



TotalConcept

Energy Renovations of Non-residential Buildings in Northern European Countries

**National non-technical
barriers and methods to
overcome them**



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Introduction

The IEE Project “The Total Concept method for major reduction of energy use in non-residential buildings” aims to demonstrate that large scale energy performance improvements in existing non-residential buildings can satisfy profitability demands set by the building owner/investor and thus become a market driver for major refurbishment towards Nearly Zero-Energy Buildings. The project aims to introduce and adopt the Total Concept method in five Northern European countries so that it will be ready to be implemented by the stakeholders and key actors involved in the energy refurbishment process. These Northern European countries are: Sweden, Norway, Denmark, Finland and Estonia.

Until now, there is little support provided to the building owners regarding how to best make investment decisions in order to improve the energy performance of their buildings and save on running costs. The decisions are often based on profitability of single measures evaluated by simple economical methods which do not take into account the life time of the total technical systems nor even the changes in energy prices. With this approach, only the very profitable measures are commonly considered and carried out. In order to overcome this obvious risk and motivate building owners, the Total Concept method has been developed and successfully applied on a limited number of buildings. The Total Concept is a method for improving energy performance in existing non-residential buildings and applies a refined systematic approach to work with energy issues in the building with the aim to achieve maximum savings in a cost efficient way. The method is based on an action plan comprising a package of measures which meets the profitability conditions stipulated by the property owner.

There are many non-technical market barriers influencing the renovation rate in the non-residential building sector, e.g. finding profitable investments, fear among investors of carrying out long-term investments, poor reliability of assessments on necessary investments and future yearly savings, lack of financial support and good business models supporting the investments. This study has been carried out to identify these barriers in the participating five Northern European countries and to investigate the possible methods to overcome them. The goal is to increase the number of retrofitting projects improving energy performance in the non-residential building sector.

Scope and method

This study aims to identify non-technical barriers for large scale energy renovations among the different stakeholders in the participating five Northern European countries and to investigate possible methods for overcoming these barriers.

The information was gathered by carrying out interviews and distributing survey questionnaires to different stakeholders in the participating countries. Stakeholders were financial experts, building owners, building managers, tenant organizations, consultants and energy distributors. Also, two working meetings including discussions on this topic have been held, both prior and after the distribution of the questionnaires.

The survey results are summarized in Appendix 2, where all replies from the specified countries to each question could be found. The following review of results and discussions are based on the survey results and the discussions at the working meetings, especially the workshop after the survey, see Appendix 1.

Driving forces for major energy refurbishment projects

Who starts a major energy refurbishment project?

In all countries, the decision to start a major energy renovation project is made by the building owner, private or public. Company rules decide on what level the decisions can be made. Because of the large costs that are often involved, the decision has to be made on a rather high company level.

Enthusiastic persons with knowledge of energy use and supply within the organisations, are often crucial in initiating and getting the necessary support to start a project.

Why is a project started?

From the property owner's perspective, renovated buildings have higher market value. The main common motivator among the countries for starting a project including energy efficiency measures seems to be the need or desire for major renovation of the building. The reason behind could be deterioration, too high maintenance and repair costs, too low occupancy rate or expired rental agreements, potential of increasing the rented space, and fulfilling national requirements on other than energy issues, e.g. fire safety, access for disabled persons, and poor ventilation. Overall, it seems that pure energy renovation projects are very rare.

Real estate companies and users who have a vision and marketing profile of being environmentally friendly with focus on energy, also have high motivation to carry out ambitious energy refurbishments. Also focus on energy efficiency in the community level has an impact on decision makers. These communities often have own energy or emission goals that has to be fulfilled, which goes beyond the national requirements.

Existing buildings are competing with new buildings for attracting tenants, who play an important role as driving force. An example of attracting tenants, especially in Sweden and Norway, is the boom for third party energy or environment certification, as the international systems EU GreenBuilding, BREEAM and LEED together with other national and international certification schemes. Many property owners invest large sums of money for the certificates, in order to get a receipt that the building has good environmental properties and good indoor climate. The EPBD energy certificates could also be a starting point in showing the building owner the potential of energy conservation measures.

In Norway, main drivers for refurbishment projects are the demands set by tenants and improved opportunities for building owners to increase the attractiveness of their property. In Norway it is the tenants who drive the market for energy refurbishment and not the energy price.

Receiving grants and support for participating in research or demonstration projects is mentioned as a driving force for the public or enthusiastic building owner. In Estonia there are some development and research projects carried out on technical possibilities. Potential for savings is huge, but economical potential is considered to be mainly in the industrial field, shopping centers and some office buildings. Focus is also on how to integrate energy efficiency at total renovation of a building.

In Denmark and Finland it is the mandatory building regulations that is the main driving force for the renovations and not the property owners own motivation. The renovation must cause as little disturbance to the tenants as possible. This leads to that usually the renovations include smaller changes.

On the specific question if indoor climate is a reason for major renovations, Sweden, Denmark and Norway recognize it as an important factor that is often considered, but not the decisive one. However, for commercial buildings where work efficiency is a measureable factor, indoor air quality is always expected to be improved by the renovation measures, as in Denmark.

In Finland, and maybe also Estonia, severe problems with the indoor climate in certain buildings from the 80ies, is the most significant reason for major renovations in public sector properties.

How are the buildings identified and selected?

Except from the buildings suffering from indoor environment problems, economical terms as high maintenance and repair costs, low rent incomes, high energy use as found in the company statistics on purchased energy are common methods to identify buildings for major renovations. Companies working with energy management systems and updated maintenance plans have good control of the buildings that are in turn to be renovated.

What are the most important non-technical barriers?

In the following, a review of the results of the survey and workshops are given. The country representatives have different experiences and work positions and it is thus difficult to obtain a whole-covering picture of the conditions in respective country. In Denmark, research projects have thoroughly investigated barriers and stakeholders regarding building energy renovation. This is not seen for the other countries.

1) Economical and financial terms for companies and organisations

Economical and financial aspects seem to be by far the greatest barrier for starting energy refurbishment projects.

The low energy prices are mentioned as a major barrier. This is probably true for all countries, but mentioned by all countries except Sweden. Energy costs are a small part of the overall budget of a real estate company and of the rents for the tenants. In e.g. Denmark it is not profitable to renovate, because energy prices are too low and thus not a driving force.

