

Opportunities and challenges for ventilative cooling solutions in compliance frameworks.

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QUALICHeCK QUESTIONS

- ? how to improve the reliability of the input data used to issue Energy Performance certificates;
- ? how to improve the quality of the works;
- ? how to take into account innovations in a compliance framework.

VENTILATIVE COOLING

CONTENT

- ▶ Definitions
- ▶ Main opportunities
- ▶ Main challenges
- ▶ Legal stuff
- ▶ A case
- ▶ Way forward
- ▶ Conclusion and outlook

What is ventilative cooling?

- Ventilative cooling refers to the use of ventilation strategies to cool indoor spaces by means of outdoor air.
- Ventilative cooling is relevant in a wide range of buildings and may even be critical to realize renovated or new NZEB.
- Effect of ventilative cooling depends strongly on the air change rate: Large rates are important

MAIN OPPORTUNITIES/MOTIVATIONS

- Very well insulated
- Very airtight



- Low heating demand

- Overheating

- Need for cooling

Air condition:

Air conditioners use about 5% of all the electricity produced in the US, at an annual cost of more than \$11 billion to homeowners [*]

Air conditioning units for post-mounting are available in any DIY store in Europe

#Chillers in buildings are expected to double next 10-15 years

Ventilative cooling

Ventilative cooling can eliminate or bring down significantly the need for mechanical cooling

Ventilative cooling shall work together with other passive cooling techniques such as the thermal mass of the building and solar protection.

MAIN CHALLENGES

- ▶ Forgotten (though ancient) simple technology
- ▶ Lack of simple-to-use evaluation tools
- ▶ Lack of focus in the design process of buildings
- ▶ **Lack of integration in most building regulations**
- ▶ **Lack of integration in most simple-to-use compliance tools**

- ▶ **FIRST MAIN CHALLENGE FOR VENTILATIVE COOLING IS NOT TO COMPLY – IT'S ACTUALLY TO BECOME PART OF THE COMPLIANCE SCHEME**
- ▶ **SECOND IS TO DEVELOP THE GOOD EVALUATION METHODS**
- ▶ **THIRD, THE RIGHT PRODUCT SOLUTIONS AND THE RIGHT CONTROL - ALREADY AVAILABLE BUT IMPROVEMENTS CAN BE MADE**

Ventilative Cooling in Building Regulations, April 2015

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Rough evaluation:

- Few countries have a structured method for ventilative cooling in regulation & compliance tools

THREE TYPICAL GROUPS:

- Nothing
- Simple guidelines: "access to operable windows"
- Fixed (low) ACH for ventilative cooling
- Crucial lack of fair evaluation of ACH with "window airing" in present EN standards

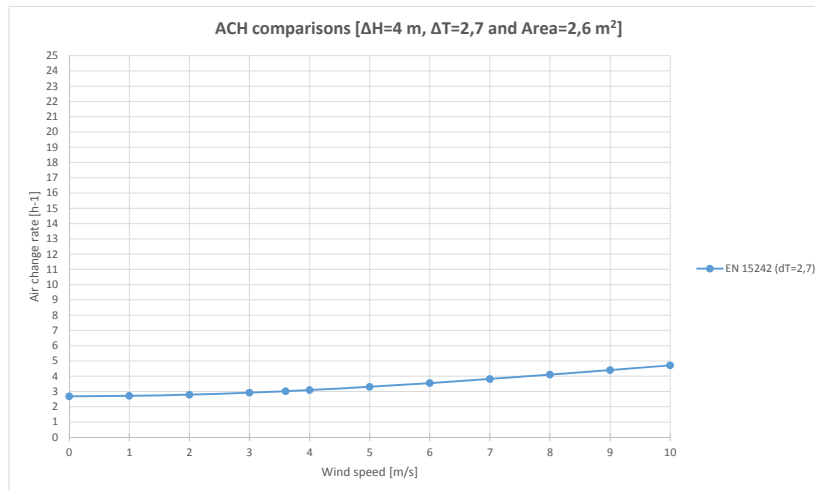


VC included in national compliance tools:

