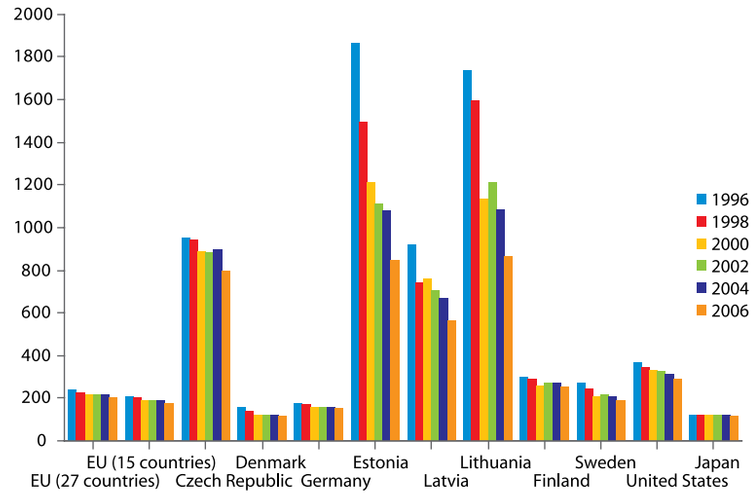

Figure 1. Energy intensity of the economy of selected countries by gross inland consumption of energy divided by GDP (kilogram of oil equivalent per 1000 Euro). Source: Eurostat.

Regarding the energy sector in Estonia, Latvia and Lithuania, the consumption of energy for earning 1 euro is presented in Figure 1. Those data come from 1996-2006 but already here we can see that Estonia (and Lithuania) are on of those using more energy to produce 1 euro than other member states in the European Union. One of the main reasons is that the living environment is oriented to wasting.

How to bring about changes? Let's look at the behaviour of capital here. Capital is generating activities that would create a new environment and a new environment would be the result. If the loan or the bank offering loans is also establishing the conditions for use of such a loan and predicts already the conditions in this new environment then this capital is already improving the quality of life of people. But our model of the economy as of today is slightly different. We are exploiting the capital - natural resources especially should be transformed into money first and then into activities. The result would also be money. That is it, no other opportunity.

The most complicated area in bringing about change is not related to the house but concerns the entire environment that is being created and the impact on our personal time. If we waste our time our attention would be lost as well and the security of the individual and at societal and national levels would be compromised. How to reduce loss of time? What are the mechanisms here? We should avoid traffic congestion and jams - the loss of time is more obvious here. There are also other ways to lose time. When the homes are far away from the schools and hobby circles and work places and the morning traffic would take place (as shown in green) – a family sitting in the car going to kindergartens, work, school (Figure 2).

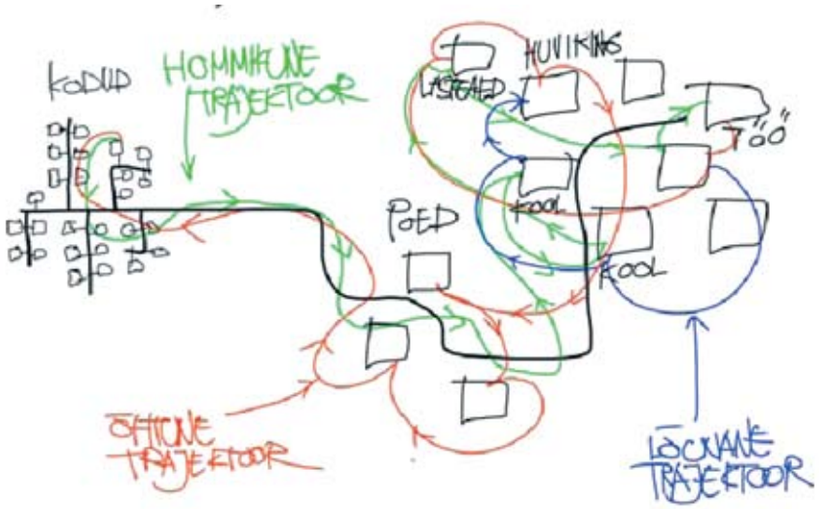

Figure 2. The typical traffic trajectories of 'typical Estonian family' living in suburban area of big cities: the morning traffic trajectory is in green, the lunch traffic trajectory is in blue and the evening trajectory is in red, altogether such family spends 1-2,5 hours every day in car in traffic jams.[5]

[5] Small dictionary to Estonian: kodud=homes, poed=shops, lasteaed=kindergarten, huviring=hobbies; kool=school, töö=jobs

Also hobby circles for children during lunch time and in the evening shopping and so on and back home late at night. And, believe me, two to two-and-a-half hours would be lost in such a traffic pattern so a person is practically a taxi driver. If we ask why productivity in Estonia is still so shaky, just look at this and you will see how time is lost.

What are the problems at the housing and in the buildings? We could even leave aside or jump over a phase in our development - the phase to detect the cold bridges in houses. It is quite clear that our houses have plenty of cold bridges here and leaking holes. The situation here in Estonia is catastrophic because the average annual energy consumption of a building is between 250 and 350 kWh/m^2. Insulation systems are shaky, the ventilation is not well thought out and, in summary, the energy loss is 300 kWh/m^2 per year and 1.1 million people are suffering with that and paying for it. Then in 20 years (the calculations here are quite modest in light of the rising energy prices) it is about 2000 kr/m^2 annually. And now, with regard to the overall EU call to reduce energy consumption by 30% and improve and refurbish houses, then we are still winning because this will cost us less than the loss in total. But the problem remains here that 1.1 million people live here in Estonia in similar houses and this is not a small number. The realistic investment package we need for refurbishing the houses and producing more ecologically friendly houses calls for technology to be there and systematic activity to be implemented. If we compare an energy-wasting house and an energy-saving house (and not even a passive house) of similar size it would be 3/ m^2 litres more consumed in energy-wasting and it is 1.5 l/m^2 in the green, energy-saving house though, definitely, the fuel prices are unpredictable to make exact comparisons.

Where to get the financing instruments in order to move quickly? The role of the state is extremely important here. KredEx[6] has managed to create some financial instruments but this is a drop in the ocean. We have to find some governmental guarantees to similar loans in order to implement a nationwide energy-saving program. This could take 10 years and cost approximately EEK 150 billion. This is the money which would be channelled into small and medium sized enterprises. This money would allow us to reconstruct and refurbish the existing heating systems and turn them into saving systems and the banks would have an important role here. A 150 000 kr loan per capita would be needed here and KredEx would tell us that it could even be smaller per capita. Only under such conditions could we achieve the goal. So small and medium sized enterprises would be actively involved and satisfied. The EEK 150 billion over ten years means that the annual GDP influx would be EEK 6-9 billion. And if somebody asked us today: "What is the program for coming out of economic depression and revitalizing the economy?" Then this is directly related to the energy performance and energy efficiency issues.

[6] Estonian State Guarantee Fund for Export, but also has the division and financial instruments for energy saving in housing in Estonia, it will be introduced in more detail in following chapters.

1.2 Legislation and funding in Estonia – strategies, action plans, experiences

Madis Laaniste[7]

The role of housing in terms of energy consumption in Estonia is presented in Figure 1, it presents the energy balance. If we look at the consumption, we see that the share of households is really big – it is 41% - but according to the present available statistics we can't differentiate here between apartment blocks and private households or the like. The energy is consumed not just in households, but also in other sectors: for example offices, retail shops, hotels, restaurants, industrial buildings. When we speak about energy consumption then, from the point of view of the state, we focus not on those different users but on the whole picture.

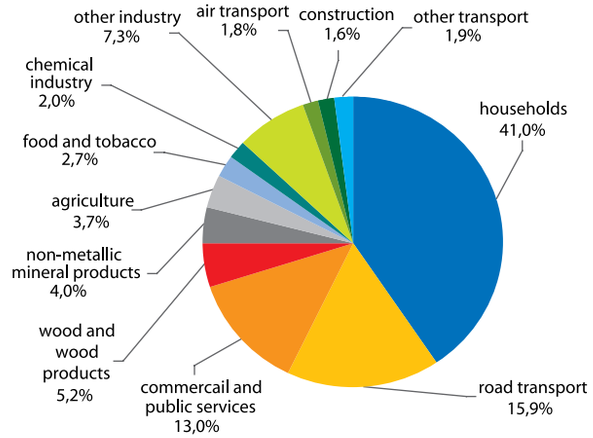

Figure 1. Energy consumption by sectors in Estonia.

Now, bearing in mind the building stock in Estonia, then, as a matter of fact, houses, or any other buildings you can classify as residential buildings, are the biggest consumers because the space that they are occupying actually corresponds to 50% of the total. That influences quite a lot of our action plans here in Estonia and it means that a lot of work in our department is connected with housing stock and hopefully there is quite a lot we can do about it.

[7] Ministry of Economy and Communication of Estonia

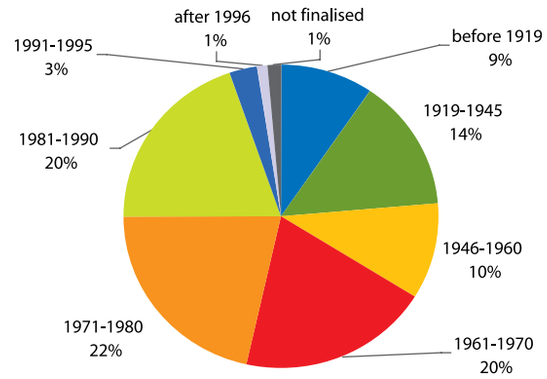

Figure 2. Housing stock by year of completion, total number of dwellings is 638.180.

If you look at the age structure of the housing stock in Estonia (Figure 2) you see that most of it has been built during times when energy conservation was not very important and the most important thing connected to housing stock was providing shelter for people. That means that the majority of houses, considering today's building standards, is in a relatively bad state and there is a lot of work to be done in order to improve the situation. How can we achieve that from the point of view of the government? Well, the government is compiling its strategies and plans and I am also going to mention which legislation documents we have to support us in this work. Of course the list is much longer but I tried to choose the most important ones. First of all we have the National Energy Efficiency Action Plan; secondly we have the Housing Sector Development Plan for 2008-2013 and then we have the Operational Programme for the Development of the Living Environment – that is for the use of the Structural Fund resources and it is also closely related to the energy conservation objectives.

A short overview of what has happened in this sphere. First of all, the National Energy Efficiency Action Plan which was compiled for the years 2007-2013. The compilation was based on the EU Directive 2006/32EC and, according to that document, all member states have to achieve 9% energy saving during those years. For that purpose, the governments have to compile an action plan. Tõnu Tuppits in his opening words already mentioned that four things are important from this aspect in a society. First of all, the will to do something. Then the know-how, the resources and favorable circumstances. The first area of our activities is connected with raising the awareness of people and, for that purpose, there are specific measures intended to achieve those objectives – environmental education and whatever is important in order to raise awareness, e.g. focus on improving the awareness of energy consumers, eg. through supplying the information in energy bills, websites, includes specialised measures for local governments and SME's. Secondly the know-how or the training connected with that. Additional training offering possibilities for people who are working in this field and also widening the scope

of additional training. All these people who, in their everyday life, are connected with housing conditions or housing problems should be informed about the new possibilities, new technologies and the possibilities for achieving energy conservation. Now, when we come to the next item, governmental resources are limited (which is something we all very well know), but the promotion of investments to energy efficiency through direct grants, obligations to energy suppliers and instruments improving the attractiveness of energy efficiency investments are these measures government can implement.

Government also tries to make use of the Structural Funds which are available to us now for that purpose. The fourth area would be the development of the legal system or the framework necessary to enable all those activities, e.g. transposition of EU directives in energy company 'Eesti Eenergia' field and getting prepared for actions under Commission's Energy Efficiency Action Plan.

In terms of the budget the resources are allocated between different areas, that the biggest share of it goes for investment support (€89.3 million). Specifically for housing, according to the present plans, from Structural Funds it is about €16.3 million for the period 2007-2013. It is also important to finance the awareness-raising activities (€12 million). In other spheres we are talking about smaller sums. All in all, something like €100 million has been allocated in state budget for energy saving measures via different strategies and action plans.

On the other hand, speaking about the legislative framework in Estonia and the development of it, especially from the point of view of housing, some amendments have recently been introduced into the Building Act of Estonia. The Building Act of Estonia was brought in line with the requirements of the energy conservation documents of the EU. The requirements are relatively high which means that, in our case, most of the housing is facing the problem that they have to start taking steps in order to get the energy labeling. In the next few years, when houses are bought or the ownership is transferred or they are rented, we hope this energy labeling process will be acknowledged. If we look at the governmental resources and compare the possibilities of the private sector (what the private sector contributes to housing annually, for example, in order to get housing loans) the difference is very big. The amount of mortgage loans is about 200 – 300 times greater than the funds allocated by the government to housing. This means that it is the consumers who can largely influence the future housing conditions in Estonia.

The main activities with which the ministry has been involved in recent years are the compilation of the Action Plan and also working out the infrastructure. By today, we have companies which are capable and able to provide services - energy audits and the issuing of energy labels. Of course these procedures need to be simplified but that doesn't mean that the aim is simply to handout the label or the certificate but it is also to make the whole process more reliable and to ensure that the analysis is conducted in a serious way. We currently have 38 auditors and training is ongoing in order to increase that number. Year in year out we are also going to continue the governmental support for the training programs and also for the reconstruction of older houses. The Energy Efficiency Competence Centre most certainly has also to increase its work to raise the awareness of people.

Conclusions

The Minister of Economic Affairs and Communications has to issue the regulation which specifies the houses which need the energy conservation labeling. It is clear that the government-owned buildings, those of state agencies will certainly need this energy-performance label in the future. If the energy auditing has already been done, then the issuing of the energy label is a very simple procedure. So for those it won't be a problem in the case where biuilding owners already have the energy audit.

Specific measures for solar panels on roofs or land heat pumps will be in the national plans in future. These spheres which are connected with renewable sources of energy, this is actually something on which we are going to focus in the future but right now it is not such an acute issue for us. We are currently trying to disseminate information.

1.3 Estonian experiences on implementing and funding energy saving action plans via pilot projects.

Mirja Adler[8]

This chapter introduces results of a project called "BEEN". Within this framework the full renovation of a house was carried out and this article introduce the process and experiences of it. The Credit and Export Guarantee Fund KredEx (hereafter KredEx) is a self-financing foundation and is founded by the Estonian government. It offers services and, in actual fact, housing is just one part of its activities. KredEx also guarantees loans and for that service it charges a fee and it is from this fee that our income derives. KredEx has 27 employees, of whom 7 are in the Housing Products Division. The owner's representative is the Ministry of Economic Affairs and Communications with which KredEx has quite close cooperation.

The name BEEN is an acronym for the English words: Baltic Energy Efficiency Network for the building stock. In the beginning, BEEN had 26 partners from different countries of the Baltic Sea region, among others from Estonia, Latvia, Lithuania, Poland, and Germany. The partners from Estonia were KredEx, Tallinn University of Technology, Estonian Union of Cooperative Housing Associations, Association of Estonian Facilities Administrators and Maintainers, Ministry of Economic Affairs and Communications of the Republic of Estonia and Tallinn City Government. The European Union covered 75% of the project costs.

The objective of this project here in Estonia was to achieve energy saving of up to 50%. At that time we were not very sure how much it could be possible. We wanted to create an example of good practice for how to renovate an apartment block. We intended to monitor the results over a 5 year period and, later on, we wanted to expand the real estate management know-how and follow best practice for a period of at least 10 years. In the beginning we had to find the apartment block and for that purpose we had to set down some criteria according to which we were going to choose it. It was not that we simply walked around town and decided that this could be a block to start renovating. In order to determine the criteria we consulted our German partner (the lead partner). We believed that it had to be a typical apartment block in Tallinn – either of panel, block or brick construction and that it should have meters for measuring heat and hot water consumption. We also wanted access to all the heat and hot water consumption data for the past 3 years. In addition, we required that no reconstruction work had been undertaken on the apartment block during the previous period and that the owners of the apartments in this building would pass a decision to take a renovation loan. This decision was vital from the point of view of starting the project quickly because, if you start decision making process, e.g. applying for a loan and, it takes quite a lot of time. Additionally the building had to be constructed in the period between 1955 and 1990 – this was the period the BEEN project was focusing on. We also needed the annual reports of the economic activities of the apartment association for the preceding 3 years. In addition, we needed to have an energy audit or the expert opinion of the renovating company. The competition was opened in

[8] Head of the Housing Products Division of KredEx Foundation

2006 and, as a matter of fact, we only received 3 applications. The competition lasted for one month.

From the 3 applications received, we chose an apartment block on Paldiski Road. The reason why there were not very many applicants was probably because we demanded quite a big investment – it was EEK 5 million. Which, at that time, was not very usual in Estonia. The decision to renovate had to have already been made (that is, the apartment association could not make that decision after the competition was over but that it was something that they should have had in hand by the end of the competition). That also minimized the possibility for other apartments to apply.

This building also had an energy audit and, in 2004, the consumption of energy in this apartment block was 180 kWh/m^2 per year. Our objective was to achieve up to 50% energy saving after renovation.

Figure 1. This was what the BEEN project pilot building looked like before anything was started to do.

The building was built in 1977. It is a very typical example of panel construction in Tallinn - there are many of them all over Estonia – 5 floors, 4 staircases, 60 apartments and 31044 m^2 of living space. The side walls were not insulated and we had energy consumption data for 3 years.

First of all, the designs and plans had to be made because you can't start any construction work without them. We renovated the roof, we added extra insulation and all the windows were changed except those windows which had been replaced earlier by the apartment owners themselves. The whole facade was insulated apart from the side walls which were already insulated and required only a little finishing work. The heating system was completely replaced – from a one pipe system they went over to a double pipe system. Glazing to all the balconies and loggias was undertaken. Where loggias had already been covered, these existing coverings were removed so that the facade was consistent and it looked beautiful. With regard to ventilation, we didn't have enough time so works are still going on this year. (The BEEN project ended before that but the apartment association is continuing with ventilation on their own this year).

The building supervision company was chosen by the KredEx Foundation and it was the KredEx Foundation rather than the apartment association who was in contractual relations with and paid for the building supervisor. The cost of the project management was 120,000 EEK. We had quite a tight budget and we were looking around until we found a project manager who agreed to do the work for that amount of money. The cost for design was 93,000 EEK. Reconstruction became a little bit more expensive than we had actually planned it because it was during the peak of the construction boom in Estonia. This meant that most of the work cost more than we had budgeted for it. The roof cost more than 800,000 EEK, the windows cost approximately 700,000 EEK and the balconies added 1,700,000 EEK to that. The whole cost of the project was EEK 6.3 million which means 2,005 EEK/m^2 which is quite expensive, above average in Estonia.

How was the project financed? Self-financing was 581,993 EEK which was 9.2% of the total cost of the project. The support allocated to them from the BEEN project was 1,017,134 EEK and 120,000 EEK from that was allocated to the project management and 897,134 EEK to reconstruction. At the same time, we also had a national program for supporting the renovation of apartments to which they could apply and they received 507,000 EEK from there. They also took a loan from Hansapank for EEK 4.2 million for 15 years. The EEK 4.2 million for 15 years has an interest rate of 7% which is fixed for the first 5 years. That gives a self-financing cost of 9700 EEK per apartment which means it was 185 EEK/m^2. The loan repayments are 39,500 EEK per month which means it is 12.60 EEK/m^2 per month.

Figure 2. This photo of the renovation work going on.

The people who had to replace their windows made a special loan arrangement because some people didn't need to since they had already replaced their windows earlier.

We also wanted feedback regarding what people thought about the whole process. We conducted a survey among the apartment owners and the people living in the apartment block.

The survey was carried out in November 2007. Work was still going on (it was finished by December) but most of the work was done. We had a questionnaire with 40 questions. It was not posted into the mail boxes but students interviewed all the people who were available and who were willing to answer. From 59 apartment owners – actually there are 59 apartments in this block because 2 apartments have been combined and they belong to a single owner – 48% answered (which is quite a good response rate). General feedback was positive. 56% of the apartments are privatized, 34% are bought later on from the real estate market and the rest are obtained by other means, for example inherited. 39% say that they have lived in this apartment block for a period longer than 20 years.

15% of the people said that their financial situation was such that they could afford almost everything. 58% responded that once in a while they could make some bigger investments. From that point of view, it was not a very heavy burden for them. Regarding support for the renovation plans: 67% said that they supported them fully, and 23% said that they partially supported them. This is explained by the fact that many respondents didn't like the design of the loggia coverings.

