Lancaster West Retrofit Options Appraisal

Indicative cost estimates and business case

May 21st 2020

Retrofit Accelerator - Homes

Turner & Townsend

energie sprong uk

CARBON TRUST

Key objectives

- Address tenant issues with damp, mould, cold, overheating
- Achieve as close to zero carbon as possible
- Optimise value for money with £59m budget

Summary of work so far

- Initial assessment based on EPCs, energy data (where available), planned maintenance and walkaround
- Outline Energiesprong business cases
- Heat loss calculations based on available data
- Liaised with Arup on heat network feasibility

- Design competition for Treadgold House with BowTie Construction

Cost estimate assumptions

- Cost estimates are based on limited information on the buildings and the kind of solution that will be needed
- The figures should be treated as indicative and may vary considerably after detailed design and survey work has taken place
- Cost information from several sources has been used, including:
  - Spon's
  - Parity Projects' CROHM tool
  - BEIS "What Does It Cost to Retrofit Homes?" report
  - Energiesprong UK team experience
  - Sense check with Carbon Trust experience

Approach to choosing packages

- Tenant priorities
- Technical viability and avoiding unintended consequences
- Energy/carbon saving

Exclusions based on:

- Technical viability
- Disruption to tenants (e.g. major internal works)
- Heritage (Talbot Grove House/Morland House)
- Less established technology (lack of data about effectiveness or technical viability)

The Walkways: Options for appraisal

	Walls	Thermal bridging	Air-tightness	Glazing	Roof	Ventilation	Heating	Solar
0 Current situation	Unclear if cavity, probably not insulated	Very high due to concrete slabs	Very poor, mostly due to windows	Very poor, single glazed. Cold in winter, overheats with direct sunlight.	Uninsulated? Causes overheating for top floor flats in summer, cold in winter.	Poor as evidenced by damp and mould. Kitchen/bathroom extract fans?	Temporary gas boiler feeding heat network. Poor network efficiency and poor controls internally leading to overheating.	None
1 Essentials			Basic draught proofing in addition to improved glazing.	High performance double / triple + new external doors	Super-insulated	Additional MEV	Heat pump-based heat network	
2 High performance envelope	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Heat pump-based heat network	
3 High performance + solar PV & storage	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Heat pump-based heat network	Solar PV + Communal storage

The Walkways: Options for appraisal

Per property results

	Annual CO_2 emissions (tonnes)	Heat demand (kWh/m²) Ground – Mid – Top Floor			Tenant cost (heating and electricity)
0 Current situation	5.1*	168	133	215	£915-1,085**
1 Essentials	1.7	103	67	80	£770
2 High performance envelope	1.4	39	30	43	£680
3 High performance + solar PV & storage	0.5	39	30	43	£460

- MEEF carbon emissions factors used
  - Gas: 0.184 kg/kWh
  - Electricity: 0.351 kg/kWh

*Includes system inefficiencies leading to approx. double the heat needed being delivered into the system

**Not currently paying for metered heat. Assumption based on a gas boiler and typical levels of underheating seen in hard-to-heat properties.

The Walkways: Options for appraisal

Costs per property, excluding heat network costs

	Upfront cost	Heat network cost	Maximum MEEF finance	Additional income/savings (over 30 years)	Cost per tonne of CO_2 saved (over 30 years)
0 Current situation	£0	Highest	£0	n/a	n/a
1 Essentials	£20,000	Medium	£20,000	£0*	£200§
2 High performance envelope	£32,000	Low	£26,000	£0*	£290§
3 High performance + solar PV & storage	£40,000	Lowest**	£32,000	£350***	£290§

- Heat network cost is unknown at this stage, but it will be linked to heat demand; the lower the heat demand, the lower the network costs (installation and running costs).

*Assumes any RHI received feeds into heat network business case

**Assumes PV generation feeds into heat pump to reduce running costs

***Smart Export Guarantee for solar PV

§ Because the costs don't include the heating system, the cost per tonne is lower than for blocks where the heating system is included in the cost.

