
New Build Homes

Tom Lelyveld and Jessica Hogg



Outline

- Flat or Aggregate Target?
- Relative or Absolute Target?
- Energy efficiency standards
- Review of modelling methodology
- Learning rates
- On-gas results
- Fuel factors
- Off-gas results

Flat or Aggregate Target?



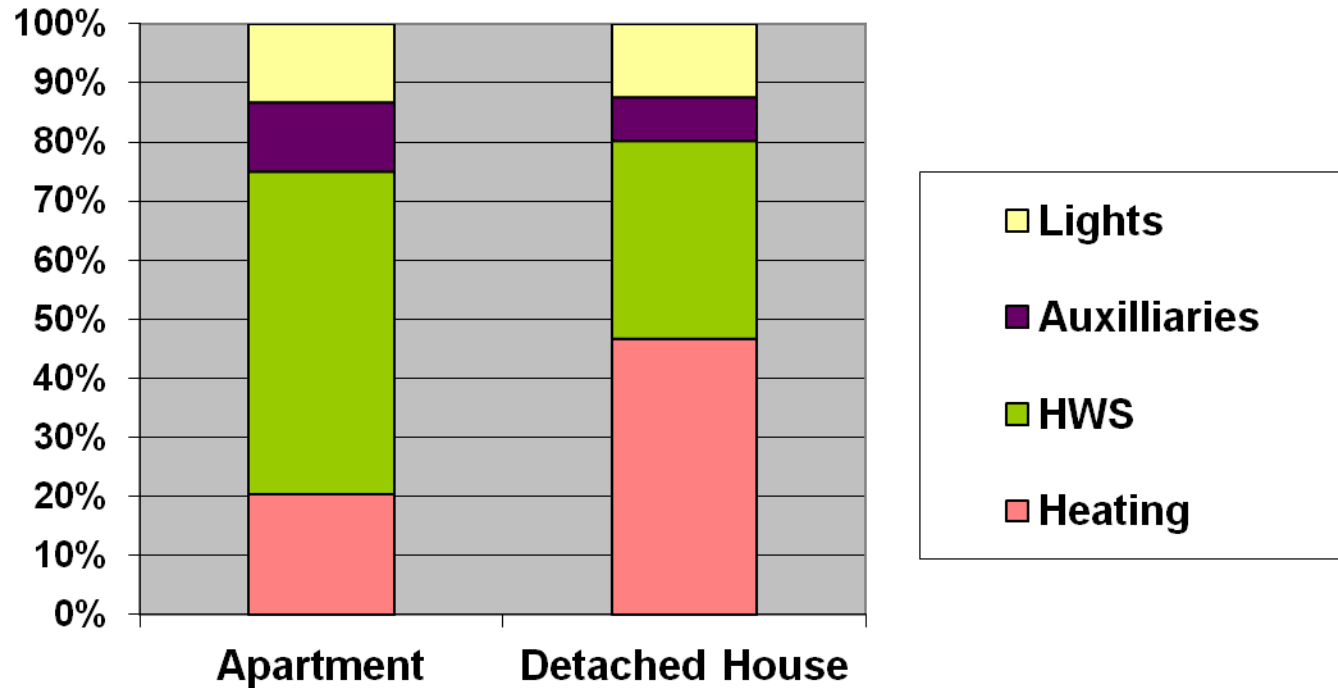
Flat or Aggregate Target?

Flat target

- Carbon emissions for all dwellings should be 40% better than Part L 2010
- Compares improvement against a historic notional dwelling
- Advantages:
 - Easy to understand and meets current approach in Part L
 - Will achieve 40% improvement whatever build mix
- Potential Disadvantages:
 - Complications in basing on 2002 notional dwelling
 - May result in significant differences in the ease with which different dwellings meet the target.

Flat or Aggregate CO₂ Target?

Relative proportion of end-use energy demands (dwellings)



Flat or Aggregate Target?

- Baseline PPW fabric specifications

	Detached	Apartment
External walls (W/m ² K)	0.18	0.15
Party walls (W/m ² K)	n/a	0
Ground floor (W/m ² K)	0.17	0.13
Roof (W/m ² K)	0.13	0.13
Windows (W/m ² K)	1.4	1.2
Doors (W/m ² K)	1.2	1.0
Air tightness (m ³ /hr.m ²)	4.50	4.68
Thermal bridging (W/m ² K)	Halfway ACD-ECD	ECD plus
Ventilation type	Natural with extract fans	Natural with extract fans
Low energy lights	100%	100%

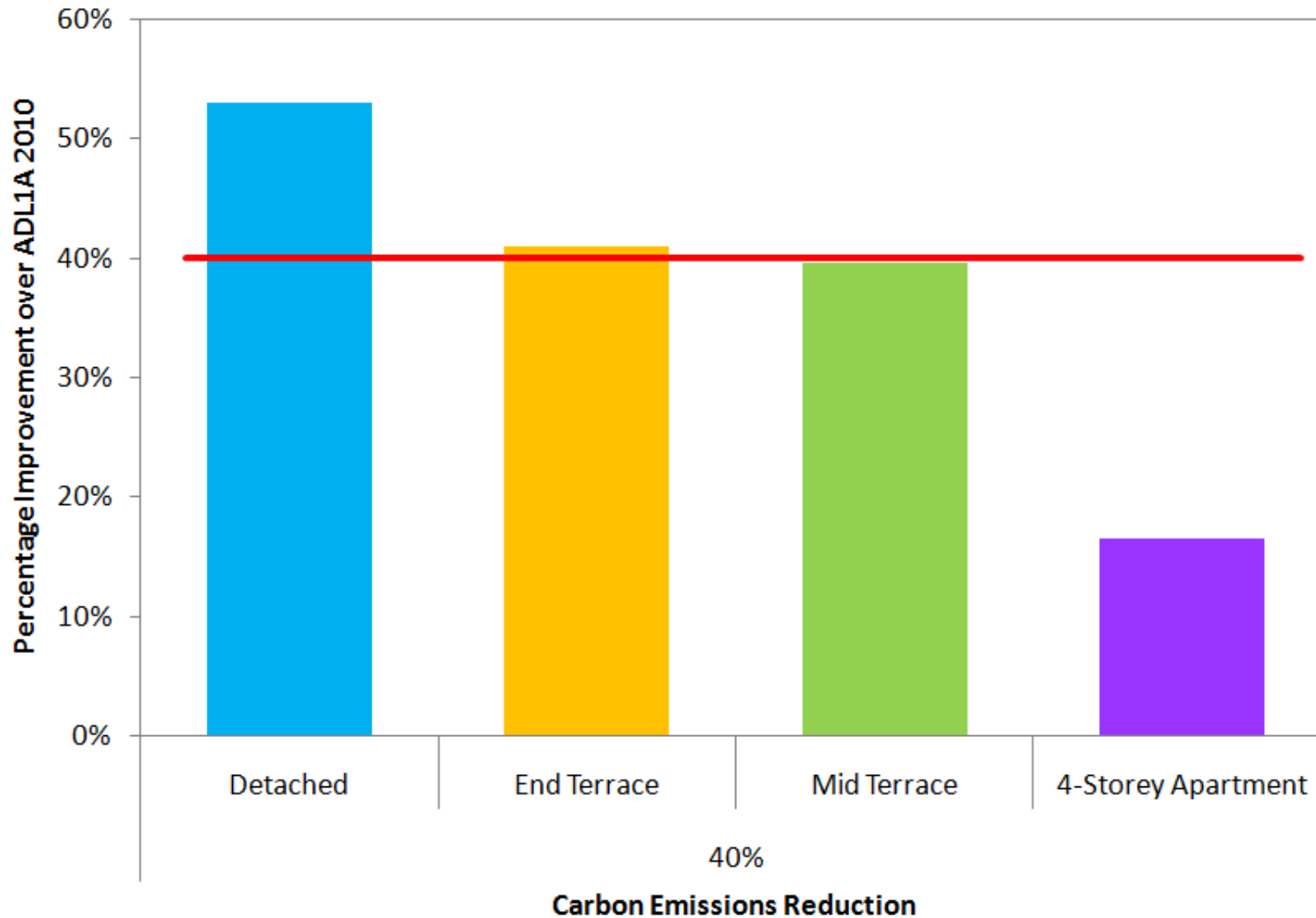
Flat or Aggregate Target?

Aggregate target

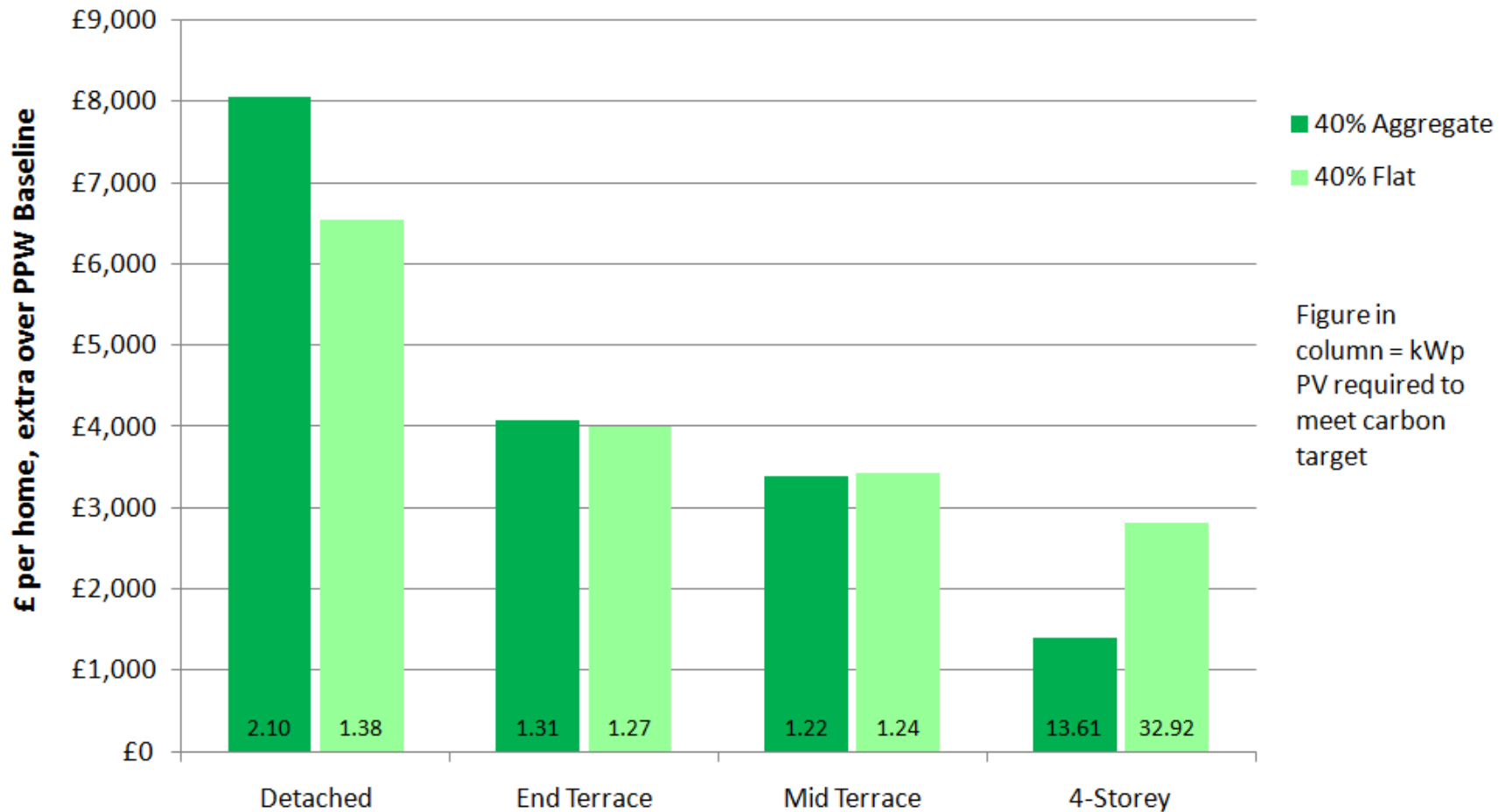
- Each dwelling has its own reduction target such that over build mix would achieve 40% reduction
 - e.g. based on a common specification (a 2013 notional building) or set different target (kg.CO₂/m²/yr) for different building types
- Should be more equitable
- Relies on build mix predictions

