# 6 Renewable energy

**KEY MESSAGES**

There are a variety of renewable energy technologies that can be installed to supplement a development's energy needs

Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies.

6.1 This guidance covers Stage 3 of the energy hierarchy. Stage 3 involves considering how renewable energy technologies can be used to further reduce the carbon dioxide emissions of a development. You will find information in this section on the types of renewable energy technologies that are available and when they are most appropriate. Stages 1 and 2 of the energy hierarchy – energy efficiency and decentralised energy & CHP – are dealt with in sections 2, 3 and 4.

6.2 Core Strategy policy CS13 - *Tackling climate change through promoting higher environmental standards* encourages developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. Paragraph 13.11 states that developments will be expected to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation unless it can be demonstrated that such provision is not feasible. The 20% reduction should only be attempted once stages 1 and 2 of the energy hierarchy have been applied.

**WHAT DOES THE COUNCIL EXPECT?**

All developments are to target at least a 20% reduction in carbon dioxide emissions through the installation of on-site renewable energy technologies. Special consideration will be given to heritage buildings and features to ensure that their historic and architectural features are preserved.

When assessing the feasibility and viability of renewable energy technology, the Council will consider the overall cost of all the measures proposed and resulting carbon savings to ensure that the most cost-effective carbon reduction technologies are implemented in line with the energy hierarchy.

## Renewable energy technologies

### Solar/Thermal Hot Water Panels

#### What is it?

A system made of flat plate collectors or evacuated tubes which allow water to flow through and be heated by the sun's rays.


Solar hot water tubes


Solar hot water plates

#### What does it do?

Uses the sun's heat to warm water - up to 85 degrees Celsius

#### What issues should I consider?

- Flat plate systems are cheaper. Evacuated tube systems are more efficient so need less space.
- Generally used for hot water where approximately 4sq m of solar panel per household is sufficient with 80 litres of hot water storage.
- Aim to minimise pipe lengths as this reduces heat losses.
- Not ideal with combined heat and power as it can reduce the efficiency of the CHP system.

#### Where might this technology be appropriate?

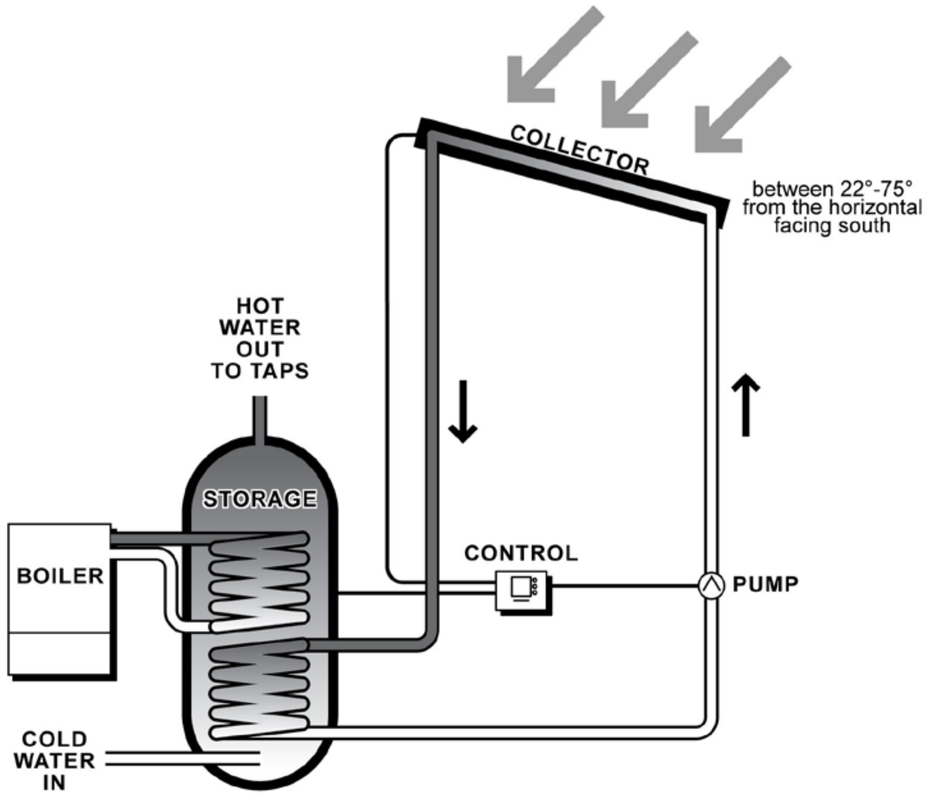
- Suitable for developments with all year hot water demands.
- South facing at 30-40 degrees is ideal, but as the panels do not rely on direct sunlight they can still be efficient at other angles.
- Can be fitted to existing buildings, but need to consider additional weight of the panels and compatibility of heating/hot water system

