

# Building Regulations Part L 2013 Wales Wider Engagement Event

Approach to Energy Modelling – New Build  
Non-Domestic – Part L2A

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6th and 8<sup>th</sup> December 2011

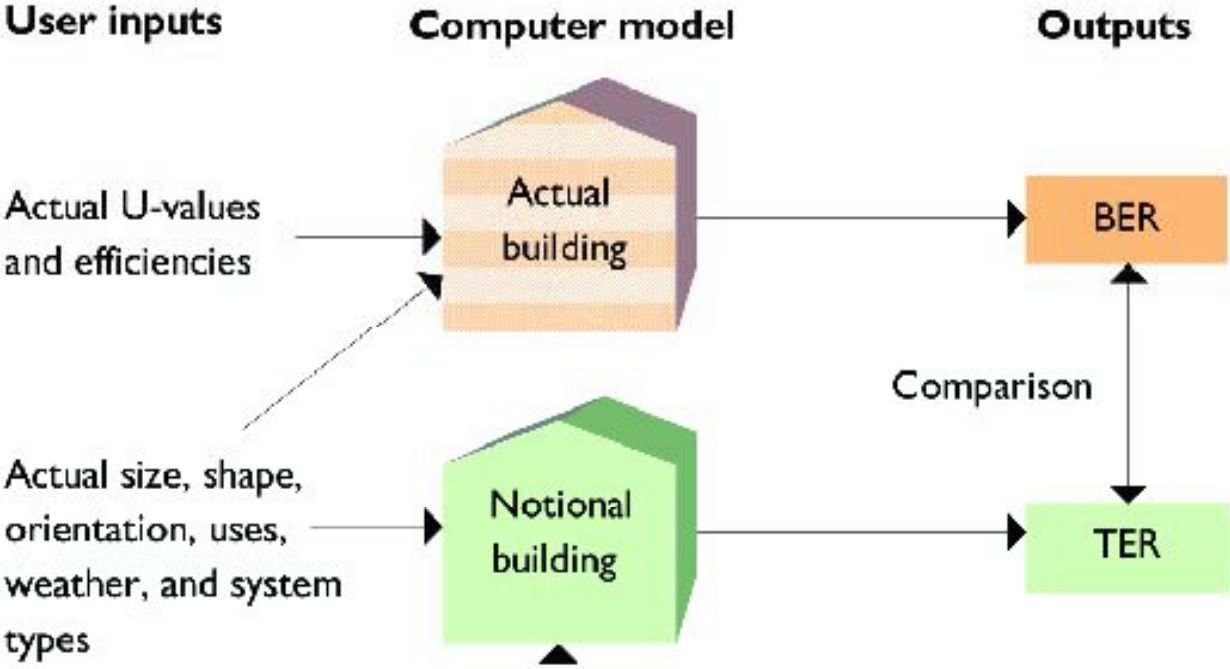


# Recap on 5 criteria for Building Regulations Part L2A compliance

Criteria:

1. Building Emission Rate  $\leq$  Target Emission Rate
2. Limits on design flexibility
3. Limiting the effects of solar gains in summer
4. Quality of construction & commissioning
5. Providing information / O&M instructions

# Criterion 1 – Target Emission Rate (TER) *Recipe approach in 2010*

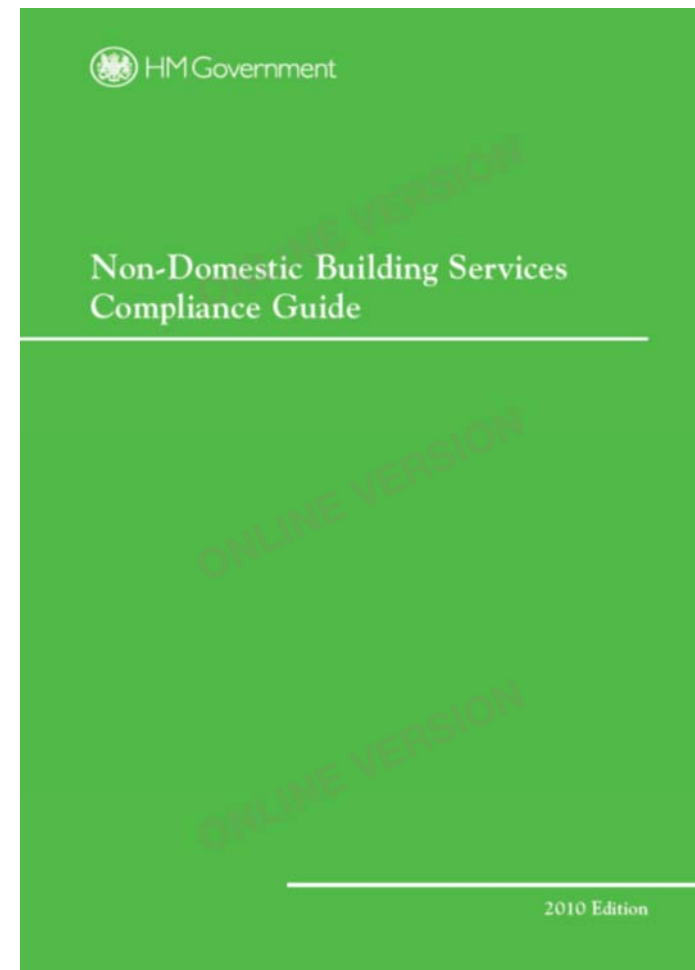


U-values and efficiencies for a 2010 building

Not to be confused with....

