helping householders, businesses and communities create a better environment

Overview

- Low and zero carbon energy technologies
  - Associated planning issues
- Financial support
- Incentives
- Workshop Exercise
- Discussion and Questions

Low and zero carbon technologies

	Technology	Energy type generated
	Wind turbines	Electricity
	Solar photovoltaics	Electricity
	Solar water heating	Water heating
	Biomass heating (and biomass CHP)	Space and water heating (or space and water heating plus electricity)
	Ground source heating and cooling	Space heating and/or cooling
	Gas CHP	Space and water heating plus electricity

Solar Photovoltaics (PV)

- **Technology:**
  - Uses semi-conductor cells to convert light energy into electricity
- **Product options**
  - Solar panels: conspicuous, effective, possibly heavy, mounting on flat roofs possible
  - Cladding: on prestige offices can be a cost-effective option, good PR
  - Tiles: blends with tiled roofs, suitable for conservation areas
  - Thin-film: like paint, you can put it almost anywhere, low efficiency and high cost, integrate into glazing


Thin film

Credits: solarcentury.com; evoenergy.com; evillagesolar.com

Solar Photovoltaics (PV)

- **Requirements:**
  - Crucial to avoid shading
  - Orientate panel between SE and SW
  - Tilted to 30-40 °
- **Further Key Considerations**:
  - Cost - £4-5,000/kWp
  - Almost no maintenance
- **Where to use:**
  - In theory any building with an electricity demand (or grid connection).
  - Cladding on prestige offices can be a cost-effective option

Richmond Fire Station: SolarCentury

Case Study: CIS Solar Tower

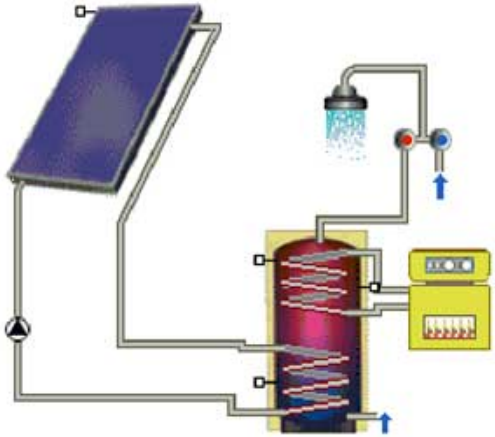
- **Background:**
  - Headquarters of CIS (insurance company) in Manchester used PV cladding to replace deteriorating grey tesserae
- **Driver:**
  - Cost-effective way to replace façade; addressing company CSR
- **Financial:**
  - £5.5m, assisted by grants (e.g. DTI)
- **Figures:**
  - Enough electricity generated per year to service 61 houses.
  - 100 tonnes CO_2 saved per year

Credits: solarcentury.com

Technical details: Sharp 80W wall-cladding PV modules (total system size 391 kWp)

Solar thermal (aka solar water heating)

- **Technology:**
  - Uses solar energy to heat a fluid which transfers its heat to water in tank. Can be installed in individual dwellings or communally to deliver c. 60% of domestic hot water requirement.
- **Product options**
  - Flat plate collectors : conspicuous, effective, possibly heavy, mounting on flat roofs possible
  - Evacuated tube collectors: conspicuous, (more) effective, possibly heavy, mounting on flat roofs possible
  - Tiles: blends with tiled roofs, suitable for conservation areas



Credit: Cel-f Solar, solarcentury and japanfocus.org

Solar thermal (aka solar water heating)

- **Requirements**
  - Orientate panel between SE and SW and tilted to 30-40 °
  - Space for twin-coil cylinder
- **Further Key Considerations:**
  - For single dwelling houses, will be considered ‘permitted development’ (if fixed appropriately and the property is not listed or within a conservation area, national park or other designated area).
  - Very low maintenance.
- **Where to use:**
  - Buildings with year-round hot water demand (e.g. low-density housing)

Case Study: Gallions Eco-park

- **Background:**
  - Housing association comprising 39 two- or four-bedroom houses using solar thermal as part of a range of environmental measures.
- **Driver:**
  - To demonstrate that sustainable design can be incorporated at very low extra cost and effort.
- **Financial:**
  - £2,479 additional cost per dwelling
- **Figures:**
  - 900-1300kWh heating per year per house.
  - 65% of household's annual hot water needs met.

