In this study, the current trends of adaptive facades are investigated, with particular emphasis on their performance assessment. The gaps in assessment of adaptive facades are determined and a new object-based façade characterization and classification approach is proposed. Furthermore, a generic stakeholder map and process map are presented to explain current adaptive façade delivery practices. In addition, the findings of interviews with several specialists are presented to elucidate their expert opinions, leading to a framework of key performance indicators. As results of this paper, the gaps related to adaptive façade systems’ assessment are identified and insights in current trends and future challenges of adaptive façade system assessment are provided.

Façade performance, envelope, delivery process, façade contractor, key performance indicators, interviews.

Adaptive facades can accomplish step-change progress in energy efficiency and in promoting the use of renewable energy in the built environment. However, despite continued technological development of façade solutions, many of which break new ground with respect to innovative dynamic use of façade glazing and fenestration, AFs have not yet achieved a significant market share.

The objective of this paper is to identify the gaps related to AF systems’ evaluation requirements and processes, and to provide insights into current trends and future challenges in this domain.

The audiences are facility managers, users, façade contractors and architects.

What are the current trends and future challenges in the assessment of adaptive façade systems?

By mapping performance standards and indicators of AFs, the assessment framework intends to identify and group key performance characteristics of AFs. The framework is meant to define the intrinsic performance driven functions of AFs in a structured way. In this sense, we did not develop new indicators, however, we developed a group of indicator sets that can provide a logical framework to assess the dynamic nature of AFs. This involves occupant satisfaction and behavior, comfort, energy consumption or systems controls as well as cost.

This framework was based on the identification of different façade delivery processes and milestones, and highlighted the importance of prototyping and façade testing and inspection.

This study is organized into 7 sections. Section 2 describes a literature review in which more than 50 publications were analyzed, discusses the definition of AFs that is used throughout this study, and presents an object-based AF assessment framework. In the third section, the process-mapping activity of three detailed case studies is presented, leading to a generic process map for AF design and delivery. In Section 4, the set-up and main results of series of interviews with façade industry professionals are described. Section 5 presents a new classification of AF performance and KPIs. Finally, Section 6 discusses the main findings of the study.

Energy and Environmental Performance
In this category, we classified energy and carbon emissions related aspects that get influenced or interact by the façade design.

Functional Performance
We grouped all performance aspects related to structural stability and safety together with construction related criteria under this category.

Building Control and Services
Under this group we address the four types of comfort indirect relation with building management systems and façade controls.

User Control and Experience
The subjective perception on the indoor environment of users in relation to their ability to act and engage with the façade to regulate their living or working environment is grouped under this category.

Maintenance, Durability and Life Cycle
Aspects related to the life of the façade during operation are grouped in this category including maintenance, replacement, cleaning and durability.

- A novel framework for the assessment of adaptive facade systems is developed
- A SWOT analysis characterized adaptive facades from the market perspective
- Process mapping of three case studies identified facades’ process delivery hurdles
- Currently most adaptive facades are nor designed with a user-centered approach
- Façade sub-contractor & building operator is crucial for long-term performance