ENERGY EFFICIENCY IN URBAN RESTRUCTURING PROJECTS

Bridging the gap between ambitions and practice using guidelines and lessons from the ENPIRE project

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1.0 INTRODUCTION

1.1 Background and aims of the ENPIRE project
All over Europe local governments are involved in projects to improve the quality of houses in the urban environment. These involve not only the development of new urban areas but increasingly also the restructuring of existing urban areas. Although improvement of the overall quality of the dwellings and of the social conditions in the neighbourhood are generally the primary aims of such projects, there are also often very good opportunities for improving the energy efficiency of the dwellings. Improvement of energy efficiency will not only contribute to the mitigation of climate change but can also help to stabilise energy costs for inhabitants. However, it is very important that the issue of energy efficiency is considered at the earliest stages of the urban planning processes so that optimal choices can be made with regard to energy infrastructure, energy efficiency measures and renewable energy generation.

Local authorities have a specific and very influential role in promoting and facilitating the process of integrating energy efficiency considerations into urban planning, and are often in the best position to take the lead in CO2 reduction initiatives. In order to provide the different parties in the planning and decision making process with good information and best practice examples the ENPIRE project was started in January 2008.

1.2 ENPIRE project results
Within this project general guidelines have been developed with regard to energy planning in urban renewal projects and relevant practical experiences have documented.

Three different guideline documents have been prepared by the ENPIRE project, covering the following subjects:

Process
How should the process of energy planning and the preparation of an energy vision study be organized in order to achieve good results?

Legislation and Ambitions
Which efficiency requirements are required by existing legislation in different countries and in what way can one set an ambition level that exceeds the legal requirements?
Embedding Agreements
In what way can a certain ambition level for energy efficiency or CO2 reduction be agreed between stakeholders and laid down in a joint agreement?

1.3 Local ENPIRE case studies
In addition to these guideline documents a number of local projects involving urban planning and energy visions studies have been documented and implemented in:

Albertslund, Denmark
Ávila, Spain
Breda, Netherlands
Casale, Italy
Dublin, Ireland
Havirov, Czech Republic

1.4 Overview of report
Strategies, guidelines and good examples derived from the work carried out by the ENPIRE participants, including recommendations and guidelines for local policy processes are presented in this brochure.

Chapter 2 presents the 6 local projects which served as case studies for developing and testing the ENPIRE guidelines. The projects are located in the Czech Republic, Denmark, The Netherlands, Ireland, Italy and Spain. Although the same European EPBD directive serves as a common basis for national legislation in all of the countries, each local project has very different detailed national regulations to follow and different project contexts to deal with.

Chapter 3 presents the ENPIRE guidelines for the local energy and urban planning process in 5 main steps.

Chapter 4 presents an overview of legislation, practical tools and developed guidelines for setting energy ambitions and for embedding agreements for implementing these ambition in local projects. The financing of extra efforts/higher ambitions above and beyond building regulations requires new ways of obtaining low rent loans – a model for such procuring such financing is proposed.

Chapter 5 presents methods and tools for energy vision studies and for the analysis of energy options. This information is required for setting the final ambitions and for the final stakeholder agreement.

Chapter 6 focuses on the implementation of the energy plan and monitoring of the practical results.

1.5 Other documents from the ENPIRE project
Practical results and lessons from the local projects have been collected in the “Evaluation Report of Local Projects”.

Our key recommendations and lessons are described in more in detail in three guideline documents on, respectively organising the Process, Setting ambitions and Embedding agreements. All of these documents can be downloaded from the ENPIRE website www.enpire.eu or by contacting the project coordinator (W/E Consultants, email: info@w-e.nl. You can also find versions of this brochure and the three guidance documents in different languages on the web site.
Local case studies in 6 European cities

The local case studies provided an indispensable source of information and practical lessons for the guidelines developed within the ENPIRE project. An energy study was carried out for each of these projects and can be found in the project reports on the ENPIRE website, together with other documentation material.

The existing situation at each of the sites of the local projects was quite different. It varied from areas with dwellings that needed to be renovated or demolished (Albertslund, Breda, Havířov) to agricultural lands with agricultural buildings (Ávila) to an industrial area with cement industry that will be demolished completely (Casale). Only one project involved strictly
new buildings and is being realized on a ‘green field’ site (Dublin).

The prefabricated row houses of the period 1965-1970 in Albertslund and the masonry blocks of flats of the 1950’s in Havířov will be refurbished. The dwellings in Breda will be partly refurbished and partly demolished and rebuilt anew. A project in Grand Chalon, France, was unfortunately cancelled at an early stage so it provided only partial lessons.

2.1 Albertslund, Denmark
The Danish housing company, BO-VEST, is responsible for the largest and most costly renovation plan for social housing in Denmark where approximately 2,200 prefabricated concrete housing units from the 1960’s, located in the municipality of Albertslund, will undergo an urban renewal renovation at an estimated cost of not less than 180,000 Euros per unit. In total around € 360 million will be invested, of which € 200 million is available for retrofitting the social housing dwellings.

In the plan the partnership between the housing association, the municipality and the tenants organisation is very important. A central council manages the communication among partners and has to approve every decision.

2.2 Ávila, Spain
The project in Ávila is an urban development project in the rural area of Sanchidrian, which was previously mainly used for agricultural activities. The project will transform the agricultural area into an urban area with more than 200 houses, annexed buildings and a golf course. This is one of the most common changes of use in Spain, so is of potential interest for many other projects.

2.3 Breda, The Netherlands
The Heuvel refurbishment project in Breda comprises of a residential area with 3,200 dwellings, built in 1945 – 1960, with a great variety of housing blocks and local facilities. Of these dwellings, 2,500 are owned by housing associations and 700 have private owners.

The energy is supplied by natural gas and electricity. The restructuring process (2005 – 2015) comprises of the demolition of 650 houses, the renovation of 650 houses and the construction of 950 new dwellings. In addition a new retail centre and a new school will be built and an old monumental church will be changed into a multifunctional centre.

2.4 Casale, Italy
The Ronzone district used to accommodate a cement-asbestos production facility and other cement industries of the Piedmont region. The area has been decontaminated and reclaimed for reuse. After the demolition of the abandoned factories, an eco-village will be built, integrating eco-technologies like bioclimatic design, passive solar, PV modules,
biomass heating systems on the village scale and using recycled materials for basements. All this is necessary to meet the high standards of an eco-settlement. Presently the main energy carriers are natural gas and electricity.

2.5 Dublin, Ireland
Tyrrelstown Housing is a new development of Social Rented, Shared Equity and Affordable Purchase family dwellings by the National Association of Building Co-operatives (NABCo) Society Ltd, a Government approved Housing Body. The project comprises of the construction of 234 new family homes including both houses and apartments in 2 and 3 storey blocks together with 3 communal welfare facilities including a crèche, community centre and estate management offices and a public park. The site is located to the northwest of Dublin city. The Fingal County Development Plan 2005-2011 sets out the Local Authority’s policies and objectives for the development of the County for a six year period from 2005 to 2011. The Plan seeks to develop and improve in a sustainable manner the environmental, social, economic and cultural assets of the County and includes specific policies for the improvement of qualitative standards for sustainable building design. The dwellings will generally be heated by individual high efficiency condensing gas boilers and a percentage of hot water will be provided using solar thermal technology.

2.6 Havířov, Czech Republic
The buildings in the local project are owned by the city of Havířov and managed by its housing company MRA. The dwellings are of masonry construction and were built in the 1950’s. They presently have a low energy efficiency and are in an unsatisfactory technical state.

From an economical point of view 85% of the apartments administered by MRA have regulated rentals (fixed low rent) which provide insufficient financial resources for technical renewal of the buildings. In the period 2007-2010 this will be solved by deregulating rents, so that they can be increased from 0,73 to 1,60 €/m2.

The site is a protected landmark and is named “Sorela” after the building style that was applied. A specific requirement is that the original appearance must be preserved after renovation, including frescos, colours and decoration. The challenge is how to insulate the external walls without loosing these frescos and decorations. This will be done in collaboration with the Monument Protection Office.

2.7 Le Grand Chalon, France (cancelled)
The planned intervention at the heart of “les Près-Saint-Jean” was the demolition of 5 social housing blocks with a total of 492 dwellings, the building of 170 new social dwellings and 290 new private
dwellings. Besides refurbishment 3 other buildings were planned. Unfortunately this planned project was cancelled in early 2009 due to new political priorities resulting from changes in the city government. Therefore no full energy study was carried out and only partial lessons could be supplied to the ENPIRE project.
3.0 ORGANISING THE PROCESS OF ENERGY PLANNING

3.1 Overview
The preparation of an energy plan as part of an urban planning programme involves a complex process with input from many different stakeholders and many issues to take into account. It requires specific knowledge and experiences, and an efficient interaction amongst the relevant participants and decision-makers involved in the process. In this chapter we will give a general description of the decision making process and suggest how it could be organised. The objective is to inform local authorities and other actors so that they know when, how, and which steps they should carry out to develop the energy plan, and understand the main roles, distributions, priorities and tasks required to bring the planning process to a successful conclusion. The main steps of the energy planning process are presented in the figure to the left.

