Installing Renewable Energy in New Buildings

February 2008

Organised by:

Devon Sustainable Building Initiative
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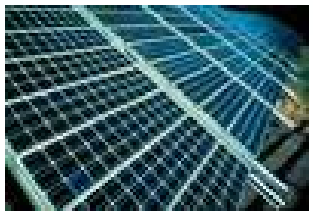
FUTURE FOUNDATIONS
Building a better South West

Renewable Energy Technologies





Okehampton

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Background provided by Proven Energy Ltd

Sustainability Drivers

- Social desire – reducing CO_2 emissions
- Financial incentive – pay back period
- Marketing incentive – adding value and sellability
- Governmental/International requirement – reducing CO_2 emissions
- Environmental requirement – reducing CO_2 emissions

What is the green house effect?

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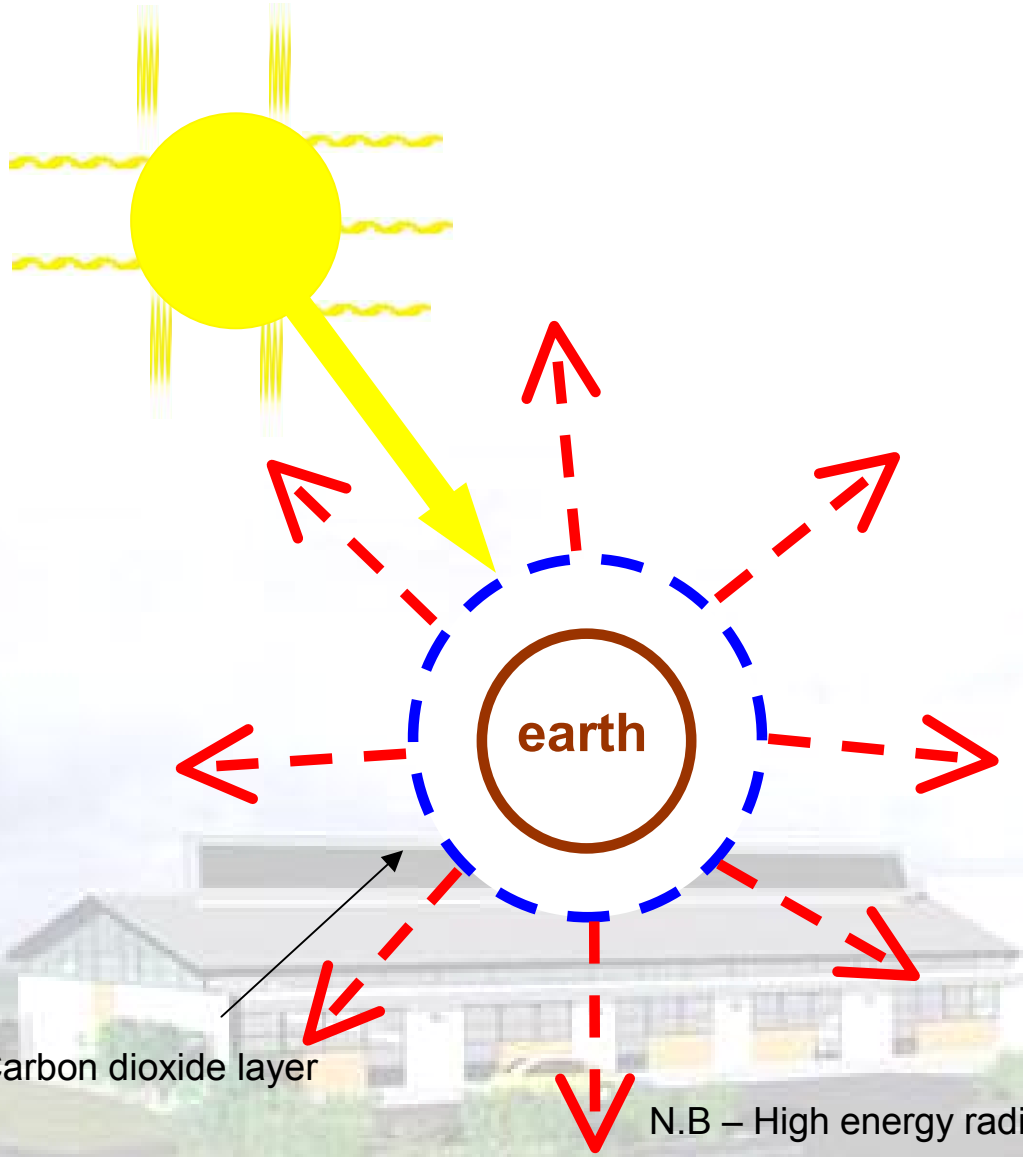


