Dinetard student residence, Toulouse, France

A new student residential building heated by air source gas absorption heat pumps for space heating and solar support for domestic hot water, monitored.

Key facts

Building

Location	Toulouse, France
Construction	2015
Heat distribution	in building
Heated area	2200 m² living
Level of insulation	High

Heat pump and source

Number of heat pumps	2
Installed capacity	35 kW
Operation mode	monoenergetic
Heat source	Outside air
Brand and type	France-Air - Xinoé, developed by ROBUR
Refrigerant	NH3/water
Sound level	54 dB

Heating system

Heat demand	
Heating temperature	45°C

Domestic hot water

Type of system	
Max. Temperature	°C
Circulation system	
Legionella measures	Thermal
Storage size	2 x 1,500 litres
Number of storage tanks	2
Storage losses	unknown
Temperature control	

Other information

Electric energy	
Consumption year	kWh
Investments costs	unknown
Solar thermal	42 m²

More information/similar projects

- 87 apartments in Annemasse
- Résidence Lyautey et Poncaré in Malauney
- ROBUR information

The Dinetard student residence is located in Toulouse (31). Called 'La Coulée verte' because of its proximity to the green area of Argoulets, it is made up of 119 T1-type student accommodation , including 7 studios on the ground floor suitable for people with reduced mobility, a l T4 type accommodation for the caretaker and several common rooms (work rooms, laundromat, etc.). The building has a total area of 2200 m² on R + 3 and today it reaches the Very High Energy Performance level of RT2005.

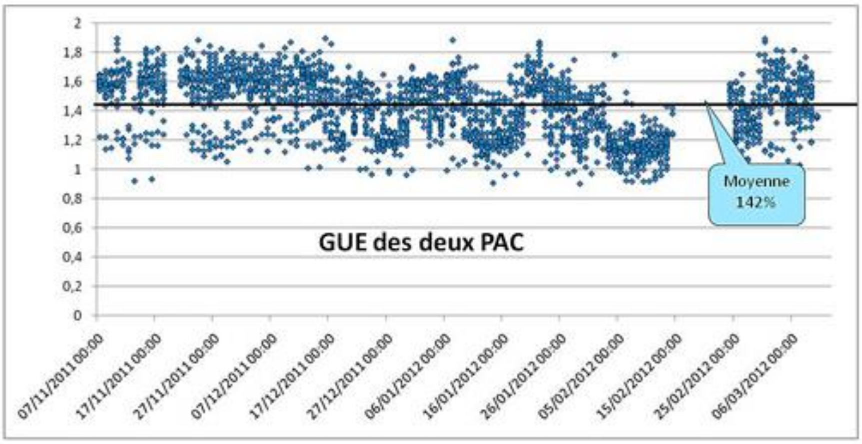
The solution chosen: condensing boiler, solar thermal & aerothermal gas absorption heat pump.

Three different configurations were studied by the Atmosphere fluids BE, in comparison with a reference solution with an efficiency of 95% PCI (excluding DHW), which would have been composed of two condensing boilers with a power of 110 kW, of which one exclusively dedicated to domestic hot water. By adding one, then two and then three absorption heat pumps, these simulations made it possible to show that the technical and economic optimum for this residence was a solution composed of two heat pumps.

The building is heated by an installation composed of:

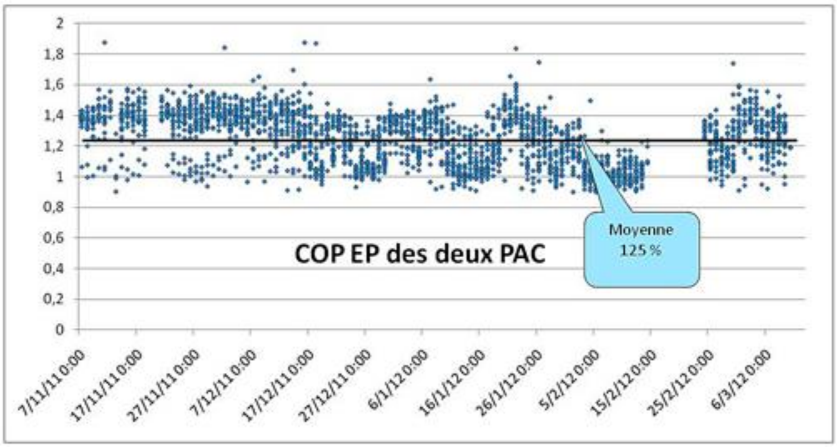
- Two heat pumps (PAC) with natural gas absorption, with a nominal heating power of 35 kW each, which only come into play for heating.
- A condensing boiler . The back-up by the boiler starts as soon as the heat pumps are no longer sufficient to supply the energy needed to heat the building.