Finding capital to invest in, in many cases expensive, measures is also a barrier, mentioned by the public sectors of Estonia and Finland, the latter caused by centralized budget management. Investment profit must be clearly stated. For Norway and Finland a good documentation and argumentation is required to persuade decision makers that investing in energy savings can be a good business deal in the long term. In Estonia, many property owners wait for the financial support from EU. They are not motivated to carry out bigger projects only with their own means. Also political decisions and social responsibility of the public sector plays an important role in the investment decisions.

Energy efficiency is not yet really recognized to increase the value of a building. There might be some influence if high energy costs affect the net profit of the building.

One barrier is the widespread use of the simple payback method when profitability of an investment is evaluated. The profitability demands set for the payback time can be less than 5 years and up to max 10 years as in Finland. In Estonia, the investments in the commercial building sector are often limited to 5 years of payback time. The payback models used does not take e.g. increasing energy prices etc. into account, and thus underestimates the profitability and positive cash flow effects.

Many countries use also LCC calculations, which seem to increase in use. In Sweden, it is even mentioned as a main method together with the Total Concept method. Interest rates and life time expectancy are the most important calculation inputs, and they differ a great deal within and between the countries.

2) The relationship between tenant and owner

When tenants rent agreements is exclusive of heating and cooling, i.e. when the utility bills are paid by the tenant, one high barrier is that the benefits of the investment go directly to the tenants and not to the property owner who makes the investment. This influences the renovations in many of the participating countries. Thus, there is less motivation for the property owner to carry out investments.

In Denmark, the building owner needs the approval of the tenants to make major changes to a building. The tenants, on the other hand lack willingness to pay for the measures. A revision of the Danish Rent Act is under way, which will make it easier for the building owner to carry out energy measures even if some tenants are in opposition.

Indoor climate aspects are also important for the relationship between tenant and owner and could be a driving force for major refurbishments. In Norway, many projects have faced a great skepticism towards energy refurbishment since it is believed that indoor climate will get worse and the cost will be too high.

Unwillingness to disturb the tenants could also be an obstacle as mentioned by Norway and Estonia.

3) Knowledge and education

There is a lack of knowledge and experience of many stakeholders on the building level as well as on decision-making level, as mentioned by all countries. Owners may not know how to start with the energy refurbishment. Especially in the public sector,

e.g. in municipalities, the lack of competence is considered as a problem for bigger energy renovation projects, as the total and long-term picture of the energy supply system is not often understood. Uncertainties regarding economic aspects could result in insufficient funding.

The reliability of results is also connected to the competence level of the stakeholders and an important factor for the client. It can be considered as a risk factor in energy refurbishment projects.

What could be done to overcome the non-technical barriers?

1) Economical and financial terms for companies and organizations

Funding models for investments are needed in Estonia and for Finland's public building owners. It would be better to have financial aid from government through energy taxes rather than through subsidies. Subsidies are not considered to be a good measure for increasing the renovation rates in Estonia, Denmark and Finland. According to them they just destroy the market conditions for the different actors and the price levels. However, in Norway, financial support is provided by the government for energy renovations, where additional cost needed for achieving low energy or Passive house level in a building is paid, if energy measurements are installed in the building. This seems to have increased the number of low-energy refurbishment projects.

Financing schemes exist, mostly for specific types of measures or measurement and evaluation. Subsidies are given in Norway for measures as previously mentioned. The EPC (or ESCO) contracts include financing of the measures in some cases, however not so popular in Sweden. In Denmark, special loans are available for municipalities. Here EPC contracts seem more common. The Swedish Energy authority gives subsidies for measurement, evaluation and documentation of demonstration building projects with high ambition for energy efficiency.

Some property owners in Norway and Sweden also see the benefits of being part of a demonstration project and are willing to go a little bit further with the efforts compared to traditional projects. Additionally, when the property owner sees the extra value of these projects, for example when the experiences from one upgrading project can be applied also in the future projects, they have a higher motivation to invest in the upgrading and energy refurbishment of the building.

It looks like the mindset needs to be changed among stakeholders. The difference in value estimation of a property with and without refurbishment should be made clearer. The credibility of the calculations (cost savings, profitability) needs to be improved to clarify the benefits for the decision-makers. Using inputs that promote long-term investments in the economic calculations should be “marketed”. Benchmarking against capital investment can be a good approach to motivate the property owners to invest. The governments could do their share by lowering discount rate and increasing energy taxes, making it more attractive for building owners to invest in long-term improvements.

The property owners need to get a better overview and comparison of future running costs with and without measures, e.g. when no investments are carried out and what would be the running cost after the renovation. A simple and clear evaluation tool and adapted services to property owners are desired as mentioned by Sweden and Denmark.

It is important to think about what guarantees are given to the results. Guaranteed savings are sometimes given by EPC contractors (ESCOs). In Denmark, a contract model with built-in guarantee is now during testing. In Sweden, the Sveby energy contract, which is a voluntary agreement between a client and a contractor, includes a penalty model if the expected savings are not met.

2) The relationship between tenant and owner

There must be a clear benefit for the owner in order to invest in renovation. All-inclusive leasing contracts (utilities are not paid separately) and green lease contracts should be developed further and applied in both public and private sectors. Motivation needs to be increased among different stakeholders.

It is considered very important that changes in the building can be carried out in an easy way and with little disturbance to the tenants.

3) Knowledge and education

Development of energy services more adapted to building owners is desired in Sweden.

Development of simple and holistic tools assisting the stakeholders in making decisions in early stages of projects will encourage towards more investments in energy efficiency.

Having reliable methods and tools for carrying out projects for energy improvements is very important as well as educating the stakeholders and key actors. Delivering a whole package, e.g. as in Total Concept, can be one possible

measure. Also during the renovation the energy savings should be combined with measures for improved indoor climate.

Promoting increased knowledge for maintenance staff and design teams is suggested from Norway. More energy and environmental knowledge and focus in the society will increase the demand for energy efficiency. Overall it is important to find a method to increase the motivation level among the different stakeholders.

Mapping of know-how in the organizations from maintenance staff up to owners' side should be carried out, to be able to create relevant training program for different stakeholders and key actors.

In Estonia Total Concept approach has already been applied in few projects. They have modified some technical aspects in the method a bit in order to fit to the needs and business model of the company involved in these projects. For example a package of measures is formed by sorting measures into 4 groups: Measures that are strongly recommended to be carried out, measures that are recommended, measures that can be considered, and measures that should be forgotten.