Indication of Flat vs Aggregate Target Approach

40% Target, FEES Specification



Flat or Aggregate Target Capital Cost, Extra-over PPW Baseline FEES, Gas boiler + PV



2013 Notional Building or Absolute Targets?



2013 Notional Building or Absolute Targets?

2013 Notional Building

- Incorporates a compliant notional building
- Regulatory requirement will be to perform no worse than the notional building

Example Notional Building Specification	
External walls	0.15 W/m ² K
Ground floor	0.15 W/m ² K
Roof	0.11 W/m ² K
Windows	1.4 W/m ² K
Doors	1.0 W/m ² K
Air tightness	4 m ³ /hr.m ²
Thermal bridging	0.04 W/m ² K
Ventilation type	Natural with extract fans
Low energy lighting	100%
Renewables	PV, equivalent to 22% of ground floor area

2013 Notional Building or Absolute Targets?

Absolute Target

- Each dwelling will have an absolute annual carbon target to achieve
 - Detached: 9 kgCO₂/m².yr
 - End-terrace: 12 kgCO₂/m².yr
 - Mid-terrace: 11 kgCO₂/m².yr
 - Apartment block: 15 kgCO₂/m².yr
- Design of more efficient building form would gain benefit

Setting a Minimum Fabric Efficiency



Setting a Minimum Energy Efficiency Standard

- ADL1A includes minimum elemental standards to avoid 'green-washing'.
- For England, the Zero Carbon Hub has proposed a minimum fabric energy efficiency standard.
 - Performance standard (kWh/m²/yr)
 - Covers space heating and space cooling energy demand only
 - The standard is met through implementing passive measures such as fabric u-values, improved air permeability and thermal bridging.
- DCLG has confirmed that the minimum fabric energy efficiency standard will be taken forward in future revisions of Part L in England. The minimum fabric energy efficiency standard is now included in the Code for Sustainable Homes (ENE2).

Setting a Minimum Energy Efficiency Standard

Criteria			
Dwelling Type* ¹		Credits* ²	Mandatory Levels
Apartment Blocks, Mid-Terrace	End Terrace, Semi- Detached & Detached		
Fabric Energy Efficiency kWh/m ² /year			
≤ 48	≤ 60	3	
≤ 45	≤ 55	4	
≤ 43	≤ 52	5* ³	
≤ 41	≤ 49	6	
≤ 39	≤ 46	7	Levels 5 & 6
≤ 35	≤ 42	8	
≤ 32	≤ 38	9	
Default Cases			
None			

Setting a Minimum Energy Efficiency Standard

- FEES results in different specifications across the build mix

	Detached	End Terrace	Mid Terrace	Apartment
External walls (W/m ² K)	0.15	0.18	0.18	0.18
Party walls (W/m ² K)	n/a	0	0	0
Ground floor (W/m ² K)	0.13	0.13	0.15	0.15
Roof (W/m ² K)	0.13	0.13	0.13	0.13
Windows (W/m ² K)	1.2	1.4	1.4	1.4
Doors (W/m ² K)	1.0	1.0	1.0	1.2
Air tightness (m ³ /hr.m ²)	5.2	5.0	5.5	5.4
Thermal bridging (W/m ² K)	ECD	ECD	ECD plus	Halfway ACD-ECD
Ventilation type	Natural with extract fans	Natural with extract fans	Natural with extract fans	Natural with extract fans
Low energy lights	100%	100%	100%	100%
FEES / kWh/m ² .yr	46	46	39	39

Setting a Minimum Energy Efficiency Standard






- Should we introduce a minimum fabric energy efficiency standard?
 - Stresses that you should first reduce the energy demand in the home
 - It better avoids ‘green-washing’.
- If so, should we retain the elemental backstops?
 - Keeping both could result in confusion within the industry.
 - However, it does provide a “safety net”
- Should a fabric energy efficiency standard be made a regulatory requirement?

Modelling Methodology



Modelling Methodology

- Four core housetypes
 - Detached
 - Semi-detached
 - Mid-terrace
 - 4 Storey apartment
- Five fabric specifications
 - FEES-
 - FEES
 - FEES+
 - Fabric Limits
- Aggregate targets, 40% and 25% for comparison

	Small Apartment	Large Apartment	Mid terrace house	End terrace / semi detached house	Detached house
					
	Top floor Mid floor Ground floor	Top floor Mid floor Ground floor			
TFA (m ²)	43	66	76	76	118

4-Storey Apartment block
(4x small & 4x large per floor)

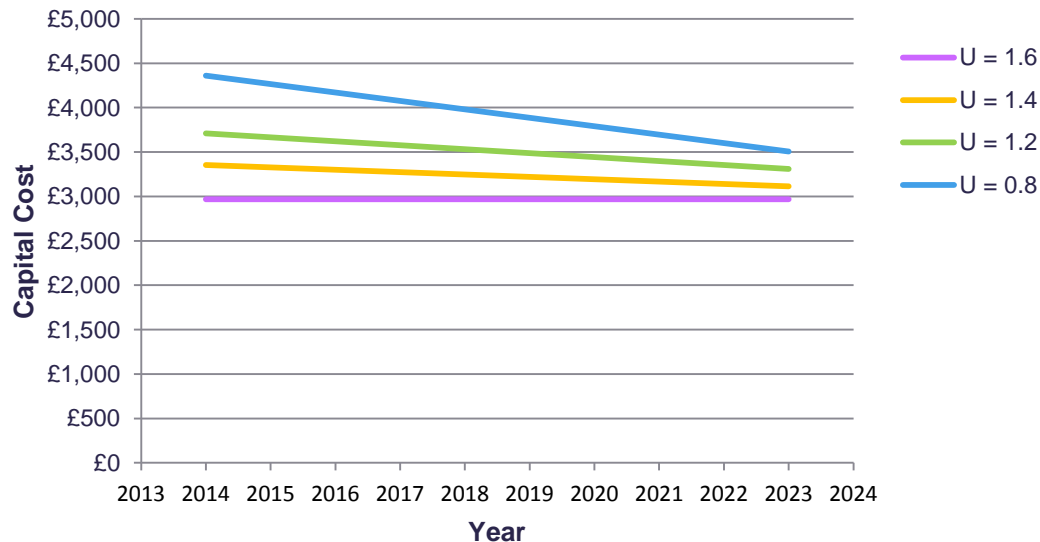
Modelling Methodology

Detached House	FEES-	FEES	FEES+	Fabric Limits
Ext. walls (W/m ² K)	0.18	0.15	0.15	0.11
Ground floor (W/m ² K)	0.13	0.13	0.13	0.11
Roof (W/m ² K)	0.13	0.13	0.11	0.11
Windows (W/m ² K)	1.4 (double)	1.2 (double)	0.8 (triple)	0.8 (triple)
Doors (W/m ² K)	1.0	1.0	1.0	1.0
Air tightness (m ³ /hr.m ²)	4.65	5.2	5.05	1.0
Thermal bridging (W/m ² K)	ECD	ECD	ECD	ECD plus
Ventilation type	Natural with extract fans	Natural with extract fans	Natural with extract fans	MVHR
Low energy lights	100%	100%	100%	100%
FEES / kWh/m ² .yr	49.00	46.00	42.00	34.92

Learning Rates

- Represents the decrease in cost of certain elements due to greater production and installations in buildings
- Applied to photovoltaics, thermal bridging, windows and air permeability