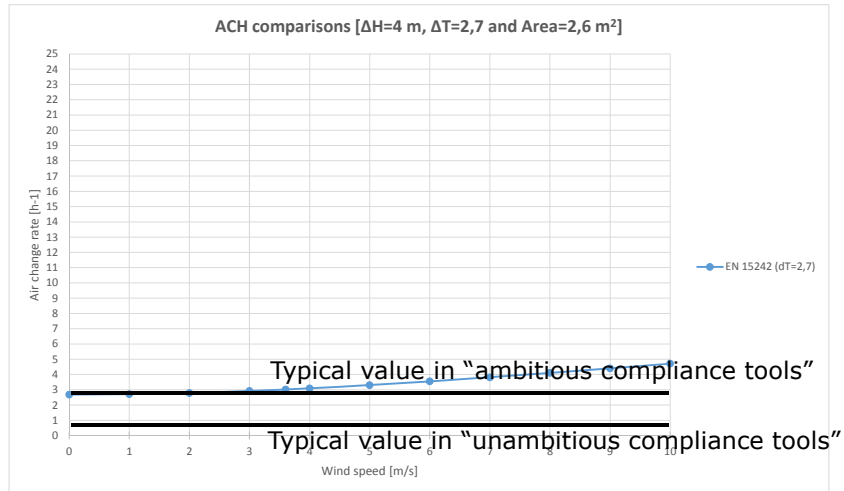
- Very simple, under estimates NV
- Simple, more fairly treated ?

Standard ACH single sided ventilation

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Standard ACH in compliance

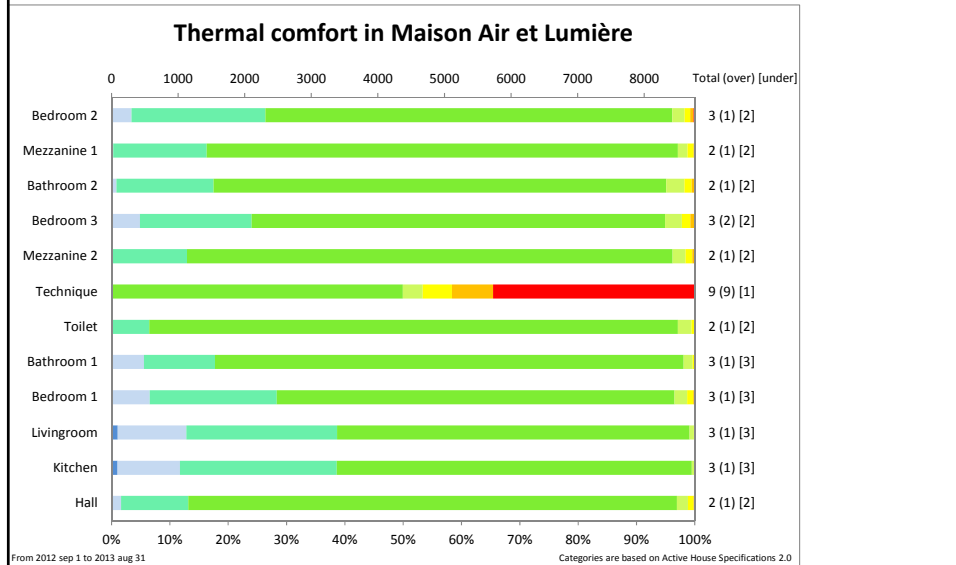


ONE CASE of many cases



Situated near Paris, 135 m² Active House,
 Automated operation of windows, shading etc,
 Window-floor ratio 33%
 Comprehensive monitoring programme

Adaptive thermal comfort Active House Specifications



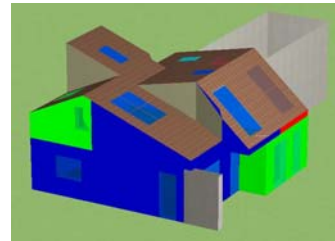
- ▶ Ventilative cooling really works in practice
- ▶ What about the theory?

Theory and practice

Multi-zone simulation of airflows using CONTAM

Multi-zone dynamic thermal simulation of indoor air temperatures using French tools PLEIADES + COMFIE