ESCO services could be a solution, however in the public sector the small municipalities cannot buy the services from ESCOs (e.g. Finland). There can also be political barriers for ESCOs in the public sector. In Denmark the ESCO model seem to work well, although the ESCOs project models differ between the countries.

For Denmark the Total Concept can be a good concept, but the last measures can be difficult to be carried out. Also defining the baseline is extremely important and how to set it needs to be clarified for the consultants.

Final remarks

The results from the survey and discussions indicate that work should be initiated with the following contents:

- 1) **Improve incentives to start low energy refurbishment projects.**
This could be done by improving green lease contracts or create new contract forms that makes both the building owner and tenants benefit from the measures as well as encouraging tenants to demand more sustainable existing buildings that could compete with new buildings.
- 2) **Increase the credibility of the concept.**
By tutorials and training in economic and energy calculation models, including scenarios to forecast future energy prices increase the confidence in that using the Total Concept method gives the predicted results. Also point

out shortcomings in the simpler short-term economic models that doesn't consider future increase in energy prices, increased value of the property after measures etc.

3) **Make use of the successful projects performed so far.**

Encourage companies and organisations that have explicit environmental profiles and interested personnel to start more projects, which will create followers.

Low energy prices in some client categories were considered to be an "impossible" barrier in Denmark. It does not motivate the owner to carry out energy investments.

Appendix 1. Outcomes of the discussion at the Total Concept Working Meeting

Stockholm, August 20th 2014

National non-technical barriers and methods to overcome them

1) Select important barriers, divide them into different owner categories (public, private)

The following was pointed out during the discussions:

1) Financial terms in the company/organisation

In public sector the budget is managed differently compared to private sector and has often nothing to do with the capital control. There is often centralized budget management in the public sector. As an example, city of Helsinki has a fixed annual budget for everything and within this budget all the work must be carried out (including social sector, health care, public building sector, etc). Good business case is needed for receiving the investment. Also political decisions and social responsibility of the public sector plays an important role in the investment decisions.

In the private sector the capital control is very important. Private companies are very much profit oriented. Investment profit must be clearly stated. Often payback time of an investment is considered when profitability of an investment is evaluated. The profitability demands set for the payback time can be less than 5 years and up to 10 years max. In Estonia, the investments in the building sector are often limited with the 5 years of payback time requirement.

2) Tenant/owner relationship

This influences the renovations in several participating countries. What comes to leasing contracts, then there is less motivation for the property owner to carry out investments when the utility bills are paid by the tenant.

3) Competence level

There can be lack of competence in technical know-how among stakeholders on the building level as well as lack of competence on decision making level. Especially in public sector, e.g. in municipalities, the lack of competence is considered as a

problem for bigger energy renovation projects. The big picture is not often understood. ESCO services could be a solution, but there can be political barriers for ESCOs in the public sector, 4-5 years period for contracts and investment decisions is too short for public sector.

2) What would be done to overcome them? By whom? To whom?

1) Financial terms in the company/organisation

Mindset needs to be changed among stakeholders. Value estimation of property should be clearer. Credibility of the calculations (cost savings, profitability) needs to be improved.

It would be better to have financial aid from government through energy taxes rather than through subsidies. However, in Norway financial support provided by the government for energy renovations, where additional cost needed for achieving low energy or passive house level in the building was paid by the government, increased renovation rates.

2) Tenant/owner relationship

All-inclusive leasing contracts (utilities are not paid separately) and green lease contracts should be developed further and applied in both public and private sector. Motivation needs to be increased among different stakeholders.

3) Competence level

ESCO services could be a solution, however in public sector the small municipalities cannot buy the services from ESCOs (e.g. Finland). In Denmark the ESCO model works well. Find a method to increase the motivation level among different stakeholders. Train relevant stakeholders and key actors.

3) Which barriers are “impossible” to overcome (too expensive, too complicated, too political)?

Low energy prices in some client categories is considered to be “impossible” barrier in Denmark. It does not motivate the owner to carry out investments.

Appendix 2

Summary of survey questions and answers from the participating countries

Interviews with different stakeholders in Sweden, Norway, Denmark, Finland and Estonia have been performed by the national contact persons during the summer of 2014. Stakeholders were selected having knowledge on national conditions regarding the survey questions. The interviews were made with a sufficient amount of knowledgeable persons to get a good national representation for the answers to the survey questions. Documentation of information sources and countrywide summarized answers is given in the following text.

Responsible partners (organizations and persons)

Sweden: Projektengagemang Energi- & Klimatanalys AB, Per Levin

Norway: SINTEF Building & Infrastructure

Denmark: Danish Building Research Institute / Aalborg University, Alireza Afshari

Finland: Bionova Oy, Panu Pasanen

Estonia: Eesti Kütte- ja Ventilatsiooniinseneride Ühendus (EKVÜ), Kalle Kuusk

Information sources

Sweden:

AMF Fastigheter, Michael Eskils

Diligentia, Lars Pellmark

Fortum, Olle Hansson

Statens Fastighetsverk, Mikael Gustafsson

Wihlborgs Fastigheter, Anna Claesson

www.sveby.org

www.boverket.se

Norway:

Reports:

[1] Potensial- og barrierstudie Energieffektivisering i norske Yrkesbygg (2012)

Interviews:

[2] SHC IEA Task 47 (2013-2014)

[3] DNB Eiendom (2014)

[4] Grønn Byggallianse (2014)

[5] Statsbygg (2014)

[6] SINTEF

Finland:

Keva (Local Government Pensions Institution), Petri Suutarinen
Construction Establishment of Defence Administration, Kari Huttunen
Tampere Hall, Marko Koivisto
Real Estate Department, City of Helsinki, Veikko Saukkonen
Real Estate Centre, City of Vantaa, Pasi Salo
Liikelaitos Oulun Tilakeskus, Veikko Kotilainen
And others.

