Case study 1

Perry Street, Darlaston

Archetype
Pre-1945 terrace

Landlord
Accord Housing Group

Description

The Perry Street terraces form part of three streets of 51 properties which were built between 1900 and 1910. Units are typically two bedroom and a typical floor area of 110 m². The construction is traditional masonry with solid walls. Floors are suspended timber with air brick ventilation.

Gas central heating, dry lining and loft insulation were installed in 1985. It is possible that the dry lining may not have been adequately ventilated. Air bricks have been added to ventilate the suspended timber ground floors. The windows and front doors were replaced in 2004. The windows and rear doors are uPVC units. The windows have relatively narrow reveals of 12mm.

Whilst the external appearance of the streetscape has no formal heritage status it is unlikely that external changes to its appearance onto the street would be accepted. The externals feature a range of window and door features, as well as guttering, and the eaves are relatively shallow in depth.

Improvements to date
Dry lining, re-roofing (including loft insulation) and gas central heating, 1985
uPVC double glazing (without coating or gas fill) and doors, 2004
Top-up loft insulation to 150mm in total, 2004

Schedule improvements
Kitchens, 2011/12 (subject to budget)

Performance analysis

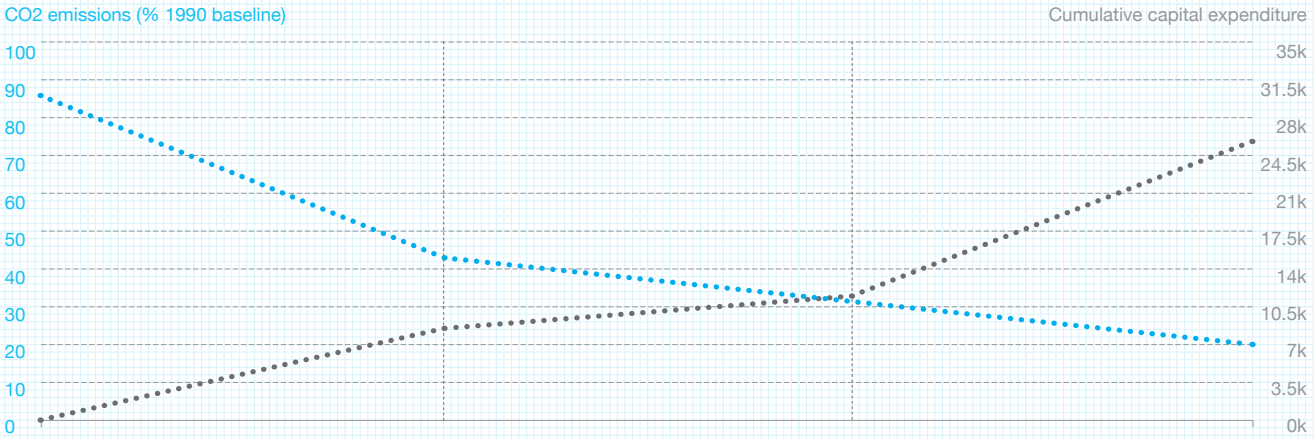
Capital cost	£25,717.68
by floor area	£233.80/m²

Performance metrics	1990	2009	2025
SAP rating	64 (D)	69 (C)	86 (B)
Fuel cost	£631.50	£588.59	£273.13
CO_2 emissions	5.8	5.0	1.2
% reduction	- 0%	-14%	-80%

	Baseline 1990		As of 2009		Target 2025	
Fabric U-Values	U Value W/m²K	Heat loss W/m	U Value W/m²K	Heat loss W/m	U Value W/m²K	Heat loss W/m
Windows	4.0	53.6	2.5	33.5	1.2	16.0
Doors	3.5	5.5	2.9	4.6	1.2	1.9
Floor	0.7	40.6	0.7	40.6	0.2	9.5
Walls (front)	0.7	13.5	0.7	13.5	0.7	13.5
Walls (rear)	0.7	20.2	0.7	20.2	0.2	5.6
Roof	0.4	19.6	0.35	17.7	0.1	5.1

Energy and CO_2 emissions	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)
Space heating	18,772	3.6	14,012	2.7	4,006	0.2
Hot water	3,719	0.7	3,719	0.7	1,389	0.0
Electricity	3,321	1.4	3,385	1.5	2,124	0.9

Timeline for future investment



	Phase 1 (2010 - 2015)	Phase 2 (2016 - 2020)	Phase 3 (2021 – 2030)
1.Fabric performance	**Roof:** Top-up existing insulation (to 350mm);	**Walls:** Overcladding of back walls and gable walls of properties with a rendered external insulation system;	**Glazing:** Replacement of existing glazing units with high performance double glazing units; **Floors:** Insertion of insulation bats (200mm) between rafters of suspended timber floor; **Doors:** Solid timber panel insulated doors;
2. Fit out	**Water fittings:** Replacement of all tap fittings with spray taps and/or flow restrictors, and the fitting of low flow shower heads; **Appliances:** Provision of new A+ rated washing machines and fridge/freezers as part of kitchen refurbishment (subject to tenant agreement); **Lighting:** Switchover of all light bulbs to low energy compact fluorescent (subject to tenant agreement);		
3. Energy supply	**Biomass heating:** Installation of one communal biomass boiler (sized to phase 2 load), one backup gas condensing boiler and hot water accumulator tank to serve 51 properties and the Innovation Centre; **District Heating network:** Installation of a flow and return network to supply all properties with heat from the energy centre (see above);		**Solar thermal:** Installation of evacuated tube and/or high performance flat plate collector, supplementing primary heating system;
4. Monitoring	**Heat metering:** Fitting of remotely read heat and power metering for the purpose of billing for district and solar heat, and with household access to energy use data;		**Internal heating systems:** Fitting of thermostatic controls and timers for each heating zone in each home;

Case study 2

Buckley Road, Wolverhampton

Archetype
Pre-1945 semi-detached house

Landlord
Wolverhampton Homes

Description

The Buckley Road properties form part of an estate of semi-detached housing built during the inter-war period. They are four and five bed and the largest floor area is 226 m^2. They are traditional masonry construction with, for the most part, rendered external walls. Floors are concrete screed on a slab.

