ENPIRE Summary Local Project
De Heuvel, Breda (NL)

Final Report

Municipality of Breda / WonenBreburg

March 2009

1 Project context

Existing situation De Heuvel, Breda

Heuvel refurbishment project in Breda Municipality comprises a residential area built in 1945 – 1960 with a great varity of housing blocks and local facilities. Total about 3200 dwellings with 8000 habitants. 2500 dwellings are owned by housing associations WonenBreburg and Laurentius, and 700 are private owned.

Restructuring process 2005 – 2015 will comprise demolishing of 650 houses and renovation of 650 houses – besides new built houses for total 950 dwellings. Also a new retail centre, a new school and an old monumental church changed into a multifunctional centre.

The functional urban design by Peutz will be preserved.

The dwelling types are mainly apartment blocks and single family dwellings (semi-detached).

The insulation level and the energy performance are low. Despite the low energy quality, the energy consumption is also low because the houses are heated by means of single gas stoves. The comfort level that goes with it is also low and the indoor climate of the dwellings are poor.

The rent of the dwellings is low.

Energy supply is from gas and electricity.

Stakeholders

The main stakeholders in the project are WonenBreburg, the Municipality of Breda and the Neighbourhood Council "Heuvelbelang".

WonenBreburg owns almost 30.000 dwellings in Breda and Tilburg. WonenBreburg restructures De Heuvel because it is necessary for them to have a healthy housing stock now and in the future. To look at the current energy use and energy infrastructure and to take future developments into account and to take the right action, they can change the current neighbourhood in a healthy neighbourhood that can face the future.

The Municipality of Breda has an important role in this process, because they can overlook the larger scale that is important in these matters and have ideas to develop an approach for restructuring neighbourhoods with attention for energy costs, CO_2 emissions and quality for the whole of Breda.

The Neighbourhood Council "Heuvelbelang" was important to discuss important choices like demolition of parts of De Heuvel and the readiness to pay for energy measures.

Ambitions of stakeholders

The strong point of the development in De Heuvel is that all stakeholders came to the point where they had common benefits as better value, higher comfort, respond to environmental issues, the solution of social issues, lower energy cost, no increase of living costs a better healthy inner climate and so on.

Because of these common benefits the stakeholders worked well together.

Legislation, standards and policies

Energy performance of buildings (EPN)

On building level the Netherlands have developed the energy performance of buildings (EPN). This is a calculation method for building related energy flows based on an energy balance for heating and cooling, the energy use for domestic hot water and the use of electricity for pumps, ventilators and lighting. The energy performance factor (EPC) is the primary energy use of these energy flows, corrected for the effective floor area and the building envelope.

When introduced in 1996, the maximum EPC in the Dutch legislation was 1,6. In the current building regulations the maximum EPC = 0,80. There are plans to lower the maximum EPC to 0,6 (2011) and 0,40 (2015).

An EPC of 0,80 is approximately a primary energy consumption of 70 – 75 kWh/m^2.

Energy performance of locations (EPL)

On location level an energy performance of location (EPL) is developed. The EPL is an instrument that calculates the CO_2 emission of a location compared to the reference CO_2 emission of that location.

If the CO2 emission of the location is equal to the emission of the reference the EPL is 6. If the CO2 emission of the location is zero (0), the EPL is 10. Other values of EPL will be attained by linear interpolation between these two points. Neighbourhoods with houses that have an EPC according to current legislation have an EPL of approximately 6,6.

The calculated CO2 emissions include the building related energy use according to the method of EPN, consumer-related electricity use (tv's, computers, washing machines, et cetera; demand depends on the size of the dwelling) and public installations (150 kWh per dwelling). The calculation of the CO2-emission is based on the calculated energy demands and the CO2 emissions of energy conversions. The energy savings within the energy system and local renewable energy generation are valued.

2 Ambitions for energy/CO2

Stakeholders and arguments important for formulating ambitions

The starting-point of course is the current Dutch legislation (EPC 0,8) and the predicted development of the EPC (2011:EPC 0,60; 2015:EPC 0,40).

For now the municipality of Breda wants more. For all new dwellings in the municipality they demand an EPL of 7,0, aiming at EPL 7,4. The new climate policy of Breda speaks of a minimum EPL of 7,2. This matches an EPC of 0,6.

The stakeholders agreed for (re)new(ed) build in a convenant in 2005 an EPL of minimal 7, aiming at EPL 7,4

There is no legislation for existing dwellings. For De Heuvel the stakeholders agreed in a convenant on energy measurements that have a payback time within the lifetime of the energy measure.

