Implementing ambitious energy performance targets for buildings in new urban development areas: The example of the CONCERTO communities

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Abstract

The limited availability of fossil fuel sources, rising energy demand and dependency on energy import led to energy reduction becoming more and more an important topic. The major share in energy consumption is related to buildings. Therefore it is important to set up rigorous energy performance standards to reduce energy consumption in this sector. The CONCERTO programme, an initiative of the European Commission, was developed in order to support European cities focusing on the reduction of CO_2 emissions, increase energy efficiency in buildings and facilitate the integration of renewable energy sources. 45 cities in 18 European countries are taking on the challenge of sustainable energy supply in order to show solutions for new development areas, urban regeneration as well as solutions in rural areas.

A unique comprehensive approach is used to cover substantial measures such as monitoring, research and training activities and involving all relevant actors. The aim is to develop ready-to-use solutions for other European cities and gather and analyse policy recommendations at the local, regional, national and European levels. The analysis of the implementation process plays a major role. This paper analyses success factors such as excellent cooperation and coordination among key stakeholders, innovative financing mechanisms and involving tenants in monitoring energy use in their buildings. Barriers include administrative and financing issues, slow behavioural changes and conflicting urban planning objectives. These findings together with results from technical and socio-economic monitoring are analysed by a number of CONCERTO communities.

This paper will focus on the findings in new urban development areas in CONCERTO communities and highlight potential solutions which can be applied in many future communities with ambitious energy performance targets for buildings, which go beyond the national and local requirements. The different approaches and their applications in other situations will be discussed.

Key words: new urban development, sustainable communities, buildings, energy efficiency, renewable energy sources, energy performance targets

JEL Classification: O31

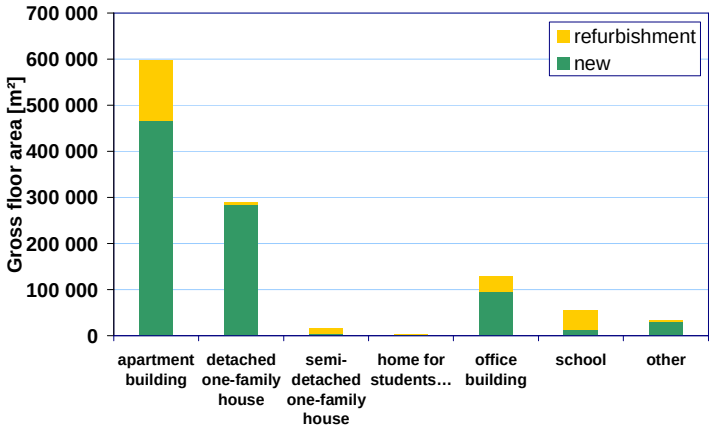
1 Introduction

In the CONCERTO initiative, demonstration activities are implemented as milestones in the development of sustainable communities in new urban development areas, existing urban neighbourhoods and rural areas. Measures are carried out in the field of energy efficiency (thermal retrofitting of existing buildings, construction of new low-energy buildings, increasing the efficiency of every kind of energy system and introducing polygeneration technologies) and renewable energy systems. Large or small scale energy systems based on renewable energy sources (RES) are being built to provide single buildings or whole districts with electricity,