The properties are characterised by large pitched roofs and deep overhanging eaves. The external walls were constructed with a small cavity of 25-30mm which has subsequently been filled with insulation.

Double glazing was installed in the later 1990's. An investment programme has upgraded the heating systems of the properties, with modern condensing gas boilers installed. Loft insulation has also been topped up from 100mm to 250mm.

Improvements to date
Double glazed uPVC windows (without coating or gas fill) and cavity insulation, 1999
Condensing boiler and radiators, 2008

Schedule improvements
Re-roofing, 2010
Kitchens, bathrooms and electric rewiring, 2011/12

Performance analysis

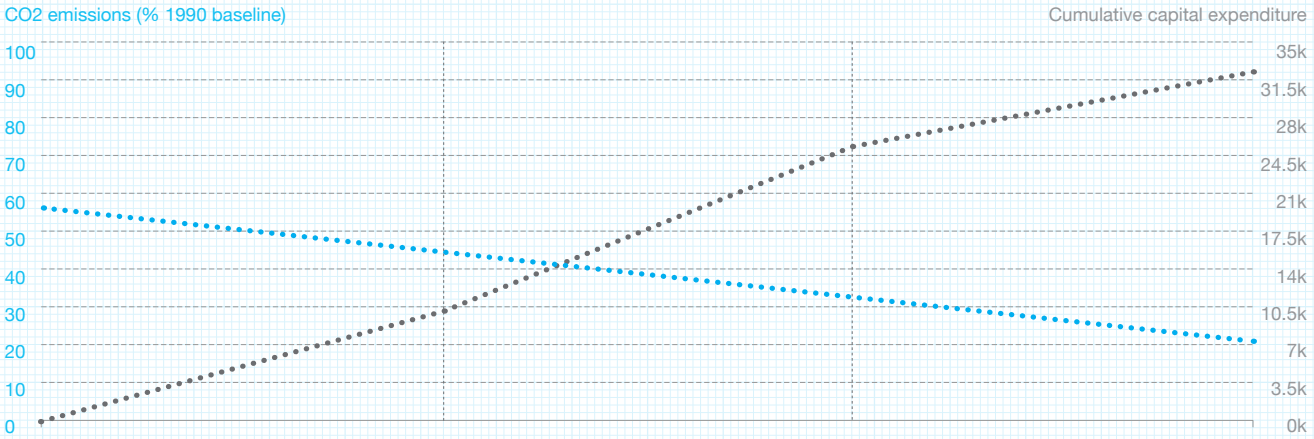
Capital cost	£32,170.56
by floor area	£142.35/m^2

Performance metrics	1990	2009	2025
SAP rating	69 (C)	78 (C)	93 (A)
Fuel cost	£860.40	£669.09	£308.10
CO_2 emissions	10.1	5.5	2.1
% reduction	- 0%	-45%	-79%

	Baseline 1990		As of 2009		Target 2025	
Fabric U-Values	U Value W/m^{2}K	Heat loss W/m	U Value W/m^{2}K	Heat loss W/m	U Value W/m^{2}K	Heat loss W/m
Windows	4.0	61.8	2.4	36.5	0.7	10.8
Doors	2.8	10.0	2.8	10.0	1.2	4.3
Floor	0.7	72.8	0.7	72.8	0.4	45.1
Walls	1.4	97.3	0.7	48.0	0.2	14.0
Roof	2.0	98.4	0.4	17.2	0.1	5.0

Energy and CO_2 emissions	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)
Space heating	36,371	7.1	15,216	3.0	3,503	0.7
Hot water	6,351	1.2	5,075	1.0	1,218	0.2
Electricity	4,249	1.8	3,779	1.6	2,769	1.2

Timeline for future investment



	Phase 1 (2010 - 2015)	Phase 2 (2016 - 2020)	Phase 3 (2021 – 2025)
1.Fabric performance	**Roof:** Top-up of existing loft insulation (to 350mm);	**Walls:** Overcladding of external walls with rendered external insulation system (150mm), with detailing to incorporate replacement windows; **Windows:** Replacement of existing frames and glazing units with high performance triple glazing; **Doors:** Solid timber panel insulated doors;	**Floors:** Installation of insulated timber flooring (10mm insulation, 25mm overall) over existing concrete ground floor;
2. Fit out	**Water fittings:** Replacement spray taps and/or flow restrictors, low flow shower heads as part of kitchen/bathroom works; **Appliances:** A+ rated washing machines and fridge/freezers (subject to tenant agreement); **Lighting:** Switchover to compact fluorescent (subject to tenant agreement);		
3. Energy supply	**Solar thermal:** Installation of evacuated tube and/or high performance flat plate collector with hot water accumulator tank, supplementing primary heating system; **Upgrade of condensing boiler** controls to feed solar accumulator tank.		**Ventilation heat recovery:** Whole house system with heat recovery in the roof void, drawing warm air from kitchens and bathroom;
4. Monitoring			**Internal heating systems:** Fitting of thermostatic controls and timers for each heating zone; **Low temperature heating:** Replacement skirting radiators (utilising existing pipework), or underfloor heating alongside floor insulation;

Case study 3

Kerry Green, Bishops Castle

Archetype
1945-1964 semi-detached house

Landlord
South Shropshire Housing Association

Description

The Kerry Green estate consists of semi-detached houses built in 1938. The houses are two bed and has a typical floor area of 76 m^2. The properties are of standard masonry construction with a cavity wall of between 50 and 60mm. Floors are concrete screed on a raised slab.

