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Better implementation of ventilative cooling (cooling of buildings using outside air as main source) in national building standards, legislation and compliance tools

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SUMMARY

Low energy buildings are highly insulated and airtight and therefore subject to overheating risks, where Ventilative cooling (VC) might be a relevant solution. VC is an application (distribution in time and space) of air flow rates to reduce cooling loads in spaces using outside air driven by natural, mechanical or hybrid ventilation strategies. Ventilative cooling reduces overheating in both existing and new buildings - being both a sustainable and energy efficient solution to improve indoor thermal comfort (State-of-the-art-review, Kolokotroni et al., 2015). VC is further an important topic supported by the International Energy Agency (IEA) - where the IEA Annex 62 has had a special focus on this area.
One of the tasks of IEA Annex 62 has been to evaluate the current status and make recommendations for better implementation of VC in future standards, legislation and compliance tools for 11 different countries, incl. e.g. Denmark, Italy and Japan (Status and recommendations for better implementation of ventilative cooling in standards, legislation and compliance tools, Plesner, 2018).

The purpose of this task is to evaluate how well ventilative cooling is currently integrated into national standards, legislation and compliance tools and thereby make future recommendations based on this.
The approach is to evaluate to which extent certain ventilative cooling parameters are integrated into national standards, legislation and compliance tools through questionnaires asking if e.g. cross ventilation is included, which calculation time step is used for thermal comfort and if the position of windows is taken into account.

Based on the answers from the questionnaire a concise status was established for the different countries, conclusions were drawn and thereafter concrete recommendations were given.
The authors hope that the recommendations found throughout the IEA Annex 62 activities will help and inspire policy makers, regulators and experts to improve future standards, legislations and compliance tools and better address natural ventilative cooling, which is why a workshop like this will be a way to discuss the findings from this study and hear people's views on if these recommendations could be used in their countries as well.

Results show that ventilative cooling is not explicitly addressed in all building legislation nor national standards. There is presently, among others, lack of information on how to use windows, night cooling possibilities, window control and automation. In many building legislation and compliance tools, design air flows are specified by the designer as fixed air flow rate. In reality air flow rates, especially from natural ventilation, are seldom or never constant and a recommendation could be to allow the possibility for variable air flow rates.

The objective of this topical session on "Better implementation of ventilative cooling in national building standards, legislation and compliance tools" is to give the participants an insight and discuss how well "Ventilative cooling" currently is integrated and used in EN, ISO and national standards, as well as in national legislation and compliance tools. There will be presentations based on national inputs for the status and recommendations for better implementation of ventilative cooling from 4 countries (UK, Italy, Switzerland and Denmark) with a special focus on natural ventilative cooling. The reason to focus on natural ventilative cooling is the fact that it is the area where we see the biggest compliance gap as calculation methods fully supporting e.g. wind and stack effects are not always present nationally, e.g. if too simplified methods are used for example only allowing the input of fixed air change rates.

KEYWORDS

Ventilative cooling, standards, legislation, compliance tools, recommendations

1 WORKSHOP CONTENT

The session starts with the introduction of Ventilative cooling (cooling of buildings using outside air as main source driven by natural, mechanical or hybrid ventilation strategies) and examples of calculation approaches. The session ends with an open discussion, asking if the participants feel inspired to use the input and recommendations given during the workshop to be used in their country or for new and upcoming technical documents.

Questions to be discussed at the workshop among the participants:

- Do you see a clear potential of including ventilative cooling in your national building legislation/guideline?
- Is new work/research (in your country) needed to reach a better implementation of ventilative cooling?
- Are there some national barriers for implementation of Ventilative cooling?
- How is the air flow rate determined for ventilative cooling in your national building legislation/guideline?

2 CONCLUSION

It is recommended that the full effects of ventilative cooling are evaluated reflecting the real conditions for the building, control, use and climate. This should in particular include the actual building physics and geometry. Legislation should include or refer to guidelines, standards or compliance tools on how to calculate the cooling effect, resulting temperatures and the energy performance. Moreover, compliance tools should also reflect what is stated in the legislation. To allow for ventilative cooling to be treated better in standards both at the design stage, where initial calculations of e.g. the natural forces are made as well as, at more detailed stages where more detailed calculations are needed, it is important that several parameters are taken into account, such as (Status and recommendations for better

implementation of ventilative cooling in standards, legislation and compliance tools, Plesner, 2018):

- Assessment of overheating, e.g.:
  - Utilizing thermal comfort indicators, including adaptive temperature sensation
  - Utilizing energy performance indicators
- Assessment of natural and mechanical ventilative cooling
- Assessment of night cooling
- Calculation methods that fairly treat natural ventilative cooling for determination of air flow rates including e.g. the dynamics of varying ventilation and the effects of location, area and control of openings

3 ACKNOWLEDGEMENTS

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Table 1 – Research participants helping with input to IEA Annex 62 report

Name	**Institute-Affiliation**	**Role in report**
Christoffer Plesner	VELUX A/S, Denmark	Author and editor
Flourentzos Flourentzou	ESTIA SA, Switzerland	Author and reviewer
Guoqiang Zhang	Centre for Sustainable Built Environment, Hunan university, China	Author and reviewer
Hilde Breesch	KU Leuven, Belgium	Author and reviewer
Per Heiselberg	Aalborg University, Denmark	Author and reviewer
Michal Pomianowski	Aalborg University, Denmark	Author and reviewer
Peter Holzer	Institute of Building Research and Innovation (IBRI), Austria	Author and reviewer
Maria Kolokotroni	Brunel University, United Kingdom	Author and reviewer
Annamaria Belleri	Eurac Research, Italy	Author and reviewer
Giacomo Chiesa	Politecnico di Torino, Italy	Author
Guilherme Carrilho da Graça	University of Lisbon, Portugal	Author
Hans Martin Mathisen	Norwegian University of Science and Technology (NTNU), Norway	Author
Paul D. O' Sullivan	Cork Institute of Technology (CIT), Ireland	Author
Toshihiro Nonaka	Lixil Corporation, Japan	Author

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4 REFERENCES

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