A very important question to ask was: "how significant was the outside support which they got for the renovation?" Here is a small contradiction, but we can see that 90% of the respondents believed that without the support they wouldn't have been able to carry out the renovation. At the same time, 31% said that the support received was not a decisive factor. We have feedback regarding the results of the renovation works. Mostly it was the heating system and the facade to which people reacted. They tended to like the heating system but they didn't like the balconies because it caused some people to lose the functionality of their previously enclosed balconies. Some people preferred to have an extra warm room and some people had used these balconies for additional storage. The most important thing which we found out from the questionnaire was that the reconstruction process was complicated by the attitudes of people and their different ideas and tastes. The majority of the residents were happy with whatever was going on. Many people noted the positive side of involving an independent institution - in this case KredEx, which also participated in the meeting in which the additional loan was discussed. It was a very difficult meeting and it was not an easy decision to be made. But from that time on, we saw how support grew for the renovation and also for the additional loan because inhabitants could see with their own eyes that things were improving.

Table 1. Comparison of energy consumption for heating, unit cost and average monthly costs in 2005 and 2008.

Paldiski 171 energy consumption for heating	**2005**	**2008**
Heating, MWh	392	241
Price of heat unit, EEK	431	936
Energy consumption for heating, EEK	169 082	225 020
Cost EEK/m²/month/heating period (9 Months)	5,98	7,95
Apartment in month in average, EEK, heating period	310,96	413,40

The first data about energy consumption is presented in Table 1. The work was finished in December so we can only compare the results of the 2008 only. The heat consumption (corrected for recorded temperatures) has decreased by 38%. If we compare the years 2005 and 2008, the price of heat energy has risen by about 117% and , at the same time, the cost of energy per month has increased only 33% in this case which means that they have certainly gained significantly.

The first data about energy consumption is presented in Table 1. As I said, we finished work in December so we can only compare the results of the first quarter of 2008 only. The heat consumption (corrected for recorded temperatures) has decreased by 30%. If we compare the first quarters of 2005 and 2008, the price of heat energy has risen by about 80% and , at the same time, the cost of energy per month has increased only 24% in this case which means that they have certainly gained significantly. In April, the costs had risen even more (1200 EEK/MWh) and we are probably facing further increases.

Figure 3. The pilot building of BEEN project in Paldiski road in Tallinn after refurbishment in 2008.

The new outlook after the refurbishment is presented in Figure 3. Of course, the building itself with its modern facade is something that catches your attention straight away. The living environment has improved considerably and, for at least 5 years, the apartment association must forward their energy consumption data to KredEx so that we can monitor and analyze the situation. We have also made a film about the project. Both the film and the detailed reports are available on the KredEx homepage (www.kredex.ee). The reports are in both the Estonian and English languages and provide a detailed description of the whole project.

Individual energy conservation end up with some residents living at the expense of others as they can turn down their own radiators because lots and lots of heat comes through the walls from the neighbouring apartments? But, the individual apartment cost of heating calculation is not based only on their meter readings. I believe that 30% of the cost is shared according to the apartment sizes. So it is still preferable to heating the atmosphere because some people believe it's too hot and open their windows.

1.4 Finnish experiences on energy saving and efficiency in spatial planning and housing

Gordon Douglas[9]

Introduction

Eighty per cent of people in the European Union now live in cities. A significant way forward in controlling energy consumption is to manage and control cities through spatial planning. By doing so, energy consumption can be reduced with the aim to achieve zero carbon emissions in cities. This will entail cities needing to be more aware of how the physical structure impacts on energy use and how the location of functions have a material effect spatially within a city-region. Helsinki is one city that aims to use spatial planning to achieve energy savings.

Helsinki is as far north as Anchorage in Alaska. It means that housing production must take account of keeping houses warm in winter, yet cool in summer. This makes the building process very expensive in Finland compared to most other European countries. In the future, cities will need to build more energy efficient housing; housing that is smaller, more compact and dense, and closer to the city proper. In this respect, spatial planning has a role to play in the planning and housing processes.

The management of cities and how new development can fit into the city structure requires that planning must be aware of alternatives. Cities have a choice. They can either opt for a more 'Americano' style of city planning, based upon the car, with the consequences of creating urban sprawl, or, to adopt a more European city structure based on compactness and a polycentric structure if cities of the future are to seriously overcome rising consumption of energy and reduce CO2 emissions.

I intend to explore three issues in this chapter. Firstly, I will look at the impact of planning instruments and policies, and how they can be used to improve the effectiveness of city-regional development. Secondly, I will describe, with reference to Helsinki and other cities, how spatial planning can be translated into practice very differently, with major consequences for energy use. In doing so, the drivers of change will show how the spatial structure of our cities respond to current trends and future planning and how Helsinki's new strategic plan aims to achieve spatial cohesion through planning in practice, with particular reference to energy saving. And finally, the 'reasons why' a city like Helsinki is able to succeed in creating a structure that is already shaping the city to take account of energy savings, and the lessons we can learn from Helsinki.

Planning Policies and Instruments: Mitigation factors

Spatial planning is essential if the intention is to lower energy use. Spatial planning, through its policies and instruments, can improve the effectiveness of cities and make regional development more cohesive. To do so requires a series of mitigation factors to come into play.

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[9] Architect, City Planning, City of Helsinki, Finland

Mitigation, in reference to controlling energy use, needs to be understood in spatial terms in order for cities to be managed properly. There are a number of mitigating factors that come into play at the spatial level. Cities have to be compact. It is no longer the case that cities by themselves are capable of dealing with the energy issue – cities now have to include the city-region if we are serious in solving the energy crises. In order to do this, city-regions need to be dense and based around high quality public transport networks, particularly rail i.e., metro, trams, commuter rail, if cities are to provide an alternative to the car. Urban sprawl needs to be stopped and controlled. This can be achieved through the creation of polycentric city-regions. Spatial cohesion is needed through a long-term strategic planning strategy if cities are to be managed properly. This will require creating strategic plans that set out the physical compactness of a city-region for 30 or 40 years ahead. By doing so, planning can map the intended areas of growth to be built within the existing city-region, to re-use desolate and worn-out 'brownfield' sites rather than on 'greenfields', and construct the new city-regional structure around public transport network inter-changes. The new development areas can be fitted into 'development corridors', which aim to restrict any new development outside of those corridors. Urban sprawl will be significantly reduced. A compact city-region offers a superior use of energy by reducing the length of commuter journeys. A more radical solution is required to rationalise work-place location spatially with new housing development.

Planning instruments, such as long-term strategic planning, play an essential part in making a city. Criticism of strategic planning usually refers to the point that economic life is so rapid that planning is insufficiently responsive to market change. It is also suggested that it is impossible to dictate to a city's physical structure if the economic changes cannot be correctly forecast. However, planning works at two levels. The first level consists of economic and social relationships. Planning has to take account of these relationships and the trends that follow, but a strategic plan, or master (local development) plan can build flexibility into a plan. The second level, the city structure, operates at a different time-scale. In Helsinki, the planning of the metro took approximately 15 years from initial sketch designs to implementation. For the new high-tech goods harbour in the east of the city, the planning to implementation required nigh on 20 years. Analysing the physical requirements of a city, or city-regional structure, requires both long-term planning and resource commitment. A master plan should locate the physical changes required in the management of new development with the compact city criteria outlined above; hence, if the economy slows down, achieving the long-term goals on housing, transport and the environment will merely take longer. If the economy speeds up, the objectives will be met quicker. The key point is that the spatial structure of the plan – the physical land-use changes – remains the same. Future plans must take account of these mitigation policies in order to be more effective in the long run.

Planning is highly important in respect of how energy is used efficiently. A more compact polycentric city-region, with a hierarchy of centres, will aim to balance the economy and its benefits more evenly at a spatial level, it will decentralise a number of functions to the periphery yet it still relies on maintaining a strong centre, and this will produce greater spatial cohesion. This in turn will go towards reducing energy consumption and ultimately, carbon emissions.

Housing production will also require a renaissance in thinking in terms of reducing the use of energy. Housing in Helsinki is small and compact. Some 87% of households live in residential blocks of flats. Ironically, Finnish households complain that housing in the capital city is too cramped. This is the future scenario for all of Europe. Housing consumption will need to change towards the levels of living as it is in Helsinki. Europe will need to get used to living in smaller flats, and flats that are energy efficient and with zero carbon in emissions. Housing costs will need to rise to meet the new criteria of energy-efficient buildings. The extra costs will be balanced by the savings in energy.

Cities in Comparison

Major structural changes will take place in Helsinki (Figure 1) in the next 30 years. The population of 568.000 is expected to continue to grow. It has grown by nearly 15 % in the past 10 years. The question is whether or not those significant changes will impact adversely on the use of energy. I claim spatial planning will benefit cities. By comparing how Helsinki has managed its city spatially with examples from other cities, it is easier to comprehend the importance of the spatial planning process.

Figure 1. Master Plan of Helsinki 2002, city structure and new development areas are indicated in red colour.

Let us take for example, Helsinki's neighbour to the west, Espoo. Espoo is about the same size as Helsinki but with half the population. Espoo is useful as it is allows us to see what can happen to a city that is growing in similar circumstances to Helsinki, namely, it conforms to the

same planning legislation, adheres to the same set of National government guidelines, and must take account of the statutory regional plan. Yet, Espoo's planning process has created a completely different shape to Helsinki. There is more urban sprawl in the city-region, with a lot of low-density housing, the majority of people are car-based, space is mainly privatised and the key areas of development are in unconnected clusters. Helsinki on the other hand, is compact, dense, and has, in relative terms, one of the best public transport networks in Europe. Its environment is considered very sustainable, and Helsinki's long-term strategic plan aims to create a polycentric city-region over the next 30 to 40 years. This will require a change in attitude, though, by the surrounding municipalities if better spatial cohesion for the city-region is to be achieved. Hence, there are lessons to be learned from this for cities like Tallinn, who are experiencing similar growth problems as Helsinki. The development trends attempt to concentrate new residential areas outside the city boundaries thereby reinforcing more urban sprawl within the region. This stimulates greater car usage, leading to rises in energy consumption. Unless the city-region acts as a single unitary whole, the foreseeing future looks bleak from an urban sprawl point of view.

The same planning system and process has been used in both cases, in Espoo and in Helsinki. How then is this possible? Basically, it comes down to the way city management is organized, and whether a city uses long term strategic planning methods or resorts to short-term management. It is about choice.

Long term strategic planning starts with a vision. In most cities, projects lead the strategic vision, rather than the vision leading local projects. Stakeholders can participate in what they want their city to be in the next thirty, forty or fifty years. That is their wish list and it is called a vision. Planners put that vision into a set of policies. The policies create a mixture of programmes to be implemented. As the programmes are translated into practice, this results in changes to the physical structure of a city which matches with the economic and social needs of a city and its region. This in turn will demand changes in governance. New forms of governance will be required in order that a city-region can manage and develop in tandem. The alternative is likely to lead to sprawl and wasteful competition between local authorities and a rise in energy consumption.

Structural Differences: Plan-led and Developer-led planning

What Helsinki is witnessing today is the greatest physical structural change the city is experiencing in 200 years. Helsinki is building four times more than London, three times more than Stockholm, and three times more than Amsterdam. Helsinki's planning process is plan-led. In practice that means the plan leads private and public investment spatially. This is primarily due to the fact that land is 80% in public ownership.

In consumption terms, the only two cities that come near to what Helsinki is producing today have been Dublin and Madrid. Let us take Dublin, as it is similar in size to Helsinki. Dublin is a beautiful city, well-known for its cultural quarters. But on the outskirts, it is a different matter. Dublin is developer-led. During the recent boom years, private developers were able to have a major say as to where development was to take place. Development took place where money was likely to achieve highest returns on investment. Dublin in the past 25 years has had the same amount of investment as Helsinki. And what has happened? Similar results as to Helsinki's

neighbour, Espoo. Dublin allowed significant amounts of development to take place on the periphery without due course to public transport needs. This is well documented. This resulted in greater numbers of commuters coming in from the outskirts by car, resulting in traffic chaos during rush hours in the city centre. The majority of housing has tended to be low-density, with greater urban sprawl. The net result is that the Irish government had to come in and invest €738 million in building 2 tram lines to contribute to mitigating the traffic problems. Helsinki already has 12 tram lines and metro lines for the same size of city. In Dublin, private investment of new housing was allowed unabated and there were no controls to tax new development to create a fiscal surplus to contribute to much-needed new public transport. In Helsinki, it is the City that controls land-use development. The City decides where to locate new development, what the land-uses are to be, how dense the developments will be, and even divides the development projects for implementation into three, 10 year time-frames to spread investment more equitably against the highs and lows of booms and slumps. The spatial differences between Helsinki and Dublin are remarkable: everything is controlled and managed in Helsinki. A plan-led system enables Helsinki to harness private and public investment in partnership. Spatial disparities are minimised at the plan stage. Helsinki probably is the least spatially segregated city in Europe. By regulating the spatial structure and controlling development, Helsinki is well advanced to take account of the necessary changes required to minimise energy consumption and be in a position to contain carbon emissions in the future.

Drivers of Change

The drivers of change are population growth and social equity, economic growth and new technology, environmental change married to transport issues, and spatial cohesion (Table 1). These form the key-issues that will transform Helsinki's structure during the next 30 years in an attempt to reduce future energy consumption in the city through its strategic and master-plans.

Table 1. Driver of change and indicators to measure the change.

Drivers of change	Indicators to measure change
Population growth	1.5 % per annum
Economic growth	New jobs; new technology development clusters
Social justice in the City	Nordic welfare city principle
Environment & Transportation	Climate change and zero carbon emission
Spatial Cohesion	polycentric city-region structure

Helsinki already has three overland metro-style rail connections going north, north-west and west **plus** a metro which goes to the north-east and south-east borders of the city. Helsinki will build a new metro to the west, to the neighbouring city of Espoo. In doing so, Helsinki will contribute about a third of the total cost in the aim to reduce cars coming into Helsinki daily. A new metro to the south of the city is to be built, together with a new circle line from the city-centre to Pasila in the north. Additionally, a new metro connecting the centre with the expanding Airport City will also be constructed.

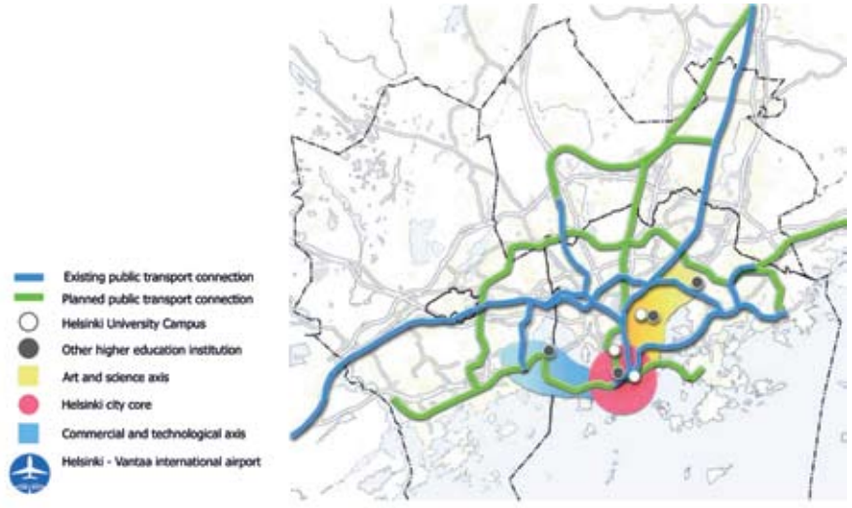

Figure 2. The existing and planned public transport connection in Helsinki metropolitan area.

New technology clusters will affect the spatial structure of the city-region. Central Pasila will have over a one million square meters of new offices and residential. The city centre is likely to double the amount of office space to strengthen the centre's economic position. All the sites will be brownfield sites. The old harbours in the centre are being relocated to the new high-tech harbour 14 kilometres to the east of the city. The City of Helsinki pays for this new harbour, at a cost of nearly €1.5 billion. Space will then be released in the city centre for 45.000 extra residents. This brings people closer to jobs that helps save energy.

Helsinki's Strategic Plan 2040

The City of Helsinki new strategic plan (2008) sets out new ideas for the next forty years.

The Key components of the Plan are:

From City to **City-region**

- **Polycentric Helsinki:** a polycentric city-regional structure will promote greater balance of development. Key growth areas are identified as to where the new hierarchical centres will be located in the future (red squares).
- **City-centre and Periphery:** the city centre will be strengthened whilst the periphery will receive additional economic and social support to mitigate the disadvantages of being located on the periphery.
- **Development Corridors:** new development is promoted through 'development corridors' along the east-west axis. (There are five main development axes. The main one is the northern rail axis towards the city of Tampere. This is well-established and does not require further economic support. In order to create better regional balance, the aim is to even-out the northern growth corridor by creating two new sets of corridors west to east along the

southern shorelines, thereby creating a perpendicular economic growth structure. Beyond 2040, the fourth axis, the north-west rail-link growth corridor is expected to take-off. Beyond 2070, the thrust of economic growth is expected to switch westwards towards Lohja, parallel to the main rail link towards Turku, which is situated in the south-west of Finland.

- **Urban Sprawl:** by encouraging growth to be managed within the development corridors, this is expected to reduce urban sprawl in the rest of the region.
- **Spatial Cohesion:** the underlying principles of promoting public rail transport (metro, commuter rail, and trams) is at the core of the strategy, as is the need to significantly control CO2 emissions, promote balanced economy, social equity in housing, and spatial cohesion.

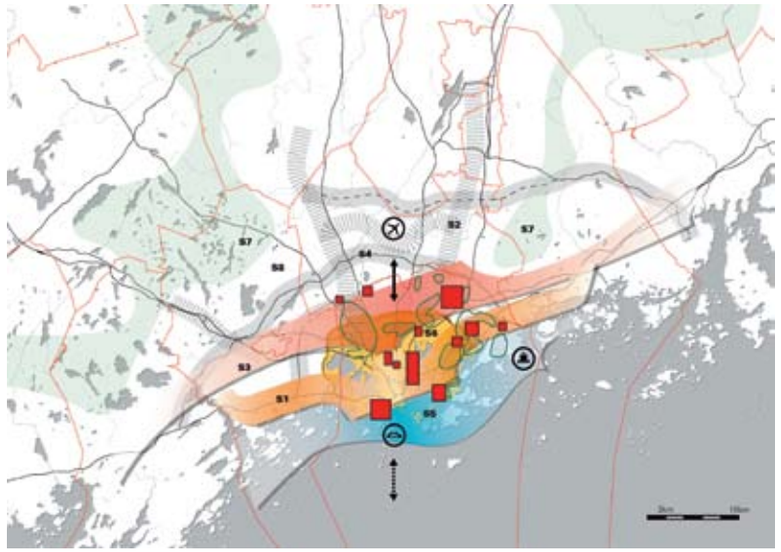

Figure 3. City of Helsinki Strategic Plan: City-Region

New development will be concentrated into development corridors. Most investment is concentrated to the northern axis at the moment. By creating a horizontal east-west axis, it creates a better balance. It is about spatial cohesion. Strengthening of the city centre is essential because without a growing economy you cannot plan. Without a reliable economy you cannot achieve your physical ends. A better balance with the city centre and the periphery will be a key aim over the next 40 years. The intention is to overcome the disadvantages of living on the periphery vis-à-vis the centre, and to minimise the disadvantages of living further away in the region. There will need to be more decentralisation of resources. A new polycentric city-region, with a hierarchy of centres, will achieve greater spatial cohesion. The result will be the transformation from a city structure to a polycentric city region. This is Helsinki's vision for the future. A vision that views the need to re-think how energy is used spatially and that the lowering of carbon emissions is an important element of the strategic plan and energy conservation.

A new form of city-regional governance will be required. There are alternative scenarios. It can either be a single large city region, or, a second tier of regional government, or a more informal set of strategic alliances.

Planning in Practice:

There are 15 major development project areas in the Helsinki Master Plan. The smallest of these will be in Arabia waterfront, for 7.000 people, and the largest area, located in the east of the city, will be for 40.000 people, in Vuosaari. In all the developments, the aim is for housing to achieve approximately 50% social housing, and 50% private. All of the major developments are connected to open-spaces. There are no gated communities in Helsinki. This sends a strong message to uphold the Nordic welfare ideal. Every place where there will be a new community will include jobs. In Arabia, for example, there will be 7.000 new jobs. Arabia will be the first 'wired-city' in Finland. Another area, to the north, Aero-Malmi, will consist of low-level housing but very compact and dense.