A series of improvements have been made to the properties over the last twenty years, including double glazing, cavity fill and loft insulation. External doors are scheduled for replacement.

The town of Bishops Castle is not connected to the gas network and so space heating and hot water are provided using solid fuel. Coal fired stoves with back burners are currently installed. These are supplemented by electric immersion heaters which also supply wet radiators for space heating.

Improvements to date
uPVC double glazing (without coating or gas fill), 1992
Solid fuel heating system (coal and wood) with electric immersion backup, 1997
Loft insulation (100mm), 1999
Cavity insulation (50-60mm) and top-up loft insulation (200mm), 2005
Kitchen replacement, 1996
Electrical testing, 2007

Schedule improvements
External door replacement, 2011/12
Bathroom replacement, 2015/16

Performance analysis

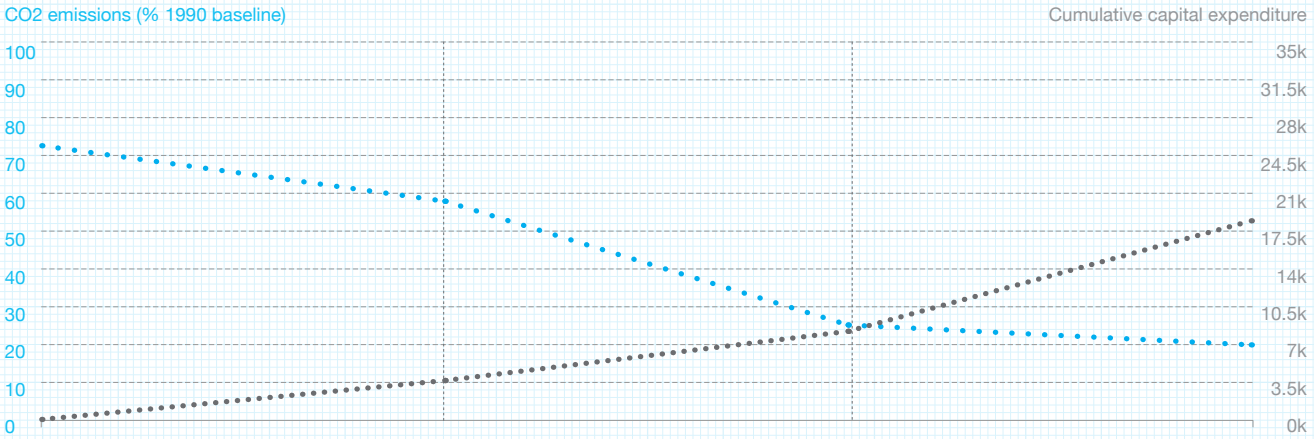
Capital cost	£18,581.70
by floor area	£244.50/m^2

Performance metrics	1990	2009	2025
SAP rating	27 (F)	51 (E)	86 (B)
Fuel cost	£975.63	£681.54	£286.60
CO_2 emissions	5.2	3.8	1.0
% reduction	- 0%	-27%	-80%

	Baseline 1990		As of 2009		Target 2025	
Fabric U-Values	U Value W/m^{2}K	Heat loss W/m	U Value W/m^{2}K	Heat loss W/m	U Value W/m^{2}K	Heat loss W/m
Windows	4.0	50.9	2.5	31.9	1.2	15.2
Doors	3.9	14.7	2.9	11.0	1.2	4.5
Floor	0.7	26.6	0.7	26.6	0.2	6.3
Walls	1.4	89.2	0.7	44.0	0.7	40.6
Roof	1.8	67.6	0.4	14.7	0.1	3.8

Energy and CO_2 emissions	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)
Space heating	15,990	1.8	4,599	0.1	3,503	0.7
Hot water	5,262	0.6	1,768	0.0	1,218	0.2
Electricity	3,304	1.4	2,058	0.9	2,769	1.2

Timeline for future investment



	Phase 1 (2010 - 2015)	Phase 2 (2016 - 2020)	Phase 3 (2021 – 2030)
1.Fabric performance	**Roof:** Top-up existing insulation (to 350mm); **Doors:** Solid timber panel insulated doors;	**Floors:** Installation of insulated timber flooring (10mm insulation, 25mm overall) over existing concrete ground floor;	**Glazing:** Replacement of existing glazing units with high performance double glazing units;
2. Fit out	**Lighting:** Switchover to compact fluorescent (subject to tenant agreement); **Water fittings:** Replacement spray taps and/or flow restrictors, low flow shower heads as part of kitchen/bathroom works;		
3. Energy supply		**Solid fuel heating with back boiler:** Installation of an efficient biomass fuelled heating stove with back boiler to provide hot water during the heating season;	**Solar thermal:** Installation of evacuated tube and/or high performance flat plate collector with twin coil hot water accumulator tank and electric immersion (to provide backup);
4. Monitoring			

Case study 4

Pinfold Lane, Walsall

Archetype
Post-1945 low rise flats

Landlord
Wolverhampton Homes

Description

The Pinfold Lane properties form part of a series of flats and houses built using the 'Mactrad' timber frame system between 1996 and 1971 (as described in BRE report 284). The flats are one bedroom with a typical floor area of 40m^2.