## Criterion 2: Limits on design flexibility

- Non-domestic Building Services Compliance Guide
- Reasonable Provision...
- Values that should not be worse than
- Example:
- Notional Building, chiller SEER = 4.5
- Back stop, chiller SEER = 2.5



## Packages modelled - Fabric

<b>Fabric</b>					
<b>Element</b>	<b>Unit</b>	<b>Package A (2010 Notional)</b>	<b>Package B</b>	<b>Package C</b>	<b>Package D</b>
Roof	U-value (W/m2.K)	0.18	0.18	0.16	0.1
Wall	U-value (W/m2.K)	0.26	0.26	0.20	0.20
Floor	U-value (W/m2.K)	0.22	0.22	0.2	0.15
Window	U-value (W/m2.K)	1.8	1.8	1.6	1.4
Window	G-Value	40% (10% FF)	40% (10% FF)	40% (10% FF)	40% (10% FF)
Window	Light transmittance	71%	71%	71%	71%
Roof-light	U-value (W/m2.K)	1.8 (15% FF)	1.8 (15% FF)	1.6 (15% FF)	1.4 (15% FF)
	G-Value	43%	43%	43%	43%
Roof-light	Light transmittance	67%	67%	67%	67%
Air-permeability	m3/m2/hour	5	3	3	3
Thermal Bridging	To British Standard detail	Yes	Yes	Yes	Yes

## Packages modelled – Building services

<b>Building Services</b>					
<b>Element</b>	<b>Unit</b>	<b>Package 1 (2010 Notional)</b>	<b>Package 2</b>	<b>Package 3</b>	
Lighting	Luminaire lm/ circuit watt	55	65	65	
Occupancy control	Yes/no	Yes	Yes	Yes	
Daylight control	Yes/no	Yes	Yes	Yes	
Heating efficiency	Heating and hot water (side lit)	88%	91%	91%	
Heating efficiency	Heating and hot water (top lit) – i.e. gas- radiant space heating	86%	91%	91%	
Central Ventilation	SFP (w/l/s)	1.8	1.8	1.8	
Terminal Unit	SFP (w/l/s)	0.5	0.4	0.3	
Cooling	SEER	4.5	4.5	4.5	
Heat recovery	%	70%	70%	70%	
Variable speed control of fans and pumps	Yes/no – multiple sensors	Yes	Yes	Yes	
Demand control (mech vent only)	Yes/no – CO2 sensing with variable speed	No	Yes	Yes	

## Aggregate Approach

### Target improvement over Part L 2010

	A1	A2	A3
<b>Warehouse (Distribution)</b>	<b>0.0%</b>	<b>5.6%</b>	<b>8.0%</b>
<b>Office (Deep-plan, AN)</b>	<b>0.0%</b>	<b>11.9%</b>	<b>19.5%</b>
<b>Warehouse (Retail)</b>	<b>0.0%</b>	<b>6.8%</b>	<b>10.9%</b>
<b>Office (Shallow-plan, AN)</b>	<b>0.0%</b>	<b>12.2%</b>	<b>18.9%</b>
<b>Hotel (5-star)</b>	<b>0.0%</b>	<b>8.8%</b>	<b>11.6%</b>
<b>Secondary School</b>	<b>0.0%</b>	<b>8.3%</b>	<b>10.6%</b>
<b>Aggregate</b>	<b>0.0%</b>	<b>8.8%</b>	<b>13.5%</b>

Note: these are results from English modelling,  
Expected to be similar in Wales

