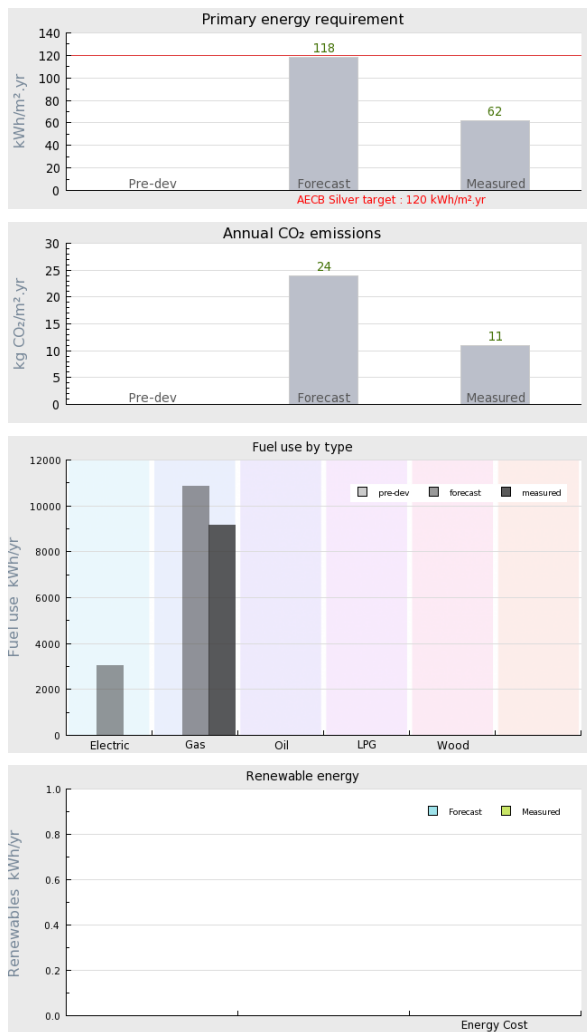


Project name Clapham Retrofit

Project summary This 4-storey semi-detached Grade II listed Victorian townhouse has been eco retrofitted to a high standard of airtightness and thermal performance. The 170-year old, solid brick building has been internally retrofitted with over 9 types of insulation material, each a bespoke solution to localised performance requirements respecting the historic significance of the existing fabric. The existing sash windows and doors have been upgraded through the installation of double glazed secondary glazing. High performance insulation materials together with careful airtightness and thermal bridge detailing have resulted in a historic building that is both highly energy efficient and more comfortable to live in.



Project Description

| | |
|------------------------------|-------------------------|
| Projected build start date | 11 Feb 2013 |
| Projected date of occupation | 14 Nov 2013 |
| Project stage | Occupied |
| Project location | London, London, England |
| Energy target | AECB Silver |
| Build type | Refurbishment |
| Building sector | Private Residential |

| | |
|---|---|
| Property type | Semi-Detached |
| Existing external wall construction | Solid Brick |
| Existing external wall additional information | Top 3 storeys brick, lower storey lime rendered |
| Existing party wall construction | Solid brick |
| Floor area | 170 m ² |
| Floor area calculation method | PHPP |

Project team

| | |
|---------------------------------------|---|
| Organisation | Arboreal Architecture |
| Project lead | Arboreal Architecture - Harry Paticas |
| Client | Anonymous |
| Architect | Arboreal Architecture - Harry Paticas |
| Mechanical & electrical consultant(s) | Alan Clarke |
| Energy consultant(s) | Harry Paticas and Alan Clarke |
| Structural engineer | The Morton Partnership |
| Quantity surveyor | |
| Other consultant | Jennings Aldas (Air Leakage Specialist) |
| Contractor | Noble & Taylor |

Design strategies

| | |
|--------------------------------------|---|
| Planned occupancy | Two people with occasional guests. Both occupants have their own home-office. |
| Space heating strategy | Low temperature hot water heating. Gas fired 12kW condensing boiler. |
| Water heating strategy | Unvented hot water cylinder with solar twin coil. |
| Fuel strategy | Mains gas. Mains electricity. |
| Renewable energy generation strategy | Solar hot water collectors. 3sqm facing due south. |
| Passive solar strategy | n/a - retrofit of existing listed building. |
| Space cooling strategy | Natural cross-ventilation. |
| Daylighting strategy | n/a - retrofit of existing listed building. |
| Ventilation strategy | Whole house mechanical extract ventilation. |
| Airtightness strategy | Continuous air barrier formed by internal lime plaster and poured screed floor with vapour check membrane below. 2nd floor ceiling membrane sealed with tape and mesh to plaster walls. Joist ends and door/window frames sealed with tapes. Grommets installed to all services penetrations. |

Strategy for minimising thermal bridges

Continuous layer of internal insulation. Careful detailing of a range of insulation materials including: aerogel blanket, perlite, technopor, perinsul.