The steps shown in the scheme may or may not be fully applicable to a specific project. Also there may be a different emphasis in projects which involve mainly new buildings or mainly restructuring and renovation. However, this scheme should give a good overall impression of how the process of energy planning was managed in a number of successful ENPIRE projects. The schematic flow diagram specifies the following steps:

**Discussing Ambitions:** In this first step the ambition level of the project will be discussed between stakeholders. Themes in this discussion can extend to more than just the reduction of energy consumption and/or CO2 emissions. The technical quality of the buildings, the indoor climate, comfort levels and energy costs for inhabitants can all also be relevant subjects. CO2/energy ambitions will be set in relation to national and local regulations, climate policy targets and the overall project context (type of buildings, area, prospective users). A first agreement on the overall ambitions may be set out in a joint agreement document between local authorities, investors and prospective users. A first agreement on the overall ambitions may be set out in a joint agreement document between local authorities, investors and prospective users. In later stages of the decision making process, after the analysis of reduction potentials and required investments, a recalibration or reconfirmation of the ambitions may be necessary. The approaches that may be used in this phase of ambition setting will be expanded on in chapter 4.

**Inventory phase:** In this step all information is collected to characterise the project area, local resources of renewable energy, the present and...
future energy demand of buildings and building users, existing energy infrastructure, technical characteristics of the buildings, comfort levels, indoor climate requirements, and various social aspects. Also planned developments in adjacent areas may be considered as they may affect the possibilities for new energy infrastructures and certain collective solutions (e.g. activities generating waste heat or expected increases in heating/cooling demand). A good input from the stakeholders will be necessary to obtain all relevant information. Based on the inventory a portfolio of potential energy options can be prepared.

**Analysis:** The Analysis step builds further on the inventory phase by analysing the most promising energy options in terms of expected energy/CO2-reductions, required investments and energy costs for inhabitants. Also the analysis study will look at issues like security of energy supply and the flexibility of each concept with regard to future changes in the energy context. The analysis step and the preceding inventory phase will be discussed in more detail in chapter 5.

Setting ambitions and selection of energy options: Depending on the detailed analysis results the original ambitions may need to be revisited, leading to either a reconfirmation of the ambition level or a downwards- or upwards modification of the original ambition. Broad support from all stakeholders for the decisions reached in this phase will be crucial for the further success of the project. Also at this stage, a decision may be made on the most suitable combination of energy measures which can achieve the agreed ambitions at acceptable costs and which also meet the additional requirements that were formulated in the first two steps. Potential bottlenecks in the following phase of implementation should be identified at this point and possible solutions for these bottlenecks should also be considered at this early stage.

**Implementation:** The implementation phase is of course the most important part of the process, and in many cases also one of the most challenging. This phase involves further participants with more interests than considered in previous steps and it has its own dynamics. Several measures can be taken to help in maintaining the ambition level intact and to monitor the (intermediate) achievements. The implementation phase will be focussed on in Chapter 6.

We will now review the planning process in general terms and roles of different parties in it. In chapters 4 to 6 we will discuss in more detail the best approach in key parts of the process.

**3.2 Discussion of ambitions**

At this stage the Municipality / local authorities must decide how to develop the urban plan and what the critical factors and driving issues are to ensure the successful integration of energy issues into the urban planning process. There should be a consensus on the energy/CO2 reduction targets and on the decision making procedures that will be followed by the various stakeholders involved in the energy planning process. The energy/CO2 reduction targets should be set in accordance with or preferably go beyond the level required by national or local regulation or climate policy targets. They should also respect the objectives contained in the overall urban development plan and satisfy other relevant requirements, such as security of supply or economic issues. Motivation for making plans will vary between different stakeholders and municipalities depending
on different national conditions, needs of new/refurbished buildings, public facilities or surrounding areas, or their own interests and agenda. It is important to identify and understand the motivations before a plan is made so that the best model may be adapted for each municipality and the best criteria and goals may be identified to help formulate a common decision-making process. The main participants in this process are:

**BREDA nl**

The Municipality of Breda encourages and supports energy efficiency in new buildings and in restructuring of neighbourhoods and also evaluates the overall quality of plans. Inhabitants played a role in the discussions about setting the energy ambitions. A very important issue was the total housing costs, (i.e. the sum of the rent and the energy costs). In the case of projects involving energy efficiency measures it is important to aim at lower or at least equal total housing costs for tenants. In order to cover the costs of the investments, the cold rent for the dwellings has to increase however, the positive effect is that the resulting energy costs for tenants are reduced. In Breda the provision of a guarantee on total housing cost was very important in persuading tenants to agree with the higher ambition on CO2 emission reduction. The tenants had an active role in formulating the ambitions in the covenant that was drawn up for Breda, but were not involved in the energy study and the choice for energy measures.

**CASALE it**

The municipality played an important role in searching for the best contractors, through the help of the Council of Building Developers of the Alessandria Province. The inhabitants were involved in various meetings from the very beginning of the project. They were first asked how they would like to see their area developed, and then shown the first projects which included a special approach to environmental protection.

**Local Authorities**: The municipal administration will have to achieve a compromise between making a high contribution to national climate policy and a good allocation of available space. It should contribute to the accomplishment of the target goals of national energy and environmental policies. They are obliged to encourage the reduction of energy costs and CO2 emissions and an improvement in the social infrastructure and the overall quality of life for the municipality. Local authorities therefore play a key role and have a common responsibility in the development of the process. Different parts of local authorities should be involved in the process and cooperate to achieve final goals.

**Housing associations**: These are independent non-profit bodies whose primary objective is to provide low-cost social housing for groups in need. Reduction of the total costs of living in their houses (i.e. cold rent plus the energy and general service costs) and improvement of the quality of houses will be the main focus of this participant in the ambition discussion. As a major investing party the housing associations, if involved, will play an important role in the decision-making process.

**Project developers / Constructors**: These parties are interested in making an economic profit and building a positive market image. They are also responsible for the actual realisation of the project, are concerned with maximising the value of the dwellings e.g. by increasing the indoor climate conditions and overall dwelling quality, and by decreasing future energy costs. Project developers are directly involved in the process because they are responsible for organizing the financial investments and sometimes also for the economic management of the dwellings. Constructors, on the other hand, may not be involved in the first phases of the process as they are mainly responsible for the technical realisation of the buildings. Constructors usually play a more significant role in private housing developments because in that instance they would normally have more freedom to make their own choices with regard to the building construction. The use of labels advocating low energy cost and/or ecological design can help both parties in marketing their buildings.

**Other important participants involved in different stages of the process include the following**:

**Tenants / Inhabitants**: may not always play a direct role within the energy planning process, especially in new construction projects, but it is wise to inform and when possible involve them. The main issues on which tenants / inhabitants should be encouraged to express their viewpoint are those relating to the quality and condition of the dwellings and services, the comfort degree, and about the energy costs necessary to support the work.
Local Energy Agencies: are responsible for promoting a reasonable use of energy in the local area and are usually in communication with the municipal authorities. Energy agencies can play a significant role in promoting the relations between the other involved parties and in deciding on different energy related issues.

Energy Company: The companies supplying heat and electricity to dwellings and surroundings must often be an active partner in the process of energy planning, because the existing infrastructure is not always suitable for the new requirements and demand levels. In such cases the infrastructure will need to be restructured. However, in case there is no existing infrastructure it may be wise not to include the energy companies because of their vested interests.

To achieve the initial energy targets it is necessary to obtain involvement from the various community stakeholders. So local authorities should prepare meetings with such groups not only to make clear what the final goals are, but also to decide how best to cooperate and divide responsibilities.

3.3 Inventory phase
In the inventory phase information on the current energy situation and the buildings technical state should be collected. Based on this initial appraisal, local authorities can draw up a strategy and estimate energy consumption growth and energy targets for the medium term, always taking into account the legal conditions, best practices and energy reduction options.

The initial framework for the process will be defined through analysis of:

• Building conditions, indoor climate, insulation materials, type of energy supply, description of available resources and utility infrastructure in the surrounding areas.
• Current building energy consumption and the Energy Label calculated with the tools that comply with legal requirements

The inventory will obviously be useful because it is necessary to know how energy is being used in the area to be developed or to be refurbished; it will form the basis of decisions in the future. Different measures to achieve potential savings will be listed in the inventory.

The best way of describing the current energy situation depends on the type of action to be carried out:

• Construction of new dwellings
• Refurbishment of existing dwellings

HAVIROV cz
The refurbishment of 1950’s SORELA housing blocks in Haviro present a big challenge. They have external walls made of bricks with a thickness of 45 cm. They have no additional heat insulation and the average energy consumption for heating is 0.64 GJ/ m².year. The buildings have poor thermal performance, damaged and ill fitting windows, inadequate lighting in common spaces and inhabitants complain of thermal discomfort in the rooms. The buildings are mainly ventilated naturally, including most kitchens and toilets.

Since the buildings are protected landmarks, a specific requirement is that the original appearance of buildings must be preserved after renovation. This presents a major challenge when a solution for proper insulation has to be found.

In the case of new construction, important issues to analyse include the existing energy sources and infrastructure, local climate, the energy profile of the expected future tenants, the number of dwellings to be constructed and any other characteristics specific to the location.

When it comes to existing dwellings, the main issues to take into account are related to local climate characteristics, existing local energy sources, current energy supplies and public facilities in the surrounding areas. The existing characteristics of the dwellings, social issues and limiting factors should also be taken into account.

