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The Role of Low Carbon Technologies

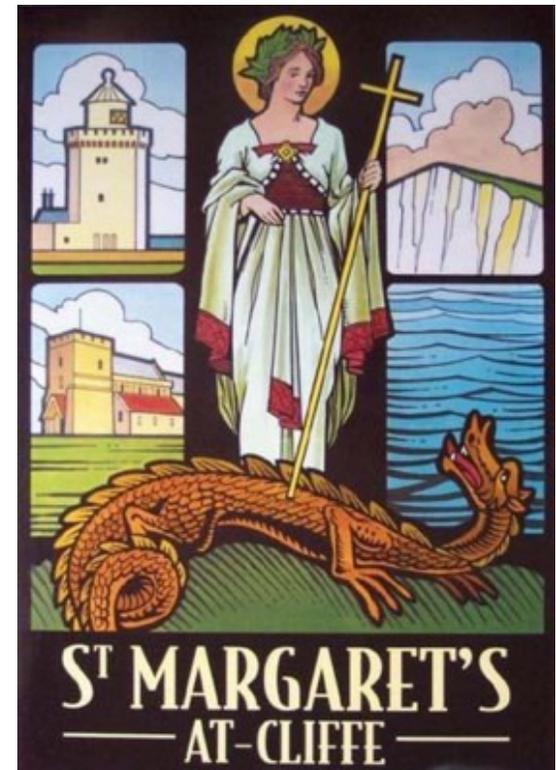
Jae Mather
Director of Sustainability
Carbon Free Group

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The Community of St Margaret's at Cliffe in Dover

- St Margaret's is a seaside village set on the White Cliffs of Dover in Kent; it is located 3 miles from the city of Dover.
- The village has approximately 3000 permanent residents with around 1370 households .
- The estimated total electricity consumption for the St Margaret's Bay community is **8,300,000 kWh/yr.**

82% of the electricity consumption is from households
15% of the electricity consumption is from businesses
3% of the electricity consumption is from agriculture



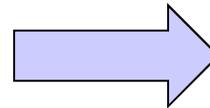
Large Scale Wind

**4 E48 800 KW turbines
mounted on 50 meter masts:**

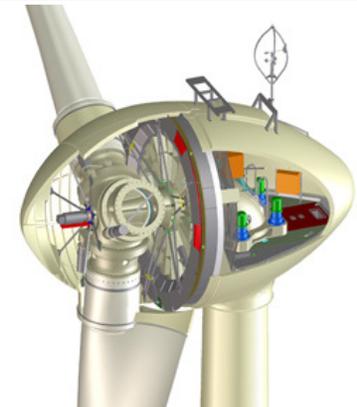
- Total cost £4 million
- Annual Revenue £710,000
- Payback Period 5.7 years
- Return on Investment 17.5%

-Cost per household: £2920
-Annual Income per household:
£519

E48 800 kW
turbine
mounted on 76
Meter mast



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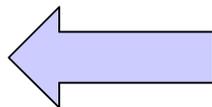


**2 E70 2.3 MW turbines
mounted on 64 meter masts:**

- Total cost £4.6 million
- Annual Revenue £982,000
- Payback Period 4.7 years
- Return on Investment 21%

-Cost per household: £3358
-Annual Income per household:
£717

E 70 2.3 MW
Turbine
mounted on 113
meter mast



Bio-Mass



4.5 MW WID Bio-Mass system

- With fuel price of £30/Tonne
 - Total cost £16 million
 - Annual Revenue £3,548,913
 - Payback Period 4.5 years
 - Return on Investment 22%
 - 16 Permanent Jobs Created
-
- Cost per household: £11,765
 - Annual Income per household: £2609

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Example of a Low Carbon Renovation of an Existing Solid Wall Victorian Semi Detached House

Before Renovation

Existing structure: North facing, gable solid wall brick with single glazed windows and poor levels of air tightness.

