CARBON TRUST
Making business sense of climate change

Renewable energy sources

Opportunities for businesses

enter

Preface

Climate change is emerging as a major challenge for modern society. Government, business and wider society will all be affected and all have a role to play in tackling it.

The Carbon Trust provides simple, effective advice to help businesses take action to reduce carbon emissions.

This overview introduces the main sources of renewable energy and helps readers to assess whether using renewable energy is a viable option for their business.

Introduction

Using renewable energy sources releases no net greenhouse gases, and therefore does not contribute to climate change.

Releasing greenhouse gases (such as carbon dioxide) into the atmosphere causes climate change across the globe. Around 86% of the UK's carbon dioxide (CO_2) emissions originate from burning fossil fuels to produce energy. Using renewable energy sources ensures that no net greenhouse gases are released and helps to mitigate the effects of climate change.

As well as reducing carbon emissions[1], using renewable energy sources can make financial sense for businesses.

Renewable energy sources can be available on-site (such as wind and solar energy) or produced locally (such as biomass). Because it is produced under local control, the use of renewable energy ensures increased security of supply and can result in greater energy price stability for businesses, making it easier to predict future energy costs.

Did you know?

A typical small office of around 300m^2 uses around 54kWh/m^2/pa or 16,200kWh of electricity a year. Generating this energy from fossil fuels sends around seven tonnes of carbon dioxide into the atmosphere.

Getting started – the energy hierarchy

Renewable energy can offer significant environmental and economic benefits. It is part of the energy hierarchy – the order in which energy saving and 'green' energy measures should be prioritised. The energy hierarchy was conceived in 1998 as part of the Local Government Position Statement on Energy. This states that organisations and individuals should pursue energy issues in the following order:

1. Reduce the need for energy
2. Use energy more efficiently
3. Use renewable energy
4. Any continuing use of fossil fuels should be clean and efficient.

The first priority for a business is to reduce energy consumption before considering fuel switching to a renewable source. Anyone considering investing in renewable energy technologies should take the following steps:

1. Calculate heating and electricity needs and see if they can be reduced. Treating energy efficiency measures as a priority means that when the switch to renewable energy is made, it will be more likely to meet the reduced energy need in an affordable way. For further information on energy saving measures visit www.carbontrust.co.uk/energy
2. Once energy needs are known, consider whether renewable energy is appropriate to meet requirements. This overview will help determine whether it may be appropriate to switch to renewable energy and provides information on which technologies may be suitable. Guidance is also provided on the availability of financial support for installations.

[1] "Carbon emissions" is a shorthand term for carbon dioxide (CO_2) emissions used in international climate change negotiations. 1 tonne of carbon is equivalent to 3.67 tonnes of CO_2.

Renewable energy overview

What is renewable energy?

Renewable energy refers to energy that occurs naturally and repeatedly in the environment. This can be energy from waves, wind, the sun and geothermal heat from the ground. Renewable energy can also be produced from plant sources such as wood or crops grown specifically as a fuel.

Organic fuel sources can also be found in by-products from manufacturing and other processes. Under certain circumstances, these can be converted to renewable energy using environmentally acceptable processes. Biomass fuels are replaceable and while they liberate CO_2 when they are burnt, this is generally the same amount of CO_2 that was taken up when the biomass grew, so they are considered to be carbon neutral.

As the term suggests, renewable energy will not run out, unlike energy from fossil fuels.

Why do we need renewable energy?

In 2007, UK greenhouse gas emissions were over 636MtCO_2. The majority of the electricity and heat that we generate comes from fossil fuels. Electricity generation is responsible for over 543MtCO_2 equivalent per year.

This dependency on fossil fuels is driving the continued rise in carbon emissions leading to climate change. Our huge demand for fossil fuels is depleting our indigenous supplies of oil and gas, creating the need to import more of our fuel. This is leading to concerns over security of supply. In addition, the UK is subject to increasing fuel-price volatility as we become more exposed to world market fluctuations. This means that UK businesses are facing the prospect of interruptions in the supply of energy and continued uncertainty over its costs. These risks present potential barriers to future business growth.