In the case of refurbishment of existing buildings the best way to discover where and how to save energy is by employing a certified external consultant to perform an energy audit. This will help to identify potential energy and economic savings compared to the current use of energy. The energy study will establish the energy consumption and its distribution to give a picture of the actual situation and so ensure an informed choice of best energy options and energy efficiency measures to implement.

Special requirements which should be taken into account can be identified in this step, for example wishes with regard to building quality or comfort levels, or specific architectural demands, like the conservation of certain elements in the building shell.
The inventory of the existing situation will help to support or dismiss general action lines and focus the process on the really promising options. It provides the necessary information for the following analysis step in the form of a collection of energy saving or energy generating options that deserve further consideration.

### 3.4 Analysis of energy options – Energy Vision Study

All the stakeholders must decide which energy options they are interested in in the context of the current energy situation of the area, the financial resources available within the process and the common energy ambitions and targets.

Energy efficiency measures may be set at different levels depending on the state of dwellings and actual status of the construction or refurbishment project. (More details on analyses of energy options in Chapter 5)

Many of the energy options have very little or no cost implication, and a selection of them can be introduced into development plans if they are prioritized. In order to get the best results in relation to the energy saving goals the main drivers for the prioritizing of the options are:

- Political and environmental reasons: reducing energy use and dependence on fossil fuels
- Economic saving reasons - decreasing cost of energy bills by implementing energy efficiency measures and best practices (related with financial resources as well)
- Habitability conditions arguments – increasing comfort and safety within the dwellings, taking advantage of daylight when possible, etc.
- Market arguments - increasing market appeal of the dwellings and improving the public image of the involved parties, by means of the different technical solutions.

In order to ensure considered implementation of the results, a strategy should be detailed and thoroughly described in order to clearly define the responsibilities of each stakeholder and to facilitate effective coordination amongst them. Local authorities might be the leaders of the process, but all participants should contribute actively to achieve good results.

### 3.5 Setting ambitions and selection of energy options

The final ambition level for the project can be established and agreed using the results of the analysis of energy options. Initial ambitions may need to be adapted in view of realistic energy saving/generation potentials and levels of investment needed. At this point it makes sense to really fix the ambition level and secure the commitment of relevant parties. Involvement of all stakeholders is therefore necessary at this stage.

Based on the analysis and vision study report the technical solutions that are considered most suitable can now be selected. However it is also possible that the actual choice of the technical measures is left to the architect and constructor and that only the ambition level is settled at this point.

### 3.6 Implementation

The implementation phase often involves different participants from those involved in the previous phases. Also, practical obstacles may arise which stand in the way of the original ambitions. Therefore clear communication to the new participants is important, together with careful planning of procedures. Monitoring the process is very important as it allows you to stay on top of it and identify potential problems in time.

Main actions to carry out during the implementation phase are:

- Decision-making
- Making an implementation plan
- Verifying energy targets during and at the end of the process
- Establishing a maintenance plan in order to ensure energy efficiency values throughout the dwelling/area lifetime
ALBERTSLUND dk

Most of the housing scheme consist of single storey one-family housing units with a little courtyard for each dwelling but approximately 25% of the area accommodates 2 storey row houses. Until now heating and domestic hot water have been provided by district heating where the pipes have been placed under the dwellings in a crawlspace. Unfortunately these crawl spaces lack protective membranes to prevent moisture transfer to the dwellings. To remedy this problem, it is expected that the new district heating pipes will be placed in front of the dwellings. The old crawlspace will then be filled with insulation gravel.

Furthermore, a quality assessment study has shown that the roofs will have to be replaced since they are not rain watertight and are filled with fungus. Poor indoor air climate is also a frequent problem, often with related mould problems, mainly due to poor ventilation. This is seen by the housing company as the most important quality problem which requires to be improved. At BO-VEST, and in the municipality, there is a strong interest in optimising a renovation approach which offers a low energy renovation design with improved indoor air climate and an optimised energy supply solution.
4.0
TOOLS FOR SETTING AMBITIONS AND EMBEDDING AGREEMENTS

4.1 Introduction
For the successful procurement of low energy buildings and sustainable energy systems, the stakeholders involved in the local projects (housing associations, developers, (local) authorities, tenants etc.) have to agree on the level of energy saving and CO2-emission reductions they will strive for. It is very likely that at the beginning of the project the ambition is different for every participant. Therefore a common agreement on those ambitions is essential to make the ultimate goal of the building project clear.

Within the ENPIRE local projects it was very clear that the ambitions would be set at such a level as to probably make the building process unusual. This meant that the risk for failure was bigger if there was no firm agreement in advance. In addition, extra efforts and extra investments would probably be needed. So the common agreement on the ambition level had to be quite good in order to really achieve the project goals. It is good to note that many projects fail to realize a low energy result, despite good ambitions. It is very important to have a firm agreement, not only on the final target, but also on the way to cooperate and communicate in the process.

4.2 Legislation
The EU-EPBD has contributed to more uniform building regulations in the European countries, but in spite of the fact that it has been implemented by most countries and others are about to implement it there is still a great difference between the actual building regulations in each country. Different parameters have to be included and excluded within the national energy calculations (gross- and net areas etc.). Energy sources and their efficiency also differ from country to country and when combined with variations in climate it often becomes rather difficult to compare the European countries.
Denmark

**Building Regulations** in Denmark require energy frame values for new buildings. A maximum energy demand is specified in the code and accompanied by three other low energy classes denoted as energy frame 2, 1 and 0. These correspond to respectively 75%, 50% and 25% of the present standard for the energy demand. In 2010 the standard will be changed to the current low energy class 2, in 2015 low energy class 1 will be the legal minimum required and in 2020 low energy class 0. As regards renovation projects the energy requirements only affect building components, except for larger renovations in which the minimum demand for new buildings is recommended.

Planning law in Denmark includes an important instrument which allows municipalities to demand improved energy standards in connection to local plans for all types of buildings.

Netherlands

**Building Regulations** in the Netherlands include different legislation for existing and new buildings. New buildings have to meet a certain Energy Performance Coefficient (EPC) in order to obtain a building permit. The EPC is a relative score which indicates the primary energy consumption of the building in relation to a certain energy consumption reference for the building. Under the EPC regulation a builder is free to make his own choices on how to achieve the EPC level. The energy consumption for residential buildings in 2009 is about 70-75 kWh/m²/year (excl. lighting). This will be decreased in 2011, 2015 and finally in 2020 when residential buildings should be energy neutral.

Czech Republic

**Building Regulations.** Since January 2009 it has been mandatory in the Czech Republic to have an energy certificate for the following building types: new buildings; renovated buildings (larger than 1,000 m², 25% of building shell or energy installation) and public buildings (larger than 1,000 m²) and other newly built or renovated buildings for rent or sale.

Italy

**Building Regulations.** In order to get a building permit in Italy all new buildings need to meet some minimum requirements which are increasing in 3 steps; 2006, 2008 and 2010. The type and level of performance requirements for heating differ according to the function of the building (residential, non-residential). A proof of compliance must be made after completion of the building. Legal responsibility rests with the director of works. Control of the regulation is the responsibility of the municipality in which the building is located.

In public buildings, the EPBD requires compulsory installation of solar thermal systems for domestic hot water.
Spain

Building Regulations. The new requirements established by EPBD have led to the generation of some new Spanish legal documents, which are: Spanish Action Plan of Saving and Energy Efficiency, Renewable Energy Foster Plan, Building Technical Code, Building Energy Certification, Changes in the Regulations of Thermal Installations in Buildings and Actualization of the Thermal Insulation law.

The Building Technical Code contains a number of different requirements that will result in improvements in the energy performance of buildings and the indoor climate. The most relevant of these requirements are related to improvement of the insulation level and the obligation to use solar energy.

France

Building Regulations. The current legislation in France is based on the EU Energy Performance Directive for Buildings (EPBD) and on the Thermal Regulation (i.e. Réglementation Thermique, RT) for buildings. The RT applies to new projects in residential and non residential sectors. Its overall objective is to reduce energy consumption in new buildings by 15% in 2010 looking to achieve a further 40% by 2020 within the framework of the National Climate Plan. In order to reach these targets, the RT is favouring the use of renewable energy sources, materials with high thermal mass and preventing the use of air conditioning through bio climatic design. The RT has also resulted in the use of energy labels for new buildings where there are 4 categories. The 4 categories also take into account the geography and the energy source (fossils/electric heating).

Ireland

Building Regulations. The Irish Government has made a commitment to achieving a 20% reduction in energy demand across the entire economy through energy efficiency measures by 2020. It is estimated that improvements in the energy performance of the residential sector will contribute 53% of the total national reductions required to meet the overall target of 20% reduction in CO2 emissions by 2020. Minimum Energy targets required by National Building Regulations specific to new housing are as follows;

<table>
<thead>
<tr>
<th>Year</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Building regulations reference level</td>
</tr>
<tr>
<td>2008</td>
<td>40% improvement on 2005 building regulations</td>
</tr>
<tr>
<td>2010</td>
<td>60% reduction on 2005 building regulations</td>
</tr>
<tr>
<td>2012</td>
<td>Carbon Neutral homes</td>
</tr>
<tr>
<td>2019</td>
<td>Zero Energy, in accordance with the recently revised European Performance of Buildings Directive EPBD</td>
</tr>
</tbody>
</table>

The maximum energy consumption for new building in 2008 is 75 kWh/m2/year.
4.3 Setting ambitions

Determination of ambitions above the EU EPBD directive regarding new build and renovation is of the utmost relevance and in the long term also very rational. By raising the ambitions, contributions are made not only to the reduction of energy consumption but it will also, to a certain degree, contribute to improve the entire future building stock. When the ambitions are determined it is important to carry out a realistic assessment of how high or low the ambitions can go in the actual case.