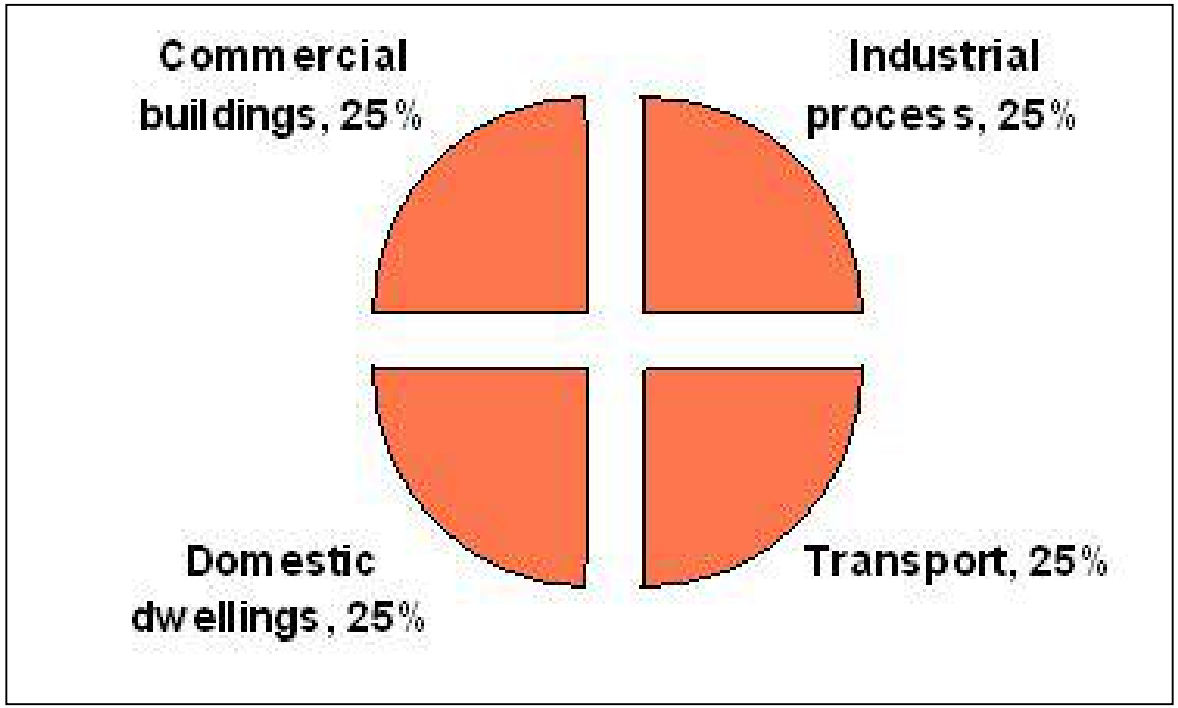
High energy radiation is emitted by the sun and hits the earth's surface

Some is absorbed but most is reflected as low energy radiation

Some of the low energy radiation escapes back to space but some is trapped and reflected back to earth by layers of carbon dioxide which heats the earth further

N.B – High energy radiation is unaffected by carbon dioxide

Why should we bother with sustainability & renewable energy technologies?