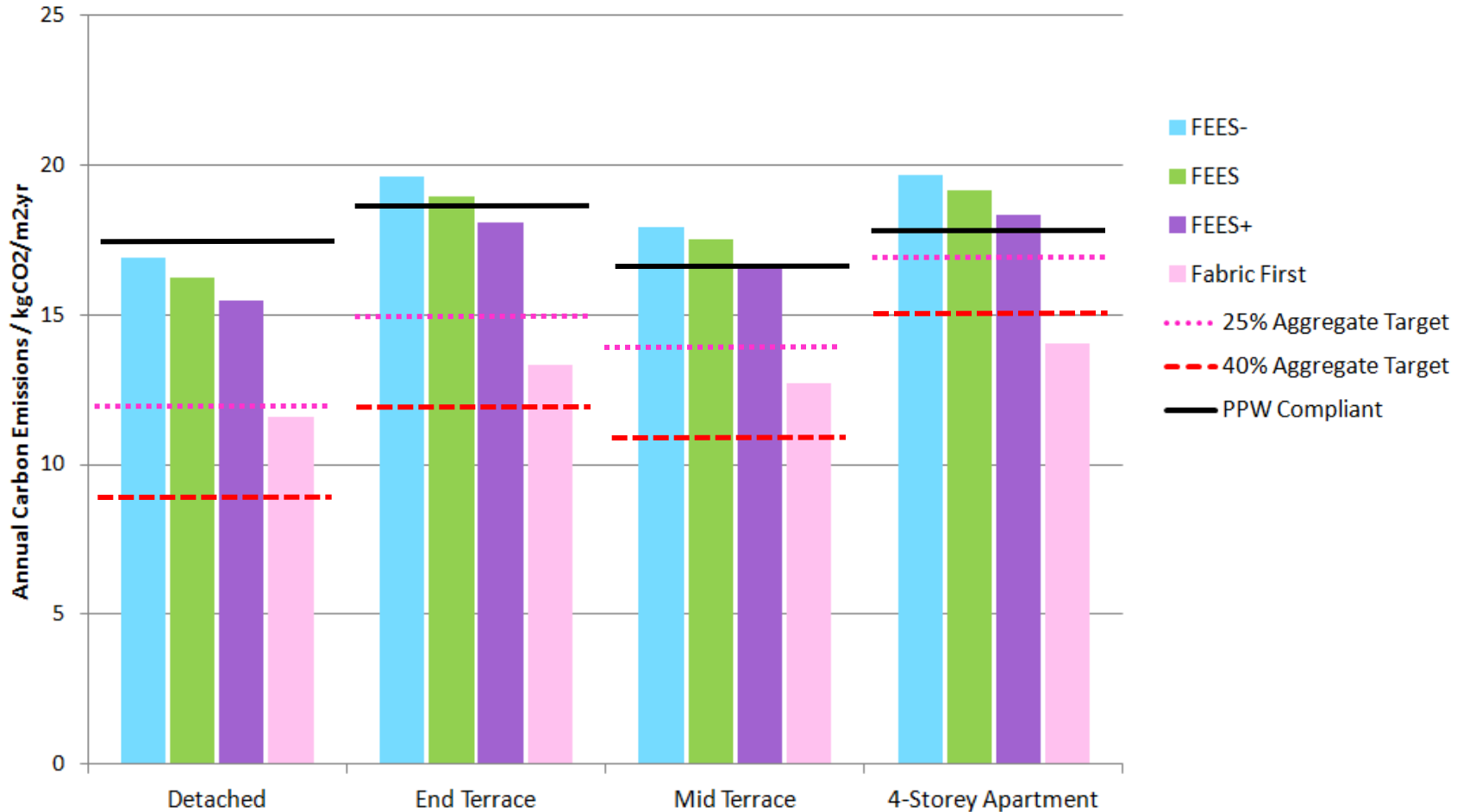
Predicted Cost of Windows for End-Terrace Dwelling



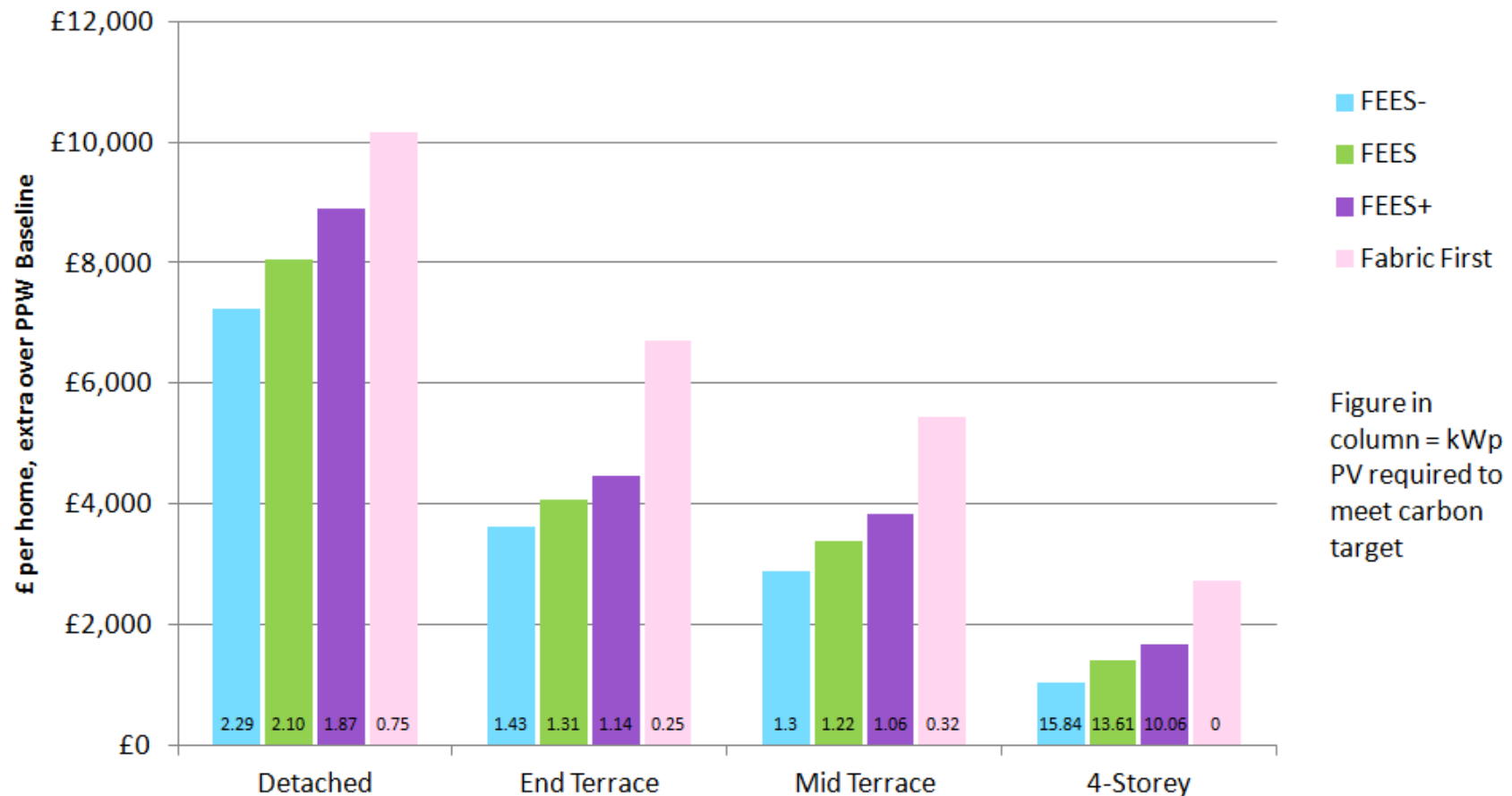
On Gas Results



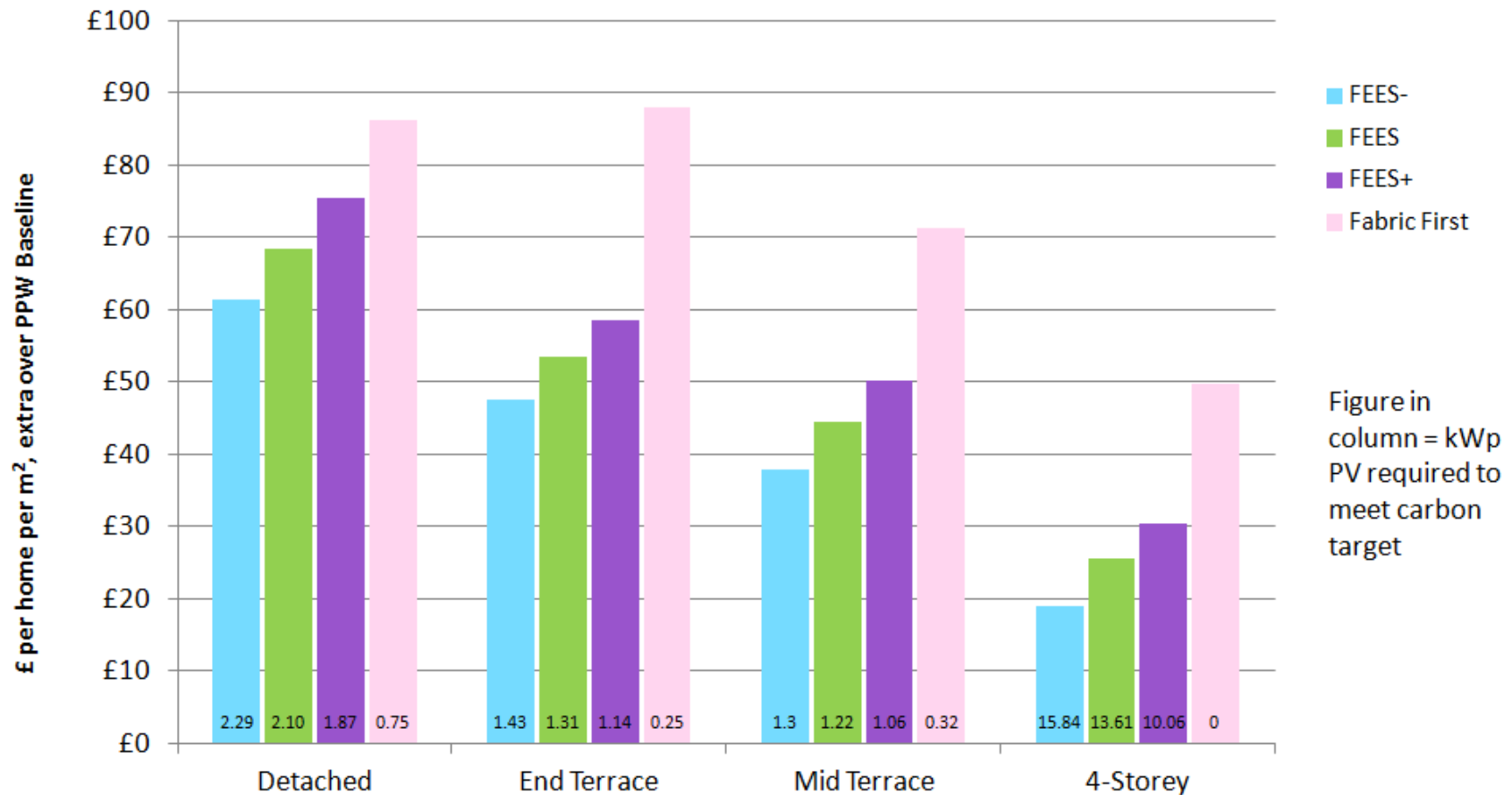
Carbon Comparison: 4 Fabric Specifications 2013 carbon emission factors