This is determined using the national building regulations as a reference to estimate the additional costs of extra measures, compared to the additional value it will acquire. When it comes to defining minimum and best practice standards there are two different possible approaches:

- To focus on the performance of individual components and the performance of the whole building shell separately (for example by specifying U-values)

- To focus on the performance of the whole dwelling, including installations as an energy frame value and also taking into account performance of district heating systems. This approach is presently used in Denmark, as well as in the Netherlands and Austria.

The level of ambition will depend on the estimated resources, knowledge and the financial support and/or financial construction that is available to the project team. Technical and financial feasibility is of course very important. Subventions are not very widely available.

**AMBITIONS AND COSTS**

- examples from Albertslund, dk and Breda, nl

In Breda the municipality made a deal with the tenants which included a guarantee that the total housing costs would not increase beyond the current level. In that way investments could be financed by higher rents and the lower energy bills would keep the housing cost at the same level.

In the Albertslund local project, the Albertslund Municipality in co-operation with the housing association has helped to determine the ambitions. To create a common reference, the Passive Haus standards, low energy class 1 and 2 have been used. The usage of clear definitions has meant that all stakeholders have been aware of the common vision of the project.
The level of reduction is usually related to the level of the current level of energy performance of new buildings. The percentage of reduction in the formulated ambitions for ENPIRE local projects is in the order of 30-40% improvement compared to actual legislation.

Setting of ambitions requires a process of investigating specific relevant legislation and starting conditions together with planning possibilities for energy savings, CO₂ reduction, renewable energy supply etc. as illustrated in figure 4.1

When you are considering the idea of introducing minimum and best practice standards for energy efficient renovation it is at the same time very relevant to look at the prospects of really influencing the market so that well defined energy efficient renovation standards will actually be introduced in practice. Experience from the Salzburg region in Austria for instance shows how a simple energy point system, affecting the financing of building projects, has had a tremendous influence on the improvement of the energy quality of especially new housing projects.

4.4 Embedding agreements

To formulate an ambition for realizing low energy dwellings is one thing, to make it really happen is another and quite often that is not easy. It is therefore very important to record the ambition in an agreement. The agreement will be more effective when the goals are clearly defined, when there is also a mutual agreement on the way partners cooperate and communicate and when legal and financial parameters have been discussed and have largely been agreed upon.

The agreement should really be focused on the goal itself and on the process to get there.

If European and national regulations are supposed to drive the constant development of energy efficient projects in new and existing buildings, it is noted that the levels of ambitions expected have not yet been reached in many member countries. The lack of control in the implementation of regulation and, moreover, the lack of financial or technical resources make it difficult to ensure the final performance of energy-efficient urban projects. The risk of poor performance is bigger if there is no proper agreement.

A Joint Agreement is made between the local authority and the owner or the developers, on the technical measures needed for the project to achieve the ambitions set out in the Vision Document. The Joint Agreement will be used as a reference for all stakeholders in order to maintain the highest level of ambitions all along the project design and construction phases. The Joint Agreement can be made under different formats: from a specific document to a full integration in project contracting documents.
The embedding of the agreement can follow the steps described hereunder. This approach is meant to be adapted and integrated into the typical development process of urban projects.

**Important steps to be respected are:**

- The **expression of shared ambitions** by the majority of project stakeholders,
- The **formalised commitment of stakeholders** to achieve these goals.

This can lead to a first stage Joint Agreement after a workshop with stakeholders.

The first part of ENPIRE process scheme (chapter 3) illustrates how such a first stage Joint Agreement may be reached. The first stage Joint Agreement will subsequently provide the basis for the following steps in the ENPIRE process, namely: Inventory phase – Analysis and Vision Study – Setting ambitions and selecting energy options

In the latter step the energy study results are presented and discussed in a second workshop with stakeholders.

The expected result of the second workshop is a **Joint Agreement document** where stakeholders:

- Share a common vision of the level of ambitions the project is meant to achieve,
- Agree to pursue these ambitions, from conception to construction
- Accept to monitor the implementation process and the results

The Joint Agreement can prove to be a useful tool to bring elected representatives, owners, promoters, end-users and technical designers and construction teams together to formalise their ambitions at the very beginning of the project. The political risk of the project not being implemented with high ambitions should be reduced. The Joint Agreement document survives political change and will be used as the reference for the development of the project. All parties involved in the implementation of the Joint Agreement have to orientate their work as best they can in order to make sure the ambitions are reached.

The format for the embedding of agreements can vary from a formal document providing precise ambition levels to be adopted by all stakeholders to contracting elements. The final format will depend on:

- Local ambitions on energy efficiency and renewables for existing and new buildings,
- The level of intervention, area planning, new or renovation project
- The project itself: layout, structure etc.

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**INFLUENCING THE MARKET**
- examples from Salzburg, Austria

An example from outside the ENPIRE project may illustrate the use of innovative financing schemes. In 1993, a simple energy point system which affects the financing of building projects was introduced in Salzburg. Since that time the specific heating load for dwellings has decreased from 63 W/m² to 25 W/m², while the heat loss value of the building shell has decreased by 65%. At the same time the use of solar heating for domestic hot water has increased so that it is now used in 60% of all new houses, while biomass heating has reached a 72% penetration.

By comparison, solar heating for domestic hot water is used in less than 1% of new buildings in Denmark, so the Austrian example can be considered as a remarkable achievement.

When one looks at the way the energy point system is defined, one discovers that it involves a mix between individual components and overall building performance criteria. However, the strength of the approach lies in how the financing of the building or renovation project works with no costs incurred for the region. Existing funding systems have been adapted to suit the new demands of energy efficiency, to allow, for instance builders or housing associations to get improved financing where they support an improved energy standard. If they choose to omit this, they will get less financing than previously.
EXAMPLE OF JOINT AGREEMENT
Sustainable development in Esonne, fr

"The commitment of participants

All participants must understand their role and fulfill their obligations in development activities. The aim of this 2nd stage joint agreement is to get commitment from local participants: economic participants, associations, institutions or simply citizens towards an ambitious action plan. The involvement of stakeholders is recorded in a Memorandum of Shared Commitments. This document is signed by all those who wish to participate from the beginning or at later stages. It defines the rules that govern the development work and ensures real commitment of its signatories to participating in building a common culture of sustainable development.

To this end, the signatories to this protocol commit to:

• Recognizing the need for change and the inclusion and cooperation of all parties involved in sustainable development.

• Include issues of sustainable development and cooperation in their own operations.

• Participate in workshops arranged to define and agree the actions of partners in the 4 clusters of issues included in the forums.

• Designate a representative, with a clear mandate, to be responsible for communications and dissemination of information on discussions held in workshops within their own organization and those of their partners.

• Agreeing to arrange pilot actions in areas under their own jurisdiction, and those of their partners where their presence is required.

• Accept that these actions are monitored, evaluated and regularly recorded and communicated.

"
sustainable building or refurbishment. An example is provided in the separate Guideline document on Embedding Agreements (Chapter 7).

All agreements in the ENPIRE local projects were made on a voluntary basis. The chances for realization of the ambitions will be considerably higher when stakeholders look for other common interests than energy alone, like housing value, comfort, environmental issues, solution of social issues, energy cost, healthy indoor climate and publicity.

4.5 Practical measures for building renovation
One of the major challenges in a renovation project is to improve the existing building construction. It is characteristic of all the participating countries within the ENPIRE project that they have not set any visionary requirements in the national building regulations when it comes to existing buildings. This lack of legal requirements makes the process of achieving high energy ambitions for renovation projects more difficult.

Possible solutions for low energy retrofit (building renovation)
- Use of super low energy windows with low frame losses
- Use of prefabricated facade insulation components
- Use of low-cost, low-noise, building-integrated heat recovery ventilation systems for quick installation
- Use of passive house standards for retrofit
- Use of overall building designs with daylight use and low electricity use
- Use of solar heating systems with a high contribution for both heating and DHW, possibly by combining them with boost heat pumps
- Use of building integrated PV and intelligent PV systems e.g. like a PV powered ventilation system in combination with natural ventilation e.g. for offices or public buildings
- Solar thermal collector systems directly supplying solar heat into the district heating network
- Biomass gasification CHP systems based on wood chips and bio-oil from waste
- Development of Community Energy Management System
- Intelligent low temperature district heating concepts

4.6 EPL - Energy Performance of Location
In the Netherlands when the municipalities develop larger projects with new or existing buildings they often make use of a tool called the Energy Performance of a Location (EPL) to set a certain ambition level. The Energy Performance of a Location (EPL) is a Dutch instrument to realise fossil fuel and CO2-emission reductions in building projects that comprises of several buildings. EPL is used next to the EPC (Energy Performance Coefficient), the Dutch energy standard for single buildings. While a certain EPC-value is obligatory for obtaining a building permit, the EPL on the other hand is not legally embedded. The EPL is a relative indicator of the CO2-emissions which are due to the energy use of buildings in a location. It is calculated by dividing the project specific CO2 emission by a certain reference CO2-emission for the location. EPL includes the energy use for heating, cooling, hot water, lighting, ventilation and publicity.

