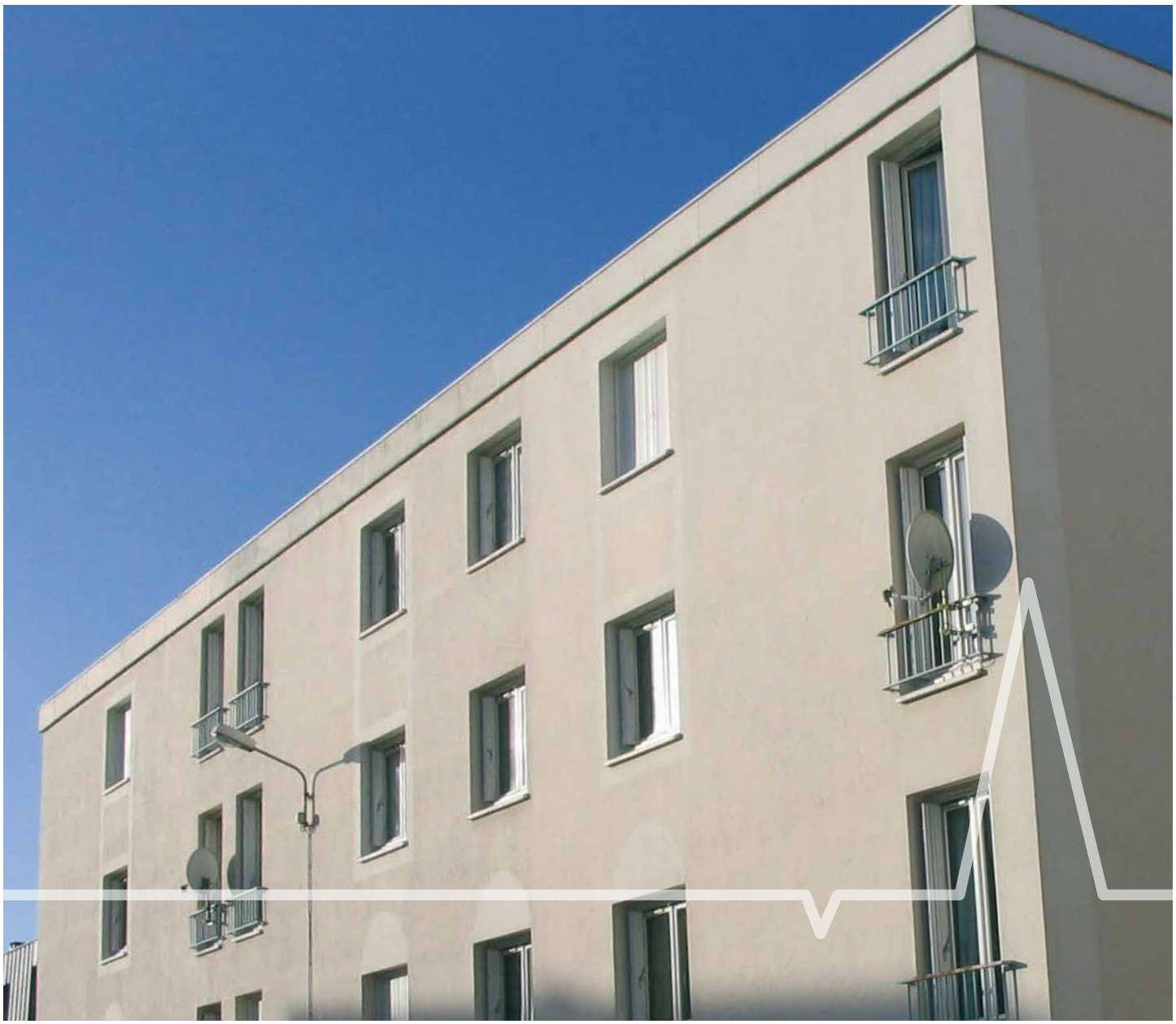
AERECO

hr·vent
hybrid residential ventilation nangis monitoring

MONITORING OF AN INNOVATIVE HYBRID VENTILATION SYSTEM IN OCCUPIED HOUSING

RESULTS OF THE HR-VENT STUDY



An operation carried out in partnership with:

ADEME
GIE ACTHYS
CSTB le futur en construction
SOCOTEC
Groupe Logement Français
Gaz de France

HR-VENT:

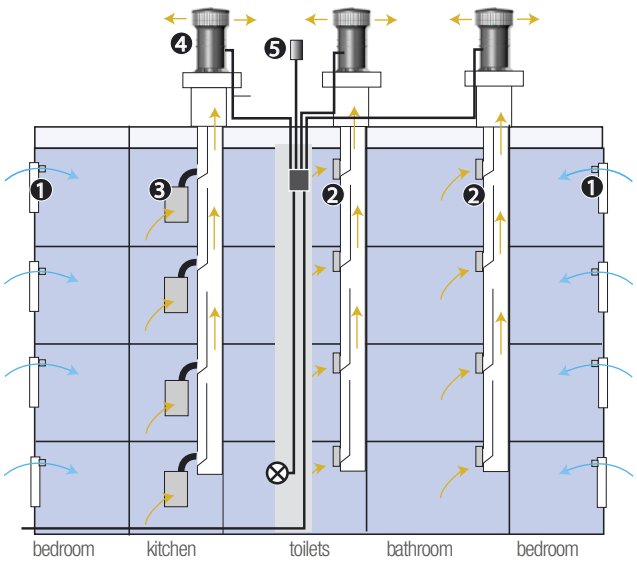
two years of measuring of hybrid ventilation in occupied housing

Realised in France in Nangis (Paris area), HR-VENT is an experimentation in occupied housing whose exceptional character lies in its size as well as in the implemented measuring tools.

With more than 700 million values recorded during two years out of 55 dwellings representing 5 buildings, the experimentation has been the opportunity to measure the efficiency of a new concept: a natural humidity sensitive ventilation system assisted by a low pressure fan with intermittent operation. This study also contributed to improve the knowledge of how passive stack and hybrid ventilation work in collective housing. From January 2004 to December 2005, relative humidity, temperature, pressure and extracted airflow values were recorded each minute in each wet room of each dwelling using specifically developed sensors.
In connection with weather data, these measurements have shown the performance of humidity sensitive ventilation the contribution of mechanical assistance. **They also determined the capacity of hybrid ventilation system to improve indoor air quality and to control thermal losses.**

Carried out in collaboration with major French institutional partners such as the CSTB and Gaz de France, thanks to ADEME financial support, HR-VENT opens the door to the development of innovative ventilation solutions for residential buildings.

Ventilation system and measurement tools



Fresh air is admitted by the humidity sensitive air inlets (1) located above windows in bedrooms and living rooms. The polluted air is evacuated in toilets and bathrooms through humidity sensitive extract grilles (2), and by the damper of the gas appliance connected in kitchens (3). Ducts are linked to a low pressure assistance fan (4) whose operation is depending on temperature. A thermostatic probe (5) manages the fan control as per outside temperature.

In each building, each stack of the dwellings was installed with measuring equipment in order to monitor every minute the pressure parameters, opening section of extract grilles, temperature and humidity in wet rooms. In kitchens, the operation of the connected gas appliances was measured by the combustion product temperature.

Information was stored in a database.

