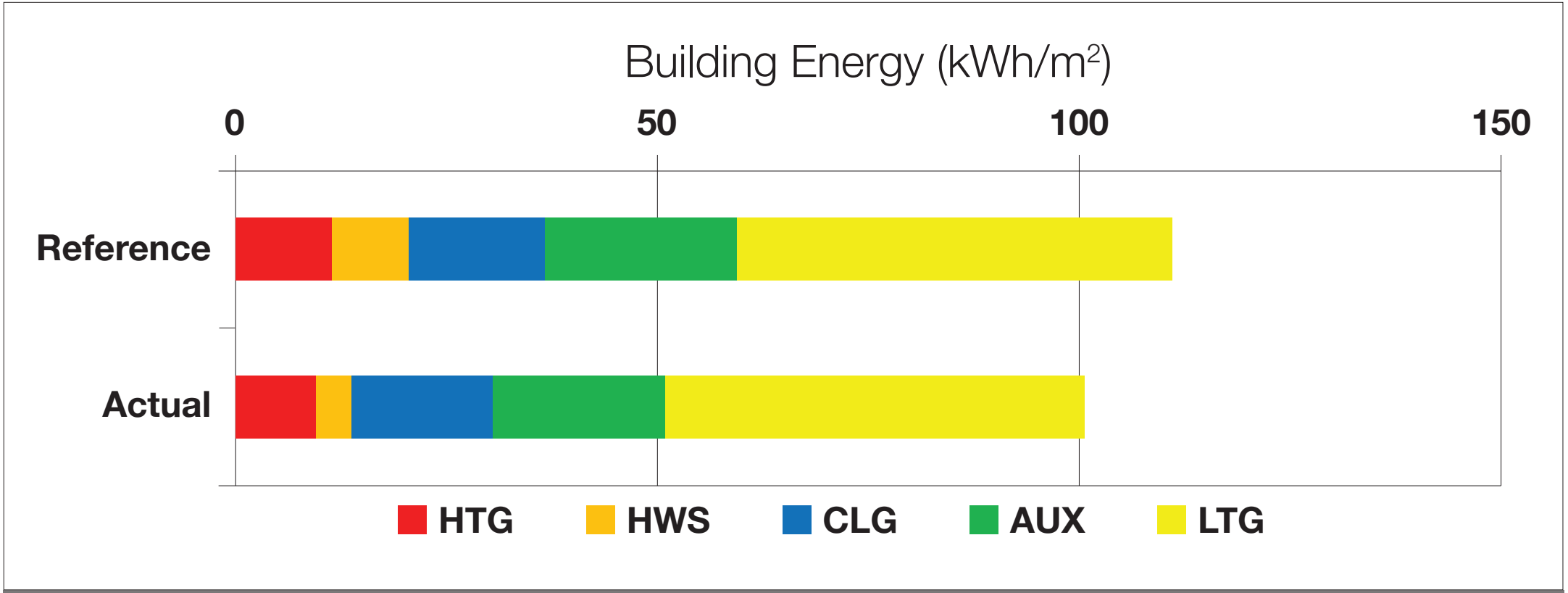
IN2
ENGINEERING DESIGN PARTNERSHIP

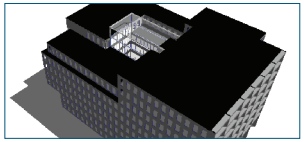
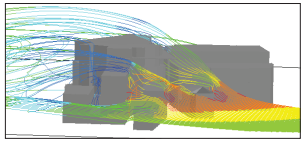
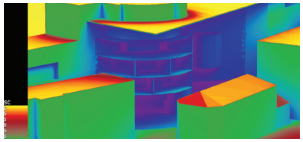
Presentation by David Walshe
Technical Director
IN2 Engineering Design Partnership



Strategies for Achieving the NZEB Standard

Overview

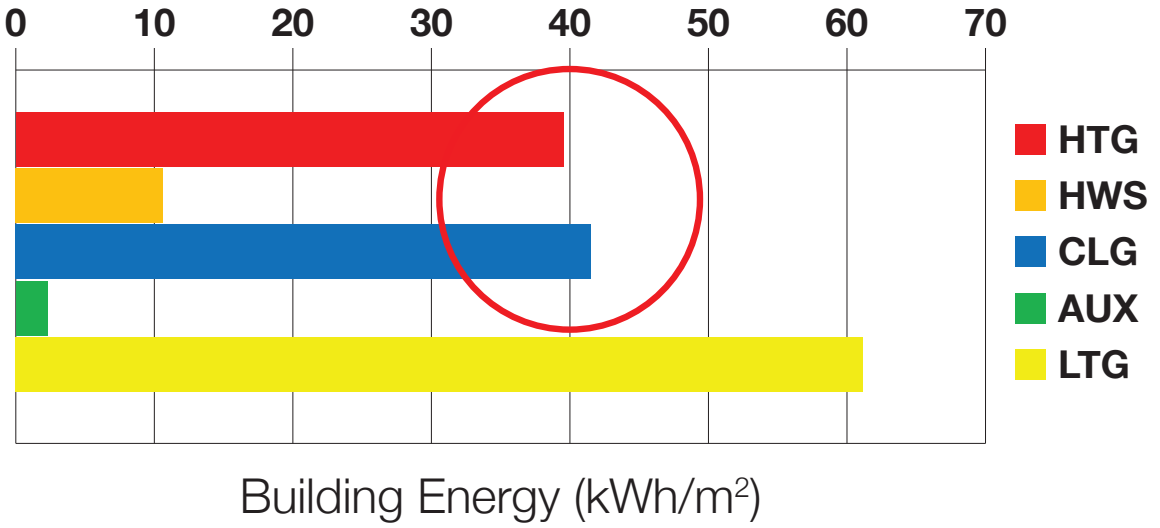
01. Part L Overview
02. NZEB Analysis
03. BER Equivalent
04. Building Simulation

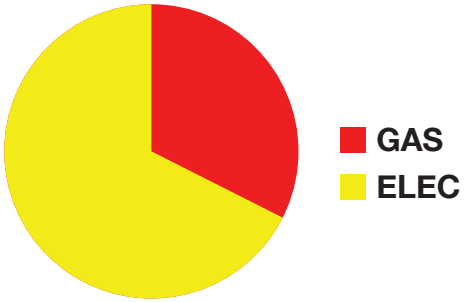




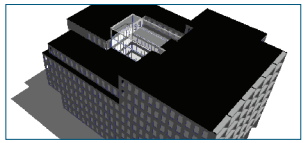
1.0 Part L Overview

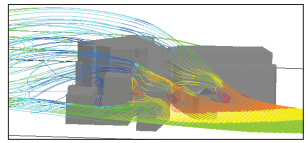
1.1 Building Energy

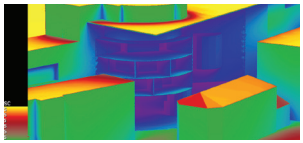
- What is Building Energy?
- ***Building*** Energy is:
  - *Heating*
  - *Hot Water*
  - *Cooling*
  - *Auxillary*
  - *Lighting*







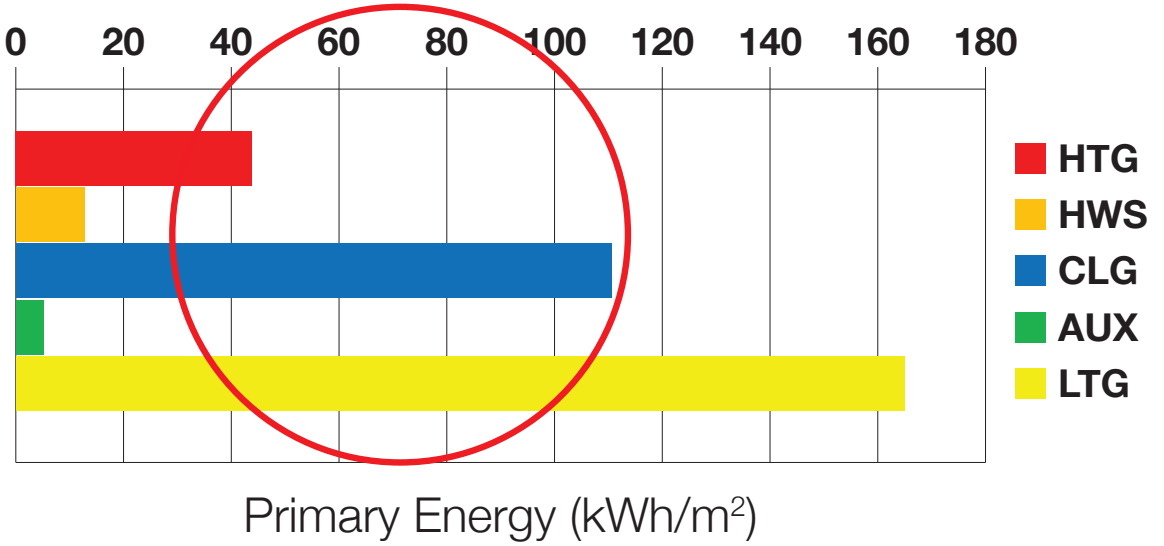


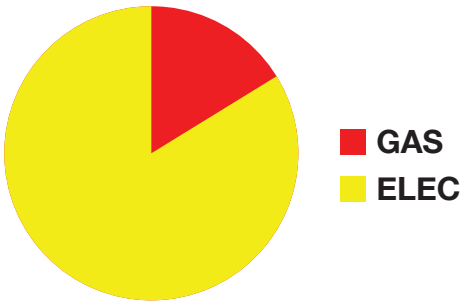


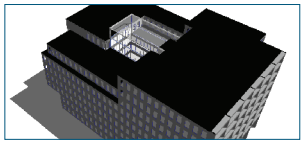
1.0 Part L Overview

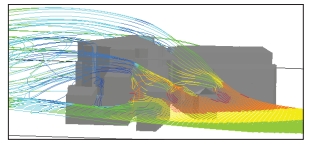
1.2 Primary Energy

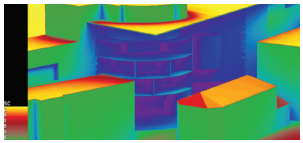
- What is Primary Energy?
- Energy at Source
- ***Primary*** Energy factors:
  - *Gas* = *1.1*
  - *Electricity* = *2.7*
- Electricity usage penalised for generation inefficiency





