APPENDIX 10: Renewable Generation

You may be interested in renewable generation for your building. Electricity and heat can be generated separately or as combined heat and power in a number of different, renewable or sustainable ways. These are often quite expensive to install, and have long payback periods. However, with funding opportunities such as the Green Deal and FIT, these may be things to consider.

There is a lot of information about renewable technologies on the NEP website, the following paragraphs provide an overview of some of the more commonly used technologies.

ELECTRICITY

PHOTOVOLTAIC PANELS

Solar panels used to generate electricity are called photovoltaic, or PV. These panels work by giving some of the energy in photons (particles of light) to electrons, exciting them so that they flow as electricity. This relies on a semiconducting material, which can be made from abundant sources, such as silicon.

The feed-in tariff scheme will improve the payback of any PV system. Generally speaking, paybacks can vary between 10 and 20 years, and each case should be assessed individually. You can see an example about different PV installation sizes above, as well as their annual generation and pay-back.

Required information	Small System	Medium System	Large System
Size of system (kWp)	5.64	11.75	16.45
Active PV Surface Area (m^2)	40	82	114
Chosen energy technology	**PV**		
Estimated annual generation (kWh)	4,595	9,686.7	13,705
Estimated total system cost (£) ex. VAT	14,100	29,289	39,645
Payback time (years) applying the current FITs rate	**11.2**	**9.9**	**10**
Annual CO_2 savings from chosen renewable energy technology (tonnes)	2.27	4.8	6.77
System Efficiency (%)	13	12	12.3

* The funding rates (FITs) used in the calculations are from 1st July 2013

WIND TURBINES

Wind turbines harness power from the wind to generate electricity. The UK has the largest wind resource in Europe which offers a great potential to generate renewable electricity. The energy in wind can be used to power a generator which makes electricity using magnets. These magnets should be very strong in order that the turbine can be as efficient as possible.

There are a number of different types of wind turbines. The large national grid turbines are not the only style. It is possible to have turbines that rotate on a different axis, which are usually considered for small installations. Pay back periods vary, and are similar to PV.

Please, find below an example of a small scale wind turbine in a typical UK site (for a 5m/s site)

Product	Rated power (kW)	Cost (including installation and 5% VAT%)	Annual generation at 5m/s (kWh)	Saving (£/annum)	Payback time at 5m/s (yrs)
Swift	1.4	£7,350	1,974	£519	14.2
Skystream 3.7	3.7	£8850	3,420	899	9.8
Evance R9000	5.3	£22,050	9,034	2,410	9.1

This type of technology is funded by the FITs program. Please see Appendix 1 Funding for more information about different scales and tariffs.

For more information about the technology and the project, please follow next link:
http://www.nottenergy.com/images/uploads/pdfs/Energy_from_the_wind.pdf

HYDRO ELECTRICITY

Small hydro plants can be installed on small areas of running water. They work using the same principles as wind power, and also benefit from rare earth magnets.

This type of technology is funded by the FITs program. Please see Appendix 1 Funding for more information about different scale and tariffs.

For more information of this technology please follow next link:
http://www.british-hydro.org/mini-hydro/download.pdf

HEAT

HEAT PUMPS

Air source heat pumps take heat from the air outside your building and use it to heat a fluid inside the building. Ground source heat pumps work in much the same way, taking the heat instead from the ground. Air source heat pumps can be easily retrofitted onto existing buildings. From the perspective of a building occupant, they can work in much the same way as an air conditioning system, though they can also be used to heat water, like a boiler. Heat pumps can be located on walls or flat roofs.

To gather heat from the ground, a large amount of piping or coils must be buried under ground. This can either be in a shallow trench under a large area of land, or a very deep trench which is harder to dig, but requires less ground space. These can be dug beneath the building, with the foundations, while the building is being constructed.

If a large area of land, such as a playing field, can be dug up, it would be possible to install a ground source heat pump. These are expensive technologies however, and should only be used in buildings that are going to require all or most of the heat produced, in order to shorten the pay-back period.
Heat pumps are not renewable on their own. They require some electrical input, but they are very efficient and worthwhile at the right site. Individual cases will have to be assessed separately to determine suitability.