heating and cooling. Most of these activities are also accompanied by socio-economic research activities, especially targeted to involve the relevant stakeholders or inhabitants and increase the level of acceptance of the implemented measures. [1]
The 45 CONCERTO communities are inhabited by approximately five million people of whom 500.000 are directly or indirectly affected by the programme's measures. The projects in the communities consist of chosen defined neighbourhoods. In the view of the whole initiative, the cities will cover their energy use in buildings by 100% through renewable energy sources (RES). Some communities are providing even more energy than required by the CONCERTO demonstration areas by implementing large scale energy systems based on RES. These projects compensate the share of other projects, whose energy mix is set up in another way concentrated more on energy efficiency activities and not having a high share of RES in the energy supply of the buildings. However the situation resembles the one in reality where cities concentrate on activities which are more suitable or where they do have more resources.
Out of these communities, the activities of the 26 communities are monitored and assessed by the CONCERTO Plus project. CONCERTO Plus is a special project, which supports the European Commission by enhancing networking and providing assessment. The results of this project will be policy recommendations based on a comprehensive analysis of the communities.
In new urban development areas of the CONCERTO communities a holistic approach is used in order to keep high energy performance standards and ensure a high level of quality of life. These ambitious energy performance standards for buildings are being combined with optimised community energy systems.
This paper brings the currently implemented measures in context with the situation foreseen and planned for the year 2009. The measures have been planned in the years 2004 and 2005. Some of the reasons behind the differences can be shown already, even if most of the activities in the communities will be finished in 2010 or 2011.

2 Overview on measures in new urban development areas

The new urban development in CONCERTO communities concerns mostly the residential sector. Commercial buildings are thought to be more an enhancement in order to complete the existing spatial plans of the municipalities. Industrial areas were not part of any of the CONCERTO projects and even if some projects included them without receiving any funding, they are not part of the analysis. Among all buildings planned, approximately 20% (270.000 m^2) of buildings are completed up to now.



Picture 1 Overview of the different types of buildings planned

In general there are two types of new urban development projects. The first one includes communities that redevelop areas that were previously e.g. in military or in industrial use. Buildings or facilities erected in these communities are all newly built. However, the area also includes buildings that previously were in industrial or military use which are not part of the CONCERTO demonstration activities. The aim of these projects was to revitalise sites that would otherwise remain brown fields and include elements of sustainable urban development. The other communities built new buildings/facilities on previously completely undeveloped sites (i.e. green fields). The aim of these projects was to develop completely new neighbourhoods including elements of sustainable urban development. Compared to the projects of the first type, these areas initially did not have any public or technical infrastructure.
Table 1 gives an overview on buildings and measures planned initially and those implemented already. The table delivers additional information about the change of targets made during the implementation. The different implementation levels, as well as the change of targets indicate the existence of barriers and drivers. The analysis of barriers and drivers is one of the bases of the planning and implementation assessment done by CONCERTO Plus and will be used to provide policy recommendations for the future.

2.1 Redefinition of targets

In most of the cases, where the targets of implementation have been adapted, the aimed gross floor area of the buildings has been increased. The reason being that in several cases other targets (i.e. renovation measures) were reduced and budget was shifted to new buildings. Investors are mostly larger construction companies (i.e. in Zlín and Neckarsulm). After successful first demonstration sites, these companies were capable of enlarging the number of newly built apartments. In the past it has already been tested that better energy performance could be reached with only marginal cost increases. Problems with new building technologies had largely been eliminated. Projects are not confronted with barriers occurring in renovation projects where the implementation is done mostly by many single-family house owners rather than a large company.
Often the major investor withdraws from the project for financial reasons, which is resulted in having reduced the original targets. Several projects indicated problems due to the financial and retail market crisis. The search for a new investor in such a short time is difficult and the results are uncertain. Projects therefore shift budget to other activities.

2.2 Delays in implementation

The delays in implementation result from a couple of case-specific barriers. As most of these barriers can be identified, when the project already started, there is not always the possibility to use different solutions or take actions to overcome the barriers without any delays. Following the analysis of the barriers encountered during the planning and implementation stage for each major measure major deviations from the original planning can have different reasons:

- Legal / administrative – Since some technologies are still a novelty, there have been legal and administrative problems to deal with. New energy supply systems do not find the right framework in all countries (e.g. in the field of distributed energy generation Energy service companies have common problems with distribution grid owners), funding models are missing or regulations not adapted.

- Political / institutional – Changed political support can cause several problems. The new politicians have to be convinced of the value of the project. Also a complete change of the master plan because of political changes and agenda resetting by the city council can delay the implementation as the measures have to been adapted to new conditions (e.g. in San Sebastian, Tudela, Almere).