AN EXTRACTED AIRFLOW AUTOMATICALLY ADAPTED TO THE NEEDS

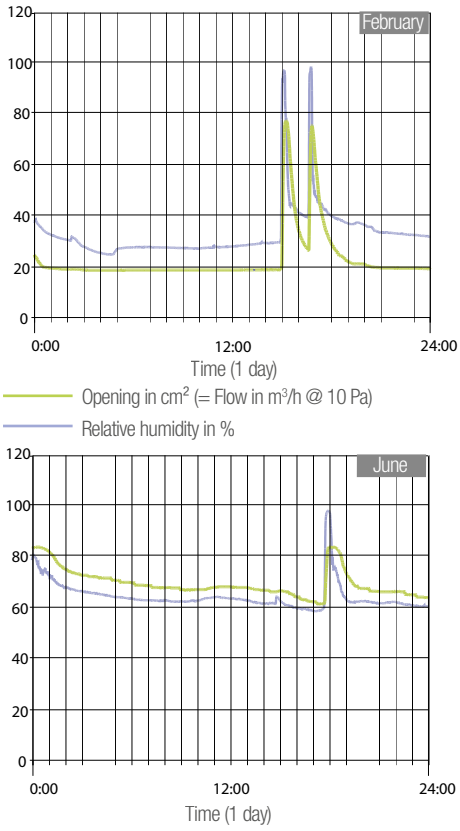


Figure 1: Instantaneous sight over one day of the opening and the indoor relative humidity variation of a humidity sensitive extract grille in the bathroom, over 2 different climatic periods.

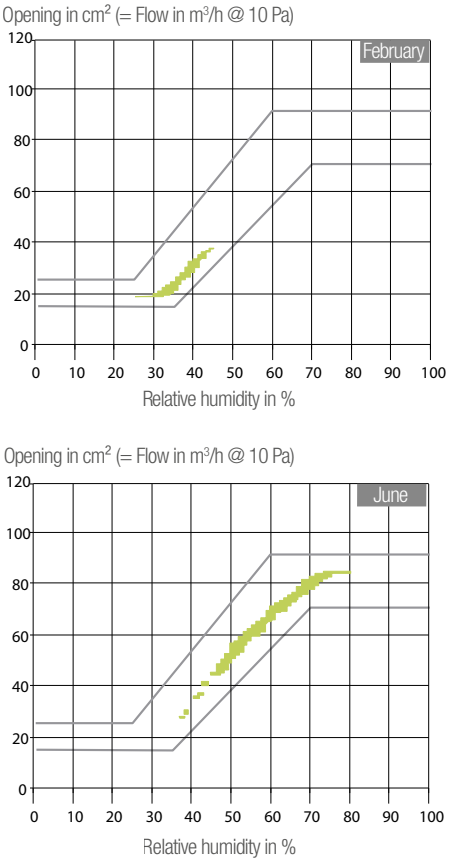


Figure 2: Statistical sight over one month of the opening according to the indoor relative humidity of a humidity sensitive extract grille in the bathroom, over 2 different climatic periods.

Note: This statistical representation corresponds to cases without humidity production inside housing. The grey curves represent product tolerances.

As stated on graphs of Figure 2, **the average opening of a humidity sensitive ventilation extract grille depends on the season:** it is low in cold season and shifts towards a stronger opening as the season becomes hotter, reflecting the seasonal evolution of absolute external humidity during the year (low in winter, strong in summer).

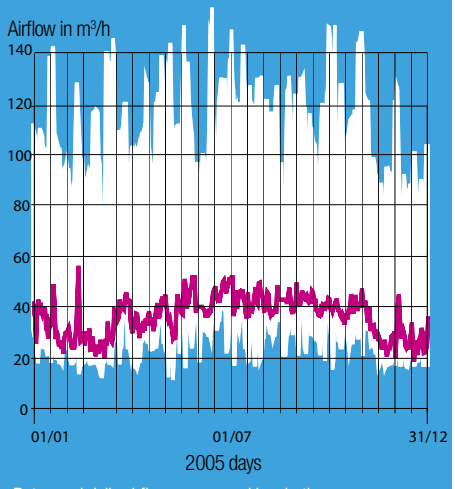
If the average airflow depends on the season**, the instantaneous airflow follows the specific variations of relative humidity in the room,** as shown in graphs of Figure 1, and this whatever the season. Taking a shower, in summer or in winter, increases rapidly the indoor relative humidity rate which boost the grille open for a few minutes, long enough to evacuate the excess of humidity.