Eco-Viikki is particularly dedicated to the energy issue. The Viikki local plan was based on the principle of building for 15.000 residents and 7.000 jobs, and that only a 1/3 of the land would be used for housing and economic development; the other 2/3 would remain green. The photos show how eco-Viikki is beginning to look-like. It consists of medium-density housing at the southern end, rising in higher densities to the north. Solar panels are used extensively, public transport is encouraged, and communal gardens abound. (Figure 4)

In relative terms, the area tends to use about a 50% less energy than a comparative size neighbourhood elsewhere in the region. There is a 40% reduction on the use of water, with grey and brown water being re-circulated. Chimneys (air ducts) allow for up to 40% improvement in the circulation of air in the flats.

Figure 4. Examples of buildings in Eco-Viikki area in Helsinki.

The other key development areas, such as Jätkäsaari, Hernesaari, the Fish Harbour and Töölönlahti Bay, all located in the city centre, aim to maximise public transport use, will be highly compact, mainly residential apartment blocks, and will create new synergies of employment clusters. The re-organisation of space applies throughout the city-region developments, with the emphasis on locating new synergies around the City Airport, the new high-tech harbour, and connectivity rail/metro hubs. Development areas outside the centre, such as in Sipoo to the east, and Kuninkaantammi to the north of the city, will adhere to the new ideals of the compact city. Altogether, it is anticipated that there will be 120.000 new homes being built within Helsinki. For the city-region, it is expected that the region will double in volume, with some 70 million m^2 of housing construction.

The Reasons Why: the importance of energy saving in cities

The third and final part of this chapter examines the 'reasons why' Helsinki is capable of achieving tomorrow's energy standards because of its spatial planning, and the lessons to be learned for other cities.

The City, together with the State, own 80% of the land. This is a fundamental principle that enables Helsinki to control the redistribution of wealth for its citizens. Helsinki upholds the Nordic Welfare set of ideals, in that a system of high taxation and regulatory processes ensure that the population is cared for and given a high standard of living. In Helsinki, it goes even further. Ownership of land, of public transport, the harbours, energy, and water, health and education, provide a clear statement of intent to create a comprehensive welfare state and to support social justice in the city. There are no slums in Helsinki. This in turn has produced lower levels of social polarisation spatially. The City uses a highly integrated and coordinated approach to the new development areas. Planning and traffic and transport are married together for planning purposes.

The city has nearly 400.000 jobs and the city-region some 780.000 workplaces and a population of 1.284.000. Public transport has been documented above. This translates into 72% of people coming into downtown during rush-hours use public transport. The reverse is true of the city-region, a major cause for concern. And because of the continued high investment in public transport over the next 30 to 40 years, the intention is to maintain and extend the networks into the city-region. A key objective is to reduce the use of cars, which is why the city has one of the lowest car levels per 1000 inhabitants, standing at around 340 cars per 1000.

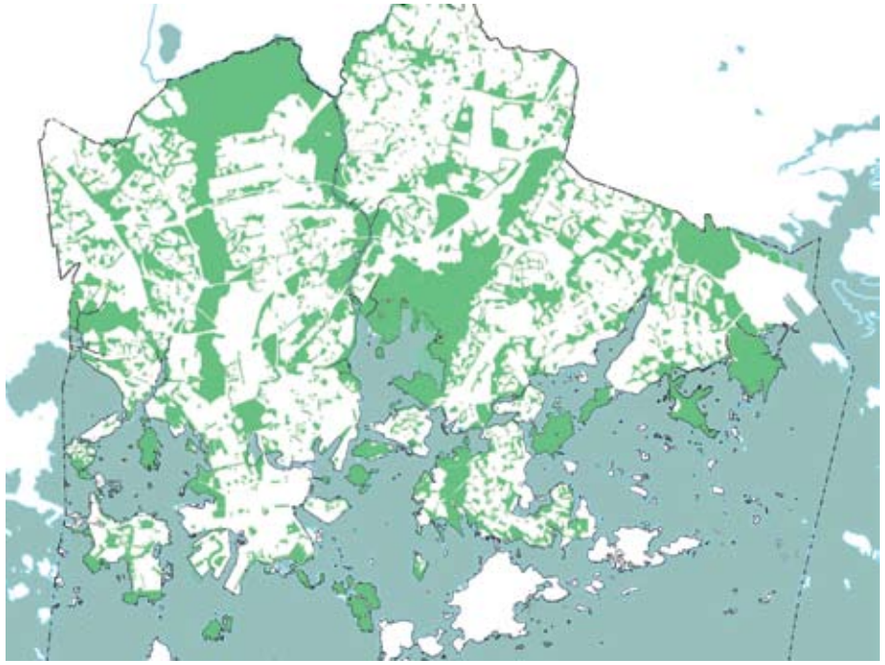

Figure 5. Helsinki's City Landscape structure of green areas.

Helsinki places great emphasis on achieving a blue-eco city (Figure 5). Despite the huge structural changes taking place some 35% of Helsinki will still remain as open-space. There are 1000 kilometres of cycle routes within the city, 48 parks, and there are some 220 kilometres of shoreline. All new developments are open to public access. But it is energy efficiency where Helsinki excels. Helsinki is 93% efficient. It means that 93% of all homes, offices, shops, leisure facilities and shopping malls are connected to the City's district central heating. The City is currently building a new city-wide cooling network for all homes and workplaces. In terms of waste management, 96% of waste is utilised to 100%, and can be re-used if necessary. But it isn't. Instead, waste waters, sufficiently purified to drink, is carried through 10 kilometres of natural granite tunnels and emptied into the sea. This has contributed to the successful improvement of the Helsinki bay area over the past 40 years. Additionally, the City has constructed 200 kilometres of service tunnels under the city, stretching to the four corners of the city boundaries. A new Underground Master Plan has recently been approved.

Helsinki works and practices at the intra-metropolitan level. But it thinks transnationally. Helsinki is working with Tallinn and St.Petersburg to create a future Gulf of Finland development triangle based upon a polycentric pattern. The goal is to promote transnational innovative regional clusters, strengthen trans- European transport networks and aim to conserve energy. The aim is to share common goals and to give better spatial balance through more compact and denser city-regions with improved spatial cohesion. Climate change cannot be dealt with by one city

standing alone. It requires changes in attitude. This is why the spatial planning project Helsinki-St.Petersburg-Tallinn attempts to work together to reduce greenhouse gases, by amongst other things, improving the high-speed rail connections between the cities and the construction of a tunnel between Helsinki and Tallinn. Cross-border cooperation will support the need to lower carbon emissions, and utilize territorial potentials for a more efficient, safe and environmentally friendly production of renewable energy within the transnational scene. (Figure 6)

Figure 6. Helsinki-St.Petersburg-Tallinn Spatial Vision.

Conclusion

In conclusion, I have argued that spatial planning is essential if cities are to achieve significant reductions in energy consumption in the future. But cities cannot do it alone. Cities need to take account of their city-region to tackle problems. Spatial cohesion is as much about managing a balanced economy as achieving energy savings. The organisation of space has to be managed efficiently if energy consumption is to be reduced. In my opinion, this can be better achieved through plan-led spatial planning in comparison to a developer-led process. City planning needs to direct new investment as to where it should go and not simply where the developers can achieve the best returns. The world financial crisis clearly demonstrates that markets are not as efficient in determining where and how investment should be managed in the best interests of cities. The Nordic welfare culture practised in Helsinki appears to be a possible solution for cities to consider, rather than allow market forces to predominate. Long-term strategic planning is an essential part of controlling energy use and CO2 emissions. The futures of Helsinki and Tallinn are very closely related. The Gulf of Finland development triangle – Helsinki-Saint-Petersburg-Tallinn - requires a more unified vision to be universally adopted by all three cities to encourage greater spatial cohesion in order to cut energy consumption and lower carbon emissions.

1.5 Experiences from Denmark with low energy and passive house design and architecturally optimised solar roofs.

Peder Vejsig Pedersen[10]

Cenergia has been one of the partners in the SECURE project. Cenergia has been involved in many energy saving projects with the support from the European Commission. Cenergia did the first EU-supported project in 1990. Some examples of realised projects will be introduced in this chapter. One very early project realised in cooperation with the Technical University of Denmark, a small housing-project north of Copenhagen, we are still working on. Cenergia has one big project with a seized storage of solar heat, which was realised near Copenhagen with 1.400 sqm solar collectors for 100 housing units in 1990. Skotteparken - a solar energy demonstration project - was developed in 1992. It also has 100 housing units and the whole layout of the building plan was made so that all 700 sqm of solar collectors faced either towards the south, south-east or south-west. That involved a mix of electricity, water and heat savings. We received the "World Habitat Award" for this project. It was actually a great success because we achieved a 60% energy saving compared to normal buildings at that time. Based on this, the Danish government decided to actually focus on what they call 'social economy', the optimisation of social housing projects. That means that you try to invest a little extra initial capital (up to 3% perhaps) to save on the subsequent costs. A couple of years later we started a very big project with EU support, 11 projects in 7 countries, in cooperation with the European Housing Ecology Network. And in 1996 the EU project European Green Cities of a similar nature was realised. (Figure 1).

Figure 1. Examples of Danish energy saving houses.

Like everywhere else in the EU, Denmark has received the EU directive for energy efficiency in buildings. Due to this, we had to improve our energy standard, introduce a certificate system and so on. We trialled these in some pilot projects before the new demands started in Denmark in 2006. At that time, in 2003, we made a project with 50% savings compared to normal and this was also obtained in practice, so we reached 62 kWh/sqm per year. It is particularly important, if you look at low energy building, to achieve savings in the ventilation. Normally we are quite good

[10] Cenergia, Hilleröd, Denmark

in terms of insulating houses and buildings, and making very good window glass which does not cost extra. But, if you want to have savings in ventilation use, then you have to use a heat recovery ventilation system. This is the basis for passive house design, for example. But if you want to have good results and savings in practice, then it is very important to ensure good airtightness.

We started a project in Herning to educate the builder how to focus on airtightness. We made very early tests when the building was assembled but not finished. Failures were identified and remedied and then further tests were conducted and the results were very good.

We have also developed several house solutions. One example was a very small test-house developed in 2003 which was exhibited in Copenhagen. In addition, we developed low cost heat recovery units. This focus on low energy housing was realised in several projects, one in Hilleröd (Solengen) which is part of the SECURE project. In Solengen we built houses with heat recovery ventilation at an extra cost of only 1.100 Euro per housing unit and this gets paid back within three or four years. The reason for the low costs is that everything is very compact, all rooms are very close to each other, so you do not need so much space heating. There is a little flat roof where you draw in fresh air and expel used air.

The first Danish passive house

In 2006 we established the first passive house project in Denmark. This was a rather small project with only eight housing units but we learnt a lot from it. The idea was to use solar energy to have a complete CO_2 neutral operation of the heating demand. This is possible. We used a shared ground coupled heat pump system and the electricity use had to be covered by a PV panel on the roof. We had to import windows from Germany because there were no windows-producers which were good enough in Denmark at this time. It is very important to focus on these kinds of quality issues, the heat recovery efficiency and the electricity use per m^3 per house. We also tested preheating ventilation air in the ground. Using this kind of measure you have to take care of frost problems in the winter. We used pumps from Sweden and, as I already mentioned, windows from Germany. (Figure 2).

Figure 2. The Danish passive house project Rønnebækhave II in Næstved comprises a small housing block with 8 apartments realised according to the German passive house principles.

Today there are also Danish constructors able to build such windows. The solar heat pump is shared, one solar collector for the eight dwellings and each dwelling had an individual solar domestic hot water tank with some electrical back-up heating. In summary, we can say that everything was quite good in this project. We focused on indoor air climate which had very good results. We also learned that in the passive house the energy demand is very low (only 10 kWh/sqm) and if you have, for example, floor heating, then the energy demand is very low. We were not critical enough about the control system, so it unfortunately had to be shifted for all the apartments. We also overlooked some aspects of the temperature control and the solar hot water system.

Power roofing project SOLTAG

The second project I am going to present in detail is SOLTAG, a power roofing project we realised in cooperation with the Velux Group in Denmark. This was a CO_2 neutral housing unit where the idea was to place it on concrete housing blocks. You can find further information on this project at: www.soltag.net. The project was realised with several partners and exhibited in Copenhagen for around a year. You can see the energy balance on Figure 3. We are down to low-energy class 1, we used a heat pump as supplemental heating and PV, which can cover the energy use of the building. Prefabricated units were erected. The house has very good daylight quality which was the main focus from the Velux group. Window area is 35% of floor area which is a rather high figure but provides very high daylight quality. Due to this we could actually not meet low-energy class 1 as we aimed but we had to use some extra PV-panels to reach it.

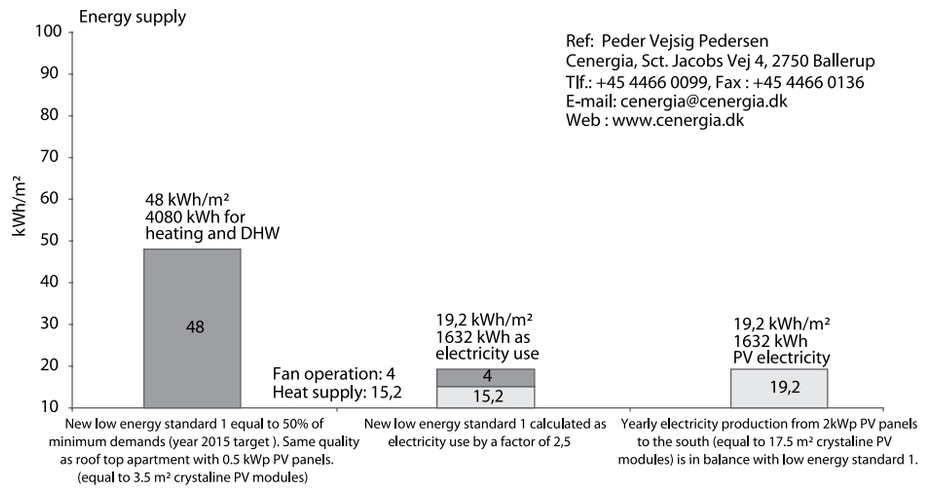

Figure 3. A Prefabricated CO_2 neutral rooftop apartment was exhibited in 2005 at Ørestad Nord in Copenhagen. It was developed in co-operation between Cenergia and the Velux Group, Kuben Urban Renewal Denmark and Rubow Architects. Homepage: www.soltag.net

The dwelling has a small hot water tank for the solar hot water. This tank is the heart of the energy system. Energy is taken out of the tank for the floor heating, for example, and then the small heat pump provides extra energy beside the solar energy. It works in the way that you preheat outside air, you take it into the whole solar roof (where there is a small gap) and take it down to the heat pump. The philosophy of the project is: (1) we are making prefabricated constructions, no cold bridges and airtightness; (2) use heat recovery ventilation and try to limit the costs; (3) use very low-energy windows and solar hot water; (4) use PV to meet all energy use. Then you have an energy supply system, in this case a very small heat pump.

The CO_2 neutral rooftop dwelling was designed according to an "Energy Quality Design" philosophy: 6 steps to reduce energy consumption

Step 1: Prefabricated constructions without cold bridges and with good airtightness. (Better than 0.6 l/sqm□ as natural ventilation rate)

Step 2: Use of heat recovery ventilation (HRV) with low electricity use. Extra costs of item 1 and 2 are only 10.000 – 15.000 DKK per apartment (1.350 – 2.000 Euro), based on the use of a new thin EcoVent HRV unit which is easy to integrate. This is considered the cheapest way of obtaining the new Danish 2006 low energy demands with a 25 – 30% reduction in energy use. Experience from realised Danish housing projects has shown that items 1 and 2 alone can lead to a 50% reduction in the yearly heating bill and an improved indoor air climate without moisture problems.

Step 3: Use of low energy windows with good daylighting transparency and, at the same time, avoidance of overheating problems.

Step 4: Use of a solar domestic hot water (DHW) system to obtain a 50-65% reduction of the energy use for DHW. Extra costs 10.000 – 25.000 DKK per apartment (1.350 – 3.300 Euro).

Step 5: Use of Photovoltaic (PV) modules to reach a desired or even a climate-neutral low-energy level. With 0.5 kWp PV panels, equal to 3.5 m² crystalline PV modules, a low energy class 1 quality can be obtained for the rooftop dwelling (50% better than building regulations demand). Extra costs today 20.000 DKK (2.700 Euro). With an extra 2.0 kWp PV panels, equal to 14 m² crystalline PV modules, a zero energy and climate neutral energy design can be obtained on a yearly basis. Extra costs today 100.000 DKK (13.300 Euro). The use of PV energy is considered a very interesting energy option, because we know that we need to depend on renewables in the future and also because there has been a trend of a 50% price reduction in a 7 year period. In Germany 30.000 new jobs have been created in this industry in the last few years.

Step 6: Use of an adapted energy supply for heating and DHW. For a low-energy class 1 housing unit you only need a very small energy supply level on a yearly basis. All existing energy supply options can in principle be used (gas furnace, district heating, a small heat pump or electric heating). When a small air and solar roof-based heat pump is used you obtain a good energy "quality" and at the same time avoid a separate energy supply (besides electricity). A competitive investment cost of the energy supply system at around 25.000 – 30.000 DKK per apartment (3.300 – 4.000 Euro) is possible. In any case it is very important to avoid heat losses from the energy supply system because a normal-size heat loss will mean a much higher relative percentage in low-energy dwellings.

With this project we won two Danish awards in 2005 and 2006. During 2007 a SOLTAG power roofing secretariat has been established at Rubow Architects in Copenhagen.

A new project has been developed by the same group. 140 housing units will be built, the first 25-50 will be realised in 2009. That will be made with the passive house standard using solar heating.

We do have the two low energy standards for new buildings class 1 and 2 in Denmark with a further 25% and 50% energy saving compared to the new minimum standard. These are used as examples for the expected revised minimum standards for year 2010 and 2015 in Denmark.

Green Solar Cities Project

The abovementioned activities and the general work on passive housing and SOLTAG designs are also very important in relation to a new Danish co-ordinated, EU-Concerto project, Green Solar Cities, where there will be demonstration activities in Valby in Copenhagen as well as in Salzburg in Austria[11]. The aim of the project is to implement large scale PV in Valby with 45.000 inhabitants and to cover 15% of all energy use with PV in 2025. Several projects have already been developed and realised. We want a mix of what we call 'eco-building standard' (very low energy standard) for new urban development areas in Valby building around 600 housing units in all and also public and commercial buildings. The German passive house standard matches requirements very well in Denmark. The German passive house standard is a very strong tool with respect to limiting the energy use for room heating to 15 kWh/m²/year, so it is possible to cover the heating demand with the help of the fresh air you anyway need to supply in connection with the necessary balanced heat recovery ventilation system (with 10 W/m²).

Solar Energy in the Energy Frame value

Cenergia has developed a new tool, "Solar Energy in the Energy Frame Value" in connection to a research project by the same name supported by the Danish Energy Agency. Here you can make energy calculations according to the new Danish energy rules, and the EU Directive for Energy Performance of Buildings in a very simple way. First you need to establish the reference situation. For example, a heat pump compared to a reference is already a little better. If you have established a reference you can introduce different energy saving measures like better windows and insulation, heat recovery insulation, airtightness and so on. Then you can, for example, make an optimisation to be able to reach low energy class. You can also calculate what is needed to reach a passive house level and the costs for this and, according to your aims, the costs are higher. The program has been developed for the Danish situation, it can be downloaded from the Solarcity website and from Cenergia. So, it is free software and an English version is coming soon.

There are about 2.750 solar hours in Denmark. Solar energy in Denmark of course is not as good as it is in Southern Europe but it is not that bad either. For example, in Copenhagen we

[11] See www.greensolarcities.com

have more solar energy than they have in Paris or Amsterdam. In South-Germany, Austria and Switzerland they have 20% more, in Spain of course you can find areas with 50-60% more. But there is a very good opportunity for solar energy use in the Danish climate and in general in Scandinavia there is only 5% less, so there is plenty of solar energy available.