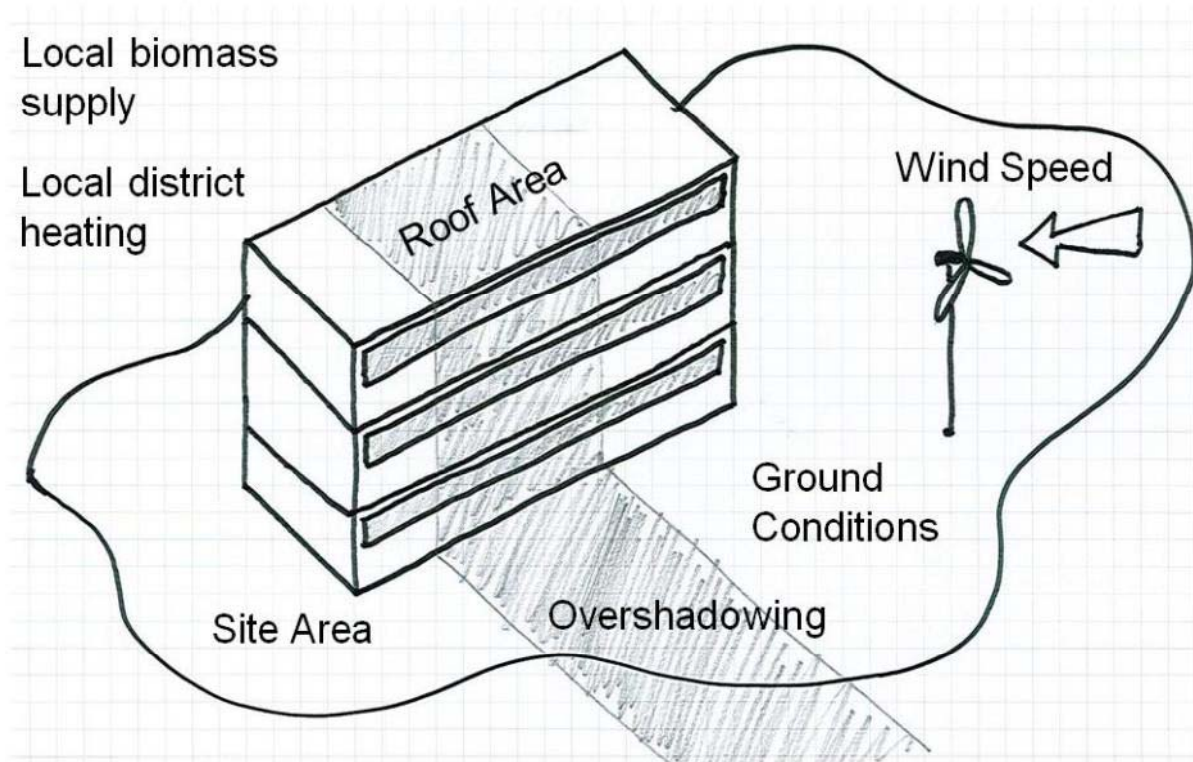
# Initial Results – Energy Efficiency Packages

<b>A1</b> <b>0.0%</b>	<b>A2</b> <b>8.8%</b>	<b>A3</b> <b>13.5%</b>
<b>B1</b> <b>1.6%</b>	<b>B2</b> <b>10.3%</b>	<b>B3</b> <b>15.0%</b>
<b>C1</b> <b>3.8%</b>	<b>C2</b> <b>12.3%</b>	<b>C3</b> <b>17.1%</b>
<b>D1</b> <b>6.2%</b>	<b>D2</b> <b>14.7%</b>	<b>D3</b> <b>19.4%</b>

Note: these are results from English modelling,  
Expected to be similar in Wales

# Need for Low and Zero Carbon Technologies in notional building?

- Once Energy Efficiency measures exhausted target can only be moved forward by assuming LZC technologies
- But which ones?



# Need for Low and Zero Carbon Technologies in notional building?

- Conclusion: PV only technology applicable in all cases
- Notional building includes % roof area covered in PV



