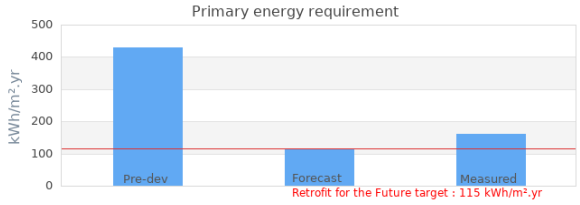
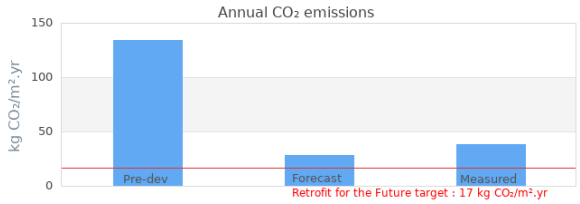
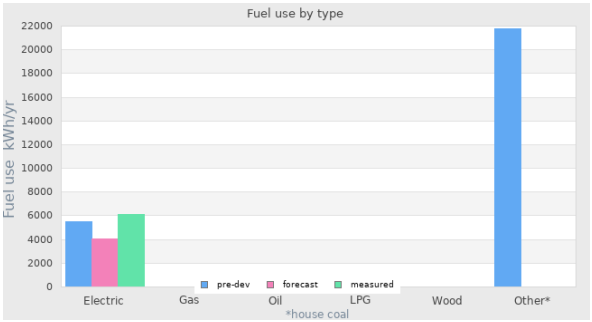
https://www.lowenergybuildings.org.uk/

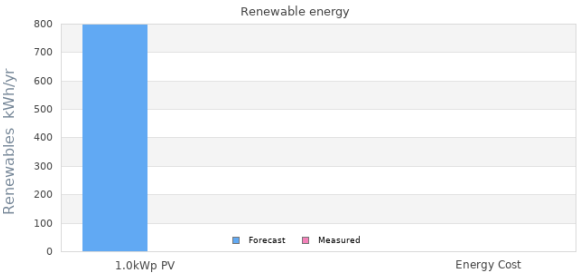
Project name Rural solid wall terrace house - 80% carbon emission reduction through whole house upgrade approach using innovative technologies

Project summary Existing: Solid brick walls (430mm); Slate roof; Projecting stair hall (half brick walls); Rear kitchen extension. Proposed: Separate hall from the heated envelope (retain as draft lobby only) & change stair to discharge into l/room; Insulate & dry line house & kitchen walls; Increase roof insulation to 350mm; Insulate kitchen roof; Insulated floating floor with u/floor heating in l/room & kitchen; Triple glazed composite windows; GSHP serving u/floor heating; LED lights with 50k hours guaranteed max light output; Sun pipe to f/floor landing; Decentralised whole house ventilation system; 1.0kWp PV;Solar thermal panel; Shower water heat recovery; Reduced water consumption; Smoke alarm system; AA++ appliances; Smart metering with display.









Project Description

Projected build start date	01 Mar 2010
Projected date of occupation	16 Apr 2010
Project stage	Under construction
Project location	Sea Palling, Norfolk, England
Energy target	Retrofit for the Future
Build type	Refurbishment

Building sector	Public Residential
Property type	Mid Terrace
Existing external wall construction	Solid Brick
Existing external wall additional information	430mm thick solid brick
Existing party wall construction	215mm solid brick plastered both sides
Floor area	86 m²
Floor area calculation method	PHPP

Project team

Organisation	Victory Housing Trust
Project lead	Victory Housing Association
Client	Victory Housing Association
Architect	PRP Architects
Mechanical & electrical consultant(s)	N/A
Energy consultant(s)	PRP Environmental
Structural engineer	Scott Wilson
Quantity surveyor	
Other consultant	CDM Coordinator: PRP Project Services
Contractor	Hill Partnerships Ltd

Design strategies

Planned occupancy	Currently empty, but potential for 3 or 4 person family home.
Space heating strategy	Ground source heat pump serving under floor heating.
Water heating strategy	Solar thermal and GSHP
Fuel strategy	Solar thermal and GSHP hot water, PV panels and mains electricity
Renewable energy generation strategy	1.0kWp photovoltaic panel
Passive solar strategy	The house faces north east and the original window openings are small, but in proportion with the age and style of the property. There is no proposal to change window sizes. Glazing will be specified to compensate for potential overheating.
Space cooling strategy	Natural cooling via openable windows. Adjustments to glazing G-values to guard against overheating
Daylighting strategy	Existing windows will remain with a sun pipe added to illuminate the landing.