MONITORING RESULTS



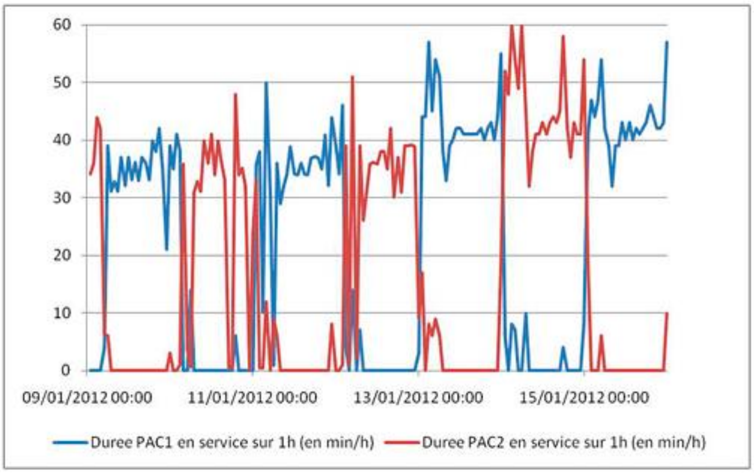
The GUE (or COPgaz, measuring the efficiency of the heat pump through the ratio between the production of heating or air conditioning and the associated natural gas consumption) measured was 1.42 on PCI , i.e. a production yield of 142% PCI for an emission temperature varying between 40°C and 45°C without apparent water law contrary to what had been recommended. The graph presents the evolution of the GUE over this winter 2011-2012. The outside temperatures varied from 0°C to 13°C with an average of 8°C.

AUXILIARY CONSUMPTION Like the boiler, the heat pump is equipped with electrical auxiliaries for its operation:



- Circulation pump.
- Fan.
- Remote control.

For this installation, they consume 13% of the total energy consumption, relatively constantly. The graph shows the COP on primary energy (COP EP), i.e. the relationship between the production of heating and the consumption of gas and electricity brought back into primary energy. On this installation, the electrical auxiliaries impact the overall performance of the heat pump, with a COP on primary energy of the order of 125% on PCI. The manufacturer has been made aware of this and today already offers pumps and auxiliaries (notably fans) that consume less energy.



LESSONS FROM THIS INSTRUMENTATION CAMPAIGN
This measurement campaign proved to be useful, since it highlighted that the regulation did not give the PACs time to express themselves. The installation in fact caused the boiler to start before the second heat pump had time to start.

This graph shows that the two heat pumps (one in red, the other in blue) do not work at the same time while the boiler is on. This regulation setting has since been modified, but this example illustrates the sensitivity of regulation in today's installations. Only instrumentation like this could identify this problem. As the regulation was initially set up, the second heat pump was useless. The suppliers of this machine were therefore strongly sensitized on this point for their actions during the commissioning of the machine: making the right initial adjustments, awareness of the installer and operator.

Dinetard student residence, Toulouse, France Technical details

Roof-top absorption heat pumps, storage tanks in basement and solar collectors.

Description of the technical concept

Domestic hot water is provided by an installation consisting of:

- 42 m² of flat solar thermal panels on the roof of the building, which provide DHW preheating.
- The condensing boiler in support.
- Two buffer tanks of 1,500 liters each for storage.
- A semi-accumulation type system of two 1000 liter tanks for production.

The installation was dimensioned according to the total losses of the building, calculated according to standard EN12831, which represent 140 kW. The free contributions (internal and external), calculated according to the Costic method, represent 20 kW, with a free heat recovery efficiency of 0.95. The establishment's set temperature has been set at 19°C; the radiators operate at a temperature of 65/50°C.
To size the solar installation, in a building sparsely inhabited during the summer school holidays, the design office based on an occupancy rate of the residence of 30% during the months of July and August. This rate is the result of the experience of Crous, which manages many student residences.

Site monitoring has made it possible to quantify the performance of the installation in terms of occupant comfort by measuring the temperatures and humidity of the premises in winter. During the months of January and February (the two coldest months of this winter 2011-2012), an average temperature of 22.3°C was measured with a humidity of around 40%. The atmosphere was therefore comfortable over the entire period of instrumentation.

The system consisting of the gas condensing boiler and the gas absorption aerothermal heat pump provided heating services over the entire period : the availability rate was in fact 100%.