When people take a passive house, it is also about trying to reduce the use of cars and maximising the public transport around the city. We have made plenty of projects with housing-blocks as well. At the moment we have a project with 450 dwellings in Copenhagen, housing-blocks which will be renovated. They will get heat recovery ventilation at a very low cost (250-300 Euro per unit) together with an improvement in airtightness. Cenergia is an energy specialist company and we are focussing on buildings and the energy supply systems for new buildings. At the moment, I am also the chairman of the Danish Association of Sustainable Cities and Buildings and there, of course, we try to focus on all aspects including transportation and so on and all these other aspects of sustainability in the cities are very important as well.

2. Economical aspects of energy saving

2.1 E3 – Edification – Energy – Efficiency

Elmar Römpczyk[1]

The title of this chapter indicates as its red line that Energy Efficiency must definitely be improved in the building sector throughout the Baltic region. It is urgent. The image of the still running Nuclear Power

Figure 1. Green (Eco) Houses in Freiburg in Germany, called often as capital of energy efficiency.

Plant of Ignalina (Lithuania) is seen here as a negative symbol of propagated solutions. The increase of energy production at any cost is not the answer to the energy-policy challenge, rather saving energy and being much more efficient in the supply mix and more energy education on the consumers´ side provide the answers. (Figure 1)

The perception increases in Europe that Green Houses symbolize the character of a sustainable city and that our cities can reach sustainability if certain technical and behavioural criteria merge together, like: energy education from early school age onwards; energy-conscious consumers demanding fuel alternatives and economies of renewable energies´ supply. Technical support and tailored credit-lines have to accompany the behavioural change. All this together with a farsighted and actively regulating public sector that cares for combined heat and power (CHP) as baseline of energy policy and which does not leave energy supply nor shelter nor food

[1] Friedrich Ebert Fond former coordinator in Baltic countries.

nor labour security to the so-called free market eruptions. EU has recognized the interrelation of these different dimensions for future-oriented energy policy and has made energy saving the key element of its European energy and climate change strategy. It is widely known that the building sector accounts for roughly 40% of final energy demand and that it therefore forms a major source of greenhouse gas emissions. In its green papers (2005: Green Paper on Energy Efficiency; 2006: EU Energy Efficiency Action Plan; 2007: EU Energy Policy for Europe) the Commission addresses clearly the importance of the various kinds of buildings and their character as a potential source for energy saving policies. The EU-drafted strategies diverge from the monopolized interests of public energy suppliers and from a clearly atomized (hence weak) Civil Society. This divergence helped encourage most member states of the EU to simply extend the Energy Performance of Buildings Directive (EPBD) from January 2006 into 2009 and to postpone putting the binding requirements of the EU to install passive heating and cooling technologies into practice until December 2008. The EU Commission estimates that proper implementation of the EPBD could permit savings of 40 megatons of oil by 2020, equivalent to some 11% reduction in final EU energy consumption.

Technical solution

Saving of oil and gas means saving CO_2. CO_2-dumping is therefore propagated as a headline for the visionary technical solutions to stop climate deterioration from the excessive consumption of hydrocarbon energies. Dag Myrestrand / StatoilHydro Sleipner-Gasfield is the best known pilot project off the Norwegian coast. There they press about 1 million tons of CO_2 p.a. 800 meters below sea-level into sandstone layers.

Biomass, of course, seems to be the much better solution for both ***heating and power generation***[2] while it is based on timber and forestry residues, which are available in ample quantities in the Baltic and Scandinavian countries. Only the required investment costs are still a barrier to the broad-based use of this energy source.

Solar energy looks even more attractive for housing because it can be used on the spot for the three principle purposes: production of warm water; alleviating the heating system of flats or villas; or for power generation, which, at its best, will be feeding into the local grid and being financially compensated for by the local or regional utility.

For all forms of buildings, including throughout the Baltic Sea Region, you can make use of such simple installations like the solar panel facades seen in Figure 2 below.

In my understanding, each public edifice (ministry, town hall, school, university, hospital, etc.) should be checked for its technical and economic ability to produce as much as possible of the heating and power it requires. The German situation offers two lessons learnt: during recent years the actual production cost of PV-panels has decreased visibly and will continue to decrease down to 2.100 Euros per KW by the year 2010. Given this development, the production costs of solar power can be reduced in southern Germany down to 15 Euro-cents per KW/h and therefore be fully competitive with traditional power generation in 3-4 years.

[2] interesting success story for Combined Heat and Power generation is Tervola in Finland, see: http://www.cardiff.ac.uk/archi/programmes/cost8/case/energy/finland-tervola.pdf

The down side of this success story is that the panel producers did not forward the cost reduction to the final consumer, but increased their profits. This must be regulated by public authorities if all attempts to save energy and to educate consumers towards greater energy efficiency and use of renewables should show comprehensive gains for society and for the climate. (Figure 2).

Figure 2. Assembling wall elements of a Passive House in Linz, Austria; fabrication on the spot

Baltic reality re-written

Reality in most of the Baltic communities and hence in the countries as such is shaped by the fact that there are still too many of those energy inefficient private buildings and fabrics from Soviet times. That is true, but it is also true that nearly 18 years after regaining independence, the energy sensitivity of individual house owners and of city councils is not recognizing the interdependence of E3 (edification-energy-efficiency) and that governments and parliaments are still pursuing single issue solutions: here some pilot blocks with improved outside insulation and hermetic windows; there a pilot biogas installation on a landfill site. Always only technology-driven solutions. Meanwhile, the close to monopoly acting utilities Eesti Energia, Latvenergo and Lietuvos Energija are keen to go on selling power and heat at unsupportable price levels, not showing sufficient interest in being forerunners of modernizing the building sector´s energy efficiency, of dropping the leakages of their grids, of improving the energy service to the benefit of the majority of the population. Instead: the heating season of 2008/09 started with a heating price increase of 40-50% in the Baltic countries. This is first of all an anti-social attitude by the utilities, more so when the crude oil price went down significantly. In all this the Baltic utilities unfortunately are copying perfectly their Western European sisters Vattenfall, RWE, E.ON and others.

The aforementioned change of attitudes in energy consumption requires a parallel change of attitudes of organized Civil Society (NGOs), architects, city planners, credit institutes and of potential energy suppliers. Among themselves and with government and city councils, they should insist on dialogues about how to best cooperate in complying with the cited EU regulations like EPBD and introduce, for instance, Energy-passports for buildings.

Those productive dialogues among the social, economic and political partners are no longer dreams since we know of best practice cases from Spain, Germany, Sweden and other European countries. Two renowned cases are the German agrarian community of Jühnde (near Göttingen) and the Swedish town of Växjö.

Växjö, where in 1996 a unanimous decision was taken that this sympathetic business and tourist centre shall be a Fossil Fuel Free City. In 2007 the city was granted the Baltic Cities Award for the greenest city in Europe. In between these 11 years the public and private and the social sectors of Växjö cooperated to achieve very concrete goals, like:

1. reduce CO2 emissions per inhabitant by at least 50 % by the year 2010, compared to 1993
2. reduce electric energy per inhabitant by at least 20 % by the year 2015, compared to 1993
3. increase cycle traffic in Växjö by at least 20 % by the year 2015, compared to 2004
4. increase local public transport by at least 20 % by the year 2015, compared to 2002.

Jühnde (Germany) is exceptional because the whole community decided upon, supported and implemented the concept of being self-sufficient in energy production and in applying exclusively eco-proven technology. In Jühnde farmers, consumers and the community as a public entity have formed a cooperative and made themselves independent from any external supplier or utility. (Figure3).

Figure 3. Jühnde community, Germany, social decision making process about sustainable energy future

Back to the Baltic region. In 2008 it is interesting to recall that even in Riga residents prefer ecological and locally-produced energy. According to a public opinion survey of May 2008, 80% of Latvia´s residents support wind, solar and hydropower plants and are negative about nuclear energy (Ignalina), but are also critical about new coal and gas plants. Among other issues, this has much to do with the full dependence of Latvia on Russian gas imports and Belarusian coal imports. This dependence on Russia should not simply be substituted by dependence on Poland or Sweden or the Caspian Region. 62% of the survey respondents believe that the development of biomass and woodchip power plants must be encouraged on a national level. This is in principle very much in line with the cited praxes of Växjö and Jühnde.

In Lithuania´s second biggest city of Kaunas the Regional Energy Agency showed political will to follow the EU energy and climate targets for 2010. The Agency presented data of audits which showed that heat consumption could be reduced by 50% in five-storey buildings and by about 40% after the renovation of nine-storey buildings. By 2010, 113 five-storey and 55 nine-storey buildings are due to be renovated, resulting in a total decrease in energy consumption of 29115 MWh. The total possible heat energy savings in all five- and nine-storey residential buildings in Kaunas city reaches 266,258 MWh. The total heat energy saving potential in the entire housing sector in Kaunas city reaches 437,241 MWh. This equates to a reduction in CO_2 emissions of 83,950 tonnes per annum. A big, but unavoidable challenge for the new Lithuanian government.

The challenges pyramid

As was said before, energy efficiency and energy saving is not a single issue, but can be successful only as a comprehensive policy approach. That means, for Baltic and other European authorities, that green housing should be just one important challenge among others. The most striking challenges can be given the order of a pyramid presented in Figure 4:

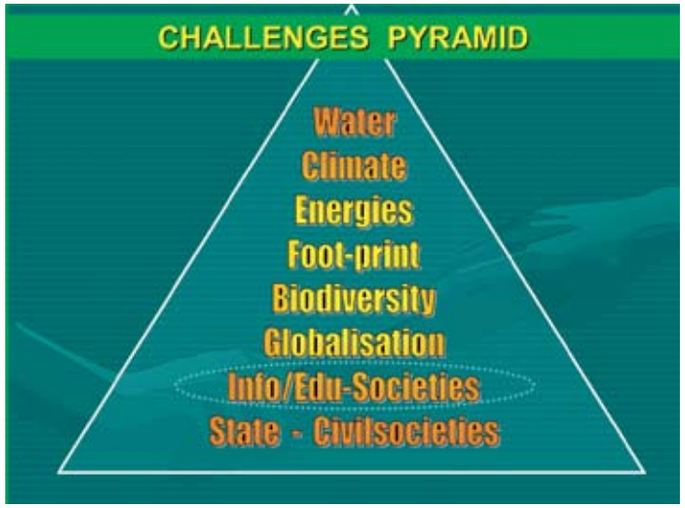

Figure 4. The pyramid of challanges.

Part of this pyramid is the energy and the climate sector, but they are both actual boom topics. Soon they will be complemented by the ever more urgent topic of drinking water worldwide; of foot-print limits for EU societies and for emerging societies in Asia and Latin America; of surplus societies among the oil exporting states. And the governing generation will be forced to decide upon regulations referring to biodiversity protection; to contain globalization; to promote a knowledge society; to democratize the political relations between state and civil society (weak relations in all the Baltic states) and to redefine the value systems of our actual development

projections (the collapse of the global finance system made it ultimately clear that the so-called free market and free-of-state-intervention approach was a very poor neo-liberal illusion, which also led into the energy- and climate-crisis).

The solution, i.e. the way out of our development crisis, is by no means more of the same (like more nuclear energy as in the Ignalina case), and it is neither the burning of the energy invoices as some countries experience it these days, but the awareness of sustainable development with a clear priority of human development, where energy is a vital instrument – and not the other way round.

Safe energy in the building sector, in the transport sector and wherever possible also has much to do with the competition between bio-energies for fuel (heating, power) or for food. Poverty is increasing on a global level, so is demand for food. Energy saving therefore is directly related to survival opportunities for the Baltic population (in the long-term) as well as for the population in Sudan or in India (right now).

2.2 Self-sufficient and self-sustainable living styles in the eyes of an architect.

Veronika Valk[3]

This chapter is that we have to go in for awareness-raising activities but not in the way we have been used to, this article is about totally new concept for raising awareness - it is competitions for architects. Pictures from an international architectural competition will be presented, which was started in Spain and which is all about energy conservation. It is the first such architectural competition and, when one looks at the letter, one can start to think that perhaps we are talking about a new approach – in Estonia we talked about the "IME" – programme (Isemajandav Eesti or self-sufficient Estonia, but word 'ime" means also miracle in Estonian and can also be translated as self-sufficient living or 'IseMajandavElamine' in Estonian) which was something totally new when it was started in the beginning of the 1990's – so perhaps this is a new page in the history of architecture.

In the 21st century we speak about a space to live in from a totally different aspect - we speak about a home which is an autonomous or self-sufficient place to live in. A home today is like a living organism which is in dialogue with the environment and the development of architecture has come to the phase where a house is not just a product of an architect but it is something else. It is something that meets the needs of the inhabitants, both major and minor needs, and this self-sufficient house is communicating with its surroundings. This house 'knows' how to meet these requirements and how to find its own rightful place among all other housing opportunities no matter how big the distances we are talking about.

We are surprised that, in the towns of Western societies, the price per square meter is continuously rising despite the fact that the quality of the living space is not improving. This is a direct result of the expenditures connected with traditional houses. It means that we have to be able to design a new type of house which is going to produce 100% of the energy that its inhabitants need and which meets their air, water and waste requirements. If, in the 20th century, we were speaking about the necessity to have available energy then, in the 21st century, we are speaking about the need to conserve energy.

Architecture has to meet all these new requirements. The regions, homes and houses have to take into use all the new technologies (sensors, batteries, whatever equipment) and to integrate all that into the existing, constructed solutions. We have to demand more from architecture. We, the architects, should be able to design and to build those self-sufficient organisms which, perhaps, even more closely resemble living organisms than houses. These new homes should be able to develop the processes which were earlier found in wild nature and not in the urban context. Once upon a time, when not all of us had a PC, nobody could imagine that some day we would be in a situation where everybody is communicating via computers.

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3 Estonian architect

Why not start fantasizing right now? Why can't I have my own wind generator or solar energy plant or whatever? Everything depends on our capacity to fantasize and the challenges we set for ourselves. And not just to employ all these new technological solutions one on top of the other, but to integrate them. For example, new materials and materials science certainly need new technological solutions and these are very closely connected with the use and development of local raw materials.

In order to meet those challenges, I think that all the different areas of science or sectors of industry need to reach out to each other. The architectural competition I was referring to could be just such a context where different sciences, different sectors, effectively coexist and cooperate. Such architectural competitions can also provide a means for raising awareness. So my question to all of you and also the topic of my 'round table' discussion later on is: why not organize a similar architectural competition here in Estonia? Not a competition to find a solution for a specific plot for a specific client but a competition for ideas in which anybody would be welcome to participate. That is, anybody who has an interesting idea from the energy conservation point of view.

The most important thing about such competitions is determining the objectives. What do you actually expect to get? What would be the outcome of the competition as such? So let us think about that - if works would be submitted to this competition and if some of the ideas submitted would be closer to fantasy than reality, then would our market be ready for such solutions? Of course, there is then the other aspect - whether the existing legislation can allow such solutions. But then it is important to understand the laws and the corresponding standards which they give you the right to demand. For example: "from now on everybody has to build a passive house".

This is one possible approach. The other possibility is that people themselves want to do something and that means that they start seeking new solutions. I believe that this kind of competition of architectural ideas should also refer to certain principles. Now the question is: "how can these principles be described so that everybody would understand them?" One of those criteria could be for example "common sense". Another principle might be global avant-garde and I believe that in the world context Estonia still has managed to keep its image as a small, brave tiger and I think that we could show our enduring willingness to grasp new technological possibilities. I think that we should free the housing sector from the monopoly of energy and that we can bring forth new ideas with new residential models where scientific, high-tech research work is connected with the modern lifestyle. Such new models needn't have borders between different areas of human activity but could be very flexible and could also be more friendly.

Figure 1. Here you see possible homes which make use of different energy production approaches, recycling measures and everything else. In this home for example, they use sea water.

Figure 2. A summer cottage which can be floated in coastal areas. The room is surrounded by a pool which also acts as a water treatment system.

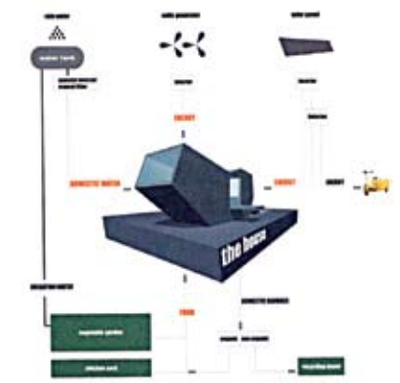

Figure 3. This is quite a usual solution. Here they talk about the possibility of it being a home for a middle-aged couple. It is intended for Spanish conditions. A couple of wind generators, 10 m^2 of solar batteries and 100 m^2 garden which produces 130 kg of tomatoes, 100 kg of potatoes, water melons, etc. In addition, they have a chicken run. The house itself looks very cozy but, at the same time, also very modern. Not very provocative but a nice home.

Figure 4. Here they come back to the idea of a house as a machine which means that they consider what an apartment building can be.

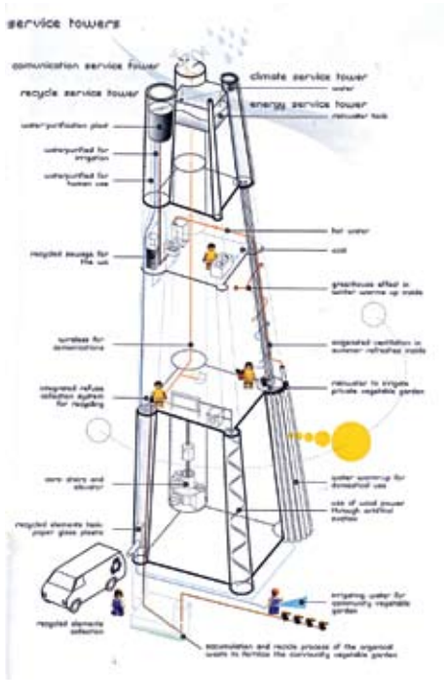

Figure 5. This is an endless tower that keeps growing into the heights – one of the prize-winning designs which can be placed into different parts of a town. The tower has the same shape but when one tower has a better orientation for example for harnessing solar energy but another tower is located in a windier place, then all those different aspects are taken into consideration.

There are very complex and also very interesting systems that have been put forth by the architects and, now, all those designs are scattered around amongst the organizers of those different competitions. I come back to the idea now that here in Estonia we could also start up our own small databank of interesting ideas.

2.3 First experiences on passive house concept, design and building in Estonia

Mihkel Pukk[4], Tõnu Mauring[5]

The multi-storey 2100 m² building in passive house standard is planned to Kiisa settlement, North-Estonia. As of today, there is no service base in this settlement but the number of settlers is 5000-6000 and the demand exists for a local service centre. The building has the function to provide to communities public services (a library and a general practitioners' centre, a dental surgery, a post office). Additionally, on the ground floor is the mini-market type of shop and on upper floors eight apartments. The developer and the project's financing authority is company called BaltReal Invest. It had aim to reach radically better energy efficiency standard and get as low running costs and environmentally hazardous emissions as possible.

The land planned for building had no restriction for building placement and form, which could conflict with energy efficient house planning goals; the general goal was formed to reach the passivehouse standard using comprehensive building simulation tools from the very beginning of the planning. The detailed task was to examine, how principles like compact form and exposing glazed areas to sun could work best in Nordic latitudes, realising the strategies of passive heating and cooling. The comfort parameters, including first-hand reaching the good levels in daylighting in functionally relevant areas were considered important too. The simulation was provided by Spin-off company of University of Tartu called PassiveHouse OÜ. Motivated architect in the team was Rene Vallner. The design team had common understanding that much effort has to put in variant calculations and discussions in the first sketch phase. As passive house standard is not widely experienced in Nordic countries, the project had to seek the optimized decisions for that type of building. The issues like insulation demands, passive cooling, but especially proportions of passive and active use of sun (using solar thermal panels) are different in conditions of higher latitudes and points to discuss. There are no buildings to use as prototype, as comparable cases are missing, unlike to Germany, Austria and Switzerland, where passivehouse concept is practised by architects for a decade and more.

Overview of the designed parameters is shown in table 1. Planning has proceed currently the preliminary design phase. The parameters show which parameters allow to reach the passivehouse design. (Table 1)

[4] Private entrepreneur of company BaltReal Invest, project manager of passive house for public services in Kiisa

[5] Head of Core Laboratory of Energy Efficient Buildings of Institute of Technology of University of Tartu

Table 1. Example in Estonia: Kiisa community center.