Size: 90 Square Metres

Annual heating requirements including hot water: **14,000 kWh**

Annual electricity load: **8200 kWh**



After Renovation

Mix of internal and external insulation, replacement double glazed timber windows, very high levels of air tightness and the integration of a MVHR

Size: 85 Square Metres, this represents a **loss of approximately 5% of floor area** due to increased insulation

Annual heating requirements including hot water: 2000 kWh, this is an improvement of **85%**

Annual electricity load: 6000 kWh, this is an improvement of **27%**

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Example of a Low Carbon Renovation of an Existing Solid Wall Victorian Semi Detached House

Before Renovation

Annual cost for heat (14,000 kWh at 4.5p per kWh): £630

Annual cost for electricity (8200 kWh at 10p per kWh):£820

Total cost: **£1450 per year**



After Renovation

Annual cost for heat (2000 kWh at 4.5p per kWh): £90

Annual cost for electricity (6000 kWh at 10p per kWh): £600

Total cost: **£690 per year** or a reduction of £760 per year

This equates to a reduction of:

86% in Heating cost

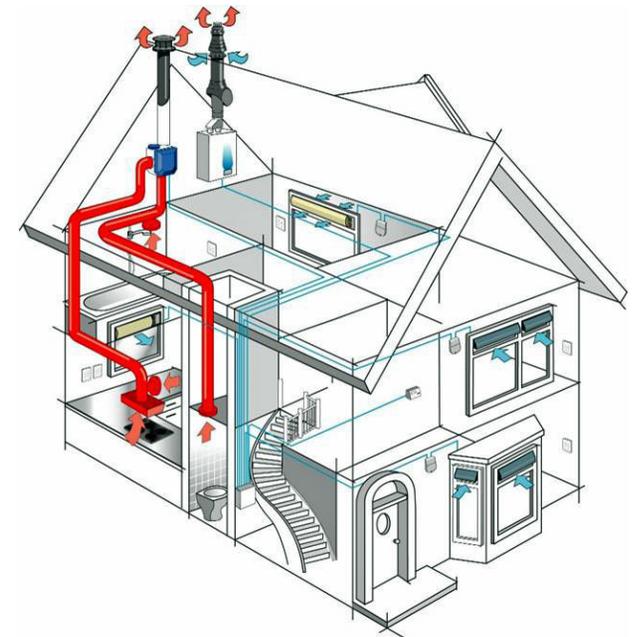
27% in Electricity cost

53% in Total cost

Practical Examples of Sustainable Procurement

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Example of a Low Carbon Renovation of an Existing Solid Wall Victorian Semi Detached House



Building Fabric Improvement Costs:

In Wall Insulation:	£2500
Under floor Insulation:	£725
Under floor heating:	£2375
Water:	£650
Solar Hot Water and new Boiler:	£5500
Mechanically Ventilated Heat Recovery:	£2500
Glazing*:	£1000

*Regular glazing that would have met building regulations would have cost £4800; high performance glazing cost £5800 so the uplift to high performance glazing was £1000.

The total cost for Low Carbon aspects of the renovation come to £15,250 or 18% of the total renovation.

Pay Back Period: 20 years at current energy prices

Return on Investment: 5% at current energy prices

Practical Examples of Sustainable Procurement

Example of a Low Carbon Renovation of an Existing Solid Wall Victorian Semi Detached House

Carbon Emissions Before Renovation

From heat (14,000 kWh at 0.204 KG per kWh): 2856 KG

From electricity (8200 kWh at 0.48 KG per kWh): 3936 KG

Carbon Emissions per year for heat and electricity: **6972 KG per year**

Carbon Emissions After Renovation

From heat (2000 kWh at 0.204 KG per kWh): 408 KG

From electricity (6000 kWh at 0.48 KG per kWh): 2880 KG

Carbon Emissions per year for heat and electricity: **3288 KG per year**

This equates to a reduction of:

86% in Heating emissions

27% in Electricity emissions

Reduction of 53% in Total emissions

Technologies

PV-T (Photovoltaic Thermal)

- **hybrid technology** that combines, monocrystalline photovoltaics and a high efficiency solar thermal collector
- **simple low cost**, low maintenance energy solution able to facilitate the governments zero-carbon strategy
- **25% higher output** efficiency than monocrystalline PV
- **space saving** as only one panel producing heat and electricity **paybacks** in generally less than fifteen years.



Technologies

PV-T (Photovoltaic Thermal)

1 kWp 1 to 1 PV-T

Cost: £12,850 installed

Size: 8.16 Square Metres

Average annual Electricity production: 1100 kWh

Average annual Heat production: 1100 kWh

Pay Back Period: 21 Years

Carbon Offset: 752 KG

Total Carbon Offset when viewed on renovation: **64%**

3 kWp 1 to 1 PV-T

Cost: £24,100 installed

Size: 24 Square Metres

Average annual Electricity production: 3558 kWh

Average annual Heat production: 3558 kWh

Pay Back Period: 11 Years

Carbon Offset: 2434 KG

Total Carbon Offset when viewed on renovation: **88%**



2011 Hot ROC's are expected to be introduced at 4.5p per kWh

Technologies

Solar Hot Water (SHW)