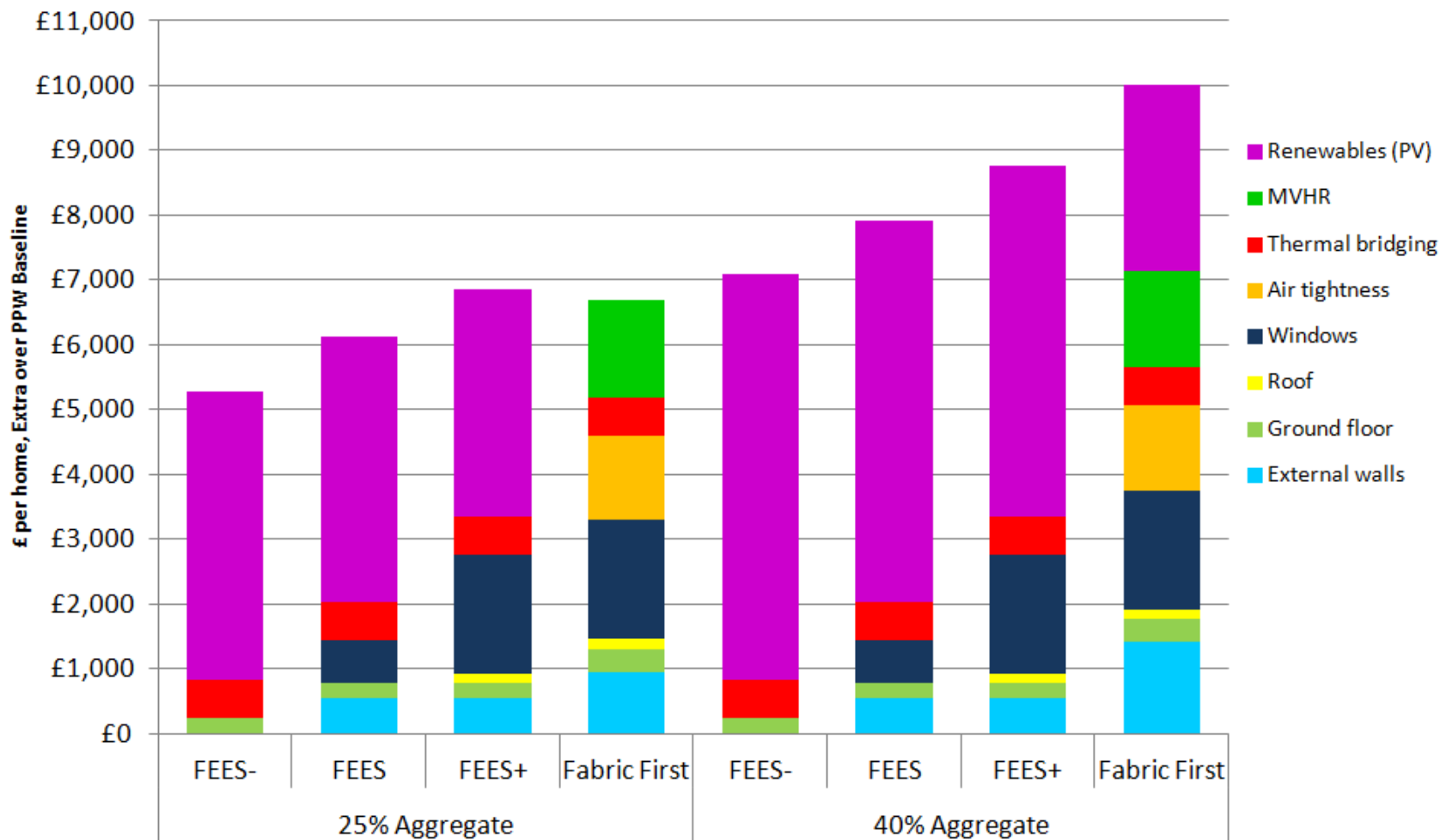
Capital Cost, Extra-over PPW Baseline, 40% Aggregate Reduction over ADL1A 2010 Gas boiler + PV



Capital Cost, £/m², Extra-over PPW Baseline, 40% Aggregate Reduction over ADL1A 2010 Gas boiler + PV



Capital Cost, Extra over PPW Baseline Detached house, Gas boiler + PV



Fuel Factors and Off-Gas Results



Fuel Factors

- Currently applied under ADL1A 2010, historic notional building utilises gas as the heating fuel
- Increases the acceptable carbon emissions target depending on the heating fuel
- Applied even if the heat generation plant is a low or zero carbon technology (such as heat pumps)
- Options available for Wales
 - Keep fuel factors as they are
 - Keep fuel factors but reduce them
 - Remove fuel factors completely

Table 1: ADL1A 2010 Fuel Factors

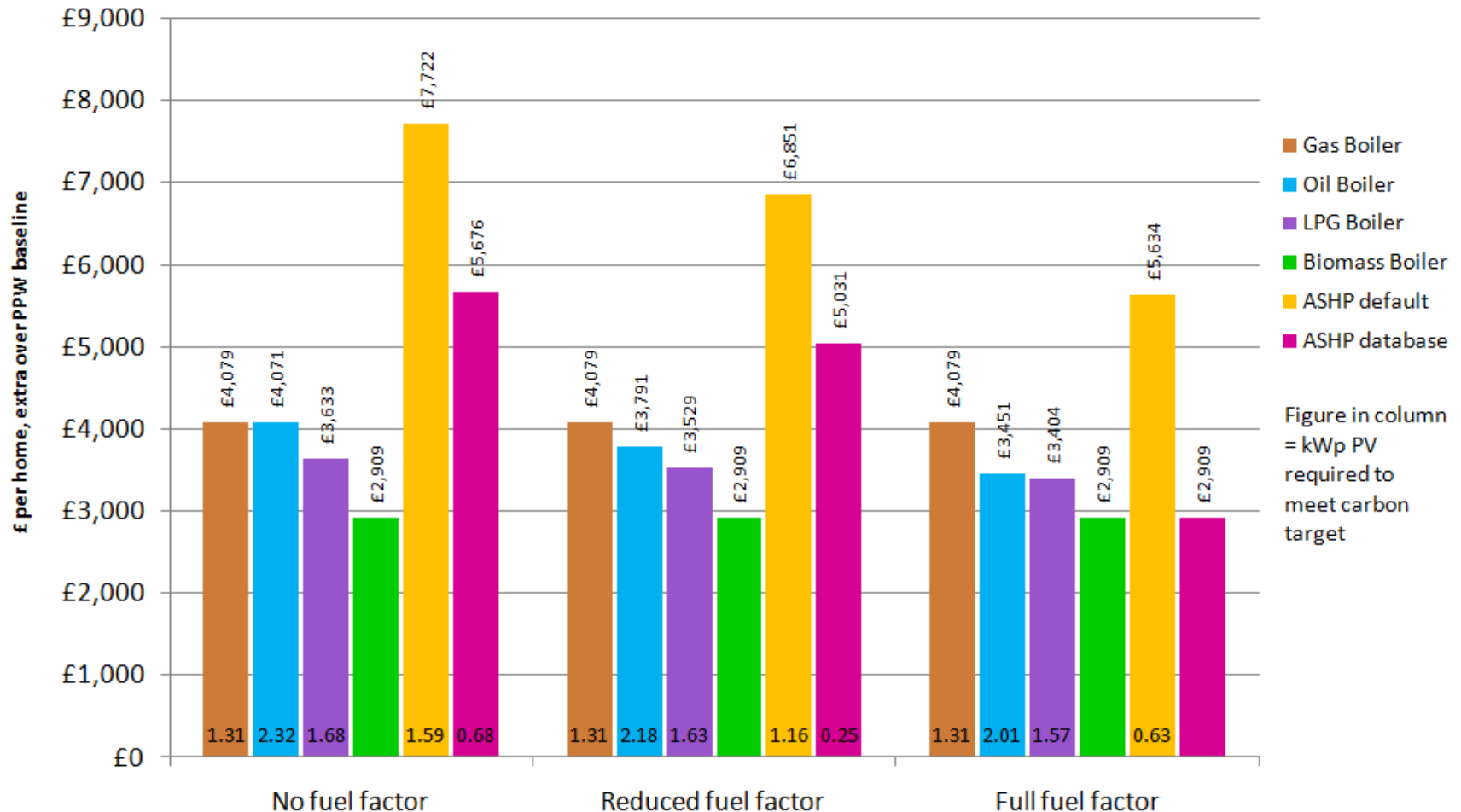
Heating Fuel	Fuel Factor
Natural gas	1.00
LPG	1.10
Oil	1.17
Grid Electricity	1.47
Solid mineral fuel	1.28

Fuel Factors

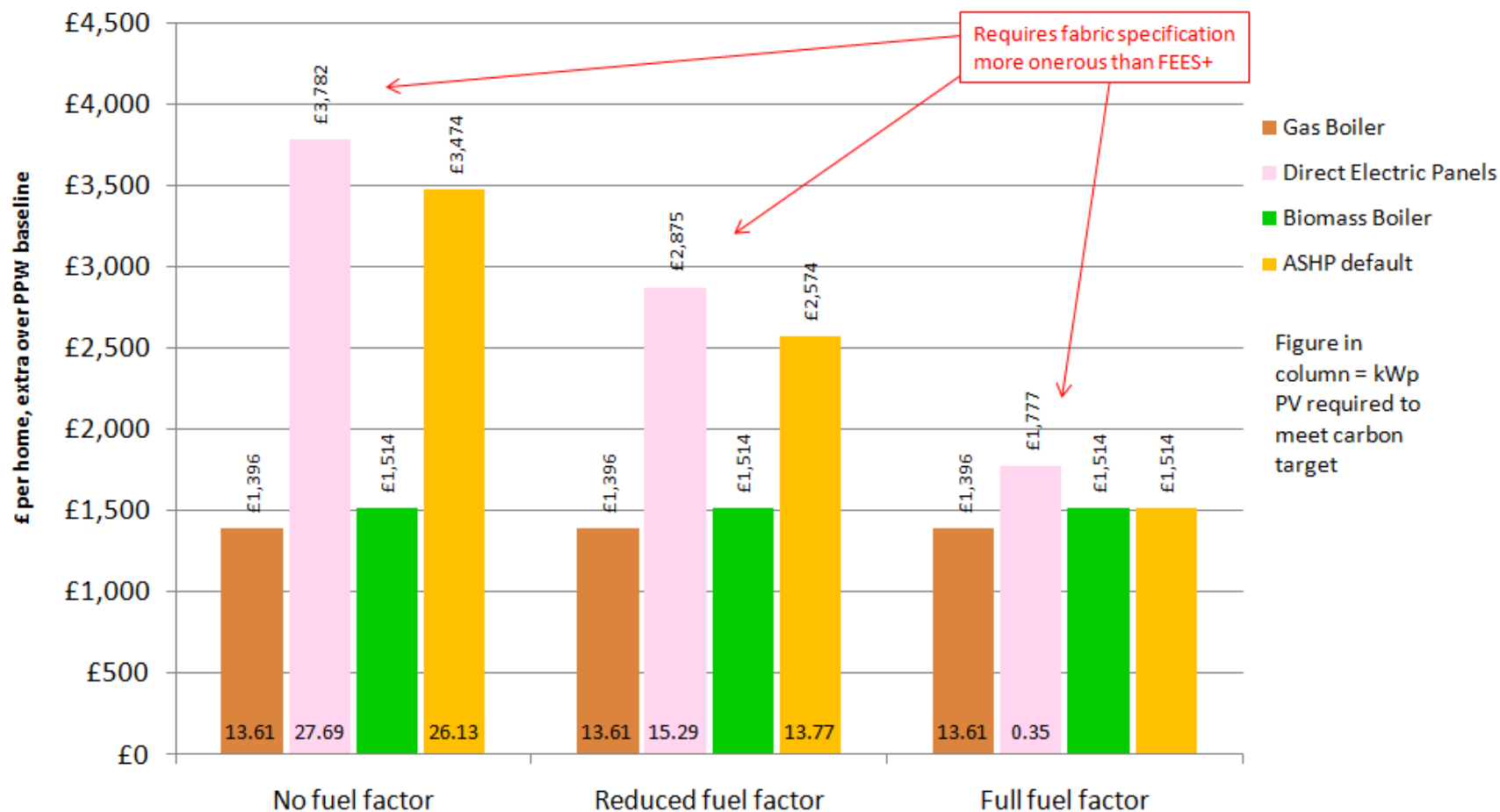
- Modelling work on end-terrace house and 4-storey apartment block only
- Effect of the carbon reduction target and fuel factors
- Fuels modelled include:
 - Oil
 - LPG
 - ASHP with default SAP efficiency
 - ASHP from database (therefore improved efficiency)
 - Biomass woodpellet
 - Direct electric panel
- Compared with gas boiler