Credit: www.gallionsecopark.co.uk

Technical details: Aquasol duo, dual coil system.

Biomass

- **Technology:**
  - Uses organic matter (e.g. wood chip or pellet) as fuel to power stoves, boilers or CHP systems.
  - Very low carbon technology if managed sustainably, as CO_2 released in burning is equivalent to that absorbed when growing
  - Can deliver over 40% CO_2 savings
- **Where to use:**
  - Systems can be sized as appropriate, but most favourable where heat demands are high

Credit: ALenergy

Biomass

- **Key Considerations**:
  - Space for power plant and fuel store; fuel delivery; fuel transfer.
  - Local fuel source is preferable
  - Maintenance is vital
  - Exempt appliances for smoke-control zones
  - Pollution (e.g. NO_x, SO_x, CO, particulates) must be minimised by design features of plant

Case Study: St Peter's Church

- **Background:**
  - A church in Lewisham that uses both biomass heating and solar PV
- **Cost:**
  - 100% from external funding (e.g. EDF energy)
- **Figures:**
  - 100% of church's space heating requirements met
  - c. 8.3 tonnes CO_2 expected annual savings

Credit: Creative Environmental Networks

Technical details: 80kW pellet boiler

Wind Turbines

- **Technology:**
  - Uses energy from wind to generate electricity. Can be stand-alone or building-mounted.
- **Key Considerations:**
  - Orientate towards prevailing wind (SW) Away from obstacles such as trees
  - Savings from roof mounted turbines are yet to be proved
  - Aesthetic?
  - Noise?
  - Safety? (cf. “Flicker”)
  - Cost
  - Risk to wildlife?
  - Building structure? (for build-mounted)
  - Low maintenance
- **Where to use:**
  - Low density developments; schools; industrial/business parks

Credit: Proven

Credit: XCO2

Case Study: Ford Dagenham

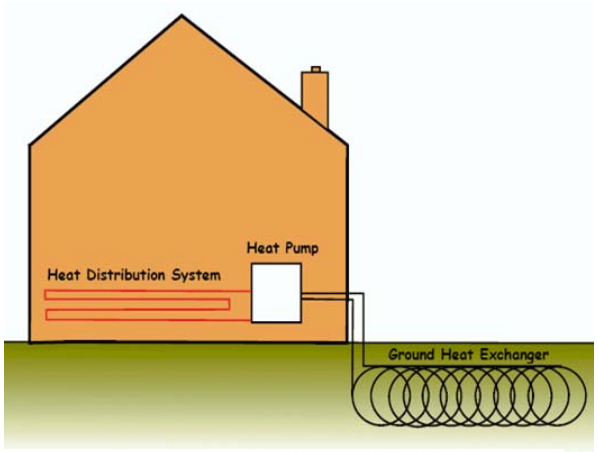
- **Background:**
  - Two stand-alone wind turbines have been constructed at Ford's Dagenham Diesel Centre.
- **Driver:**
  - Cost-saving through avoiding Climate Change Levy; addressing company CSR
- **Financial:**
  - Turbines funded by Ecotricity, and electricity sold to Ford by contract at low cost
- **Figures:**
  - 6.7 million kWh per year (equivalent to powering over 2,000 homes)
  - 100% of site's electricity demand met
  - Approximately 5,700 tonnes CO2 saved per year

Credit: ecotricity.co.uk

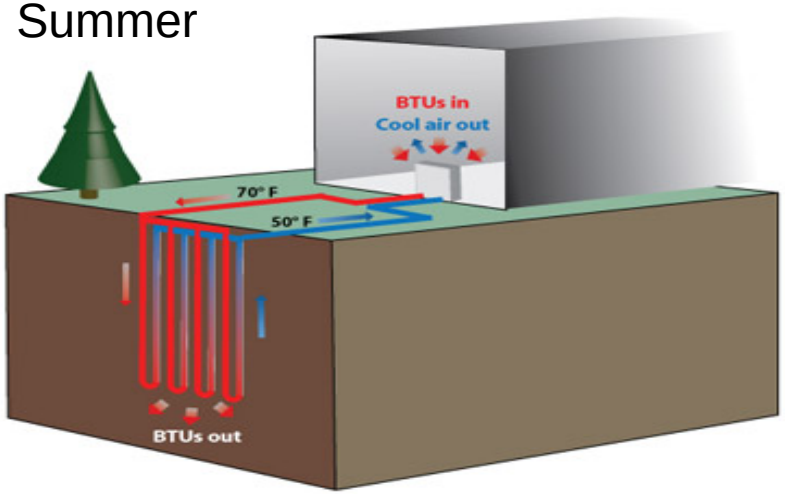
Technical details: Enercon E-66 turbines (combined system size 3.6MW)