- Economical / financial - In some countries (e.g. the Netherlands), the decline of the real estate market following the economic crisis and credit crunch has started later and the peak does not appear to have been reached yet. Whilst the projects that started early had little to no delay, the projects that were scheduled later (2008/2009) are experiencing delays. There have been problems in finding demonstration projects because of the actual situation on the housing market and the funding rate offered by the initiative. Interested parties consider this as too low compared to the requested standard of the demonstration project. (e.g. Milton Keynes, Nantes, Tudela, Almere, Viladecans, Zaragoza)

- Technical - Technical barriers are expected as the systems are quite complex, however the influence of technical barriers on the process are quite rare.

- Acceptance – Acceptance problems result from low public awareness to the planned / implemented measures. Even if acceptance is not strong influencing barrier, the higher popularity can work as a driver to a project and influences initiating of follow ups.

2.3 Gaps between measures planned and implemented

The measures, which could not be implemented at all are varying depending on the community:

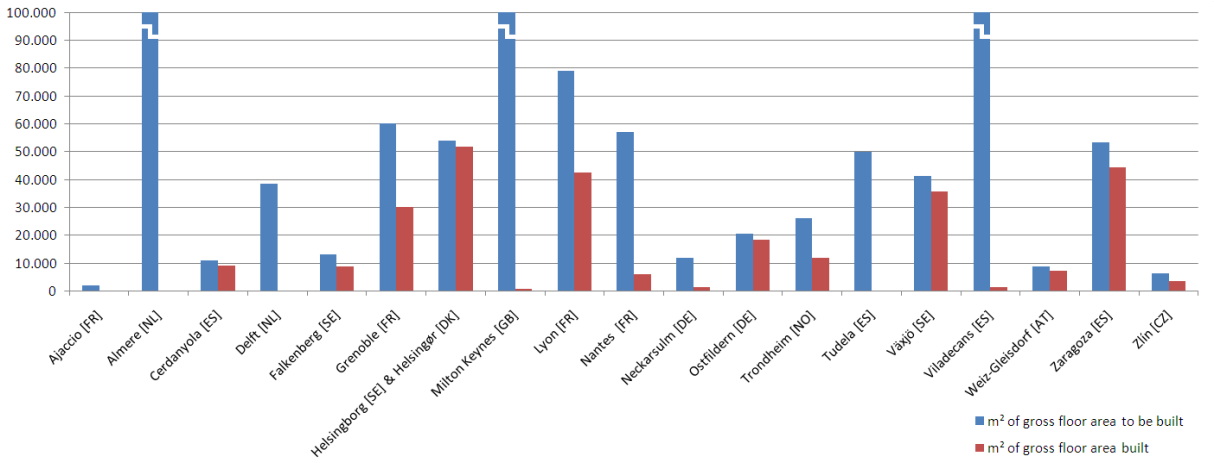
- It is difficult / nearly impossible to substitute natural gas supply with biomass heat only systems in Denmark both in the legislative framework and as gas supply companies work against or delay such projects (example of Helsingør).

- In Almere there will not be any biomass CHP (combined heat and power) plant as it was planned initially. The main reason for that is linked with the current situation in the Netherlands. The national energy policy strategy supports rather the use of waste heat from existing large thermal power plants than the construction of new CHP plants. The main idea consists in avoiding using RES to produce heat energy when heat is already produced in thermal power plants.

- In Delft the low energy district heating could not be implemented due to economical feasibility of this project. The district heating network with higher temperature, which will be implemented also in other parts of the city, will be built instead.