Goal: passivehouse standard + solar thermal	**Calculated net energy need for heating 14 kWh/(m2 a)** (PHPP2007)
4-storey multifunctional building	Wall, basement U=0,09 W/m2K (350mm)
8 apartments	Wall, upper part U=0,10 W/m2K (400mm)
2100 m2 floor area	Floor U=0,08 W/m2K (450mm)
Shop, library, offices	Roof U=0,09 W/m2K (400mm)
	Windows:
	Glas, U=0,56 W/m2K, G=0,51
	Frame, U=0,93 W/m2K, psii=0,035/0,040 W/mK
under planning	Heat recovery in ventilation 91%

The passive housing concept in this location is brand new because, historically, they don't have apartment blocks there or in the vicinity.

If you look at the Figure 1, this is a southern view, the windows open to the south and their shades have not been planned yet - it is not so pleasant to have sunshine right into the window. Hot water collectors using solar energy are planned to roof, but cannot be seen in this picture yet.

Its not finally clear whether the air heating alone could serve for whole house heating because of relative complexity of this multifunctional house. The separate ventilation systems are planned for each floor. In addition, every flat would have an individual device to ensure that heat exchange or heat collection would be effective. In principle, it is possible to build the house by traditional, ordinary methods.

Figure 1. An illustration of the general solution for the community centre building in Kiisa.

Dramatic decrease in energy need is achieved by reducing of heat losses and using sun as heat source to partially cover the heat demand. In higher latitudes where the outside air temperatures tend to be lower and there is less solar irradiation in heating period compared to Central and Western European climate. The barriers between interior and exterior should be correspondingly better, to stay at the statement that space heating should be possible using only preheated ventilation supply air (heat load less than 10W/m2; see Figure 2).

Passivehouse standard

In Europe widely spread passivehouse standard declares the energy need for space heating less than 15 kWh/(m^2 a). In Estonia, as common to other European countries, the corresponding figure for currently newly built buildings is around 150 kWh/(m^2 a); for stock average rather higher than 220 kWh/(m^2 a).

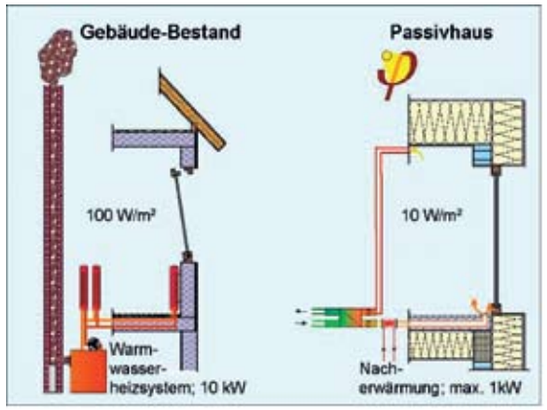

Figure 2. Comparison of energy consumption of common building (in left) and passive house (in right).

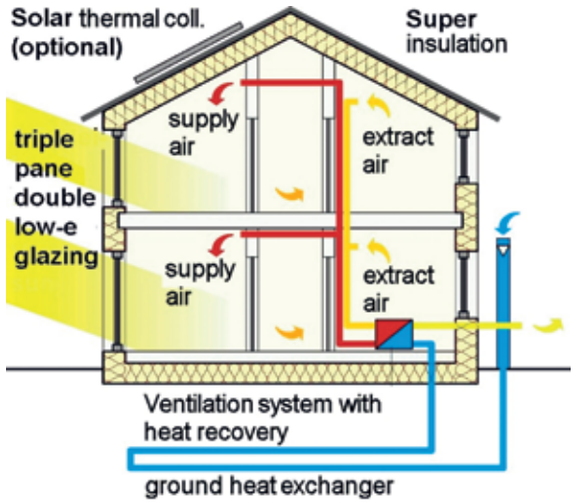

Figure 3. The principal concept of passivehouse. Passivehouse criteria are: Net energy need for heating < 15 kWh/(m2 a); Airtightness n50 < 0,6 1/h; Primary energy need < 120 kWh/(m2 a) (considering internal gains 2,1 W/m2).

However, the design includes using solar thermal panels on the roof and storing the heat in tanks, which allows to support the heating also in other ways than supply air preheating. De-central ventilation concept should allow maximum flexibility in considering different users demands.

The main motivation to start passive house – community centre – in Kiisa was dislike for monopolistic energy companies from whom everybody are forced to buy energy in order to satisfy one's everyday energy needs. These should be superseded as from today, buildings and living spaces could be self-sustaining.

Kiisa community centre is not supposed to be an extremely exclusive project at all. It will be an ordinary house where solutions have been found in a different way, already in the design phase it appears that the payback period for the additional costs incurred will be extremely short.

Construction costs are supposed to stay at the average level, which is about 13,000 – 15,000 EEK/m^2. During the implementation the costs will be followed very carefully, because the Kiisa community centre initiators want to prove, that this solution could be effective, while maintenance costs for heating are low. It need not be considerably more costly than traditional construction. Hopefully in future studies one can assess the feasibility of passive house constructions in Estonia and find answers from practice when the Kiisa community centre is constructed according to the standard of the passivehouse and actual construction costs and ongoing energy demand is measured in practice.

In summary Kiisa passivehouse project might meet following weeknesses: (1) to reach compact form and proper window design in schetch phase; (2) considering also passive cooling and daylight demands in design phase e.g. **80% of "intelligence" of the project is in the schetch;** (3) attention to thermal bridges (in detail); (4) ability to plan airtightness (in detail); (5) choosing and following the **energy concept** from the beginning of the project; and (6) planning the envelope and the technical system as a whole (=reasonable construction cost)!

3. Policy and planning measures as tools to ensure the design of energy efficient houses

3.1 Climate consciousness - working with companies and citizens in Malmö

Roland Zinkernagel[1]

This chapter will present some results of the EU SECURE project, where Malmö, Dublin, Hillaröd and Tallinn participate. The SECURE project consists of a certain number of different work packages, two of them are presented in this chapter: carbon neutral enterprises and sustainable energy citizenship.

Malmö is in the very south of Sweden, just across from Copenhagen. It has an agricultural belt around the city which prevents the city from growing because the agricultural land is one of the best in Sweden and Europe. So we tried to avoid building there. Instead, we try to use brown field land. Like Helsinki, Malmö tries to develop mostly within the city borders. In the past 30 years Malmö experienced some changes. For example, an area with 100% local renewable energy supply in which 3.000 people live was established. Furthermore, we try to involve local residents in the development of their area. Of course there are problems in Malmö as well. There are big differences between the western part, where a quite rich population is living along the coast and the eastern part of the city with mostly poor inhabitants. Both parts normally don't meet. We work on putting the two parts together.

Carbon Neutral Enterprises

Some background figures follow. Every Malmö person emits approximately 5,1t $C0_2$ per year which is quite low and even under the Swedish average which is 6,5t. That's because Sweden is fortunate enough to have an energy supply which includes lots of hydro-power, e.g. 50% of electricity is hydro-powered, the other 50% is nuclear power. Malmö's emissions have increased over the past years but still CO_2 emission is too much. Our aim is to reduce the figure to 1,5t. So, we are working with different approaches to achieve our aim. One thing we did in the SECURE project was the work with climate neutral enterprises. This basically involves calculating every company's emissions. Then you try to reduce the emissions and implement measures for energy saving. The aspects, for example transport, for which you cannot reduce emissions, can be compensated for. A very important aspect is to communicate the effort, so the company can use it as a marketing advantage. Also to inform people about their consumption, for example, regarding the production of consumer goods and how they impact on the climate and how they

[1] Environment Department, City of Malmö, Sweden

may change their behaviour. In the SECURE project we wanted to find 30 companies to join the scheme and I have to admit that we did not achieve this number at all. We do a lot of marketing and companies are interested. They join our workshop and get to know our methods, they even start to calculate their emissions but at the end of the day they do not think that it pays off to be completely climate-neutral. They are interested but do not think that the marketing-value is high enough for them. We do have a number of companies, the environment department itself for example, who went climate-neutral. So we do have experience in implementing and using the scheme but we still have to work on communicating the scheme much more. So, that is a bit of the downside. As I already mentioned, we are arranging workshops, we invite them and we go out to companies ourselves. Mostly it happens that companies come, are very interested, discuss, calculate their emissions but do not take the last step.

Sustainable energy citizenship

The other part of this chapter will cover the work with citizens, similarly to the city of Freiburg, both cities are very keen on involving citizens. We have exhibitions (for example one exhibition with newspaper headlines how Malmö will be in 50 years time like Spanish tourists invading Malmö beach because their own are too hot), then we have campaigns like billboards in the city, buses, posters just to raise awareness: Can you do something against climate-change? – Yes. You can eat locally produced food!

This is just to inform people that it does not take a big effort but that small changes can have an impact on the climate. We also produced two films which were shown in the cinemas for one month each. Of course, we evaluated our campaigns. Some results are presented in Table 1.

Table 1. Some results of the SECURE project evaluation on citizens' climate change awareness.

Evaluation		
	Before	**After**
Have you heard of global warming?	89 %	97 %
Do you think global warming will effect the people living in Malmö?	78 %	93 %
Do you believe that something can be done on the local level?	65 %	75 %
Have you seen any of the following:		
Billboards		6 %
Ads		18 %
Movie commercials		9 %
Website		5 %
Climate smart party		11 %

The result of the first question *"Have you heard of global warming?"* actually didn't result from our campaign. That was the time when there were a lot of climate-scares in the media and the newspaper. So this probably had an impact as well. The percentage of people in Malmö that think that climate change will affect Malmö went up a lot. Many people, however, think that something can be done at a local level. And then we asked more specifically *"Have you seen any of our billboards, posters and so on?"* The results were more than modest. We were a little surprised concerning our movie commercial. We can only advise that making short films appears to have a very good impact.

Figure 1. Exhibition on climate change to raise awareness of citizens.

At the end of the day, it is all about moving people, getting them together, making them understand and using existing knowledge and incorporating that with the new knowledge. The synergy-effect of being a member of the SECURE project has been, first of all, learning from each other. When it comes to communication, climate, citizenship, Malmö made a kind of tool-box that other cities could use as well. When it comes to calculating emissions from companies, one partner within the SECURE project has developed a methodology and a tool based on Swedish statistics and numbers, for example, for the energy mix. For the city, calculations are either based on the Swedish statistics office or the city has its own statisticians and energy-advisors. One possible reason why enterprises are unwilling to go carbon-neutral is simply a cost question - they do not see that the investment will be compensated. They do not see the long-term savings. Companies we are approaching are those that the city is already working with, for example, a printing company. Different departments are working together with different companies. The environment department of Malmö city administration calculated its GHG emissions and found out that the biggest reason was travel (mostly by plane). So the environment department bought videoconference-facilities, for example. The environment department has cars that run on bio-fuel instead of petrol or diesel. We communicate a lot to the employees and check their behaviours like do they switch off the computer and the light. All employees went to climate training sessions. The remaining carbon emissions we offset in India.

3.2 Solar region and green city. The importance of civic initiative in the ecological rebuilding of Freiburg city and region.

Björn Slawik[2]

This chapter focuses on awareness-building for the usage of renewable energy and the removal of barriers to energy efficiency in Germany. The green city Freiburg is located between the Upper Rhine and the Black Forest. It has a very good reputation and is called the 'ecological capital of Germany'. Freiburg is known worldwide for projects in the housing sector like Vauban or 'Solarsiedlung' which are producing more energy than is needed. Vauban is an area with 5.000 inhabitants with a very low energy demand. Houses in this area meet the passive house standard.

This positive development has historical roots. Until 1962 Freiburg had been a rather sleepy and conservative city. Its location at the edge of Germany and the wars with France had led to the absence of large companies and consequently less pollution. Around 1975, massive ecologically-motivated protests came up, for example by staging sit-ins. The construction of a French chemistry factory not far from Freiburg was prevented as well as the installation of three nuclear power plants in Germany and nearby French and Swiss cities. Based on the successful 'no' to nuclear power, and the only 'yes' to sustainable energy sources, regional networks of environmentalists came into existence. Among many environmental organisations Fesa is important for energy and there are other organisations in the sector of public transport. There is a network of many civil society organisations in Freiburg.

This chapter is divided into three parts. First of all, the organisation Fesa is introduced, secondly, some of the projects and their positive effects on Freiburg are described and finally, a brief view of the next steps for Freiburg as a really green city will be given.

Fesa – environmental and energy efficiency organisation – promoting renewable energy power plants owned by citizens.

Fesa was founded solely by ten persons with the target 'just to do something' in 1993. It was and still is today a non-profit association focussing on local action. Fesa encourages the local and regional political and economical actors to support sustainable energy actions. By initiating innovative projects, Fesa promotes the use of renewable energy and energy efficiency. One such project was the implementation of renewable energy power plants with public participation and ownership, meaning that ordinary citizens invested in renewable power plants and thus became owners of the plants. Today we have about 220 members and more then 500 shareholders of our renewable power plants. Fesa's vision is to make the region's energy production 100% renewable. For this we need much greater energy efficiency and it is also common sense in our region that all participants-citizens-shareholders should profit from the change in energy system. Fesa believes that there is nothing more important than to raise the level of energy

[2] director, e.V.Solar Info Center, Germany

efficiency and to make the energy production sustainable in the 21st century. A study was published in Freiburg last year where the authors found that possibilities for the reduction of emissions are more than 40% until 2013.

The best method to initiate a change is to involve the citizens. Without them, a change is not possible. Fesa's objectives were to improve the political framework in 1993, to put pressure on policy-makers for faster change, to inform all citizens about the possibilities of renewable energy economy and to launch an energy agency. At the time it was a new initiative to found an energy agency. Nowadays there are about 30 energy agencies in the federal state of Baden-Württemberg but at that time Fesa was the first energy agency to start the work.

Implemented projects of Fesa

The environmentally consciousness part of the population in and around Freiburg had a strong desire not only to be energy-consumers but to become energy-producers in the early 90's. Therefore, a company had to be founded via the chosen 'civil law association'. The first public participation, citizens-owned solar power plant called 'Regiosolarstromanlage' was constructed in 1994 and financed in cooperation with the main newspaper 'Badische Zeitung'. This cooperation was very important because, due to this cooperation, Fesa had very good public relations. At the time it was one of the first big solar electric installations in the region and the positive support in the region was overwhelming. This was the launching point for Fesa's next eight solar electric installations in Freiburg and the rest of Germany began to take notice. The solar power plant project with 'SC Freiburg', the local football club, for example, had a resonance all over Germany and many sports grounds / stadiums began to install solar plants. Fesa bought one of the first wind power stations in Baden-Württemberg in 1997. That was also the starting point for many others to follow. Fesa founded the energy agency in 1999, which up to now has 10 employees and is also a strong player in rebuilding the energy sector. Fesa realised the performance contracting project 'Eco-Watt' in 1999. Fesa's wind and solar installations produced approximately 30.000 MWh per year in 2006.

Why public-participation-citizens-owned power plants were needed

The advantages of building a common installation with many citizens together (between 8 and 200 persons) are the following: already with limited financial capital, a single citizen can take part in building a solar, wind or water power plant. The minimum of investment was between 1.000 and 5.000 Euro. Working together, people get the possibility to build bigger installations than they could do alone. And, very importantly, it also increased awareness in that investors have a vested interest in the city's energy sources. Perhaps the most important advantage was the increase in consciousness of energy supply. The effect of the initiative was that the public-participation-citizens-owned power plants were the starting point for building up sustainable energy production in Freiburg and, today, the city welcomes delegations from all over the world, who want to know how Fesa and Freiburg city did it.

Figure 1. the "Einsparkraftwerk" on energy saving in a school with 1.200 pupils in Freiburg, which was built in 1973. Its' annual energy cost was 250.000 Euro.

Another project was the "Einsparkraftwerk" on energy saving in a school with 1.200 pupils in Freiburg, which was built in 1973. Its' annual energy cost was 250.000 Euro (Figure 1). The aim of the project was to install energy saving measures and the results were even better than expected. The energy saving measures yield an additional annual income of between 60.000 and 75.000 Euro with the annual share for the school between 2.500 and 10.000 Euro. At the end of the project, energy and cost reductions of about 30 % had been achieved. Besides the economic success, the special effect of this project was the inclusion of pupils, teachers and some parents who were engaged to realize the saving targets by technical changes and changes in the behaviour of the pupils.

Regular working groups were initiated to involve all pupils of the school in energy saving projects or in building their own renewable power plants (Figure 2). By the end, participants achieved high energy saving targets, not least by changing their behaviour. Studies show that simply by changing the behaviour of the energy user saving targets of 10-15 % could be achieved.

After the contractual term, the city of Freiburg will save between 400.000 and 600.000 Euro over the next 15 years. This was clearly motivation for the city government to start two other, bigger energy saving projects with other schools.

Awareness-raising is key for motivation to save energy

Fesa has some further awareness campaign projects. For the past ten years Fesa has produced several publications like the Journal SolarRegion dealing with the topics renewable energy and energy efficiency and which reaches 25.000 readers in the wider Freiburg region. Each edition covers on-going sustainable energy developments in the region and highlights a specific topic with an in-depth collection of articles and case studies. In addition to "SolarRegion", Fesa

brochures, homepage, newsletter and DVDs keep the region up to date and informed. Also, within our realm of expertise is the organization of information sessions and expert panel discussions on current renewable energy topics.

Fesa e.V. is today an established organisation with members that represent the main actors in sustainable energy policy as well as representatives from conventional energy suppliers like the regional energy supplier 'badenova'. Important members of Freiburg city parliament are members and supporters of Fesa. The head of the executive committee of Fesa e.V is a member of the environmental board of the city parliament. Regular meetings with the biggest regional energy supplier are organised to give impulse for new programmes in renewables and efficiency. Fesa e.V applies political pressure with its public relations and works closely together with the regional press, TV and radio stations.

Conclusions

Freiburg citizens, environmental groups and companies as well as the committed city administration have achieved many leading ecological objectives. There are many reasons to be proud of the results achieved, and in crucial fields Freiburg indeed is more environmentally friendly than many other cities. The city has made the first steps in the right direction. But the legitimate pride sometimes leads to a certain laziness, a weakening of efforts and the fallacy of believing that the city has (almost) reached its main ecological aims. The essential pressure of the environmental movement has also decreased. Freiburg is still far away from achieving a real sustainable way of life. So there is no room for Freiburg to settle back and take a rest. The title 'Ecological Capital Freiburg' means that, with lots of effort, people succeeded in regionally slowing down the global processes of resource depletion and environmental destruction. But the current consumption of resources and energy cannot be called sustainable. Looking at Freiburg, its ecological footprint can be overlooked easily. The footprint of Freiburg is about 4 hectares on average for each and every citizen of the city. This is almost four times more than estimates of the permitted global average. The proportion of alternative energies used in Freiburg is still small. Municipal initiatives are still too slow and inadequate. Sometimes even far from it: for example, Freiburg´s wind energy plans for a sustainable and future-oriented energy supply are now prevented by the regional administrative authority.

If Freiburg city wants to cope successfully with these challenges, it has to act much faster than it does today. The potential is high, the recent study for the Freiburg region showed that a reduction of carbon dioxide emissions of 40 % by 2013 is technically and economically possible in the context of oil prices being half as much as they are today.

Nevertheless, the challenge is still large and looms ominously. Freiburg has a very high potential to turn the current challenges into future success. If city and Fesa e.V. work together and integrate the citizens as a foundation for success, the way for a truly sustainable future will be paved.

Figure 2. Elements of using solar power in Germany, the regular working groups were initiated to involve all interested stakeholder groups in building their own renewable power plants e.g. using the roofs of sports ground buildings for the solar panels.

3.3 The National Energy Savings Target and Examples of Good Energy Efficiency in the Housing Sector in Latvia

Ivo Lemss[3]

The 'National Energy Efficiency Action Plan' was adopted by the Latvian government on May 13th 2008. The plan includes indicative energy saving targets and covers five branches (households, services, industry, transport and agriculture). It also describes horizontal and cross-border energy efficiency (EE) measures and stresses and the exemplary role of the public sector covered by the Energy Performance of Buildings Directive article no. 5. With regard to the five abovementioned branches, households represent the biggest part of the target for energy saving (Figure 1).