Ground Source Heating and Cooling

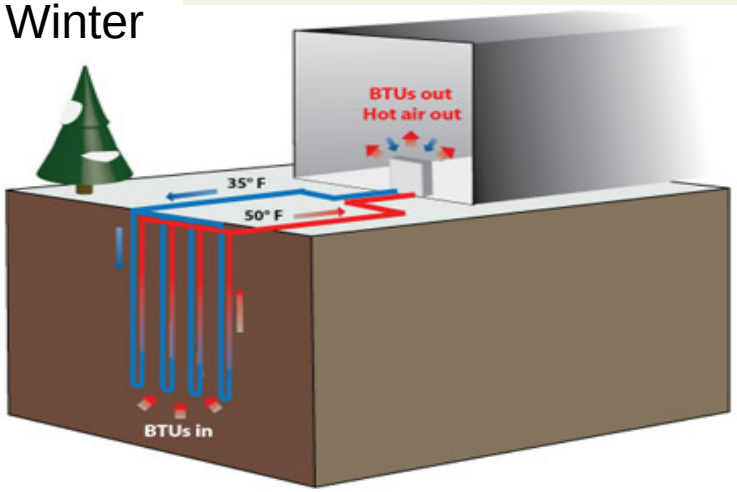
- **Technology:**
  - Uses loops and pumps to utilise stable ground temperature for space heating or cooling.
  - Usually sized to meet > 50% of building's space and water heating requirements (sometimes 100%)



Summer



Winter



Ground Source Heating and Cooling

Credits: Kensa and 24houranimalcontrol.com

helping householders, businesses and communities
create a better environment
cen

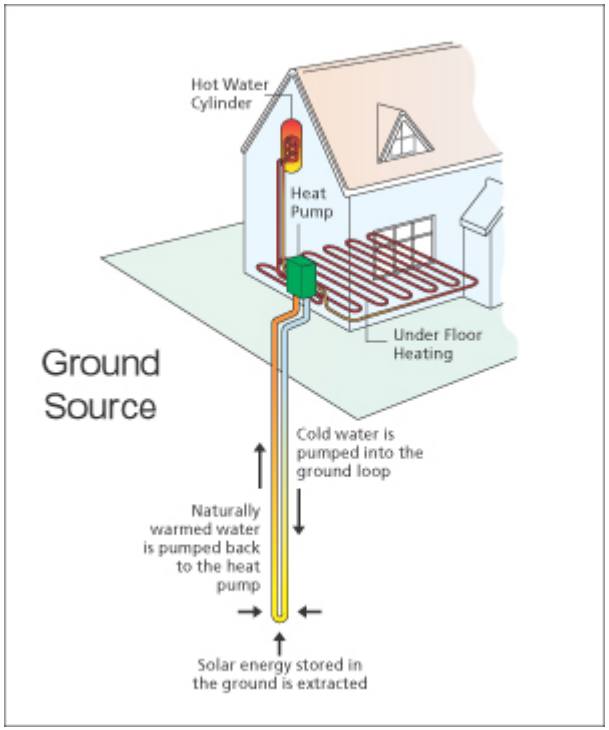
Ground Source Heating and Cooling

- **Requirements:**
  - Horizontal pipes (trenching): need large open space
  - Vertical pipes (boreholes): require ground survey and drilling license (avoid services, aquifers etc)
- **Further Key Considerations:**
  - Need electricity to power pumps, usually from mains.
  - Coefficient of Performance (CoP) shows how many kW heat produced per kW electricity consumed (usually 4 – 4.5 for space heating; higher for cooling)
  - Heating/Cooling balance
  - Open land/included in building pilings?