For these reasons, renewable energy is becoming more attractive from both an economic and strategic viewpoint.

Did you know?

Small-scale renewables became eligible for feed-in tariffs in April 2010, and will be covered by the Renewable Heat Incentive from 2011.

UK renewable energy targets

The UK Government supports the development of renewable energy. The Renewables Obligation (RO) was introduced in April 2002 and is the Government's main mechanism for encouraging the uptake of renewable energy.

The Renewables Obligation requires licensed electricity suppliers to source a specific, and annually increasing, percentage of the electricity they supply from renewable sources. The percentage target began at 3% in 2003 and is rising gradually to 10% in 2010 and 15% by 2015.

Eligible generators of renewable electricity receive Renewable Obligation Certificates (ROCs) for each MW of electricity they generate. These can then be sold by the generator to suppliers so that they may fulfil their obligation. As a result, renewable electricity generation can be profitable for some scheme owners.

Why use renewable energy?

Producing your own renewable energy is not just a matter of 'environmental ideology'; it can offer a wide range of benefits to businesses including:

- Reduced reliance on fossil fuel, potentially lowering energy bills
- Providing possible backup if fossil fuel supply fails
- Improving businesses' 'green' credentials, leading to brand strengthening
- Providing the capacity to sell renewable electricity to an electricity distributor at a premium.

Businesses that can demonstrate that their energy supply comes from renewable sources will also be exempt from the Climate Change Levy (CCL) for that element of their energy use. A fact sheet on the CCL is available from the Carbon Trust (see right) or visit DEFRA's website, at www.defra.gov.uk

When considering investing in renewable energy, it is important to assess all of the above points in conjunction with each other. For example, ask what is the cost to the business of rising energy prices and how would a move to renewable energy sources affect adherence to any Climate Change Agreement.

It is also useful to take into account the rising value of renewable energy in the market. The Renewables Obligation can make renewable energy generation schemes profitable for some owners where they can generate and sell electricity under attractive commercial terms. Further information on the Renewables Obligation is available from the DECC website.

Further information

To order a copy of the Climate Change Levy (CTL005) and other publications relevant to renewable energy, contact the Carbon Trust.

Renewable energy opportunities

How to select a renewable energy technology

The use of any of the renewable energy technologies requires considerable thought and planning. Renewable energy projects can also take a long time to implement due to the relatively immature nature of the market. However, as already discussed, they can make both environmental and economic sense in the long term.

Understand the current usage

It is important to identify the appropriate renewable energy technology in the first instance. Factors to consider when deciding which technology to adopt include:

- What is the current mix of energy use? Is it mainly electricity or mainly heat?
- Is energy demand constant or does it fluctuate between night and day and between seasons?
- How much of the energy supply would ideally be replaced by renewables?

The energy mix

Assessing the energy mix helps a business to decide which renewable energy technology may be appropriate for them. For example, some renewables, such as wind and photovoltaics, just produce electricity. Others, such as solar water heating, just produce heat, while biomass, including anaerobic digestion can provide heat and electricity.

Consider the limitations

While renewable energy has many benefits, businesses need to be aware that there are limitations to its use. The major limitation is in the intermittent nature of certain renewable technologies. For example, wind turbines will not provide electricity when it is not windy, just as solar electricity cannot be generated at night. For this reason, either a grid connection or a battery bank may be required to provide backup and power storage.

Of the electricity we produce, only 4% currently comes from renewable sources

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Conduct a feasibility study

Once an appropriate renewable energy technology has been identified, a feasibility study can then be undertaken to determine the suitability of the technology in terms of its technical, economic and environmental performance. This should include:

- Assessing physical constraints (such as space and visual impact)
- Providing a cost-benefit analysis to determine the economic viability of the project
- Carrying out a risk assessment to address the issues associated with switching to a renewable energy supply.

Consideration of any planning permission issues should also form part of this study. Given the range of issues to be covered, these feasibility studies are usually undertaken by experienced consultants.

