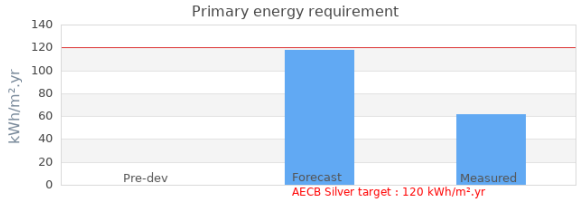
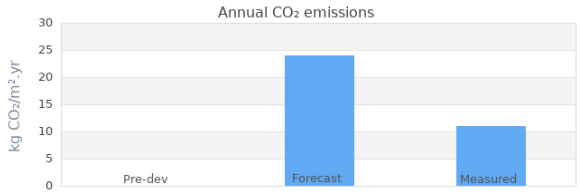
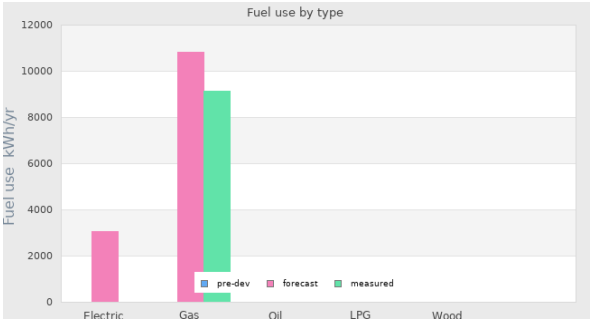
https://www.lowenergybuildings.org.uk/

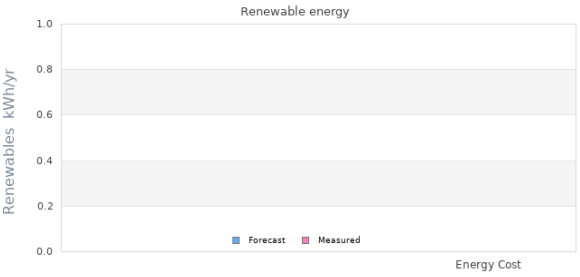
Project name Clapham Retrofit

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 m²
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, calsitherm, 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/m².yr)	-	24	11
Primary energy requirement (kWh/m².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/m² (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	613m³
Thermal fabric area	376m²
Roof description	Insulated 2nd floor ceiling with cold (but windtight) roof above. TGI joists with blown cellulose.
Roof U-value	0.15W/m² K
Walls description	Internal wall insulation including: woodfibre, aerogel, IQtherm, PIR, calsitherm, rigid thermoset insulation.
Walls U-value	0.11W/m² K

Party walls description	Solid brick. Party wall returns to external walls insulated (u-value = 0.63).
Party walls U-value	1.21W/m² K
Floor description	30mm vacuum insulated panels with lytag screed over.
Floor U-value	0.25W/m² 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/m² 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/m² K uninstalled
Windows description	Existing single glazed sash windows with secondary double glazing (argon filled).
Windows U-value	1.25W/m² 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