Capital costs extra over PPW baseline, Fuel Factor Comparison

End terrace, 40% Aggregate Target, FEES



Capital costs extra over PPW baseline, Fuel Factor Comparison 4-Storey Apartment (per unit), 40% Aggregate Target, Varying fabric efficiency



Points for Discussion

- Should we adopt a flat or aggregate approach to carbon target setting?
- If aggregate – is the preference for a 2013 notional building or absolute carbon targets?
- Would a fabric energy efficiency standard be preferred to the current elemental backstops (or both)?
- Should we be looking to set standards to encourage fabric energy efficiency even if the use of PV is more cost effective?
- Should we reduce/remove fuel factors and should any change depend on fuel type?

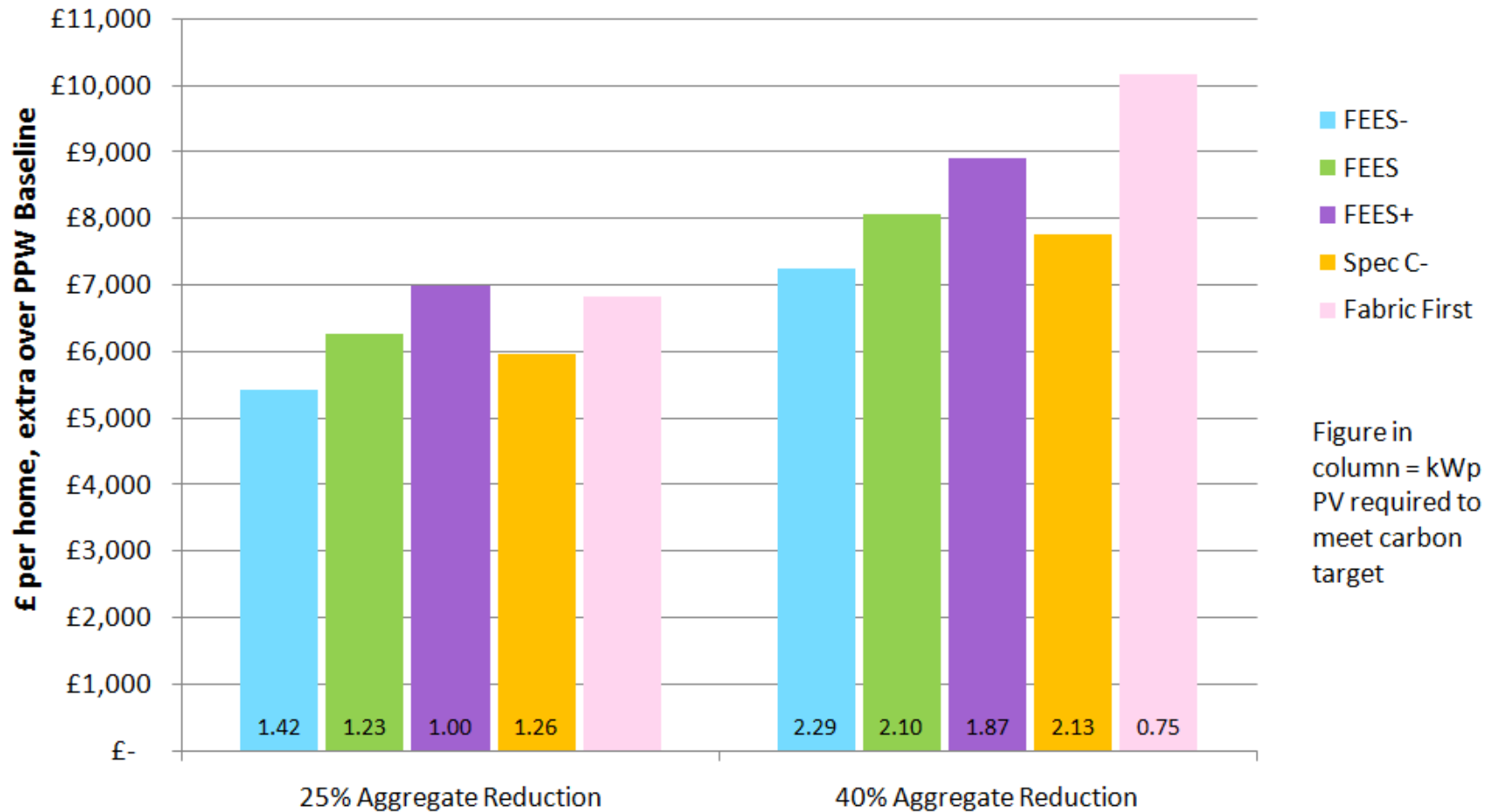
Extra slides if required



Capital Cost, Extra-over PPW Baseline

Detached house

Gas boiler + PV



Capital Cost, Extra-over PPW Baseline

End terrace house

Gas boiler + PV

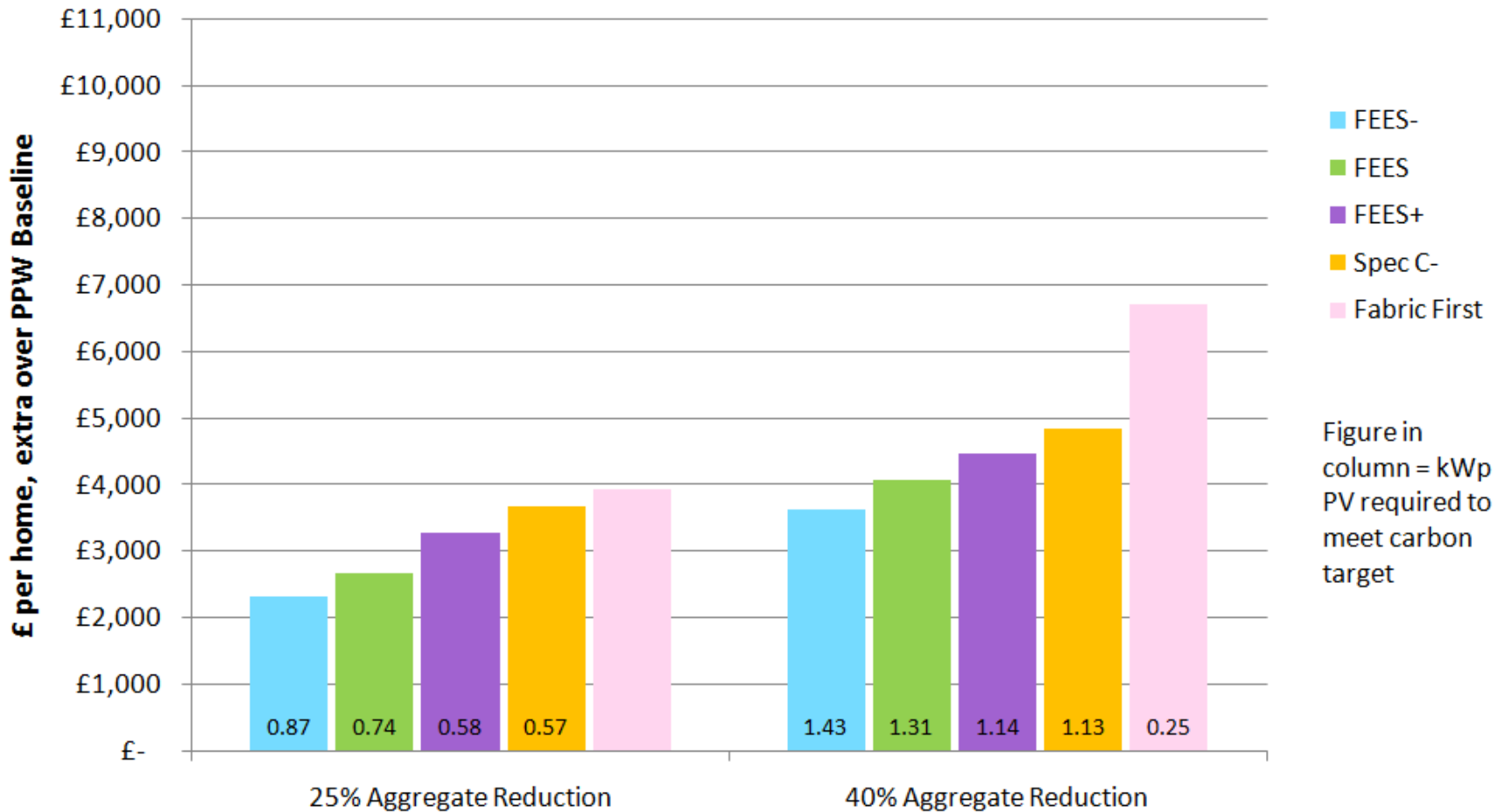
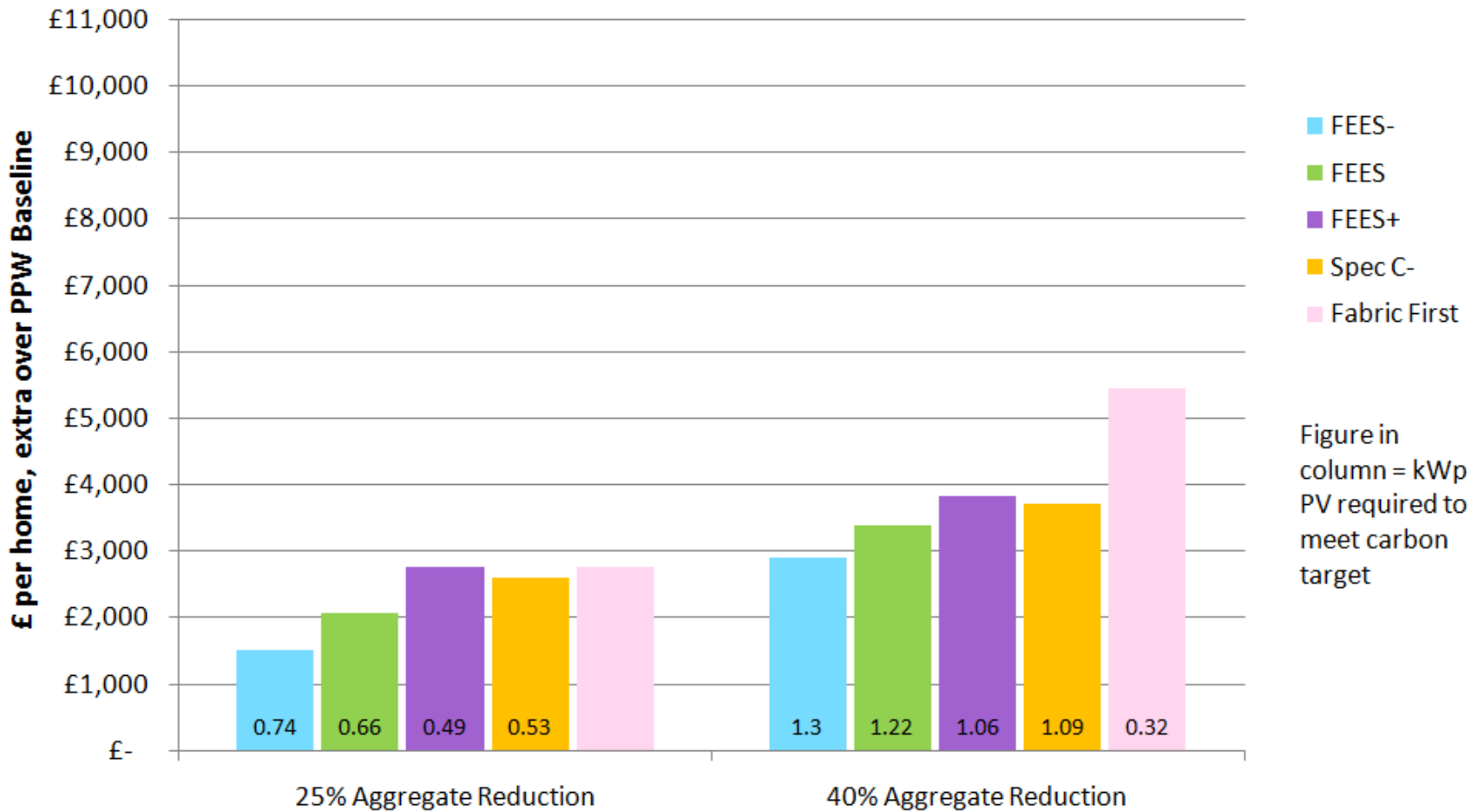


