

Presentation of a national consultative body on ventilation issues: actors, working groups and projects overview

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ABSTRACT

Indoor environment and indoor air quality (IAQ) are considered as subjects of major concern: as we build more and more energy efficient and airtight buildings, the conflicting issues of energy efficiency, adverse health effects and discomfort become more relevant. Significant rates of malfunctions of ventilation systems are still observed among new constructions. They are caused by technical reasons (poor design, inappropriate choices of equipment, poor installation, inappropriate use, poor maintenance) and by organisational issues due to the multiple interactions between professions during the construction phase.

In the face of this issue, in 2016, the French ministry in charge of construction decided to invite all major actors of the ventilation field to join a working group called “Club Ventilation”. The aim of this group is to identify the main pitfalls, to propose major projects and to prefigure future labels and regulations. The 45 participants include building manufacturers, building managers, craftsmen, building companies, label and certification, and ventilation manufacturers representatives but also specialists of the ventilation field including training organisations, public agencies, engineering consultants.

In order to prevent degradation of the IAQ and the building itself, specialists agree on the need to improve the knowledge and the know-how of professionals by providing them with training resources and accompaniment tools.

We present two on-going multi-partner projects that aim at developing such resources for French professionals on IAQ and ventilation, namely :

- the development of a massive open online course (MOOC), by Cerema and Platform Tipee, under the initiative of ADEME
- the development of a resources centre internet platform, by Cerema and CETIAT, with a serious game developed by ACA-O, with Cerema, under the initiative of the French Ministry for construction (DHUP).

Both projects will be released by the end of 2018. They are accompanied by the PACTE Program (Programme of Action for the quality of the Construction and the energy Transition), that was launched in 2015 by the French public authorities with the ambitious goal to accompany the necessary skill development of the professionals of the building sector in the field of energy efficiency, and this, in order to enhance the quality in construction and reduce the loss ratio.

KEYWORDS

Ventilation, Indoor Air Quality, Resources Centre, MOOC, Serious Game

1 CONSTRUCTION OF A NATIONAL CONSULTATIVE BODY ON VENTILATION ISSUES

1.1 Context

Indoor environment and indoor air quality (IAQ) are considered as subjects of major concern: as we build more and more energy efficient and airtight buildings, the conflicting issues of energy efficiency, adverse health effects and discomfort become more relevant.

In France, the recent thermal regulation (RT2012) generalizes low energy dwellings and imposes envelope airtightness requirement for any new dwellings. For a single-family dwelling, the requirement is $Q_{4Pa_Surf}=0.6 \text{ m}^3 \cdot \text{h}^{-1} \cdot \text{m}^{-2}$, that is around $n_{50}=2.3 \text{ h}^{-1}$. This energy performance-regulation does not include any new requirement on ventilation rates. Dwellings airing is concerned by another 30 years old regulation (JO, 1982).

Yet, dysfunctions analysis of a 1287 dwellings sample allowed us to establish that on-site ventilation systems quality was often low (Jobert and Guyot, 2013) with a non-compliance rate of 47% for the whole sample, 68% for single-family dwellings and 44% for multi-family dwellings. This analysis confirms others in Europe (Balvers et al., 2012; Caillou et al., 2012), which observe that in-site ventilation system mounting is often far from the hoped performance. And such results were recently also observed on low-energy houses (Guyot et al., 2017).

Malfunctions of ventilation systems are caused by technical reasons - poor design, inappropriate choices of equipment, poor installation, inappropriate use, poor maintenance - and by organisational issues due to the multiple interactions between professions during the construction phase.

1.2 Players

In the face of this issue, in 2015, the French ministry in charge of construction decided to invite all major actors of the ventilation field to join a working group called “Club Ventilation”. The aims of this group are:

- To coordinate and propose projects and studies, their results, and new proposals;
- To propose reference texts and follow normative evolutions;
- To support and train professionals;
- To bring together actors;
- To bring about a change in ventilation systems design, mounting, use and maintenance.

The Club Ventilation bring together 45 participants including building manufacturers, building managers, craftsmen, building companies, label and certification, and ventilation manufacturers representatives but also specialists of the ventilation field including training organisations, public agencies, engineering consultants.

Plenary meetings occur 4 to 5 times a year. There, the organization of working groups and the building of major projects are decided to contribute to improving the ventilation quality. On-going actions are presented during these meetings.

