

## Double Skin Walls & Dynamic Façades



Le Corbusier called them "*mur neutralisant*," a system of ventilated double glazing that at that time was deemed too expensive and inefficient to be built. Villa Turque (Schwob) (1916) had an experimental "*mur neutralisant*."

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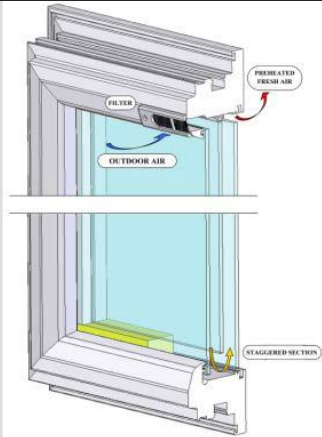
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The first studies on airflow windows were published in the 1950s in Scandinavia. The issue was to improve the energy efficiency and the thermal comfort of residential fenestration by **providing tempered fresh air and slowing heat loss.**

In 1957, the first patent related to airflow windows was filed in Sweden. In 1967, the EKONO Company built the **first office building** equipped with airflow windows in Helsinki, Finland.



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## Modern air-flow window configurations

- For winter fresh air
- For summer ventilation
- For winter warming
- For summer cooling

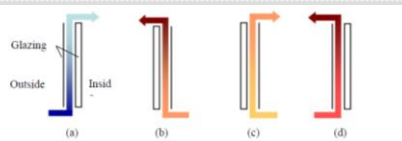


Figure 1. Existing airflow window types: (a) supply mode, (b) exhaust mode, (c) indoor air curtain and (d) outdoor air curtain.

### Heat exchanger

- Winter mode (vent air warms fresh air)
- Summer mode (vent air cools fresh air)

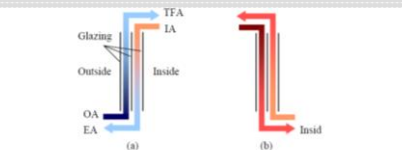


Figure 2. Two operating modes: (a) supply and (b) exhaust; note that TFA = tempered fresh air, IA = indoor air, OA = outdoor air and EA = exhaust air.

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Can this technique be applied to modern curtain wall buildings?

Arup has been exploring this notion for the past two decades and has established **façade engineering** groups on four continents. The air-flow window has morphed into the double skin façade.

For example, "Our double-skin façade is key to the sustainability credentials that earned a six Green Star rating for **1 Bligh Street, Sydney**. Double skin façades are often used to combat cold in Europe, but are relatively new to Australia and had not before been used locally on a high rise of this scale. The double skin provides great solar control but also permits the use of very clear glass – making the most of Sydney Harbour views."



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*A double-skin façade is an envelope construction, which consists of two transparent surfaces separated by a cavity, that is used as an air channel.*

Advantages include:

1. Tempering ventilation air
2. Reducing heat transfer rates
3. Sunlight control/shading
4. Exterior shading device protection

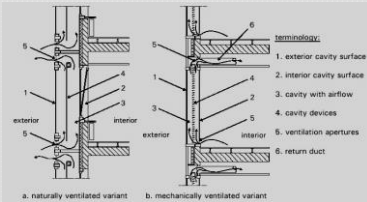


Figure 1.1: Multiple skin facades terminology applied to a naturally (left) and a mechanically (right) ventilated multiple skin facade example.

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### Three-story double skin



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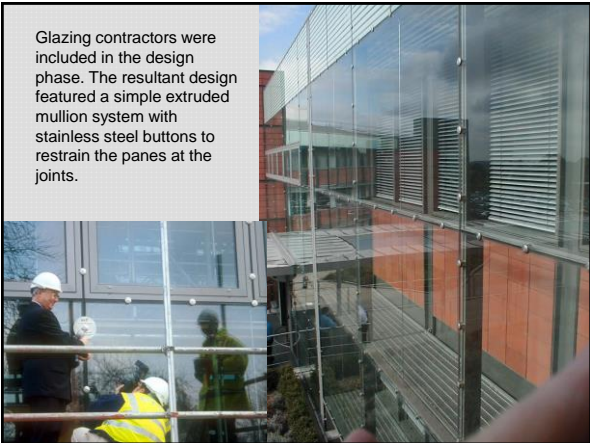
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Glazing contractors were included in the design phase. The resultant design featured a simple extruded mullion system with stainless steel buttons to restrain the panes at the joints.