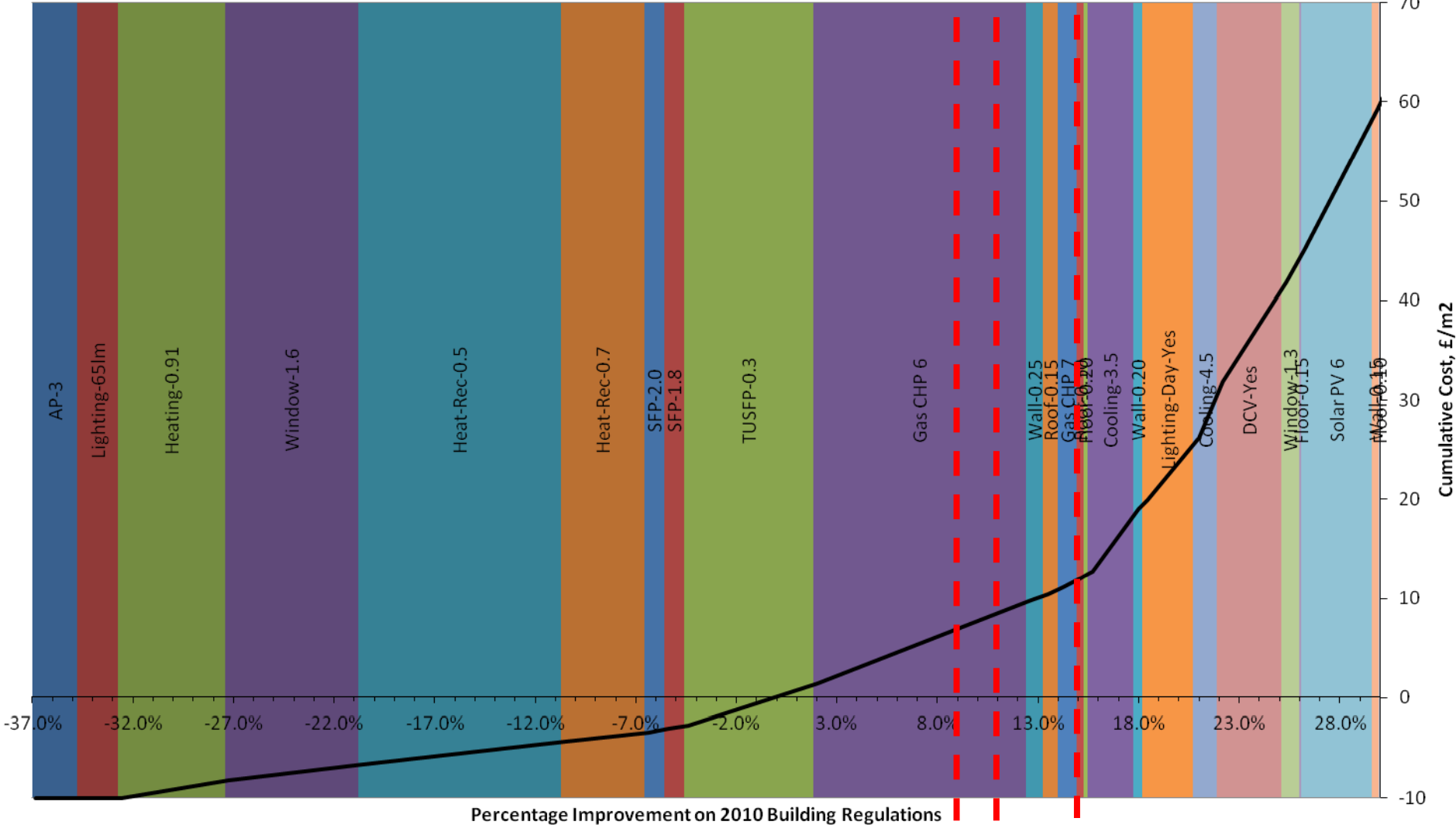
## Differentiated notional building

- Different notional buildings for different building types:
  - Heated only (school, hotel)
  - Heated *and* cooled (retail warehouse, air-conditioned office)
  - Toplit (warehouse)
  - Residential
  - Others?