The properties have shallow pitched roofs and external walls clad with brick and timber tiles. The walls and roof have a thin layer of mineral fibre insulation. The floors are concrete screed on a slab.

The properties have electric heating systems throughout, with immersion hot water tanks and economy 7 radiators. The windows were replaced in 1999.

Improvements to date
Double glazed uPVC windows (without coating or gas fill), 1999

Schedule improvements
Re-roofing, 2010
Kitchens, bathrooms and electric rewiring, 2011/12

Performance analysis

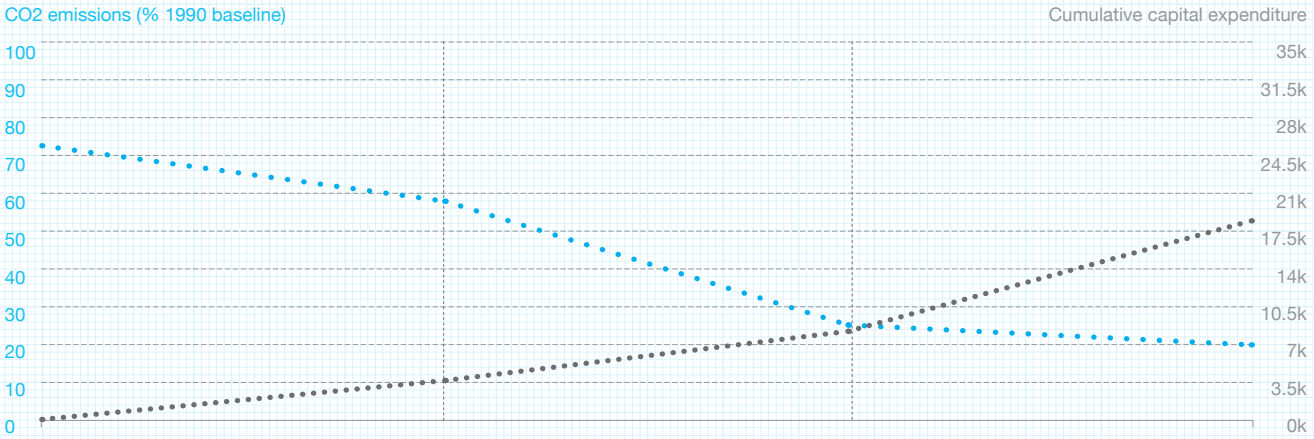
Capital cost	£24,474.16
by floor area	£582.72/m^2

Performance metrics	1990	2009	2025
SAP rating	23 (F)	53 (E)	86 (B)
Fuel cost	£726.61	£430.73	£178.63
CO_2 emissions	5.1	4.0	1.1
% reduction	- 0%	-22%	-79%

	Baseline 1990		As of 2009		Target 2025	
Fabric U-Values	U Value W/m^{2}K	Heat loss W/m	U Value W/m^{2}K	Heat loss W/m	U Value W/m^{2}K	Heat loss W/m
Windows	4.0	45.7	2.4	26.8	0.7	8.0
Doors	3.0	5.4	3.0	5.4	1.2	2.2
Floor	0.7	29.4	0.7	29.4	0.7	29.4
Walls	0.9	25.2	0.9	25.2	0.2	5.3
Roof	0.8	14.9	0.6	10.6	0.2	3.4

Energy and CO_2 emissions	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)
Space heating	8,111	3.4	5,721	2.4	2.143	0.4
Hot water	2,471	1.0	2,471	1.0	1,098	0.2
Electricity	1,593	0.7	1,350	0.6	1,030	0.4

Timeline for future investment



	Phase 1 (2010 - 2015)	Phase 2 (2016 - 2020)	Phase 3 (2021 – 2030)
1.Fabric performance	**Re-roofing:** Installation of loft insulation (to 350mm); **Doors:** Solid timber panel insulated doors;	**Walls:** Insitu re-build of timber stud walls with masonite cassettes/panels to be filled with cellulose insulation (150mm) and incorporating replacement windows; **Glazing:** Replacement of existing frames and glazing units with high performance triple glazing;	**Floors:** Installation of insulated timber flooring (10mm insulation, 25mm overall) over existing concrete ground floor;
2. Fit out	**Water fittings:** Replacement spray taps and/or flow restrictors, low flow shower heads as part of kitchen/bathroom works; **Appliances:** A+ rated washing machines and fridge/freezers as part of kitchen works (subject to tenant agreement); **Lighting:** Switchover to compact fluorescent (subject to tenant agreement);		**Communal solar thermal:** Evacuated tube and/or high performance flat plate collectors supplying communal hot water accumulator tank and backup condensing gas boiler, located within a dedicated outhouse, supplying heat via insulated heat distribution mains and risers; **Wet space heating systems:** Installation of new wet radiator systems and risers within each block to replace electric storage heaters;
3. Energy supply			**Communal solar thermal:** Evacuated tube and/or high performance flat plate collectors supplying communal hot water accumulator tank and backup condensing gas boiler, located within a dedicated outhouse, supplying heat via insulated heat distribution mains and risers; **Wet space heating systems:** Installation of new wet radiator systems and risers within each block to replace electric storage heaters;
4. Monitoring			**Heat metering:** Remotely read heat and power metering to bill for solar heat, and provide household access to energy use data;

Case study 5

Cophall Street, Sandwell

Archetype
Semi-detached house
(non-traditional construction)

Landlord
Sandwell Homes

Description

The semi-detached homes on Cophall street were constructed between 1945 and 1955 using the 'Smiths' prefabricated system (as described in BRE report 37), with external load bearing walls constructed from prefabricated concrete panels with a brick slip facing. They have three bedrooms and have a typical floor area of 82m^2.