Ground Source Heating and Cooling

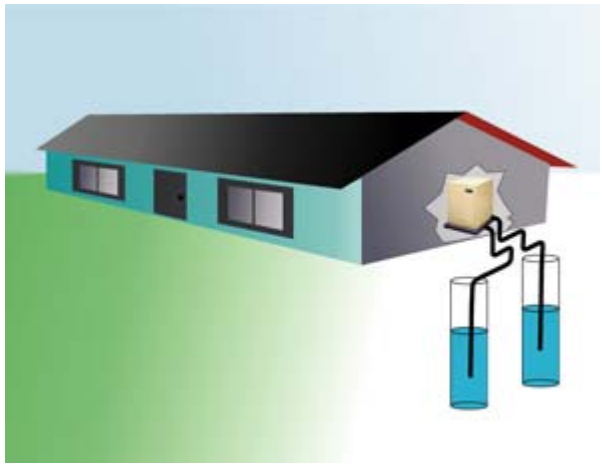
Closed Loop system

- Boreholes 150mm wide, up to 150m deep
- Hole filled and sealed with thermally enhanced grout
- Liquid passes through sealed coil



Open Loop system

- Ground water abstracted, passed through heat pump and then returned to ground
- Constant supply of water needed
- Need regulatory approval for abstraction license
- Suited to large commercial scale



Credits: heatpumps.org and nygeo.com

Case Study: IKEA distribution centre

- **Background:**
  - IKEA Distribution Centre in Peterborough runs one of the largest ground source heating and cooling systems in the UK
- **Driver:**
  - Reduce running costs; address company's CSR
- **Financial:**
  - Entirely funded by IKEA
- **Figures:**
  - Capacity: 198 kW heating; 232 kW cooling
  - c.100 tonnes CO_2 saved per year

Credit: www.clima-gas.co.uk

Technical details: ETT – Cat 358D heat pump, linked to 8km of pipework in 45 vertical boreholes drilled to 70m.

Case Study: Earthdome

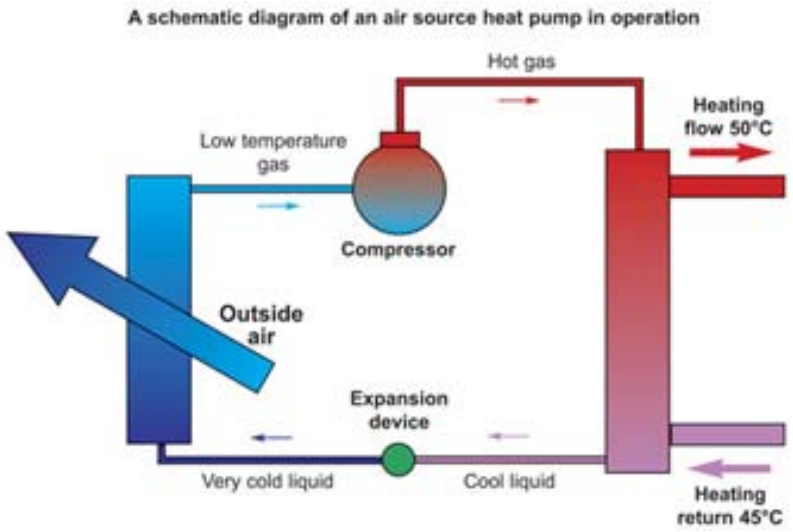
- **Background:**
  - London's first domestic buildings to use GSH – two 2-bed flats and two 1-bed flats
- **Financial**:
  - c. £5,000 per system + £200 for electricity to power the pumps.
- **Figures**:
  - System sized to meet 100% of development's space and water heating.
  - c. 20% CO_2 reduction

Credit: www.earthdomes.co.uk

Technical Details: 3 IVT Greenline C4 GSHP's running at 4kW per system with a CoP of 4