It is usually a good idea to combine the renewable energy feasibility study with an independent assessment of issues that come higher up the energy hierarchy, such as reducing the need for energy and energy efficiency. Such an assessment usually identifies significant cost savings as well as more cost-effective means of integrating renewable energy into an existing energy supply.

The following section provides an overview of each of the renewable energy sources to assist in selecting an appropriate technology.

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Wind power

In the UK, wind power is the most well developed and economically viable form of renewable energy. Wind turbines produce electricity by capturing the natural power of the wind to drive a generator.

Types of wind turbine

Large turbines can be seen around the UK countryside generating electricity to feed into the national grid, but small-scale turbines are also available to generate electricity on-site for individual businesses.

There are a variety of turbine types available including free-standing and building-mounted versions.

Building-mounted wind turbines (BUWT) are usually situated on the roof of a building. These turbines are an emerging technology and, while the market is now beginning to develop, they are still not currently widely deployed.

Free-standing turbines are also available in a range of sizes. Large (1-2MW machines) are used in wind farm developments. They are also appearing as single installations or small groups on existing industrial sites. Smaller <1MW turbines may be more suitable for on-site applications, and many of these have already been installed at businesses in the UK.

Did you know?

In the optimum circumstances, a 6kW turbine – comprising a rotating blade and generator – will produce around 15,000kWh/year, enough to power a small office.

Site suitability

To make a sound business case for investment, good wind conditions are required.

The Carbon Trust's wind estimator tool can help you calculate wind speed and turbine output. The tool can be accessed at www.carbontrust.co.uk/wind-estimator

To ensure a site is sufficiently windy, site wind conditions should be measured. Anemometry equipment can be installed prior to turbine erection. It may also be possible to refer to conditions monitored nearby, such as at UK Met Office stations.

Wind power is an intermittent source of electricity. Therefore all sites will need either a grid connection or battery to back up the power supply.

For roof mounted installations, a structural survey may be necessary to ensure the building can bear the additional load. Also, planning permission may be required before a turbine can be erected. Businesses should speak to their local council for advice before proceeding.

Costs and payback periods

The economic feasibility of wind turbines depends on wind speed. Generally the greater the wind speed, the more electricity will be generated and the faster the investment will be paid back as a result.

Case study

Supermarket turbine

A 600kW turbine has been installed at a supermarket site in East Kilbride. This is a turbine designed to exploit low wind speed with maximum efficiency. In return for a power purchase agreement, this project required no capital outlay for the host site.

Solar electricity (photovoltaics)

Photovoltaic panels (known as PV cells) convert sunlight into electricity. Many people find them visually attractive, and in an effective installation, they can demonstrate commitment to sustainability.

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Types of PV cell

Photovoltaic materials are usually solid-state semiconductors which generate electric current when exposed to light. Panels are available in a variety of glass-based packages, including traditional aluminium-framed panels, plain cladding, solar roof tiles and custom built glazing with integral PV cells.

Site suitability

PV cells are most effective in bright sunlight but are still able to produce some limited power in the UK on cloudy days. A PV system will not meet the entire electricity needs of a business, but could provide a significant percentage.

New-build sites are ideal for PV installations because architects are able to design the system to be truly integrated, for example, as roof tiles.

Retrofitting PV cells to existing buildings is also an option. However, the building must first be surveyed to ensure that it is able to take the additional load. This will incur an additional cost when compared with new-build, which must be taken into account along with installation costs.

PV cells should be installed so that they are oriented in a southerly direction to face between south-east and south-west. They should be installed in an unshaded area and tilted at an angle of around 30-40° to the vertical for optimal performance. Planning permission is not usually required for small-scale PV installations. However, there are exceptions (for example, on listed buildings). Businesses should always contact a planner at their local council for advice before proceeding.

Costs and payback periods

As a rule of thumb, the average output from a 1 kW peak solar cell in the UK is 700-850 kWh/year. A typical PV system of 1.5-2 kW peak would require 10-15m^2 of appropriate roof space.[1]

Maintenance costs for the cells are low and generally only involve cleaning the panels.