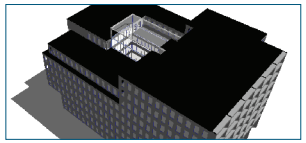
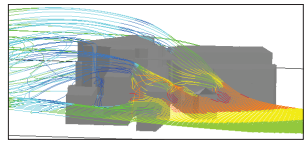
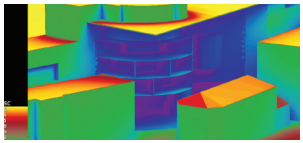






1.0 Part L Overview

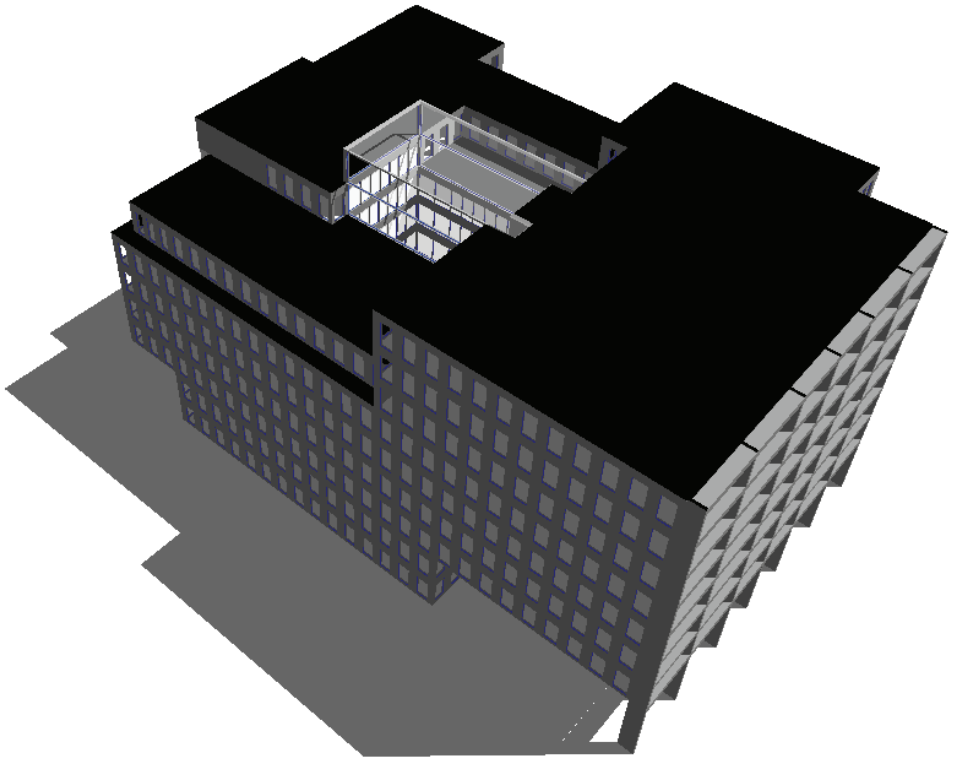
1.3 Targets

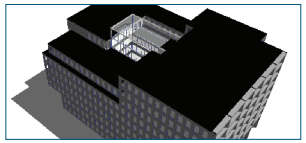




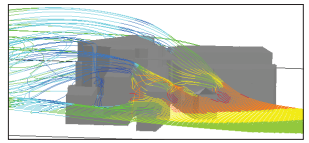
2.0 NZEB Analysis

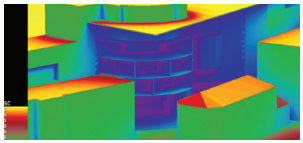
Which of these will get us closest to the NZEB reduction?

1. Improved Insulation
2. Improved Leakage/ Infiltration
3. Improved Glazing
4. Natural Ventilation in lieu of A/C
5. Energy Efficient Lighting
6. Lighting Controls
7. Photovoltaics









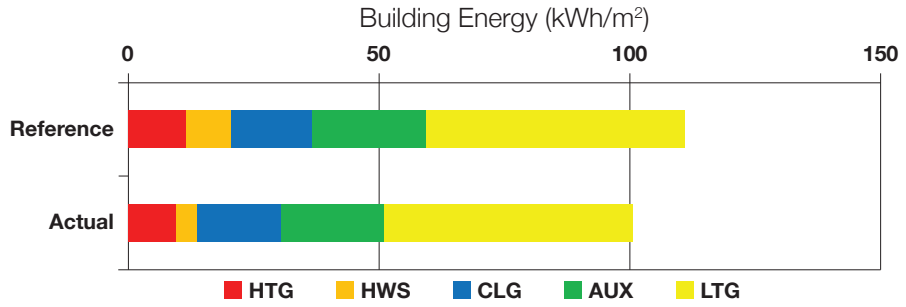
2.0 NZEB Analysis

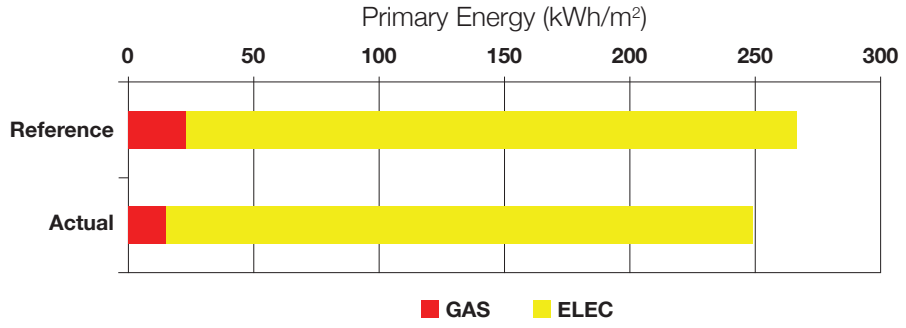
2.0 Base Case

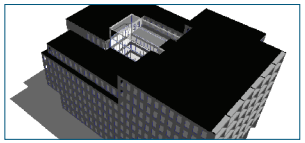
- 2,700 m² Office over 1 floor
- Fabric U-Values to meet Part L
- Standard Leakage
- Low-e Double Glazing (60% approx)
- Fan Coil System
- T8/High Freq. Fluorescent Lighting
- No Lighting Control
- No Renewables

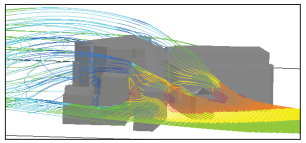
6% Reduction on Part L 2008

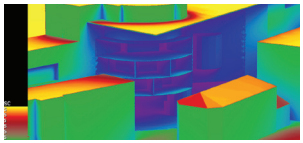
Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	11.36	9.2	16.13	22.62	51.59	0	22.62	243.92	266.53
Actual	9.41	4.37	16.69	20.4	49.62	0	15.16	234.12	249.28
Improvement on Part L: 6%									









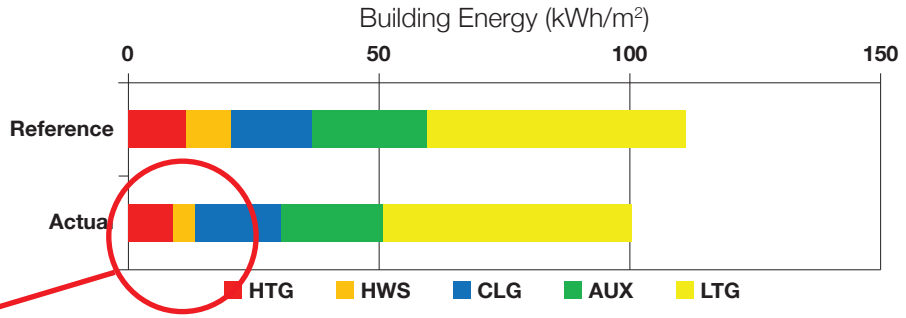


2.0 NZEB Analysis

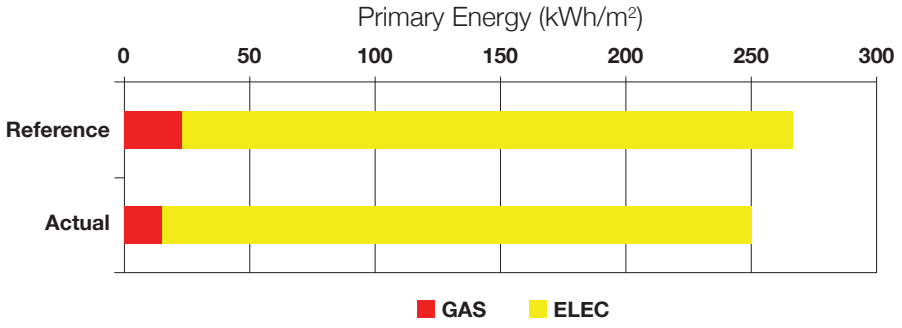
2.1 Improved Insulation

- Super-Insulated Walls, U=0.13 W/m²K
- 300mm insulation (k=0.04 W/mK)