4.5 Square Meter Flat Plate Solar Hot Water system

Cost:	£2800 installed
Average annual Heat production:	2055 kWh
Pay Back Period:	15Years
Carbon Offset:	398 KG
Total Carbon Offset when viewed on renovation:	59%

8 Square Meter Flat Plate Solar Hot Water system

Cost:	£3900 installed
Average annual Heat production:	4096 kWh
Pay Back Period:	10.6 Years
Carbon Offset:	794 KG
Total Carbon Offset when viewed on renovation:	64%

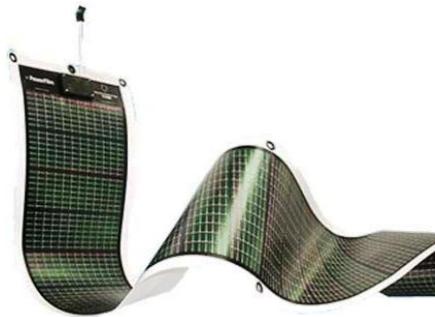


Technologies

Photo Voltaic (PV)

Photovoltaic's are semi-conductors that produce electricity

The three main types of PV used in the UK:



thin film

efficiencies 4-9%
cost £1,000-£2,000kW



polycrystalline

efficiencies 14-17%
costs £3,000-£5,500kW



monocrystalline

efficiencies 17-19%
costs £4,000-£6,500kW

Technologies

Voltage Optimisation

- The technology trims the voltage drawn from the national grid.
- Electrical Energy savings of between 8% and 18% are achievable.
- Average payback periods less than 3 years.

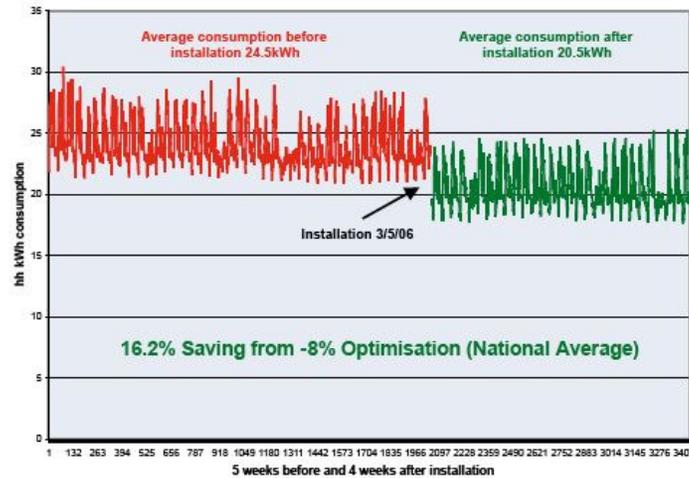
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pP740kVA-1000A