EXAMPLE OF JOINT AGREEMENT
Convenant energy ambition Heuvel, nl

"The following energy ambitions will be realised for the neighbourhood “Heuvel” (including Talma-zone).

"With this ambition we strive for a higher level of quality with respect to comfort, healthy indoor climate, future flexibility and the environment.

New buildings
Guaranteed realisation of a minimum EPL =7 for new buildings and aiming for the realisation of EPL = 7,4 and the use of low temperature heating systems;

Appraisal of suitable energy options for the Talma-zone will be carried out jointly by the building parties. As part of the energy study the possible advantages of connecting to the energy system of the Heinsius street will also be investigated.

Existing buildings
Realisation of minimum EPL 5,7 for existing houses that will be retained, provided that tenants agree and in accordance with the participation rules.

Those measures, which pay themselves back within the technical life time, will be realised within the period of the Development Vision Heuvel 2001-2015.
"
household purposes in buildings and also a (fixed) value for the energy use for public lighting and water management of the public areas.

The EPL-scores scale from 0 to 10, where 10 implies a CO2-neutral energy supply of the location. For new locations with buildings that meet the current (2009) Dutch energy efficiency regulations for buildings, the EPL score will be approximately 6.6. Better scores of the EPL can be realised by reducing the energy consumption in a location or by producing renewable energy. The method contains some restrictions for compensation of CO2 emissions. When new renewable energy capacity is realised, it has to be within the boundaries of the location. CO2 emissions cannot be compensated outside the location. So, the method stimulates renewable energy use at the location itself.

EPL has been developed to stimulate energy efficient building and sustainable energy supply in a location. The municipality can translate their ambitions for CO2 emission reduction to an EPL score. The Community of Breda for example, requests an EPL of 7.2 for new building projects and restructuring areas, which implies a 15% CO2 reduction compared to the present building standards. Using EPL-scores this ambition can be monitored during project development and the final EPL-score can be used to check if the ambition has been realised.

Since 1998 the EPL-scores of new building projects and restructuring areas in the Netherlands have been monitored. The last EPL Monitor (2006) shows that in locations with EPL ambitions, the EPL is considerably higher than in locations without EPL ambitions, corresponding to a 20% CO2 reduction on average for the locations with EPL ambitions.

4.7 ASCOT - assessment tool for additional retrofit construction cost

ASCOT tool is a tool that has been developed in Denmark to assist the user in evaluating and thereby optimising the economical costs of a building renovation project in relation to sustainable development issues. The tool is designed to take into consideration:

- all investment and operation costs over the total lifetime of the building;
- the savings from the investments with respect to sustainable issues (energy, water, waste) over the total lifespan of the building;
- the reduced environmental impact from the energy savings;
- the social or environmental and other external costs incurred by the project (not included in the first prototype but an option that can be added at a later stage).

The ASCOT model allows a comparison between a traditional (reference) building renovation and different sustainable concepts for the renovation of the building. This comparison will take into account demand reductions during the total lifetime of the building and the frequency of future replacing of building components and systems. The tool is primarily intended for use in the early stage of the design process. It can be used for both new constructions and renovation projects.

The ASCOT calculation tool includes a calculation of the heat consumption for space heating. The calculation covers different climate conditions in Europe and different building categories. That means the programme must handle many different combination of programme input. It is the intention that the programme must be easy to use by many different users.

The ASCOT tool calculations are based on international standards for energy calculation, such as “Thermal performance of buildings – Calculation of energy use for space heating and cooling” (ISO/DIS 13790), “Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies: Heat generation system, thermal solar systems”.

The ASCOT program can be downloaded from the homepage of ENPIRE.

4.8 Financing the ambitions – Danish example

In order to achieve ambitions which have been set higher than the national standard requirements it is essential to ensure that the required financing is available. For example in Denmark a positive response has been gained with ESCO loans in which there has been a co-operation with local energy saving companies / local energy companies.

The idea is to obtain loans with low interest rates, based on a municipal warranty like the one which is practised in Denmark for district heating systems. Figure 4.2 illustrates how one can help to organise energy efficient renovation of social housing projects based on a Danish example. The main results of this are that rather than financing energy savings and solar energy systems by a normal bank loan where the interest rate can easily be 7.5-8% by the end of 2008, instead you can obtain a municipal guaranteed loan at an interest rate of app. 3-4%. In practice this can actually secure up to a low energy class 1 level in housing renovation according to calculations. This is 50% better than the present building regulation standard of new build.
MUNICIPAL MORTAGE BANK
Can grant municipal guaranteed low interest loans to non-profit organisations.

ENERGY SAVING COMPANY
Is set up to operate and maintain the energy saving installations for the housing association on a 20 year contract. The company is led by a board of local stakeholders and can be linked to, for example, a local district heating supplier. Any profit can be invested in new energy saving technology or can be returned to the owners.

HOUSING ASSOCIATION
Is a non-profit organisation. Using the favourable loans it can invest in energy saving measures.

ENERGY SAVING HARDWARE
Owned by the housing association.

Payback of loan + interest

Low interest 20 year loan

Investment in energy saving installations

Payment for operating the energy saving installations

Figure 4.2 Illustration of the organisation of an Innovative Energy Saving Financing System which can secure low interest loans for energy saving projects. It works in the same way as the Danish model for organizing district heating schemes. Payback times of up to 20 years can be achieved with this model because municipal guaranteed loans can be utilised.
5.0 ANALYSIS OF ENERGY OPTIONS

5.1 Introduction
After a certain ambition level has been agreed between stakeholders it is time to investigate which energy options can be used to achieve the ambitions. Such a study is sometimes called an Energy Vision Study. In this chapter we will discuss how an energy vision study can be set up and how it can be communicated to stakeholders. We will illustrate this with practical lessons from ENPIRE projects.

5.2 Methods and tools for energy vision studies
An energy vision study may be built up from the following steps:

- Drawing up an inventory of measures to reduce energy demand (demand side options) and/or generate renewable energy (supply side options).
- Screening of this inventory of measures and selection of a number of promising options which seem feasible for the project;
- Compilation of measures: suitable combinations of demand and supply side measures which are tailored to the project at hand;
- Evaluation of the packages with respect to investment cost, energy savings, effects on indoor climate; total housing cost for inhabitants;
- Recommendation of the best combination of measures and on practical issues with regard to implementation.

In fact the first two steps above are already described as part of the overall ENPIRE process flow scheme in chapter 3. But as they provide the starting point for the energy analysis step we discuss them here in a bit more detail too. Steps 3 to 5, on the other hand, are in fact included within the Analysis step of the ENPIRE process scheme.

Inventory step (1)
In general the inventory of the existing situation and the most promising energy efficiency measures may generally be divided into different categories depending on the technical state of dwellings and the realisation phase of the construction or refurbishment project. These levels include:

- **Category 1:** Urban building coefficients, which physically characterize the buildings in the project. Examples are the Floor area and the Shape factor, i.e. maximum height in relation to the building surface;
- **Category 2:** Site layout - the distribution and orientation of dwellings and of spaces within the dwellings should be such that one achieves the
lowest energy demand and optimal gain from natural resources such as sunlight and use of natural ventilation.

- **Category 3**: District solutions - this category includes options which are only possible or most attractive on a larger scale, like district heating, combined heat and power generation (CHP), geothermal heat and heat and cold storage in the underground. While some of these options are only attractive in new construction areas one can also consider improved efficiency or “greening” of an existing district heating system or even a change from individual to central heating/cooling systems. If this is considered it is important to remember that the choice of a certain energy-solution should take into consideration the local energy infrastructure and its potential for use with renewable energy sources. For example a distribution network for natural gas may not be available or suitable for transportation of energy from renewable sources like biogas, whereas a heat distribution grid can transport heat from any heat source.

- **Category 4**: Building components solutions, this comprises all technical measures with regard to insulation of the building shell, choice of building materials and the selection of (energy) installations in the building.

This inventory step will lead to a portfolio of energy options which may or may not be viable in the specific project.

**Screening step (2)**

A first order screening of energy options may consider the following aspects:

**A: For demand and supply side options:**

- is it technically possible?
- potential savings with respect to energy production?
- does it conflict with architectural or legal requirements?
- how does it affect indoor climate and comfort level?
- technical complexity?
- maintenance requirements?
- minimum scale on which it can be implemented (building level/ project level)?
- technical and financial risks?

**B: Additional aspects for supply side options can be:**

- availability of resource (wind speed, biomass);
- vulnerability to changes in project environment (e.g. shading from new buildings);
- flexibility with regard to future changes in energy demand or infrastructure;
- aesthetic aspects;

- nuisance for inhabitants or neighbours (noise, vibrations, shadow hinder);
- required permits (building permit, groundwater extraction permit).