With a statistical average airflow limited in winter, the humidity sensitive ventilation system considerably reduces the impact of ventilation on energy, but remains able to boost the airflow when requested.

A strong modulation for a greatly reduced average airflow

With a typical variation amplitude of 90 m³/h each day, we can observe on the graph opposite the great capacity of humidity sensitive grilles to modulate airflows. But because the periods with strong airflow are occasional (mainly corresponding to shower or bath periods), **we can note that the average airflow is very close to the daily minimum airflow.**

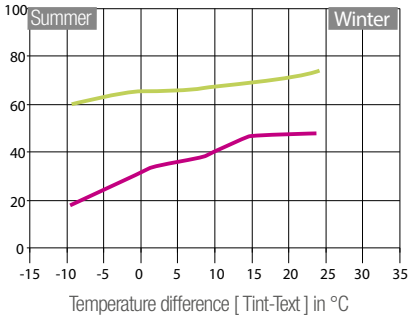
So, important instantaneous airflows ensure indoor air quality, without having negative impact on the energy consumption.



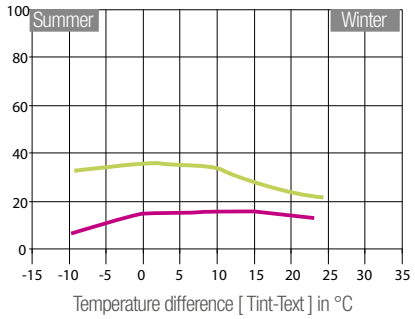
Rates and daily airflows measured in a bathroom over the year 2005

INCREASED AND STABILIZED AIRFLOWS THANKS TO LOW PRESSURE MECHANICAL ASSISTANCE

Average airflow of a CONSTANT airflow grille in m^3/h



Average airflow of a HUMIDITY SENSITIVE grille in m^3/h



Statistical evolution of the average airflow measured according to the temperature difference [Tint-Text] in all the dwellings.

Working fan
Switched-off fan

Results show that the low pressure mechanical assistance eradicates any risk of reverse airflow, in particular in summer when the risk is the most important. The mechanical assistance also showed a capacity to control automatically the effect of thermal draught, as shown in the graphs opposite. On the «working fan» curve, we can note an increase in the average airflow of 30 m3/h in the case of constant extract unit, 20 m3/h in the case of humidity sensitive grille, and also an attenuated variation of amplitude according to the season. **The contribution of the mechanical assistance is indeed stronger in summer than in winter,when its interest is the most important.**

Main results on passive stack and hybrid ventilation

Measurements carried out within the Nangis site confirmed the performances of the humidity sensitive ventilation system, in particular its capacity to improve indoor air quality, to decrease condensation risks and to limit thermal losses. Its stabilizing role has been highlighted: **it attenuates airflow imbalances between floors and limits airflow variations over the year by offering a real control of the natural «engines» (wind and stack effect)**. The mechanical assistance optimizes passive stack ventilation performances: with a consumption of only 5 W by housing, **the fan increases the pressure levels and thus ensures healthy airflows all year long, and avoids reverse airflow.**

Coupled with humidity sensitive ventilation, the low pressure mechanical assistance optimizes the use of natural forces: average airflows are limited in winter, contributing to **energy savings**, and positive
airflows are assured all year, in particular in hot season. In case of renovation, the hybrid humidity sensitive ventilation system offers comparable airflows with those required by the French regulation for new buildings.

The HR-VENT experiment received the ADEME (French Environment and Energy Management Agency) financial support for the program «Préparons le bâtiment à l'horizon 2010» (Building 2010). The study results were the subject of a CSTB report written in collaboration with Aereco (n. DDD-DE-VAI 06-054R).

AERECO

62 rue de Lamirault – Collégien – 77615 MARNE LA VALLEE CEDEX 3 – FRANCE
tel. +33 1 60 06 26 63 – fax +33 1 64 80 47 26 – www.aereco.com

FLY302GB_HR_VENT_v1