Table 1 Overview on new buildings planned and implemented

Community [Country]		Planned initially *In cursive: successively revised targets*		Implemented 2009	
		m² of gross floor area to be built	**heat supply measures planned**	**m² of gross floor area built**	**heat supply measures implemented**
Ajaccio	[FR]	2.000	none	0	none
Almere	[NL]	245.208	- district heating	0	none
Cerdanyola	[ES]	10.962	- district heating	9.012	- district heating
Delft	[NL]	35.177 *38.571*	- district heating	0	none
Falkenberg	[SE]	9.180 *13.257*	- decentralised measures (funding schemes for residential and commercial sector) - district heating	8.887	- municipal funding programme - district heating system implemented
Grenoble	[FR]	44.920 *60.142*	- co-generation with natural gas	30.258	- co-generation with natural gas
Helsingborg & Helsingør	[SE] [DK]	54.019 *53.989*	data missing	51.789	data missing
Milton Keynes	[GB]	241.414	- district heating - heat pumps	700	none
Lyon	[FR]	78.870	- biomass boilers	42.611	- biomass boiler
Nantes	[FR]	57.185	- district heating	6.058	- district heating
Neckarsulm	[DE]	2.300 *12.011*	- decentralised measures (funding schemes for residential and commercial sector)	1.250	- municipal funding programme
Ostfildern	[DE]	20.585	- district heating	18.285	- district heating
Trondheim	[NO]	22.400 *26.260*	data missing	12.000	data missing
Tudela	[ES]	70.000 *50.000*	data missing	0	data missing
Växjö	[SE]	36.476 *41.314*	- district heating	35.864	- district heating
Viladecans	[ES]	231.439	- district heating	1.398	data missing
Weiz-Gleisdorf	[AT]	7.750 *8.825*	- decentralised measures (funding schemes for residential and commercial sector)	7.386	- municipal funding programme
Zaragoza	[ES]	53.360	- natural gas	44.380	- natural gas
Zlín	[CZ]	5.000 *6.301*	- decentralised measures (funding schemes for residential and commercial sector)	3.541	- municipal funding programme
Total		**~ 1.400.000**		**~ 270.000**	