The Walkways: Options for appraisal

Risks

	Highest risk	Impact	Likelihood
1 Essentials	Does not address severe thermal bridging from concrete slabs	• Cold spots, damp and mould will continue to be an issue	High
2 High performance envelope	Tenants may not accept external wall insulation	• Default option becomes Package 1 with high risk of damp and mould issues. • Higher bills for tenants	High
3 High performance + solar PV & storage	Tenants may not accept external wall insulation	• Default option becomes Package 1 with high risk of damp and mould issues. • Higher bills for tenants	High

The Walkways: Options for appraisal

Key questions for multidisciplinary design team:

- Are the walls cavity and can they be filled?
- Can the thermal bridging of the concrete slabs be overcome without full external wall insulation?
- Is internal wall insulation an option (since radiators are likely to be replaced anyway)?
- Will improved glazing and low-temperature heat network resolve the overheating issues, or is external shading also needed?

East Side: Options for appraisal

	Walls	Thermal bridging	Air-tightness	Glazing	Roof	Ventilation	Heating	Solar
0 Current situation	Unclear if cavity, probably not insulated	Very high due to concrete slabs	Very poor, mostly due to windows	Very poor, single glazed. Cold in winter, overheats with direct sunlight.	Uninsulated? Causes overheating for top floor flats in summer, cold in winter.	Likely damp and mould issues. Kitchen/bathroom extract fans?	Gas boilers (unknown age) feeding heat network. Unknown efficiency and internal controls.	None
1 Essentials			Basic draught proofing in addition to improved glazing.	High performance double / triple + new external doors	Super-insulated	Additional MEV	Heat pump-based heat network	
2 High performance envelope	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Heat pump-based heat network	
3 High performance + solar PV & storage	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Heat pump-based heat network	Solar PV + Communal storage

East Side: Options for appraisal

Per property results

	Annual CO_2 emissions (tonnes)	Heat demand (kWh/m²) Ground – Mid – Top Floor			Tenant cost
0 Current situation	3.6*	153	118	197	£1,100**
1 Essentials	1.9	112	78	89	£790
2 High performance envelope	1.4	49	27	39	£690
3 High performance + solar PV & storage	0.6	49	27	39	£460

- MEEF carbon emissions factors used
  - Gas: 0.184 kg/kWh
  - Electricity: 0.351 kg/kWh

*Based on standard gas boiler - no other information available on heat network costs/kWh.

**Based on a gas boiler and typical levels of underheating seen in hard-to-heat properties.

East Side: Options for appraisal

Costs per property, excluding heat network costs

	Upfront cost	Heat network cost	Maximum MEEF finance	Additional income/savings (over 30 years)	Cost per tonne of CO_2 saved (over 30 years)
0 Current situation	£0	Highest	£0	£0*	n/a
1 Essentials	£18,000	Medium	£12,000	£0*	£360§
2 High performance envelope	£27,000	Low	£15,000	£0*	£420§
3 High performance + solar PV & storage	£35,000	Lowest**	£21,000	£350***	£390§

- Heat network cost is unknown at this stage, but it will be linked to heat demand; the lower the heat demand, the lower the network costs (installation and running costs).

*Assumes any RHI received feeds into heat network business case

**Assumes PV generation feeds into heat pump to reduce running costs

***Smart Export Guarantee for solar PV

§ Because the costs don't include the heating system, the cost per tonne is lower than for blocks where the heating system is included in the cost.

East Side: Options for appraisal

Risks

	Highest risk	Impact	Likelihood
1 Essentials	Does not address severe thermal bridging from concrete slabs	• Cold spots, damp and mould will continue to be an issue	High
2 High performance envelope	Tenants may not accept external wall insulation	• Default option becomes Package 1 with high risk of damp and mould issues. • Higher bills for tenants	Medium
3 High performance + solar PV & storage	Tenants may not accept external wall insulation	• Default option becomes Package 1 with high risk of damp and mould issues. • Higher bills for tenants	Medium

East Side: Options for appraisal

Key questions for multidisciplinary design team:

- Are the walls cavity and can they be filled?
- Can the thermal bridging of the concrete slabs be overcome without full external wall insulation?
- Is internal wall insulation an option (since radiators are likely to be replaced anyway)?
- Will improved glazing and low-temperature heat network resolve the overheating issues, or is external shading also needed?