Carbon Dioxide Emissions in the UK

Before Considering Renewables

Element	Consider
Increase the potential for natural ventilation	Building orientation, plan depth, window design, thermal mass for night cooling, solar shading to reduce overheating and glare
Reduce heat loss	Improve U-values, air infiltration rates, thermal bridging
Reduce lighting demands	Window design, light pipes and intelligent controls
Reduce water consumption	Low use WC's, aerating taps, rainwater harvesting
Recycle materials	Sub-base, insulation, flooring aggregates
Transport links	Building location, building type, encourage cycling (bike racks and shower facilities)
Increase biodiversity	Natural British planting and management

Basic Sustainability Recipe

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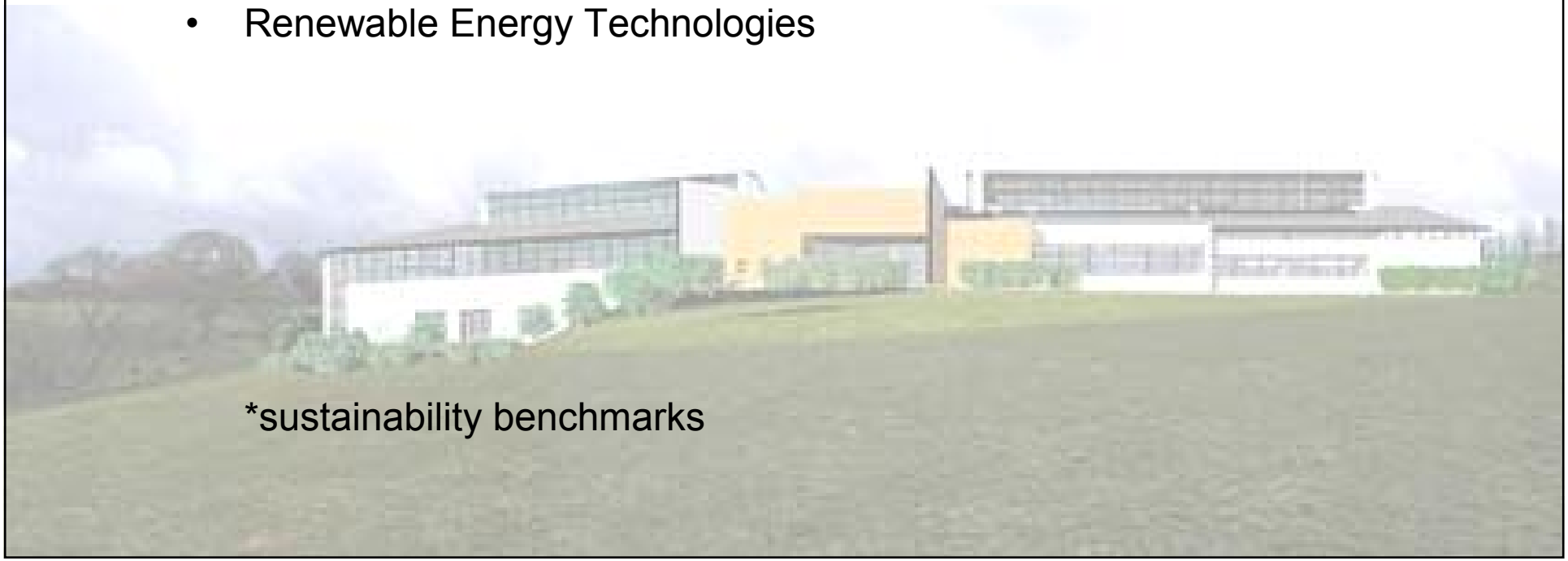
- Building Physics – low energy, intelligent building design
- BREEAM/Code for Sustainable Non-domestic Buildings*
- Code for Sustainable Homes/Ecohomes*
- Renewable Energy Technologies



*sustainability benchmarks

The Big 5 Renewable Energy Options

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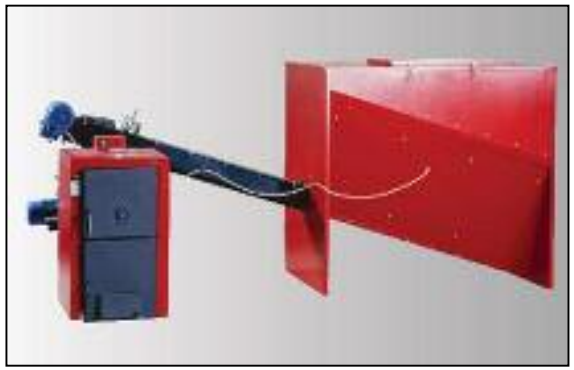
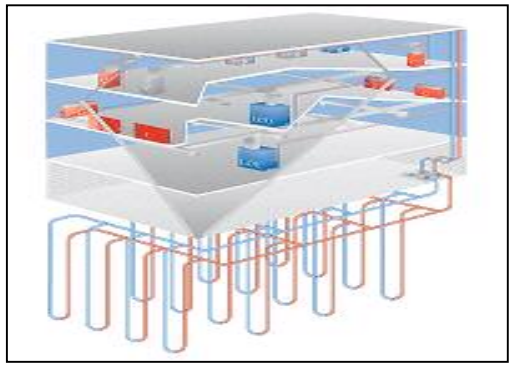
Biomass



