DESIGNING
Sustainable Façades

A high-quality building designed with occupant's wellbeing in mind not only is good for people but also makes financial sense. The building envelope plays a critical role in contributing to energy efficiency and overall sustainability in buildings as well as improving occupants' comfort.

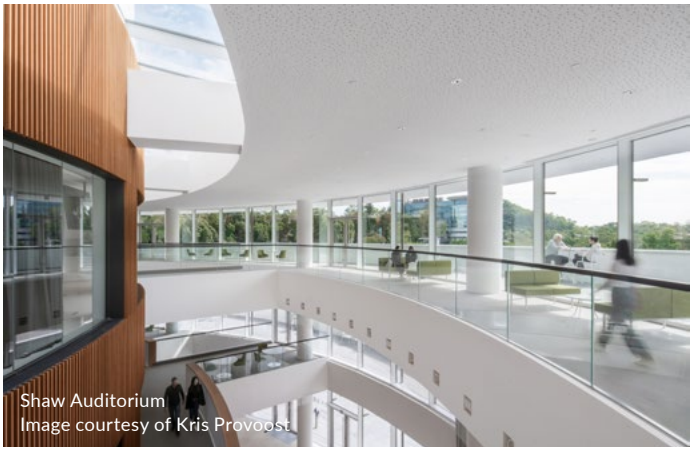
Additionally, future façades will need to be designed with changing climatic conditions in mind, to maintain performance in warmer environments, higher outdoor ambient air temperatures, with longer periods of heat and changes to rainfall patterns.

As a barrier between the interior and exterior environments, by incorporating appropriate insulation materials the façade prevents heat loss and reduces heat gain, significantly reducing the energy required for maintaining a thermally comfortable indoor environment. In Hong Kong's sub-tropical climate, incorporating shading devices into the façade, such as louvres or a brise soleil, reduces the amount of solar heat gain, which can help to reduce internal solar heat gains and thereby reducing the building / space cooling demand. In the design of the Hong Kong Ocean Terminal Extension the form of the building is a direct response to its climatic context. Large, cantilevered terraces shade the lower levels from the tropical sun while the building's balustrades act as louvred shading devices for the terrace below.

Designing the façade to harvest natural light into the building can reduce the need for artificial lighting during daylight hours, saving energy and creating a more comfortable interior environment for

French International School
Image courtesy of Philippe Ruault

Shaw Auditorium
Image courtesy of Kris Provoost


Shaw Auditorium
Image courtesy of Kris Provoost

the occupants. The Shaw Auditorium at Hong Kong's University of Science and Technology was designed with floor-to-floor glazing with a relatively high visual light transmission (VLT) of approximately ~70%. This was possible due to the large overhangs of the offset rings of the structure providing shading to the glazed façade elements and reducing heat loads.

Advanced façade engineering

Advanced façade engineering involves the use of cutting-edge technologies and materials such as smart glazing, insulated cladding, and Building Integrated Photovoltaic (BiPV). Advanced glazing technologies such as low-e coatings, triple glazing, and dynamic glazing can significantly reduce heat transfer and solar gain.

It is estimated that embodied carbon accounts for over one third of carbon emissions of a building. The use of sustainable materials in the building envelope with a high recycled content, materials manufactured with renewable energy, and ecologically sensitive materials can contribute to the overall sustainability goals of buildings, including significantly reducing embodied carbon emissions.

Sustainable façades can provide a range of benefits to building occupants and the wider community, promoting access to natural ecosystems, daylight experience and honouring alignment with human's circadian rhythms. These benefits, reduced energy consumption and greenhouse gas emissions contribute to increased property value.

Designing and implementing sustainable façades requires a holistic approach taking into account a range of technical, economic, and regulatory considerations. Careful consideration must be given to factors, such as availability, cost, materials, maintenance, and energy efficiency.

The use of high-quality materials and advanced technology can be an upfront expense expensive to procure and install which means the cost of sustainable materials in the building envelope may be higher than implementing traditional façades, which can make this option less appealing to developers and building owners.

The design of sustainable façades must take into account factors such as the orientation of the building, the local climate, and the surrounding environment. In the case of the French International School in Tseung Kwan O, the windows are recessed and carefully oriented to minimise the effect of Hong Kong's intense sub-tropical sunlight while allowing ample daylight into the building's spaces. Also, the façade's precast GRC panels are profiled in such a way that the recessed windows with low-e glazing within the reveals are partially shaded and therefore the solar heat gain is reduced to create a more energy efficient building.

For sustainable façades to function effectively they require regular maintenance. Vested operations team need to participate in the design process to understand and provide comment and experience on keeping a building operating at its best potential - which includes maintenance of the asset. An integrated access and maintenance solution that is designed at the outset of a project will allow easy and regular maintenance which positively influences the user experience for the building's occupants.

Code and regulatory compliance

Building codes and regulations may not always support the implementation of sustainable façades, particularly when renovating older buildings. Regulation does not yet fully address sustainability considerations in major refurbishments and this can make it difficult to obtain permits and approvals for installation within a limited timeframe.