Denmark:

Literature and interviews with:
Kim B. Wittchen, SBi/AAU
Jesper Ole Jensen, SBi/AAU
Jesper Kragh, SBi/AAU
Niels Christian Bergsøe, SBi/AAU
Graves K. Simonsen, Danish Association of Construction Clients
Pawel Krawczyk, Rambøll
Nikolaj Haaning, Rambøll

Survey questions and answers

- 1. Please describe how are the decisions made to start an energy refurbishment project? What are the main driving factors and/or who are the persons influencing the decision. E.g. tenants, national requirements, legislation and regulations in the building sector, Certification systems, other (describe)? Who makes the decisions to start such projects and who carries out the investment (e.g. property owner, EScO, tenant)?**

Sweden: Identification of buildings for energy refurbishment projects could be done by high cost for maintenance, low occupancy rate and potential for increasing the rented space. Some use technical methods involving energy monitoring or comparing purchased energy use per square meter. A major driving force is the buildings need for large scale renovation for refurbishment and in order to fulfill national requirements on other than energy issues, e.g. ventilation, fire safety, access for disabled persons. Energy and environmental goals seems to be a big driving factor for governmentally and community owned real estate companies.

The decision to start an energy refurbishment project is made by an authorized person in the real estate company. Larger project require decisions at higher company level, e.g. an investment group within the company.

The economic incentives (expressed in LCC or pay-off) mostly decides which measures that is to be performed.

Norway: A renovation project mostly starts with a need for a larger maintenance. The need can be enhanced, when put as a demand from the tenants in the end of contracts and the process of renegotiating. This is the time tenant have their main impact, when the building owner risks to lose tenants and income [2-6].

A high ambition level, a desire or a vision is also factors which can change the plan of a smaller renovation to a more energy efficient renovation. Energy focus in the organisation and the image of the organisation is also important [2-6].

To make the renovation, an ambitious one, there is a need to have an initiator/ one or more enthusiast within the organisation or in the energy consultant. The idea must be anchored in the head management [2-6].

The Energy Performance Certification is usually used. In case of more ambitious renovations NS3701 (Norwegian Passive house standard for commercial buildings) is used (former requirement for financial support from Enova). BREEAM Nor has become more common, as a "third party" control, that both building owner and tenant can rely on. [3, 4] The energy performance certification together with a condition analysis, is basis of maintenance plans and further renovations [5]

To take part in a research project and be a demonstration project can also be a driver for more ambitious renovation.[2]

Denmark: For rented non-residential buildings, the owner or tenants are responsible for keeping the building in good condition, including all repairs and maintenance. The owner needs the approval of tenants in order to make major changes to the buildings.

According to 10 interviews (Jensen, et al., 2013) with different stakeholders in Denmark it was concluded that deterioration of buildings are motivators for energy renovation of buildings. In some cases improvement of indoor climate in newer buildings are motivators for renovation involving energy optimization.

In the analysis none of the interviewees could present pure energy renovation projects. It is because energy renovations in Denmark are mostly combined with general refurbishment, moving/redesigning, or as a last minute solutions when service life of building components already has expired. Therefore energy renovation can be divided in comprehensive refurbishments, where energy

renovation is an integrated part of an overall building refurbishment, and energy optimization, where mostly profitable measures with a fairly short payback time are implemented. There are a couple of parameters that have an impact on a decision process. In many cases payback time is the most important parameter when considering energy renovations. Decision makers are mostly interested in short payback times which do not require huge investments.

The lack of confidence in achieving expected energy performance is an important reason for an increasing interest in Denmark for ESCO (Energy Service Companies) or Energy Performance Contracts, where a company promise guaranteed energy savings to the building owner. Particularly many municipalities have initiated ESCO projects in recent years (Jensen et al., 2011), but an increasing interest among other types of building owners is also becoming evident. ESCO is seen as a possible way to overcome the landlord/tenant problem not least in private rented housing.

Reference:

Jensen, P.A., Maslesa, E., Gohardani, N., Björk, F., Kanarachos, S. and Fokaides, P.A. (2013): Sustainability Evaluation of Retrofitting and Renovation of Buildings in Early Stages. Proceedings of 7th Nordic Conference on Construction Economics and Organisation, 12-14 June 2013, Trondheim, Norway.

Jensen, J. O., Hansen, J.R. and Nielsen, S.B. (2011): ESCO in Danish municipalities: Experience, innovations, potential. Paper presented at the 6th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'11) 24-26 May 2011, Copenhagen, Denmark.

Finland: The decision to start an energy refurbishment project is almost always initiated by a functional need to change or update building systems or modify the function of the available space, or it coincides with a major change of tenant and related tenant requirements where timeframe allows other repairs to be made. Here energy refurbishment is understood as a significant project, not a single enhancement.

The main driving factor for energy refurbishment is compliancy with company policy. Especially public sector's real estate departments may have to comply with the respective emissions goals of the city itself. However, this depends on the control exercised by the central administration over its subsidiaries and departments. Organisations with strong political control and sound finances (e.g. Helsinki and Espoo) exercise a tight policy for energy renovations. Less centralized public sector organisations and private companies typically follow mostly financial performance.

The Finnish national implementation of EPBD Recast is weak. This is implemented in the “Miljöministeriets förordning om förbättring av byggnaders energiprestanda vid reparations- och ändringsarbeten”, 27.2.2013. It allows three alternative routes to demonstrate improvement of the buildings energy efficiency, however no measures are required when they are not technically, economically or functionally justified. Because the law does not provide a method for testing validity of these claims, it does not drive that much investment.

The decision for the project and the investment is almost always done by property owner. Recently some property owners (e.g. city of Vantaa) have had success in launching ESCo project portfolios over a chunk of their property portfolio; however launching, tendering and negotiating such projects requires very intensive effort and competence, which is not typically available in smaller organisations.

Estonia:

Public buildings

The renovation decision of public buildings is made by local municipality or by the state (owner of the building). The main problem is lack of competent officials in local municipalities who are competent in energy efficiency field. The main motivations to renovate public buildings are the uncomfortable and unhealthy indoor climate, legal requirements, and available grants.

Major investments are usually not made without grants in local municipalities in the EU grant period. The ESCO scheme has not found significant use.

Commercial buildings

General background and prudent behavior are key factors. The tenants / space users is unfortunately not very knowledgeable in this area and does not delve into energy efficiency problems. Energy costs represent a relatively small proportion of the space use costs. Energy costs are negligible in the real estate company total budget.

Renovation decision should be made by the owner of the property, even though the actual users should have a greater motivation. The financing model is a critical issue in the usual situation where the investment is made by the property owner, but the beneficiary is tenant.