Figure in column = kWp PV required to meet carbon target

Capital Cost, Extra-over PPW Baseline

Mid terrace house

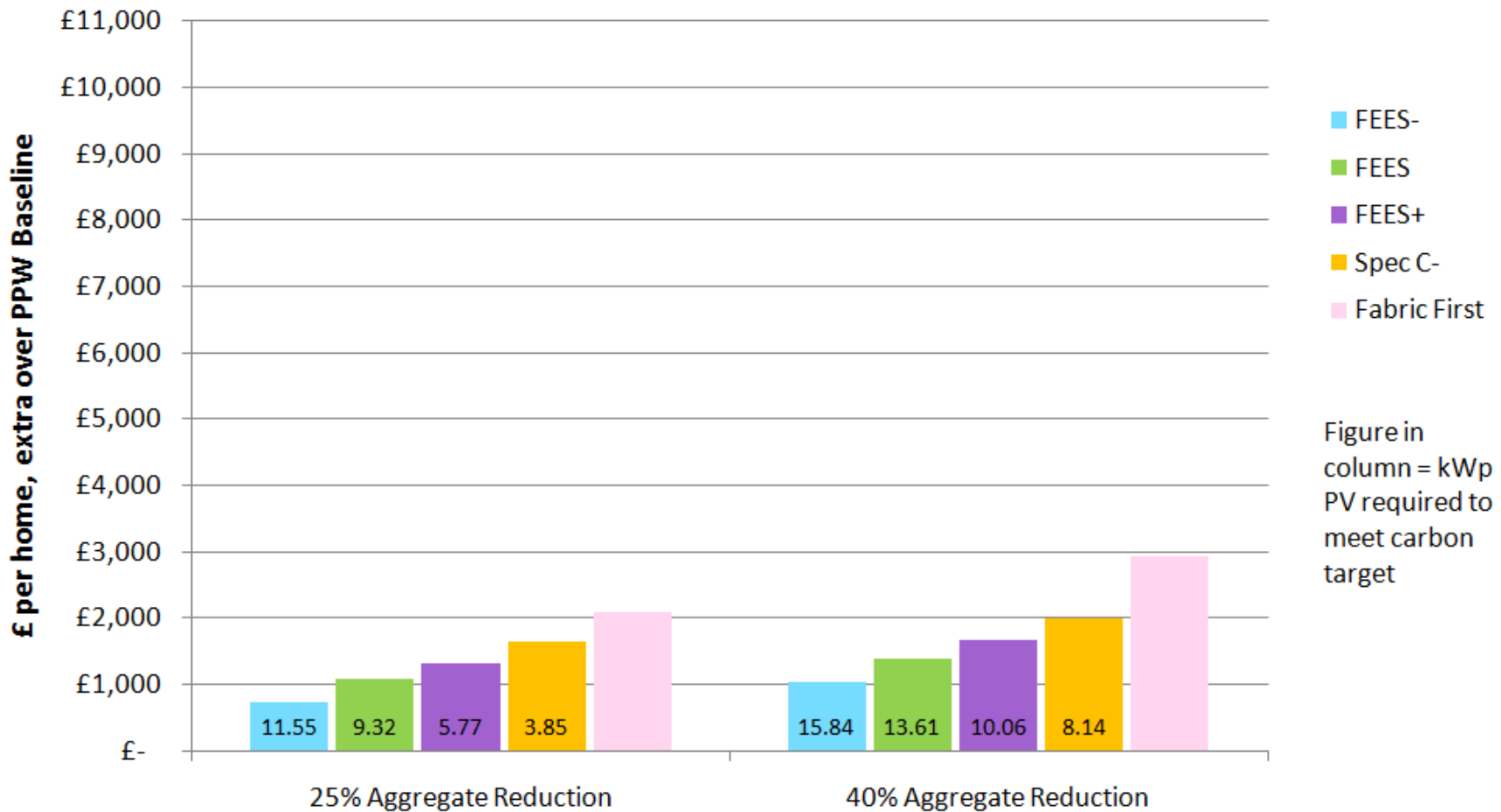
Gas boiler + PV



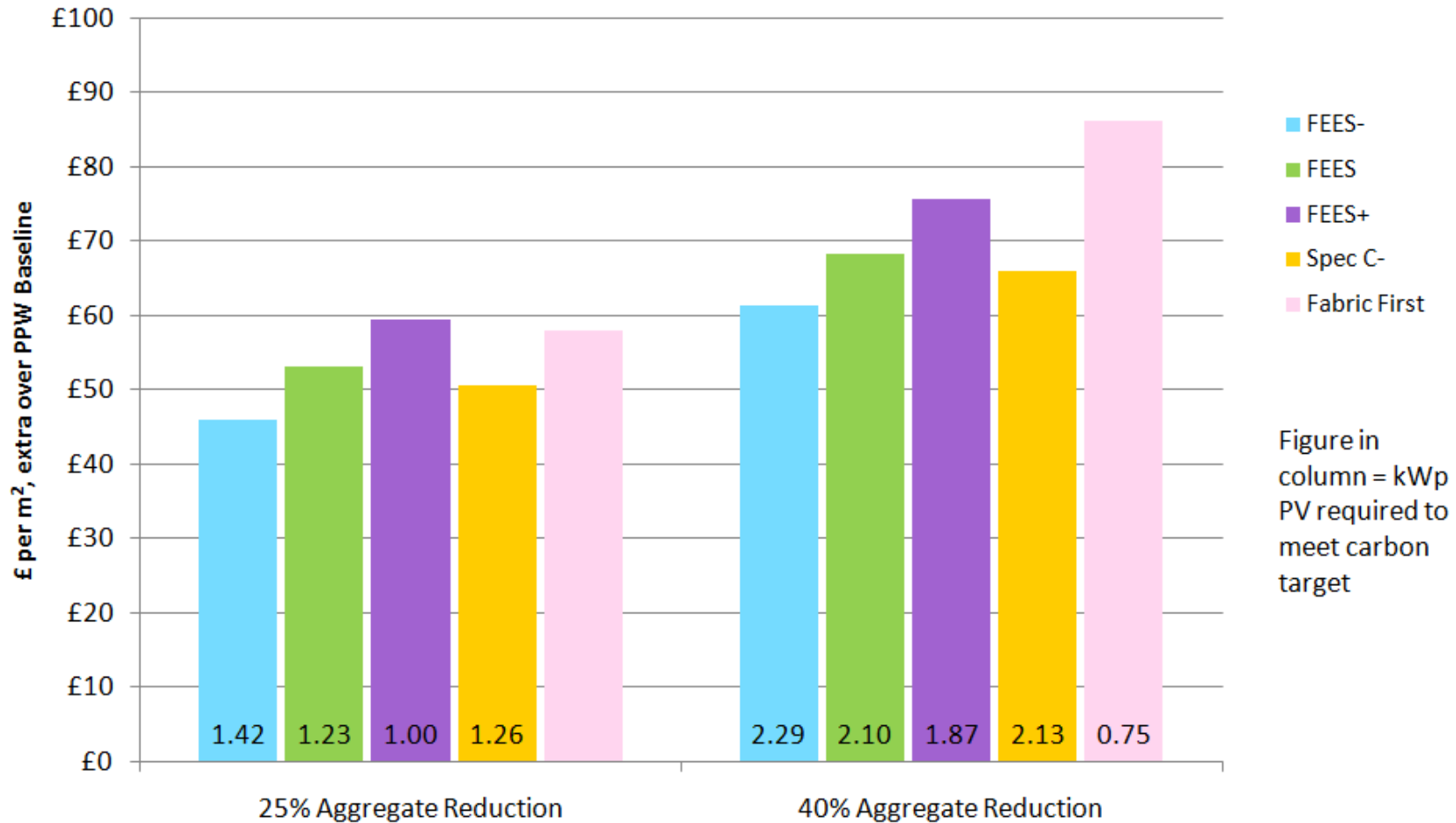
Capital Cost, Extra-over PPW Baseline

4-Storey Apartment (cost per unit)