Solar Water Heating

Wind Turbines

Ground Source Heat Pumps



Other Renewables:

- Hydro electricity
- Bio diesel and biofuels
- Combined heat & power
- Fuel cells

Photovoltaics

When Should We Consider Renewables?

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Renewables should be considered and agreed at the project conception stage as they can influence:

- Planning Application
- Building layout
- Plantroom size
- Heating and ventilation strategy of the building
- Floor make-up
- Civils works and road layout
- Costs

Biomass – The Facts

CO_2 Savings:	• 40% to 60%, 12-16 tonnes of CO_2 pa
Capital Costs:	• £30k for a 45kw biomass boiler, fuel hopper and fuel delivery system
Running Costs:	• 3.5 pence/kWh for pellets, 1.5 pence/kWh for chips (gas 2.5 p/kWh, oil 5 p/kWh)
Arch Issues:	• Large plantroom, access required for fuel delivery (3-4 times per year)
Technical Issues:	• Controls especially with gas top-up systems, choice of boiler, thermal store/buffer vessel, fuel storage, fuel delivery, fuel type: pellets<100kW, chips>100kW

GSHP – The Facts

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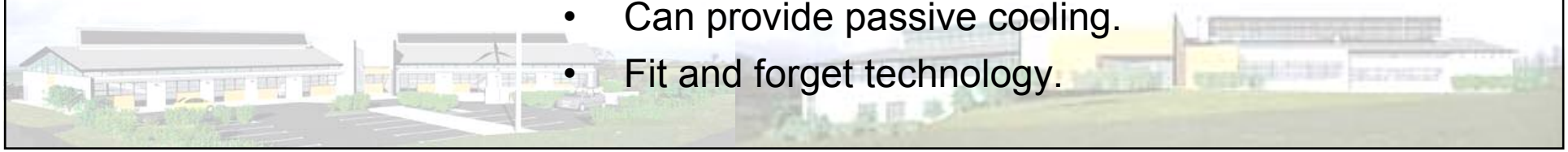
CO_2 Savings:	• 10% to 20%, 3-4 tonnes of CO_2 pa
Capital Costs:	• £55k for a 45kw borehole GSHP
Running Costs:	• 2 to 3 pence/kWh
Arch Issues:	• Limited to underfloor heating. • 3 times floor area for horizontal slinky • 1 times floor area for boreholes (80m deep)
Technical Issues:	• Ground conditions influence viability, costs and choice of loop array. • Hot water generation is not straightforward. • Uses large amounts of electricity to drive pumps and compressor. • Can provide passive cooling. • Fit and forget technology.



Solar Hot Water – The Facts

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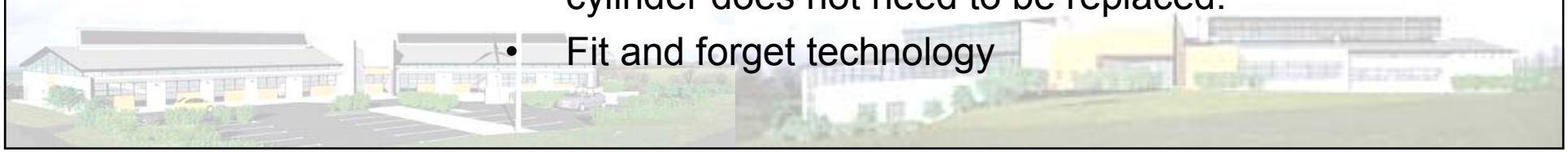
CO_2 Savings:	• 5%, 1 tonne CO_2 pa
Capital Costs:	• £3k to £5k
Running Costs:	• £50 saving pa
Arch Issues:	• Planning, good public statement, South East to South West elevation required.
Tech Issues:	• Ideal for hotels, tennis/cricket pavilions and houses (but not for offices, warehouses etc). High temp safety devices required. • Tubes less robust but more efficient than flat panels. • Cost reduced for new build as existing hot water cylinder does not need to be replaced. • Fit and forget technology