**WHAT DOES THE COUNCIL EXPECT FOR THIS TECHNOLOGY?**

- Where space allows, panels are to meet 100% of the site's summer hot water needs, which equates to 50-60% of the annual demand.
- Applicants are to confirm the number and size of panels or the overall square meters to be installed

- The accompanying heating system such as the top up boiler must be compatible. For example, it must include a storage tank and be able to use pre-heated water.
- Larger schemes should use a central system
- A meter is to be installed on the system for monitoring

**Figure 6. Solar Hot Water Heating Schematic**



## Photovoltaic (PVs)

### What is it?

Photovoltaic cells are panels you can attach to your roof or walls. Each cell is made from one or two layers of semiconducting material, usually silicon. There are a number of different types available e.g. panels, tiles cladding and other bespoke finishes.


Solar PV roof tiles


Solar PV panels,

### How does it work?

When light shines on the PV cell it creates an electric field across the layers. The stronger the sunshine, the more electricity is produced.

### What issues should I consider?

- PV works best in full sunlight.
- Consider movement of shadows during the day and over the year. Overshadowing can impact the overall performance of the PV array.
- The best commercial efficiency is 22%.
- In general 1sq m of conducting material such as crystalline array will provide an output of 90-110 kWh per year.

### Where might this technology be appropriate?

- On a roof or wall that faces within 90 degrees of south, and isn't overshadowed by trees or buildings. If the surface is in shadow for parts of the day, your system will generate less energy.
- On top of a green or brown roof is ideal because the cooler temperature created locally by the vegetation improves the efficiency of the solar panel.
- Can be fitted to existing buildings, but need to consider additional weight of the panels.

**WHAT DOES THE COUNCIL EXPECT FOR THIS TECHNOLOGY?**

- Preference is for PVs to be flush to the roof or wall, but considerations will include the efficiency of the panel/s and whether they are visible
- Applicants are to confirm the number and size of panels or the overall square meters to be installed
- A meter is to be installed on the system for monitoring

## Ground Source Heat Pumps (GSHP) or geothermal

### What is it?

A network of underground pipes, which circulate a mixture of water and chemicals (to prevent freezing) through a loop and a heat exchanger.

### How does it work?

The heat from the ground is absorbed by the liquid that is pumped through the buried pipes. A heat exchanger in the heat pump extracts the heat from the liquid and transfers it the water in the building's heating system which can be used for central heating and hot water. In the summer, when the ground is cooler than the air, the system can be reversed to provide cooling.

### What issues should I consider?

- There are horizontal and vertical systems.
- Horizontal systems, also known as loop systems use trenches
- Vertical systems use boreholes which require a ground survey and a drilling license from the Environment Agency
- There are a range of permits and consents that might be required
- Generally provides heat at lower temperatures (30-50 degrees Celsius) than normal gas boilers.
- Buildings need to be well insulated for a GSHP to be effective
- The pump requires electricity to run so this technology will not be renewable or energy efficient in all developments.