The estimated payback time for a system ranges significantly and will depend on circumstances of each site, though it should be noted that some payback periods can be quite lengthy. The estimated life of a PV cell is around 25 years.

For buildings with a limited lease, or life expectancy, the removal of the PV cells should also be included in the initial cost assessment for the technology.

Did you know?

A small office could generate 20% of its power with 40m^2 of cells.

[1] Source: Energy Saving Trust, Renewable Energy fact sheet (EC39), December 2005.

Solar water heating

Solar water heating is a well known renewable energy technology in the UK. It can be used to provide hot water at temperatures of between 55 and 65°C.

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Solar thermal or solar hot water systems work by absorbing energy from the sun and transferring it, using heat exchangers, to heat water.

Types of solar water heating system

There are three main types of solar heating collector that are suitable for mounting on buildings. These are:

- **Flat-plate collectors** – a sheet of black metal that absorbs the sun's energy encases the collector system. Water is fed through the system in pipes which conduct the heat to the water.
- **Evacuated tubes** – a series of parallel glass heat tubes grouped together. Each tube contains an absorber tube. Sunlight passing through the outer glass tube heats the absorber tube contained within it, and in doing so, the heat is transferred to water flowing through the tube.
- **Solar matting** – a range of extruded hollow sections of flexible black material that can be used for solar collection. Water passes through the hollow tubes, absorbing the heat from the sun.

Site suitability

Ideally, systems should be roof-mounted and oriented to face between south-east and south-west. It is also advantageous to be able to locate equipment (such as the heat exchangers) in the roof space close to the collectors. A system for a small office would use around 4m^2 of roof space, so this must be taken into account in the design of a building. Retrofitting is a more costly option due to the complex nature of installation. However, a solar thermal system could be integrated into an existing gas-boiler system.

Planning permission is not usually required for small-scale solar water heating systems. Businesses should contact a planner at their local council for advice before proceeding.

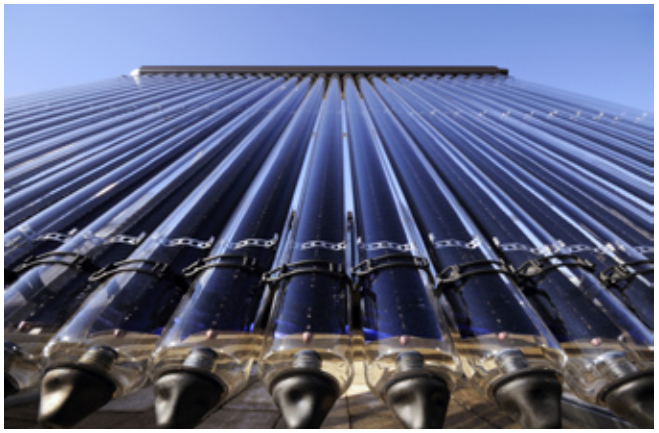
Costs and payback periods

Solar hot water heating is only truly economically viable in a business where there is a sufficiently high level of demand for hot water, such as in a canteen.

Generally, solar hot water is more economical in larger systems.

Did you know?

An efficient solar water heating system can meet up to 60% of a building's hot water needs.



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Biomass

Around 30% of the UK's overall 15% renewable energy target could come from biomass heat and electricity in 2020*.

Biomass refers to the use of a wide variety of organic material such as wood, straw, dedicated energy crops, sewage sludge and animal litter for the generation of heat, electricity or motive power.

It can be viewed as a form of stored solar energy. The sun's energy is captured and stored via the process of photosynthesis in growing material. This energy is released by processes of conversion such as combustion (burning) or fermentation and distillation (to produce liquid transport fuels).

Biomass is a low carbon fuel source because the carbon dioxide released when biomass is converted for energy purposes is largely offset by that absorbed by the organic material during its growth. With the appropriate management this can be recaptured with new growth. However, other energy inputs may affect this carbon balance, for example via the energy used by vehicles harvesting or transporting the biomass to its point of use.