For the screening step most of these aspects can be considered in a qualitative way, based on experiences from other projects or studies. A (detailed) consideration of investment and operating cost of each measure is not yet necessary in this stage, although options with a very high cost and low saving potential may obviously be excluded already at this point.

**Compilation of measure packages and reference case (3)**

The result of the screening step will be a shortlist of the most promising options to save energy and/or reduce CO2 emissions. This shortlist can still comprise of a fair number of technical options, some of which may be mutually exclusive. Also demand reduction options will have an effect on the economic performance of some supply side options. For example higher insulation levels will make investments in district heating less attractive.

In the project at Breda (NL) the following reference case and 8 alternative packages of energy saving measures were compiled:

- **Reference**: good thermal insulation, efficient natural ventilation, low-temperature underfloor heating, efficient condensing boiler for domestic heating and hot water, natural gas infrastructure.

- **Variant 1**: like reference, with better thermal insulation, more efficient natural ventilation and solar thermal collector for domestic hot water.

- **Variant 2a**: compared to reference: better thermal insulation, more efficient natural ventilation, individual heat pump per residence for domestic heating, hot water and highly efficient cooling.

- **Variant 2b**: like variant 2a, not individual but collective ground source heat pump, heating and cooling infrastructure.

- **Variant 3a** and 3b: like variants 2a and 2b, with demand-driven natural ventilation (CO2-concentration), shower-drain heat-recovery.

- **Variant 4**: compared to reference: better thermal insulation, demand-driven natural ventilation (CO2-concentration), collective solar collector for domestic heating and hot water, heat supply infrastructure.
For the Breda project the following results were obtained:

<table>
<thead>
<tr>
<th></th>
<th>Reference</th>
<th>Variant 1: energy efficient + solar</th>
<th>Variant 2a: individual geothermal heat pump</th>
<th>Variant 2b: collective geothermal heat pump</th>
<th>Variant 3a: individual geothermal heat pump</th>
<th>Variant 3b: collective geothermal heat pump</th>
<th>Variant 4: collective solar boiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>User cost (€/year)</td>
<td>€</td>
<td>€ 1.074</td>
<td>€ 1.072</td>
<td>€ 490</td>
<td>€ 908</td>
<td>€ 968</td>
<td>€ 968</td>
</tr>
<tr>
<td>Primary energy consumption [kWh/m²]</td>
<td></td>
<td>74</td>
<td>667</td>
<td>45</td>
<td>31</td>
<td>32</td>
<td>34</td>
</tr>
<tr>
<td>CO2-emission [kg/m²/year]</td>
<td></td>
<td>15,3</td>
<td>11,5</td>
<td>10,9</td>
<td>7,8</td>
<td>7,6</td>
<td>7,0</td>
</tr>
<tr>
<td>CO2 mitigation (€/kg CO2)</td>
<td></td>
<td>14</td>
<td>20</td>
<td>10</td>
<td>13</td>
<td>9</td>
<td>15</td>
</tr>
</tbody>
</table>

We can observe that in this case the variant 4 with the collective solar boiler gives the highest CO₂ reduction but also has the highest investment costs. For the variants with heat and cold storage the collective systems are more attractive not only in terms of CO₂ reduction, but primarily in terms of cost. The costs for the user are the lowest for variant 3a, while variant 3b is more attractive in terms of CO₂ reduction per invested euro.

A good approach to carrying out the detailed analysis of these interacting options is to compose a number of measure packages, where each package represents a technically feasible combination of demand and supply side options. Subsequently the different packages can be evaluated as a whole.

**Detailed evaluation of costs and performance (4)**

For each package and for the reference case a detailed analysis of the costs, energy savings and CO₂ reductions can now be performed. As a minimum at least the following criteria should be assessed:

- investment costs;
- yearly maintenance cost;
- yearly energy cost for the inhabitant;
- Consumption of fossil fuel (primary energy);
- CO₂ emission from energy consumption.

In addition to this, other performance indicators may be calculated, for example the building energy performance indicator, the investment per tonne CO₂ reduction or the pay-back time.

**Recommendation/results (5)**

The results of the energy vision study will be laid down in a report and presented to stakeholders in a workshop. An example set of results from the local project in Breda (NL) is shown in figure 5.1.

**5.3 Communication to stakeholders**

A well-written energy vision document will be very valuable in the discussion with stakeholders about the best way to achieve the agreed ambition level. Therefore, it is important that such a study also pays attention to issues which are relevant for stakeholders other than the building owner or project developer. For example the issue of user costs, indoor climate and comfort levels, which are relevant for inhabitants of the dwellings, should be addressed.
Also, it is wise to inform stakeholders of and/or involve them in the choices made in critical steps of the study. For example, when the scope of the study is settled and when the shortlist of measures is drawn up. When presenting the analysis results in a stakeholder meeting, relevant issues for each stakeholder group should be pointed out. It may be wise to leave the choice of the most suitable package to the stakeholders or even with the construction company. In the latter case only the final level of energy demand is set out and the constructor is free to choose the best technical solution to achieve this level. The way this is done will depend on the situation and on the possible conflicting interests among stakeholders.

5.4 Conclusions

An energy vision study is essential to get a clear picture of the possible energy saving measures, their potential and cost in relation to each other and in relation to choices with regard to (energy) infrastructures. It is important to address issues for all involved stakeholders so that every party gets an informed and balanced view on what is realistically possible and what is not. Based on such information stakeholders may then decide on the right ambition level for their project and, if they want to, also on the best way to achieve this ambition.
In the implementation phase the technical solutions thought out behind the desk have to be actually realized in practice in the building or renovation process. Different kinds of obstacles will arise of a technical, financial or organisational nature that may lead to delay, modification or even cancelling of planned measures. Also new participants will be involved and the project leader responsible will often be a different person than in the planning phase. The risk is that a severe “watering down” of the initial ambitions can occur due to difficulties encountered and the change in participants. In order to reduce such risks the following action points may help:

**Communication and transfer of knowledge**
- Proper documentation and communication of the ambitions and planned energy measures to the project coordinator and builder that are responsible for the implementation phase;
- A broad support by the new actors for the ambitions agreed upon in the earlier phases;
- The realisation of the agreed energy plan should become the full responsibility of the (new) project leader;
- Clearly inform participants who get involved at later stages about the energy plan;
- Clearly inform future buyers/tenants, especially if a less common form of energy supply will be realised;
- Pay attention to (partial) successes, inform and involve all parties with regard to such achievements by means of publicity, festivity, etc.

**Agenda setting**
- Prepare a clear route plan with intermediate targets: this will help to keep the process on track;
- Make the energy plans part of the regular project plan and place it as subject on the agenda of project meetings;
- Prepare regular updates of the energy study, especially in case of project delays. An outdated energy study will soon lose its significance;

**Facilitation**
- Take care of the financing of necessary follow-up work: detail studies, support in contracting procedures;
- Facilitate the flow of information about the energy plan;
- Select architects and builders with relevant experience;
Monitoring of the achieved reductions helps to keep up morale and drive in a project team; Contractual obligations towards (sub)contractors will help to spread the responsibility; A minimum performance level of installations can be laid down in a contract with the installer, possibly in combination with a bonus-malus system;

**Perseverance**
- Timely signalisation of potential bottlenecks is very important;
- Take care that energy measures are properly included in decision documents like the zoning plan and the Terms of Reference for (re)construction projects;
- Plan for a check of building plans on energy aspects;
- If originally planned solutions turn out to be impossible, consider the list of back stop options from the energy study for alternative solutions;

**6.2 Monitoring and maintenance**
Monitoring of achieved reductions is a very important instrument to keep the process on track but also to account for the realization of the agreed ambitions. One should consider in advance:
- What kind of data can be used for monitoring achieved reductions?
- How can the energy use or CO2 emissions of the reference situation be established? Obviously the reference case used in the energy vision study will be an important input for this “zero measurement”, but this may have to be adapted or differentiated to get the zero measurement closer to the actual practice at the project start.

- How long will the monitoring continue after the end of the building process? In the first few years technical equipment may show initial problems especially in the case of technically complex installations. Monitoring will help to signal equipment failures in time thus avoiding long periods of malfunction.
- Finally maintenance schemes for installations form an important but often neglected contribution to continued good performance of equipment.