1.3 Working groups

Working groups meet all year long, with feedbacks to each plenary meeting. At the moment three working groups about “Training and Qualification”, “Quality management approaches” and “White book” have been finished. This white book has just been signed and proposes that a certificate of taking into the airing regulation become

compulsory at the design stage of every new and major refurbished building with new ventilation installations (<https://www.cerema.fr/fr/actualites/cerema-signes-livre-blanc-ventilation>).

Three working groups are on-going: 1-“Diagnosis”, 2-“Moisture”, 3-“Equivalence criteria”.

1.4 On-going projects

On-going multi-partner projects connected to this national group are:

- the development of a massive open online course (MOOC),
- the development of a resources centre internet platform,
- the “Ventil’acteurs” project.

This last project’s aim is to mobilize all the actors from building’s sector in the field of ventilation in order to propose an action plan to eradicate each of the dysfunctions observed on mechanical ventilation installations in residential buildings.

In order to collect advice and recommendations from all professional of the field, a survey is being built and published online:

https://docs.google.com/forms/d/e/1FAIpQLSdoO_308O_DvbINgsCh-FI708Cfp14HRFfpKT6S4zFKcTIXaQ/formResponse

Results will allow getting a shared overview of pitfalls and difficulties met by all the professionals with areas of improvement. Then, the action plan will be proposed in order to provide more reliable and performing ventilation installations in residential buildings.

The first two projects are further developed in the above sections.

2 A MASSIVE ONLINE OPEN COURSE

A MOOC is a course of study made available over the Internet without charge. It is a free Web-based distance learning program that is designed for the participation of large numbers of geographically dispersed students.

Our current project consists in creating a MOOC, entitled "Ventilation: the keys to control indoor air quality", open to all actors of the building sector. The major objective is to meet the needs of synergies and growing skills among the professionals, but also among decision-maker in order to raise their consciousness on the issues of IAQ and ventilation, including health, environmental, economic and social issues. This MOOC applies indeed to all professional actors since the designing steps and the prescription to the reception and maintenance of ventilation systems: project management, engineering, architects, operators, installers, businesses (HVAC, plumbing, electricity,...), local authorities technicians and building managers, diagnosticians, energy advisors. The target is deliberately very broad since occupants can also be concerned.

The educational objectives of the MOOC are various. Namely, they consist in better knowing:

- the sources of indoor pollutants, ventilation systems and air treatment
- the health and economic issues related to a good IAQ
- the regulations on IAQ and ventilation in buildings
- the design and implementation rules of a ventilation system in residential buildings
- the pathologies associated with the incorrect implementation of ventilation systems and to understand their impacts
- the keys to a ventilation and IAQ

- the principles of measurement audits, analysis methods, protocols of measurement and sampling procedures
- the ways to improve IAQ
- IAQ management methods (commissioning)

In order to answer to these objectives, the MOOC is sequenced into 5 sections (corresponding to 5 weeks, each of them being divided into 3 modules), according to the following program:

1. IAQ and regulations in the building sector
2. Ventilation and regulations in French buildings
3. Design of a ventilation system in Residential (new and refurbishment)
4. To control a ventilation system and analyze the IAQ
5. Implementation of actions promoting a good IAQ

The MOOC will be hosted by the end of 2018, on the platform FUN of ADEME dedicated to Sustainable Buildings (<https://www.mooc-batiment-durable.fr/>). Launched by ADEME and Plan Bâtiment Durable from Ministry of Ecology and Solidarity Transition, the platform has two objectives :

- the growing competence of the professionals of the building industry and real estate on the themes of the energy transition and sustainable building in general (construction and renovation),
- the dissemination to the general public, to a knowledge of the issues related to green building, in particular, the energy renovation of housing.

In order to meet these objectives, the testimony of the experts of Tipee and Cerema in the MOOC give a pragmatic view of the practices of the field and the current regulatory framework and prospects of developments. These testimonies are completed by external contributions (installers, designers, contractors) intervening in demonstration projects to support best practices experiences, through operational examples. A special care is taken to systematically ensure the neutrality and independence in the content of the presentations.

