



Energy Performance and Indoor Climate: Progress in the last 20 years and Perspectives

A summary of the presentation of Francis Allard, professor at the University of La Rochelle, at the 34th AIVC Conference in Athens

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The closing session of the conference included a presentation by **Francis Allard, professor at the University of La Rochelle**, in France. The presentation focused on Energy Performance and Indoor Climate covering the main progress and perspectives in the last 20 years in the fields of: modeling tools, materials and components, the indoor environment quality concept, integration of environmental challenges, evolution of the regulation frame and accompanying initiatives.

With respect to **modeling tools**, the speaker underlined the development of both Building Energy Simulation (BES) and Indoor Air Quality (IAQ) models during the last 20 years including: CFD models, renewable energy source modeling, enhanced energy simulation capabilities, VOC emissions models, etc. The recent coupling between BES and Indoor Environmental Quality (IEQ) by creating integrated system models, reduced-order models for specific application, design and occupant oriented models and models on advanced platforms was as an important step forward.

Furthermore, as regards the evolution in **materials and components** the presentation highlighted the integration of high performance insulating materials, the evolution of glazings and windows, Phase Change Materials (PCM) integration and cool materials.

According to the speaker, the **Indoor Environment Quality concept** has built on progress on *thermal comfort* (from standard “set-point” comfort conditions to adaptive comfort theory included into standards), *IAQ* (from a comfort-based approach to a more detailed health-based approach today), and *ventilation* (work on airtightness, natural ventilation, hybrid ventilation, ventilation cooling potential, combined evaluation of ventilation and health).

Regarding the **integration of the environmental challenges**, Francis Allard referred to the example of the heat island and its impact and stressed the fact that a building interacts strongly with its environment and should no longer be considered as an isolated system. Also, emphasis was given to the development of ECO labeling concepts (BREEAM, LEED etc.), a quality performance management for the building design and construction.

The **regulation framework** in the EU before 2001, mainly involved individual building codes with no coherence between them. The EPBD of 2002 and its recast of 2010, the RES directive of 2009, the energy efficiency directive of 2012 etc. have given coherence to the approach but have also sealed the evolution in the energy regulation framework. Energy should not be the only driver: health, comfort, quality of use has to be considered in a more global and environmental evaluation of building performance. The above have been supported by a series of European **initiatives**, research and demonstration projects (Non-Nuclear Energy (Joule-

Thermie); Energy, Environment and Sustainable Development; SAVE ALTENER; CONCERTO; Intelligent Energy Europe; IEA Annexes; BUILD UP Platform) and conferences (e.g., EPIC).

The new challenge for Europe to reduce drastically the CO₂ emissions of the building sector between 88% and 91% by 2050 requires strong policies. Every country in Europe is now working on the implementation of nZEB. The target is to reach very low energy consumption for 2020, the main challenge being retrofitting the building stock. *'In Europe, if we want to succeed we have to renovate the whole building stock before 2050. That means that we need to do this with a rate of 3%; so far we are around 1 %'* (Figure 1).

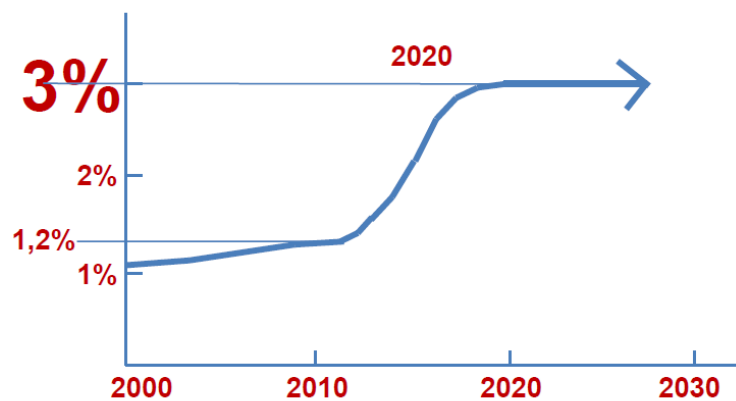


Figure 1: Building stock retrofitting (F. Allard-AIVC 2013-Athens)

Emphasis was also given to the conceptual evolution of the Building Energy and Environmental System. The speaker pointed out that the target is to ensure comfort, safety and health keeping in mind the interaction of the indoor environment with the outdoor environment and the global environment. Therefore, the research objects need to be carefully defined with focus on the boundaries (e.g. the zone of the building envelope, the surrounding environment etc.) and the fact that these boundaries involve flows of energy, mass and information. The presentation also highlighted the main characteristics of the Building Energy and Environmental System which are:

- Multi-scale in space and time
- Multi-factorial
- Multi-performance objective (energy, IAQ, ...)
- Multi-disciplinary
- Multi-purpose (application point of view)

The conclusion acknowledged the huge steps and efforts made during the last 20 years in research and development and the support by strong policies. The speaker stressed the need for the continuation of the development of models (more confidence in prediction and integration of the surrounding environment), new metrics (performance based overall evaluation means index definition and multidimensional evaluation), technology developments from components to systems and an occupant centered conceptual evolution.