Combusting biomass fuels such as wood, straw or energy crops (for example, willow coppice or specific types of grasses) to raise heat or steam for space or process heating is one of the most cost-effective applications for biomass from a cost-of-carbon point of view at the present time.

Biomass heating plant can come in a wide range of sizes from a few kWs to many MW of heat. For biomass CHP (combined heat and power), sizes tend to range from around 1MW to many MW of electrical generation capacity.

At the smaller sizes, fuel is usually supplied as wood pellets or wood chips. Hand-fed, log-based systems are rare outside the domestic sector. At the larger scale, wood chip is one of the most common fuels at present.

Further information

For further details on application and opportunities in the UK, see the Carbon Trust's publication, Biomass heating: a practical guide for potential users (CTG012).

* Source: DECC, 2010

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Site suitability

To install a biomass boiler or CHP plant, a reliable and accessible source of fuel must be located, as well as a suitable supplier.

Biomass is a particularly attractive generation option for businesses that produce a by-product that can be used as a fuel, either alone or in combination with bought-in biomass fuels.

Adequate space is also necessary to accommodate fuel storage and delivery. For example, a 20kW thermal boiler typically consumes 0.6m^3 of wood chip daily in winter, and the volume of one tonne of dried wood is about 6m^3. If possible, the fuel-transfer distance should be minimised. Therefore, the boiler will often need to be located on the ground floor or in the basement to be close to the fuel store. The biomass boiler itself will be larger than an oil or gas-fired boiler and boilerhouses for CHP plant will be larger to accommodate the additional generation equipment.

Expert advice from relevant consultants should also be sought to ensure that any system that is installed will comply with legislation such as the Clean Air Act, building regulations and local planning rules.

The electrical power output of biomass CHP installations ranges from 1MW to over 100MW. For each MW of electrical generation around 3MW of heat will be produced. Typically, the economics of biomass CHP installations are based on the capacity to use the heat rather than the electrical production.

Costs and payback periods

The capital cost of a biomass boiler is dependent on the size, fuel type used and level of automation of the system. The payback period for a biomass heating boiler also depends on the cost of fuel (which can be zero if a business produces a combustible by-product) and the cost saving of the displaced fuel. In good circumstances, payback can be relatively short, although this varies considerably from project to project.

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Anaerobic digestion

Anaerobic Digestion (AD) is one method for converting biomass. It is a process in which bacteria break down organic material in the absence of oxygen to produce a methane-rich biogas, which can be combusted to generate electricity and heat. The organic material used may include industrial wastewater, manure, garden waste and organic food residues such as vegetable peelings.

AD technology uses tank-based systems in which a bacterial culture is maintained in anaerobic conditions and the organic feedstock introduced, such that a continuous digestion process is maintained. The bacterial population is robust and comprises a natural mix of organisms to maximise degradation.

AD is one of the few waste-to-energy processes eligible under the Renewables Obligation. While this technology has limited general application, if a company produces high-strength liquid waste, AD can be an attractive option as it takes waste with a high disposal cost and turns it into an increasingly valuable renewable energy source.

Site suitability

Due to the complexity of permitting sites to accept wastes from external sources, only sites that produce high-strength liquid organic wastes are suitable. These must also have enough room for the AD plant.

Planning permission may be required when installing an AD system. Businesses should contact a planner at their local council for further advice.

Specialist advice from relevant consultants should also be sought regarding emissions and odour control.

Costs and payback periods

AD systems vary greatly in price depending on the complexity of the plant and the speed at which the feedstock is treated. Despite relatively high cost, payback times for installations tend to be short, even less than five years. This is because the avoided cost of waste disposal is usually high, which reduces the payback time of the project.

Ground-source heat pumps

Ground-source heat pumps (GSHPs) take low-level heat which occurs naturally underground and convert it to high-grade heat by using an electrically-driven or gas-powered heat pump.

This heat can then be used to provide space heating for a building. GSHPs can also be driven in reverse to provide comfort cooling.

The heat is collected through a series of underground pipes laid about 1.5m below the surface, or from a borehole system. In both of these options, water is re-circulated in a closed loop underground and delivered to the heat pump, which is usually located inside the building.

