



La Darnaise, Vénissieux - France

Vénissieux is a municipality of 60 000 inhabitants located in the Grand-Lyon conurbation, the second largest in France, with a mix of social housing and industry. *La Darnaise* is a group of multi-storey apartment buildings built in the 1970s and composed of, at that time 1000 dwellings. The area suffers from a bad image due to urban riots that occurred in this area in the past.

Today, Vénissieux is undergoing significant urban regeneration in order to improve the quality of life of the inhabitants. Between 1989 and 2004, four multi-storey buildings were demolished and replaced by semi-detached housing. The refurbishment of the 11 remaining multi-storey buildings, including improvement of the building insulation and the use of renewable energy sources began in 1998 and ended in 2006. Today *La Darnaise* district is a concrete illustration of the possibility to transform an old social housing area into an energy efficient and renewable energy powered district.

As part of the PV UP-SCALE project, interviews were held with many people who had been involved in the regeneration of *La Darnaise* district. These included members of OPAC Grand-Lyon, the public social housing organisation that owns those buildings, the Local Energy Agency and Tenesol, the PV system supplier.

Discussions focused on the benefits observed from the installation of renewable energy systems that, in the case of solar thermal and bio-mass, are reducing service charges for inhabitants and improving their quality of life, and in the case of PV, improve the image of the district. Another topic of particular interest to the stakeholders involved was the fact that PV is in reality a much more simple technology than expected at the beginning of the project.

Within the *La Darnaise* area, PV was installed on the façade of 11 multi-storey apartment buildings and supplies renewable electricity to 727 dwellings. This project was funded by the French National Agency for the Environment and Energy Savings (ADEME) and the Rhône-Alpes Regional Council.

Site Plan of la Darnaise – Vénissieux

The refurbishment of the *La Darnaise* buildings, owned by OPAC Grand-Lyon, a public social housing organisation, was part of a large urban regeneration scheme (Great City Project) under the leadership of the Grand-Lyon Community. Launched in 1998, the objective was to improve the quality of life for inhabitants and to give a positive image to this





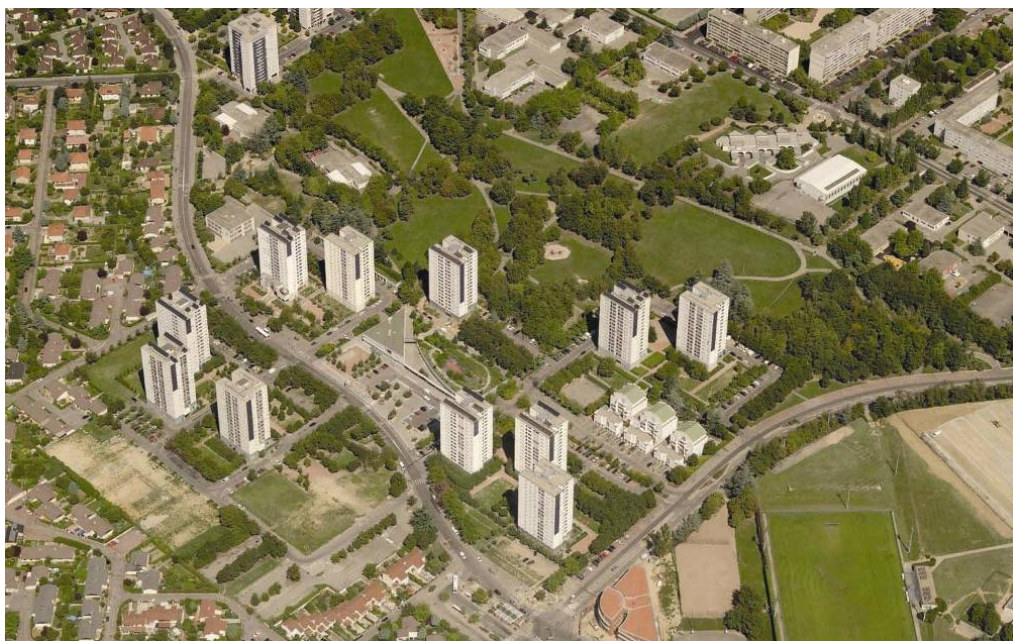
dilapidated district. Priority was given to improving the thermal comfort of dwellings and reducing service charges for tenants.

Initially, renewable energy sources were not part of the refurbishment plan which consisted only of the installation of high-efficiency external insulation and low-emissivity windows. But in 2001, the local energy agency organised for OPAC Grand-Lyon technical visits to renewable energy systems. The technical visit on PV was to a multi-apartment building near to Grenoble owned by another public social housing organisation, OPAC 38, which was equipped with a 10 kWp PV system installed in 1999 within Green Cities, a European Commission funded project. This initiative was more than successful since it led OPAC Grand-Lyon to modify their project to include renewable energy systems.

A 730 m² solar hot water system was installed on the roof of several buildings in order to reach an optimal sizing of 1 m² of solar collector per dwelling. The coal powered district heating station was also replaced by a 12 MW wood chip fired power plant.