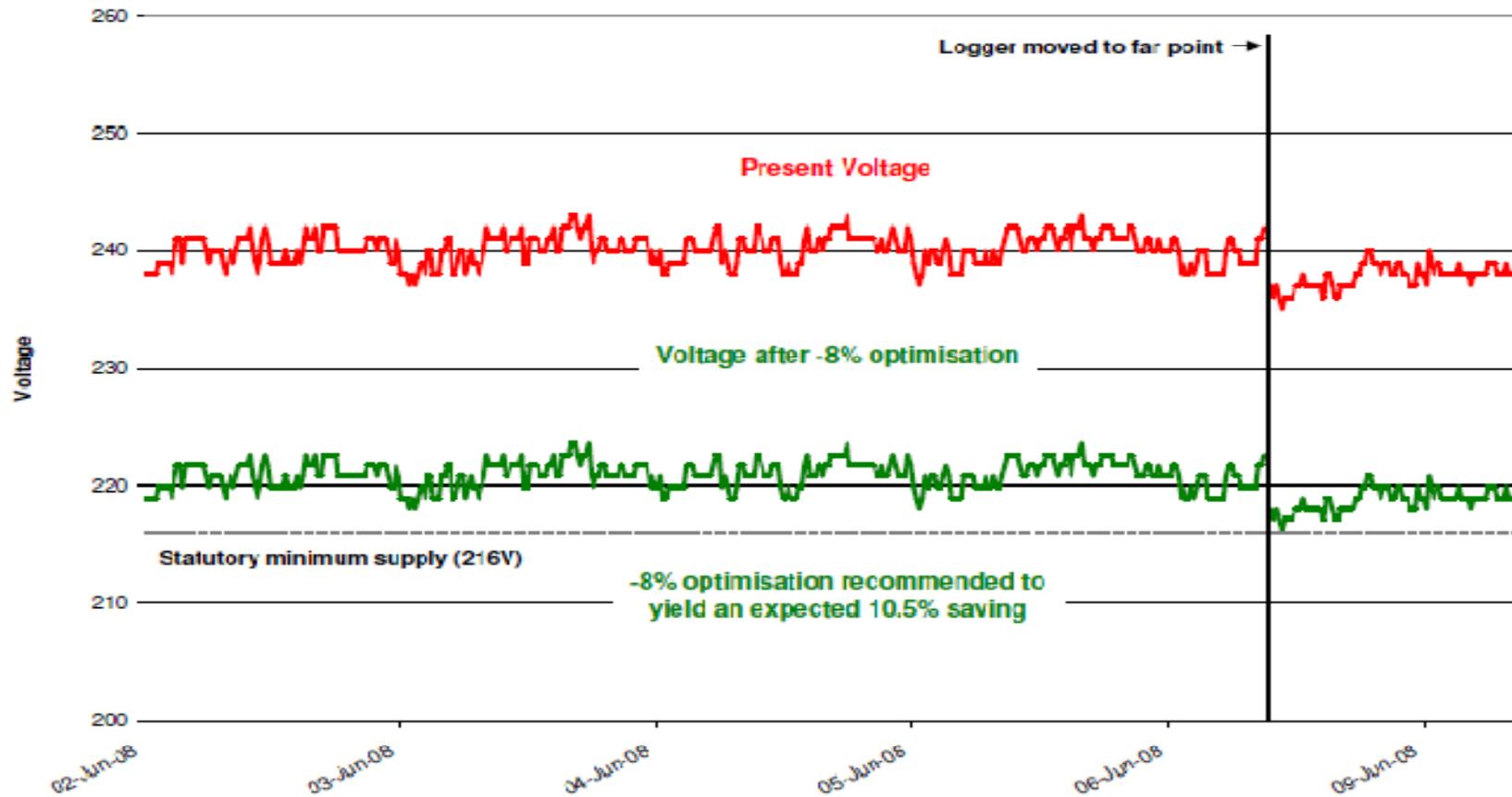
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Swan Car Park



Technologies

Voltage Optimisation



Technologies

Domestic Voltage Optimisation

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-£300 per dwelling

-10% typical reduction in electricity consumption

-Payback 5-8 years

Technologies

Lighting Solutions

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Conventional Lamps	
40W Incandescent	£14.30
50W Incandescent	£17.30
60W Incandescent	£19.93
75W Incandescent	£24.33
100W Incandescent	£31.63
50W Halogen	£19.10

9W CFL (equivalent to 40W Incandescent)	£3.48 or a 76% reduction when compared with 40W Incandescent
20W CFL (equivalent to 100W Incandescent)	£7.26 or a 77% reduction when compared with 100W Incandescent
11W CFL (equivalent to 50W Halogen)	£5.34 or a 72% reduction when compared with 50W Halogen



3.6 Watt LED 35W conventional Replacement	£4.05 or a 62% reduction when compared with 40W conventional lamp and a 16% increase when compared with 9W CFL
7 Watt LED Halogen Replacement	£6.33 or a 67% reduction when compared with 50W Halogen and a 18% increase when compared with 11W CFL
Was £55 per lamp 3 months ago, now £29	

Technologies

Lighting Solutions

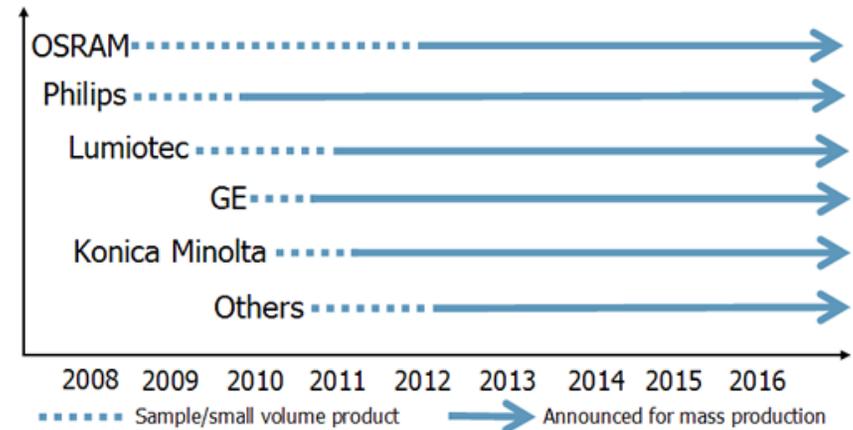
Organic Light Emitting Diode (OLED)

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OLEDs are very power efficient and they can be made very thin. An OLED light bulb is actually a thin film of material that emits bright white light. Because OLEDs can be flexible, or even transparent, there are a huge number of new OLED lamp designs possible.

