

Smart local thermal districts

An Integrated Infrastructures Solution

SMART SOLUTION 6: WASTE HEAT RECOVERY

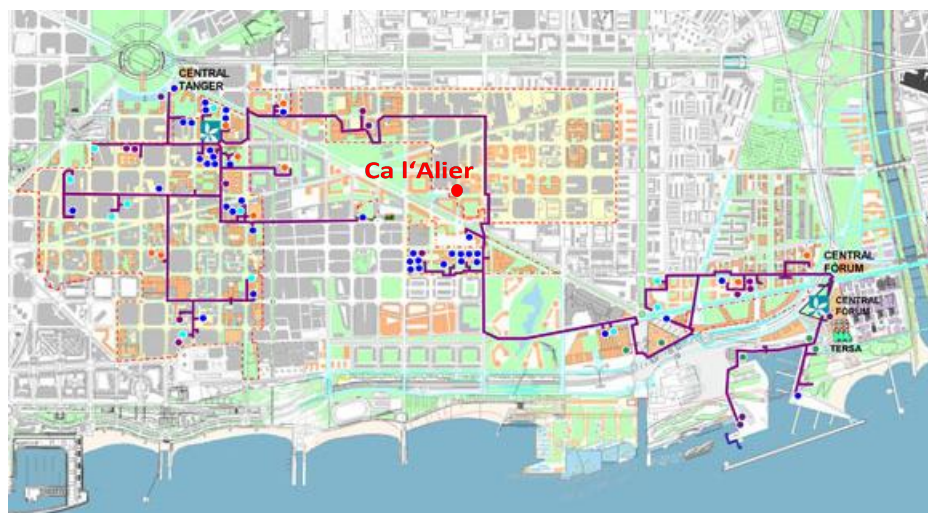


Figure 1: Districlima network in Barcelona 22@District and Ca l'Alie location

- Re-designation of an industrial building into an innovation center with a nearly zero net energy building (NZEB) criterion including an on-site electricity generation and a connection to District Heating and Cooling network.
- Innovative Public-Private Partnership to promote the concept of NZEB and serve as a reference for industrial building refurbishment in the city.
- The newly refurbished building will showcase the integration of an existing District Heating and Cooling (DHC) network including Photovoltaic (PV) generation.



Barcelona

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What is the solution?

Ca l'Alie will demonstrate the feasibility of a Nearly Zero Site Energy Use through a combination of photovoltaic power (85kWp), a connection to the district heating and cooling network that recovers heat from urban solid waste treatment plant, and the installation of an energy management system that is capable of optimising consumption as well as forecasting the building load. The existing DHC network in 22@District, DISTRICLIMA, will satisfy the heating and cooling demands of the building while the building's rooftop will be equipped with a photovoltaic installation.

How does it work?

The photovoltaic generator will be installed on the rooftop, trying to maximise architectural integration with minimal loss of system performance. The conventional grid connection will be carried out in three-phases, with the inverters feeding each phase. An energy meter will be installed at the entrance of the photovoltaic system in order to deduct any energy generated which could be consumed by the conventional grid.

At the design stage, installed power for cooling and heating is planned at 202kW and 126kW, respectively. The distribution network for heating & cooling will be installed beneath the street adjacent to the building. A room in the building's basement has already been considered in the building's design to enable the system to be connected to the primary circuit of the Districlima network. This room would include the building-owned substations and the secondary circuit. The installation will be composed of four pipes and the pumps will be able to perform at variable flowrates.

The district heating and cooling network of Districlima has a cooling capacity of 31 MW and a heating capacity of 20 MW. The vast majority of heat and cold production is based on the use of the steam produced from the incineration of municipal waste (MSW) in the nearby treatment plant TERSA. Thus, fossil energy consumption is minimised, avoiding 5,253 tons per year (2008 data) of CO₂ emissions.

The remaining cooling production is carried out in electric chiller machines cooled by seawater. Consequently, high yields are reached and the installation of cooling towers is avoided (eliminating the risk of Legionnaires' disease). This water is collected from the nearby Port Fòrum and is returned to the sea through a manifold, with virtually no environmental impact.

The system is completed by a buffer tank of cold water of 5,000 m³ which stores cold overnight and disperses it throughout the day. Hot water is supplied at temperatures over 90°C and returns at 60°C, while cold water is supplied at a temperature between 4 and 5°C and returns at about 14°C.

Business Model Used

Barcelona promoted this refurbishment in a public-private partnership with technological multinational companies in order to reactivate the 22@district and promote it as a research and development platform for new market opportunities in the domain of smart cities.

Integration with other smart solutions

The system is integrated with Measure 1.1: Efficient and smart climate shell and equipment refurbishment in Ca l’Alier. This measure’s main aim is the refurbishment and conversion of an industrial building into an innovation centre. The current measure will be part of the building refurbishment and will integrate existing DHC network including PV generation.

This solution also integrates Measure 4.2 “Resource Advisor”, through which a platform will be developed to visualise the energy data of low energy district actions implemented in Barcelona.

Expected Impact

The Districlima DHC network commonly uses waste energy sources (municipal solid waste or alternatives) coupled with energy-efficient equipment to reduce the consumption of fossil primary energy for heating and cooling production compared to conventional technologies.

The first impact is therefore the reduction of CO₂ emissions during heating and cooling generation for the Ca l’Alier building, compared to traditional heating and cooling production.

Additionally, the PV power installed is planned to be 85,5kWp whereas the regulatory requirement is only for 21kWp according to the National Building Technical Code. This will lead to higher on-site electricity production from renewable energy sources.

By implementing passive energy saving measures through envelope and smart integrated local energy generation, the local area will be nearly self-sufficient with respect to thermal energy. The users (Tech Companies applying R&D activities) are expected to experience an

improvement in comfort, energy & economic savings, and power quality due to DER (Distributed Energy Resources) technologies. Moreover, the solution is expected to have an impact on stimulating atmosphere for R&D units of high Tech Companies, and will help boost their corporate image and reputation

Potential for replication

Replicability of this measure is based on the existence of offices, residential and social spaces that need to be refurbished or converted into useful spaces for citizens.

Stakeholders to be involved are tech companies, public administration, citizens and neighbourhood associations willing to transform the district to reach nearly zero total consumption from the grid. Public-private partnership as a funding strategy is in this case based on the city strategy itself.

The combination of technologies such as solar energy and the use of a connection to the high energy efficient district heating and cooling network contribute to reach nearly zero net energy sites.

About GrowSmarter

GrowSmarter (www.grow-smarter.eu) brings together cities and industry to integrate, demonstrate and stimulate the uptake of '12 smart city solutions' in energy, infrastructure and transport, to provide other European cities with insights and create a ready market to support the transition to a smart, sustainable Europe.

GrowSmarter project partners



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