The nature of the construction system has meant there have been problems with differential movement due to poor fitting of the panels and decay of the steel reinforcement system. The properties also have very poor airtightness and are prone to water penetration.

The properties have had a limited amount of improvement work carried out, pending a decision on how/whether their lifespan should be extended. Improvement works have included new heating systems, new windows and loft insulation.

Improvements to date
Gas central heating, circa 1980's
uPVC windows and loft insulation (100mm), 1995

Schedule improvements
Replacement bathrooms and kitchens, 2011/12
External insulation and improved roof insulation, 2011/12

Performance analysis

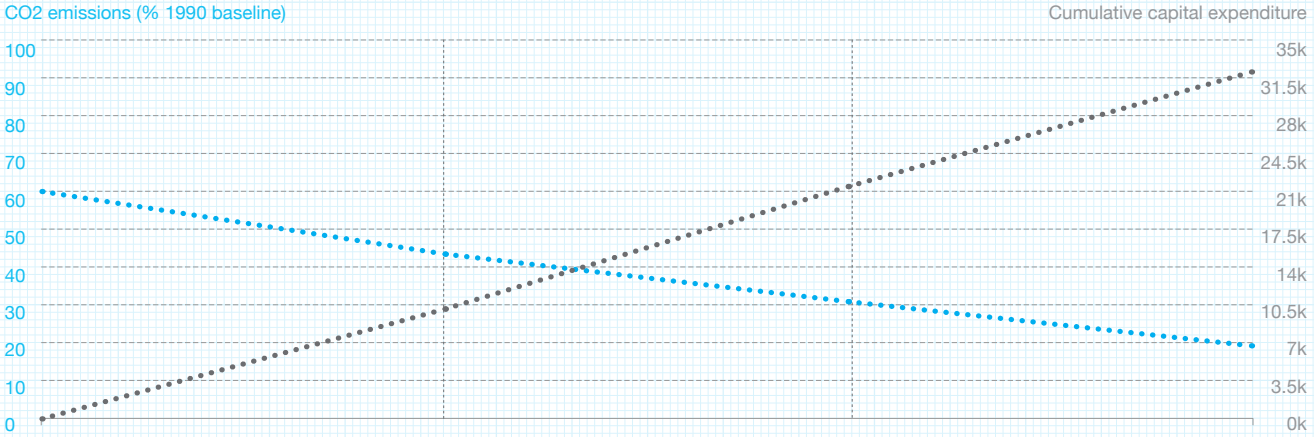
Capital cost	£32,236.58
by floor area	£393.13/m^2

Performance metrics	1990	2009	2025
SAP rating	53 (E)	72 (C)	93 (A)
Fuel cost	£661.84	£540.29	£239.05
CO_2 emissions	7.6	4.6	1.5
% reduction	- 0%	-39%	-81%

	Baseline 1990		As of 2009		Target 2025	
Fabric U-Values	U Value W/m^{2}K	Heat loss W/m	U Value W/m^{2}K	Heat loss W/m	U Value W/m^{2}K	Heat loss W/m
Windows	4.0	50.9	2.5	31.8	0.7	8.9
Doors	3.9	14.7	3.0	11.3	1.2	4.5
Floor	0.7	29.0	0.7	29.0	0.4	18.0
Walls	2.5	191.7	0.7	50.2	0.2	13.9
Roof	1.8	73.8	0.4	16.1	0.1	4.2

Energy and CO_2 emissions	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)
Space heating	28,085	5.4	11,876	2.3	1,672	0.3
Hot water	4,753	0.9	4,753	0.9	944	0.2
Electricity	2,995	1.3	3,304	1.4	2,281	1.0

Timeline for future investment



	Phase 1 (2010 - 2015)	Phase 2 (2016 - 2020)	Phase 3 (2021 – 2025)
1.Fabric performance	**Walls:** Overcladding of external walls with rendered external insulation system (150mm). Insulated blocks to be used to provide stabilisation for the wall panels; **Roof:** Top-up of existing loft insulation (to 350mm);		**Glazing:** Replacement of existing frames and glazing units with high performance triple glazing; **Doors:** Solid timber panel insulated doors; **Floors:** Installation of insulated timber flooring (10mm insulation, 25mm overall) over existing concrete ground floor;
2. Fit out	**Water fittings:** Replacement spray taps and/or flow restrictors, low flow shower heads as part of kitchen/bathroom works; **Appliances:** A+ rated washing machines and fridge/freezers as part of kitchen works (subject to tenant agreement);	**Lighting:** Switchover to compact fluorescent (subject to tenant agreement);	
3. Energy supply	**Gas boiler:** Replacement of the existing boiler with an efficient condensing gas boiler (24 kW) to supply space heating and hot water;	**Solar thermal:** Evacuated tube and/or high performance flat plate collectors (6m^2) with an oversized (560 litre) hot water accumulator tank, supplementing the primary heating system; **Low temperature heating:** Replacement of existing radiators with smaller skirting radiators (utilising existing pipework);	
4. Monitoring		**Internal heating systems:** Fitting of thermostatic controls and timers for each heating zone in the home;	

Case study 6

Okement Drive, Walsall

Archetype
Medium rise flats
(non-traditional construction)

Landlord
Wolverhampton Homes

Description

The Okement Road estate consists of clusters of flats and maisonettes, as well as a number of high rise blocks. The flats are arranged in blocks of 12 units. Each has two bedrooms and has a typical floor area of 70 m^2.