# 4 potential aggregate targets, 8%, 11%, 14%, 20% plotted on Hotel – Capital Curve

5 Star Hotel

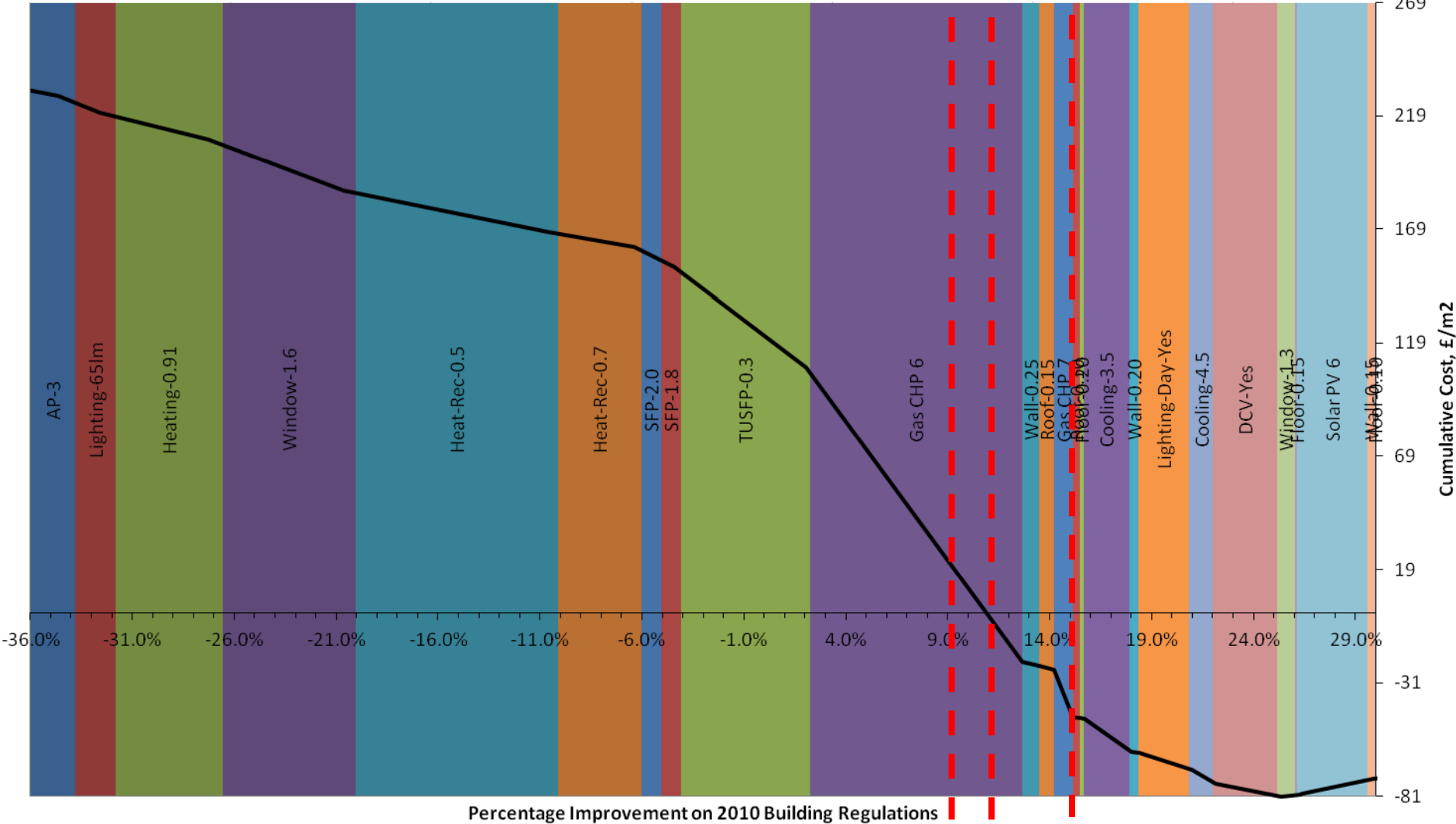
11% and 14%  
8% 20%



# 4 potential aggregate targets, 8%, 11%, 14%, 20% plotted on Hotel – Lifecycle Curve

5 Star Hotel

11% and 14%  
8% 20%



Percentage Improvement on 2010 Building Regulations

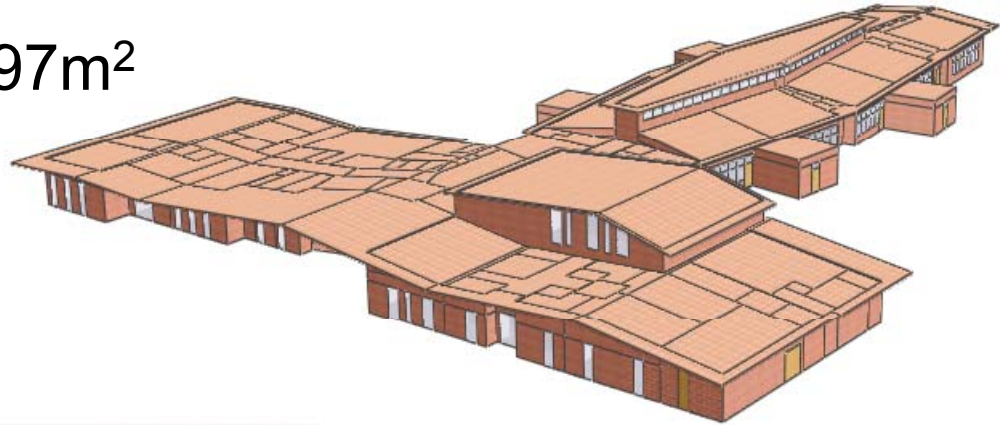
Cumulative Cost, £/m2

# Proposed Building Models for Wales

1. Education Primary school,
  - Typical built area 3,043m<sup>2</sup> - £2,150/m<sup>2</sup> - £2,350/m<sup>2</sup>
2. Health, Community Hospital
  - 2,128m<sup>2</sup> - £2,125/m<sup>2</sup> - £2,340/m<sup>2</sup>
3. Hotels, Branded budget type
  - 1,459m<sup>2</sup> – £35K/room - £45K/room
4. Offices, Shallow plan, heated only
  - 919m<sup>2</sup> – £1,100/m<sup>2</sup> - £1,300/m<sup>2</sup>
5. Retail, Supermarket
  - 1,248m<sup>2</sup> – Shell only £55/m<sup>2</sup> - £65/m<sup>2</sup>
6. Warehouse / Industrial
  - 5,322m<sup>2</sup> – Shell only £55/m<sup>2</sup> - £65/m<sup>2</sup>
7. Multi-residential (ie Care Homes etc)
  - 1,555m<sup>2</sup> – £2,150/m<sup>2</sup> - £2,350/m<sup>2</sup>

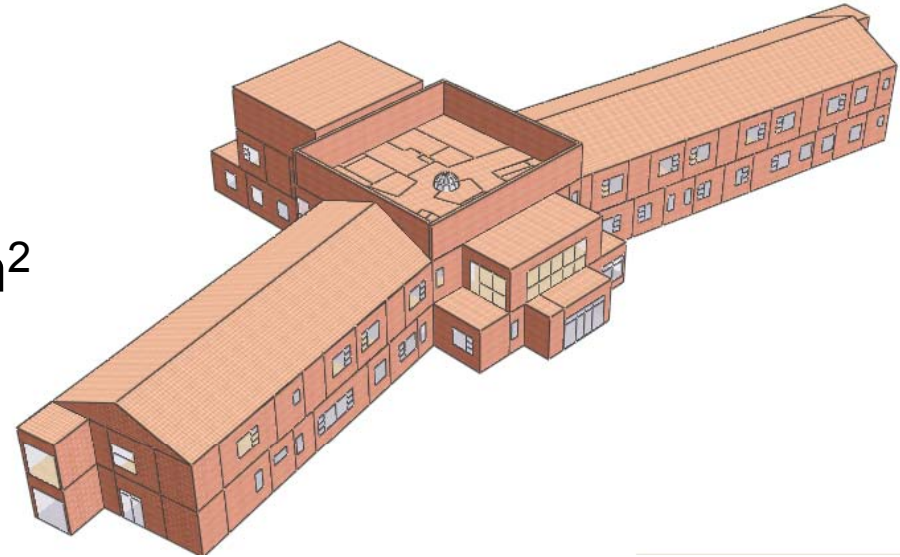
## Education – Primary School

- Williamstown Primary School
- Gross Internal Area: 2,297m<sup>2</sup>
- Location: Penrhiwfer