Ventilation strategy	Natural ventilation via openable windows, plus decentralised whole house ventilation system using continuously running low energy fans drawing air out through wet rooms.
Airtightness strategy	The property is close to the sea and will be subject to severe winds both infiltrating the house as well as drawing air out through any openings. A major air leakage point is the half brick thick stair hall; air tightness will be improved by changing this into an entrance lobby separated form the rest of the house. Improved seals around windows. Draught sealing around loft hatch. Careful attention to detail and sealing joints when installing dry lining. Ventilation equipment checked for air leakage prior to commissioning. Careful detailing around sockets and all other penetrations. Instruction to operatives on best practice at contract stage. Air proof films are not proposed due to the risk of sweating and mould growth.
Strategy for minimising thermal bridges	Minimisation of thermal bridges at design stage by careful detailing of all material and component junctions to ensure continuity of insulation and thermal performance. Continuation of dry lining along internal return walls. Insulation of new 'floating' ground floor and exposed areas of first floor adjacent to external walls. Instruction to operatives on best practice and careful site monitoring during construction.
Modelling strategy	Whole house modelling was undertaken using SAP (with NHER Plan Assessor software) in conjunction with the Extended SAP worksheet. AutoCAD produced plans and elevations were used to assist with visualisation and detailed design.

Insulation strategy	Ground floor - new timber suspended in living room, 25mm nanogel blanket Resultant U-value W/m2K 0.43 Exposed front & rear walls - 65mm nanogel foam internal insulation Resultant U-value W/m2K 0.17 Kitchen extension walls - 40mm nanogel foam internal insulation Resultant U value W/m2K 0.28 Pitched roofs with flat ceiling - Top up to 350mm mineral fibre quilt Resultant U-value W/m2K 0.12 Flat roof over rear kitchen - 100mm phenolic foam overlay with 30mm nanogel foam internal insulation Resultant U-value W/m2K 0.15 Windows and doors Replacement uPVC triple glazed low-e Resultant U-value W/m2K 1.1
Other relevant retrofit strategies	Our proposals are designed to be carried out with the present resident remaining in occupation. Considering the wider application of Retrofit it will be neither practical nor economically viable on a large scale to decant residents while the work is in progress. Pre commencement discussion and engagement with residents, plus regular monitoring during and after the works, will help to minimise the degree of inevitable inconvenience.
Other information (constraints or opportunities influencing project design or outcomes)	Proposals have been selected to address the challenge of achieving CO2 reductions in a small house in a semi rural area, specifically where the property is not connected to the gas network. We propose to demonstrate that location and small size need not preclude the use of renewable technologies such as ground source heat pumps. In this particular location the landlord owns open ground in front of the house suitable for a heat pump to serve the whole terrace. The other houses are currently on oil heating.

Energy use

Fuel use by type (kWh/yr)

Fuel	previous	forecast	measured
Electric	5474	4020	5503
Gas			
Oil			
LPG			
Wood			
house coal	21772		

Primary energy requirement & CO2 emissions

	previous	forecast	measured
Annual CO2 emissions (kg CO2/m².yr)	134	28	38
Primary energy requirement (kWh/m².yr)	430	117	160

Renewable energy (kWh/yr)

Renewables technology	forecast	measured
1.0kWp PV	797.5999756	
-		
Energy consumed by generation		

Airtightness (m³/m².hr @ 50 Pascals)

	Date of test	**Test result**
Pre-development airtightness	-	8.06
Final airtightness	-	10.92

Annual space heat demand (kWh/m².yr)

	Pre-development	forecast	measured
Space heat demand	-	56	-

Whole house energy calculation method	SAP Extension for Whole House
Other energy calculation method	
Predicted annual heating load	-
Other energy target(s)	