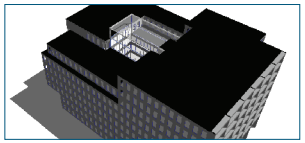
Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	11.34	9.2	16.13	22.62	51.59	0	22.59	243.92	266.51
Actual	8.82	4.37	17.1	20.42	49.62	0	14.51	235.28	249.79
Improvement on Part L: 6%									

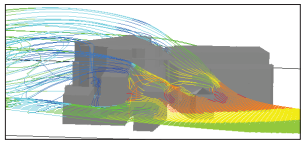


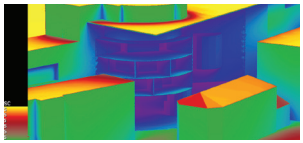
- ***Heating is small part of Energy!***



No Further Reduction, still 6%







2.0 NZEB Analysis

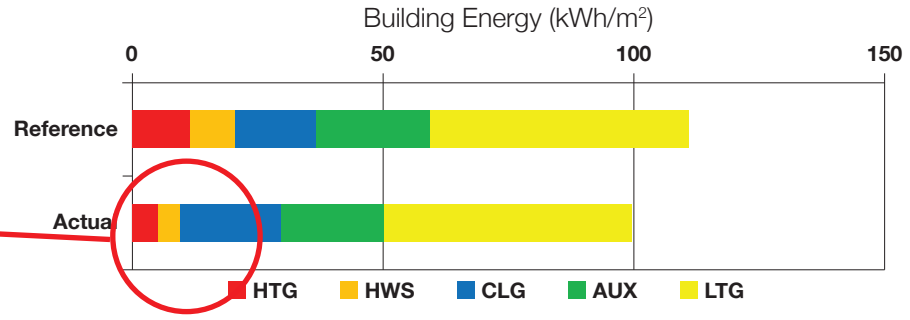
2.2 Improved Leakage

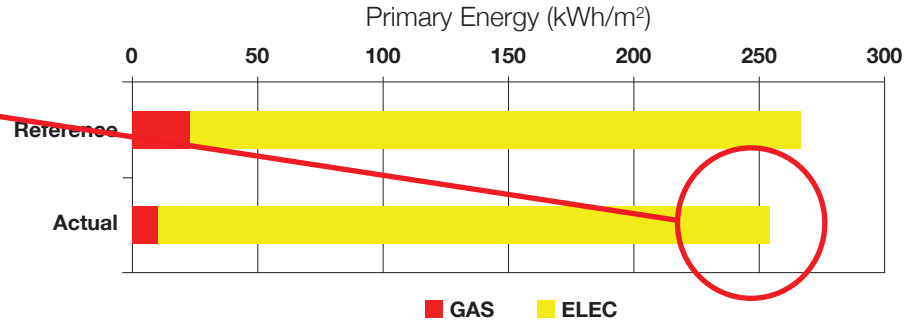
- Air Test: 5 m^3/hr per m^2
- 50% improvement on Part L (10m^3/hr)

Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	11.36	9.2	16.13	22.62	51.59	0	22.62	243.92	266.53
Actual	5.19	4.37	20.11	20.52	49.62	0	10.52	243.68	254.19
Improvement on Part L: 5%									

- ***Infiltration has dis-improvement!***
- Decrease in Heating Energy
- Increase in Cooling Energy
- Increase in Primary Energy
- (Note, not cumulative)

Decrease in Reduction to 5%





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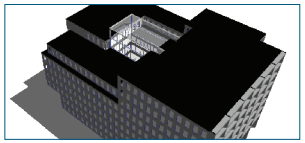
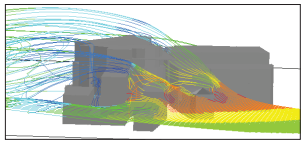
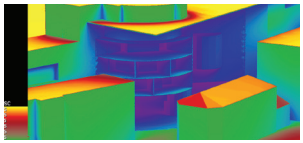






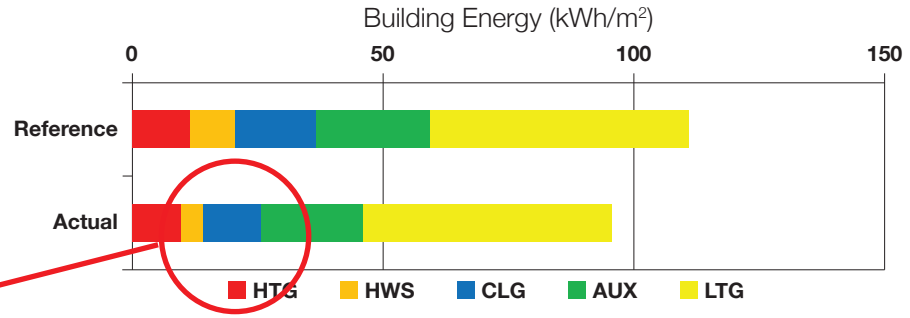
2.0 NZEB Analysis

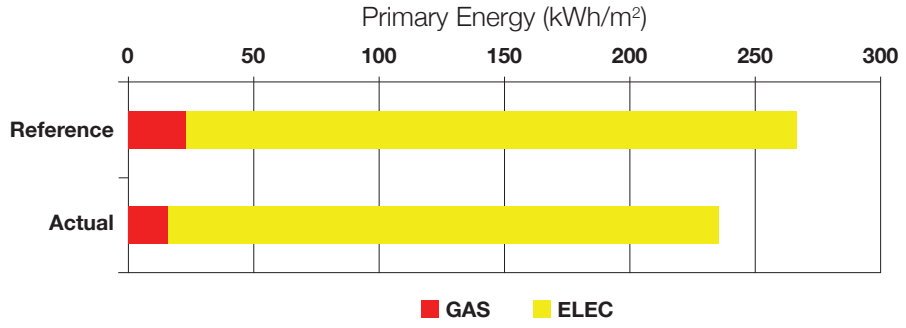
2.3 Improved Glazing

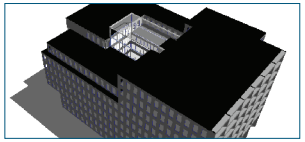
- High Performance Clear Glazing + External Shading (Brise Soleil)
- U=1.6 W/m²K, g = 0.10
- ***Large Reduction in Cooling Energy***

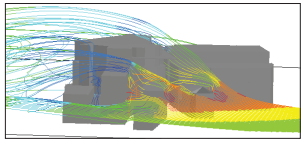
12% Reduction on Part L

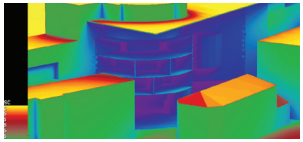
Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	11.36	9.2	16.13	22.62	51.59	0	22.62	243.92	266.53
Actual	9.75	4.37	11.55	20.25	49.62	0	15.53	219.83	235.37
Improvement on Part L: 12%									









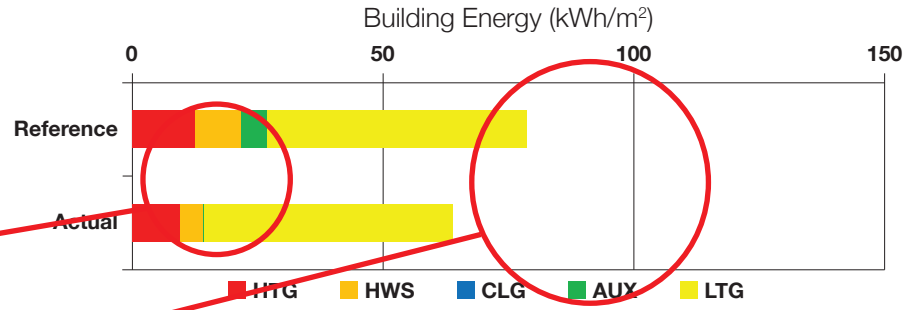


2.0 NZEB Analysis

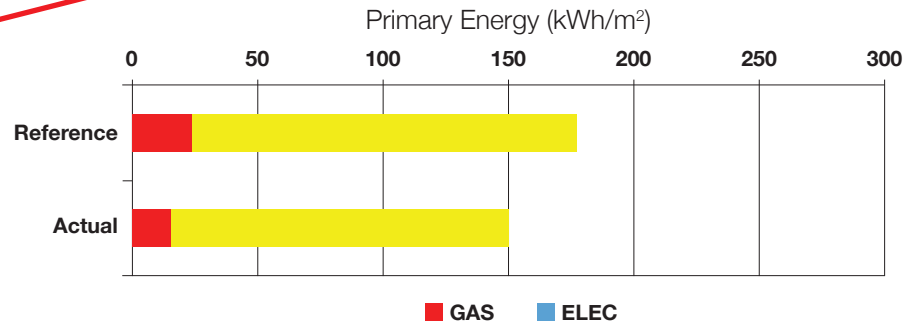
2.4 Natural Ventilation

- Natural Ventilation and Perimeter Trench Heating in lieu of A/C
- Gas Fired Boiler