### Where might this technology be appropriate?

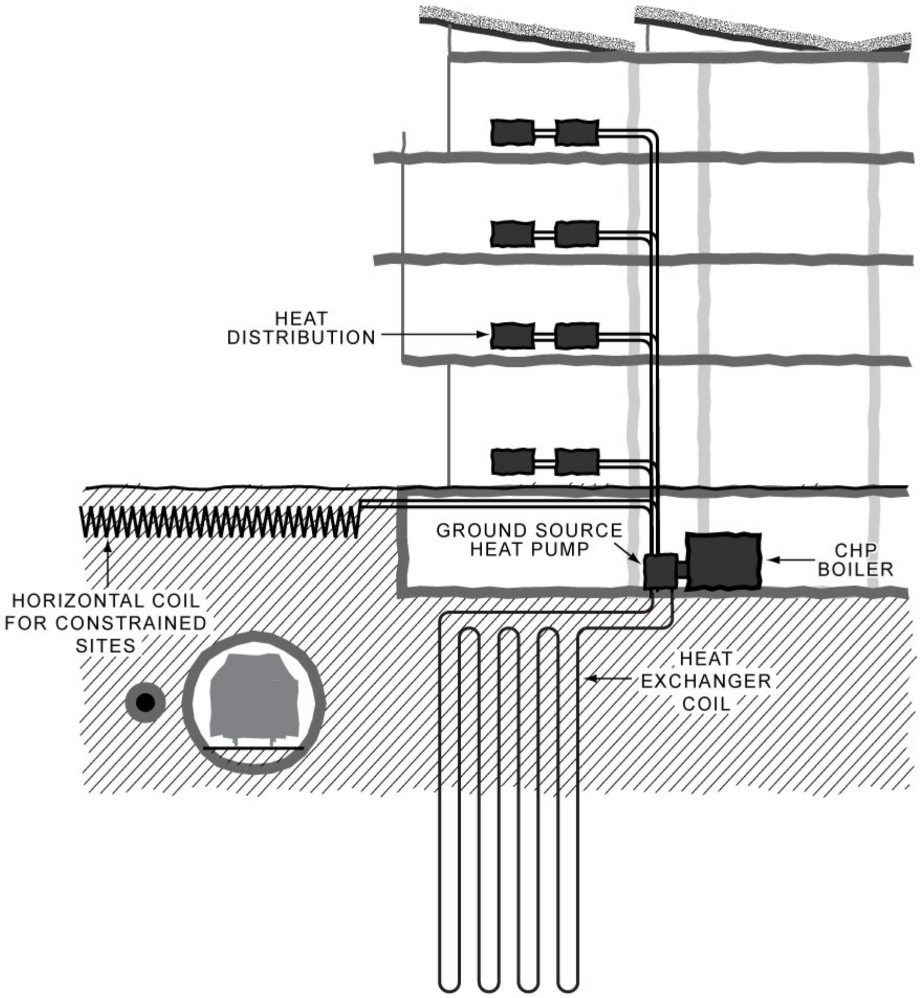
- The lower temperatures mean that GSHPs are well suited for underfloor heating
- Ideal for buildings which need heating in winter and cooling in summer

**WHAT DOES THE COUNCIL EXPECT FOR THIS TECHNOLOGY?**

- Evidence is to be provided to demonstrate that the local geology can accommodate the necessary excavation
- Consider how much electricity is required to work the pump versus the energy savings of providing heat or cooling. The carbon content of the electricity required to run the pump could be higher than the gas need to run a traditional gas boiler. The ratio of heat or cooling produced to the energy used to produce the heat is called the coefficient of performance (COP). For example, a heat pump which uses 1kW of electricity to produce 4kW of usable energy has a COP of 4 and is therefore 400% efficient. GSHPs need to have a COP of 4 or more to be considered renewable.

- When considering the carbon efficiency of a heat pump system the Council will take into account research and evidence of past performance of heat pumps and the seasonable performance.
- A meter on the system for monitoring

**Figure 7. Ground Source Heat Pump Schematic**



## Air source heat pumps (ASHP)

### What is it?

A heat pump that extracts heat from the outside air to heat the interior of a building or to heat hot water. It can also extract the heat from inside a building to provide cooling.

### How does it work?

Air to water heat pumps operate on a similar principle to an ordinary refrigerator. Heat from the atmosphere is extracted by an outdoor unit and is absorbed by a refrigerant solution which is then compressed to a high temperature. The heat generated is used by the indoor unit to create hot water for a traditional heating and hot water system.

Air to air heat pumps work in a similar way, but instead of generating hot water, the heat from the compressed refrigerant solution is turned into hot air by an indoor unit which is used to heat the building.

### What issues should I consider?

- ASHPs need electricity to run
- Can be less efficient than GSHPs as air temperature is more variable, i.e. colder in the winter when more heat needs to be extracted from the air.
- Consider the noise and vibration impact.
- Consider the visual impact.

### Where might this technology be appropriate?

- Where there is no gas connection.
- Where the heating demand is isolated and for a short period of time.
- Can produce cool air as well as heat, so could be suitable in buildings which may otherwise require air conditioning

**WHAT DOES THE COUNCIL EXPECT FOR THIS TECHNOLOGY?**

- Consider how much electricity is required to work the pump versus the energy savings of providing heat or cooling. We will expect carbon calculations to show that that their use for heating is more efficient than gas. Otherwise they will not be acceptable. The calculations will be based on the co-efficient of performance (COP) and the carbon content of electricity and gas. ASHPs need to have a COP of more than 4 to be more efficient than a conventional heating system.
- When considering the carbon efficiency of a heat pump system the Council will take into account research and evidence of past performance of heat pumps and the seasonable performance.
- Noise assessment and mitigation report to be submitted
- A meter on the system for monitoring

## Biomass heating and power

### What is it?

A boiler which generates heat for central heating as well as hot water or a system which generates heat and electricity, known as a Combined Heat and Power (CHP) system.