**6.3. Conclusions**
The implementation phase is a very crucial phase in which loss of focus on the energy ambition may occur and practical problems may arise. A clear route plan, good communication with the (new) project parties and a set of back-stop options will help to reduce the risk that the agreed ambitions will not be achieved. Monitoring of actually realized reductions is a very important tool to account for the achievements and avoiding energy losses from malfunctioning equipment. Performance-based installation and maintenance contracts will help to realize the continued good results from the planned system.
<table>
<thead>
<tr>
<th>Input</th>
<th>Process step</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project context</td>
<td>Discussing ambitions</td>
<td>Ambitions for energy / CO₂ reduction, quality of buildings and energy costs. Joint agreement - first stage</td>
</tr>
<tr>
<td>Regulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy targets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stakeholder views</td>
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Realisation of a high level of energy efficiency in building projects starts by giving this subject its own place within the overall urban planning process. In this document we have described a number of key steps in which the energy planning process may be broken down and discussed methods to manage the process. These recommendations are based on practical experiences in local projects in 6 European countries. Some key lessons that we have learned from these local projects were:

- Local authorities are in a good position to initiate the process of preparing an energy vision.
- A wide range of participants should be involved in initial discussions about ambitions. These discussions may cover more aspects than only energy or CO2 reduction but can also address energy costs and comfort levels for inhabitants, technical building improvement, etc. In this way a common set of interests can be identified with regard to improvement of existing buildings or the requirements for new buildings.
- A broad consensus among stakeholders on the desired ambition level is crucial for success in the implementation phase.
- The enhancement of market value of dwellings should be sought by improvement in technical quality, comfort levels and reduced energy costs in parallel with energy saving measures.
- Technical analyses should be used to support and guide this ambition setting process, but parties themselves will have to decide on the ambition they want to commit themselves to.
- An energy vision study should consider also the options for the project area as a whole and not be restricted to measures on a building level.
- Technical solutions should preferably have a high degree of flexibility to accommodate future changes in energy infrastructure, energy demand and energy pricing.
- Regulations that place an upper limit on the cold rent can create a serious bottleneck for the economic feasibility of investments in energy saving measures. Consideration of total housing costs (i.e. rent plus energy costs) and guarantees by property owners on the maximum level of these total housing costs in the future will help to overcome this problem.
- Good communication, a clear route plan and perseverance are essential ingredients to keep the high ambitions alive in the final step of project implementation.
ENPIRE Local Project: Ávila, SP
From agrarian to urban with energy efficiency

ENERGY AGENCY OF ÁVILA.

The selected project in Ávila has been an urban development project in a rural area. It was chosen because this change of use (from rural to urban area) is one of the most usual changes in Spain. Moreover, it is very common in the province of Ávila, as consequence of having a very low population density (the province of Ávila has 1.59% of Spain surface but only 0.37 % of population).

The village that is going to shelter the project is Sanchidrian, which is a small municipality near Ávila city and situated between two important urban areas (Ávila and Arelval). Agriculture is the main activity in Sanchidrian.

The chosen project is going to transform an area dedicated to agricultural until now into an urban area with more than 250 houses, annexed buildings and a golf ground. This project is a second residence urbanization, like many other projects in Spain, because building sector has been focused in this market for a long time.

AEP had a double starting point regarding to the project. On the one hand, the land use until now is related to agrarian issues, so there is not any urban infrastructure. On the other hand, there was a project to fulfill laws about energy efficiency. This was the starting point to present and study the better improvements to be applied in the urbanization.

The main ambition of the project is to improve the energy efficiency requirements established by law. These improvements are different depending on the stakeholders ambitions. For example, the municipality ambitions is related to the costs afforded by them, so municipality people in charge want to reduce the energy consumption in the maintenance of public lighting systems and green areas. In this sense, a 50% reduction in lighting system is possible.

On the other hand, the promoter-builder wants to improve the energy efficiency in a point that let him sell buildings with a little extra cost but improving the energy efficiency, so he wants to find a point which energy improvements were justified by a price raising.

The agreement has been discussed one by one with all the actors involved, from a starting point related to the ambitions that we selected and the legislation which affects to the project. After defining the ambitions and the legislation, agreements were discussed regarding to technical and economical issues. The aim of the voluntary agreement was to establish one which was not very difficult to obey, in order to foster actors involved to take part in the project.

There are different sectors related to lessons learned that is interesting to put the spotlight on:
- Speaking about stakeholders, choosing them properly is very important. We have tried to cover all the sector spectrum related to the building sector.
- Regarding to agreements, is interesting to rely on stakeholders from the very beginning, in order to give them a main role in the project development.
- Moreover, agreements shouldn’t be very strict because some stakeholders can decide not to sign if the agreement forces them to do a lot of things.
- From the ambitions point of view, a reasonable ambition has to be planned, looking for a balance point between the energy reduction and the cost increase.
- Maybe the most important lesson learnt is that economical issues should be taken into account in all of the decisions, because there are some improvements impossible to be executed because of a high cost.

The stage of realization is still at the very beginning because there was the intention of building it, but the economical situation has reduced the construction rhythm, so the project is now in the first stage.

Nevertheless, the builder is thinking the chance of introducing the options studied in some of the new houses that are being built.

E-mail: aepa@diputacionavila.es

ACTORS

DEMANDS

CHALLENGES

$1?

ENERGY

STUDY

AMBICTIONS

& AGREEMENTS

REALISATION

LESSONS

LEARNED

The ambitions on CO2 emissions and energy use have not been modified during the development of the energy study. Energy options have been proposed and will be analysed by the promoter, who will decide which one to implement, if there is any. (Voluntary agreement)

The planning process of the project was different from what is customary in Spain, because the introduction of energy issues after the project’s design is not very usual. Actually energy issues or considerations are introduced during the design phase of buildings.

Introducing any of the energy options might get a better energy qualification of dwellings than the initial one: qualification C. Promising options to be proposed to the promoter are related to:

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All the energy efficiency measures proposed above have been studied in terms of energy and economics and proposed to the promoter. He might apply to the design on buildings those ones he considers according with his criteria, as a voluntary agreement exists.
Partner information for local ENPIRE project:

**Avilà**

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<td>Architect(s)</td>
<td>Juan Antonio Chamorro Sánchez</td>
<td><a href="http://www.coaavila.com">www.coaavila.com</a></td>
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<td>Technical architects</td>
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<td><a href="http://www.coaatavila.es/">www.coaatavila.es/</a></td>
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<td>Energy Agency</td>
<td>Luisa Martín Vázquez</td>
<td><a href="http://www.apea.com.es">www.apea.com.es</a></td>
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<td>Municipality</td>
<td>Juan Antonio Rivero Villaverde</td>
<td><a href="http://www.sanchidrian.es/">www.sanchidrian.es/</a></td>
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<tr>
<td>Engineering association</td>
<td>Fernando Espí Zarza</td>
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ALBERTSLUND CLIMATE PLAN

RENOVATION OF THE BUILDING STOCK

PROJECT SETTING

Albertslund

Municipal of Albertslund is situated 20-25 kilometres West of Copenhagen. Approx. 30,000 inhabit the municipal on an area of 25, sq. km. The urban area of Albertslund was planned and build 1960-1975 and most of the housing stock is from that period. The Green areas were as well planned and shaped in the same period. 61% of the housing stock is social rented (the average for Denmark is 21%) and the rest nearly owner occupied.

AMBITIONS & AGREEMENTS

Climate Plan 2009 - 2015

The Municipal has approved on a climate plan involving all areas: Local Authority, Housing, Business Community and Transport.

The objective is a 25% CO2 reduction in 2015 with an effort of CO2 emissions in 2006, which is a reduction of 52,000 tons CO2 and 1.72 tons per inhabitant.

In Albertslund South 1,500 social dwellings has to be renovated to passive house standards (the national low energy class 1 or better demands). At BO-VEST, and in the municipality, there is a big interest to optimise the renovation approach and include a low energy renovation design with improved indoor air climate which is combined with an optimised energy supply solution which includes renewable like solar heating and PV used in local building integrated with an optimised energy supply solution which includes renewables like solar heating and PV used in local building integrated power roofing designs, and where the district heating losses are reduced considerably so they have a reasonable size compared to the need for heating and domestic hot water, (max. 30% of this).

The tool and a publication for it can be downloaded from the website www.solarcityconsult.com and the Danish version can be downloaded from the website www.cenergia.dk and from www.solarcityconsult.com.

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ALBERTSLUND CLIMATE PLAN

Regeneration

Albertslund is known as a modern municipal, with culture life, good infrastructure with modern schools and institutions for children and a lot of green areas and focus on sustainability. Most people living in Albertslund moved to the area in the 1960-1970, and one of the challenges is to attract a new generation to the area. Most of the housing stock has to be renovated and the Municipal wants to use this opportunity to upgrade the housing stock in the future demands. Together with housing association (BO-VEST) and tenants organisation and the National Building Fund (Landsbyggefonden) they have approved an ambitious renovation. The plan involves large number of organisations and companies on the building market.

Several pilot projects has been launched and there has been developed different kind of prefabricated solutions. The theory is: “The buildings were realised in a industrialized process and it has to be renovated the same way”.

There has been developed a solar prism which integrated daylight, solar thermal collectors and photo voltaic, and at the same time it can move installation from the living space and give space for the heat recovery ventilation system. Prefabricated façades and roof elements is as well as well a solution in the coming renovation. It will optimize the building process, reduce costs and assure high quality.

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Partner information for local ENPIRE project:

**Albertslund**

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<td>The housing department:</td>
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<tr>
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<td>Contact: Jakob Klint</td>
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<td><a href="mailto:jk@kubenman.dk">jk@kubenman.dk</a></td>
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<tr>
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ENPIRE Local Project: Breda, NL
A community approach to restructuring
Frans Lemmens1), Paul Paree2), Erik Alsem3)
1) Housing Corporation WonenBreug, f.lemmens@wonenbreug.nl;
2) Municipality of Breda, pg.paree@breda.nl;
3) W/E Consultants, alsem@w-e.nl

PROJECT SETTING

- Built in the 1950’s;
- Urban plan from architect Peutz;
- 3200 dwellings in apartment blocks and single family houses;
- 2500 corporation owned, 700 private;
- Presently energy label F/G;
- Heating with gas stoves;
- Poor comfort levels.