The flats looked at by this study were constructed using the Wimpey 'no fines' system (as described in BRE report 153), with solid external and load bearing walls of in-situ concrete. Roofs are flat with asphalt waterproofing.

The nature of the construction system has meant there have been problems with damp, which have been addressed by the installation of mechanical ventilation and window trickle vents.

The original warm air heating system have been replaced with modern gas condensing boilers supplying wet space heating.

Improvements to date
uPVC windows, 2001
Gas boiler and wet space heating system, 2007
Kitchens, bathrooms and rewiring, 2008

Schedule improvements
None presently scheduled

Performance analysis

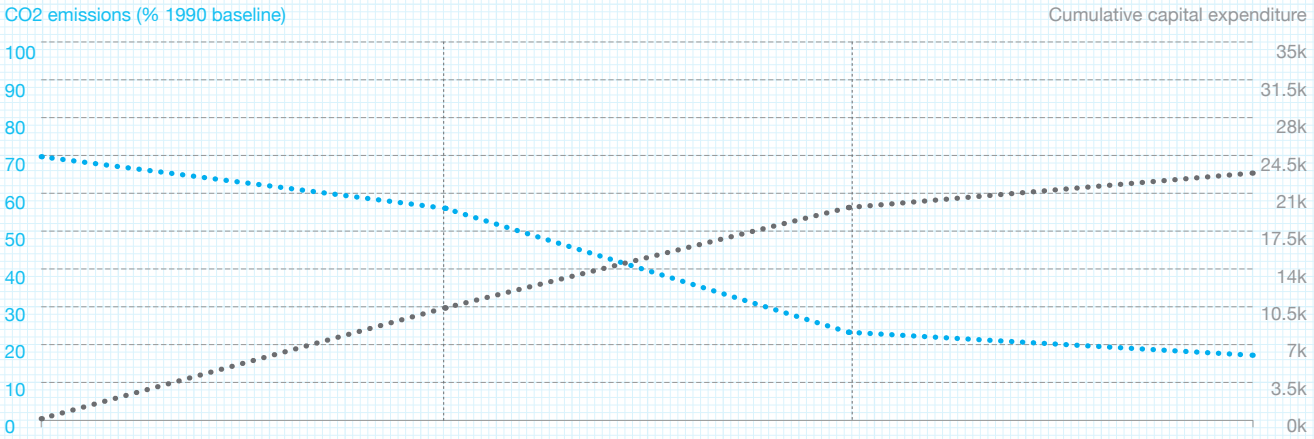
Capital cost	£22,602.33
by floor area	£313.92/m^2

Performance metrics	1990	2009	2025
SAP rating	51 (E)	76 (C)	86 (B)
Fuel cost	£571.79	£346.01	£194.74
CO_2 emissions	6.6	4.6	1.1
% reduction	- 0%	-31%	-83%

	Baseline 1990		As of 2009		Target 2025	
Fabric U-Values	U Value W/m^2K	Heat loss W/m	U Value W/m^2K	Heat loss W/m	U Value W/m^2K	Heat loss W/m
Windows	4.0	33.9	2.4	19.9	0.7	5.9
Doors	3.0	5.7	3.0	5.7	1.2	2.3
Floor	2.5	155.1	2.5	155.1	0.2	14.3
Walls	1.4	9.7	6.8	46.4	0.4	2.4
Roof	2.0	144.0	0.4	25.2	0.15	10.7

Energy and CO_2 emissions	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)
Space heating	26,365	5.1	16,715	3.2	2,406	0.5
Hot water	3,699	0.7	2,956	0.6	887	0.2
Electricity	1,889	0.8	1,858	0.8	1,109	0.5

Timeline for future investment



	Phase 1 (2010 - 2015)	Phase 2 (2016 - 2020)	Phase 3 (2021 – 2025)
1.Fabric performance	**Roof:** Installation of external roof insulation (to 200mm);	**Walls:** Overcladding of external walls with rendered external insulation system (150mm); **Windows:** Replacement of existing frames and glazing with high performance triple glazed units;	**Floors:** Installation of insulated timber flooring (10mm insulation, 25mm overall) over existing concrete ground floor;
2. Fit out	**Lighting:** Switchover to compact fluorescent (subject to tenant agreement);		**Water fittings:** Replacement spray taps and/or flow restrictors, low flow shower heads as part of kitchen/bathroom works;
3. Energy supply	**Communal solar thermal:** Evacuated tube and/or high performance flat plate collectors supplying communal hot water accumulator tank, located within a dedicated outhouse, supplying heat via insulated heat distribution mains and risers;		**Gas or biomass-fired CHP:** Installation of gas fired CHP linked to the neighbouring hospital supplying heat to the wider estate and neighbouring community buildings via a district heating network;
4. Monitoring		**Heat metering:** Remotely read heat and power metering to bill for district and solar heat, and provide household access to energy use data; **Internal heating systems:** Fitting of thermostatic controls and timers for each heating zone in each home;	

Case study 7

Parklands Road, Darlaston

Archetype
Medium rise flats

Landlord
Accord Housing Group

Description

The Parklands Road estate consists of 157 one and two bedroom flats, including 15 units of sheltered accommodation built in the late 1970's. A typical floor area for a flat is 84 m^2 for a two bedroom unit.

