THE MODEL HOME 2020 PROGRAMME

Six buildings to explore if it is possible to build healthy and sustainable buildings for the future – today. 2009-2016

Home for Life (DK)
Licht AktivHaus (D)
Green Lighthouse (DK)
Maison Air et Lumière (F)
Sunlighthouse (A)
Carbon Light Homes (GB)
POST-OCCUPANCY EVALUATIONS AND MONITORING

Continuous hourly measurements in each room:
- Temperatures
- lux
- Humidity
- CO₂-level
- Energy production and consumption
- Position of windows and solar shading

Post Occuany Evaluations by anthropologists

KEY RESULTS FROM MODEL HOME 2020

- Having many large windows doesn’t necessarily lead to overheating
- Plenty of daylight eliminates your need for artificial lighting during the day
- Moderate bedroom temperatures ensure a good night’s sleep
- Good ventilation lowers the temperature during the night
- Solar screening protects your home from overheating

- To get the full effect, you need intelligent automation
- Natural ventilation provides good indoor air quality during large parts of the year
- Mechanical ventilation in combination with natural ventilation allows an automated switch between modes
- Good air quality in the bedroom can require targeted measures
- Kindergartens and schools benefit from scheduled, natural ventilation
MODEL HOME 2020: MAISON AIR ET LUMIÈRE

It was possible to keep the indoor temperature below the outdoor temperature during daytime.

Indoor temperature was typically 5-8°C lower than without ventilative cooling.

During the summer heat wave the outside temperature reached 32°C, but inside we had a bearable temperature of 26°C thanks to the awnings.

At night the house quickly cooled down when windows at ground floor level and roof windows were opened to create a flow of cool night air through the house.
HIGH AIR FLOWS WITH VENTILATIVE COOLING CAN BE MEASURED AND CALCULATED

- Good correspondence between measured and simulated air change rate in main room in summer
- Air change rates between 10 and 23 ACH

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Max 30% difference per case, 10% difference in average

MEASUREMENTS PERFORMED ON A SUMMER DAY IN MAISON AIR ET LUMIERE BY ARMINES IN FRANCE IN COOPERATION WITH VELUX

HIGH DAYLIGHT LEVELS WITHOUT OVERHEATING

Daylight factor in all main rooms: 5% average
Almost all main rooms achieve EN 16798-1 category 1 for summer comfort
MODERATE BEDROOM TEMPERATURES

Bedroom room LichtAktiv Haus

Approximate bedtime

Approximate sleep time

Month

Hour

Green squares: Hours in category 1
Yellow -> red squares: Hours above category 1
Grey -> blue squares: Hours below category 1

FREQUENT USE OF VENTILATIVE COOLING

Cat 1 or 2, windows closed
Cat 1 or 2, windows open
Cat 3 or 4, windows closed
Cat 3 or 4, windows open

Category refers to Active House / EN 16798-1 category “Open window” if one or more windows are open in the room
SOLAR SHADING IMPORTANT

AUTOMATION IS ESSENTIAL

Automated solar shading and window openings were used frequently during work-hours on weekdays, and during the night

... e.g. at times when the families cannot be expected to be able to operate the products themselves

The indoor climate could not have been achieved with only manual products.
RenovActive
Replicable and affordable renovation of run-down social housing in Bruxelles
**RenovActive - the 7 elements**

- **Growing from within**
- **Daylight treatment**
- **Respiratory channel**
- **3rd skin**
- **Hybrid breathing**
- **Envelope upgrade**
- **New life space**

**Challenge: Overheating RenovActive elements**

- **3rd skin**
  - Use sun screening to prevent the building from getting too hot.
  - Equip windows with automated sun screening.

- **Envelope upgrade**
  - For better thermal comfort, keep your home cool in summer.
  - Some glasses can protect you from sun gains.
  - Ensure you have well insulated windows, walls and roof so you keep the heat outside.

- **Hybrid breathing**
  - In summer, prioritise natural ventilation. In winter, combine natural and mechanical ventilation.
  - Use automated cross-ventilation and stack effect to increase ventilation rates.

- **Respiratory channel**
  - Use automated ventilative cooling to cool the building when too hot.
  - To do so efficiently, you may want to place the staircase in the center of your home, with 1 or 2 roof windows over it.
Ventilation of RenovActive

- Ventilation system in RenovActive (Renson HealthBox):
  - Ventilation system C (extract ventilation)
  - Natural supply vents above the windows
  - Extraction by fan
  - Automatically controlled window openings.

- The switch between hygienic and peak ventilation is controlled based on indoor air quality and in order to prevent overheating.
The temperatures in the house stay for more than 95% of the time between 21°C and 26°C (e.g. similar to category II of EN 16798-1).

The attic has slightly higher values, but stays under 28°C, after improved staircase- and attic-window openings.

- Added new solar shading
- Added VELUX Active
- We encouraged the family to use cross ventilation in the attic to reduce peak temperatures.

During the 2018 hot spell, the indoor temperatures were too high, and the automatic system did not resolve this, but could have been improved by ensuring cross-ventilation operation.
**Temperature in the living room**

- **Winter 1**
  - ventilation by: pivoting windows, fan extraction
- **Winter 2**
  - ventilation by: natural supply vents, fan extraction

**Temperature in RNA during a Hot Spell**

- Attic
- Staircase
- Living
- Parents
- Kids
- Outdoor

Temperature (°C)
Controlled windows for ventilative cooling

Best practice examples of residential ventilative cooling

AIVC & Venticool webinar on December 9, 2020
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Bringing light to life™

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