### How does it work?

Produces heat or heat and electricity by burning organic materials (such as wood, straw, energy crops or liquid biofuels). Natural gas can also be used, however, this will be considered to be a 'low carbon technology' rather than renewable, as gas is a fossil fuel.

### What issues should I consider?

- The suitability of this technology will depend on the:
- local air quality
- need for air quality mitigation measures
- source and carbon intensity of processing the fuel
- emissions generated from transporting the fuel
- the impact on air quality – biomass boilers releases higher levels of nitrogen oxides (NOx) and particulates than conventional gas fired boilers or CHP systems
- There are a range of permits and consents that might be required
- Space is needed for power plant and fuel store
- Servicing arrangements for fuel delivery and transfer
- Possibility of sharing the system with other developments or consider establishing of a Community Combined Heat and Power scheme (CCHP)

### Where might this technology be appropriate?

Biomass fed CHP systems are generally only proven on very large scale.

**WHAT DOES THE COUNCIL EXPECT FOR THIS TECHNOLOGY?**

- Boilers must be accredited as 'exempt appliance' under the Clean Air Act 1999
- Technical information relating to the biomass boiler/CHP will be required
- All biomass boilers and CHP will require an air quality assessment, including location and height of flues, details of emissions and how the emissions can be mitigated

- Biomass boilers and CHP are required to be designed, operated and maintained in accordance with best practise measures to minimise emissions to air. (Please refer to the section on Air Quality in the CPG6 Amenity for more detailed information)
- Evidence of potential fuel suppliers – a local fuel source is preferable
- Fuel is to be carbon neutral. Preparation of fuels must be treated and handled appropriately to ensure there are zero carbon emissions e.g. natural drying process not one that uses energy
- A meter on the system for monitoring

**Wind turbines**

**What is it?**

Blades or turbines which are rotated by the power of the wind.


Vertical axis turbine


Horizontal axis turbines

**How does it work?**

The wind turns the blades of the turbine to produce electricity. Horizontal or vertical axis turbines are available

**What issues should I consider?**

- Require a certain level of wind to make them feasible which is often difficult in London where there large obstacles such as buildings and trees which distort the flow of wind.
- If poorly located could use more energy than they generate.
- Need to be orientated towards the prevailing wind.
- Noise, vibration and flicker.

> **Flicker:**
> Rotating wind turbine blades can cast moving shadows when the sun is in a low position behind the turbine

**Where might this technology be appropriate?**

Could be suitable for low density developments or those with large amounts of open space e.g. schools and playing fields.

**WHAT DOES THE COUNCIL EXPECT FOR THIS TECHNOLOGY?**

- An assessment of the impact on neighbouring properties, particularly flicker, noise and vibrations
- A wind study and feasibility report.
- A meter on the system for monitoring

### What is the feed-in tariff?

6.3 The feed-in tariff is a scheme where energy suppliers make regular payments to householders and communities who generate their own electricity from renewable or low carbon sources. The scheme guarantees a minimum payment for all electricity generated by the system, as well as a separate payment for the electricity exported to grid. These payments are in addition to the bill savings made by using the electricity generated on-site.

6.4 When considering the viability of the installation of technologies, the financial benefits of the feed-in tariff must be considered.

### Further information

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| The London Energy Partnership | Has produced a toolkit which explains how renewable energy can be integrated into new developments: London Renewables Toolkit - Integrating renewable energy into new developments: Toolkit for planners, developers and consultants<br>Available from the London Energy Partnership website<br>www.lep.org.uk |
| REAL<br>Renewable Energy Action for London | A web resource run by Creative Environmental Networks which provides information on installing renewable energy for home owners, architects and developers.<br>www.cen.org.uk/REAL |
| Environmental Protection UK and LACORS | Have produced guidance on biomass and air quality. The guidance provides background material on the issues involved, and details procedures for assessing and managing the effects of biomass on air quality – specifically nitrogen dioxide (NO2) and particulates (PM10 and PM2.5).<br>There are a number of guidance leaflet available on their website:<br>• 'Biomass and Air Quality Guidance for Local Authorities'<br>'Biomass and Air Quality, Developers' Information Leaflet'<br>www.environmental-protection.org.uk/biomass |
| The Mayor of London | Mayor's Air Quality Strategy includes emissions standards for new biomass and CHP equipment which will be implemented by the GLA<br>www.london.gov.uk/publication/mayors-air-quality-strategy |