Camelford Court: Options for appraisal

	Walls	Thermal bridging	Air-tightness	Glazing	Roof	Ventilation	Heating	Solar
0 Current situation	Unclear if cavity, probably not insulated	Very high due to concrete slabs	Very poor, mostly due to windows	Very poor, single glazed. Cold in winter, overheats with direct sunlight.	Uninsulated? Causes overheating for top floor flats in summer, cold in winter.	Likely damp and mould issues. Kitchen/bathroom extract fans?	Gas boilers (unknown age) feeding heat network. Unknown efficiency and internal controls.	None
1 Essentials			Basic draught proofing in addition to improved glazing.	High performance double / triple + new external doors	Super-insulated	Additional MEV	Heat pump-based heat network	
2 High performance envelope	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Heat pump-based heat network	
3 High performance + solar PV & storage	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Heat pump-based heat network	Solar PV + Communal storage

Camelford Court: Options for appraisal

Per property results, based on heating via heat network

	Annual CO_2 emissions (tonnes)	Heat demand (kWh/m^2)			Tenant cost
		Ground	Mid	Top	
0 Current situation	4.3*	125		168	£1,250
1 Essentials	1.8	94		69	£780
2 High performance envelope	1.4	41		29	£690
3 High performance + solar PV & storage	0.6	41		29	£460

*Based on a gas boiler and typical levels of underheating seen in hard-to-heat properties.

- MEEF carbon emissions factors used
  - Gas: 0.184 kg/kWh
  - Electricity: 0.351 kg/kWh

Camelford Court: Options for appraisal

Costs per property, based on heating via heat network.

	Upfront cost	Maximum MEEF finance	Additional income/savings (over 30 years)	Cost per tonne of CO_2 saved (over 30 years)
0 Current situation	£0	£0	£0	n/a
1 Essentials	£21,000	£17,000	£0*	£290§
2 High performance envelope	£34,000	£20,000	£0*	£400§
3 High performance + solar PV & storage	£42,000	£26,000	£350**	£380§

*Assumes any RHI received feeds into heat network business case

**Smart Export Guarantee for solar PV

§ Because the costs don't include the heating system, the cost per tonne is lower than for blocks where the heating system is included in the cost.

Camelford Court: Options for appraisal

Risks

	Highest risk	Impact	Likelihood
1 Essentials	Does not address severe thermal bridging from concrete slabs	• Cold spots, damp and mould will continue to be an issue	High
2 High performance envelope	Tenants may not accept external wall insulation	• Default option becomes Package 1 with high risk of damp and mould issues. • Higher bills for tenants	Medium
3 High performance + solar PV & storage	Tenants may not accept external wall insulation	• Default option becomes Package 1 with high risk of damp and mould issues. • Higher bills for tenants	Medium

Camelford Court: Options for appraisal

Key questions for multidisciplinary design team:

- Are the walls cavity and can they be filled?
- Can the thermal bridging of the concrete slabs be overcome without full external wall insulation?
- Is internal wall insulation an option (since radiators are likely to be replaced anyway)?
- Will improved glazing and low-temperature heat network resolve the overheating issues, or is external shading also needed?

Treadgold House: Options for appraisal

- Treadgold House is in the Energiesprong Mustbe0 design competition and has had detailed surveys from BowTie Construction.
- We have not had access to this survey data yet, so the following analysis is based on the same limited data as the other blocks.
- BowTie costings likely to be based on different assumptions and may include elements that we have not considered.