Heat pumps cover a wide range of capacities, from a few kW to many hundreds of kW machines that heat or cool large, multi-storey buildings.

Site suitability

The installation of GSHPs requires a large amount of civil engineering works, such as sinking bore holes (50m+) or digging 1-2m deep trenches to house the collector pipe. The feasibility of doing this will depend on the geological conditions at the site.

Connecting a GSHP into an existing heating system is often constrained by the requirement of the existing system to operate at temperatures higher than that delivered by the GSHP. This can often be overcome, but at an increased cost. GSHPs are generally best suited to new-build projects, where they can be included in the building design.

A 5-10kW GSHP system would be large enough to heat a small office.

Case study

IKEA installs GSHP

The IKEA Distribution Centre in Peterborough has a large GSHP installation. Here, there are over 8 kilometres of underground pipework installed in 45 vertical bore holes (70m deep) to provide the heating and cooling required for the building.

Air-source heat pumps

Air-source heat pumps (ASHPs) take low-level heat, which occurs naturally in the air, and convert it to high-grade heat by using an electrically driven or gas-powered pump.

Such systems typically use an air-source collector, which is located outside the building. The heat generated can be used to provide space heating for a building. ASHPs can also be driven in reverse to provide comfort cooling.

Site suitability

Installation of an ASHP involves siting an external unit and drilling holes through the building wall. This may require planning permission. Some degree of additional pipework may also be required. ASHPs are a good alternative to GSHPs where lack of space is an issue.

The performance of an ASHP varies dramatically with the external air temperature and this should be taken into account when considering the use of an ASHP system. In mild climates, such as that in the UK, frost will accumulate on the system's evaporator in the temperature range 0-6°C, leading to reduced capacity and performance of the system.

Costs and payback periods

The potential payback periods for ASHPs improve dramatically when the current boiler is due for replacement and installation of an ASHP is considered as part of this process. The expected life of an ASHP is between 10 and 15 years.

Further information on ASHPs can also be found on the Heat Pump Association website at www.feta.co.uk/hpa

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Small-scale hydro-electric power

Most people are familiar with large-scale hydro-electric power involving large dams and reservoirs. Small-scale hydro-electric power systems, however, are still capable of producing sufficient power for industrial use or in commercial buildings.

Small-scale hydro-electric power has a generating capacity of less than 100kW. It uses water flowing through a turbine to drive a generator that produces electricity.

Site suitability

This technology is highly site-specific as it is dependent on being near a body of water that is both flowing and has a drop in level that can be exploited.

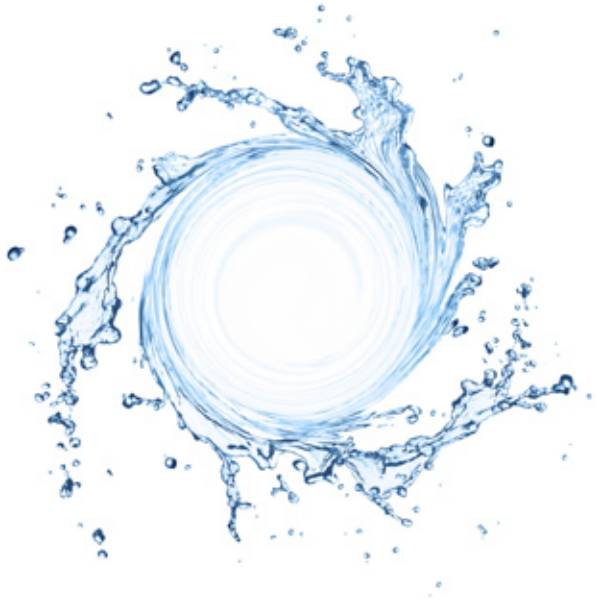
Even at a suitable site, it will be necessary to undertake some development work to install the system. Expert advice will be required to devise this system and to apply for planning permission and a water abstraction licence from the Environment Agency (in England and Wales), SEPA (in Scotland) or Environment and Heritage Service (in Northern Ireland).

