Evaluation of adaptive facades: The case study of Al Bahr Towers in the UAE

Shady Attia*

ABSTRACT
The assessment of adaptive facades presents a barrier as there is no established assessment technique. Many of the available facade performance evaluation systems or frameworks have limited applicability for such advanced building facades. The complexity of adaptive or dynamic facades' evaluation is related to the performance evaluation of facade elements, systems, and overall building performance coupled with occupant behavior and occupant satisfaction. In this context, this paper presents a case study of an adaptive sunscreen facade and evaluation of its performance and occupant behavior. The evaluation mainly focuses on pre- and post-construction phases of adaptive facades: the design assist phase (including the durability test, visual mockup, onsite mashrabiya mounting, and weather stripping), the commissioning phase (field verification and performance testing), and the monitoring phase. The selected project is a 150-meter-high twin tower that stands with a honeycomb-inspired structure and automated dynamic solar screen that responds to the sun’s movement. These solar screens respond dynamically and automatically to the angle of the sun, which improves the control over energy consumption, solar radiation, and glare with the ability to allow natural light into the building. This paper is part of the research activities of working group 3 of the European COST Action 1403 on “Adaptive Facades”. Different methods were used for evaluation and these include the following: interviews with the architect, facade engineer, technical control specialist and occupants, reviews of standards and codes, review of energy models, and a systematic design process mapping. A documentation of the case study describing the post-construction occupant comfort and facade operation was prepared. This paper’s audience comprises mainly project managers, architects, and building facade engineers together with facility managers who are concerned with the process of design, construction, and operation of adaptive sunscreens facades. The outcome of this study identifies quantifiable performance indicators and effective strategies for the design and performance evaluation of optimal adaptive facades.

Keywords: sunscreens, occupant comfort, solar gain, daylight, operation and control