2. Are indoor climate aspects regarded as a reason for major renovations? Which aspects in that case?

Sweden: Indoor climate aspects are often considered when decisions for energy refurbishment projects are made, but rarely as the main or single reason. Considered aspects could be to fulfill the real estate company’s environmental goals,

to fulfill certain certification label requirements (e.g. “Miljöbyggnad”) and to manage (future) demands from the tenants.

Norway: Yes, it is a factor but not the only decisive factor. All the aspects but especially air quality and thermal comfort [5, 6]

Denmark: In some cases improvement of indoor climate in newer buildings are motivators for renovation involving energy optimization. The indoor climate is an important factor for deciding on energy optimization of a building. Particularly in commercial buildings where (work) efficiency is a measurable factor and poor indoor air quality cause poor health and more days lost through illness among employees/users. For the same reason it is always expected – in addition to the economic impact of lower energy consumption – that the indoor air quality will be improved from a complete energy renovation and where possibly poor indoor air climate (draft, cold downdraft, uneven heat distribution, low air change rate etc.) prior to the renovation, the improvement of the indoor climate often in itself is a driver for implementing projects.

Reference

Jensen, P.A., Maslesa, E., Gohardani, N., Björk, F., Kanarachos, S. and Fokaides, P.A. (2013): Sustainability Evaluation of Retrofitting and Renovation of Buildings in Early Stages. Proceedings of 7th Nordic Conference on Construction Economics and Organisation, 12-14 June 2013, Trondheim, Norway.
Interview with “Danish Association of Construction Clients” 2014.

Finland: Indoor climate issues are probably the most significant reason for major renovations in the public sector property today. There is a very significant stock of schools, preschools, offices and healthcare buildings commissioned since the 80’s which suffer from health damaging mildew and other sick house syndrome issues. Some of these are very recent, the latest being completed less than five years ago.

These issues can’t be repaired at the rate required for good conditions and care of the buildings mostly due to the budgeting processes used in the public sector. The Finnish government has tabled a proposal for creation of a national investment fund (Renovation Ltd) for such repairs, but this is not yet formulated into a law and very far from being funded and operational. If it happens, the legislation has to be passed within the next year due to the electoral cycle.

This issue is far less pronounced in commercial sector buildings. This is partly due to different practices in design, construction and architecture (focus on risk avoidance and avoiding atypical solutions) as well as the faster reaction time to indoor air quality problems, achieved with commercial flexibility.

Estonia:

Public buildings

It's mainly the low internal temperature, thermal bridges with the resulting mold problems, low air change rate, malfunctioning of the natural ventilation system and the noise and high electricity consumption of old mechanical ventilation system. Unfortunately, it is often the way that as the new ventilation system increase the electricity consumption, the ventilation system is not used for cost-saving purposes.

Commercial buildings

Might not be (if the renovation is optimization, which actually decreases the air change rate, etc.). The needs of the space users are constantly changing, therefore there is need to change the indoor climate systems and changes in the building service systems can be made with energy efficiency in mind.

3. What do you think are the most important non-technical barriers for carrying out large scale energy retrofitting projects?

Sweden: Even though answers vary the main barriers seems to be economical profitability. Energy refurbishment projects are often not economically justifiable according to the calculation models used e.g. LCC & NPV. Lack of knowledge and time constraints are also mentioned.

Norway:

1. Economy [2-5]
Low energy price
2. Relations owner-tenant and the profit of a renovation [1]
The building owner pays, the tenant gets the profit (EPC is not common in Norway)
3. Unexperience, skepticism towards new solutions, establishing the energy efficiency focus within the organisation and in the main management [1-4]
4. Disturbance of the tenants [2]
5. Requirements from authority and tenants; Problematic with combining energy efficiency, historical buildings and indoor climate [1,3,4,5,6]
6. Time[1,2]
7. Difficult and time consuming to retrieve financial support.

Denmark: The Danish Building Research Institute has identified a number of barriers for energy renovation divided in internal barriers, which cover the inertia among building owners, and external barriers covering lack of knowledge, resources and solutions (Jensen, 2009). One of the main incentives is supposed to be the Energy Labelling system (EMO). The regulation varies for different buildings types. However, a recent report about the Energy Labelling in Europe from The Danish

Building Research Institute concludes that the label is not being utilized by Danish building owners (Gram-Hanssen & Haunstrup Christensen, 2011).

In Denmark there has been published a White Book on building renovation (BiD and GI, 2011). A stakeholder analysis has been made as part of this work, and this summarizes the main barriers as follows (Advice A/S, 2011):

- Too little political consciousness about the value creation by renovation
- Weak economical incentive structures – including the paradox problem
- Lack of life cycle cost perspective
- Lack of standard solutions/concepts
- Clear 'hen and egg' problem – lack of demand causing lack of development causing lack of demand
- Overview and common direction is lacking among the actors
- No overview of potential and priority
- Renovation has an image problem compared to new building activities.

The stakeholder analysis identifies a large number of different stakeholders with different interests in energy renovation of buildings, but except for the paradox problem the stakeholders do not have contradictory interests.

According to the Danish Association of Construction Clients, the most important non-technical barriers are:

- Lack of building classification in DK, which can serve as a reference in relation to the improvements/savings achieved – the energy label is not enough
- Uncertainty on the economic aspects (return on investment, rental consequences), based on theoretical (and not historical or empirical) data and calculations
- Lack of financial incentives as a result of relatively low energy prices (in areas with high energy supply security)
- Lack of overview over and understanding of 'the energy system' – building energy, process energy, user behavior, supply (and combinations thereof) – at the developer/decision maker
- Uncertainties on the future energy supply – particularly in geographic regions without district heating, based on the lack of long-term political decisions. This will e.g. influence whether the individual building owner wants to invest in renewable energy solutions as part of an energy retrofit project
- Payment systems without built-in incentive structure
- Lack of willingness among tenants to pay (in DK revisions of the Danish Rent Act are under way which will make it easier for the landlord to carry out energy renovation, even though some tenants do not want this implemented).