Industry publications play a vital role in promoting the adoption of sustainable façade engineering practices and showcasing innovative solutions in the field. Through highlighting new products, technologies and design strategies, these publications push the industry forward and encourage the development of more sustainable solutions.

Case studies and project success stories inspire engineers, architects and other designers to take up the sustainability challenge. Working closely with the industry experts and associations such as the Hong Kong Façade Association, promotes common practices, innovation and knowledge sharing, and collaboration in the industry. The outcome will be a more sustainable environment for our region and improved comfort and health for the wider Hong Kong community.

Jovi Wong
Regional Manager
Hong Kong, Macau,
Inhabit

建築幕牆的可持續設計

Ocean Terminal
Image courtesy of Foster and Partners

一個高質素的建築在設計時會考慮到用家的福祉，不但以人為本，同時亦要用得其所，沒有白花金錢。所以建築物外牆於節能，提升整體可持續性，和加添用戶舒適度的方面，都扮演著重要角色。

此外，在設計未來的幕牆時，還需顧及氣候轉變所帶來的環境因素，使建築物能夠在更暖的氣候、更高的室外溫度、更長的炎熱天氣、以及在不斷轉變的降雨模式之下，依然繼續保持最好性能。
幕牆作為室內和室外環境之間的屏障，通過採用適當的隔熱材料，可以防止熱量損失或減少吸收熱量，從而顯著減低因為維持室內舒適環境所需消耗的能原。
像香港般的亞熱帶氣候，將百葉門窗等遮光裝置加入幕牆之中，能有效減少太陽光的直射，減低室內的吸熱量，繼而也減少建築物內空間的冷氣需求。在設計香港海運大廈的伸延部分時，建築設計上也直接回應了相關的氣候；以懸臂式露台為較低的樓層遮擋陽光，欄杆則作為下方露台的百葉窗遮陽裝置。

設計幕牆時，讓建築物能夠取得自然光，有助減少使用人造燈光，節能之外亦能為用戶提供更舒適的室內環境。香港科技大學逸夫演藝中心以落地玻璃幕牆設計，視覺透光率（VLT）相對較高，達約為七成。能做到這點，有賴建築物上的環型懸垂設計，為玻璃幕牆提供遮蔭功能，同時又可減低傳熱。

先進幕牆工程

先進幕牆工程包括採用尖端科技及物料，如智能玻璃、絕緣覆蓋層及建築物附設太陽能發電系統（BiPV）；先進玻璃科技包括低輻射塗層、三層玻璃及動態玻璃，均可大大減少傳熱及對太陽熱能的攝取。

據估計，一座建築物的隱含碳佔整體碳排放量的三分之一。在建築物外牆使用具有高回收含量的可持續建築物料、以再生能源製造及對生態敏感物料，建築時促進項目的可持續發展目標，亦可以顯著減低隱含碳排量。

可持續幕牆能為用戶及社區提供益處，拉近與自然生態系統及自然光的距離，配合人類的生理時鐘，亦減少能源依賴及溫室氣體排放，長遠亦有利於物業價值。在設計及落實可持續幕牆需要宏觀的全面思考，平衡技術、經濟及監管的考量，必須小心處理物料供應、價格、用料、保養及節能等多方面因素。

使用高品質物料及先進科技，無疑提升前期採購及安裝成本，意味於建築物外牆使用可持續物料比傳統幕牆物料為高，難免令發展商及用戶卻步。

設計可持續幕牆時，還必須考慮到建築面向、當地氣候、周邊環境等因素。以將軍澳的法國國際學校為例，考慮到香港位於亞熱帶區，窗門的角度精心設計成向內凹入，以減低照入室內的猛烈陽光，但又保持室內自然光線充足。此外，幕牆的預製玻璃纖維混凝土板，利用低輻射玻璃向內凹入安裝，提供部分遮蔭空間，從而減低吸收熱量，提升節能效果。

定期保養維修令可持續物料幕牆能夠有效運作；管理團隊必需在設計過程參與其中，提供意見的同時亦可分享管理經驗、了解如何有效保養設備，使幕牆能夠達致最高效能。一個在設計初時，能照顧及方便用戶所需的方案，可令日後營運時的保養得以恆常及以簡單步驟完成，大大提升用戶的使用體驗

符合建築規則及監督指引

建築規則及監督指引，往往阻礙可持續幕牆的應用，尤其是用於翻新舊建築時。在法規尚未完全解決重大翻新中的可持續性問題，這可能導致難以在有限的時間內，獲得安裝許可和批准。

所以業界刊物對於推動可持續幕牆工程的應用，以及呈現業內所使用的創新方案扮演著重要角色地位。通過突顯新產品、科技及設計方案，這些刊物能推動業界繼續向前，提升使用可持續發展的應用。分享項目個案及成功故事更可啟發工程師、建築師及其它設計師接受挑戰，以可持續的創新方法來規劃發展。

與「香港建築幕牆裝飾協會」等業界專才和協會的密切合作，可促進業內的共同實踐、創新和知識共享。期盼可以為地區帶來更可持續發展的環境，及為香港各階層提供一個更舒適、更健康的社區。

黃天賜
英海特香港及澳門區域經理