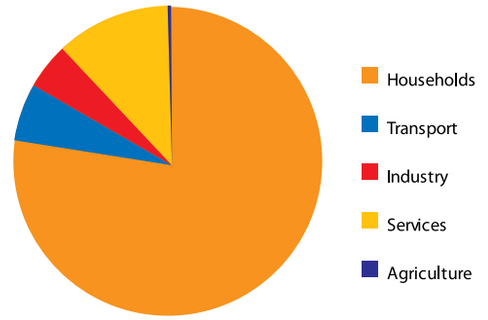

Figure 1. Energy saving target in GWh for Latvia.

The target is to save up to 2000 GWh of energy in households by 2016. The savings should be achieved via the following measures: 1) energy audits and certification, 2) increased energy efficiency in multi-apartment block buildings, 3) increased energy efficiency in public and municipalities buildings, 4) informing of energy consumers, 5) the preparation of the legislative basis. From above mentioned, direct energy savings will be achieved implementing 2 measures – energy efficiency increasing in multi-apartment block buildings; energy efficiency increasing in public and municipalities buildings. Measures remaining will give energy savings in branch overall according to impact calculation (based on comparison with and without energy efficiency measures implemented). The Parliament of Latvia adopted a Law on Energy Efficiency in Buildings on March 13th 2008 which transposes the Energy Performance of Buildings Directive (EPBD). The secondary national legislative documents (Cabinet of Ministers' regulations) are in preparation phase. Up-to-date information shows that all necessary Cabinet of Ministers' regulations will come into force in first quarter of 2009. According to the Implementation plan of the National Construction Programme 2008-2012, the overall estimated financial support to energy saving measures for housing sector is about 500 million EUR from the ESF (European Social Fund) and the state budget.

[3] Ivo Lemss, Project Manager, Construction, Energy and Housing State Agency (BEMA) of Latvia

This figure is an estimation, because also EEAP, the Implementation Plan of the National Construction Programme 2008-2012, the State Aid Programme for renovations of multi-apartment block buildings and many other programmes exist. These programmes are changeable and many amendments have already been made. The National Construction Programme's activities can be outlined as follows: energy efficiency EE measures (for apartments and social houses) financed from the state budget for around 10 million EUR. As a result, 10% of apartment buildings should be achieved energy efficiency target and 89% of social buildings should be insulated. Furthermore, 7,9 million EUR will be spent on the renovation of 233 multi-family buildings and another 700,000 EUR on information campaigns for citizens.

Some practical solutions will be presented at local level in the next section. One article of the ESD on energy use efficiency regulates the implementation of energy efficiency measures and actions at the local level.

The following example is Rezekne municipality which adopted the local binding regulation no. 7 in March 2008 (Table 1). This enables municipalities to provide co-financing for the implementation of EE measures in multi-apartment block buildings. Scheme supports 14 activities (7 EE measures, 4 activities involving the landscaping of adjacent areas and 3 renovations of badly damaged houses).

Table 1. Solutions at the local level – Rezekne municipality example.

Supported Activity	Co-financing amount
1. Energy Audit	50% of total energy audit; max. support 355 EUR
2. Change or modernization of heat points	50% of total expenses; max support 3000 EUR
3. Energy Efficiency measures	15% of the total project supported expenses; max support 15 EUR/m^2
4. Full inner yard renovation	50% of total project supported expenses
5. Servitude roads renovation	75% of total project supported expenses
6. Children's play ground	50% of total project supported expenses
7. Green zone improvement	50% of total project supported expenses
8. Inner yard lighting installation	50% of total project supported expenses
9. Official decisions of qualified expert	50%; max. 1500 EUR
10. Technical project	50%; max. 1500 EUR
11. Renovation works	50%; max. 28500 EUR
12. Change or renovation of old elevators	50%; max. 28500 EUR

The maximum amount of 28,500 Euro is spent on renovation work and another 28,000 is invested in the renovation or exchange of elevators. There are also several conditions that flat owners must fulfil when they plan to renovate their house.

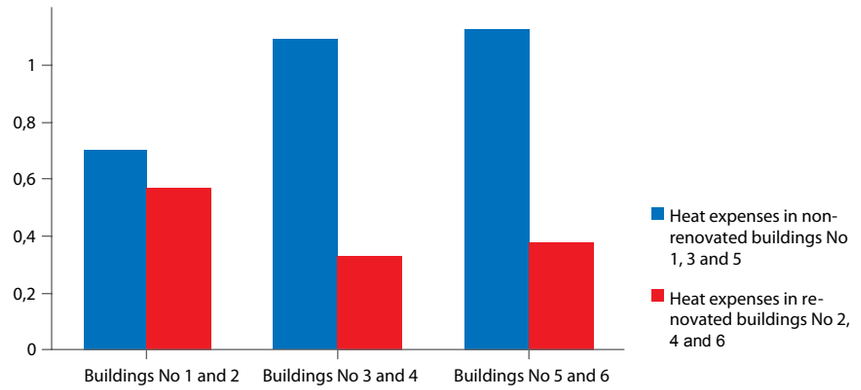

Figure 2. Comparison of heat expenses (in EUR/sq.m) in 3 renovated and in 3 non-renovated buildings in Latvia.

The city of Valmiera is presented as the second example in terms of energy efficiency in Latvia. Within 9 years, 66 buildings had been issued loans in the total amount of 384,000 EUR and in period of 2004-2007 11 multi-apartment block buildings had been issued loans for renovations amounting to 806,000 EUR. Now 80% of buildings in Valmiera are under private management and the city could find a solution without state aid. That is to say, without the new law from March 2008. The process began in 1999 when the municipality started to invest in renovations by taking money from the privatisation fund. The loans had to be paid off within four years. The amount given was quite low (3,000-7,000 EUR, though higher in several cases), but an expert from Valmiera affirmed that if you use the money for example to insulate both end walls, the benefits are realised in a short period of time. Hence house owners are very satisfied because they achieve energy savings and then have an economical advantage since they pay less for heating. Heat expenses in renovated buildings differ considerably from those in non-renovated buildings. (Figure 2)

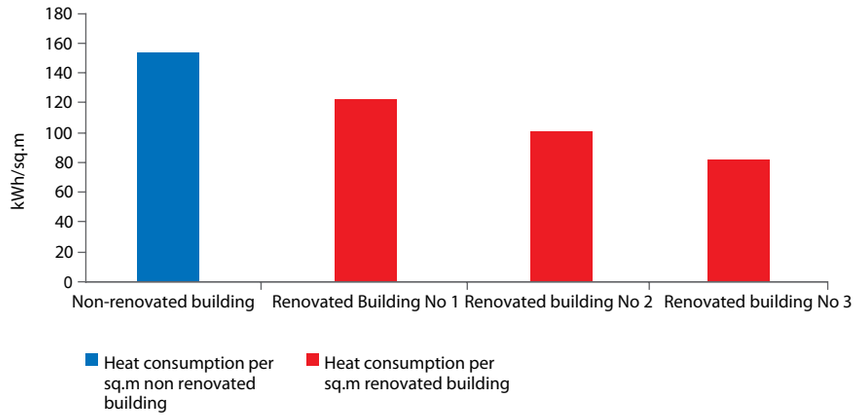

Figure 3. Comparison of heat consumption in kWh per sq.m on non-renovated and renovated buildings in Riga, Latvia.

Final remarks relate to urban art activities in energy efficiency in Riga. One example is a multi-family house built in 2002 where energy consumption is measured in flats (so that the inhabitants can regulate heating by themselves) and an automation system was installed. Compared to other houses in Riga, this house saved 48% of energy. (Figures 3 and 4).

Figure 4. Multi-store house in Riga, constructed in 2002, with total floor area of 2 628 m^2, with 40 apartments, heat tariff is 17.24 LVL/MWh, energy consumption measurement in flats exist and is automatized.

3.4 Creating Energy Action Plans and outlining the approaches adopted by the other cities involved in the SECURE project Malmö, Hilleröd and Dublin.

Joe Hayden[4]

This chapter will introduce energy action plans, the work that the SECURE project did in different cities including the development of an action plan for Dublin, which was finalised at the end of 2008.

Firstly, some background information about Codema is described. Codema is the leading agency for energy and sustainability in Dublin, founded in 1997 under the initiative of Dublin City Council with support from the European Commission. Codema's aim is to contribute directly to the economic, social and environmental sustainability of Dublin and of Ireland. It is Dublin City Council's main energy advisor and operates with other state bodies such as the National Sustainability Energy Agency and it provides a consultancy service for private sector developers and for the residential and commercial sectors. Codema has a very important position in understanding the dynamic between the public and the private sector because they work in very different ways. It is important to facilitate this gap and Codema tries to position itself here. It keeps a strong balance between environmental and business issues and does not let one dominate the other.

Codema advises from master-plan stage up to detailed design, it works currently with four different European projects. There was a 'BUDI'[5] project which just finished that was concerned with implementing the buildings' energy directive in Ireland and how to create an atmosphere to establish the energy certificates - basically a marketing campaign and that was quite successful. Ireland was one of the first countries to implement the directive fully, new houses have to have an energy certificate. At the moment, commercial buildings (as of July 2008) and all existing buildings from 2009 will have to have a certificate. Codema is also involved in a project called 'ROSH'[6] which involves the retrofitting of social housing and a programme called 'ASTUTE'[7] which is focussing on sustainable transport and mainly on creating workplace travel plan. So, at the moment, Codema is involved with 30 programmes in 15 different member states. It is a very important network for us and it is also very important for us to learn what is happening around Europe and to avoid making the same mistakes and, hopefully, to improve.

Incentives to develop an action plan

So, what are the incentives for developing an action plan? One of the main incentives is economic. Ireland is at the end of a very, very long European pipeline. So, if the lights go out

[4] CODEMA, Dublin, Ireland

[5] http://www.buildingdirective.org

[6] http://www.rosh-project.eu

[7] http://www.astute-eu.org/ & http://www.workplacetravelplans.ie

they probably will go out in Ireland first. We currently import more than 90% of our energy requirements for all our home heating, petrol, diesel for transport, gas, oil, coal for electricity production. And we only have a small amount of wind energy used at the moment. It is at 10% which is very low for a country that has such huge resources but this is developing. Regulatory incentives are also there, both national and EU. The energy forms building directive is very important. Since then, we had a very significant improvement in our building regulations for housing. We have had a 40% improvement from 2005 regulations to 2007 which is quite significant and a lot of developers are still trying to understand how they are going to achieve this but they have embraced it and they have realised that it is important. There are also the environmental incentives: reducing our carbon emissions, impact on the climate in general and taking care of the planet for future generations. As we have developed these, it is essential that we have balance between the social, economic and environmental issues - the three pillars of sustainability. When we make changes, when we make policy, it is essential that we have to achieve balance between these issues. Today it is most common that the economic issues dominate but it leads to problems, certainly socially and for the environment.

Process of developing an action plan

This section will focus on the process we went through developing an action plan in Dublin. Firstly, we focus on what we did in Dublin and then talk about Malmö but you will see that it is very, very similar. Obviously, when cities are going to develop action plans, you have to create a plan that suits your own local conditions otherwise it is not going to be implemented. But the process and steps that you must take to implement this plan are going to be the same. A rough diagram is shown in Figure 1: across the bottom we have the three basic steps, which are (1) consultation process, (2) a benchmarking process for energy and CO_2 for establishing where you are and how much energy you are using today and (3) then a review of the current policy - local and international - just to make sure that you are not in conflict with any policies that exist. So, the consultation is with key stakeholders and is vital to the success of the action plan in the sense that the consultation stage is usually a way of establishing who the key stakeholders are in the area. The benchmarking is very important to understand where we are beginning. First of all, we have the consultation. We had a consultation with the residents' groups in Dublin. We sent out a questionnaire, short questions on what their ideas for an energy action plan would be for Dublin city, with focus groups within the city council - within the key departments in the council who would be implementing this plan i.e. engineers and planners. We had a seminar in Dublin, just to kick-off. We had one to one meetings and then we had a student following the process up. (Figure 1).

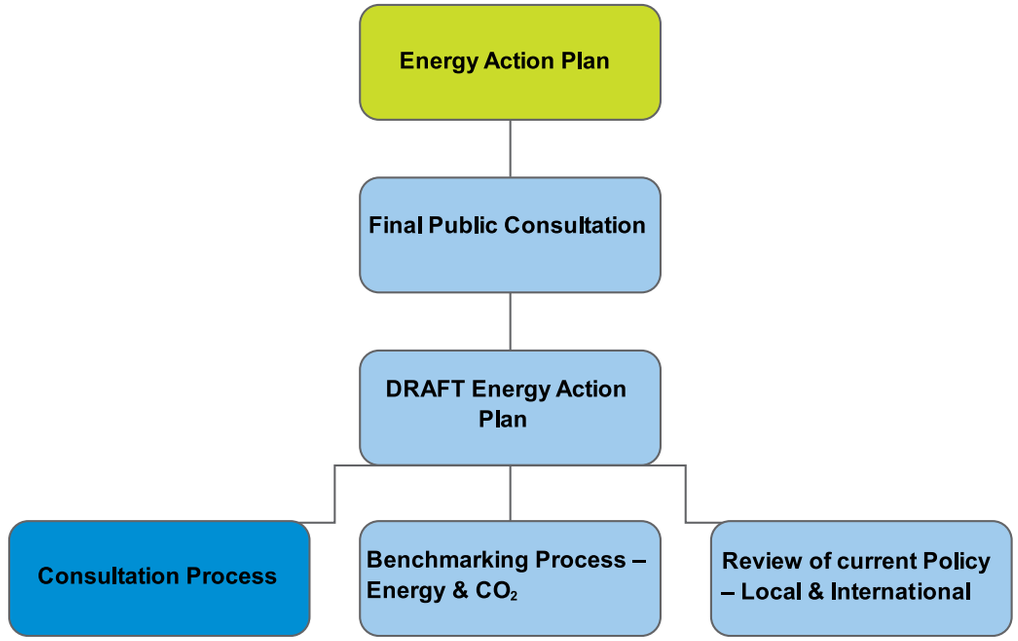

Figure 1. The process and steps for development of an energy action plan.

The seminar in Dublin was at the beginning of the energy action plan, it was the initiation of the consultation phase in Dublin. We had a SECURE partner over to speak. It was the first step in developing the action plan. It was for generating awareness and for identifying the key stakeholders. The audience were informed of the concept of the action plan and where Dublin City Council wanted to go in the future and what the next steps were going to be. We tried to bring in a good list of speakers from the department of environment in Ireland and the city council and from Sweden and Denmark. We followed this process with a series of one to one meetings. The idea of these personalised meetings was to build the network between key individuals in the energy sector and the environmental sector in Dublin. We felt it was important to gather the views and opinions of all the stakeholders involved at the outset of the project and use this information to influence the information of the developing plan. This included people from the city council, the city manager and the electricity suppliers, the gas suppliers, NGOs involved and the business community (which are very important in terms of transport and economics in the city) and then various government departments. In total, we had one to one interviews with 49 different organisations. So it was quite a broad process.

We then followed this up with focus groups. These focus groups were held within the city council departments. We brought in a professional facilitator for this. We basically took the engineers', the architects' and the planners' and the maintenance departments and asked them what they thought would be important for an action plan and where the key issues are.

We had a series of questions for them: "What opportunities would result from the development of an energy action plan?" "What should be the key objectives of the plan?" "What issues need to be addressed in the plan?" "What outcomes would you like to see as a result of the plan developed?" and "What are the indicators, and how do we know that plan is actually working?". This process was very, very important for just getting started, because these are the people who are going to implement the plan and it gives them a sense of ownership of the plan. It is important that you develop this at an early stage. We learned a lot from this as well.

Almost in parallel, we had a benchmarking process happening in Dublin. This benchmarking process involves the main deliverables from developing the energy action plan in Dublin. So we had a calculation of the current energy and CO_2 emissions for the city. We also had a review of the possibilities for more sustainable energies. How can more energy be conserved? The review of the possibilities for more renewable energy use within the city was compiled as was a detailed report on fiscal incentives, the financial instruments and the control, the regulations and the grants that could best be used.

Most of the businesses in Dublin City are SMEs (small to medium enterprises), so we have very little industry in the city centre and little or no agriculture so we could keep energy related CO_2 emission down to the sectors of transport, residential and commercial. Transport is a very big issue in the country - for the actual city, we defined it as best we could because it is very hard to establish where transport ends. For transport we calculated that energy related CO_2 emission is 26%, for residential this is 37% and, for the commercial sector, 37% of the total. Commercial and transport can be difficult to improve, residential is one area where you can make significant improvements in a very cost-effective manner. As part of the benchmarking process, bearing in mind the future action plan, we are developing some projections for energy consumption 2006-2020.

The residential sector is currently using approximately 7,8 TWh, which is quite a broad brush analysis. We estimated that if we continue business as usual, so leave all the existing housing stock there and do nothing, just have small improvements in building regulations, we will have a 17% increase in energy consumption in housing by 2020. If we take some low cost measures like energy saving light bulbs and insulation, nothing structural, but we improve our building regulations, our building standards significantly, we can achieve almost zero growth or a 5% reduction in energy use. And, if we went completely took on all the high cost measures and insulated all the walls and all the roofs, new boilers and renewable energy, high building standards, we could possibly achieve a 37% reduction. We have currently sent it off to a financial institute to do a financial analysis. So, it will be interesting to see what that will play out when it comes back whether the 37% is realistic or not. In the end, what we are doing at the moment, in developing the plan, is a policy review. We are going to look at local, national and European policies. Our energy action plan will become a part of the city development plan once it is finished. We have a local climate change strategy which was recently voted in by the politicians. Furthermore, we have national and European policy. So, when we write the action plan we make sure that it integrates with these policies.

An Energy Action plan in Malmö

The Swedish city of Malmö carried out similar actions to what has happened in Dublin even though they are very different cities. But their process was based on Swedish law concerning energy planning. We also performed an analysis of the energy supply and consumption per sector and an analysis of the potential for renewable energy and energy efficiency. Their process involves working groups from the city planning office, the streets and parks department, the environment department, real estate, city centre administration and the business community. They set up a steering group with heads of each of these departments to oversee the process. The strategy is not policy-approved yet. The content is to answer the challenges for the energy situation in Malmö in the future, put forward overall long-term and short-term targets and specific targets (achievable targets basically). The action plan will form part of the environmental action plan 2009-2013 so again, it involves integration similarly to that in Dublin and connects our municipal plans and programmes, traffic and environment, so there are no conflicts there. The vision for Malmö is an energy system which will be 100% renewable by 2030 and their target by 2020 is to use energy with high efficiency so as to have a 20% improvement in local and regional energy sources for Malmö's energy supply. To have infrastructure distinguished by the caused effect of the transport system and minimum impact on the environment. So, just to finish: it is complex and we have to make sense of it for ourselves and to remember that you do not always get what you planned for.

4. Public awareness

4.1 Polish experiences: refurbishment process preparation - energy audit scope; financing sources available and applied development of awareness campaigns.

Andrzej Rajkiewicz[1]

Energy saving concerns everybody not only local authorities or designers. Poland is a large country which started democratic reforms at the beginning of the 1990s. Financial conditions are not very good: average per capita income is about 750 € per month. Dwelling costs are about 20% of income and 10% of households' expenditures are related to energy.

This paper is divided into three parts: energy auditing, financing schemes and a description of the housing refurbishment awareness campaign.

Energy Auditing

The building stock in Poland is in poor condition with over 85% of dwellings older than 10 years. These buildings need urgent renovation. A clear correlation between the age of buildings and their energy consumption is evident. In buildings constructed in or before 1985, energy consumption is between 240 and 380 kWh per square metre (kWh/ m^2) per year on average. This is more than in the Baltic States. After 1985, design norms and heating energy consumption norms have been more restrictive. So, for new buildings constructed in Poland the target is 90-120 kWh/ m^2 per year but over 75% of buildings in Poland have a very poor heating standard.

There are almost 1 million apartment buildings in Poland, of which 400,000 were built after World War II but before 1988. These buildings are in the worst condition. Half of them are constructed from panels. More information can be found on the BEEN project webpage[2]. The ownership structure is that private dwellings make up about half of the total, and, of the remaining part, almost half are owned by cooperatives. The others belong to homeowners' associations (HOAs), municipalities and to enterprises and small construction associations formed by municipalities (Figure 1).