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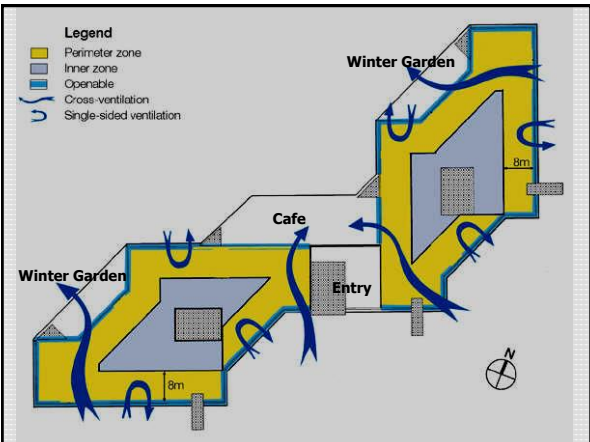
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The double glazing is used in conjunction with a displacement ventilation system.

While the building features control schemes for the window shades and electric lights, the users may override them and operate the windows for natural ventilation when conditions are favorable.

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The entry overlooks the ground floor café and terrace as well as the landscape beyond.

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The two winter gardens and the café are in wide gaps between the inner and outer walls.

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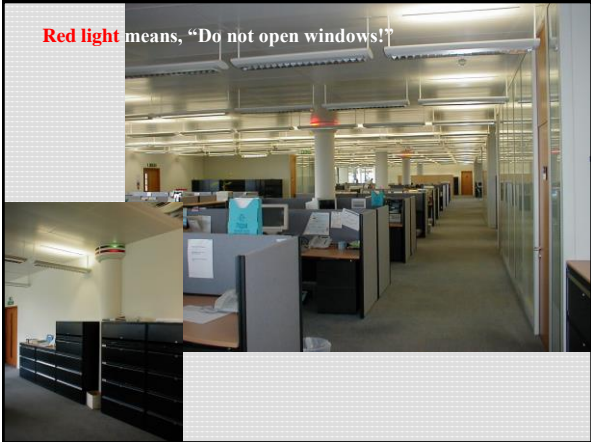
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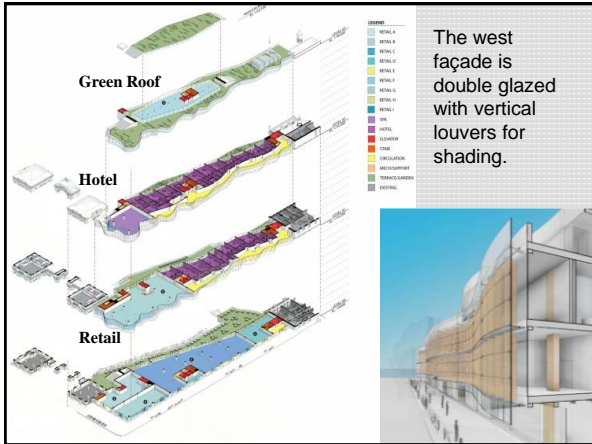