Treadgold House: Options for appraisal

	Walls	Thermal bridging	Air-tightness	Glazing	Roof	Ventilation	Heating	Solar
0 Current situation	Cavity wall, unknown if insulated	Potentially through balconies and concrete slabs	Reasonable considering double glazed windows	Double glazed	Uninsulated?	Kitchen/bathroom extract fans at most but little evidence for it from photos/Street View	Individual gas boilers	None
1 Essentials			Basic draught proofing		Super-insulated	Additional MEV	Individual/communal heat pump or heat network connection	
2 High performance envelope	High performance External insulation	New external envelope	Best practice		Super-insulated	Additional MEV/MVHR	Individual/communal heat pump or heat network connection	
3 High performance + solar PV & storage	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Individual/communal heat pump or heat network connection	Solar PV + Communal storage

Treadgold House: Options for appraisal

Per property results, based on heating via individual heat pumps

	Annual CO_2 emissions (tonnes)	Heat demand (kWh/m^2)			Tenant cost
		Ground	Mid	Top	
0 Current situation	2.8*	129	95	174	£945
1 Essentials	1.8	107	72	83	£755
2 High performance envelope	1.4	45	23	35	£670
3 High performance + solar PV & storage	0.6	45	23	35	£457

*Based on a gas boiler and typical levels of underheating seen in hard-to-heat properties.

- MEEF carbon emissions factors used
  - Gas: 0.184 kg/kWh
  - Electricity: 0.351 kg/kWh

Treadgold House: Options for appraisal

Costs per property, based on heating via individual heat pumps.

	Upfront cost	Maximum MEEF finance	Additional income/savings (over 30 years)	Cost per tonne of CO_2 saved (over 30 years)
0 Current situation	£0	£0	£0	n/a
1 Essentials	£26,000	£7,000	£6,000*	£720
2 High performance envelope	£49,000	£10,000	£6,000*	£1,000
3 High performance + solar PV & storage	£57,000	£15,000	£6,000*	£780

*If connecting to a heat network, RHI income will divert to the heat network owner/operator.

Treadgold House: Options for appraisal

Risks

	Highest risk	Impact	Likelihood
1 Essentials	Thermal bridging issues causing damp and mould	• Cold spots, damp and mould	Medium
2 High performance envelope	Traditional procurement approach results in energy performance gap	• Damp and mould if thermal bridges not addressed • Higher bills for tenants • Higher maintenance costs • More disruption for remediation works	High
3 High performance + solar PV & storage	Higher cost	• Worse business case	Medium

Treadgold House: Options for appraisal

Key questions for multidisciplinary design team:

- Thermal bridging
  - Balconies
  - Around windows if no EWI
- Ventilation strategy

Talbot Grove & Morland House: Options for appraisal

	Walls	Thermal bridging	Air-tightness	Glazing	Roof	Ventilation	Heating	Solar
0 Current situation	Solid wall, uninsulated	Potentially through balconies	Poor due to windows	Single glazed, sash	Room in roof, uncertain age, potentially no or little insulation	Unknown	Gas based heat network	None
1 Essentials			Basic draught proofing	High performance double / triple + new external doors	Max insulation possible with existing structure	Additional MEV	Heat pump-based heat network	
2 High performance envelope			Best practice	High performance double / triple + new external doors	Potentially new super-insulated roof	Additional MEV/MVHR	Heat pump-based heat network	
3 High performance + solar PV & storage			Best practice	High performance double / triple + new external doors	Potentially new super-insulated roof	Additional MEV/MVHR	Heat pump-based heat network	Solar PV + Communal storage

Talbot Grove & Morland House: Options for appraisal

Per property results, based on heating via a communal heat pump

	Annual CO_2 emissions (tonnes)	Heat demand (kWh/m²)			Tenant cost
		Ground	Mid	Top	
0 Current situation	3.3*	148	106	193	£1,000
1 Essentials	1.9	123	72	109	£790
2 High performance envelope	1.7	93	71	82	£720
3 High performance + solar PV & storage	1.2	93	71	82	£460

*Based on a gas boiler and typical levels of underheating seen in hard-to-heat properties.

- MEEF carbon emissions factors used
  - Gas: 0.184 kg/kWh
  - Electricity: 0.351 kg/kWh

Talbot Grove & Morland House: Options for appraisal

Costs per property, based on heating via a communal heat pump.