Building services

Occupancy	NULL
Space heating	NULL
Hot water	NULL
Ventilation	NULL
Controls	NULL
Cooking	NULL
Lighting	NULL
Appliances	NULL
Renewables	NULL
Strategy for minimising thermal bridges	NULL

Building construction

Storeys

Volume	
Thermal fabric area	
Roof description	NULL
Roof U-value	0.00W/m² K
Walls description	NULL
Walls U-value	0.00W/m² K
Party walls description	NULL
Party walls U-value	0.00W/m² K
Floor description	NULL
Floor U-value	0.00W/m² K
Glazed doors description	NULL
Glazed doors U-value	0.00W/m² K
Opaque doors description	NULL
Opaque doors U-value	0.00W/m² K
Windows description	NULL
Windows U-value	0.00W/m² K
Windows energy transmittance (G-value)	
Windows light transmittance	
Rooflights description	NULL
Rooflights light transmittance	
Rooflights U-value	0.00W/m² K

Project images

Dwelling Airtightness Testing Report

BSRIA Airtightness
Old Bracknell Lane West
Bracknell, Berkshire RG12 7AH
Phone: 0800 5871000
Fax: 01344 465691

BSRIA Airtightness & Acoustics

Report N°: DAT-VIC01-NA01 -1-PL1-T1

Date:	17/09/2009	**Airtightness Engineer:**	C Knights
Accreditation Body:	ATTMA	**Registration Number:**	0005

Client: Victory Housing Trust
Region: N/A
Address: Cromer Road
North Walsham
Norfolk
NR28 0NB
Telephone: 0845 3006648
Facsimile: 01692 502474

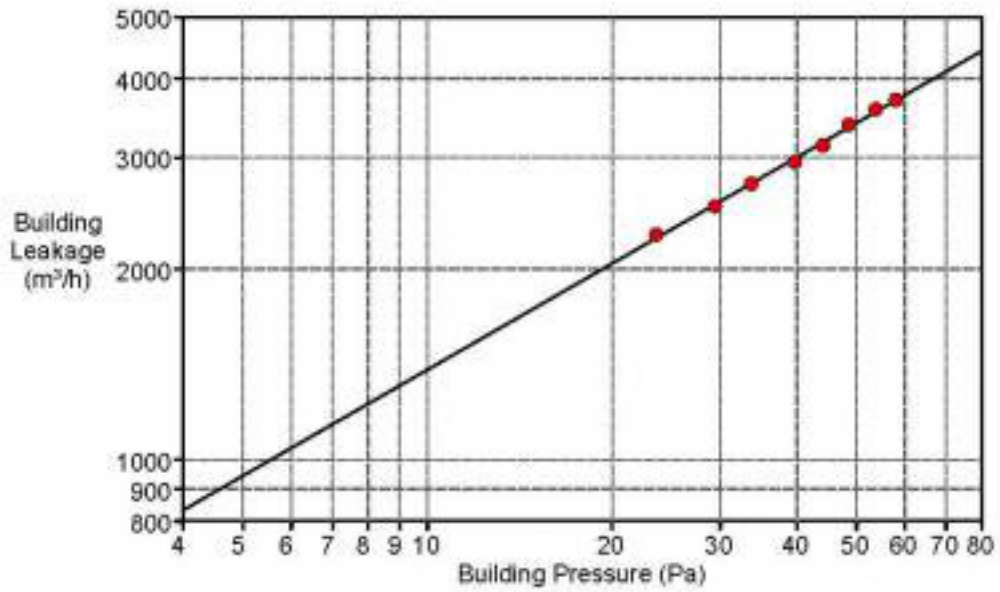
Plot N°: 1
Developers Type: N/A
Development Name:
Development Address:

Test Results at 50 Pascals		**Q_{50}: Airflow (m³/h):**	3401
Measured Air Permeability (m³/(h.m²)):	12.93	**Design Air Permeability (m³/(h.m²)):**	
Did the dwelling achieve the required air permeability as specified in the SAP calculations?			