# Health – Community Hospital

- Moreton-in-Marsh Community Hospital
- Gross Internal Area: 2,450m<sup>2</sup>
- Location: Moreton-in-Marsh



## Hotel – Small budget 3\*

- Budget Hotel
- Gross Internal Area: Approx 1,500m<sup>2</sup>
- Location: Model to be decided



## Offices – Naturally vented, heated only

- Naturally ventilated, heated only (cooling?)
- Gross Internal Area: Approx 1,000m<sup>2</sup>
- Location: model to be decided



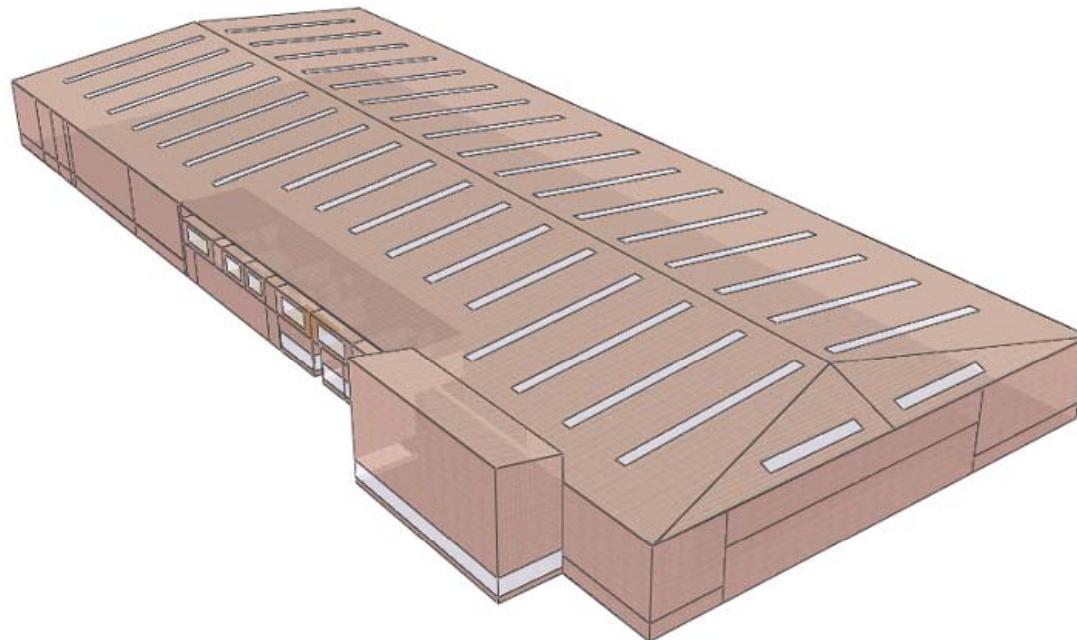
Deys County Council's new IT and adult learner centre has

## Retail – Supermarket

- Supermarket
- Gross Internal Area: Approx 1,200m<sup>2</sup>
- Location: model to be decided

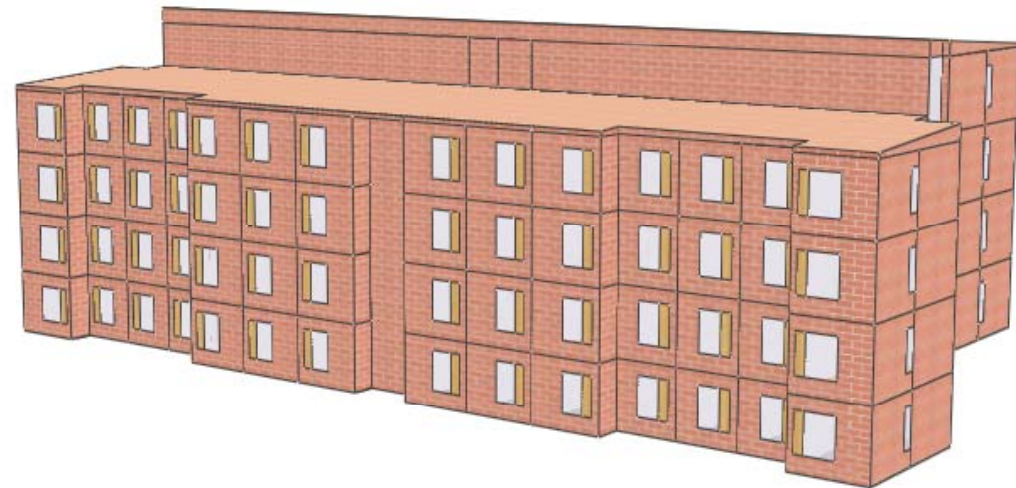
## Warehouse – distribution

- Generic Warehouse
- Gross Internal Area: 4,900m<sup>2</sup>
- Location: Wales generally