	Upfront cost	Maximum MEEF finance	Additional income/savings (over 30 years)	Cost per tonne of CO_2 saved (over 30 years)
0 Current situation	£0	£0	£0	n/a
1 Essentials	£18,000	£10,000	£0*	£430§
2 High performance envelope	£28,000	£11,000	£0*	£580§
3 High performance + solar PV & storage	£33,000	£14,000	£120**	£530§

* Assumes any RHI received feeds into heat network business case

**Smart Export Guarantee for solar PV

§ Because the costs don't include the heating system, the cost per tonne is lower than for blocks where the heating system is included in the cost.

Talbot Grove & Morland House: Options for appraisal

Risks

	Highest risk	Impact	Likelihood
1 Essentials	Uninsulated solid walls are major heat loss	• Cold, damp and mould • Overheating in summer	High
2 High performance envelope	May not be possible to insulate roof without severe disruption	• Severe disruption to tenants • Default to lower performance resulting in higher bills • Impact on heating strategy given higher heat demand	High
3 High performance + solar PV & storage	Traditional procurement approach results in energy performance gap	• Damp and mould if thermal bridges not addressed • Higher bills for tenants • Higher maintenance costs • More disruption for remediation works	High

Talbot Grove & Morland House: Options for appraisal

Key questions for multidisciplinary design team:

- What is the potential for roof insulation or new roof?
- Thermal bridging, ventilation and overheating strategies
- How does each option fit with heat network feasibility?

Camborne Mews: Options for appraisal

	Walls	Thermal bridging	Air-tightness	Glazing	Roof	Ventilation	Heating	Solar
0 Current situation	Insulated cavity	None obvious	Reasonable for the building age	Double glazed	Pitched, insulated	Trickle vents, possibly blocked. Could be damp and mould issues in bathroom	Gas boilers	None
1 Essentials			Basic draught proofing in addition to improved glazing.	High performance double / triple + new external doors	Increase loft insulation	Additional MEV	Individual heat pumps	
2 High performance envelope	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Individual heat pumps	
3 High performance + solar PV & storage	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Individual heat pumps	Solar PV + Communal storage

Camborne Mews: Options for appraisal

Per property results, based on heating via individual heat pumps

	Annual CO_2 emissions (tonnes)	Heat demand (kWh/m^2)			Tenant cost
		Ground	Mid	Top	
0 Current situation	1.8*	112	69	81	£785
1 Essentials	1.4	86	51	60	£725
2 High performance envelope	1.2	31	18	28	£660
3 High performance + solar PV & storage	0.6	31	18	28	£460

*Based on a gas boiler and typical levels of underheating seen in hard-to-heat properties.

- MEEF carbon emissions factors used
  - Gas: 0.184 kg/kWh
  - Electricity: 0.351 kg/kWh

Camborne Mews: Options for appraisal

Costs per property, based on heating via individual heat pumps.

	Upfront cost	Maximum MEEF finance	Additional income/savings (over 30 years)	Cost per tonne of CO_2 saved (over 30 years)
0 Current situation	£0	£0	£0	n/a
1 Essentials	£22,000	£3,000	£4,000*	£1,200
2 High performance envelope	£34,000	£4,000	£5,000*	£1,300
3 High performance + solar PV & storage	£40,000	£8,000	£9,000**	£900

*Renewable Heat Incentive for heat pump

**RHI + Smart Export Guarantee for solar PV

Camborne Mews: Options for appraisal

Risks

	Highest risk	Impact	Likelihood
1 Essentials	Existing cavity wall insulation may be saturated/patchy	• Cold spots, damp and mould	Medium
2 High performance envelope	High cost for relatively low energy saving	• Poor value for money	Medium
3 High performance + solar PV & storage	High cost for relatively low energy saving	• Poor value for money	Medium

Camborne Mews: Options for appraisal

Key questions for multidisciplinary design team:

