

De Bonne - Energy efficiency assessment in an eco-district

Grenoble, France 

De Bonne eco-district: a focus on energy performances evaluation

The City of Grenoble is actively engaged in the implementation of sustainable development policies and practices. Grenoble took advantage of the realization of an innovative district scaled project finished in 2008, for implementing a monitoring programme which aimed at assessing the effective energy efficiency achieved in an every-day life situation. The De Bonne District in the City of Grenoble was the first urban eco-district in France. In terms of energy efficiency, the project not only anticipated eight years of national thermal legislation for new buildings, but it also was pioneering in terms of evaluating and tracking energy performance in the long term. Until then, most of the existing European eco-districts did not have any specific assessments of energy performances.

Country/ City Profile

Country		City	
Population (2015)	63,375,971 [1]	Population (2012)	158,346 [1]
Land area (km ²)	547,557	Land area (km ²)	18.13
GDP per capita (2014, current international \$, at purchasing power parity)	39,328 [2]	GDP per capita (2010, US\$)	around 37,581 [3]
Region	Europe	Region	Rhone-Alpes
City's physical geography	Location	<ul style="list-style-type: none"> ✓ South East of France, latitude 45° 11' 13'' N, longitude 05° 43' 35'' E [4] ✓ Altitude varies from 204 to 600 meters ✓ Located in the Alps, at the bottom of a "cuvette" formed by three mountain ranges ✓ Strong geophysical constraints which interfere with the urban frame and development projects 	
	Climate	<ul style="list-style-type: none"> ✓ Continental, one of the largest temperature range areas in France, average annual temperature: 11,2 C° ✓ Average annual rainfall : 856mm [5] 	

Initiating context

Many natural factors have been shaping policies and urban planning in Grenoble through time. Cold winters (around -5°C minimum) and heat waves during summer months are raising the level of concern on environmental issues. The three mountain ranges surrounding the city are restricting urban development, which faces relevant demographic pressure. Due to its orography, Grenoble suffers from being a sink for pollution. Therefore, urban renewal and densification of the city are challenging development and urban planning issues.



Source: City of Grenoble

At the time of the De Bonne project, the City Government adopted a target of 14% reduction in CO₂ emissions from 2005 to 2014, and 14% renewable energy in the share of energy consumption. Complying with its sustainable development commitment, authorities set up a project aiming to bring families back into the city centre. Acquiring the old military barracks represented an opportunity to create a dense and efficient inner city eco-district.

Project description

The project area is situated in the heart of Grenoble. In the area, old military barracks were partly refurbished and partly demolished, making way for new buildings. The ambition was to create a neighbourhood with high environmental quality and high energetic performances, combining density, energy and space saving, and all urban facilities. The De Bonne district now hosts 850 housing units, including 435 new units and 415 refurbished units. Social diversity has been a priority for the project, a share of 40% of social housing dwelling within the district, responding to the Government's objective to bring families from the outskirts to the city centre.

Local Authorities also intended to implement high environmental and energy standards to the conception, construction and utilization phases. New methods for collaboration between the different stakeholders (architects, engineering companies, public authorities, social housing agencies, etc.) have been implemented, involving new and clean construction processes for building companies. For instance, demolition and re-use of materials on the construction site was required. 12 eco-buildings were built in the area with an energy consumption level at least 50% beyond the national average, using green technologies such as photovoltaics and solar thermal plants, biomass and cogeneration.

When compared to other well known eco-districts in Europe, such as Vesterbro in Copenhagen, Bo01 in Malmö, Bedzed in London or Vauban in Fribourg, De Bonne was the first eco-district to plan for the monitoring of energy performances after its realization [6]. This decision was triggered by the participation as a case study in the European project, Concerto- Sesac [7], the 6th European Research Framework Programme which started in 2003, aimed at promoting energy efficiency and innovation and at monitoring the effectiveness of measures. Over the course of two years, sensors were installed in eight out of the twelve Eco buildings that every 15 minutes provided measurements of energy consumption from heating, hot water and electricity. Further parameters measured were indoor and outdoor temperature and humidity. The analysis of this data was led by a private firm, who delivered two reports in 2011 and 2012. A second level of analysis [8] targeted new inhabitants, their lifestyles, their behaviour and feeling about living in De Bonne through interviews and questionnaires. The combination of both directions of analysis brought precise data on the building's efficiency when used and lived by inhabitants.

Implementation process

Projects implementation details

Process	A first public consultation (via public meetings, debates and exhibitions) on the project started in 2001, following the acquisition of the military zone by the City Government. Then, public consultations were launched prior to every decision during the project conception through urban planning workshops . Some very specific criteria on energy efficiency and social diversity were imposed by public authorities to operators and constructors, who benefited from special trainings on green technologies.
Leadership	SAGES, a development public company, via a delegation by local authorities
Financing	Overall cost of € 40 million , financed by : <ul style="list-style-type: none">✓ European grants (Concerto) : € 2,1 million✓ Sales to real estate developers✓ The City own funds
Involved stakeholders	<ul style="list-style-type: none">✓ Social landlords such as OPAC38✓ Engineering companies✓ Unions and neighbourhood organizations✓ Gas and electricity company✓ Citizens



Source: City of Grenoble

Results of the report on energy consumption in De Bonne's buildings [9]

Per building	Target (kWh/year/m ²)	Results Year One (kWh/year/m ²)	Results Year Two (kWh/year/m ²)
Heating	42,5 <i>Concerto target</i>	Max: 73,4 Min: 44	Max: 61,4 Min: 39,7
Domestic Hot Water	17,5 <i>Concerto target</i>	Max: 33,7 Min: 14,1	Max: 24,5 Min: 12,2
Electricity in commons	10	Max: 26,2 Min: 11,6	Max: 18,2 Min: 12

Results / Lessons learned

The report on energy data shows an overall excess of consumption in buildings compared to the target set by project Concerto and by planning documents. The most important excesses in consumptions were found in the heating system and the electricity used in common spaces (elevator, alarms, lights, etc). Results regarding domestic hot water performed slightly better, although the consumption was still higher than expected. The report has established that in such high energy efficient buildings, the major factor explaining the over-consumption is the inhabitants behaviours and practices. Adding the findings from the report focusing on inhabitants' behaviour, both reports conclude that the planned levels of energy performance can only be reached if inhabitants adapt to the technologies and change their habits. The high level of energy efficiency of the building makes it extremely sensitive to variations in behaviour. Nevertheless, comparing data across years, a learning process could be identified, with an overall increase in energy savings, reflecting improved practices of inhabitants. This experience highlights the need for a greater focus on training inhabitants and raising awareness on the way to best use such complex and high quality environmentally conscious buildings.

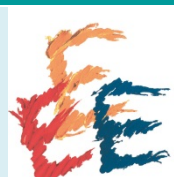
Further to these energy performances concerns, De Bonne can be considered an example of success as it integrated diverse population in terms of socio-economic backgrounds, whereas most European eco-districts target middle-class housing needs and are not affordable for low-income families. It has also succeeded in developing of eco-skills with regards to the operations and constructions parts of the project. Thanks to the training provided, expertise in construction techniques developed in 2003 that anticipated the knowledge requirements needed for complying with the national legislation on energy efficiency in new buildings emanated in 2012.

The De Bonne neighbourhood was awarded the National Great Prize of eco-district awards organized by the French Environment Ministry.

References

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