## Multi-residential –

- University of Glamorgan Student Halls
- Gross Internal Area: 2,293m<sup>2</sup>
- Location: Treforest, Pontypridd



# Thank You

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6th and 8<sup>th</sup> December 2011



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Approach to cost modelling

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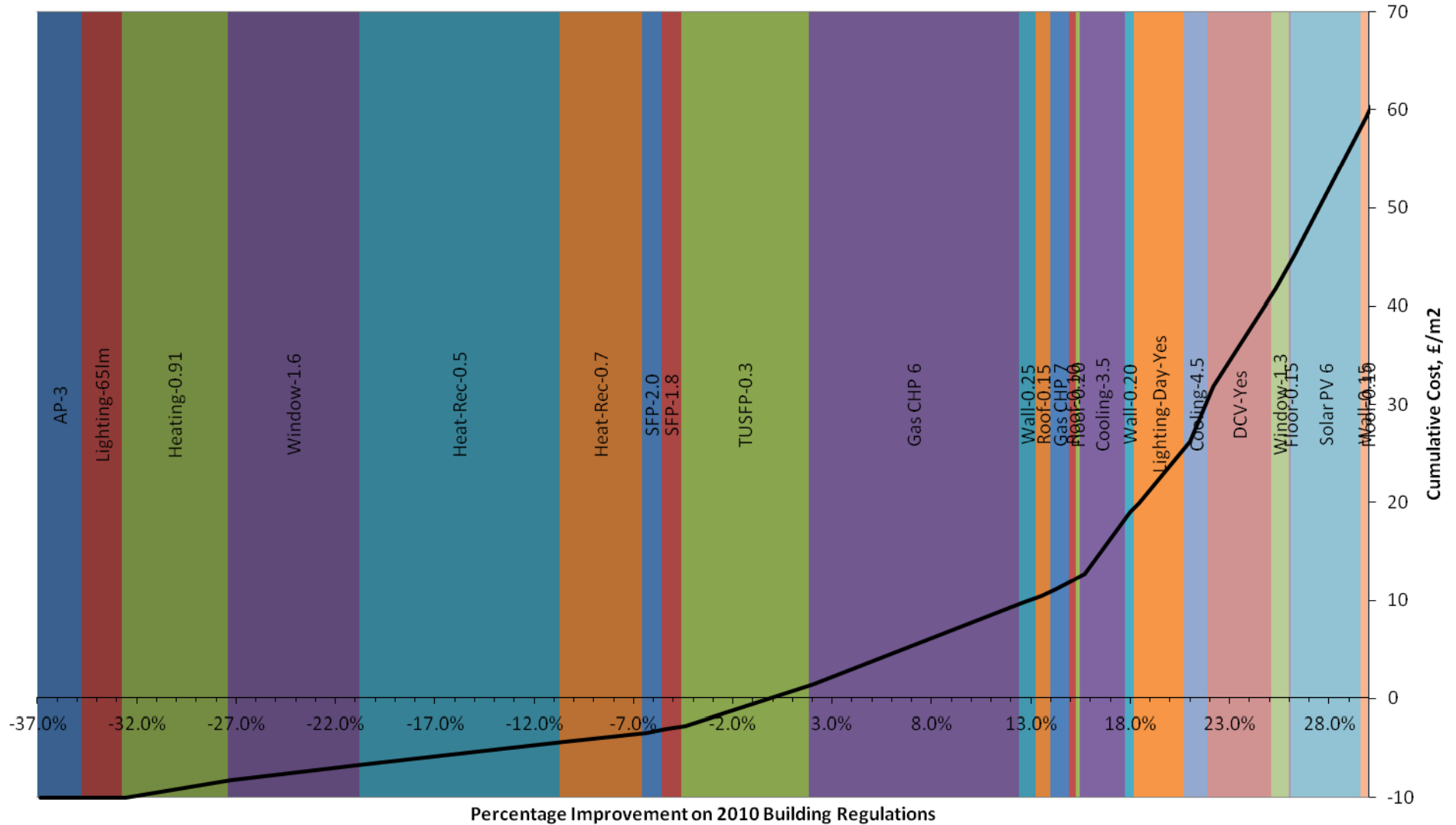
Sustainable Development Group, AECOM

6th and 8<sup>th</sup> December 2011



# Reminder of Carbon Abatement Cost Curve Built up element by element

5 Star Hotel



# Extra over costs – Office Fabric Measures

	Element	Capital £/m2	Maintenance £	Lifespan Year
Floor U-value W/m2.K	Floor-0.25	0.0	0	60
	Floor-0.20	0.2	0	60
	Floor-0.15	0.7	0	60
	Floor-0.10	1.5	0	60
Roof U-value W/m2.K	Roof-0.25	0.0	0	60
	Roof-0.20	0.5	0	60
	Roof-0.15	0.8	0	60
	Roof-0.10	1.3	0	60
Wall U-value W/m2.K	Wall-0.35	0.0	0	60
	Wall-0.25	0.4	0	60
	Wall-0.20	1.0	0	60
	Wall-0.15	2.0	0	60
Thermal Bridges according to BR 497	Thermal-Bridging-No	0.0	0	60
	Thermal-Bridging-Yes	0.8	0	60
Window U-value W/m2.K	Window-2.0	0.0	0	60
	Window-1.6	1.0	0	60
	Window-1.3	3.2	0	60
	Window-0.9	8.5	0	60
Air permeability m3/m2/hour	AP-10	0.0	0	60
	AP-7.5	1.7	0	60
	AP-5	3.3	0	60
	AP-3	6.5	0	60