Reference

- Advice A/S (2011): Renovering på dagsordenen: Interessentanalyse. PowerPoint. Grundejer-nes Investeringsfond and Bygherreforeningen. May 2011.
- BiD and GI (2011): Hvidbog om bygningsrenovering. Et overblik over den den eksisterende viden og de væsentligste studier af renoveringseffekter. Bygherreforeningen and Grundejernes Investeringsfond. August 2011.
- Gram-Hanssen, K. and Haunstrup Christensen, T. (2011): Improving the energy labelling scheme. Findings and recommendations for Denmark. Research Report. SBi 2011:23. Danish Building Research Institute, Aalborg University.
- Jensen, P.A., Maslesa, E., Gohardani, N., Björk, F., Kanarachos, S. and Fokaidis, P.A. (2013): Sustainability Evaluation of Retrofitting and Renovation of Buildings in Early Stages. Proceedings of 7th Nordic Conference on Construction Economics and Organisation, 12-14 June 2013, Trondheim, Norway.

Finland: In the public sector the main constraint the centralized budget management straightjackets some investments to a given frame, even if additional investment would be able to achieve high rewards.

In the private sector the main constraint is looking at the investments via payback time only, often not considering the potential increase of energy costs in the equation and certainly almost never considering any value add which may be achieved by having a better energy performance.

The common problem is the difficulty in setting up effective green lease or comparable benefit sharing mechanisms where investments and gains might not be achieved by the same party. This happens especially with capital rent agreements. This is made harder by the relatively small portion of rental costs being directly attributable to energy.

Estonia:

Public buildings

Shortages of adequate funding. Lack of specialists and awareness in local municipalities as a result of insufficient funding. Also problems with finding a replacement space for renovation time.

Commercial buildings

The issue of the finding suitable financing model. Also obstacles caused by users of the building. In addition, the long payback period of the energy investments, which last longer than the interest of the property owner as well as space user.

4. What do you think should be done and by whom, in order to increase the number of large scale energy refurbishment projects? What are your suggestions to overcome the non-technical barriers mentioned above?

Sweden: The participants in the study mainly points at the economic factors. Case studies showing economic and social benefits from energy refurbishments are mentioned as well as simple and clear evaluation tools for property owners. Developments of energy services more adapted to real estate owners are also desired.

Norway:

1. Financial support: Enova
The requirements strenghtens, the building costs increases but the financial support do not follow up today [1,5]
2. Green contracts
An increase of engaging in green contract with "shared" responsibility (building owner/tenant)[5]
3. Calculate with the surplus value of "green buildings" [4]
4. Increase the knowledge:
More energy and enviromental focus in the society; the demand for energy efficient buildings will be higher [1,2,6]
Knowledge Promotion for the maintenance personal and design team [1,6]

Denmark: Research on the barriers for building renovation in Denmark has revealed that an important obstacle is a lack of simple and holistic tools that can assist stakeholders in decision-making during the early stages of projects. A new report from about the Energy Labeling in Europe from The Danish Building Research Institute concludes that the label is not being utilized by Danish building owners (Gram-Hanssen & Haunstrup Christensen, 2011).

The above mentioned stakeholder analysis points at the following ways forward (Advice A/S, 2011):

1. Political consciousness and will to act
2. Economical incentives, for instance energy differentiated property tax, financial support and support of life cycle cost perspective
3. Productivity development
4. Make it easier to start renovation by one-stop delivery packages, tools to visualize measures and effect and a choice between a number of standard solutions
5. Better coordination and collaboration
6. Easier access to consulting
7. Solving the paradox problem

The stakeholder analysis identifies a large number of different stakeholders with different interests in energy renovation of buildings, but except for the paradox problem the stake-holders do not have contradictory interests.

Strategy for Energy Renovation of Buildings:

The Danish Government adopted a strategy for energy renovation of buildings in May 2014. The Strategy contains 21 initiatives which will promote the renovation of the Danish building stock and insure that energy efficiency measures are implemented on the buildings. It is expected that the effect of the Strategy on energy consumption in existing buildings will be a reduction of net energy consumption for heating and hot water with 35 pct. in 2050 compared to today's consumption. The Strategy includes the following initiatives:

- Revision and upgrade of building regulations and energy requirements that applies to renovation and retrofitting of existing buildings
- New requirements to the energy efficiency of windows. These requirements will be tightened in 2015 and 2020. Furthermore new requirements will be defined for windows, which are installed in buildings after 2020.
- Information to building owners, construction companies, financial institutions etc. on energy how to improve energy efficiency
- Revision of the energy certificates scheme to improve the efficiency of the scheme
- Promotion of the ESCO-concept
- Promotion of energy efficiency in public buildings
- Development and demonstration of new technologies.

According to the Danish Association of Construction Clients:

- The government/parliament should adopt an energy policy – and subsequent legislation – to promote clarity and certainty to the building owner's long-term investments in energy efficiency
- The government should lower the discount rate, making it more attractive for public building owners to invest in long-term energy improvements
- Payment systems in relation to energy should be composed so that embedded economic incentives – for example will a high, fixed (operating) tax regardless of consumption not imply incentive to reduce consumption, which is primarily a political decision in DK since numerous supply works are collective/municipal
- The government should establish a better classification of building for benchmarking
- The government/partners of construction sector – backed by research institutions – should develop tools and factors, which should cover the entire 'energy system', and not only the pure building energy, and which should be

founded on historical/empirical data (in combination with the building classification).

- A better basis for the calculations relative to the achieved savings and return on investments will improve the willingness among tenants to pay, particularly if an increase in rent due to the investments in energy improvements, in full or partially correspond to cost savings (logic of conversion)
- Adaptation of legislation, which is obviously a barrier to incentives.

Reference

Advice A/S (2011): Renovering på dagsordenen: Interessentanalyse. PowerPoint. Grundejernes Investeringsfond and Bygherreforeningen. May 2011.

Gram-Hanssen, K. and Haunstrup Christensen, T. (2011): Improving the energy labelling scheme. Findings and recommendations for Denmark. Research Report. SBI 2011:23. Danish Building Research Institute, Aalborg University.

<https://www.stateofgreen.com/en/news/new-danish-strategy-for-energy-renovation-of-buildings>

<http://www.ens.dk/sites/ens.dk/files/byggeri/Strategi-for-energirenovering-af-bygninger/strategi-for-energirenovering-af-bygninger-web-050514.pdf>

Finland: The government should adopt an escalator model for energy taxes ensuring a minor increase of consumer prices. Currently only electricity tax is direct consumer tax; district heat taxes are all fuel taxes. Having certainty of small increase of energy cost (e.g. 1,5 – 2 % per annum) would support investment. The proposed governmental entity (Renovation Ltd) to fund investment in sick houses is likely to stop investment until it is set up (if it is set up) and thereafter it is not very likely to support level of overall investment. However, eligibility for those funds could contain energy performance criteria exceeding legal requirements.