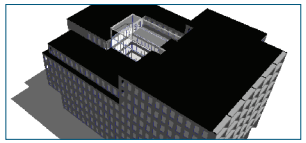
Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	12.34	9.2	0	5.27	51.59	0	23.69	153.52	177.22
Actual	9.55	4.37	0	0.27	49.62	0	15.31	134.70	150.02
Improvement on Part L: 15%									

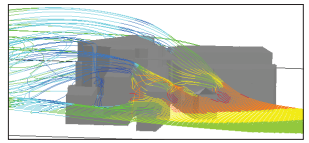


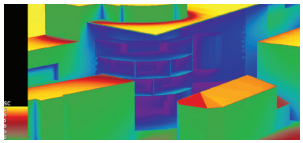
- ***No Cooling Energy***
- Proportional Reduction in Reference Building for Natural Ventilation



15% Reduction on Part L







2.0 NZEB Analysis

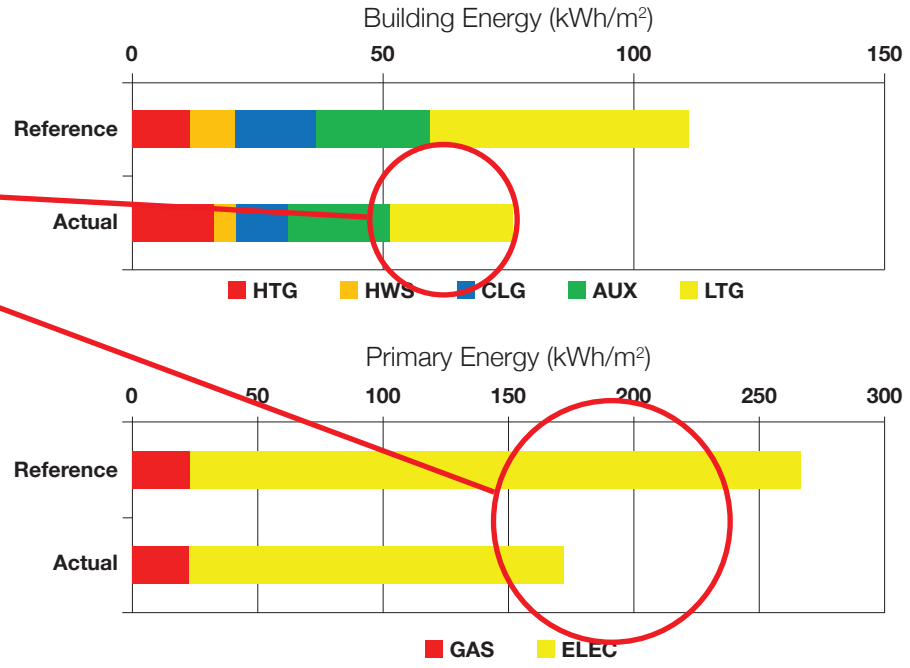
2.5 Low Energy Lighting

- T5 Fluorescent Lamps in lieu of obsolete T8

- ***Saving in Lighting Energy***
- Large Reduction in Primary Energy
- Increase in Heating Energy offset by Decrease in Cooling Energy

36% Reduction on Part L

Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	11.36	9.2	16.13	22.62	51.59	0	22.62	243.92	266.53
Actual	16.08	4.37	10.53	20.17	24.59	0	22.50	149.28	171.78
Improvement on Part L: 36%									



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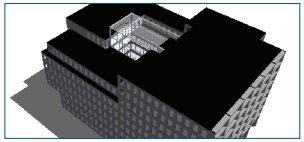
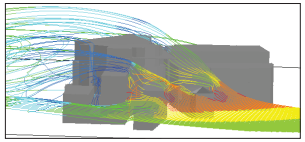
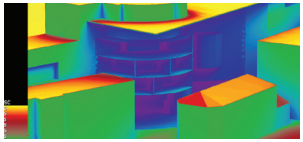




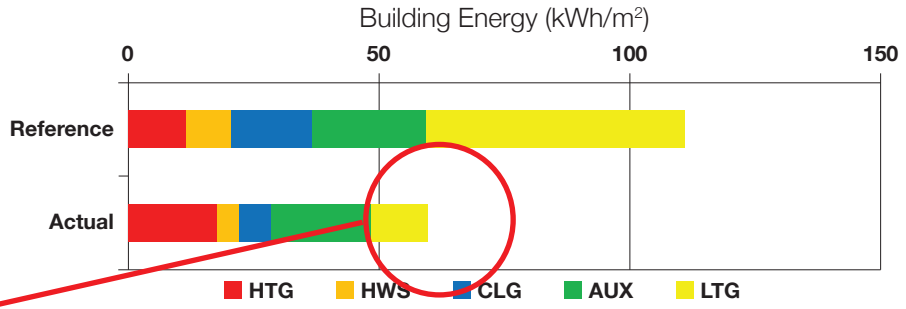


2.0 NZEB Analysis

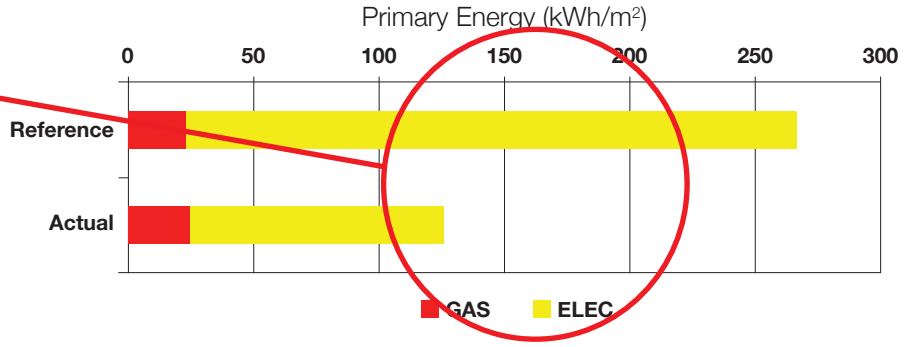
2.6 Lighting Control

- Daylight Control (dimming) to Offices
- PIR Control to Core Areas
- Building Designed for Daylight

Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	11.36	9.2	16.13	22.62	51.59	0	22.62	243.92	266.53
Actual	17.7	4.37	6.28	19.99	11.45	0	24.28	101.84	126.12
Improvement on Part L: 53%									

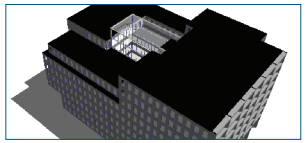


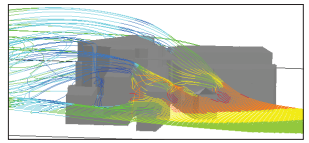
- ***Large Saving in Lighting Energy***
- Larger Reduction in Primary Energy

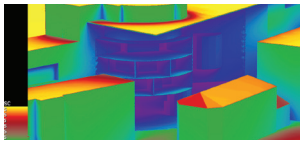


53% Reduction on Part L

IN2 ENGINEERING DESIGN PARTNERSHIP





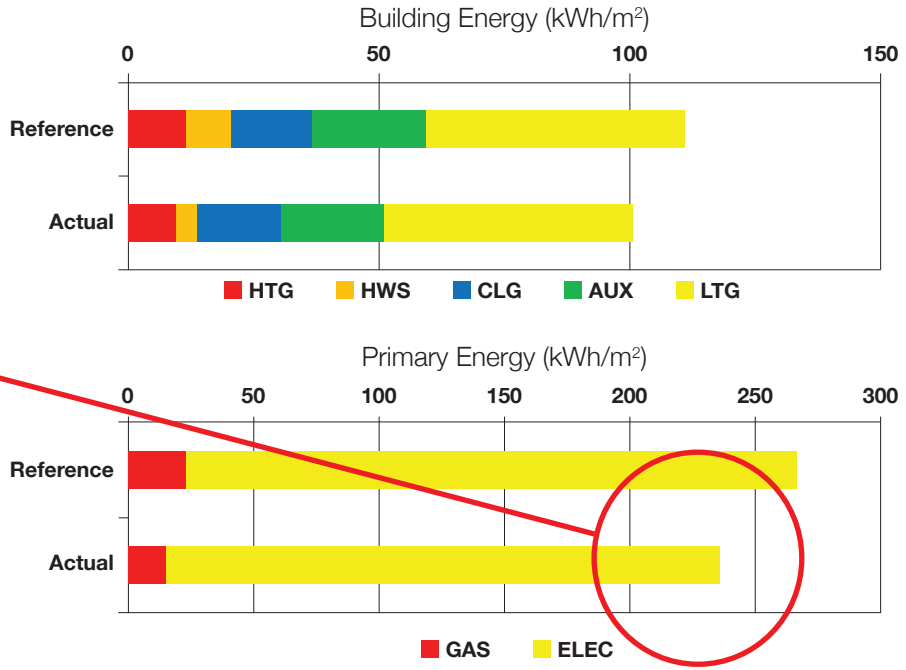


2.0 NZEB Analysis

2.7 Photovoltaics (PV)

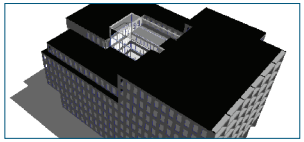
- 100m² PV per Floor
- €350 - €400k for Building

