

## ABSTRACT

Climate Change (CC) affects the air quality and concentrations of air pollutants in buildings. The resulting shifts in human exposure influence the public health. Changes can be anticipated because of altered outdoor pollution and also owing to changes in buildings effected in response to changing climate. Identifying effects of CC on Indoor Air Quality (IAQ) and risks and opportunities related to CC adaptation measures, help to protect the community health. There are three classes of parameters which govern the IAQ in occupied spaces: (a) outdoor sources, such as pollutants and temperature; (b) building factors, such as the ventilation rate and building materials; and (c) occupant behaviour. A decision support tool is developed to investigate the effects of CC on the IAQ of residential buildings. Afterwards, guidelines and recommendations are presented to preserve a good IAQ in the context of CC.

**KEYWORDS:** Climate change, Indoor air quality, decision support tool, Wallonia residential buildings, Low cost sensors.

## PROBLEM

- According to the sixth Belgium's national communication under the united nations framework convention on CC, the annual change in the number of days of summer ( $T \geq 25^\circ\text{C}$ ) and the number of days of heat wave ( $T \geq 30^\circ\text{C}$ ) are becoming more frequent as a general trend.
- For many people, the health risks from exposure to indoor air pollution may be greater than those related to outdoor pollution. In particular, chronic respiratory and/or cardiovascular diseases.
- Much of this impact is likely to arise by amplifying existing risks related to heat exposure, and correlated chemical and physical contamination in buildings that damage the IAQ.
- Potentially vulnerable subpopulations include not only the youngs and the infirms but also those who lack resources to respond effectively to changing conditions.
- Adaptions in building designs to mitigate the climate change effects can also lead to decreased IAQ.

## OBJECTIVES

- Determining how the climate change effects the indoor air quality.
- Defining parameters for indoor air evaluation in the context of CC with importance, reliability and measurement time and cost efficiency.
- Investigating relationships between outdoor air and indoor air pollutants.
- Identifying most influential occupants behavior impacting the IAQ.
- Evaluating the effect of ventilation type on indoor air quality in the context of climate change, considering the quality of outdoor air.
- Developing a tool to reflect the CC effects on IAQ, to provide recommendations for preventing IAQ degradation under those conditions.
- Performing indoor air measurement campaign with low cost sensors.

## AUDIENCE

- Policymakers, local governments, researchers and scientists, public health sector, buildings engineers, and energy sector.

## RESEARCH QUESTIONS

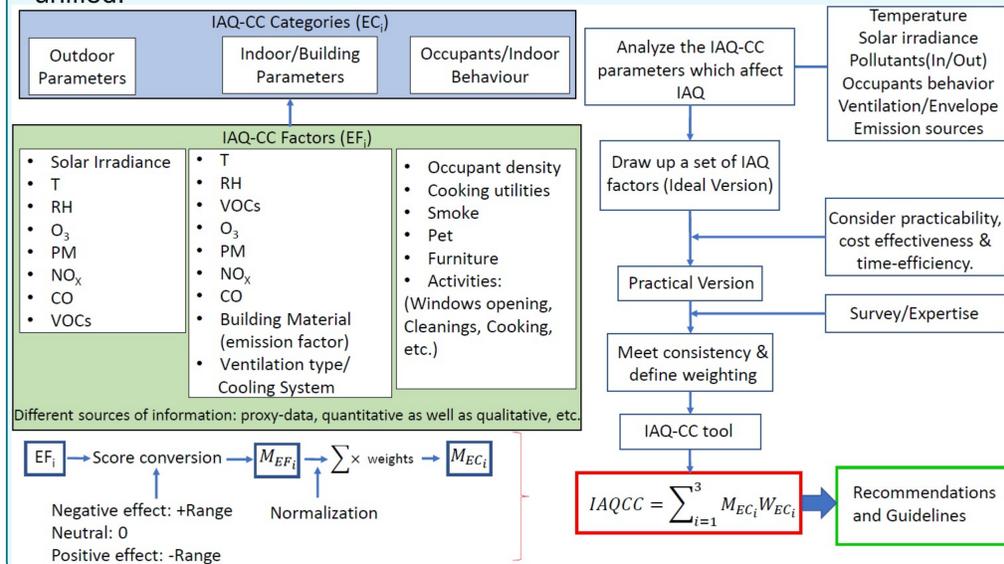
- What are the impacts of CC on the sensitivity of the IAQ in buildings?
- What are the relationships between heatwaves/urban overheating and outdoor air pollution and indoor pollutants concentration?
- How to combine thermal comfort and healthy indoor air quality?
- How could the occupants be involved in the preservation of IAQ in the context of CC?
- What are the Wallonia available/accessible information and databases linked to IAQ and CC, in order to assist developing an easy (userfriendly) and low cost support tool?
- How to adapt selected existing IAQ evaluation approaches to provide a useful tool in the context of CC?