Cities should, where possible, provide more visibility on available funds to their real estate departments, allowing investment and maintenance to be planned and prioritized according to need, not just available money (which has to be spent within a relatively short timeframe). However, where this is not possible a form of Public-Private Partnership model or ESCo model should be used.

Private sector property owners should look at energy investment more in terms of return on investment and not payback time. The payback times for several measures are often beyond the investment horizon; even though the return on capital might be attractive. This change of perspective would allow a new way of investment and also a new way to approach capital markets in form of a green bond to fund a significant investment program into energy efficiency. This could also potentially reduce the cost of capital, as green bonds have so far had a very good demand.

Estonia: Public buildings

Local municipalities should have sufficient resources in order to be able to hire the necessary experts (energy management, energy efficiency)

Commercial buildings

Funding models for public use should be developed, possibly even a national financing solutions in the form of loan guarantees.

- 5. What are common profitability requirements for property owners/investors, e.g. interest rate, calculation periods (investment lifetimes), pay-back time? How is it decided, and what are the influencing factors? Which economic calculation methods are used for evaluating the profitability? Do you find these economic models to be suitable for its purpose? Is improved energy performance of the building included in the property valuation (e.g. does it increase the value of the property)? What methods are used to incorporate the improved energy performance to the building valuation?**

Sweden: The main calculation method used is LCC. Desired interest rate and depreciation time are big influencing factors in the calculations. Other methods used are cash-flow analysis and NPV. Rents need to be adjusted to (partly) finance the refurbishments.

Norway: LCC; with a life time of 60 years, today's energy price, and an interest rate on around 4% [5]

Denmark: Applicable to most property owners, the shorter the payback time the better. In Denmark an unfortunate focus on simple payback time as a key decision factor has developed. This applies from building owner to financial institutions. An essential element of this problem is lack of awareness and application of all-inclusive economic considerations. Thus, the separation of initial costs and operating costs, which is particularly common within the public sector, is a major reason for the use of simple payback time. Furthermore, among public developers the discount rate may play a role.

It is thus primarily the (relatively few) professional building owners/portfolio managers, including pension funds, which have a long-term investment goal, founded on the principle of return on investments – and in many cases the total economic way of thinking.

Valuation of real estate in Denmark is based on general market principles of supply and demand, where location is the most important parameter. Low energy

consumption and good indoor climate are becoming significant factors in the valuation, but especially the latter are considered a given condition – and not as a valuable asset, which can immediately be capitalized (with poor indoor air quality as a reference).

In rental housing – in addition to location – also the rental income and the cash flow in the valuation/appraisal are included, while the technical and energy conditions of the building are of less importance. On the other hand, calculations of energy savings attach importance in relation to the investment – in terms of 'reversed' return. Here, the uncertainty in the calculation becomes a significant factor in the decision making, cf. above.

Excluded from these considerations are a relatively small segment of decision makers who are interested in certification, as energy savings can be capitalised. The current economic models are based on payback times as a primary factor in addition to the (uncertain) energy calculations (estimates) included in calculations on return on investments and operating costs. Life-cycle-cost calculation methods and tools is under way, particularly among public developers and professional portfolio owners.

Reference

Interview with “Danish Association of Construction Clients”, 2014.

Finland: This is extremely simple. The profitability requirement is payback time of less than 10 years, almost without exception. How many years actually will meet the requirement varies somewhat; typically any investment paying back in less than three years is always done, most paying back in less than five are often done and others are done based on perceived added value and expediency. Interest rate depends on the organization and their required return on capital or cost of capital. In public sector the typical city finance department provides finance at 7 % for long term investment. Corporate sector required return on capital is in excess of the above; typically the aim would be for something similar after taxes.

The Finnish market eminently finds this methodology suitable as this is the way it is done all over. Life-cycle costing is often used, but measures are still chosen based on straight forward payback time. (This is different from whether it should be so).

The Finnish market does not have any major players which actually apply change in valuation into their models for financial decision making. There is no local evidence of such happening and the market is very conservative. Moreover, in the public sector the properties are not and need not be liquid.

Estonia: Public buildings

Pure payback time, if the investment is made only for the purpose of saving energy. Energy efficiency as a factor for increasing the value of real estate has begun to influence the value, but as long as there is low awareness in energy efficiency area, this is not usually the main criterion for assessing the property value.

Commercial buildings

The cash flow estimation is primarily used in valuing the commercial properties. If the high energy costs does not affect the net benefits (the real users pay for all the energy costs), then there are no real financial impact.

The problem with profitability may be a long payback period mentioned in point 3: which last longer than the interest of the property owner (property changes hands before the real financial benefits of investment reaches the investor) which last longer than the interest of the tenant (inside situation of the building changes with the new tenant so there is need to change the indoor climate systems).

6. What financing schemes for renovation projects are available in your country? Any special schemes/subsidiaries?

Sweden: The participants of the survey are generally unaware of any special financing schemes or subsidiaries for energy refurbishment projects. One participant mentions subsidiaries from the Swedish department of energy. EPC is used in a small scale in Sweden as real estate companies like to invest and take the profit from it themselves. Some community owned companies have used EPC to shorten time of realization and help with investment costs.

Norway: Enova [1-6]

Denmark: The Danish Government signed a political agreement in 2005 as part of the Directive on the Energy Performance of Buildings, where the main objective was statutory energy labeling of both public and private buildings. To encourage energy savings, the municipalities were allowed to take out loans for the renovation, if they included the energy improvements outlined in the energy label for the buildings, as well as other specified energy reducing initiatives. Normally, municipalities are not allowed to start building projects by taking on loans, as a way for the state to keep municipal taxes under control. This ability to loan-finance improvements on municipal buildings was a main carrot for the municipalities to engage in energy savings, either as in-house projects or ESCO-projects.

As in other countries, for instance the US, the borrowing capability of public institutions has been very important for the growth of ESCO-providers and

performance contracting. Another change in the framework for energy retrofitting was an agreement from 2007 between the municipalities association “Local Government Denmark” and the government settling that all initiatives for energy efficiency with low payback time (< five years) outlined in the energy label on public buildings should be completed within four years.