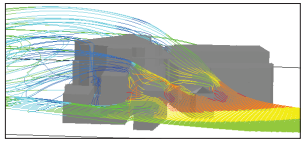
Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	11.36	9.2	16.13	22.62	51.59	0	22.62	243.92	266.53
Actual	9.41	4.37	16.69	20.4	49.62	5	15.16	220.62	235.78
Improvement on Part L: 12%									

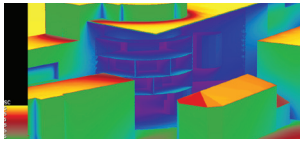


- ***Small Savings***
- Suitable to "get over line"

12% Reduction on Part L





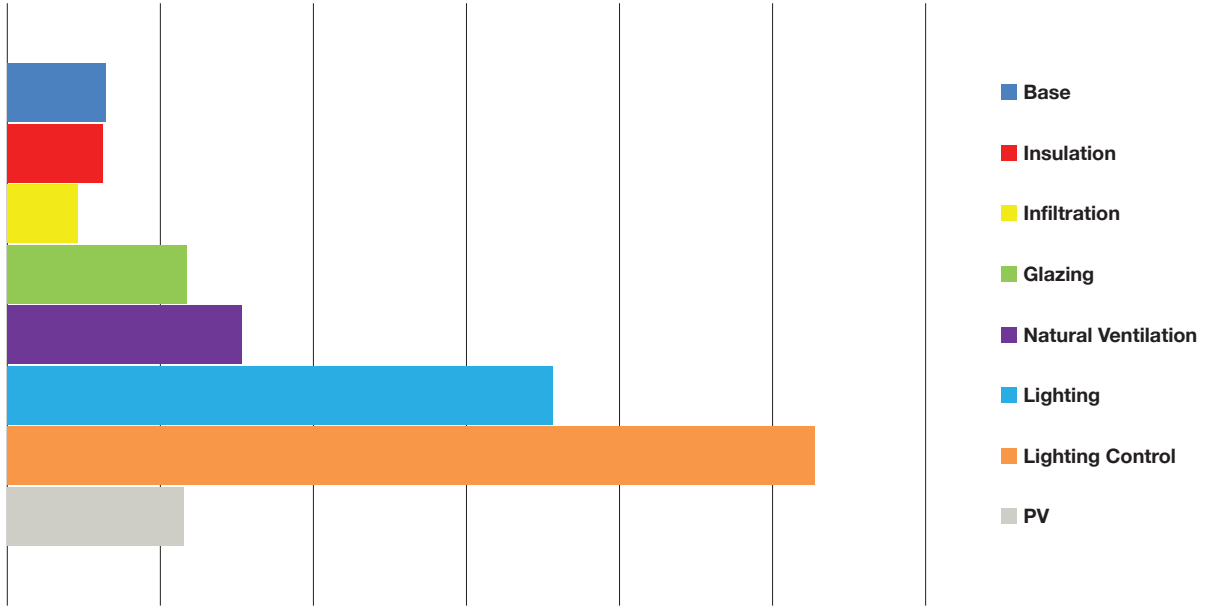


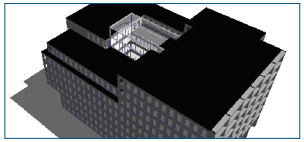
2.0 NZEB Analysis

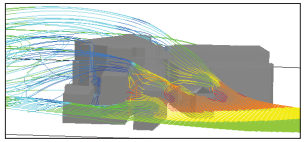
2.8 Summary

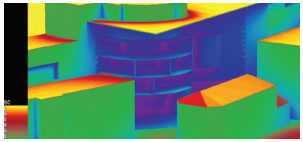
	Insulation	Infiltration	Glazing	Nat Vent	Lighting	Ltg Controls	PV
Improvement	6%	5%	12%	15%	36%	53%	12%

- Daylighting - Photocell Control / Lighting
  – ***Best Saving!!***
- Natural Ventilation
  Penalised Under NZEB?
- PV / Glazing
  Small Savings
- Insulation / Infiltration
  Negligible Impact
- ***But!....***
  NZEB Rating requires combination of technologies







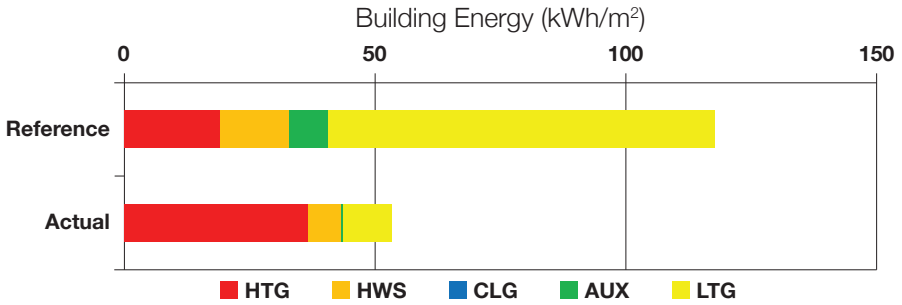


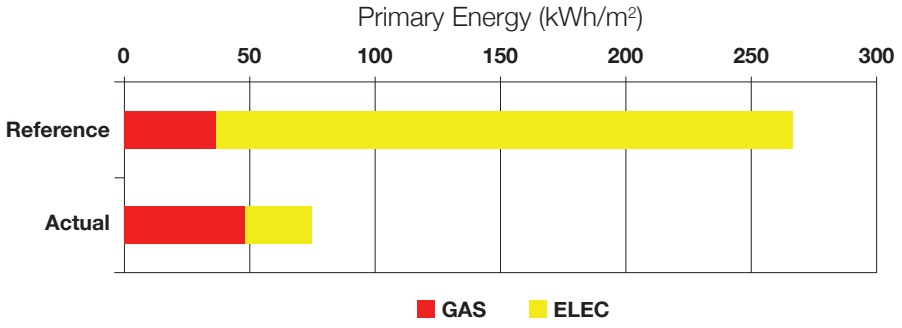
2.0 NZEB Analysis

2.9 Passive Design

- HPCL Glazing + External Shading
- Natural Ventilation
- T5 Energy Efficiency Lighting
- Lighting Control

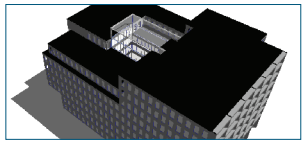
Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	12.34	9.2	0	5.27	51.59	0	23.69	153.52	177.22
Actual	24.16	4.37	0	0.35	6.32	0	31.38	18.01	49.39
Improvement on Part L: 72%									

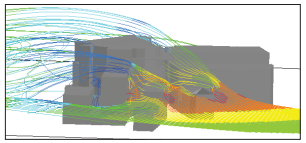


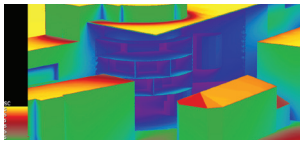


72% Reduction on Part L

IN2 ENGINEERING DESIGN PARTNERSHIP





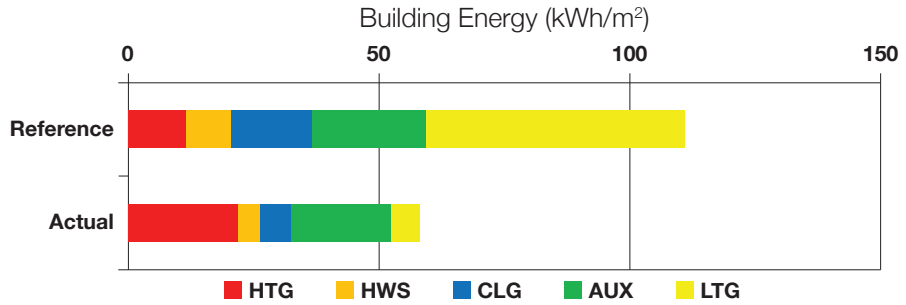


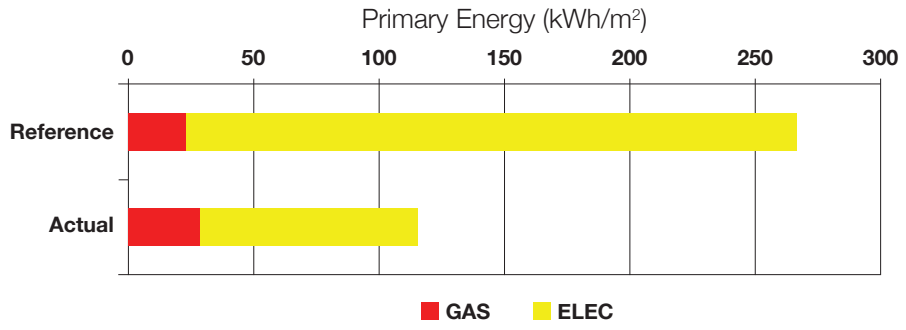
2.0 NZEB Analysis

2.10 AC and Lighting

- T5 Energy Efficiency Lighting
- Lighting Control

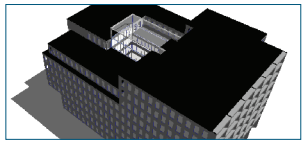
Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	11.36	9.2	16.13	22.62	51.59	0	22.62	243.92	266.53
Actual	21.9	4.37	6.11	20.01	5.9	0	28.9	86.45	115.35
Improvement on Part L: 57%									