This type of technology is funded by the RHI (Renewable Heat Incentive). Please see Appendix 1 Funding for more information about eligibility and tariffs.

For a better understanding, please follow next link:
http://www.nottenergy.com/images/uploads/pdfs/The_Hydraulic_Ram_pump_briefing_EN30042010.pdf

CHP

Combined heat and power systems generate heat for the building, and use that same heat to generate electricity. This technology is most suitable for large buildings or groups of buildings, such as a small block of flats, or a sport centre. They are most efficient when heat and power are required simultaneously.
Please follow next link to find more information. It is a real project from Carbon Trust about Micro-CHP.

http://www.carbontrust.com/media/77260/ctc788_micro-chp_accelerator.pdf

Water can be heated by the sun using solar hot water panels. Heat is exchanged between the hot fluid in the panels and the water which is to be used. This can be done using a coil in a hot water tank. This heat can be used outright, or to supplement an existing hot water system.

SOLAR WATER

Water can be heated by the sun using solar hot water panels. Heat is exchanged between the hot fluid in the panels and the water which is to be used. This can be done using a coil in a hot water tank. This heat can be used outright, or to supplement an existing hot water system.

The panels should be installed in an area that is not shaded. If possible, the panels should be facing South or South West if most hot water is used in the evening, and should be tilted at 30˚.

Renewable technologies such as solar water panels or photovoltaics are expensive. However, with the right set up, solar water panels can be very effective on buildings in this country. It is usually necessary to alter the hot water pipe work and tank in order to integrate the panels properly. This means that if the pipes and tank in your building are due to be altered anyway, it would make sense to include solar water heating into your new arrangement. However, in a building with a high hot water demand, the pay-back for these systems can be relatively short for renewable technologies, sometimes less than 10 years.

The RHI (Renewable Heat Incentive) can be a great help with installing Solar Thermal technology, as it is a form of renewable heat.

The following is a real example of a Solar Thermal System (located in Nottingham) and the benefits that it can produce:

Solar water heating makes use of freely available energy and, as long as it is used in an efficient way, can reduce water heating bills by up to 8,000kWh per year and £1057 a year with an extension of 20m2 of solar panels.

In the table below you will find an example case of Solar Thermal Energy with different cases, depending on the size and on the slope of the panels.

Size (m^2)	Cost (£)	Energy Generated	CO_2 savings (kg)	Net Annual Benefit (£)	RHI Funding £ (8.5p/kWh)	Payback (years)
20	14,000	8,000	1,560	377	680	13

*The information showed above has been compiled from The chartered institution of building Services Engineers (CISBE), having in consideration the RHI funding.

BIOMASS

Biomass boilers burn renewable fuels, such as wood, to produce heat in a similar way to a conventional gas boiler. Difficulties can arise when procuring suitable fuels. There may not be a good supplier in the local area, which would mean that your fuel would have to travel a long way before it is burned. This adds a greater carbon footprint on to the boiler.

There has been controversy recently about the proper storage of the biomass fuel pellets that are often used. It is vital that these are stored properly and with the correct ventilation, as the air in a sealed container can become toxic.

If a suitable source of fuel can be found, and the boiler can be properly sized to the site, biomass can be a great renewable heating source, with the added advantage that heating costs will not raise with gas, oil or electricity prices, unlike most traditional systems.

It is essential that a fully trained biomass engineer is consulted for biomass system installation. If all of the correct processes are followed, a biomass system can be a great investment, particularly for a building with a high heat demand. A comprehensive biomass guide is due to be published by CIBSE in Spring 2013.

Please follow the next link to find a real example of this type of renewable technology:
http://www.nottenergy.com/images/uploads/pdfs/biomass_report2.pdf

This type of technology is funded by the RHI (Renewable Heat Incentive).

Please see Appendix 1 Funding for more information about eligibility and tariffs.