As municipal loans have low interest rates third-party financing has not been interesting for the Danish municipalities in ESCO contracting. The guaranteed savings in the ESCO-contract will cover the mortgages on the loan, and the municipality can therefore complete energy renovations as expense neutral. According to the Danish Association of Construction Clients the primary factors are: Possibility of sale of reductions of energy demand to energy companies (as part of these companies efforts for savings)
Subsidies for installation of heat pumps (when scrapping old oil-fired boilers)
Settlement schemes in connection with the establishment of PV
Support for renewable energy plants for processes – for companies with energy-intensive processes

Reference

Jesper Ole Jensen, Susanne Balslev Nielsen, and Jesper Rohr Hansen. 2013. Greening Public Buildings: ESCO-Contracting in Danish Municipalities, *Energies* 2013, 6, 2407-2427; doi:10.3390/en6052407. www.mdpi.com/1996-1073/6/5/2407/pdf

Finland: There are the following main financing sources:

ARA (Housing Fund, for social housing) provides loans for construction and renovation of social housing. Such projects may include energy renovations, but are not required to.

Ministry of Environment provides budget-based subsidies to certain renovations, including elevator retrofitting and energy renovation. This is annually budgeted subsidy so it can't be relied upon in long term planning. This is targets residential buildings.

Ministry of Economy and Employment provides subsidies to certain energy efficiency measures, including ESCo projects. These subsidies have a reasonably well predictable amount of funds available and ESCo projects are given fast track and priority treatment. The funds are also available for energy efficiency analyses, provided the recipient is participating in an energy efficiency agreement within their sector. This also covers renewables investments. These funds are not sectoral; so they can be applied for by almost any organization.

Ministry of Agriculture and Forestry has their own scheme to fund farm building renovation and energy production investments. This is only available for the farming sector.

Recently, there are new options for green leases on the market. These are funded by private and public investors and the proceeds are invested into a portfolio of renovations.

Capital markets provide capable organizations required funds for suitable projects.

Estonia: Public buildings: Grants provided by the sale of the assigned amount units (AAU). The new grant period terms are currently under development.

7. What kind of guarantees (if any) are provided to the client on the results, e.g. by EPC contractors or, by other parties involved in the process? What do you think are the existing business models for energy refurbishment. Are they transparent? Are there any standard contracts used in your company for carrying out (energy) renovation projects?

Sweden: The participants of the survey are generally not in favor of using EPC contractors. They use standard contracting documents, sometimes with incentives. One participant mention that better EPC contracts and models needs to be developed.

Norway: *Green contracts between building owner and tenant* [5]
BREEAM Nor- "third party control" [4]

Denmark: Energy Performance Contracting is a contractual agreement for an energy efficiency implementation in Denmark. It is done between the beneficiary and the provider (usually an Energy Service Company-ESCO) and the investments are paid back through the energy savings after the efficiency improvement.

In the ESCO model used in Danish municipalities, the client provides the investment (i.e., no private or third-party financing), and the ESCO-supplier implements the energy retrofitting initiatives, and guarantees the agreed level of energy savings. Energy Performance Contracting would therefore be a more correct term to use, like in Sweden where similar types of contracts are used by the municipalities. As "ESCO" however is used widely in a Danish context, the paper will also use this term. Throughout the paper we will use the term "ESCO-provider" for the ESCO-companies, and "ESCO-contract" for the business model, i.e., the ESCO-contract between the client and the provider.

Practical definitions of ESCO however vary across Europe and the rest of the World. As an alternative, "Energy Savings Performance Contracts" (ESPC) are often used to characterize models for energy services. A major distinction of models is between "Shared savings" and "Guaranteed savings" that concerns different distributions of investments and savings between the client and the ESCO-provider. In short,

projects using the shared savings model is based on full financing from the ESCO-provider, who in return get a share of the savings—in contrast, projects using the guaranteed savings model are typically financed by the client, where payments include money for the ESCO-provider to implement and operate solutions, as well as guaranteeing the client a certain level of energy savings over a longer period. The shared savings model is mainly used in developing countries where clients have limited access to capital, whereas in a European context, the guaranteed savings model is predominant.

According to the EU-directive on energy end-use efficiency and energy services an energy service company (ESCO) is defined as: “a natural or legal person that delivers energy services and/or other energy efficiency improvements measures in a users’ facility or premises, and accepts some degree of financial risk in doing so. The payment for the service delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agree performance criteria”. In an ESCO contract the ESCO-provider takes the risk for achieving defined energy savings instead of the client (e.g., a building owner), making investments in energy savings measures more calculable and thereby attractive for the client.

For now only ESCO contracts that have built-in safeguards for savings are applicable – based on a baseline. In particular municipalities in Denmark have entered into (customized) ESCO's. Customized, as the financing of capital investments rarely are included in the municipal ESCO contracts, due to the municipalities opportunity to obtain cheap financing. Other building owners have until now been more reluctant. It is primarily contracts that cover installations (low payback time), while contracts for improvements on the building envelope (long payback time) occurs only to a limited extent.

At present the Danish Building & Property Agency is testing a contract model with built-in guarantee – as an offshoot of the government's energy retrofit strategy, but so far, testing is only on new buildings (a suitable renovation case has not been available yet). In addition to the above, there are no special financing models in Denmark, but this is in focus and TotalConcept could probably be introduced with some success in the commercial segment.

Reference

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Interview with the Danish Association of Construction Clients, 2014.

Finland: In the contracts, the EPC contractors typically take all the risks except the development of energy price. This risk is typically taken by the client. The client also needs to guarantee certain stable conditions of use; so the building use must not be substantially altered to avoid invalidating baseline consumption. Other practices vary from one organization and project to another. There is no standard.

A governmental agency, Motiva, provides several templates for ESCo contracts. There are three contract templates, one for parties within energy efficiency agreement, another developed by the private sector and a guideline for developing a contract for the public sector, whereby the customer is choosing the measures and possibly co-funding the project. Specific contracts are often drafted, and such contracts typically provide poor protections for the property owners and weak commitments to service companies. This is particularly case with high level cooperation agreements, where the performance of the service company is hard to distinguish from other developments.

The business models suffer mostly from complexity and relatively low overall value. There are conditions which are needed to protect both parties and negotiating these depends on how the project is managed. Typically the key obstacle is the requirement of competent in-house project manager who is able to negotiate the project with service providers and get the required approvals and get it done.

Estonia:

Public buildings: No guarantees



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www.totalconcept.info