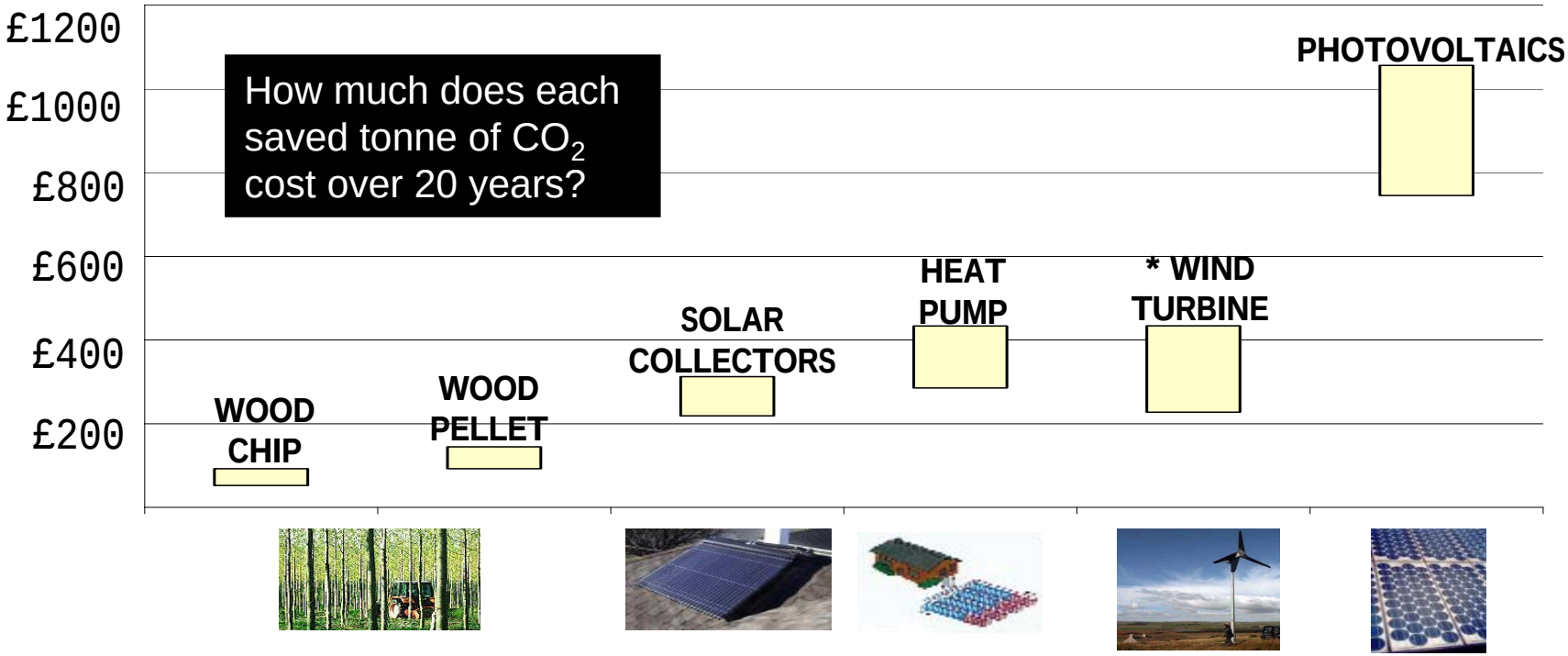
Air Source Heating and Cooling

- Technology:
  - Extracts low-grade heat from outside or inside air for space and water heating
  - COP between 2.5-4
- Considerations
  - Smaller space requirements than GSHP
  - Electricity for pump and fan operation
  - Cost



Credit: heatking

Life Cycle Costs of CO_2 Savings



* Based on low urban wind speeds - 4.5 m/s

Technology Summary

Technology	Key issues (installation and planning)
Solar PV	South facing roof, 30° pitch, no shading, high cost, visual impact
Solar Thermal	South facing roof, 30° pitch, year round hot water demand, visual impact
Biomass	Plant room, adjacent fuel store, delivery access, delivery frequency, supply, emissions
Wind Turbines	Open space, wind strength, flicker, noise, cost
Ground Source Heat Pumps	Open space, vertical/horizontal loops, plant room
Air Source Heat Pumps	External access, potential visual impact