Building Leakage Curve

Air Flow Coefficient (C_{env}):	378.9	**Air Leakage Coefficient (C_L):**	384.8
Exponent (n):	0.56	**Correlation Coefficient (r^2):**	0.9984

Test Information		**TS1 Leakage Area (m²):**	0.170
Type of Test:	Depressurisation	**Test Method:**	B
Test Standard:	TS1	**Regulation Complied With:**	N/A



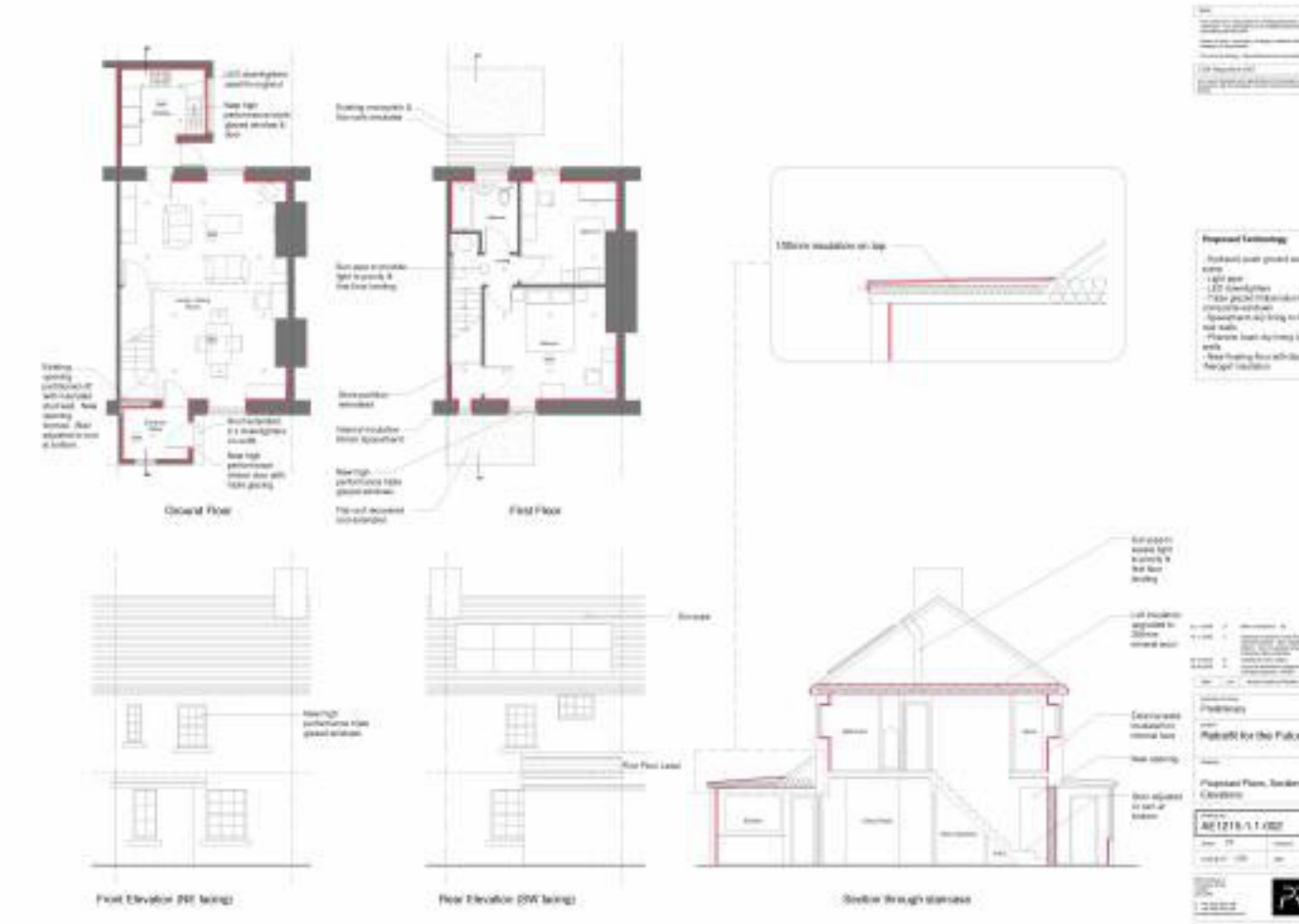
Ground Floor

First Floor

Front Elevation (NE facing)

Rear Elevation (SW facing)

Section through staircase



Front view

Rear view