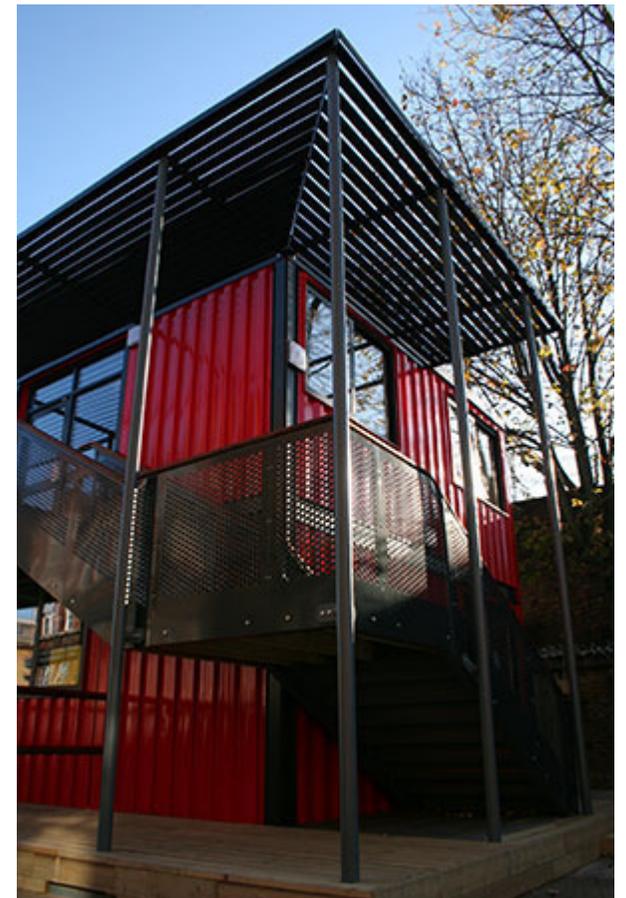
The OLED100 working group has an overall objective of 100 lumens per watt power efficacy, more than 100,000 “lifetime hours”, a unit area of 100 cm by 100 cm at a cost of €100 per square meter or less.



Buildings

Containerized Building System

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Buildings

Offsite construction

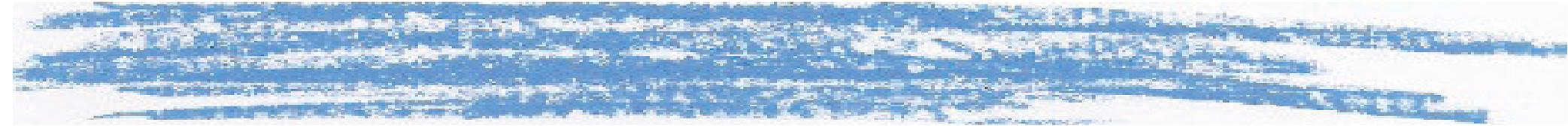
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Buildings Modern Methods of Construction/ Pre Fabrication

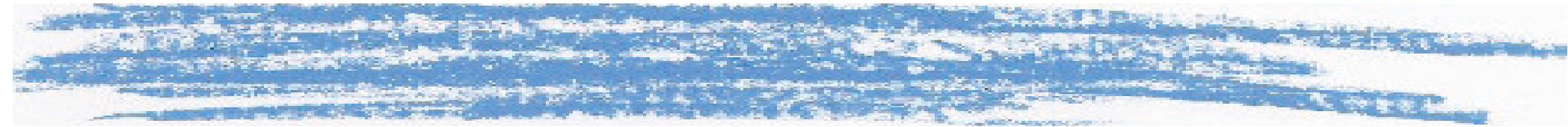
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Buildings Modern Methods of Construction/ Pre Fabrication **carbon free group**





Buildings

The Pines Calyx, our Headquarters

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Buildings

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Thank you

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