

Madrid, Spain

Energy efficiency and maximum comfort

When the 89 apartment project in the Spanish capital got the green light, the starting point was the need for a highly energy-efficient air conditioning system that would provide maximum comfort.

Key facts

Building

Location	<i>Madrid, Spain</i>
Construction	<i>2007</i>
Heat distribution	<i>underfloor heating air conditioning</i>
Heated space	<i>89 flats</i>

Heat pump and source

Number of	<i>10</i>
Operation mode	<i>Monoenergetic</i>
Heat source	<i>ground</i>
Power installed	<i>500 kW</i>

Heating and cooling system

DHW Tanks	<i>2</i>
Size	<i>5000l each</i>
Function	<i>Evaporator of geothermal system for cooling</i>

Cooling buffer Storage	<i>4000l</i>
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Other information

Coefficient of Performance	<i>4.7</i>
Refrigerant	<i>R407c</i>
Duality	<i>Cooling and heating simultaneously possible</i>

Cost

Drilling	<i>480.000€</i>
Technical room	<i>450.000€</i>
Underfloor heating & fancoils	<i>400.000€</i>

Lessons learned

- Initial costs of the construction are higher than with traditional systems but that is more than compensated during the Use Phase



When the 89 apartment project in the Spanish capital got the green light, the starting point was the need for a highly energy-efficient air conditioning system that would provide maximum comfort.

This led to the choice of a geothermal system with low levels of total energy. Vaillant's extensive experience in this technology meant it could confidently propose highly efficient solutions and high quality, reliable material.

To achieve the desired level of efficiency, geoTHERM VWS 460/3 geothermal generators were proposed (totalling 500 kW in generation), with a four-pipe generation scheme, which means the system can provide cooling and heating simultaneously to different areas of the building on demand.

It was also necessary to install underfloor heating, which is the best way to achieve high levels of comfort and efficiency.

Vaillant completed the system with four energy buffers for storage (one for heat, one for cold and two for domestic hot water), all controlled with a Vaillant management panel.

The cooling buffer storage, with a capacity of 4,000 litres, is sufficient to cover the cooling demands in Madrid, given the low humidity of the area in summer. On the other hand, maximum use is made of the borehole temperatures to cool as much as possible in this way without the need to use the geothermal generators.

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Description of the technical concept

The heat buffer storage, with a capacity of 4,000 litres, sufficient to cover the heating loads by fan coils and at a temperature of 35-45°C, which allows a high performance of the generators.

The domestic hot water accumulator, with two tanks of 5000 litres capacity each, was designed to accumulate sanitary water at low temperatures. During the cooling season the domestic hot water load is reduced to practically zero since when there is a cooling demand, the domestic hot water demand is met for free. This is because the domestic hot water storage works as the evaporator of the geothermal system for cooling output. The system is based mainly on transferring heat from one storage tank to another, thus achieving considerable energy savings.

The generation power needed to cover the system demand is distributed in 10 high efficiency Vaillant VWS 460/3 geothermal generators, sized in such a way that they will start and stop depending on the demand and alternating so that each one of them has the same operating hours.

Therefore, even if the hot water demand is covered, 10 generators are available to cover the heating demand.

Having addressed the energy supply for air conditioning the houses, the developers' attention turned to the issue of ventilation. A ventilation system with double-flow air recovery was chosen. An autonomous controlled mechanical ventilation system with heat recovery per dwelling, with air outlet from kitchens and bathrooms and supply to bedrooms and living rooms.

This project is a pioneer in Spain for integrating energy efficiency systems into high-rise residential buildings, achieving consumption levels well below those usually achieved in the standard construction of this type of buildings. While the initial cost is higher than in traditional systems, the low consumption generation system, and a solution for heat recovery in ventilation more than make up for it.

Pictures: ehpa - <https://www.ehpa.org/news-and-resources/publications/heat-pumps-and-high-rise-homes-case-studies-from-across-europe/>