The Housing association WonenBreburg also follows the legislations. They have a long term agreement with the national government (Covenant, October 2008) and the housing association umbrella organization Aedes and the tenants organization Woonbond EPC to have a CO2 neutral stock of social housing in 2044. They aim to build CO2 neutral new buildings in 2015. Based on this there has been energy-appointment made with the municipality.

Relevance indoor climate and/or comfort of inhabitants

Indoor climate, comfort and healthy inner air quality are very important aspects for all stakeholders.

An essential measure floor heating (WonenBreburg) and low temperature heating systems are applied.

Existing dwellings with serious comfort problems and poor living quality are demolished and new dwellings were built.

Role of legal regulations

Legal regulations are an essential prerequisite, because they have to be applied. Besides that, they are important as a reference for measuring energy savings.

The predicted future legal regulations are also important because the demanded EPC will be lowered within the development time of De Heuvel.

There are plans to meet the problem of split incentives for housing associations in future regulations. These regulations will allow housing associations to raise the rent when energy measures are taken. This means there will be more room for investments. For the tenants this raise will be compensated by lower energy costs and higher subsidies on rent. The aim is to keep living costs at the same level.

Role of local authorities

The Municipality of Breda stimulates energy efficient restructuring of neighbourhoods (New Climate Policy Breda, Covenants (voluntary agreements)) also addressing the overall quality of plans (Report Quality Living (Nota Kwaliteit Wonen)).

Role for inhabitants

Inhabitants had an important role in the discussions about the demolition of bad parts of the existing housing stock in De Heuvel Breda (inventory of social problems choice for demolition or refurbishment).

A very important issue were the living costs, being the sum of the rent and the energy costs. Very important principals in the Netherlands are the permission to raise the rent after energy measures and subsidies on rent for people with low income.

In case of projects with energy measures it is important to aim at lower or at least equal living costs for tenants. Because of investments the gross rent for the dwellings will rise. The positive effects on living costs are a higher subsidy on rent and lower energy costs.

The tenants had an active role in formulating ambitions in covenant, but not in the energy study and the choice for energy measures.

Determination and agreement on final target

The final target for the new dwellings in De Heuvel is an EPL of 7,4 that will be realized with heat pumps, low temperature heating and extra insulation.
The definite decision has not been taken yet, because the theoretical assumptions for costs and benefits have to be checked first.

Tools and methods used to determine target level

The most important tools were the calculation methods for calculating the energy performance of buildings (EPN to calculate the EPC) and of locations (EPL). Both methods were used to register the demands.

The Toolkit sustainable new buildings was used to generate ideas about usable concepts .

The guidelines of ENPIRE were used to check for ideas to enhance the process or embedding agreements.

Type agreement and parties to register the ambitions

An energy covenant has been signed, committing to reach 45% CO2 reduction in retrofitting / refurbishment operations before 2015.

A covenant is a voluntary agreement, without consequences if goals are not reached.

Guarantee on actual realization of targets included

There is no guarantee that the goals will be reached.

The chance that these goals will be reached are considered high, because all stakeholders have mutual gains (living costs, comfort, PR), work well together and trust each other, the goals are financially achievable and well known techniques are used and a level playing field has been created because the regulations concern all parties in the municipality.

3 Analysis of energy options

In order to achieve reduction of (fossil) energy use in the built environment, a three-step strategy is followed, the Trias Energetica:

1. Reduce energy demand, mainly through the reduction of energy loss;
2. Use energy from sustainable sources;
3. For the remaining energy demand: efficient use of fossil energy.

In addition to this strategy flexibility for the future integration of (new) sustainable energy sources is important.

The choice for a certain energy-infrastructure is decisive for the possibility to transport and therefore use energy from renewable sources. The traditional Dutch natural gas infrastructure cannot easily be made to transport renewable gases, whereas a heat grid can transport heat from any heat source.

First, the most promising (renewable) energy sources are selected. Next a number of energy concepts for the planning area (dwellings) are composed. Then, these concepts are compared on criteria like energy performance, primary energy consumption, CO_2-emission, investment, user costs and comfort.

Renewable energy sources

Several (renewable) energy sources have been compared on general criteria like local availability, scale and environmental gains, see table. The most promising technologies are then used for further analysis for use in the project area (see table).

Technology	Assessment
Photovoltaic solar energy	Suitable, relatively costly, attractive feed-in subsidy available
Solar thermal energy	Suitable
Wind energy, small scale	Less suitable: low yield in built environment, limited height of buildings, still in development
Geothermal heat pump (depth ca 20 tot 120m)	Potentially suitable, depends on local soil conditions. Preferably collective system with open ground water source. Threat: local soil contamination.
Biomass	Large-scale CHP not possible because of small scale, environmental regulations and planning. Chance for small-scale (CHP) pellet stoves. Disadvantage: environmental permit necessary, storage room.
Waste heat or large-scale CHP	Not available in vicinity, scale of project too small to connect to existing heat grid
Local combined heat & power (CHP)	Less suitable because of small number of full load hours and relatively small environmental advantage
Geothermal energy (depth ca. 2 km)	Not available in vicinity, scale of project too small for new initiative
Hydro power	Not available in vicinity

Comparison of energy concepts

Starting from above mentioned options, realistic concepts for the housing plan in Heuvel, Breda. Combination of energy saving measures and (renewable) energy technologies.