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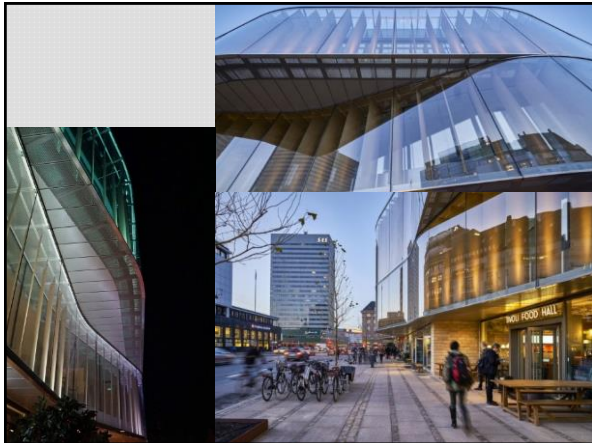
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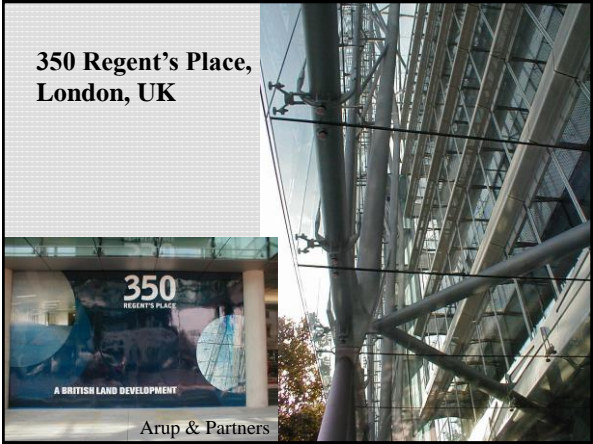
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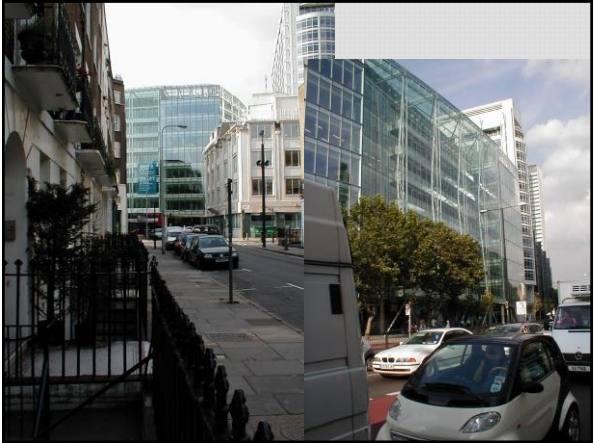
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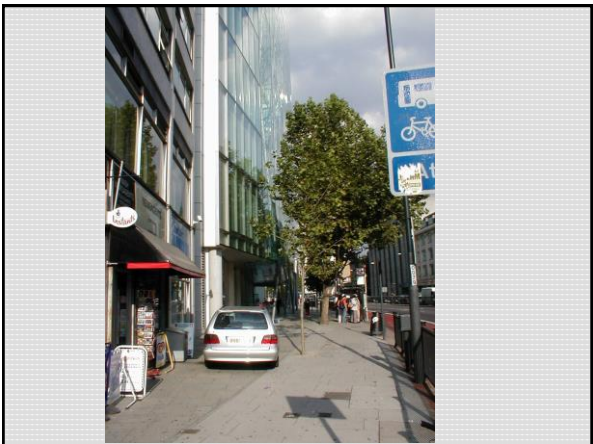
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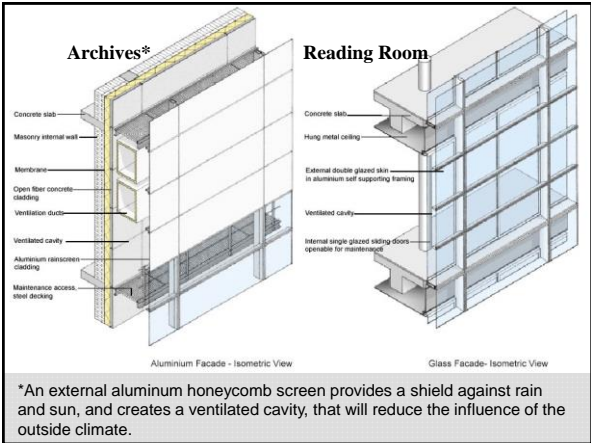
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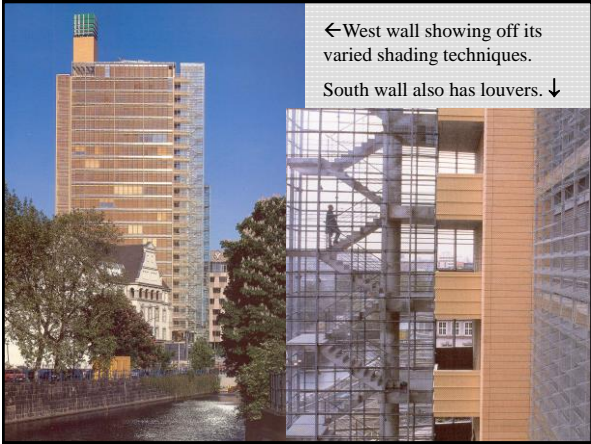
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← West wall showing off its varied shading techniques.  
 South wall also has louvers. ↓

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**Central St. Giles in London**

**Mixed-Use Complex**

- 37,000 m2 offices
- 100 flats
- Retail and cafés

Renzo Piano & Arup

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**Seattle Federal Justice Center**