Costs and payback periods

The faster the water flows and the greater the drop, the more electricity can be generated as the water drives the turbine. This will affect the viability of the installation.

Schemes have long operating lives. Civil engineering works for large and small schemes can last for decades with suitable maintenance, whereas mechanical and electrical plant can last between 15 and 50 years.

For small-scale schemes, cost of implementation relative to electricity costs may be a key issue. Since costs vary according to site-specific conditions, capital costs can vary widely.



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Renewable energy funding and grants

There is a range of funding sources for renewable energy projects, together with ways to minimise the initial cost. Useful sources of information are provided here.

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ECAs

Enhanced Capital Allowances enable businesses to claim 100% tax relief in the first year on specific technology products, such as solar water heating, biomass boilers and heat pumps.

Visit www.eca.gov.uk for details.

Loans

The Carbon Trust offers loans to SMEs for energy efficiency projects. Although renewable energy installations do not necessarily make a site more efficient, they may qualify for loans when they displace grid electricity used on-site, or heat produced for use on-site by less efficient means (both in terms of cost and as emitted CO_2).

Visit www.carbontrust.co.uk/loans

The Community Renewables Initiative

Administered by the Severn Wye Energy Agency, the Community Renewables Initiative (CRI) helps communities devise and deliver renewable energy schemes.

For further information, visit www.swea.co.uk

Low Carbon Buildings Programme

The DTI's Low Carbon Buildings Programme will provide grants for microgeneration technologies to public, not for profit and commercial organisations. It is managed by the Energy Saving Trust and covers all of Britain.

The technologies covered by the programme include solar PVs, wind turbines, small-scale hydro-electric power, solar thermal hot water, ground/water/air-source heat pumps and bio energy, among others. For further information, visit www.lowcarbonbuildingsphase2.org.uk/

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Useful websites

For further information on the technologies discussed in this guide, the following organisations may be useful. Some have information about suppliers and available grants.

British Wind Energy Association
www.bwea.com

Heat Pump Association
www.feta.co.uk/hpa

The British Hydropower Association
www.british-hydro.org

Department for Environment, Food and Rural Affairs
www.defra.gov.uk/environment

Environment Agency
www.environment-agency.gov.uk

Scottish Environment Protection Agency
www.sepa.org.uk

Environment and Heritage Service
www.ehsni.gov.uk

Further information

To order any of the publications listed within this overview, or for further information about renewables or saving energy, contact the Carbon Trust on 0800 085 2005 or visit www.carbontrust.co.uk/energy

Next steps

In summary, there are seven steps you should take when assessing the renewable energy options for your business.

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Step 1. Understand your energy requirements

The first stage is to understand what your building energy requirements are and which renewable energy technologies may be able to help you meet these. At this stage you should also be considering energy efficiency measures for your building, which will enable you to meet a larger proportion of your energy requirements using a renewable technology.

Step 2. Understand your site

You will now be able to compare your shortlist of possible technologies against the characteristics of your building. You will need to consider issues such as space, lease conditions and building structure.

Step 3. Seek specialist advice

Once you have identified a renewable energy technology that you think will be compatible with both your building and energy requirements, you will need to seek specialist advice to carry out a feasibility study. This will determine the technical and economic viability of the project.

Step 4. Identify a supplier/installer

Following the identification of a feasible technology, you will need to identify a supplier/installer. The websites listed in this overview may help you with this.

Step 5. Planning

At this stage you will have identified both a suitable technology and supplier. You may now need to take further action such as seeking planning permission, or obtaining licences from the Environment Agency. Again, you may need to seek specialist advice to guide you through these procedures.

Step 6. Implementation

Once all planning and legal issues have been resolved the project can be implemented. This may involve considerable installation works and you should consider how this will affect your business.

Step 7. Monitor and maintain your system

Once your system is up and running you will need to ensure that it is carefully maintained and is operating at maximum efficiency.

It is likely that you will need specialist support from a contractor or consultant to carry out feasibility studies and see any viable projects through to implementation.