## ORIGINALITY

- A decision support tool to deal with negative effects of CC on IAQ is being developed.

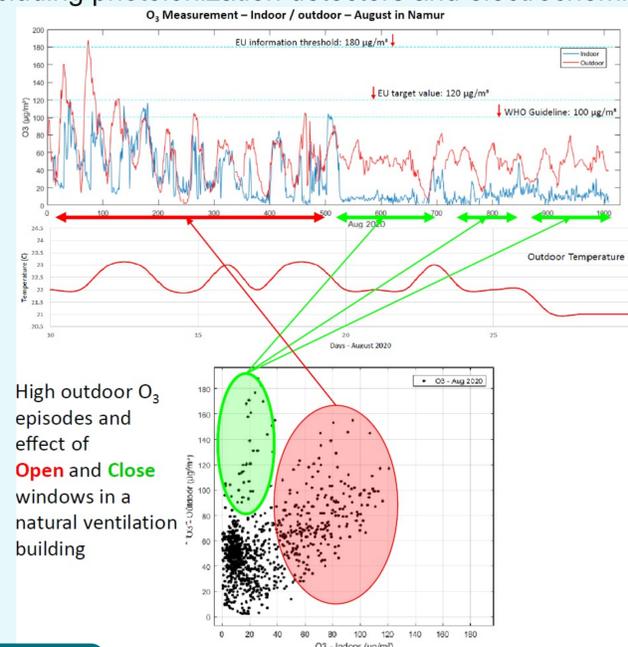
## METHODOLOGY

- A complete literature review is performed on the topic of indoor air quality measures and climate change. Low cost devices are fabricated for online indoor and outdoor air measurement within intended campaigns. A questionnaire is developed to study the impacting routines of occupants on IAQ. The trends of variation of indoor pollutants are monitored according to the outdoor environment and occupant's behavior. For the integrated IAQ-CC tool, IAQ and CC correlated categories and their respective factors are identified, calculated and their ranking order is set up. The weight of each category and corresponding factors are obtained; the evaluation criteria is unified.



## RESULTS OF A FIRST IA POLLUTANTS MEASUREMENT CAMPAIGN

- In order to perform the measurement campaign, 6 measuring devices are fabricated including photoionization detectors and electrochemical sensors.



## CONCLUSION

- The project describes the climate change impacts on the IAQ. The decision support tool under development should help to minimize the the CC effects on the IAQ status. With such results, not only the residents but all the concerned stakeholders could better apprehend the effect of CC on the IAQ, and also obtain corresponding solutions to avoid IAQ reduction.

## RESOURCES

[1] Belgium's sixth national communication on climate change, under the united nations framework convention on climate change, 2013.  
[2] Hong T, et al. "Integrated task performance score for the building occupants based on CO<sub>2</sub> and indoor climate factors changes", Applied energy, 2018.



**POURKIAEI Mohsen**  
PhD Student of S.A.M. team, ULiège Arlon

**CONTACT**  
• sm.pourkiaei@uliege.be  
• +32(0)63 230 938  
• www.labo-sam.uliege.be