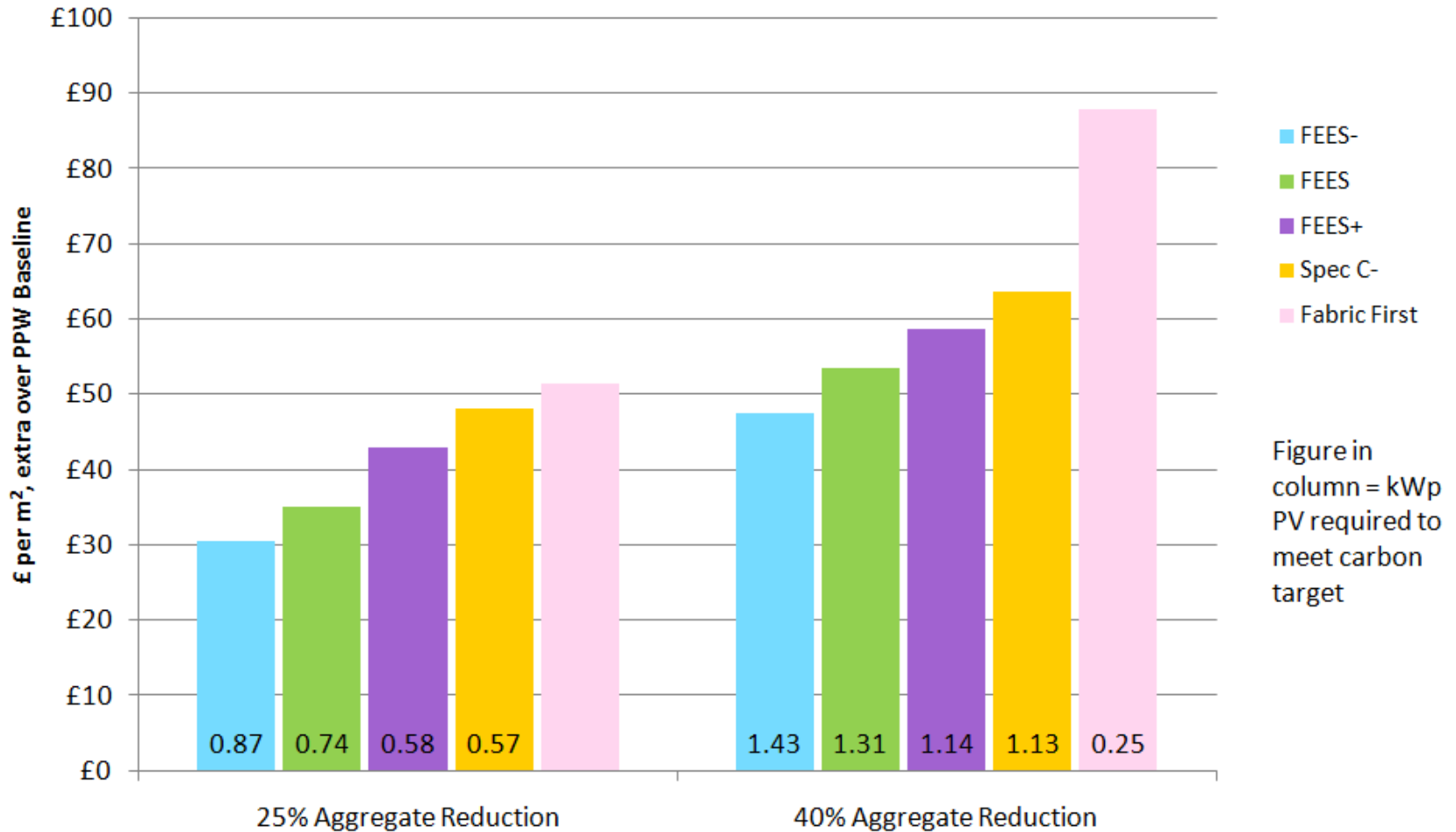
Gas boiler + PV



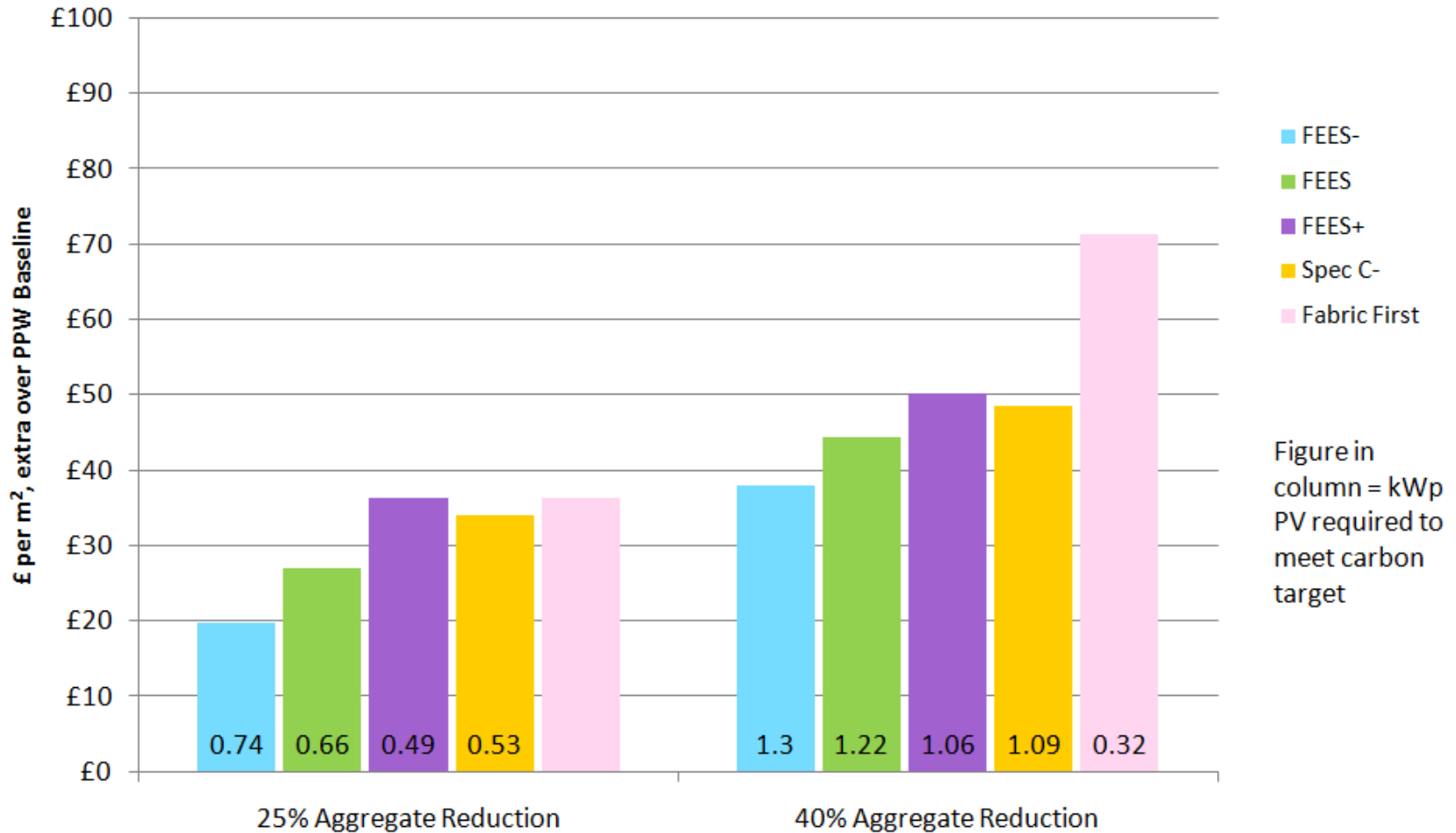
Capital Cost £ per m², Extra-over PPW Baseline Detached house, Gas boiler + PV