## Extra over costs – Office Building Services Measures

		Capital	Maintenance	Lifespan
Element		£/m2	£	Years
Luminaire efficiency Luminaire lumens / watt	Lighting-55lm	0.0	0	20
	Lighting-65lm	12.5	0	20
Lighting Occupancy Control	Lighting-Occ-No	0.0	0	20
	Lighting-Occ-Yes	6.2	0	20
Lighting Daylight Control	Lighting-Day-No	0.0	0	20
	Lighting-Day-Yes	6.2	0	20
Boiler Efficiency	Heating-0.84	0.0	0	15
	Heating-0.86	0.0	0	15
	Heating-0.88	1.8	0	15
	Heating-0.91	1.8	0	15
Heat recovery Yes (70%) / No	Heat-Rec-0	0.0	0	15
	Heat-Rec-0.7	1.5	0	15
Cooling SEER	Cooling-2.5	0.0	0	15
	Cooling-3	4.2	0	15
	Cooling-3.5	6.3	0	15
	Cooling-4.5	12.0	0	15
Central AHU Specific Fan Power w/l/s	SFP-2.2	0.0	0	15
	SFP-2.0	0.4	0	15
	SFP-1.8	0.7	0	15
Terminal Unit Specific Fan Power w/l/s	TUSFP-0.8	0.0	0	15
	TUSFP-0.5	3.0	0	15
	TUSFP-0.3	6.0	0	15
Luminaire efficiency Luminaire watts / lumen	Lighting-55lm	0.0	0	20
	Lighting-65lm	12.5	0	20

## Low and Zero Carbon Technologies

- Biomass and Heat Pumps not included
- If Biomass heating or Heat Pump in *actual* building...
- ...also in *notional* building so little incentive to use
- Leaves:
  - Solar PV
  - Solar Thermal
  - Gas CHP
  - Gas Trigeneration
  - Wind Power

# Low and Zero Carbon Technologies

## Base costs (£/unit varies), 2010 and Learning Rates

	per kW(e)	per kW(e)	per m2	per m2	per kW
Size	Gas CHP	Gas Trigen	Solar Thermal	Solar PV	Wind
0.6	3289	3299	1505	689	13542
2.5	3289	3299	744	552	5573
5	3289	3299	583	552	4792
6	3289	3299	513	534	4010
10	3289	3299	513	534	3490
15	3289	3299	513	517	2917
20	3289	3299	513	517	2917
30	3289	3299	513	517	2917
40	2741	2784	507	517	2917
50	2193	2268	507	448	2917
60	1974	2062	507	448	2917
70	1645	1753	507	431	2917
80	1425	1546	507	431	2917
90	1316	1443	507	431	2917
100	1206	1340	507	431	2917
110	1206	1340	507	431	2917
120	1096	1237	507	431	2917
130	1096	1237	507	431	2917
140	987	1237	507	431	2917
150	987	1237	507	431	2396
160	987	1134	507	431	2396
170	987	1031	507	396	2396
180	987	1031	507	396	2396
190	877	979	507	396	2396
200	877	928	507	396	2396

	Gas CHP	Gas Trigen	Solar Thermal	Solar PV	Wind
2008	100%	100%	100%	100%	100%
2009	100%	99%	100%	100%	99%
2010	100%	98%	100%	100%	97%
2011	91%	97%	100%	83%	96%
2012	87%	96%	100%	75%	95%
2013	83%	95%	98%	69%	94%
2014	80%	94%	93%	63%	93%
2015	78%	93%	91%	60%	92%
2016	76%	92%	89%	57%	91%
2017	75%	91%	87%	56%	90%
2018	73%	90%	86%	53%	89%
2019	72%	89%	85%	51%	89%
2020	70%	88%	84%	50%	88%
2021	69%	87%	84%	49%	87%
2022	68%	86%	83%	48%	86%
2023	67%	85%	82%	47%	86%
2024	65%	84%	82%	45%	85%
2025	64%	83%	81%	44%	84%

## Possible items for discussion

- General build costs (£/m<sup>2</sup>)
- Inclusion of biomass and heat pumps?
- Welsh specific costs for LZC technologies or are these similar to England?

## Possible items for discussion

- Are the building types we have selected representative of those built in Wales?
- Is the approach to target setting right?
- Is PV the right choice for the notional building?
- Are there building types with specific issues that we should take into account?
- Are we being ambitious enough with the performance specifications of elements?
- Is our approach to costing correct?