Construction is a combination of load bearing concrete frame with masonry external and party walls, with a cavity of between 50 and 60mm. Floors are concrete screed. The roofs are pitched and covered with artificial slate with a void that has been filled with 50-100mm insulation.

Three different heating systems are installed – individual gas, individual electric and communal gas. An all-electric flat is to be tested for the study. These flats have all-electric systems with storage heaters and immersion tanks for hot water. The sheltered accommodation has wet space heating supplied via a communal boiler house, which is scheduled for replacement.

Improvements to date
uPVC double glazing (no coating or gas fill), cavity insulation (50-60mm) and kitchens, 1998
Electrical rewiring, 2009 ongoing

Schedule improvements
Sheltered housing boiler and ancillaries, unspecified timing

Performance analysis

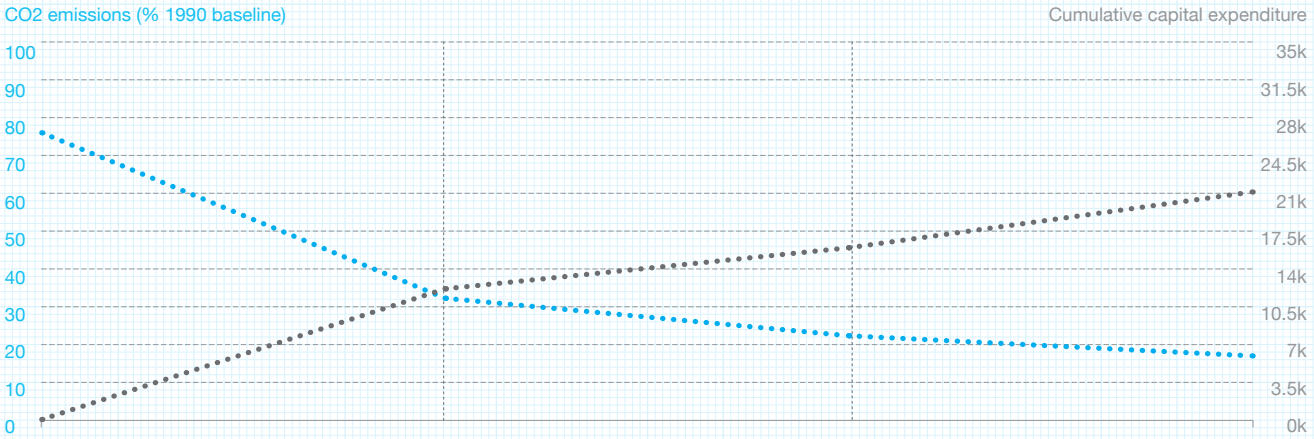
Capital cost	£21,351.71
by floor area	£254.19/m^2

Performance metrics	1990	2009	2025
SAP rating	62 (D)	69 (C)	93 (A)
Fuel cost	£511.65	£438.22	£169.90
CO_2 emissions	4.2	3.2	0.7
% reduction	- 0%	-24%	-83%

	Baseline 1990		As of 2009		Target 2025	
Fabric U-Values	U Value W/m^2K	Heat loss W/m	U Value W/m^2K	Heat loss W/m	U Value W/m^2K	Heat loss W/m
Windows	4.0	41.0	2.5	25.7	0.7	7.1
Doors	3.0	4.8	3.0	4.8	1.2	1.9
Walls	1.2	42.6	0.7	22.8	0.2	6.3

Energy and CO_2 emissions	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)
Space heating	5,016	2.1	2,852	1.2	647	0.0
Hot water	2,846	1.2	2,846	1.2	2,846	0.2
Electricity	2,034	0.9	1,858	0.8	1,109	0.5

Timeline for future investment



	Phase 1 (2010 - 2015)	Phase 2 (2016 - 2020)	Phase 3 (2021 – 2025)
1.Fabric performance	**Roof:** Top-up of existing loft insulation (to 350mm);	**Glazing:** Replacement of existing glazing units with high performance double glazing units; **Floors:** Installation of insulated timber flooring (10mm insulation, 25mm overall) over existing concrete ground floor;	**Walls:** Overcladding of external walls with rendered external insulation system (100mm), communal areas with insulated boarding (20mm);
2. Fit out	**Lighting:** Switchover to compact fluorescent (subject to tenant agreement);	**Water fittings:** Replacement spray taps and/or flow restrictors, low flow shower heads as part of kitchen/bathroom works;	**Appliances:** A+ rated washing machines and fridge/freezers as part of kitchen works (subject to tenant agreement);
3. Energy supply	**Biomass heating:** Installation of two communal biomass boilers, one backup gas condensing boiler and hot water accumulator tank to serve 157 properties, biomass boiler sized to meet heat load following Phase 2 overcladding; **District Heating network:** Installation of a flow and return network to supply all properties with heat from the energy centre (see above); **Wet space heating systems:** Installation of new wet radiator systems and risers within each block to replace electric storage heaters;		
4. Monitoring	**Heat metering:** Remotely read heat and power metering to bill for district heat, and provide household access to energy use data; **Internal heating systems:** Fitting of thermostatic controls and timers for each heating zone in each home;		

Case study 8

Birchcroft, Smethwick

Archetype
High rise flats

Landlord
Sandwell Homes

Description

Birchcroft is a fifteen storey tower block constructed in the early 1960's. There are 6 two bed properties per floor, with typical floor areas of 75 m^2, each with a balcony and lift access from a central core. Service ducts running the whole height of the building provide air extract from bathrooms and kitchens.