- Is the cavity wall insulation performing as expected?
- Thermal bridging, ventilation strategies

Verity Close (flats): Options for appraisal

	Walls	Thermal bridging	Air-tightness	Glazing	Roof	Ventilation	Heating	Solar
0 Current situation	Insulated cavity	None obvious	Reasonable for the building age	Double glazed, sash	Pitched, insulated. Potential issues around room in roof	Trickle vents, possibly extract fans in bathroom.	Gas boilers	None
1 Essentials			Basic draught proofing in addition to improved glazing.	High performance double / triple + new external doors	Increase loft insulation	Additional MEV	Individual heat pumps	
2 High performance envelope	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Individual heat pumps	
3 High performance + solar PV & storage	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Individual heat pumps	Solar PV + Communal storage

Verity Close (flats): Options for appraisal

Per property results, based on heating via individual heat pumps

	Annual CO_2 emissions (tonnes)	Heat demand (kWh/m^2)			Tenant cost
		Ground	Mid	Top	
0 Current situation	2.2*	112	68	80	£820
1 Essentials	1.4	85	50	60	£720
2 High performance envelope	1.2	32	19	28	£660
3 High performance + solar PV & storage	0.6	32	19	28	£460

*Based on a gas boiler and typical levels of underheating seen in hard-to-heat properties.

- MEEF carbon emissions factors used
  - Gas: 0.184 kg/kWh
  - Electricity: 0.351 kg/kWh

Verity Close (flats): Options for appraisal

Costs per property, based on heating via individual heat pumps

	Upfront cost	Maximum MEEF finance	Additional income/savings (over 30 years)	Cost per tonne of CO_2 saved (over 30 years)
0 Current situation	£0	£0	£0	n/a
1 Essentials	£22,000	£5,000	£4,000*	£820
2 High performance envelope	£34,000	£7,000	£4,000*	£1,100
3 High performance + solar PV & storage	£40,000	£11,000	£4,000**	£780

*Renewable Heat Incentive for heat pump

**RHI + Smart Export Guarantee for solar PV

Verity Close (flats): Options for appraisal

Risks

	Highest risk	Impact	Likelihood
1 Essentials	Existing cavity wall insulation may be saturated/patchy	• Cold spots, damp and mould	Medium
2 High performance envelope	High cost for relatively low energy saving	• Poor value for money	Medium
3 High performance + solar PV & storage	High cost for relatively low energy saving	• Poor value for money	Medium

Verity Close (flats): Options for appraisal

Key questions for multidisciplinary design team:

- Is the cavity wall insulation performing as expected?
- Thermal bridging, ventilation strategies

Verity Close (houses): Options for appraisal

	Walls	Thermal bridging	Air-tightness	Glazing	Roof	Ventilation	Heating	Solar
0 Current situation	Insulated cavity	None obvious	Reasonable for the building age	Double glazed, sash	Pitched, insulated. Potential issues around room in roof	Trickle vents, possibly extract fans in bathroom.	Gas boilers	None
1 Essentials			Basic draught proofing in addition to improved glazing.	High performance double / triple + new external doors	Increase loft insulation	Additional MEV	Individual heat pumps	
2 High performance envelope	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Individual heat pumps	
3 High performance + solar PV & storage	High performance External insulation	New external envelope	Best practice	High performance double / triple + new external doors	Super-insulated	Additional MEV/MVHR	Individual heat pumps	Solar PV + Communal storage

Verity Close (houses): Options for appraisal

Per property results, based on heating via individual heat pumps

	Annual CO_2 emissions (tonnes)	Heat demand (kWh/m²)	Tenant cost
0 Current situation	4.8*	89	£1,300
1 Essentials	1.9	69	£790
2 High performance envelope	1.4	27	£680
3 High performance + solar PV & storage	0.6	27	£460

- MEEF carbon emissions factors used
  - Gas: 0.184 kg/kWh
  - Electricity: 0.351 kg/kWh

*Based on a gas boiler and typical levels of underheating seen in hard-to-heat properties.