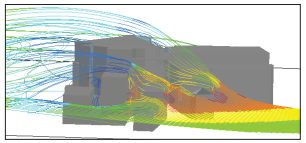


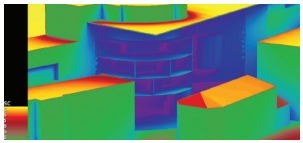


57% Reduction on Part L

IN2 ENGINEERING DESIGN PARTNERSHIP





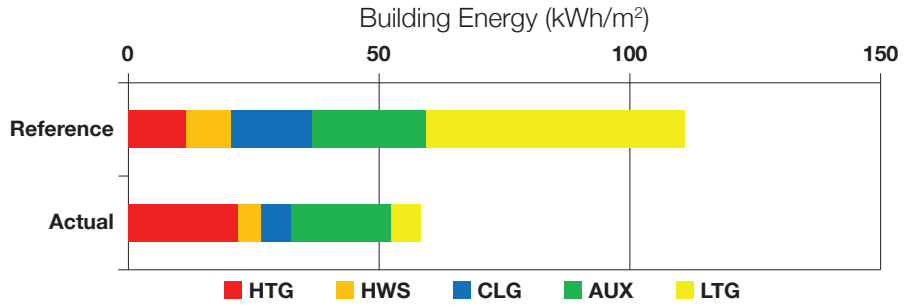


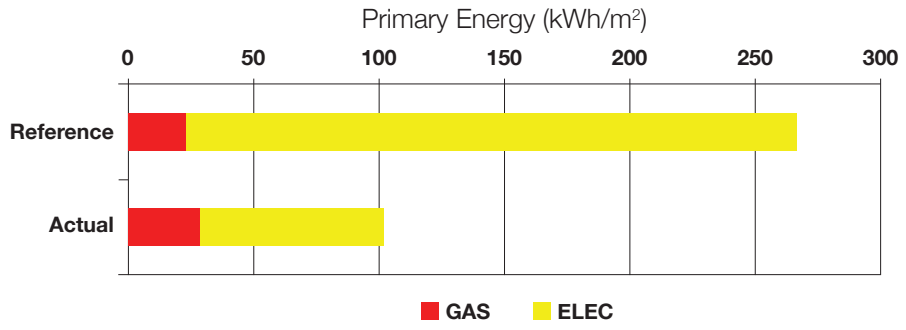
2.0 NZEB Analysis

2.11 Passive Design

- T5 Energy Efficiency Lighting
- Lighting Control
- 100m² PV per Floor

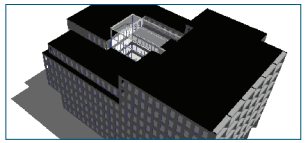
Energy Type	HTG	HWS	CLG	AUX	LTG	Renewables	GAS	ELEC	Total
Reference	11.36	9.2	16.13	22.62	51.59	0	22.62	243.92	266.53
Actual	21.9	4.37	6.11	20.01	5.9	5	28.9	72.95	101.85
Improvement on Part L: 62%									

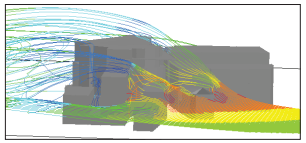


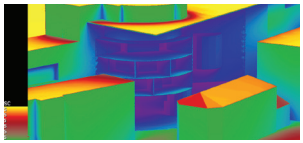


62% Reduction on Part L

IN2 ENGINEERING DESIGN PARTNERSHIP



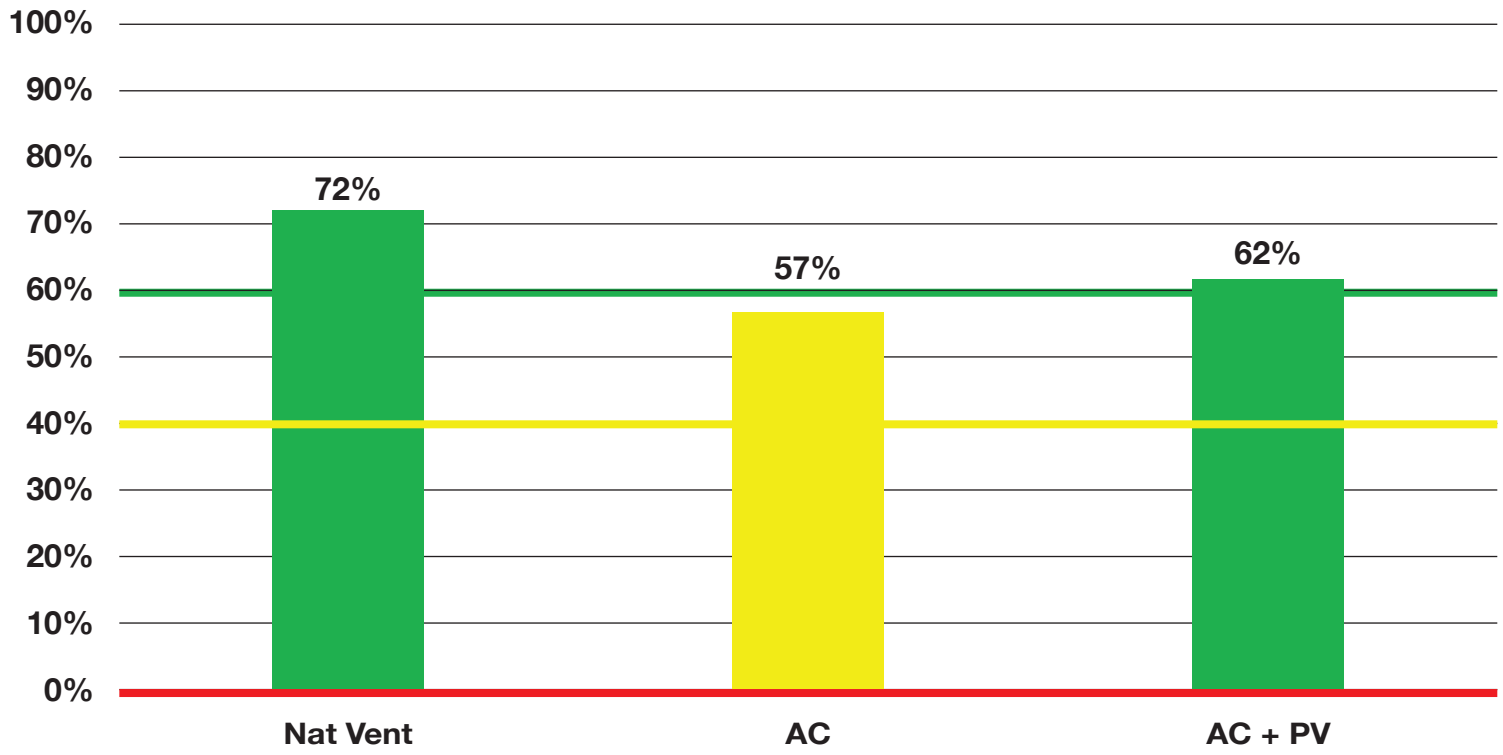




2.0 NZEB Analysis

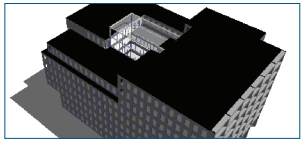
Building Designed for Daylighting With:

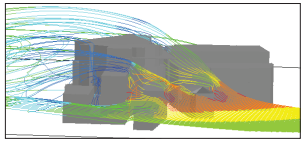
Natural Ventilation or AC Supplemented with PV