Wind Turbines - The Facts

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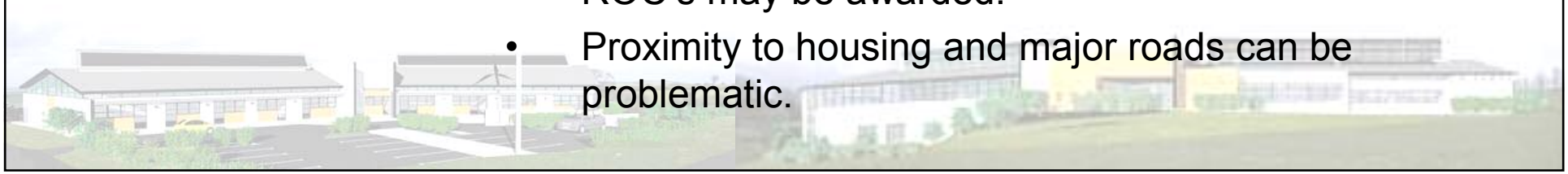
CO_2 Savings:	• 10% to 20%, 3-4 tonnes of CO_2 pa (site dependent)
Capital Costs:	• £20k for a 6kw turbine
Running Costs:	• £500 to £1,500 saving pa
Arch Issues:	• Planning, noise pollution, good public statement?
Tech Issues:	• Site and size dependent (average wind speed must exceed 5.5m/s). • Maintenance costs 1.5% to 3% pa. • Consideration of import/export meter. • ROC's may be awarded. • Proximity to housing and major roads can be problematic.



Photovoltaics – The Facts

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CO_2 Savings:	•	5% to 10%, 2-3 tonnes of CO_2 pa
Capital Costs:	•	£50k for 8kWp array (50m^2)
Running Costs:	•	£700 to £800 saving pa
Arch Issues:	•	Planning, good public statement, South elevation and no shading essential.
Tech Issues:	•	Consideration of import/export meter.
	•	ROC's may be awarded.
	•	Fit and forget technology.