Covenant between corporation, municipality and neighbourhood council:
- Ambition for “higher quality level with respect to comfort, indoor climate, flexibility towards the future and the environment”.
- Energy Performance on Location*:
  - EPL = 7,0-7,4 for new buildings;
  - EPL = 5,6 for conserved buildings.
- Guarantee for tenants that total housing cost will remain the same, although cold rent increases.

*) EPL is a relative measure for carbon emission of entire building project:
  - EPL= 10 is carbon neutral;
  - EPL= 6,6 is Building Code level

REALISATION

- No decision on investments yet;
- Corporation may take role as energy company, this offers solution for "split incentive" problem;
- Combination of heat/cold storage in underground with soil remediation is under investigation.

DAMNDS & CHALLENGES

- Restructuring process 2005 – 2015;
- Preservation of Peutz’ urban plan;
- Demolishing of 650 houses, renovation of 650 houses and new built for total 950 dwellings;
- CO2 reduction target is 45% (in 2015);
- Improvement of comfort levels and indoor air quality;
- Involvement of neighbourhood group in planning and ambition setting;
- Other investors need to agree on ambitions.

AMBITIONS & AGREEMENTS

- Initiator role of municipality is important;
- Energy Performance on Location is useful tool for setting (policy) ambitions;
- Seek active role for neighbourhood group;
- Housing comfort level as part of ambition;
- Broad support for ambitions is necessary as there is no way to enforce them;
- Guarantee on total housing costs eases acceptance of rent increase by tenants;
- Comparison of integral energy concepts instead of individual measures provides better insight.

CONCLUSIONS

Conclusions energy study:
- Collective system for underground heat/cold storage and electric heat pump seems most promising option;
- Possible combination with soil clean-up operation;
- Heat pump option is less suitable for existing dwellings.
### Partner information for local ENPIRE project: **Breda**

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<td><strong>Project management</strong></td>
<td>Ad Vingerhoets (WonenBreburg)</td>
<td><a href="http://www.wonenbreburg.nl">www.wonenbreburg.nl</a></td>
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<td>Contact: Frans Lemmens</td>
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<td><a href="mailto:f.lemmens@wonenbreburg.nl">f.lemmens@wonenbreburg.nl</a></td>
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<td><strong>Architect(s)</strong></td>
<td>Plan F1 en F2: Architecten werkgroep, Tilburg.</td>
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<td></td>
<td>Contact: Paul Paree</td>
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<tr>
<td></td>
<td><a href="mailto:Pg.paree@breda.nl">Pg.paree@breda.nl</a></td>
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Casale Monferrato is an ancient city in North Italy, built around the 11th century. Ronzone district is mainly characterised by private residential houses, built at the beginning of 1900 as a consequence of the expansion of Casale due to the setting of the first cement industries in North Italy. The industrial settlement of Ronzone covers an area of 200,000 m². The main street gives a clear idea why the city of Casale was named “the White City”: in fact, it crosses two continuous lines of cement factories and from their side one can understand the amount of workers once employed, with enormous risk for their health and for the public health. Eternit - the name originates from the negation of Eternit, the name of asbestos added cement Industries, responsible of a huge environmental disaster and of many deaths in Casale area.

Energy Ambition was reaching class B in Italy: -50 kWh/m²y, taking into account the extra passive solutions for new dwellings. In addition, various measures were adopted for the environmental protection and sustainability, such as:
- High standard passive solutions: greenhouses and solar collectors on dwellings;
- Adoption of PV modules for dwellings electricity needs;
- Use of rainwater for irrigation, reduction of water flows;
- Waste treatment, waste islands;
- Reduction of electromagnetic fields with circuit breakers in bedrooms, reduction of electromagnetic fields from electrical wiring of neighborhood Contract” signed between the Municipality of Casale and the Consortium of Building Developers of the Alessandria Province.

Based on this General Agreement, the Municipality of Casale signed single Project Contracts with each stakeholder. The CO2 abatement at least 30% below the current limits was implicit in the agreement of reducing energy consumption below national regulation.

Enpire Local Project: Casale Monferrato (IT)

The planning process was different from the common planning in public administration. The Design Ateliers, with the participation of city officers, local professionals (architects and engineers), organized in 4 design tables, had the role of reviewing the selected project, with the participation of local designers, developers, builders.

To determine the target level two calculation models are adopted:
- the "EP Model", for modeling the residential energy consumption of existing buildings, a tool for energy policy simulation, at the regional scale (Renzo Scola, 1999). As the calculation model, it has been adopted for energy analysis of buildings and green technologies, to determine the energy consumption and saving, including passive contributions of residential buildings, following the Italian codes.

Repopulation potential
This project, strongly requested by the Municipality of Casale Monferrato and under the auspices of the Italian Ministry of Environment, can be extensively replicated in all damaged urban areas, where contaminated lands and urban fabrics can be reconverted into livable and sustainable neighbourhoods. The planning process can be replicated on a Regional scale by the group of actors involved in the programme

Energy dimension of urban restructuring projects
This project could represent and show the link between urban projects and energy pilot projects at the neighbourhood scale. The potential for implementation of the energy scheme at the whole district scale is figured out the energy conservation and substitution potential, taking into account: investment costs, energy saving potentials, and environmental benefits.

The "EnergyBuilding Model", implemented by Softech-team, for modeling the energy consumption and saving, including passive contributions of residential buildings, following the Italian codes.

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Partner information for local ENPIRE project:

**Casale**

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<tr>
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<tr>
<td>Main investor / project developer</td>
<td>Consulta of Building Developers of the Alessandria Province (Project Developer)</td>
<td><a href="mailto:consulta.ed@libero.it">consulta.ed@libero.it</a></td>
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<td>Architect(s)</td>
<td>Arch. Giada Damonte for ATC Construction Company</td>
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<td>Arch. Giovanni Deambrogio for Capra Construction Company</td>
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<td>Eng. Umberto Coppo for Ginestra Construction Company</td>
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<td>(Energy) Consultants</td>
<td>Softech – Arch. Roberto Pagani</td>
<td><a href="http://www.softech-team.it">www.softech-team.it</a></td>
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TYRRELLSTOWN HOUSING, DUBLIN
LOCAL CASE STUDY, IRELAND

PROJECT SETTING

The site is located to the north-west of Dublin, just outside the perimeter of the city.

This is a predominantly residential area, with some industrial and commercial activity to the south.

The Church of Ireland, the Royal Hospital Kilmainham, and the National University of Ireland are all within easy walking distance of the site.

The surrounding terrain is quite flat, with only occasional variations in levels, making it suitable for development.

AMBITIONS & AGREEMENTS

The Energy Ambition for the project was agreed with the lead developers, NIMCO, to address two challenges:

1. First, there was an immediate legal requirement to upgrade the existing buildings to meet the new challenging 2009 version of the Building Regulations, and to do so within the project timeframe and within budget.

2. Second, there was a desire to investigate cost-effective ways in which the energy performance of the new buildings could be further improved for the benefit of the tenants. This is consistent with the wider NAMC's development across the country and, of course, to meet the urgent requirements to address the problem of climate change.

It was agreed that the stated ambition would be achieved in three stages as follows:

Stage 1: Compliance with Part L of the Building Regulations 2009, requiring a reduction of 20% in energy demand and 20% in energy consumption in all buildings, compared to the 1980-90 baseline. This is a legal requirement.

Stage 2: A further improvement of 20% compared to current Building Regulations. Achievement of the Stage 2 ambition cannot be guaranteed by budget and practical constraints.

LESSONS LEARNED

- Improving the building fabric and the efficiency of heating systems can be effective in reducing energy consumption. The implementation of these measures has been cost-effective and has contributed significantly to reducing energy consumption.

- Obtaining funding for these improvements through government schemes and grants has been instrumental in achieving the desired energy savings.

- The importance of proper insulation and efficient heating systems cannot be overstated. These measures are crucial in achieving the energy targets.

REALISATION

Construction works began in July 2009 and are due for completion in December 2010.
Partner information for local ENPIRE project:

**Dublin**

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<td>Gerry Cahill Architects</td>
<td><a href="http://www.gca.ie">www.gca.ie</a></td>
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<td></td>
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<td></td>
<td><a href="mailto:stephen@gca.ie">stephen@gca.ie</a></td>
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RESTRICTURING SORELA URBAN AREA
HAVÍROV, CZECH REPUBLIC

PROJECT SETTING

AMBITIONS & AGREEMENTS

REALISATION

LESSONS LEARNED

The importance and knowledge acquired during this project will help to define environmental and energy aware urban design in the European Union. The resulting lessons learned and project outcomes will be incorporated into the forthcoming Erasmus + project "Sustainable Energy for All: A European Perspective" (SE4A) which aims to promote and facilitate the implementation of sustainable energy practices in urban areas across Europe. The project outcomes will be disseminated through various channels, including conferences, workshops, and publications, to ensure that the lessons learned are widely shared and applied.

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Partner information for local ENPIRE project:

**Havířov**

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<td>The statutory city of Havírov</td>
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<td>Mestska realitní agentura, Ltd.</td>
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<tr>
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<td>Ing. arch. Barbara Styblová</td>
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<td>Contact: Tomas Vimmr</td>
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