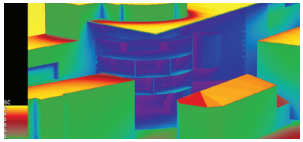


IN2 ENGINEERING DESIGN PARTNERSHIP

THE GREEN ROOM 2012

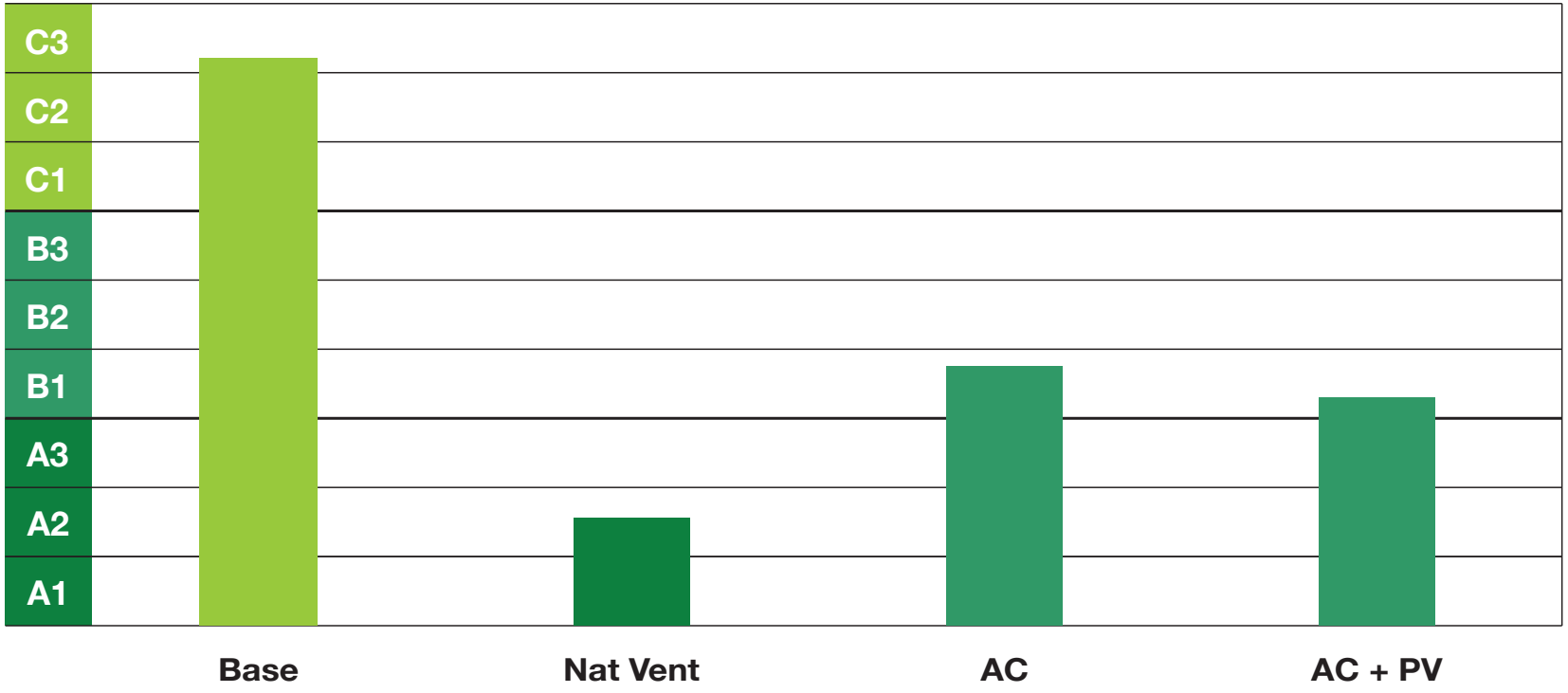


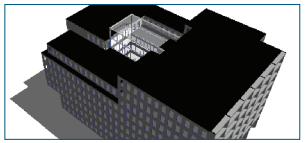
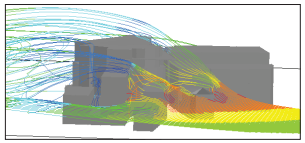
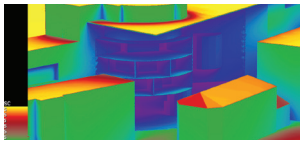




3.0 BER Equivalents

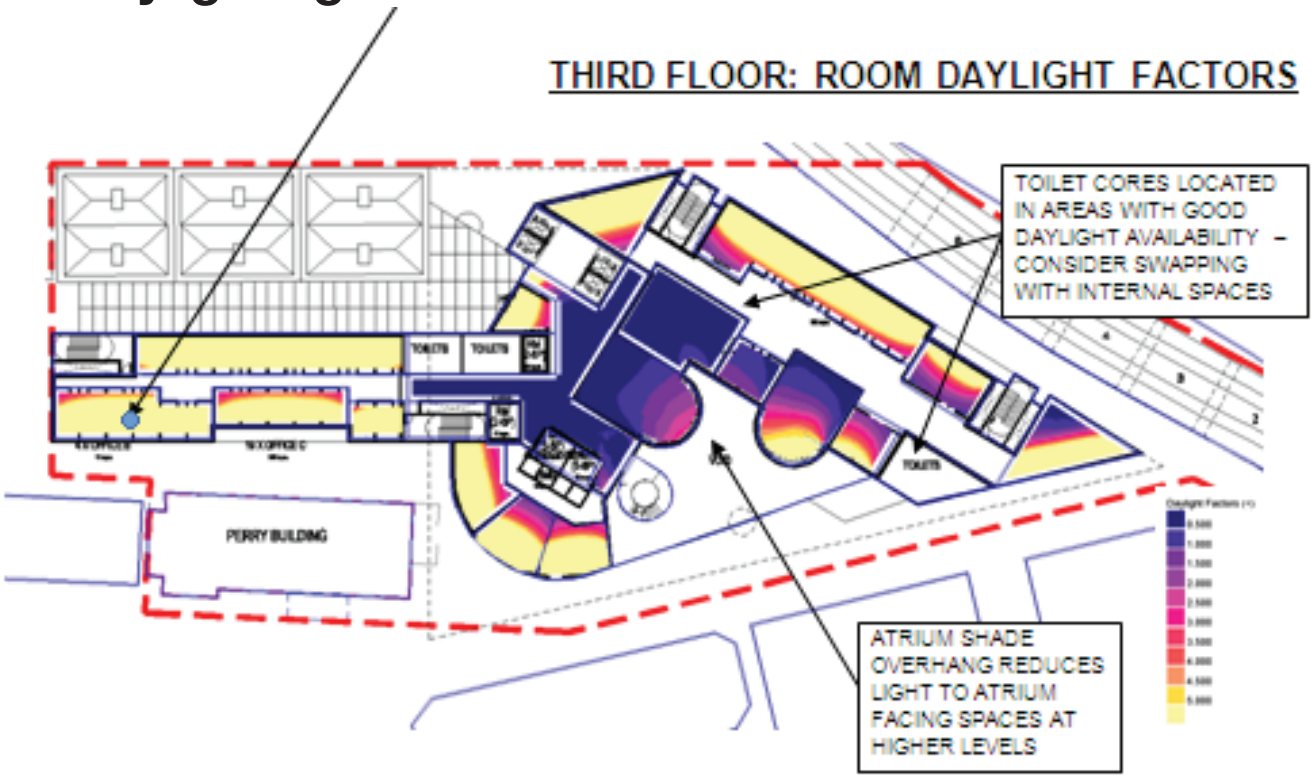
Base = C3 | Nat Vent = A2 | AC = B1 | AC + PV = B1 *(But Part L NZEB compliant!)*

