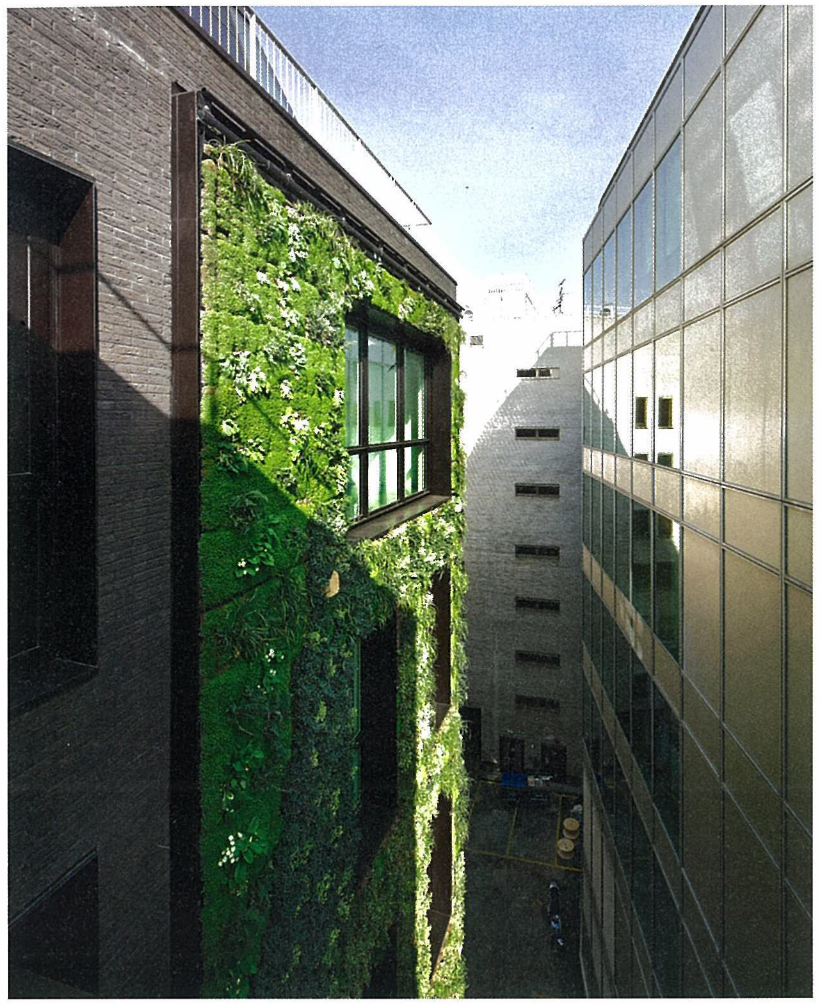


Power dressing: 5 Hanover Square

Designed by Squire & Partners, 5 Hanover Square is a sustainable mixed-used development comprising 8400 square metres of office, residential and gallery space in Mayfair, London. Rated BREEAM Offices Excellent and Code for Sustainable Homes Level 4, the £26m building incorporates a wide range of passive and active environmental technologies – most notably a saw-tooth mansard roof clad with a rainscreen of matt-black photovoltaic panels, and a five-storey living wall.

Aecom services engineer Sophia Negus says PV was the natural choice of onsite renewable, given the location and setting. Early studies suggested wind turbines would be of limited benefit due to low average wind speeds and disrupted airflows from surrounding buildings. Extensive solar shading analysis indicated the optimum position and angle of the monocrystalline PV panels used to clad the roof and south- and west-facing walls of the mansard. The former comprises 163 panels, which are oriented south/south-west, and double as a plant screen for the large air-handling units. Angled at 30 degrees, the panels are fixed to painted steel support frames, which are bolted back to the concrete structure.

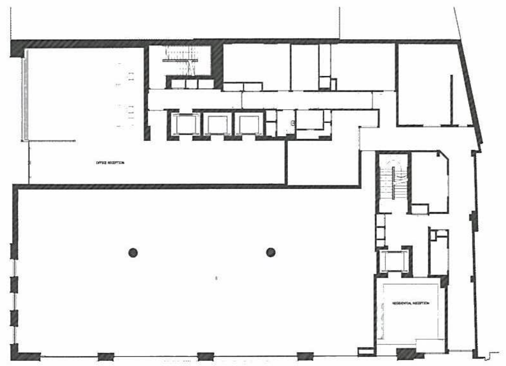
Installed on aluminium rails, the standard 1600x800mm dimensions of the angled PV panels dictated the setting out of the mansard walls. The sawtooth profile seen in elevation is derived from the angle of the rooftop PV panels. Floor-to-ceiling windows raking in parallel to the 77 panels provide order and articulation to the facades. Close coordination between the window and PV installers has resulted in narrow, precisely aligned joints. This provides a seamless 'machined' aesthetic in contrast to the handcrafted masonry facades below.

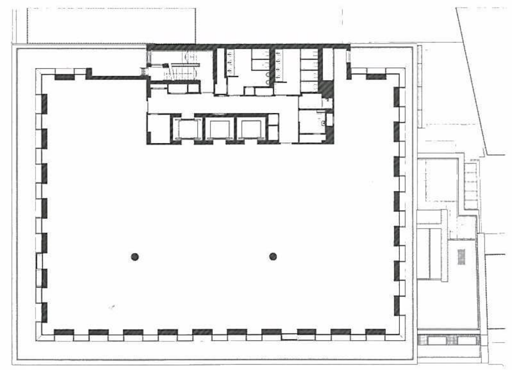
A high specification office-led development by Squire & Partners is one of the first projects in London to use photovoltaics as rainscreen cladding.