Key Facts

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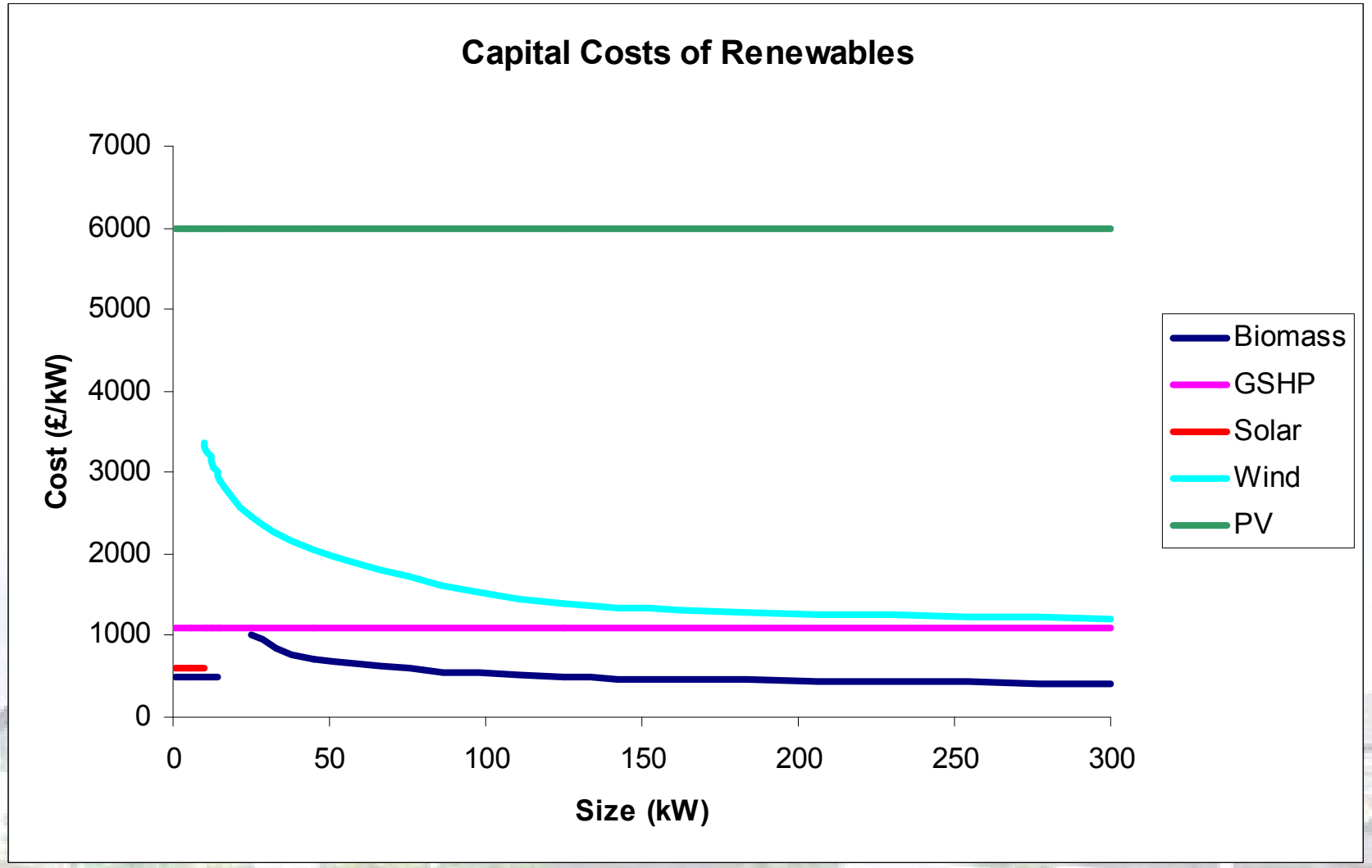
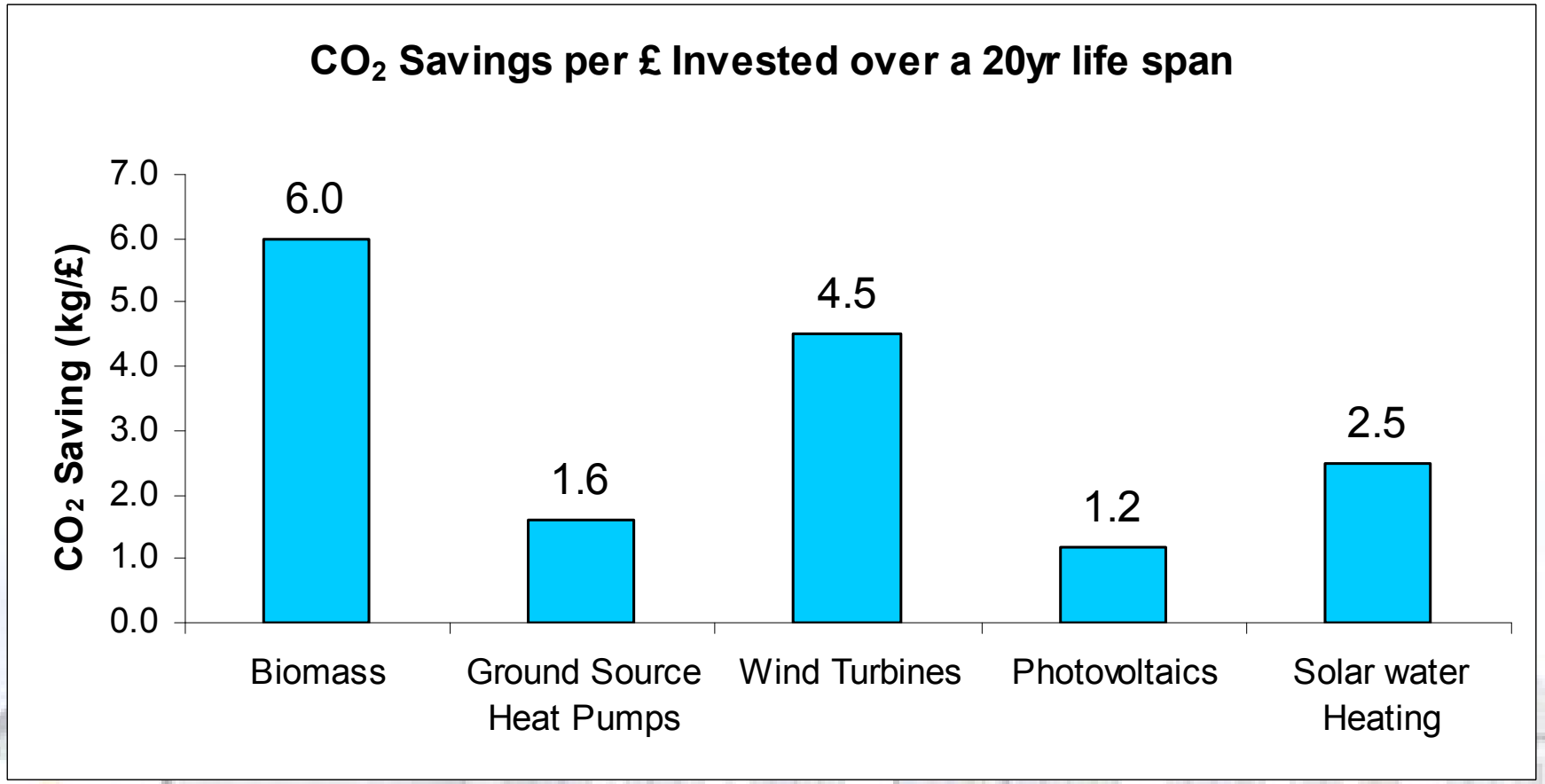
	Biomass	GSHP	Solar Water Heating	Wind Turbines	Photovoltaics
CO_2 Savings pa	40% to 60% 12-6 tonnes	10% to 20% 3-4 tonnes	5% 1 tonne	10% to 20% 3-4 tonnes	5% to 10% 2-3 tonnes
Capital Costs	£30k	£55k	£4k	£20k	£50k
Running Costs	3.5p/kWh pellets 1.5p/kWh chips	2.5 p/kWh	£50 saving pa	£1,000 saving pa	£750 saving pa
Architectural Issues	• Large plant room • Fuel delivery issue	• Underfloor heating	• Planning • South East to South West elevation	• Planning	• South elevation • No shading
Tech Issues	• Controls • Boiler sizing • Fuel supply	• Ground loop array • Hot water issues	• High temperature safety devices • Limited applications	• Site dependent • Import/export meter • ROC's • Maintenance	• Import/export meter • ROC's