Costs

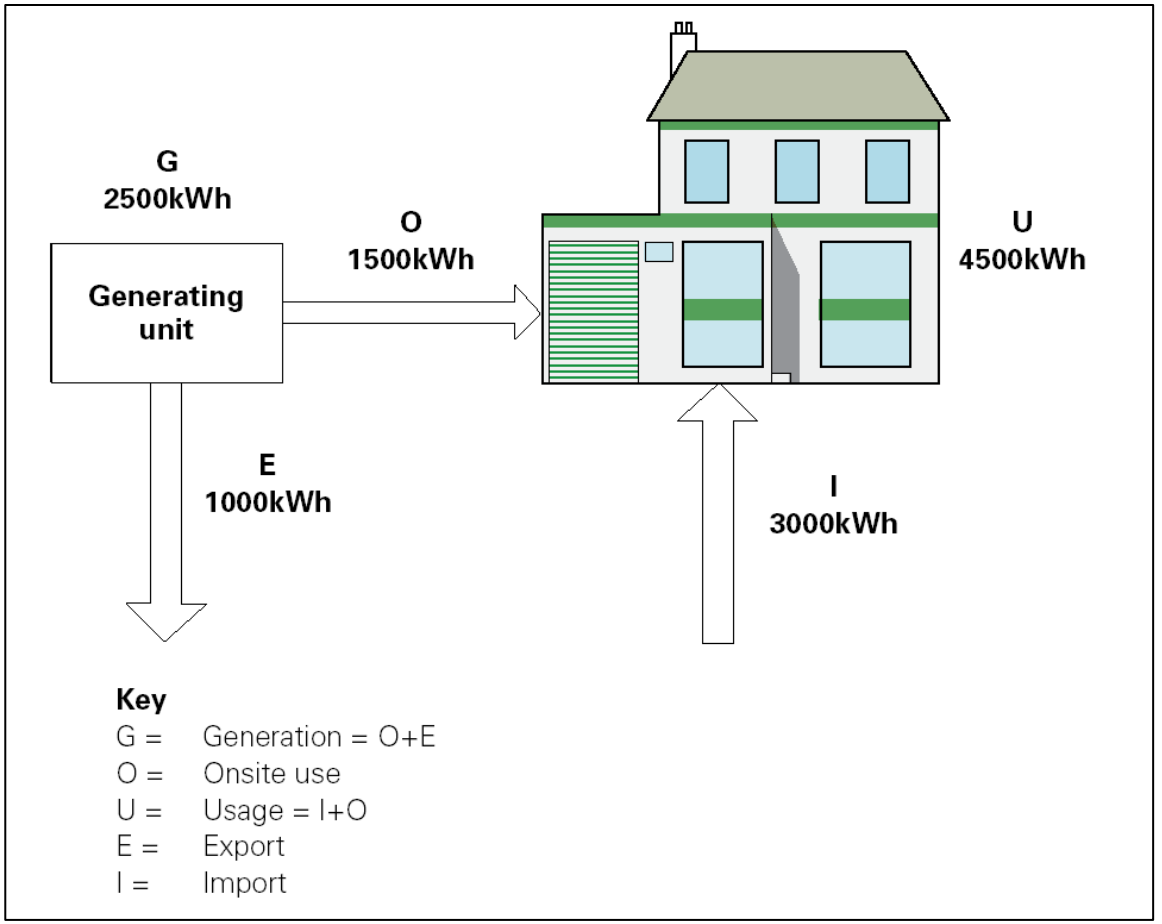
Technology	Cost	Typical System Cost (200m^2 office building)	Estimated offset (200m^2 office building)
Solar PV	£1,000 per panel	Limited by roofspace…£15,000 for 15 panels	7% energy; 15% CO_2
Solar Thermal			
Biomass			
Wind Turbines			
Ground Source Heat Pumps			
Air Source Heat Pumps			

Feed in Tariffs

- FIT will reward small scale renewables based on generation capacity
- Double reward for on-site generation and export
  - Can earn money when building not in use by exporting to the grid
  - This is in addition to reward for generation
- Long term assured energy prices

Installation	Generation tariff (p/kWh)	Export tariff (p/kWh)*
<4kWp new build	31	5
<4kWp retrofit	36.5	5
10-100kWp	28	5
100kWp-5MWp	26	5

Feed in Tariffs



Credit: Consultation on Renewable Electricity Financial Incentives 2009

ROCs vs FITs

- Scale of project
  - ROCs designed for wind farms!
- Ease of payment
  - Paperwork and Agents
- Price of payment
- Changeover in April 2010

Credit: www.windenergyplanning.com

Interest-free Loans

- £3,000 - £400,000 at 0% from the Carbon Trust
- Targeted at modernising energy services and equipment
- Available to all SMEs or companies below threshold for Carbon Reduction Commitment
- Repay over 4 years

Non-financial Incentives

- Communication and reporting
- Energy security concerns
- CSR
- Awards

gogreenrichmond UPON THAMES

MERIT ADVANCED EXCEPTIONAL

helping householders, businesses and communities
create a better environment