The construction is a concrete frame with brick skin 50-60mm cavity wall. The cavity has been filled which has created subsequent problems arising from the retention of wind driven rain. The window frames and glazing were replaced at the same time as the cavity fill was added.

The heating systems are all-electric, combining electric storage heaters with an electric immersion storage cylinder for hot water. A quarter of the rooms in each flat currently have low energy light fittings.

Improvements to date
uPVC windows and cavity fill insulation (50-60mm), 1995
Roof insulation (200mm), 2009

Schedule improvements
Upgrading of electric heating systems, 2011/12

Performance analysis

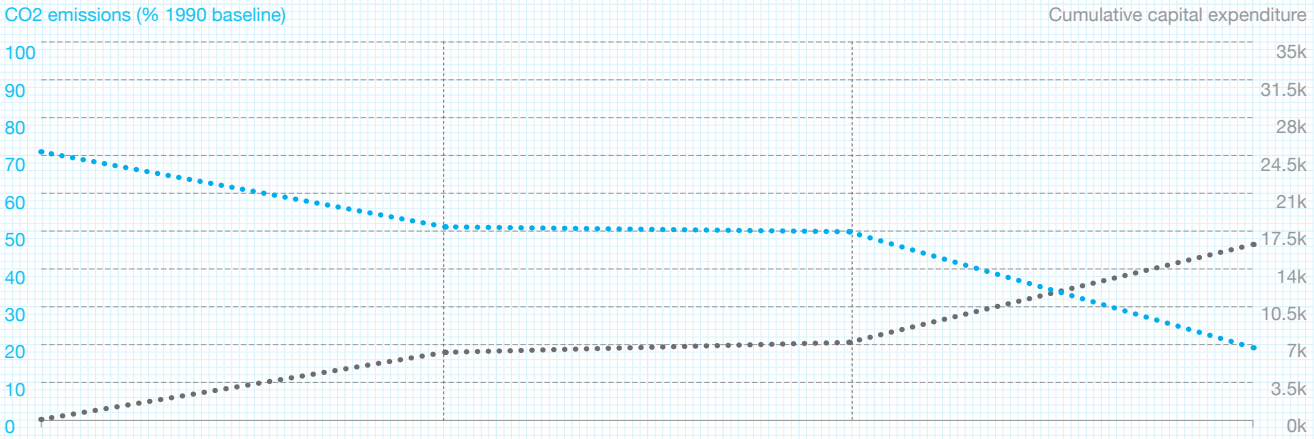
Capital cost	£16,371.26
by floor area	£218.28/m^2

Performance metrics	1990	2009	2025
SAP rating	45 (E)	70 (C)	93 (A)
Fuel cost	£647.90	£411.66	£183.39
CO_2 emissions	5.4	3.8	1.1
% reduction	- 0%	-29%	-81%

	Baseline 1990		As of 2009		Target 2025	
Fabric U-Values	U Value W/m^2K	Heat loss W/m	U Value W/m^2K	Heat loss W/m	U Value W/m^2K	Heat loss W/m
Windows	4.0	40.2	2.5	24.8	0.7	6.9
Doors	3.0	11.0	3.0	10.7	1.2	4.3
Walls	1.3	48.4	0.7	24.7	0.2	8.5

Energy and CO_2 emissions	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)
Space heating	7,563	3.2	4,242	1.8	476	0.1
Hot water	3,196	1.3	2,963	1.3	2,074	0.4
Electricity	2,034	0.9	1,858	0.8	1,311	0.6

Timeline for future investment



	Phase 1 (2010 - 2015)	Phase 2 (2016 - 2020)	Phase 3 (2021 – 2030)
1.Fabric performance		**Walls:** Overcladding of external walls with rendered external insulation system (100mm): **Windows:** Replacement of existing frames and glazing with aluminium clad timber frames and high performance triple glazed units;	
2. Fit out	**Lighting:** Switchover to compact fluorescent (subject to tenant agreement);	**Water fittings:** Replacement spray taps and/or flow restrictors, low flow shower heads as part of kitchen/ bathroom works; **Appliances:** A+ rated washing machines and fridge/freezers as part of kitchen works (subject to tenant agreement);	
3. Energy supply	**Gas-fired communal boilers:** Installation of gas-fired communal heating system on the roof of the block to supply heat to all flats via insulated flow/return risers. **Mechanical Ventilation with Heat Recovery (MVHR):** Roof mounted Installation of two MVHR units, each serving 45 flats, utilising existing ventilation ducts for the routing of air extract/supply.		**Solar thermal:** Evacuated tube and/or high performance flat plate collectors on the roof of the block, to supply supplementary heat to each flat via the insulated flow/ return risers;
4. Monitoring	**Internal heating systems:** Fitting of thermostatic control and timer for a warm air heating coil which will condition the fresh air inlet to each flat; **Heat metering:** Remotely read heat and power metering to bill for heat, and to provide household access to energy use data;		