- 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 geothermal heat pump, heating and cooling infrastructure.
- Variant 3a and 3b: like variants 2a and 2b, with demand-driven natural ventilation (CO_2-concentration), shower-drain heat-recovery.
- Variant 4: compared to reference: better thermal insulation, demand-driven natural ventilation (CO_2-concentration), collective solar collector for domestic heating and hot water, heat infrastructure.

The energy concepts are compared on a number of criteria. The quantitative comparison is represented in the following table.

Parameter	**Reference**	**Variant 1** energy efficient + solar boiler	**Variant 2a** individual geothermal heat pump	**Variant 2b** collective geothermal heat pump	**Variant 3a** individual geothermal heat pump	**Variant 3b** collective geothermal heat pump	**Variant 4** collective solar boiler
Primary energy [kWh/m²]	74	51	46	45	31	32	34
EPC	0,78	0,55	0,51	0,50	0,39	0,40	0,42
CO_2-emission [kg/m²/year]	15,3	10,4	11,5	10,9	7,8	7,6	7,0
Investment per residence [€]	6.250	12.900	13.850	10.850	16.250	13.250	19.100
User cost [€/year]	1.074	857	667	1.072	490	908	968

Promising options and bottlenecks

The most promising option is the option with better thermal insulation and a low temperature heating system with an electric heat pump for heating and cooling. The energy and CO_2 performance are very good and the user cost are relatively low.

The most important bottlenecks are that these techniques are less suitable in existing dwellings and that soil has to be suitable for storing heat and cold. Existing soilpolution can be a bottleneck, but the soil maybe can be in combination with using the heat of the soil. This will further rechearched.

4 Implementation and evaluation

Implementation and monitoring of energy options

The definite realization has not been decided on, because the assumptions on financial aspects and possible problems with the soil have to be checked first.

WonenBreburg consider to exploit the heat pumps themselves.

If WonenBreburg will exploit the heating system themselves, they are a small power company for their own small collective systems with heat pumps. They will then sell heat to their tenants and therefore know the energy use of their dwellings. Because of that they also have a notion of the realized energy savings. They already exploit this theirselves in another project.

Planning process

The CO2/energy ambitions have not been modified during the project.

The planning process of this project was not that different from what is customary in the Netherlands. The possible difference is the energy study, that is common in the Netherlands but not obligatory.

There has been a very good cooperation between the Municipality of Breda and WonenBreburg.

Use of ENPIRE Guidelines

In the project the draft guidelines on Process and on Embedding Agreement are used as a check for ideas and forgotten elements.

The search for mutual gains between partners in a project is a very important element to enhance the chances of also realizing high ambitions. Also making agreement with the developers and social housing companies on a local level is important.

Lessons learned

An energy study considering energy and CO_2 reduction measures on all levels (surroundings -> buildings) and reporting relevant parameters (investments, user cost, energy use, CO2 emissions, EPL (NL), et cetera) generate a broad range of ideas to meet the ambition. The chance that a good solution will be considered and realized are higher.

The choice for well known techniques improve the chance of realization.

Also check the consequences of choices over longer periods of time. Predicted effects in 5 years, 10 years, 20 years, et cetera.

If there is also attention for common gains of the stakeholders (including neighbourhood groups), there will be more common interest to realize the project and the chances of realizing the project are bigger.

A good project manager is very important.

In renewed build areas with remaining street patterns, the possibilities for energy measures that depend on sun orientation are possibly limited.

Exploiting your own energy system can open more possibilities for energy systems. The extra you get is monitoring information.

This project is an example for the rest of WonenBreburg. The approach is not common within the organization. A successful application of this project could persuade the board of WonenBreburg to make this is common approach for more similar future projects.

Low temperature heating makes the heating system suitable for many techniques including techniques that use renewable energy (solar, ground, et cetera).

The local authorities can stimulate energy saving projects by responding to future developments of energy legislation.

Combine energy ambitions with other, often directly linked issues as comfort, a healthy indoor environment and improvement of living quality.

In this project the energy investments will be (partly) financed by raising the gross rent of the dwellings. For tenants the living costs will not rise because of more rent subsidy and lower energy costs.