Verity Close (houses): Options for appraisal

Costs per property, based on heating via individual heat pumps

	Upfront cost	Maximum MEEF finance	Additional income/savings (over 30 years)	Cost per tonne of CO_2 saved (over 30 years)
0 Current situation	£0	£0	£0	n/a
1 Essentials	£23,000	£20,000	£11,000*	£290
2 High performance envelope	£34,000	£24,000	£11,000*	£570
3 High performance + solar PV & storage	£41,000	£29,000	£11,000**	£560

*Renewable Heat Incentive for heat pump

**RHI + Smart Export Guarantee for solar PV

Verity Close (houses): Options for appraisal

Risks

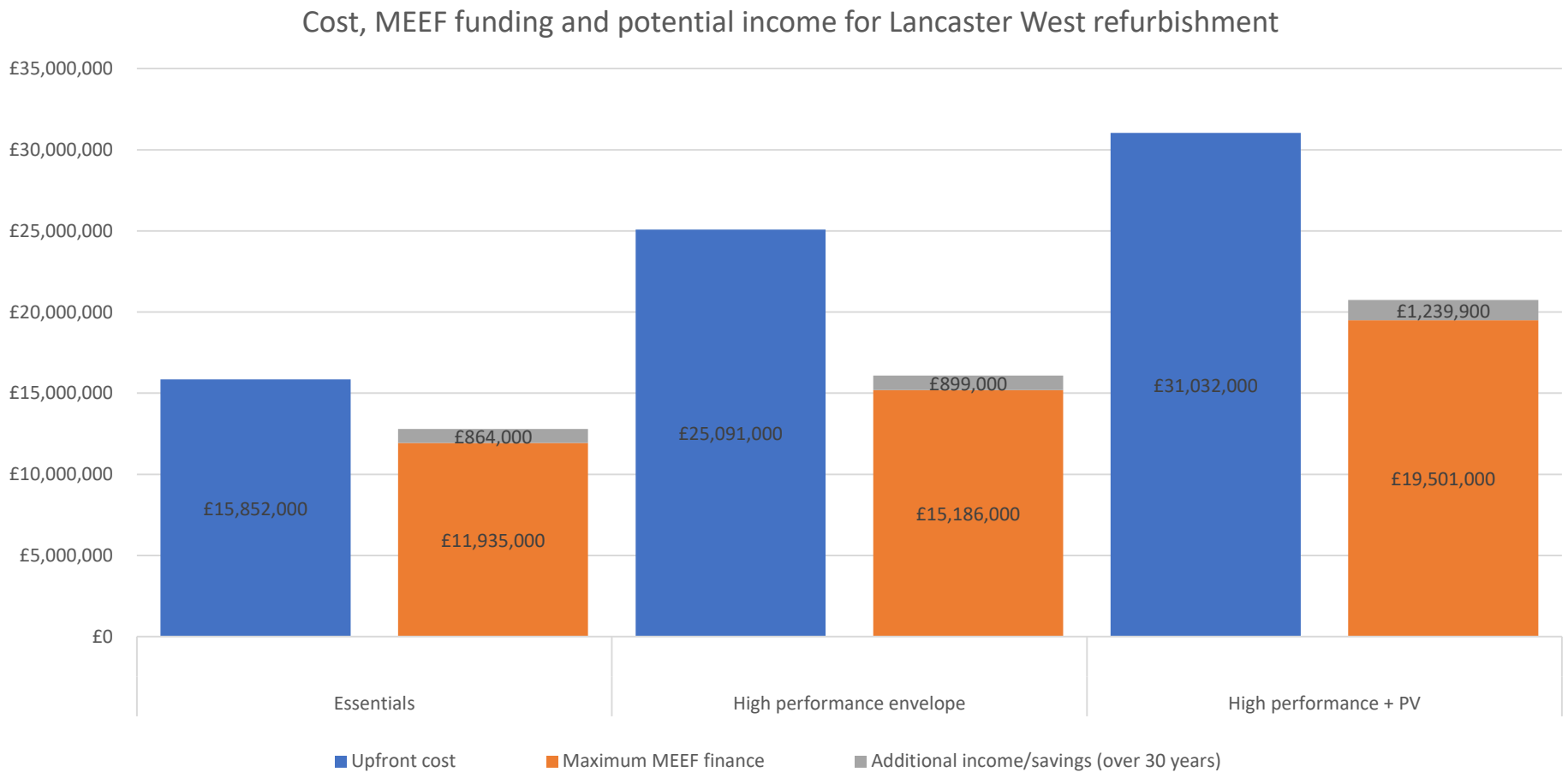
	Highest risk	Impact	Likelihood
1 Essentials	Room in roof – potentially difficult to insulate	• Cold, damp and mould • Higher energy bills	Medium
2 High performance envelope	Staggered terraces presents challenge for EWI, higher risk of thermal bridging	• Higher cost • Higher risk of performance gap	Medium
3 High performance + solar PV & storage	Staggered terraces presents challenge for EWI, higher risk of thermal bridging	• Higher cost	Medium