3 A WEBSITE AS A RESOURCE CENTRE

3.1 Objectives

Also accompanied by the PACTE programme and the French Ministry in charge of construction, the second on-going project consists in the development by the end of 2018 of an internet platform as a resource centre on ventilation issues. The overall objective of the project is to provide a set of online resources (regulatory information, baseline studies, feedback,...) to the attention of all the professionals of the construction on the subject of ventilation, both for new construction and for refurbishment. The final challenge is to enhance the quality and efficiency of the ventilation in buildings allowing the managers, owners and contractors to make optimized choices for systems of ventilation.

The need for a reference resource centre internet platform was raised by the Club Ventilation presented in the first section of the paper. An inventory of existing resources will be done throughout a database. The Club Ventilation will be consulted to complete, if necessary, this census. The partners of the project have to produce the structuring of the content, following two types of documents:

- Online articles: composed of raw texts and illustrations/diagrams directly viewable on the site; some 50 articles in lines will be produced in the project. Items will include illustrations and links to downloadable documents: factsheets or existing documents.

- Factsheets: These few pages sheets will be preferred when the content to present turns out to be too complex to take the form of an online article or when the document is intended to be printed for its release or for its use. Indeed, online articles will be privileged to encourage a smooth user experience through a directly viewable information online.

3.2 Detailed Contents of the website

The attractiveness of the internet medium (website) is based on the usefulness and the quality of content (neutrality, reliability). From a content point of view, we expect for the launch of the site the following resources:

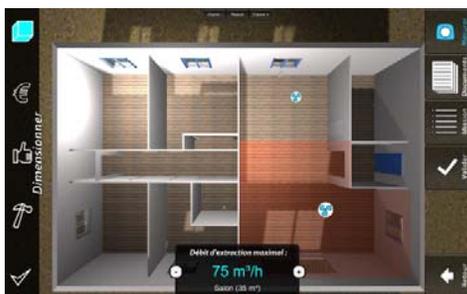
- A comprehensive and up-to-date information concerning the current regulations.
- A comprehensive and accessible presentation to all audiences target of the technical principles of ventilation;
- A bibliography extended studies and guidebooks on the topic of ventilation;
- A frequently asked questions (FAQ);
- A reformatting of existing content (teaching, repositories luggage inspection and diagnosis of ventilation systems, etc.) to make them suitable for a website.
- Interactive content ("serious games", see below) contributing to the promotion of the site;
- Regular news.

The structuring of the content will be also to title articles/illustrations/sheets, to catalogue them and to label them according to the structuring of the site. The structuring of the content (nature, title, cataloguing and labelling) will take the form of a table that will be presented to the Club Ventilation for review and approval prior to production.

3.3 A serious Game as an alternative e-learning and information tool

The serious game VENTILGAME will be developed in a posture of promotion of the site. It will have the ambition to inform and train professionals electronically to good ventilation practices and voluntary air renewal.

A serious game is a game designed for a primary purpose other than pure entertainment. The "serious" adjective generally refers to video games used by industries like military, education, scientific exploration, health care, emergency management, city planning, engineering, and politics. The idea shares aspects with simulation generally, including flight simulation and medical simulation, but explicitly emphasizes the added pedagogical value of fun and competition.



The serious game VENTILGAME is intended to be a tool for promoting Ventilation Resource Centre. It has the ambition of *e-informing* actors of the building sector on the physical quantities essential to the design and implementation of ventilation systems, according to regulatory frames, in a fun and dynamic approach, through virtual 3D dwellings simulations (see figure).

The guideline of VENTILGAME is to allow professionals accessing the site to appropriate, in a fun and informative of the regulatory and technical ventilation concepts. The educational process will be established by the partners of the project with the Fan Club. VENTILGAME will offer game sequences focus on the acquisition of theoretical knowledge, regulatory knowledge base and the basics of dimensioning of ventilation for residential, as well as a system of feedback good and bad practices. VENTILGAME will be designed to serve as a

link between the knowledge of the professionals and the proper resources of the Resource Center. Thus, the following 5 game sequences will be available on the VENTILGAME of the site interface:

1. The knowledge of ventilation in existing buildings and new devices: identifying the ventilation principles in a building.
2. The principle of operation of different ventilation systems
3. The regulatory and normative context on ventilation
4. The design of ventilation and air renewal systems in residential buildings
5. The Ventilation Code (MCQ)

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