Project architect Nick Munro says matt-black SunPower PV modules were specified for reasons of performance and aesthetics. The modules themselves are all but invisible when viewed from the street, giving the impression of a dark-coloured cementitious or metal cladding system. The original intention was to use bespoke PV panels to clad the angled areas at the top of the saw-tooth walls. However, this proved too costly and aluminium panels – polyester powder-coated to match the PVs – were used instead. These also clad the north- and east-facing mansard walls, where the cost of installing PVs was felt to outweigh their energy-saving potential.

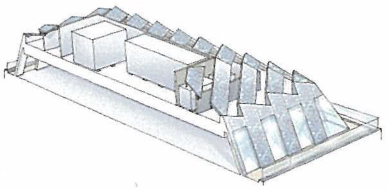
Overall, the 288-square metre installation provides 54kWp, equating to a carbon dioxide saving of over 23 tonnes per annum. The energy produced is divided between the EPC B-rated offices and the five residential apartments located on Hanover Street. One of the advantages of using a rainscreen system is that it allows for future upgrading of the PV panels.

The 90-square metre green wall was proposed as a means of softening the outlook from the rear of the residential apartments. Its north-east orientation provided a challenge in specifying plant species that would not just survive but





Above/below *A five-storey living wall boosts local biodiversity; ground- and sixth-floor plans.* **Opposite** *A saw-tooth mansard roof clad with matt-black photovotaic panels crowns the £26m development.*



thrive. An ecologist was appointed early-on to provide a suitable performance specification and to ensure compliance with BREEAM and the Code for Sustainable Homes.

Manufactured from 80 per cent post-industrial recycled material, the ANS living wall system is made up of 500x250mm modules, each comprising 14 planting cells angled at 30 degrees. The plants, which include ferns, grasses and small shrubs, were pre-grown in the cells in a nursery for six-months, ensuring they were well established before being delivered to site. Bird and bat boxes provide additional habitats for local species, including swifts and black redstarts, and add visual interest for residents.

Chambers located at the top of each module collect water from a fully-integrated emitter line, while notches at the bottom of the cells allow for drainage and irrigation. As part of the scheme's rainwater harvesting strategy, a portion of the rain collected is diverted to a specially designated tank, where plant nutrients are added before it is pumped through the irrigation system. A regular maintenance regime and remote monitoring by the supplier should ensure the wall remains healthy and vibrant.

Top/above *Mounted on steel support frames, the roof-mounted PV panels are angled at 30 degrees to maximise solar exposure.*
Above right *The facade-mounted PVs are aligned flush with the raking mansard windows; roof concept drawing.*

Complementing the living wall are two small green roofs: one at first-floor level above an electrical substation, and the other forming part of the penthouse roof terrace. Both are planted with a London wildflower seed mix and reuse rubble from the demolished building that previously occupied the site.

Energy-saving measures were an important consideration, not only for the building fabric and services, but also for the structure. Post-tensioned slabs have reduced the depth of concrete required by over 25 per cent. This has reduced the size of the foundations and quantity of steel reinforcement needed. In addition, more than 40 per cent of the concrete's cement content was replaced by ground granulated blast-furnace slag – a by-product of the iron ore industry – and 25 per cent of the aggregate content was replaced with stent – a by-product of the China clay industry, classed as a zero carbon. This has resulted in a significant reduction in embodied energy.

Given the architectural constraints of the site, which lies in the heart of the Mayfair Conservation Area, solar control is achieved on the masonry facades through the use of a relatively high solid-to-void ratio (for an office), recessed windows and overhangs. The double-glazed units incorporate high performance solar glass, resulting in an area-weighted average U-value of 1.8W/m²K and a solar G-value of 0.32.

Condensing boilers deliver centralised heating and domestic hot water, while cooling is provided by a Turbocor compressor air-cooled chiller. The latter has an energy efficiency rating (ESEER) of 5.45 (standard plant operates at 2-2.5), thereby reducing the electrical energy demand for cooling by more than 40 per cent or more. Specific fan power (SFP) on the air-handling units has been reduced as far as possible within the plant and riser confines. Heat recovery is used on the main air-handling unit, with ventilation rates reduced to suit demand. For the individual fan coil units, high efficiencies have been achieved with EC (electronic commutation) motors – instead of traditional AC (alternating current) motors – and by using variable speed drives to control flow rate in accordance with demand. This can reduce power consumption per unit flow rate by more than 50 per cent.

Energy-efficient lighting, such as LEDs, is used throughout the scheme in conjunction with time switches and daylight and PIR sensors. An interactive green screen in the reception is linked directly to the BMS system, allowing building users or visitors to review on-site generated electricity and see where energy is being consumed.

Overall, the development is expected to provide a carbon dioxide saving of 18 per cent over base-line total site emissions, including small power and equipment loads (figures based on Building Regulations Part L2A 2006).

Project team
Architect: Squire & Partners; construction manager: Mace; structural engineer: Ramboll; services engineer, services qs, ecologist, sustainability consultant, acoustician: Aecom; qs: Gardiner Theobald; interior architect: Johnson Naylor; developer: Stanhope; building owner: Mitsui Fudosan; photos: Hufton & Crow.

Selected suppliers and subcontractors
SunPower PV panels: Solar Century; ANS green wall, roof finishes: Rock; doors: Bauporte; pre-cast concrete: Techrete; windows: Schueco; brickwork/blockwork: Lyons Annoot; wc, joinery, residential fit-out: Swift Horsman; stonework: Grants of Shoreditch; metalwork: Pad Contracts; BMS: Etons; electrics: Phoenix.