Picture 2 Comparison of constructed new buildings to the plan

3 Mechanisms in new urban development areas

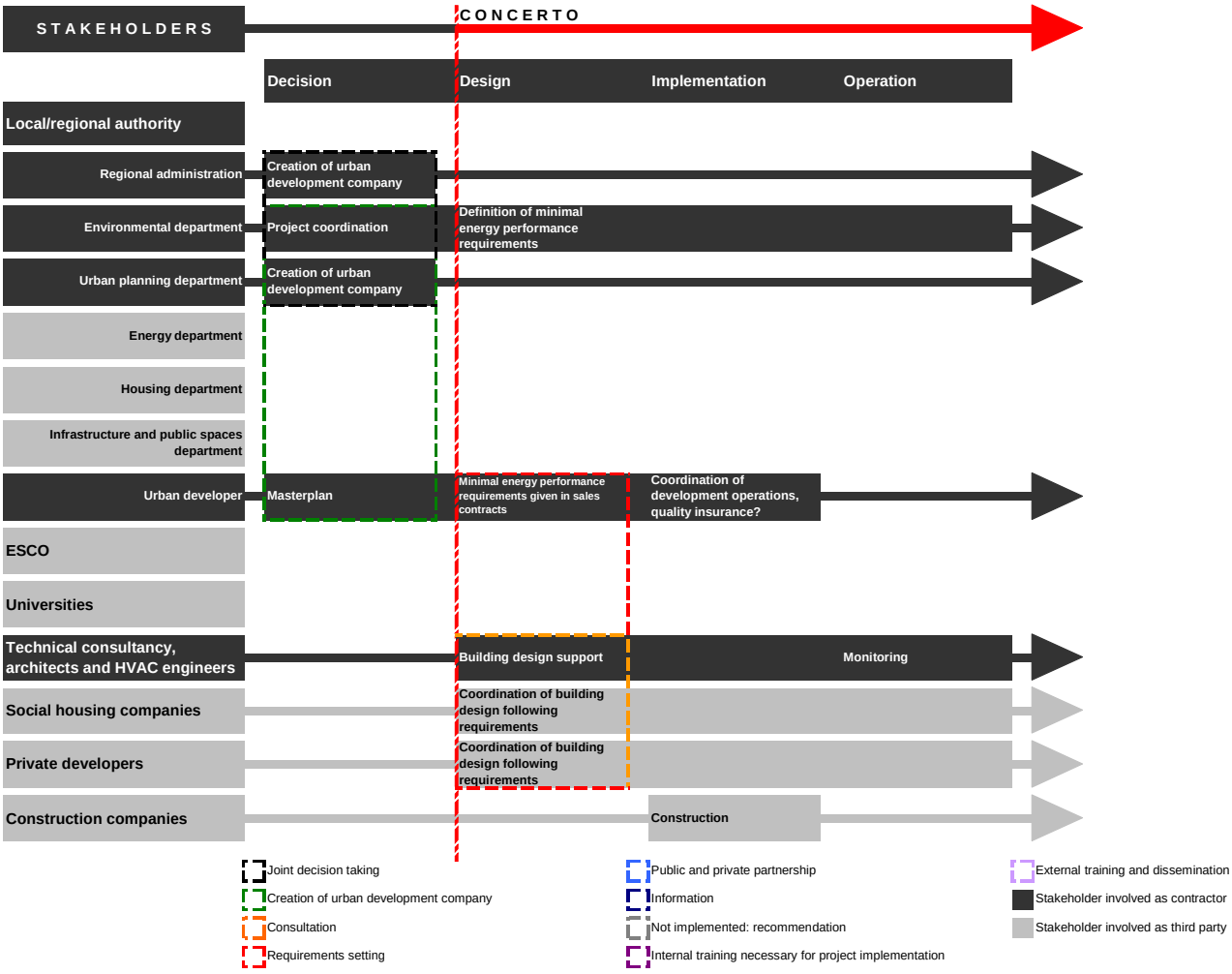
In order to analyse and compare advanced implementation stages a typology-based methodology has been developed. A core instrument of this analysis is the planning and implementation diagram (see picture above). This instrument should allow benchmarking among the different institutional structures in the projects Together with the barriers and drivers analysis it will be possible to explain the different implementation level in the projects. The following example of the French model explicates how the assessment is set up.

In the French new urban development projects (Grenoble, Lyon and Nantes) all development operations are coordinated by urban development companies with high share of public institutions and operating on behalf of the local administration authorities. In fact, the development areas are always in public hand. Energy performance requirements are specified in the contractual documents related to the real estate sales and are included in the requirement specifications:

- ambitious energy performance requirements on the projects are set
- Feasibility study for a technical solution which is much better than the minimal energy performance requirements has to be done. This is a way to oblige buildings developers and designers to consider the possibility of being even more ambitious, thus getting more familiar with alternative technologies.
- the building developer has to be supported by energy specialists
- in few cases, concrete technical solutions is to be used (e.g. external insulation, supply and exhaust ventilation systems).

In this process, the motor role of public institutions or of organisations owned by public institutions by the majority is shown schematically on Picture 3 (upper part of the diagram). The number of public stakeholders is in fact much higher than in the case of large scale renovation measures and improvements in urban areas.

In all French projects, training programmes were developed for construction companies and on-site inspections were organised to control the construction quality in order to allow for high energy performance reached. However, in practice, there was no systematic and contractually defined process to guarantee a high construction quality for all components ensuring a high energy performance.



Picture 3 Planning and implementation diagram representing the French communities

4 Conclusion

Ambitious energy performance measures for buildings are bringing several new challenges for the urban planning. The complexity of the whole implementation process needs to be assessed delivering easy interpretable results, which allow benchmarking and can explain hidden problems. Barriers and drivers need to be identified in order to enhance the developments processes in the future. Also unsuccessful projects can deliver important information.

This kind of assessment needs to be enhanced with specific technical, socio-economic and policy measures analysis of the projects in order to provide policy recommendations and improve similar projects in the future.

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