Installation Costs



Performance Comparison



Renewable Energy Mix for Okehampton

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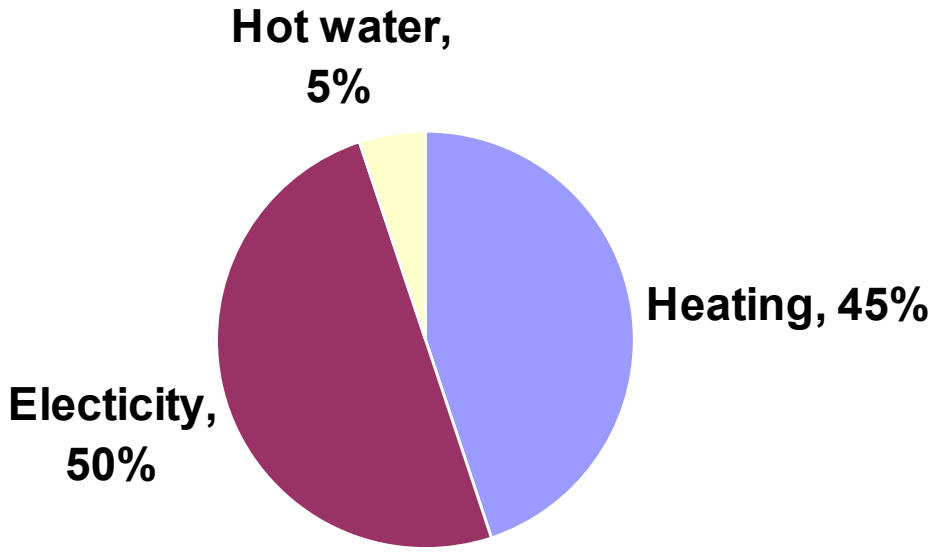
	Size	Capital Costs	CO2 Saving per £ invested	% offset
Biomass Boiler	45kW	£30k	6kg CO_2/£	30 to 40%
Wind Turbine	6kW	£20k	3.5kg CO_2/£	10 to 15%
Photovoltaics	8kWp	£50k	1.2kg CO_2/£	5 to 10%



Building Regulations CO2 Emission Factors (kg CO2/kwh)	
Gas	0.194
Electricity	0.422
Grid displayed Electricity	0.568

Part L or Actual ?????