Overview of la Darnaise district

Preliminary studies found that very little roof surface was available for PV systems, as almost all the roof area was to be occupied by solar thermal systems. The only possibility to install PV systems was to integrate them on the southern façade of each building despite the reduced energy production compared to a roof installation.



In this large scale urban regeneration, it is of course not possible to adapt the urban plan to optimize the use of PV, the PV systems were therefore sized and positioned on each building to limit mutual shadings.

Within the *La Darnaise* regeneration programme, 92 kWp of PV were installed between 2005 and 2006 on the façade of 11 multi-story buildings.

The nominal power of each system varies from 4 to 12 kWp, the size of each system was optimized taking into account the level of shading generated by surrounding buildings:

- 3 buildings equipped with a 4 kWp PV system (12 kWp)
- 4 buildings equipped with a 8 kWp PV system (32 kWp)
- 4 buildings equipped with a 12 kWp PV system (48 kWp)



La Darnaise district
PV modules were optimised in order to limit mutual shading

The total cost for the PV was 580 000 euros, of which one third was paid by the building owner, the French National Agency for Environment and Energy Savings (ADEME) and the Rhône-Alpes Regional Council co-funded this project. Although this PV system benefits from the national feed-in tariff for the electricity produced, the PV system owner will never get a financial payback for this project. The reason is that the PV system owner chooses to use the annual revenue generated by the electricity not to reimburse a loan or its investment, but instead to reduce the service charges of the buildings, in order to increase its social role and reduce the poverty of inhabitants.

PV is just a small part of this large-scale regeneration project that aims to improve the quality of life of inhabitants and reduce service charges by the improvement of energy efficiency and the use of renewable energy systems. But in contrast to the high-efficiency insulation and windows, the wood chip fired district heating and the solar thermal collectors that can't be easily seen, PV is now fully part of the visible district architecture. This makes the PV systems installed on the building façades the flagship of *La Darnaise*, the first renewable powered district in France.

Summary of problems, barriers, solutions and recommendations

This large urban renewal did not originally include the use of renewable energy systems

The scheme was aimed at improving of the quality of life for inhabitants and giving a positive image to this district. Initially, renewable energy sources were not part of the refurbishment which consisted only of the installation of high-efficiency external insulation and low-emissivity windows.

Solution: The local energy agency organised technical visits to renewable energy systems in order to increase the knowledge and the awareness of OPAC Grand-Lyon, the building owner, who then changed its project and included renewable energy systems (wood-chip boiler, solar thermal and PV).



Where to find a suitable area for PV in the case of multi-apartment buildings ?

High-rise buildings generally offer limited roof areas suited for photovoltaics, especially when the flat roof is also used for solar thermal, which is the case of this project.

Solution: At *La Darnaise*, it was decided not to install PV on the roofs, but to integrate PV on the southern façade of each building. This has the consequence of decreasing the annual energy output from the PV systems as the tilt angle of the PV modules is far from the optimal value, which is approximately 30° in Lyon. This loss of yield is, in the case of PV, compensated by additional added values such as visibility.

How to reduce the impact of mutual shading of buildings?

High-rise buildings occupy little land surface but generate significant shading on surrounding buildings. When PV is installed in façades, mutual shadings can significantly decrease the annual output of PV systems.

Solution: A detailed study was done to analyse the shading generated by each building in order to size each PV system and maximise the annual energy production. Three different PV systems were designed (4, 8 and 12 kWp) and are installed on buildings taking into account mutual shading.

Number of PV systems when several buildings are equipped

When several buildings owned by the same entity are equipped with PV, there is the choice to either install one independent PV system on each building or to install subsystems on each building that are then connected together to form a single PV system. Reducing the number of PV systems facilitates monitoring and the administrative procedures for the connection to the grid or the purchase of the electricity produced, but may be not possible if the electrical connection of each sub-system is technically complicated.

Solution: Although all PV modules are owned by the same owner, this project is composed of 11 independent PV systems, one for each building, that have their own connection point to the grid and their own contract with the utility for the purchase of the energy produced. This solution was preferred because the connection of each subsystem to a single point of the distribution grid would have been very expensive and complicated.

Is it worth spending money on PV that will have a limited impact in reducing the service charges for tenants?

In *La Darnaise* PV will produce approximately 59 000 kWh per year, an average of 80 kWh per dwelling per year. The impact of PV on service charges for tenants will therefore be limited.

Solution: PV modules are installed not on roofs but on façades in order to make PV fully part of the district architecture. This technical choice led to use PV, not only for the production of renewable energy, but also for its visibility, as the other energy efficiency measures and renewable energy systems used in the project: solar thermal, building insulation and bio-mass based district heating, are not visible to tenants or visitors. PV is the flagship of *La Darnaise*, the first renewable powered district in France. The social impact of this visible element of the urban regeneration is considered to be as valuable as the energy that could have been produced by a more optimally inclined system.



Sources of further information

Building owner website: www.opac-grandlyon.com
Local Energy Agency website: www.ale-lyon.org
PV system supplier: www.tenesol.com
Vénissieux municipality website: www.ville-venissieux.fr

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