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Glossary

Air-source heat pump (ASHP)
A pump system that raises the ambient heat contained in air to a useful temperature to be used in heating a building.

Anaerobic digestion (AD)
A process whereby bacteria break down organic material in the absence of oxygen to produce a methane-rich biogas.

Biomass boiler
A boiler that burns fuels such as wood chips, straw and agricultural residues.

Building-mounted wind turbine
A small wind turbine that is mounted on a building, usually attached to the building roof.

Clean Air Act
Legislation covering general air pollution. The act contains regulations for emissions to air; failure to comply is an offence.

Climate Change Agreement
An agreement allowing a reduction in the Climate Change Levy in return for reducing emissions/energy use.

Climate Change Levy
A levy on the use of energy in industry, commerce and the public sector.

Energy hierarchy
A prioritisation of energy related issues.

Feasibility study
A study undertaken to determine the technical, economic and environmental viability of a project.

Ground-source heat pump (GSHP)
A pump system that takes the low-level heat occurring naturally underground and raises its temperature to a level that is sufficient to heat a building.

Hydro-electric power
The use of fast-flowing water to drive a turbine to generate electricity.

Payback period
The length of time taken to recover the cost of an investment through the returns attributable to it.

Photovoltaic cells
A silicon-based material that uses the energy in sunlight to create an electrical current.

Renewable energy
Energy that occurs naturally and repeatedly in the environment.

Renewables Obligation
A Government initiative requiring electricity suppliers to source an annually increasing specified percentage of electricity from renewables.

Renewables Obligation Certificate
A tradeable certificate issued for each MWh of renewable energy generated.

Retrofitting
Fitting equipment into an existing building.

Solar water heating
A method of heating water using the sun's thermal energy.

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Go online to get more

The Carbon Trust provides a range of tools, services and information to help you implement energy and carbon saving measures, no matter what your level of experience.

Carbon footprint calculator – Our online calculator will help you calculate your organisation's carbon emissions.

www.carbontrust.co.uk/carboncalculator

Interest free loans – Energy Efficiency Loans from the Carbon Trust are a cost effective way to replace or upgrade your existing equipment with a more energy efficient version. See if you qualify.

www.carbontrust.co.uk/loans

Carbon surveys – We provide surveys to organisations with annual energy bills of more than £50,000*. Our carbon experts will visit your premises to identify energy saving opportunities and offer practical advice on how to achieve them.

www.carbontrust.co.uk/surveys

Action plans – Create action plans to implement carbon and energy saving measures.

www.carbontrust.co.uk/apt

Case studies – Our case studies show that it's often easier and less expensive than you might think to bring about real change.

www.carbontrust.co.uk/casestudies

Events and workshops – The Carbon Trust offers a variety of events and workshops ranging from introductions to our services, to technical energy efficiency training, most of which are free.

www.carbontrust.co.uk/events

Publications – We have a library of free publications detailing energy saving techniques for a range of sectors and technologies.

www.carbontrust.co.uk/publications

Need further help?

Call our Customer Centre on 0800 085 2005

Our Customer Centre provides free advice on what your organisation can do to save energy and save money. Our team handles questions ranging from straightforward requests for information, to in-depth technical queries about particular technologies.

* Subject to terms and conditions.

The Carbon Trust is a not-for-profit company with the mission to accelerate the move to a low carbon economy. We provide specialist support to business and the public sector to help cut carbon emissions, save energy and commercialise low carbon technologies. By stimulating low carbon action we contribute to key UK goals of lower carbon emissions, the development of low carbon businesses, increased energy security and associated jobs.

We help to cut carbon emissions now by:

- providing specialist advice and finance to help organisations cut carbon
- setting standards for carbon reduction.

We reduce potential future carbon emissions by:

- opening markets for low carbon technologies
- leading industry collaborations to commercialise technologies
- investing in early-stage low carbon companies.

www.carbontrust.co.uk
0800 085 2005

ACT ON CO_2 is the Government's initiative to help individuals understand and reduce their carbon footprint. Visit http://actonco2.direct.gov.uk for more information.

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CARBON TRUST
Making business sense of climate change