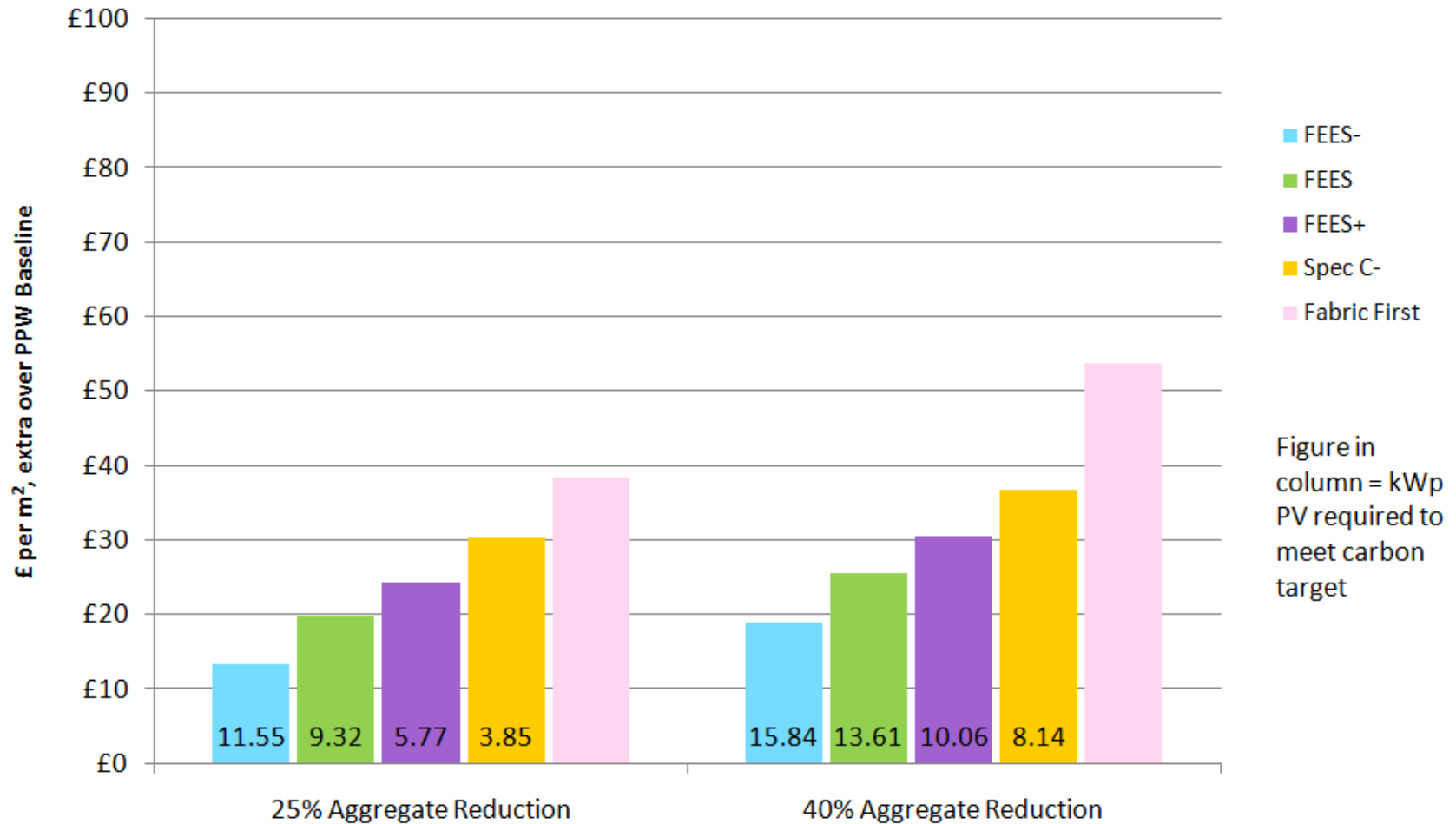
Capital Cost £ per m², Extra-over PPW Baseline End terrace house, Gas boiler + PV



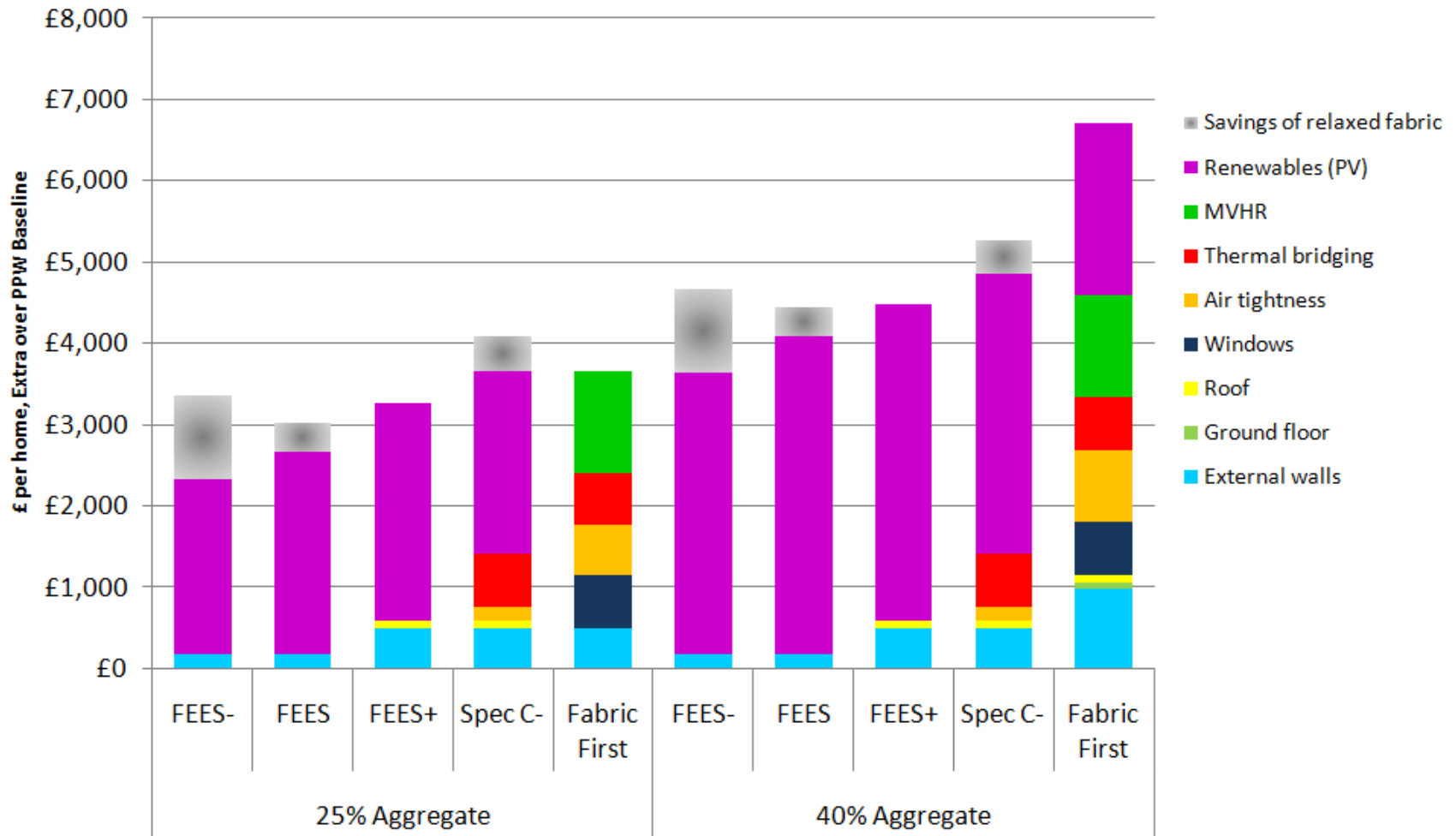
Capital Cost £ per m², Extra-over PPW Baseline Mid terrace house, Gas boiler + PV



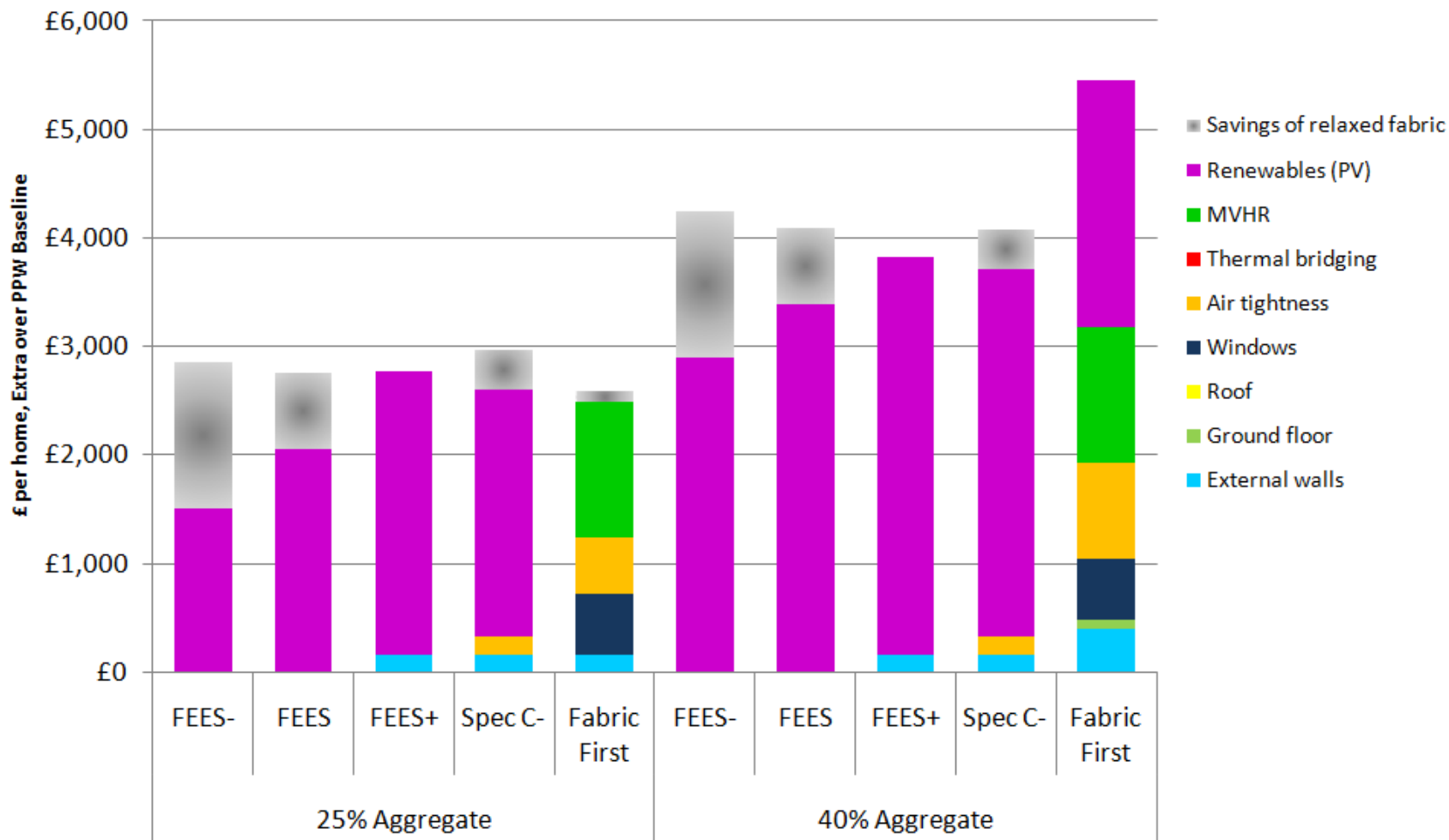
Capital Cost £ per m², Extra-over PPW Baseline 4-Storey Apartment (cost per unit), Gas boiler + PV



Capital Cost, Extra over PPW Baseline End Terrace house, Gas boiler + PV



Capital Cost, Extra over PPW Baseline Mid Terrace house, Gas boiler + PV



Capital Cost, Extra over PPW Baseline 4-Storey Apartment (per unit), Gas boiler + PV