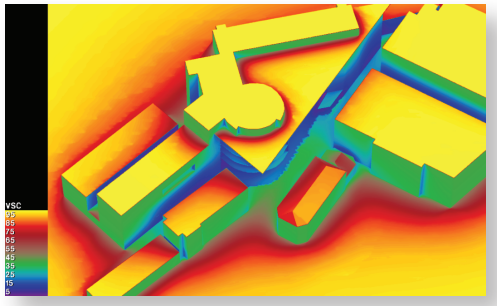


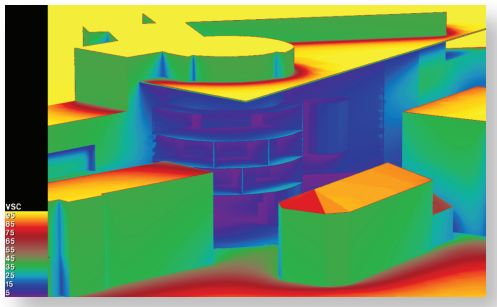




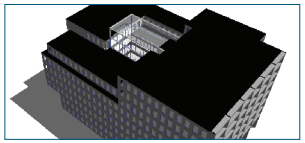
4.0 Building Simulation

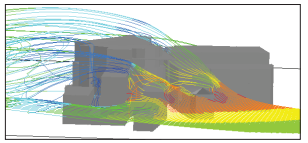
Daylighting

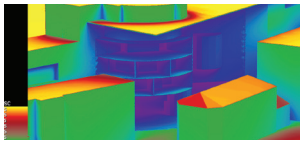






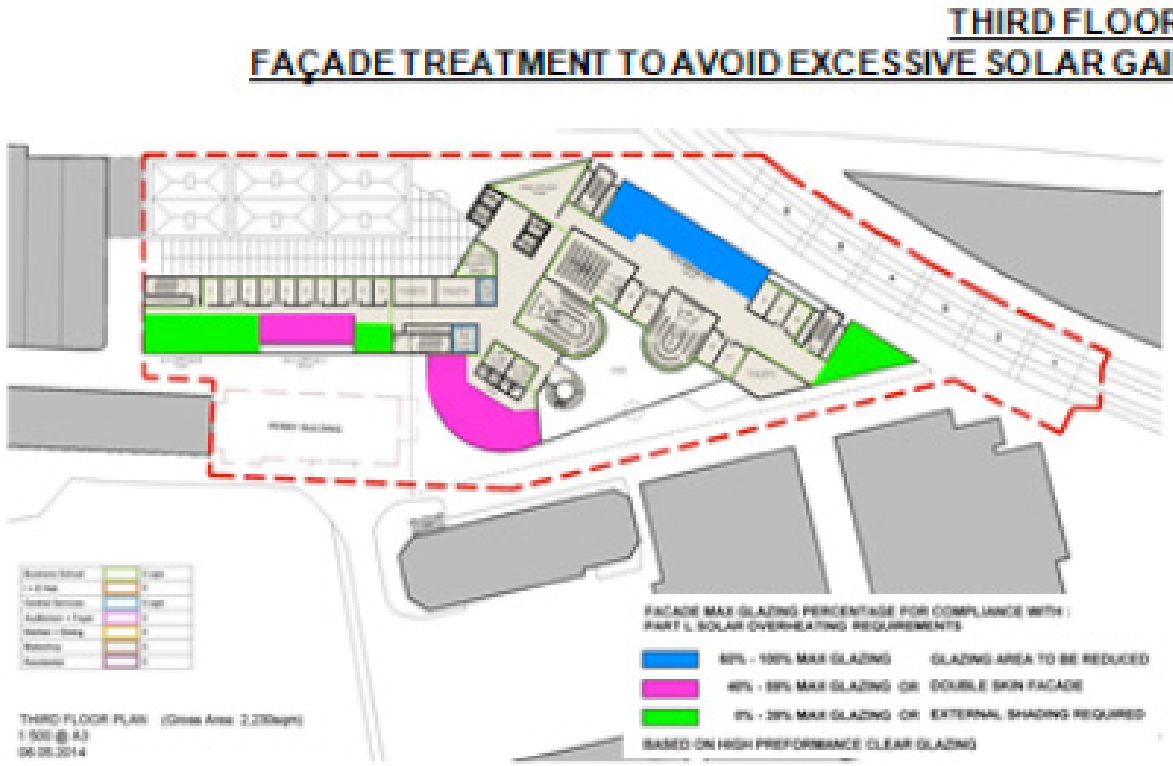


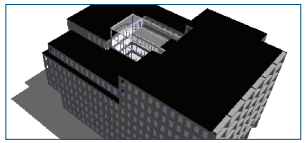


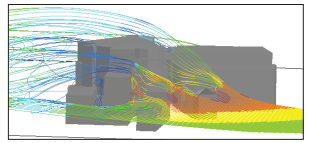


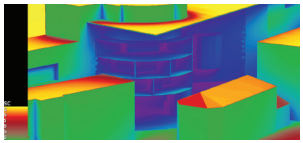
4.0 Building Simulation

Solar Heat Gain



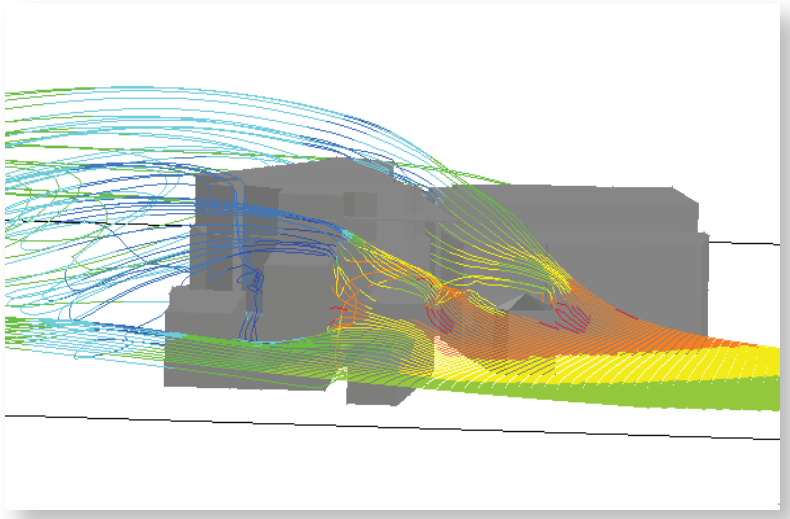


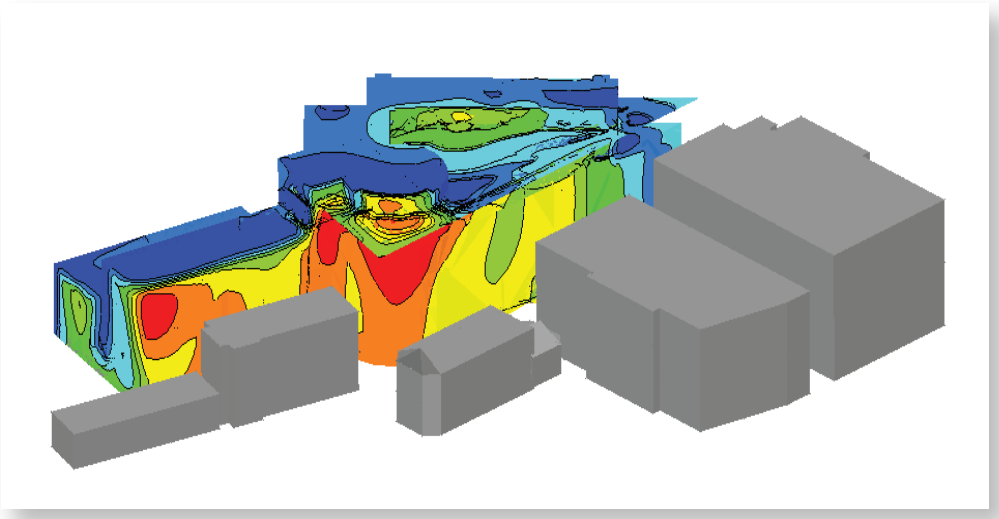


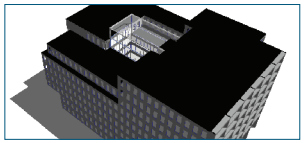


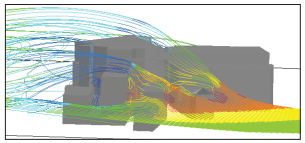
4.0 Building Simulation

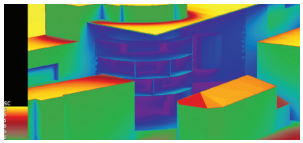
External Air Flow





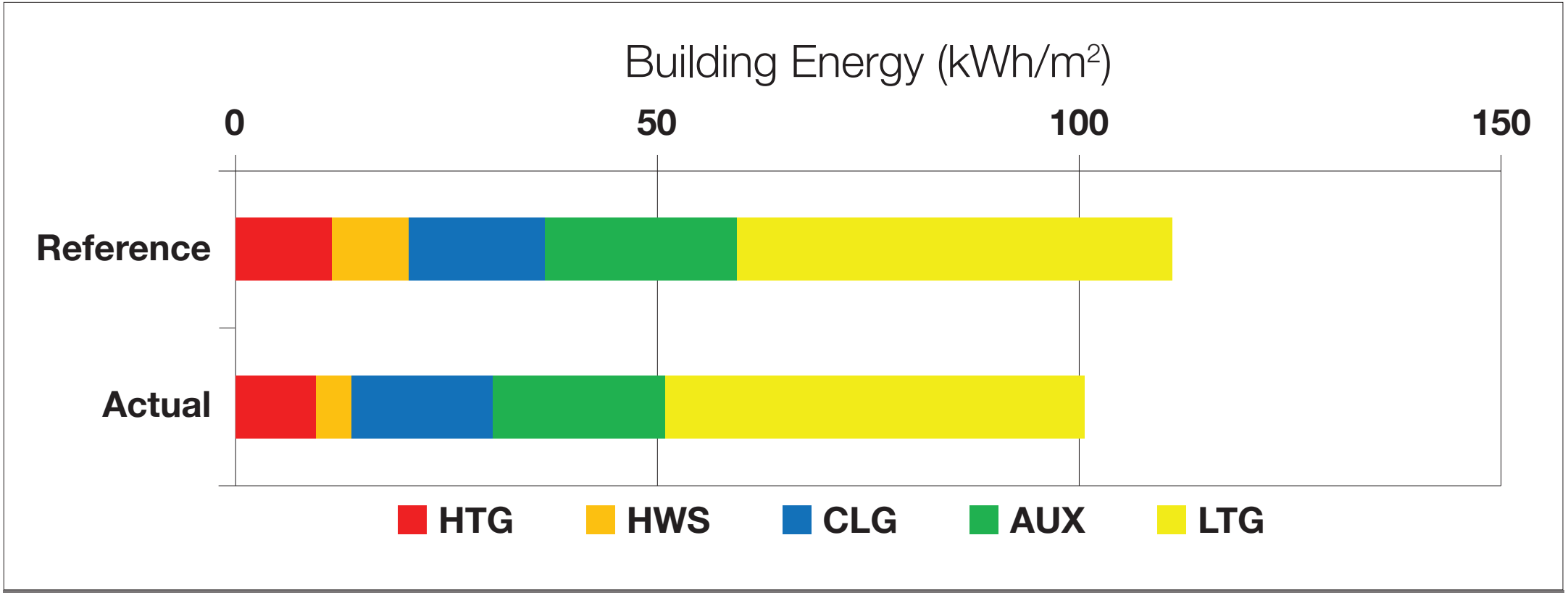






IN2
ENGINEERING DESIGN PARTNERSHIP

Presentation by David Walshe
Technical Director
IN2 Engineering Design Partnership



Strategies for Achieving the NZEB Standard