Modelling strategy

Whole house modelling in PHPP.

Insulation strategy

Application of Internal wall insulation including: woodfibre, aerogel, IQtherm, PIR, calsietherm, rigid thermoset insulation. Existing concrete slab retained but screed removed and replaced with vacuum insulated panels and lytag screed. 2nd floor roof filled with cellulose insulation between TGI joists.

Other relevant retrofit strategies

Pre-design investigations undertaken to develop an holistic understanding of the existing structure in order to allow a fine grain of design.

Other information (constraints or opportunities influencing project design or outcomes)

The existing building is Grade II listed.

Energy use

Fuel use by type (kWh/yr)

| Fuel | previous | forecast | measured |
|-----------------|----------|----------|----------|
| Electric | | 3046 | |
| Gas | | 10837 | 9171 |
| Oil | | | |
| LPG | | | |
| Wood | | | |

Primary energy requirement & CO2 emissions

| | previous | forecast | measured |
|---|----------|----------|----------|
| Annual CO2 emissions (kg CO2/m ² .yr) | - | 24 | 11 |
| Primary energy requirement (kWh/m ² .yr) | - | 118 | 62 |

Renewable energy (kWh/yr)

| Renewables technology | forecast | measured |
|--------------------------------------|----------|----------|
| - | | |
| - | | |
| Energy consumed by generation | | |

Airtightness (m³/m².hr @ 50 Pascals)

| | Date of test | Test result |
|------------------------------|--------------|-------------|
| Pre-development airtightness | 21 Feb 2012 | 11.1 |

| | Date of test | Test result |
|--------------------|--------------|-------------|
| Final airtightness | 21 Oct 2013 | 2.3 |

Annual space heat demand (kWh/m².yr)

| | Pre-development | forecast | measured |
|--------------------------|-----------------|----------|----------|
| Space heat demand | 180 | 40 | 40 |

| | |
|---------------------------------------|------------------------------|
| Whole house energy calculation method | PHPP |
| Other energy calculation method | |
| Predicted heating load | 19 W/m ² (demand) |
| Other energy target(s) | |

Building services

| | |
|---|---|
| Occupancy | Two people with frequent guests. |
| Space heating | Low temperature hot water heating. Gas-fired 12kW condensing boiler. |
| Hot water | Unvented hot water cylinder with solar twin coil. |
| Ventilation | Whole house mechanical extract ventilation. |
| Controls | Digital controller with room temperature compensation, hot water programme and control of solar thermal. Integral isolating and thermostatic radiators valves to all radiators. |
| Cooking | Gas hob with electric oven. |
| Lighting | LED lighting throughout. |
| Appliances | All appliances A+ to A+++ rated. |
| Renewables | Solar hot water collectors. 3sqm facing due south. |
| Strategy for minimising thermal bridges | Continuous layer of internal insulation. Careful detailing of a range of insulation materials including: aerogel blanket, perlite, technopor, perinsul. |

Building construction

| | |
|---------------------|---|
| Storeys | 4 |
| Volume | 613m ³ |
| Thermal fabric area | 376m ² |
| Roof description | Insulated 2nd floor ceiling with cold (but windtight) roof above. TGI joists with blown cellulose. |
| Roof U-value | 0.15W/m ² K |
| Walls description | Internal wall insulation including: woodfibre, aerogel, IQtherm, PIR, calsi therm, rigid thermostet insulation. |
| Walls U-value | 0.11W/m ² K |

| | |
|--|--|
| Party walls description | Solid brick. Party wall returns to external walls insulated (u-value = 0.63). |
| Party walls U-value | 1.21W/m ² K |
| Floor description | 30mm vacuum insulated panels with lytag screed over. |
| Floor U-value | 0.25W/m ² K |
| Glazed doors description | Thermally broken (20mm purenit) hardwood frames with single outer glazing and secondary double glazing (argon filled). |
| Glazed doors U-value | 1.10W/m ² K uninstalled |
| Opaque doors description | Existing door panels upgraded with 30mm VIPs with purenit battens and 10mm VIP sheet. |
| Opaque doors U-value | 0.90W/m ² K uninstalled |
| Windows description | Existing single glazed sash windows with secondary double glazing (argon filled). |
| Windows U-value | 1.25W/m ² K uninstalled |
| Windows energy transmittance (G-value) | 60% |
| Windows light transmittance | 67% |
| Rooflights description | conservation rooflight installed outside of thermal envelope. |
| Rooflights light transmittance | |
| Rooflights U-value | |

Project images





