9-story west-facing double skin

NBBJ with Arup & Partners

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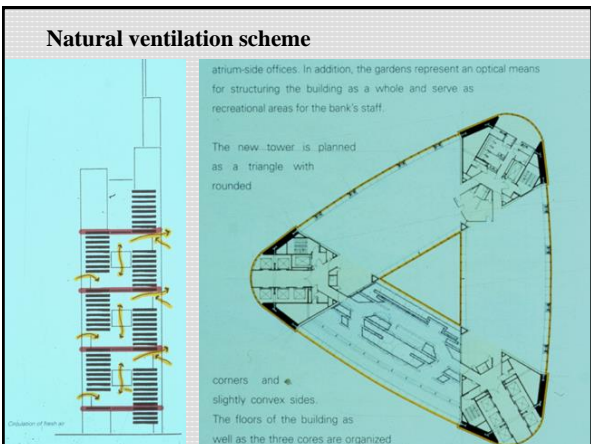
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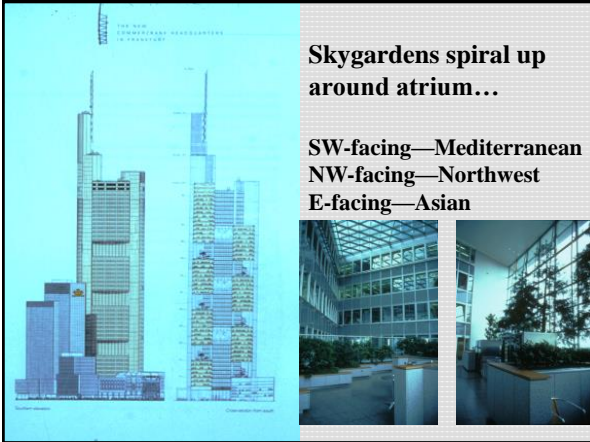
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"The almost—and occasionally completely—vertical façades comprise double-glazed cladding and, on the west elevation only, a third glass outer layer, which combine to provide a thermal-regulation-compliant skin using both solar control and insulation. The glass is fritted with a combination of red, light grey, dark grey, and beige colours echo the concrete, and red brick of the neighbouring buildings."



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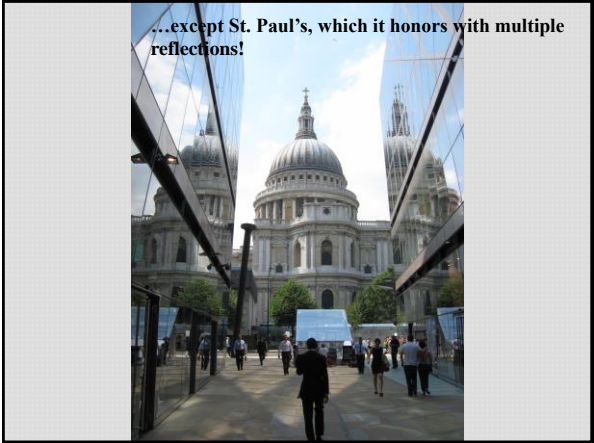
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...except St. Paul's, which it honors with multiple reflections!



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### Dynamic Façades



From 50 Design Questions Answered by Arup

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“The towers are over-clad on the south, west and east elevations by a unique dynamic shading system, a modular ‘Mashrabiya’ that opens and closes to provide self-shading as the sun moves around the building. The system is predicted to reduce the solar energy entering the building by 20% and is one of a number of innovative measures to improve environmental performance and limit energy use.”



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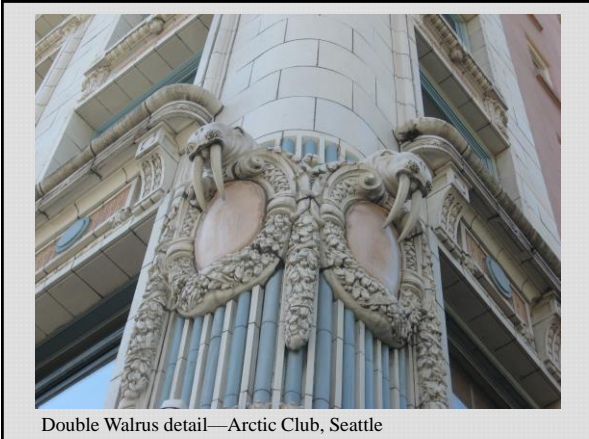
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Double Walrus detail—Arctic Club, Seattle

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