The NEXT generation of COMfort models.

Employees' comfort represents a key factor influencing both productivity and energy-related behavior in workspaces. Next.Room design aims at carefully setting, monitoring, and controlling the indoor environment and at evaluating its impact on occupants' well-being combining data collection of (i) internal physical parameters and (ii) subjects' physiological responses. Moreover, the combination of BIM and VR gives further opportunities to play with the stimuli to be provided to subjects. The research and its results can support the improvement of the workspace design process with the ultimate goal of saving energy through human-based energy retrofit. The Next.Room represents an important step-forward in the study of multidimensional comfort aiming at optimizing occupants' well-being improvement and building energy consumptions reduction. The understanding of occupants' interaction with building control systems allows scientists to keep track of the "energy weight" of the single action aimed at maximizing multidimensional comfort. Another lead of the project is to move a further step in the digitalization of the building environment towards the Digital Twin paradigm. A digital twin is a digital replica of a living or non-living physical entity, in this context, the complex system made of human and building. The full integrated sensor system together with the as-built BIM model will provide the mean to follow every step of the facility's evolution.

The whole facility has been "physically" characterized through start-up experiments concerning spatial mapping of illuminance and acoustic conditions, and response time of the thermal conditioning systems. Concerning the lightning system, the illuminance level is measured in 9 point of the room at four heights (i.e. at pavement, work-plane level, a seating person eyes height, and a standing person eyes height levels) testing all the 63 combination given by the lighting fixtures in each point. Similarly, background noise level due to the four fan speeds available for the ventilation system is measured in the same 9 points at seating person ears height. The ventilation and radiant systems are tested in terms of transient, maximum and minimum value of internal temperature achievable in a 2.5 hour interval. For the ventilation system, a longer cooling test of 8 hours is also provided. In addition, the effect of radiant asymmetry is now deeply investigated thanks to the possibility to "play" with the multiple-lines of the radiant systems. Experimental data collected through a carefully designed campaign are used to validate a CFD model of the Next.Room which will allow to predict local discomfort in every spot of the facility supporting future experiments on human comfort. Further investigations will include the study of the subject's thermal adaption and interactive, immersive, virtual environment test. Innovative materials can be tested in the high controlled environment offered by the Next.Room. All the building components can be monitored in highly controlled conditions.