[1] National Energy Conservation Agency, Ul. Filtrowa 1, 00-611 Warszawa, Poland, arajkiewicz@nape.pl

[2] http://www.been-online.de

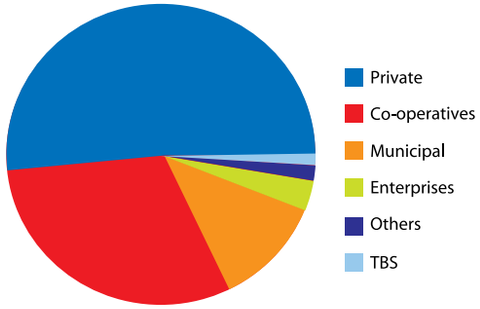

Figure 1. Ownership structure of dwellings in Poland (source: Central Statistic Office of Poland, 2005).

A new financing scheme was introduced in 1998 which replaced the direct subsidy scheme to the energy prices in Poland. Until 1996 the owners paid only 20% of energy costs. After the change, they paid 100% of the energy cost and, therefore, the state initiated a scheme which gives a special bonus (a 25% reduction in the loan taken) for the implementation of energy efficient refurbishment measures. The usual type of investment financed through this scheme is the modernisation of the heating installation and properly insulating the walls and the roof. With these activities, in every case, an energy saving of more than 25% is achieved and this is a requirement for getting the bonus. On average a 34% energy saving is achieved through the refurbishment measures financed by this scheme in Poland.

How does the system work? Specific funds are allocated via the state budget each year to the Thermomodernisation Fund. Commercial banks use the fund's money to extend the 25% reduction in loan repayments to the investors. So it is not a direct subsidy to the owner of the building but is a subsidy to the loan. It means that the investors must mobilise their own resources for getting this loan. That is, the investors must raise a minimum of 20% of the investment amount and should be credit-worthy (which means that they should be able to repay the loan after the period when the bonus is deducted from loan repayments). The investors have an obligation to present energy audits confirming the energy savings and this is required by conditions set in law. The energy audits include not only the technical assessment of the building and identification of improvements, but also a kind of business plan, for example the cash flow necessary for the repayment of the loan and the level of the bonus paid from the state are also calculated.

Scope of the Energy Audit

In addition and regardless of the bonus, it is important that there are more stringent requirements concerning some technical features, for example that the heat resistance coefficient, R is over 4,0 m^2 K/W for walls and over 4,5 m^2 K/W for roofs. This is more than the current technical conditions required for new buildings.

There are about 3,000 persons working in the preparation of energy audits. The development of the energy conservation agencies started in 1990 with about 50 persons - scientists who began to think about how to speed up the consideration of energy conservation in Poland. And, currently, these 3,000 persons are also associated with different organisations. One of these is the 'Association of Energy Agencies in Poland' which has 7 members and, from the bottom up, there is also the 'Energy Auditors Association' which has about 2,000 members.

The main problem lies in proving the creditworthiness of investors. Possible causes for this are the following: (1) the value of the renovation fund; (2) the renovation charge; (3) the remaining income; (4) the renting of free spaces; (5) special charges; (6) security for the loan; (7) mortgages; and (8) proxies for the bank accounts.

Before renovation | After renovation

Figure 2. Example of renovated house in Poland.

An example of a renovated house is presented in Figure 2. This building was constructed in 1963. The construction material is concrete panels. The number of apartments is 48 with a total floor area of 2,400 m^2. The following measures were implemented:

1. Insulation of walls 13 cm
2. Refurbishment of skylights
3. Insulation of roof 12 cm
4. Modernization of heating installation

The cost of these measures was 115,000 € or 57 €/ m^2 living area or 2,400 €/apartment. Annual heat cost savings were 1,150. The calculated annual heat consumption saving was 41.7% (47% was achieved). The apartment owners' own sources of finance were used in the amount of

25,000 (which consisted of 22% of the total cost). The loan was for 89 850 €, the bonus from the state was 25% which is equal to 22,462 € and this left 67,387 € plus interest to be repaid. Amazingly, the loan was repaid during 2.5 years.

The renovation charge was increased to 1.30 € /m²/month i.e. 2,600 €/month from the HOA during the year before the project. The calculated monthly instalments and interest to be repaid were 960 €/month (for 10 years). Tenants have reduced their private income tax through renovation tax regulation. The heat comfort has improved and the market value of the flats raised by 10%. The heat cost reduced by 0.45€ /m² /month i.e. 25 €/month/apartment.

Financing Schemes

In the process of thermomodernisation of buildings, the compilation of the energy audit marks the first step. The second step is the loan application and the collection of own funds by the owners of the dwellings. These funds, the so called 'refurbishing fund', has to be created in every multi-family building in Poland independent of the ownership type. Each association, cooperative and private multi-family building has their own fund. First, this refurbishing fund is the basis for collecting the owners' own funds for securing the loan and secondly for repaying the loan to the bank. These funds are supplied by flat owners in the form of monthly charges calculated per square meter of living area in the building. These different levels should be accepted by the majority of people living in the building. If enough money is collected and if the monthly charge is enough to repay the loan, then the owners' organisation for the building is considered creditworthy and can get the loan plus bonus without any further problems. It should only act in accordance with the construction law in Poland which requires it to prepare the design, to obtain the construction permit, to perform the measures according to good construction practice and to confirm that the refurbishment works conform to the energy audit and the design.

This finance scheme is important in Poland, because renovation costs of buildings are very high, they lie between 200 € and 400 € per square meter. That means 12,000-24,000 € per apartment. With regard to the low household income, it is not possible to cover the complex renovation of a building by monthly payments without loans as the renovation would take between 15 and 30 years. This is far too long a time because the buildings may simply collapse in the meantime. It's a fact that 40,000 buildings are demolished in Poland each year because renovation didn't start in time.

There are, of course, some barriers to this scheme like the collection of own funds, barriers regarding the mentality of owners, the passivity of building boards and local government, lack of knowledge of the thermomodernisation law and little direct additional support for vulnerable families and lack of knowledge of the scheme. But these barriers will be progressively eliminated. It is also important to note that commercial banks are treating homeowners' associations or housing cooperatives as very good clients that don't require any additional guarantees for the loans.

The current target is to cover 3,300 houses annually but this is only around 1% of the houses that need renovation. There is now talk of how to extend the financial resources and the scheme. In total, there were almost 12,000 buildings that used the scheme and performed the complex refurbishing process last year. This can be judged as a success, but in a wider sense, this is still not enough to cover the demand. Therefore, we are thinking in Poland (and in other European countries there are also discussions on this particular topic) to use the financial instrument of the European Investment Bank called 'Jessica'. This instrument gives the opportunity to create a development fund that covers all issues related to refurbishment of urban areas including refurbishment of residential buildings in such areas. A very good example of such a fund working in Europe can be found in Schleswig-Holstein, Germany. Working since 1950, the fund gives loans with low interest rates for a long period so that the monthly repayment rates are very low. Money is available for all types of buildings.

Housing Refurbishment Awareness Campaign

The awareness campaign has been operational for three years and is called 'Friendly Home'[3]. It runs under the patronage of the Ministry of Construction and has the aim to provide informational material like brochures, leaflets and postcards and to distribute these among the population. This action is financed in a very transparent way by the private sector - not directly by producers of construction materials but by their associations. So you do not find any producers' logo but only that of the association. The National Polish Post is also involved since it pays for the distribution. Furthermore, banks are part of the campaign.

We try to organise public partners for raising awareness in this matter. This action will also be used for the implementation of an energy performance awareness campaign.

There is also another example financed by companies: the professional monthly 'Energy and Building', founded in 2006 as an initiative of the Energy Auditors' Association. This is addressed to the energy auditors, designers, facility managers and construction companies but does not have any advertisements. A good example of private sector financing in a transparent manner. Financed by commercial companies – suppliers of goods and services for energy efficient refurbishment of buildings and heat supplies. It is published in 2,700 copies monthly and distribution is as follows: 1,000 to energy auditors, 1,200 to interested persons, 500 for archives and as a part of training materials.

Conclusions

Due to moving the residential buildings issue from state to municipal level, there is a need to compensate for this by the development of instruments at the state level. Municipalities, as former owners of dwellings and managers of the buildings, should be interested in the development of local long-term working instruments to support energy efficient (EE) refurbishment. For vulnerable families, there is still a need to establish instruments of direct aid for the maintenance of dwellings and for participation in the refurbishment cost born by the condominiums. The issue of profits from EE measures should be the subject of large scale awareness campaigns supported by the state and the private sector.

[3] http://www.domprzyjazny.org

4.2 Sustainable construction - experiences from the SECURE project

Anna Jarnehammar[4]

The Swedish Environmental Research Institute in Stockholm is one of the partners in the EU SECURE project. The main part of the project is the development of energy action plans but, as you heard in Joe's presentation, the building sector represents a lot of the energy use in cities. We have a special work package for sustainable construction, we can learn not only from the cities participating in the project, but also from other cities in Europe. We have made a benchmark study of the best practice urban development projects within the EU. And we are also looking into best practice in passive housing, for example as they did in Denmark. This benchmark study is described in this chapter, which is also available on the website of the SECURE project.

Figure 1. Satellite image of Europe during night-time for illustration of energy consumption, building sector is responsible of using 40% of energy.

It is my colleague Ivana Kildsgaard who has made this study together with Malmö and some of the other partners in the project. Figure 1 illustrates energy use in Europe , it shows Europe during night-time. As you can see there is a lot of light throughout Europe. This is part of the energy use for the cities. Lighting is mainly concentrated in the cities. In general, the building sector is responsible for approximately 40% of the energy use. If we have a look at CO_2 emissions, the United States is the biggest consumer of energy and emits a lot of CO_2. The developing world has low emissions now, but things are starting to grow also in this part of the world and, therefore, bearing global responsibility for climate change is extraordinarily important. What will be the situation for new building constructions, for example, in China? Will they have the same

[4] IVL, Stockholm, Sweden

standards as we have in Europe or in the US? Actually, we really have to show the way how we can decrease energy use and the construction sector is one very important part of that. The best practice review of energy performance that we did in the SECURE project was also realised with another project in Malmö. We have actually concentrated on the Nordic, cold climate regions. We have not looked into cooling although this is also a very important aspect for the southern parts of Europe – having efficient cooling systems in houses.

What are the motives for cities to have sustainable development for urban areas? Most cities actually want to become leaders and to show that sustainable city development is making the city more attractive, gets financial benefits for the cities and creates new business for companies in the region.

Most of the European urban planning projects that were developed had those three pillars: environmental, social and economic. Most of the economic aspects are the steering ones. But actually in the projects the environmental issues have been quite high on the agenda. That is thanks to financial support from the cities and the EU. In order to make this development happen it is still necessary to have this economic or financial back-up. A question remains: how can we mainstream this without a lot of financial support?

On the environmental side there is not only energy. Now we are discussing energy very much, which is good, but we should not forget about the other issues like waste management, water management and also the phasing out of dangerous substances in building materials which has been a big problem in the past. These are the main parts which most of the cities have used. We have been looking in 24 different development areas. One of the bigger projects has been Viikki in Helsinki, introduced in earlier chapters of this book, where realistic ecological innovations were implemented and PIMWAG criteria for steering ecological planning was used - 5 main factors: pollution, utilization of natural resources, healthiness of buildings, bio-diversity, and relation to food production (nutrition). These 16 criteria for assessing a project from a sustainability point of view are presented in Table 1.

Table 1. PIMWAG criteria for steering ecological planning with 5 main factors: pollution, utilization of natural resources, healthness of buildings, bio-diversity, and relation to food production (nutrition) in Finland.

POLLUTION	Minimum level	1 point	2 points
Carbon dioxide emissions	3200 kg/gross m^2	2700 kg/gross m^2	2200 kg/gross m^2
Clean water consumption	125 l/person/day	105 l/person/day	85 l/person/day
Building material waste	18 kg/gross m^2	15 kg/gross m^2	10 kg/gross m^2
Household waste	160 kg/person/year	140 kg/person/year	120 kg/person/year
Environmental labelling	No additional requirements	Environmental labelling for min. 2 products used to a substantial degree	Environmental labelling for several products used to a substantial degree

NATURAL RESOURCES			
Primary energy	30 GJ/gross/50 years	25 GJ/gross/50 years	20 GJ/gross/50 years
Heating energy	105 kWh/gross m²/year	85 kWh/gross m²/year	65 kWh/gross m²/year
Electrical energy	45 kWh/gross m²/year	40 kWh/gross m²/year	35 kWh/gross m²/year
Adaptability and multi-use of space	Standard solution	15% adaptability in flats OR housing functions concentrated in communal spaces	15% adaptability in flats OR housing functions concentrated in communal spaces + versatile spaces in the building
HEALTH			
Internal climate	S = Class 2* P = Class 1 M = Class 2	S = Class 2* P = Class 1 M = Class 1	S = Class 1* P = Class 1 M = Class 2
Moisture risks	Standard good solution	Min. 2 important prod. Groups better than build. Standard Rak MK C2 (1997) minimum level	Innovation used
Noise	Standard solution	Rak MK C1 level (1997)	Noise insulation better than Rak MK C1 level
Wind and sun	Standard good solution	Excellent solution	-
Alternative house plans	Standard solution	15% of flats differ in plan	30% of flats differ in plan
BIODIVERSITY			
Plant selection and habitat types	Plant selection based on defined habitat types	Vegetation characterized by varied flora and through layeredness	Yard design promoting biodiversity of plant habitats. Plant communities containing different species.
Storm-water management	Solution in accordance with building standard RakMk D1	Rain water utilized for creating varied ecosystems and for watering gardens	Innovative solutions
NUTRITION			
Cultivation of useful plants	Standard solution	A third of bushes and trees yield produce	Residents given opportunity to cultivate their own yards
*Indoor climate classification system: S = target values for indoor climate; P = Guidance for design and construction; M = Requirements for building products			

Really important for the development is the fact that they all had quality programmes. One key issue was that they expressed their goals (what should be achieved? Which are the visions? What are the measures?). If we look at the technologies used in the city development programmes, we tried to have energy production within the buildings, solar cell and collectors, PVs, combined heat and power generators, wind turbines (like they built in Malmö, for example). You also have to minimise energy use within the buildings, improve insulation, no thermal bridges, heat recovery for exhausted air and waste water. These are basic solutions requirements for sustainable development. Those two parts (to minimise energy use and to create buildings as energy-producers) of city development are shown in Table 2.

Table 2. Principles of buildings as energy producers and users.

Buildings as producers of energy	Buildings as energy users
Implement technology for producing energy and increasing the share of renewable energy	Implement technologies for improving energy efficiency of buildings
Solar cells (PV)	Heat recovery*
Solar collectors	Improved insulation
Combined heat and power generators	No thermal bridges
Wind turbines	District heating
	Green design
	*Air to air heat exchanger
	*Extracting heat from waste water

Concerning the use of solar energy, there are two different solutions: stand alone/independent and integrated systems. There are some problems with the integrated solar systems (serving for example as a roof). You have to plan them right from the beginning, what is their direction? If they are not integrated, you have the possibility to change their direction according to the position of the sun during daytime. One advantage of integrated solar cells, although they are quite expensive, is that you can use them in different functions, as solar shading for example.

But there are a lot of barriers for PV cells, first of all their efficiency. They do not actually produce that much electricity. Secondly, there are high costs but, to give one example, they did not use the energy produced for the building but they used it for charging their electric cars. Thirdly, the pay-off time changed radically.

Market barriers were such as the fact that people did not rely on the PVs. There is no discussion about solar collectors, but concerning PV cells, people still think that it is too expensive and does not work that well. We also found institutional barriers, for example, in Sweden, we cannot connect the solar collectors to the grid, so we cannot deliver electricity. In conclusion, some barriers have to be changed in order to simplify the introduction of PV cells. (Table 3).

Table 3. Approaches and solutions utilizing solar energy

Technical barriers:	**Market barriers:**
Efficiency of PVs	Consumer awareness and education of professionals
Current efficiency for thin-film and crystalline-silicon modules is **7%** to **10%** and **12%** to **14%** efficient, respectively	Government, legislative, and regulatory roadblocks
Goal: industry has established an **18%** to **20%** conversion efficiency goal at a cost of less than **50 cents per watt** for each module technology	Financing & costs (down by 40% by 2010)
High manufacturing costs of solar-electric power components	
Complexity of installation - should be **"plug and play"**	
Institutional barriers:	
Integration of PV systems with grid electricity (current 1% of world's electricity)	

In Sweden and Denmark we mostly use district heating but in some other countries this is not available. Therefore many of the projects have introduced a lot of smaller heating power plants but really small ones do not work very well. You have to come up to a certain scale to have them producing both electricity and heat. So, combined heat and power plants have not been very successful.

When it comes to wind power, the best example in Europe is Malmö where they built a large scale wind park outside the city district area. Outside Europe you can find a lot of good examples like Bahrain which could be used as a model for the future although it was not very common in the analysed projects. In most projects they took good care in minimising the energy need in the houses – passive house principles have been used (but not always to the very end). Trying to save energy in the houses is a very good initiative within the city development projects. This was actually missing in some of the projects. They did not reach energy efficiency. The overall energy system was good like a 100% renewable energy but the single buildings had poor energy efficiency. So, this is one thing you have to think about when you develop a city area: to have both the big overview like transportation (how should the energy system be supplied? What kind of renewable energy you can use?) but also to have energy efficient buildings. Think both at the big and at the small scale!

One very important issue, especially in cold climates is the exchange of used air. For example, in Sweden, we have very high standards on how much air we have to exchange every hour to maintain good indoor air quality and to produce heat. For this, you need a heat recovery ventilation system.

Another consideration is the behaviour of people. There is one example in Sweden, a passive house which was very good and energy efficient. The **Swedish definition of passive houses**

states that (1) energy requirements are different for southern and northern climate zones; (2) specific power need exists – max 10W/m^2 while in the northern zone it should not exceed 14 W/m^2 and (3) for houses max 200m^2 additional +2W/m^2 is required. Other initiatives of low energy consumption are Minergie ® with Minergie-P® and Minergie-Eco®, KlimaHaus/ CasaClima (gold, a, and b).

But if you have a look into the different apartments, there are very big differences in the energy use, you may call it a 'factor 3' or something like that. Then you have to think about how to encourage people to use less energy. In one of those houses they had a lot of computers and the heating system was on the veranda. In the cold weather, they used a lot of energy to heat the outside veranda.

In most of the city development projects that we looked into, individual metering was a key issue to get people aware of their energy use. You can find several good examples.

We should not forget about the other sustainability issues as well as the social issues. The goal should be a combination of all the issues. You can use energy to upgrade an area like they did in Gårdsten, Sweden - they used solar energy as a vision. Involving people in the process is very important. Having enviromental issues covered. We have the tendency to look at one thing at a time, maybe it is too complex for us to do better.

Conclusions: there is no universal recipe for sustainable building! But still you always have to respect the local conditions, what is applicable in this area, in this neighbourhood? It is important to cover all three aspects of sustainability. The overall programmes and guides are very important in order to achieve your aims. You have to have a plan to get there. You have to put up goals that are achievable otherwise you will get disappointed. But the goals should not be too small as well. Raising awareness is a key issue within the process.

4.3 Estonian first experiences of energy efficiency in buildings

4.3.1 The case of KredEx as an example of an implemented solution for fiscal incentives in Estonia

The Credit and Export Guarantee Fund KredEx was founded in 2001 by the Ministry of Economic Affairs and Communications with the aim of improving the financing of small enterprises in Estonia, decrease export-related credit risks, enable people to build or renovate their homes and promote energy efficiency in Estonia. The mission of KredEx is to help raise the competitiveness of Estonian enterprises and the improvement of living conditions. The vision of KredEx is to offer financial solutions based on the best practices from all over the world.

KredEx has a high regard for competence, reliability, openness and innovativeness, thinking that punctuality, cooperation and objectivity in decision making are important. KredEx has 4 instruments for housing:

Housing loan guarantees

KredEx`s guarantees for housing loans are meant for young families and - professionals and the tenants of restituted buildings who wish to purchase, construct or renovate a home. The housing loan guarantee helps to decrease the down payment amount, which enables them to purchase a new home more easily.

Loan guarantees for apartment buildings

Loan guarantees for apartment buildings help an apartment association, housing association or the apartment owners united into an association to take a loan for the renovation of an apartment building. In addition the guarantee enables to solve temporary payment problems of an apartment building, avoiding the situation of overdue payments to the bank.

Grants

According to the "Estonian housing policy" KredEx provides state grants, the purpose of which is to help activate the renovation of apartment buildings and increase municipal rental housing fund.