Tracer gas measurements of Air change rate

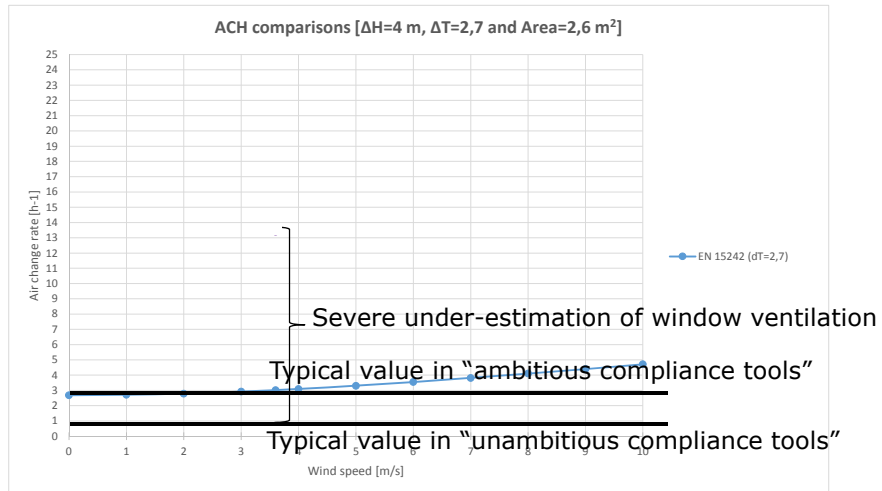


ACH measured & simulated

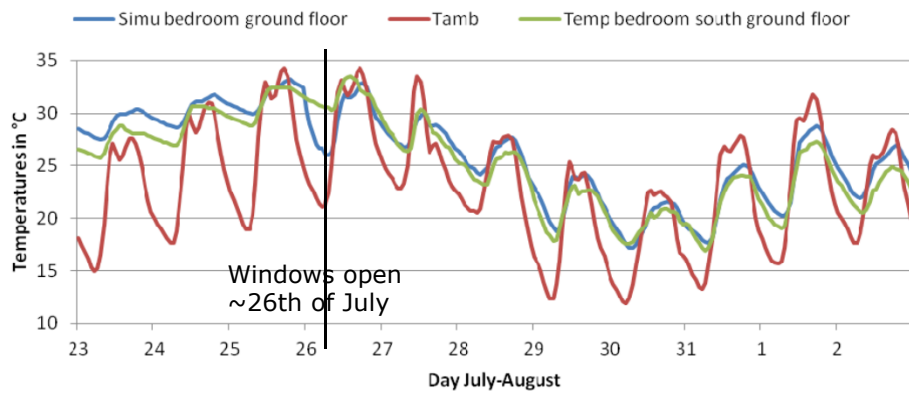
		South bedroom temp	North bedroom temp	Bath room temp	Wind speed m/s	Tracer Gas ACH	Simulated CONTAM ACH
Morning	Closed door	23.7	21.3	22.5	3.6	13.4	13.9*
	Open door	23.7	21.3	22.5	2.8	22.5	20.6
Afternoon	Closed door	27.1	26.5	26.2	2.3	13.2	16.6*
	Open door	27.1	26.5	26.2	2.3	19.8	19.5
Morning	Closed door	24.2	22.5	23.3	3.6	13.4	14
	Open door	24.2	22.5	23.3	3.6	14.6	17.4
Afternoon	Closed door	26.5	25.2	25	2.9	10.6	13.2
	Open door	27	26.1	25.6	2.8	13.1	17

Good correspondence between measured and simulated air change rate – max 30% difference per case, 10% difference in average.

Standards vs measurements

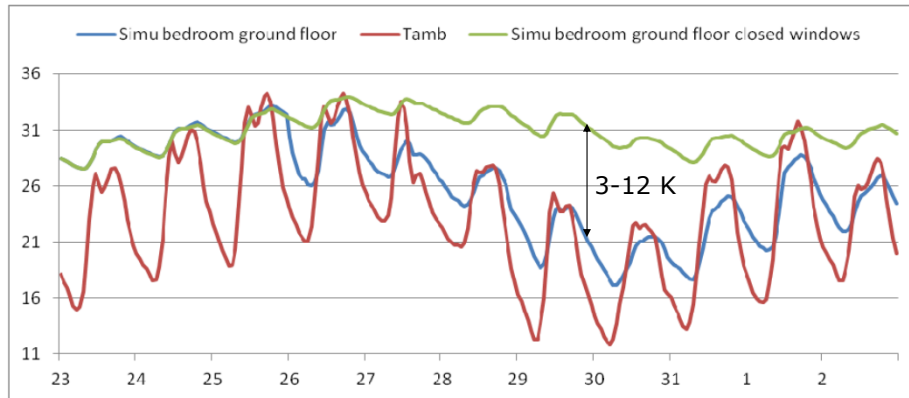


T_i measured & simulated



Good correspondence between measured and simulated indoor air temperature (~1 K difference in average)
Good dynamic correspondence

Effect of ventilative cooling



Simulated indoor air temperatures of the ground floor bedroom.
Green: No ventilative cooling
Blue: With ventilative cooling via constant windows opening from 26th of July.
Red: Ambient temperature.

LEARNINGS FROM VELUX MONITORING PROJECTS

- ▶ how to improve the reliability of the input data used to issue Energy Performance certificates;
- ▶ how to improve the quality of the works;
- ▶ how to take into account innovations in a compliance framework.

Main reasons for deviations between predicted and realized performance (prioritized):

1. User pattern differs from predicted
2. Component "errors" (incl unrealistic test methods)
3. Construction errors

CONCLUSION

- ▶ how to improve the reliability of the input data used to issue Energy Performance certificates;
- ▶ how to improve the quality of the works;
- ▶ how to take into account innovations in a compliance framework.

- ▶ **BASE COMPLIANCE ON
REALISTIC PHYSICS,
REALISTIC USER BEHAVIOR
AND EXECUTE WELL**

Thank you for your attention

