ENERGY LOSS DUE TO VENTILATION : IMPACT OF AVERAGE VALUES AND SIMPLIFICATIONS ON CALCULATIONS

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INTRODUCTION

The project of CEN Standard from the Ventilation for dwellings group TC156/WG2/AH4 [1] for airflows calculations is being submitted to enquiry.
This method can be easily compared to AIVC guides to calculate the ventilation airflow (natural or mechanical) in a given status. Yet, for energy loss estimation, these airflows calculations must be done either hour per hour, either with average values and simplifications. The aim of this study is to determine the real influence of each parameter in AH4 calculations and the impact of the method on energy results of simplifications that could be made in.
We have modelised a four-storey dwelling building. On each floor, there are three flats.
The real building is situated near Paris but for the purpose of the study, we have simulated different sites in France.
Ventilation in the building was simulated to be either natural or mechanical (exhaust system) which were dimensioned according to French state of the art and regulations.

MAIN PARAMETERS INFLUENCING RESULTS IN NATURAL VENTILATION

As natural ventilation is more sensible to meteorological conditions, we have studied, for our building situated near Paris, in urban zone half-shielded, the most sensible parameters on energy loss due to ventilation.
A full calculation has been run for our building near Paris, with air tightness supposed equal to 1.2 m3/h/m2 ext. walls for each flat under 4 Pa, and detailed wind pressure coefficient (Cp) from AIVC [2]. This air tightness value is proposed in the project of new french thermal regulation. Then, we have run again calculations with one parameter modified and obtained the following differences of heat loss :

- Building Air Tightness : - 23%
  (from 1.2 down to 0.4 $m^3/h/m^2$ ext. walls for each flat)
- Without wind velocity correction : + 11%
- Wind orientation (from 0 to 360°) : ± 7%
- Weibull meteo file (*) : - 7%
- Shielding (from half to no shield) : + 2%
- Simplified Cp compared to AIVC detailed ones [2] : < 1%

(*) The Weibull meteo is a simplified file that gives wind occurrences each month and average temperature of the month.

INFLUENCE OF A SINGLE ZONE CALCULATION

Table 1 shows, due to stack effect in natural ventilation, the variation obtained from one floor to another.

Table 1. Ventilation loss

	Ventilation loss (kWh)	% to ground level
Ground level	12 412	--
1st floor	11 178	-10%
2nd floor	9 804	-21%
3rd floor	8023	-35%
Total	41 597	

In a simplified method, considering the whole building as a single zone, it would be quite probable to find out an average height of the building to obtain a correct result in global energy for the building. Yet, we must note that, if the energetic calculation is correct, average value does not show any difference between ventilation systems which induce more or less dispersion from one floor to another. A correct check on Air Quality is necessary.

INFLUENCE OF METEOROLOGICAL CLIMATE

For energy calculations, we use to consider in France, three main zones :

- H1 with continental climate, which is the largest one
- H2 in Oceanic part of France
- H3 near Mediterranean Sea.

Of course, in each zone, there are dispersions from on site to another. In the continental zone H1, we have noticed between different sites up to 10% difference on airflows in natural ventilation. This difference was, of course, most reduced (< 1%) in mechanical ventilation.

INFLUENCE OF INFILTRATIONS WITH MECHANICAL VENTILATION

For the same building with mechanical exhaust ventilation, the global average airflow calculated was 1104 m^3/h. As 1 058 m^3/h were extracted by the fan, infiltrations were about 4% of the fan airflow (Building air tightness was supposed 1.2 $m^3/h/m^2$ ext. walls).
Therefore, the influences of the parameters discussed above are reduced to 4% of the ventilation loss amount and simplification is much easier.

CONCLUSIONS

To calculate energy loss due to ventilation, simplified method may be applied. These simplifications induce some impact on results. Main parameters to be considered and chosen carefully are building air tightness, meteorological and site conditions and wind pressure coefficient (Cp).

REFERENCES

[1] CEN TC156/WG2/AH4 – "Calculation methods for the determination of air flow rates. in dwellings", 1998.

[2] M. W. Liddament – "A guide to energy efficient ventilation" – AIVC Guide, March 1996.