Energy Efficiency Consulting Centre

Starting from January 2006 KredEx also offers energy efficiency consulting service to apartment owners and apartment buildings. The Energy Efficiency Consulting Centre (ESK) provides information on implementation of energy efficiency measures for apartment buildings; manages information pertaining to energy conservation in apartment buildings and arranges meetings between various parties who have a bearing on the further development of energy use in buildings in Estonia.

ESK provides information on energy saving by:

1. consultation in office and via phone;
2. website;
3. information brochures, leaflets
4. seminars all over Estonia;
5. magazines, newspapers and other media channels
6. (www.kredex.ee)

4.3.2 First steps in practice in Estonia concerning energy efficiency in buildings

Few residential houses are refurbished and one private company has declared the ambition to become the first industrial passive house. Two social houses, namely a kindergarten in Valga and the Culture Centre in Kiisa and Hotel Saekoja are under construction. Kurtna Primary School is refurbished according to the low energy consumption standard in 2008. Only first energy audits have been made since 2006, thus the certified audits are not available for demonstration houses.

The Core Laboratory on Energy Efficient Buildings of the University of Tartu is the main know-how centre and is involved in most of the demonstration cases. One spin-off company called Passive House OÜ has been established on the base of the knowledge, skills and experiences of the abovementioned Core Laboratory. All key persons expressed their experiences, that they found and worked out all solutions by themselves, thus there are no market-ready solutions for energy efficiency in Estonia. On the other hand, all key persons expressed their willingness to participate in a new initiative to gather existing experiences into one publication called "Guidelines for Energy Efficiency Building Refurbishment and Construction in Estonia". The price of heat per 1 MWh from the Tallinn District Heating System has increased from 400 EEK (25€) in 2006 to 1200 EEK (75€) in 2008. This could be the main financial incentive for energy refurbishment and construction in Tallinn, the situation is similar in other cities as well.

Ecoprint as the front-runner in energy efficiency and implementing mitigation measures of GHGs

Ecoprint[5] is a printing house and publishing agency, established in 2008, but based on 3 companies established by the same owners in 1993, 1995 and 1997. Its new industrial building re-designed for printing house needs (collecting rain water for technological use in the production process, special ventilation, passive heating from machinery, etc., maximum use of day-lighting, using wind energy). **The company's mission is** to provide optimal printing solutions that enhance the competitiveness and reputation of corporate customers; to develop "Green Print", the

[5] www.ecoprint.ee

first environmentally friendly printing service on the Estonian market. **The company's vision:** Ecoprint is the most environmental and preferred printing partner in Estonia. The customer loyalty and reliability of Ecoprint are based on quality, contemporary values and environmental consciousness. A few important facts about Ecoprint:

- Owner of the FSC Chain-of-Custody certificate;
- An annual turnover of more than 27 million EEK (1,7 million EUR);
- Ecoprint was created through the merger of the companies Triip, Guttenberg, and Repro which had operated in the Estonian printing market for fifteen years;
- A contemporary office and production building which relies on renewable energy (we use wind power to generate electricity and the sun for heating);
- A wide range of services and a good network of partners;
- Continuous investments in modern and environmentally friendly technologies (in 2008, we have invested over fifteen million EEK in new production equipment);
- A loyal team of 35 well-trained specialists;
- A clientele of more than 800 companies and organisations;
- An extensive portfolio containing both design and print products;
- A sustainable environmental policy and constant development.

Figure 1. The Ecoprint printing house in Tartu, Estonia. In the background, you can see 3 windmills, with a capacity of 3 kW each. Ecoprint was one of the 3 finalists for the European Business Awards for the environment (management category). This is the first time that an Estonian company has reached the EBAE final.

Ecoprint has reported its GHG emissions according to the Ecological Footprint methodology. The voluntary GHG emissions and mitigation measures are publicly presented in Ecoprint's

Environmental Statement.[6] It has produced the company's Ecological Footprint report since 2001 and every year plants forest to reduce it's footprint. The ecological footprint of Triip was 122.0 ha-years/ 4.4 ha-years per employee in 2006, which requires planting of 22 ha of forest to fit into its ecological footprint.

Ecoprint was declared the most environmental company of 2008 in Estonia. For a second time, Ecoprint was successful in the national environmental contest, held by the Estonian Ministry of the Environment. This year, Ecoprint was nominated for 2 categories - in the area of environmental management and the environmentally friendly product - Green Print.

Ecoprint was one of the 3 finalists for the European Business Awards for the environment (management category) in 2008. This is the first time that an Estonian company has reached the EBAE final.

Refurbished residential multi-storey building in Sütiste road in Tallinn

The 9 floor multi-storey residential house in Sütiste Road in Tallinn was established in 1972. It has 2 entrances, 72 flats, 160 inhabitants, 3-room flats are 66,5 m2, 2-rooms flats 43,5 m^2 on average, total living space is 3934 m^2. The building was refurbished during 2002-2007. The total cost of refurbishment was EEK 7,25 million, out of which the HOA took a loan in the amount of EEK 5,5 million, half a million was a grant and the rest was self-funded.

Since then, the following refurbishment works were implemented:

1. the one pipe heating system was changed to a two-pipe system
2. insulation of the whole envelope
3. all windows were changed to doubl-glazed windows
4. inside walls of balconies and the basement floor were insulated
5. sliding windows were installed to all balconies and covered with thin metal plates
6. all water pipes were changed
7. the main electricity installations were changed
8. middle doors were built into all corridors
9. the roof was insulated with 30 cm of Ekovilla thermal insulation[7] and covered with thin metal plates
10. the heat pump was exchanged for an energy efficient circulation pump with frequency converter
11. all radiators in all rooms now have thermostats and MESA individual measuring devices with automatic on-line calculation of consumption of heating energy were installed and residents pay according to the actual heat consumed by flat

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6 http://www.ecoprint.ee/admin/files/mod_upload/upload/Triip_Ltd_environmental_statement_2006.pdf

7 Ekovilla uses clean recycled newspaper. Certified by various studies, Ekovilla also provides you with excellent insulation qualities, and the opportunity to live the same way the thermal insulation material is fabricated - naturally in terms of life and environment: http://www.ekovilla.es/index_eng.html

12. all elevators and corridors were renovated
13. waste tunnels between floors were removed and built in, thus corridors do not smell
14. the base of balconies at ground floor level are closed with a wall of fibo-blocks
15. all facades are now covered with natural paint mineral plaster
16. all corridors have timers for maximum use of daylighting
17. new porches with special design were built for both entrances with new intercom
18. all new windows have passive vents

The energy consumption has been measured since 2001, when it was 845 MWh for heating in a year. After all refurbishment works were implemented, the heating energy consumption was 437 MWh/year, which makes **almost a 50% reduction.** The heat energy consumption per square meter was 93,8 kWh in 2007. The price of district heating energy has risen 3 times during this period, thus the saving in absolute terms is significant and pay-back times for loans have shortened remarkably. A "Certificate of Good Home Owners Association" has been awarded to the house by the Union of Estonian Home Owners' Association for the first time in Estonia.

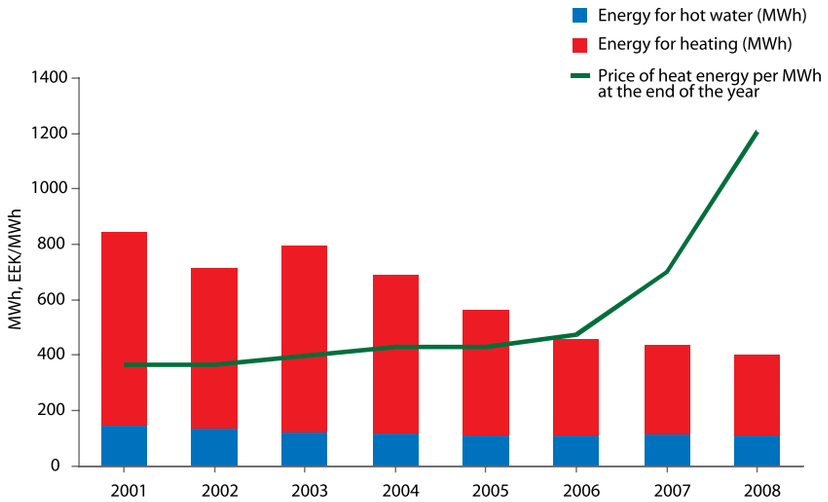

Figure 1. Energy consumption for hot water (blue column) and for heating (red column) with average price for heating (dark green line) at the end of the year in Sütiste house during 2001-2008.

But the HOA of Sütiste Road has ambitions to implement at least 8 additional measures to increase energy efficiency over 50%, namely:

1. to tune the thermostats of radiators where users are not able to use 0 option
2. to insulate the ceilings of cellars
3. to install solar panels for heating water, the total area of roof is 600 m^2, out of which 250 m^2 cover the total heating and hot water demand for the whole building
4. to install an air to air heat recovery ventilation system
5. to install heat recovery from waste water
6. to train people to use thermostats properly
7. to fit a hot water pump to heat the water only in use, without use not to heat the water just circulate water in the system without heating
8. to install a floor indicator to each floor (currently the floor indicator is installed only to ground floor)

The main lesson during the renovation process has been that not having a holistic and complex renovation plan from the very beginning to lead the step by step process, meant that not all steps were in the right order. The main barrier to having one complex refurbishment plan with steps in the right order was scepticism and the negative attitude of some of the building's inhabitants. Now, when the hard economic figures prove uncontroversially that it was profitable in any terms, the people start to believe, but unfortunately this 'late-faith' doesn't make radiators smaller, because these were over-dimensioned while the radiators were changed before the insulation of the envelope and, after the insulation works were completed, the radiators turned out to be too big. Over-dimensioned radiators meant also over-investment in radiators.

Thus, the suggestion to all HOAs who plan to start refurbishment – make a proper, complex, holistic plan and technical design, it has been proved by front-runners that in any other way it will become more expensive in all terms, in financial, social (nerves and energy of responsible persons) and environmental terms. Sustainability, e.g. balance between all forms of capital turns out to be the only right option.

Conclusions

This book is published in order to make social innovation – to make changes – happen in energy efficiency in the building sector. The building sector is often called the 40 % sector as it uses 40 % of the energy produced and consequently stands for 40 % of the CO_2 emissions. The great potential for the EU community to improve its energy performance through this sector depends very much on the implementation stage, which still lacks the speed and an efficient spreading mechanism.

The implementation of energy efficiency solutions will depend on the will, opportunities, motivation and commitment of all stakeholders dealing with energy saving issues. The role of governmental institutions will be to work our legal environment with economic and financial incentives to promote energy saving in housing. Private companies will import or produce and offer to clients the technical solutions, if the market demand appears. NGOs, like home owners' associations can calculate how much the renovation will cost and how much energy they will save after renovation. Trustworthy experts and methods need to be in place in order to make decisions, based on their professional energy audits and cost-benefit analyses. Danish, Polish, Estonian and Latvian experiences, presented in this book, prove that up to 50% energy saving is possible and feasible, comparing renovated and non-renovated buildings. The monthly communal rent payments were 3 times lower in a renovated building in Estonia because the price of heating has increased 3 times during the last 5 years. Suggested solutions in this book, described in more detail in previous chapters, are briefly summarized below:

Awareness

1. Raise the awareness of all stakeholders.
2. Organize the above Housing Fair – a fair on small buildings and energy saving.
3. Establish good working examples in cities, to present positive experiences and feelings, possible technologies, the accessibility and approximate cost in places and locations people often visit, while waiting for public transport, etc.
4. Start positive campaigns at all levels of administration with concrete examples, e.g. demo-houses.
5. Involve big building companies in energy saving projects – it might be an eye-opening experience for other companies – by their nature, a lot of persons and companies like to copy.
6. Promote understanding that oil peak is reality and substantial changes are needed.
7. It should be relatively easy to do the right things – to get a small car and to build a passive house.

Training

1. Provide professional training and education to decision-makers, politicians, journalists, architects, engineers, planners, consultants and builders.
2. Provide training for managers of HOAs, to ensure the rotation of managers of HOAs to avoid stagnation.
3. Train local self governments and HOAs (people).
4. Promote international cooperation and training and to demand energy saving measures from the programs of political parties.
5. Expand the training in energy auditing and licensing in Estonia.

Funding and legislation

1. Establish funding and incentives for energy saving projects.
2. Ensure steady state funding for energy saving projects.
3. Create funding mechanisms for innovative energy saving projects.
4. Amend legislation with measures supporting energy saving.
5. Harmonize and standardize the renovation and energy saving projects (to have ready solutions packages) in order to make it easier for clients (home owners) to select solutions and implement the projects.

Local government

1. Local government should make right decisions and choices towards energy saving and renewable energy projects.
2. Support common strategy on energy saving for local self governments.
3. To increase the administrative/institutional capacity of public authorities – there should be funds for further training.
4. Establish the qualification system for public servants to give advice.
5. Motivate local self governments at the state level, e.g. once local self governments fulfil agreed conditions they are justified to receive agreed incentives, support, and funding.
6. Encourage local self governments to create complex strategy and action plans for renewable energy and energy saving.

Institutions

1. Ensure that energy saving feasibility studies are made correctly and neutrally, e.g. not focusing on the interests of any partners (HOAs as potential clients are confused, they don't know whom to believe if different studies present different results).
2. Promote holistic and complex planning and technological solutions.
3. Give technical assistance to all sectors, including the private sector.
4. Establish criteria for managers of HOAs (to avoid situations where a manager is not interested in energy saving and the mechanism for changing managers is inadequate).
5. Promote national coordination and cooperation on energy saving.
6. Support energy saving pressure groups (it is not clear who these pressure groups are but HOAs are possibly among these). Some actors were mentioned in the Estonian context e.g. HOAs, SEI-Tallinn, state institutions. It is not clear who should take the lead as the Ministry of Economic Affairs and Communications is understaffed.
7. Increase support to institutions (e.g. KredEx) and their role in the implementation of public awareness-raising actions.

In spite of the fact that the implementation of energy efficient projects is at a very early stage in Estonia and in the Baltic Sea Region, the editors hope that all the information published here will contribute substantially to the key factors of social innovation, namely motivation, knowledge, resource mobilization, institutional set-up and the commitment and faith of all stakeholders. It is evident that changes will take place in society only if critical mass is achieved - the critical mass of those brave persons who are ready, who want and act towards making these changes real. We are happy if this book raises the number of persons who will contribute to making an energy saving of 40% a reality in the next decades.

Annex 1. Agenda of the Third Baltic Energy Dialogue on Energy Efficiency

International Conference – Baltic Energy Dialogue 3

How to achieve changes on energy efficiency in housing – what makes 30% energy saving possible?

Tallinn, Estonia
Tallink Spa and Conference Hotel, Sadama 11A
May 29-30, 2008

Organizers

1. Tallinn City Government – Department of Environment/ EU project SECURE
2. Friedrich Ebert Foundation in Baltic States
3. Consultant Mõnus Minek SEES - Sustainable Energy and Environmental Solutions

Objectives

1. To rise the awareness of civil society, business community, local and central governmental institutions on energy saving and efficiency in housing sector.
2. To share the national and international experiences on energy saving and efficiency
3. To enhance the cooperation and participation of stakeholders (local and state government, business community and civil society) on promotion of the energy saving,
4. To ensure sustainability in energy saving policy making and implementation

Topics

a) Identification of gaps and needs in policy instruments, public-civic cooperation, legal regulations (e.g. fiscal tax reform) and monitoring
b) Good and bad lessons learnt to ensure sustainable demand and supply of power and heating and cooling and housing
c) What lessons are learned from energy-mix policies and de-centralised energy transformation
d) Funding and return of particular energy saving concepts, like e.g. CHP

Presenters

Partners of Tallinn city in EU SECURE project – City of Malmö, IVL Swedish Environmental Research Institute, Codema (City of Dublin Energy Management Agency), and Hillerød Electricity, Water and Heating supply company,

NGOs, entrepreneurs and government agencies from Baltic Sea Region

Special comprehensive cases, like Freiburg/Germany (i.a. participation of civil society in local government´s energy planning)

EU with future-oriented energy regulations

Participants

Estonian local, county and national governments authorities
City planners and developers; civil servants on energy, city development, building and renovation
KredEx, The Credit and Export Guarantee Fund[8]
Civil society organisations – NGO, unions, associations
Business community – architects, real estate developers, builders
Market Place, to allow companies the presentation of energy saving concepts.

Agenda
Presentation ‘a 15 minutes, questions and answers 5 minutes
29.05.

10.00 **Opening, welcome, introduction of the objectives of the conference and participants**
Tõnu Tuppits, Head of Environmental Department of Tallinn City Government
Ahto Oja, conference moderator

I session Legislation and Funding of energy efficiency in housing in Baltic Sea countries

10.15 **Legislation and funding in Estonia – strategies, action plans, experiences**
Madis Laaniste, Ministry of Economy and Communication of Estonia

10.35 **E3 - Edification. Energy. Efficiency**
Elmar Römpczyk, Friedrich Ebert Fond coordinator in Baltic countries

10.50 **Estonian experiences on implementing and funding energy saving action plans via pilot project BEEN.**
Mirja Adler, KredEx

11.10 **Energy saving opportunities as sector of economy.**
Marek Strandberg, Member of Parliament of Estonia

11.30 **National energy savings target and good energy efficiency examples in Housing sector in Latvia.**
Ivo Lemss, Project Manager, Energy Efficiency Division,
Energy Department, Construction, Energy and Housing State Agency (BEMA)

[8] KredEx was founded in 2001 by the Ministry of Economic Affairs and Communications of the Republic of Estonia with the aim to improve the financing of small enterprises in Estonia, decrease export-related credit risks, enable people to build or renovate their homes and promote energy efficiency in Estonia.

11.50 **Polish experiences: refurbishment process preparation – energy audit scope; financing sources available and applied development of awareness campaigns.**
Andrzej Rajkiewicz, Vice-President of the Board, National Energy Efficiency Agency

12.10 - 12.30 **Tea/Coffee**

II session Process, policy making and participation

12.30 **Solar region and green city. The importance of civic initiative in ecological rebuilding of Freiburg city and region.**
Björn Slawik, director, e.V.Solar Info Center, Germany

12.50 **Finnish experiences on energy saving and efficiency in housing –**
how urban planning and housing can contribute to energy issues.
Gordon Douglas, Planning Department, City of Helsinki, Finland

13.10 **Identification of gaps and needs in policy instruments, public-civic cooperation, legal regulations** (e.g. fiscal tax reform) **and monitoring from architect point of view.**
Veronika Valk, Estonian architect

13.30 - 14.30 **Lunch**

14. 30 **First experiences on passive house concept, design and building in Estonia**
Mihkel Pukk, Project manager of passive house for public services

14.50 **Implementation of energy efficiency from business point of view**
Jaan Tepp, Energiasäästu Büroo OÜ

15.10 **Pilot project on energy saving on Sütiste tee 45**
Ragnar Kuusk, Head of Home Association of Sütiste tee 45

15.30 - 16.00 **Tea/Coffee**

16.00 - 17.30 **World Cafe* on Energy saving in housing,**
Exchange of experiences in intensive working group method called World Cafe, includes 3 rounds of intensive “around cafe- table discussions” ‘a 30 minutes on interesting topics, identified by participants.

17.30 - 18.00 Results of working groups and closing the Day I.

19.00 - 21.00 Reception at Town Hall (Raekoda), Raekoja Square 1.

II DAY 30.05.2008

9.00	**Introduction of the day**
9.10 - 10.30	**III session: SECURE project presentations**
9.10	**Climate consciousness - working with companies and citizens** Roland Zinkernagel, Environment Department, City of Malmö, Sweden
9.30	**Experiences from Denmark with low energy and passive house design and architecturally optimised solar roofs.** Peder Vejsig Pedersen, Cenergia, Hilleröd, Denmark
9.50	**Creating Energy Action Plans and outlining the approaches adopted by the other cities involved in the SECURE project Malmö, Hilleröd and Dublin.** Joe Hayden, CODEMA, Dublin, Ireland
10.10	**Sustainable construction - experiences from the SECURE project** Anna Jarnehammar, IVL, Stockholm, Sweden
10.30 - 11.00	**Tea/ Coffee**
11.00 - 12.30	**World Cafe II - Overcoming non-technological barriers for energy efficient buildings**
12.30 - 12.45	**Reports from World Cafe II round tables**
12.45 – 13.00	**Discussion and closing the conference**
13.00 - 14.00	**Lunch**
14.00 - 16.00	**Excursion to 2 study sites** BEEN project on house renovation and insulation CHP using landfil gas produces heat for settlement and electricity for grid

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