Sustainable Okehampton Gains
BREEAM Excellent Rating

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Natural light
Windows and interior spaces are designed to maximise the use of natural light reducing the need for artificial lighting

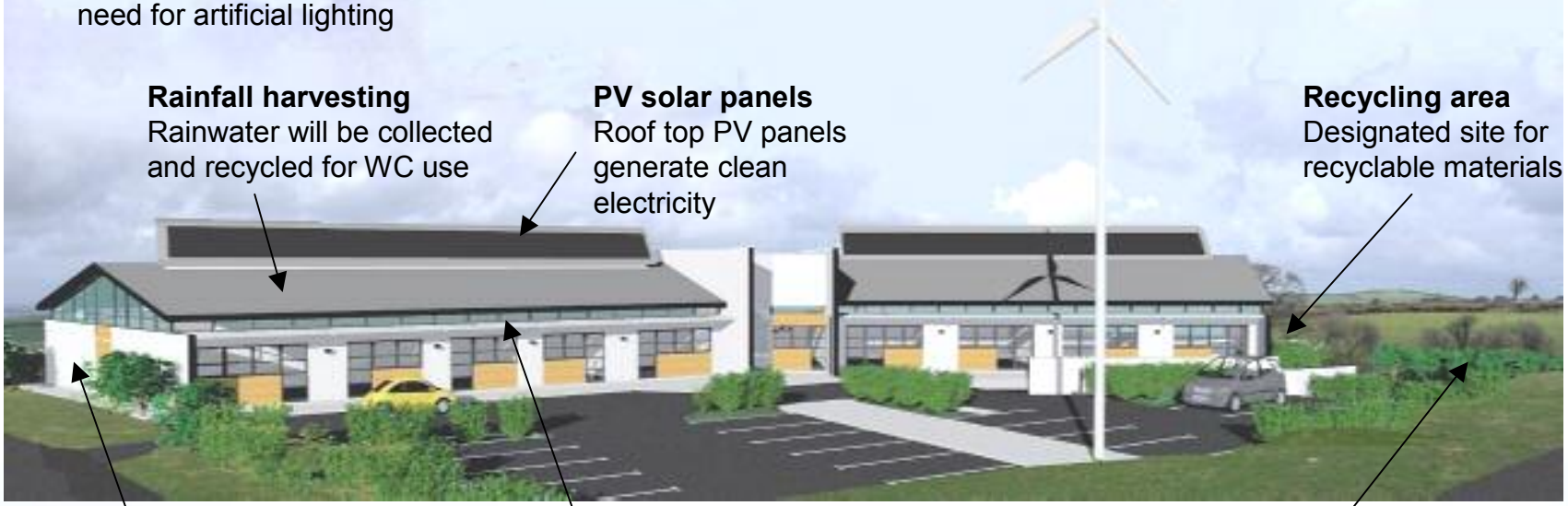
Intelligent lighting
High efficiency, daylight dimmed luminaires minimise energy consumption

Wind turbine
The 6kW turbine will provide the site with renewable and sustainable energy

Rainfall harvesting
Rainwater will be collected and recycled for WC use

PV solar panels
Roof top PV panels generate clean electricity

Recycling area
Designated site for recyclable materials



Wood pellet boiler
Heating is provided by a biomass boiler harnessing a renewable energy source

Natural ventilation
Intelligently controlled windows utilise natural air currents to provide cross and stack ventilation

Attenuation ponds
These provide a sustainable method of retaining surface water. Extensive planting of trees and shrubs will increase the floral and faunal diversity of the site.

Landscaping
Planting of native woodland enhances the visual appearance and ecological habitat

Building materials
These have been selected to create little environmental impact

Sustainable drainage (SuDS)
Impermeable surfaces are kept to a minimum and run off is controlled