Verity Close (houses): Options for appraisal

Key questions for multidisciplinary design team:

- Is the cavity wall insulation performing as expected?
- Thermal bridging, ventilation strategies
- What are the options for room-in-roof?

Total Indicative Cost*



*Excludes heat network costs for blocks currently connected to networks. Income from RHI excluded where it would feed into heat network.

Indicative Upfront Cost, excluding potential income

Block	Option 1	Option 2	Option 3
Excluding heat network costs			
Walkways	£20,000	£32,000	£40,000
East Side	£18,000	£27,000	£35,000
Camelford Ct	£21,000	£34,000	£42,000
Talbot Grove & Moreland Hse	£18,000	£28,000	£33,000
Including boiler replacement costs*			
Treadgold House	£26,000	£49,000	£57,000
Camborne Mews	£22,000	£34,000	£40,000
Verity Cl (flats)	£22,000	£34,000	£40,000
Verity Cl (houses)	£23,000	£34,000	£41,000

*Figures do not include income from RHI and Smart Export Guarantee

Indicative Cost per tonne of carbon saved

Block	Option 1	Option 2	Option 3
Excluding heat network costs*			
Walkways	£200	£290	£290
East Side	£360	£420	£390
Camelford Ct	£290	£400	£380
Talbot Grove & Moreland Hse	£430	£580	£530
Including boiler replacement costs**			
Treadgold House	£720	£1,000	£780
Camborne Mews	£1,200	£1,300	£900
Verity Cl (flats)	£820	£1,100	£780
Verity Cl (houses)	£290	£570	£560

*These figures include the benefit of reduced carbon from replacement heating but not the installation costs as these will be included in the heat network replacement costs. The figures should not be directly compared with those on individual heating systems where the cost of replacing the boiler is included.

**Figures include income from RHI and Smart Export Guarantee

Summary and recommendations

- The options presented provide substantial energy efficiency improvements to all properties
- Some options have a high risk of creating unintended consequences, potentially undermining the purpose of the improvements
- These issues require further investigation by the multidisciplinary design and M&E teams
- Each option should be eligible for MEEF finance, repaid over 18 years
- Only the performance-guaranteed option has the potential to offset upfront cost and ongoing MEEF payments
  - This option is unlikely to be suitable for all blocks
- Each option should be considered alongside the heat network feasibility study, as higher performance could lead to lower network costs, resulting in a better overall business case

Data quality recommendations

1. Obtain current heating charges for tenants/leaseholders on heat networks
2. Take monthly meter readings for all accessible meters (see template started by Phoebe)
3. Obtain bills for as many tenants as possible, ideally:
   a) Multiple from top, mid and ground floor for each block
   b) At least 1 year, but the more the better
   c) Get a signed letter of authority if paper/electronic bills not available and phone energy suppliers (see template provided). Note the letter of authority authorises a named person.
4. Install energy, temperature and humidity monitoring in as many properties as possible. Winter monitoring is most useful, but summer monitoring gives data on overheating and hot water use.