energy envoys

Energy Tutorial: Energy and Sustainability

Renewable energy systems compared

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RENEWABLE ELECTRICITY SYSTEMS COMPARED

	HOW MUCH ENERGY?	INCOME	COST	SPACE	PLANNING PERMISSION
SOLAR PHOTOVOLTAIC	A 2kWp PV system can generate approximately 1600 units of electricity per year, depending on the location. That would be sufficient to provide the base load of a typical home's electricity use, or about 40% of its total annual demand. In most cases, the limitation for bigger systems on homes is usable roof space.	A 2kWp system would typically earn around £400 per year through a combination of FITs and reduced electricity bills. The system will typically be guaranteed for 25 years, though it should last much longer.	The cost of PV installations varies according to the complexity and size of the system. An average 3kWp system will cost around £10,000 (including VAT at 5%). Most domestic PV systems cost around £3,000 - 3,500 per kWp installed, though small systems cost proportionately more. A large community sized system would usually work out cheaper per kWh.	Each kW of PV requires approximately 6-7m^2 of east to west, through south facing roof or a slightly larger area of flat roof or ground on which sloping frames can be erected. It is possible to install panels on other aspects and angles, though the amount of power produced will be reduced. South facing is the optimum orientation.	Most domestic PV installation won't need planning permission but you should check with the planning department of your local authority, especially if your home is a listed building, or in a Conservation Area or World Heritage Site. PV systems are permitted unless the panels protrude more than 200mm when installed.

WIND POWER	It all depends on the size and location of the turbine. You can check the estimated wind speed in your area here. For a more accurate indication of wind speed an anemometer can be installed for 6-12 months. For reference, an appropriately sited small 6kW standalone turbine with a blade diameter of 5.5m, raised 15m above the ground should be capable of producing around 7,500 units of electricity from an average wind speed of 5m/s. That's about double the needs of a typical home.	A small to medium turbine could pay for itself in ten years.	The cost of a system will depend on the size and the mounting method. Building-mounted turbines cost less to install than pole-mounted ones. For equipment and installation, with VAT at 5%: • a roof-mounted 1kW microwind system costs around £2,000 • a 2.5kW pole-mounted system costs around £15,000 • a 6kW pole-mounted system costs around £22,500. Large stand-alone turbines may also require foundation work, which can cost another few thousand pounds.	Best results are achieved at 10m or more above surrounding buildings and trees. In mounting any turbine, avoid sites with excessive turbulence, which will not just reduce performance but also shorten the device's working life.	Planning regulations have become more favourable and wind turbines are now regarded as permitted development as long as they meet strict criteria. For bigger projects planning can still be a huge challenge. It is recommended you always contact your local Planning Office

HYDRO	Given the nature of hydro, every project is different. The upfront cost and future income depends entirely on the site. So while Settle's community installation cost a little over £400,000 and is expected to generate around 150,000kWh in a typical year, others may be significantly more or less expensive per unit generated.	A hydro system can generate 24 hours a day, often generating all the electricity needed and more. Hydro systems will also receive FITs payments so significant savings and income can be gained.	A typical 5kW scheme suitable for an average domestic property might cost around £25,000 including installation. Some sites cost less than this to develop; others cost much more due to the nature of the site, and so will be less financially attractive and less likely to be developed. Maintenance costs vary but are usually low as hydro systems are very reliable.	To be suitable for electricity generation, a river needs to have a combination of: • flow – how much water is flowing down the river per second • head – a difference in height over a reasonably short distance	Planning permission is necessary for installing any domestic or community hydroelectric system. You should contact your local authority at an early stage. The Planning Office will be able to advise you on other organisations that need to be consulted, such as the Environment Agency, and the process you need to go through.
ANAEROBIC DIGESTION	The amount of energy produced by AD will vary depending on the material that goes into it and the particular type of digester that is used. Digesting 1 tonne of food waste can generate about 300 kWh of energy. According to the Renewable Energy Association, if all the UK's domestic food waste was processed by AD, it would generate enough electricity for 350,000 households.	An AD plant can generate 24 hours a day as long as there is enough waste material available. AD systems will also receive FITs payments so significant savings and income can be gained.	Huge capital investment is required for anaerobic digestion systems costing in the £millions. Upfront costs vary massively depending upon the site and available waste.	AD is not suitable for domestic use. It requires large areas available to install the large tanks. A large farm could be a suitable location for an AD plant.	Planning permission is necessary for most anaerobic digestion installations. Small scale digesters using only on-farm waste may only require an Agricultural Notification, but it is recommended you get legal advice before pursuing this. Any installation accepting third party waste will need full planning permission.

RENEWABLE HEAT SYSTEMS COMPARED

	HOW MUCH HEAT?	INCOME	COST	SPACE	PLANNING PERMISSION
SOLAR WATER HEATING	In the UK, a typical domestic system will provide enough hot water for a family home in the summer – and around a third of its total annual hot water demand. A home located in South West England is likely to generate more heat energy than a system installed in Scotland.	You can estimate how much money you could earn through RHI using the Department of Energy and Climate Change (DECC)'s RHI payment calculator. The income and savings for SWH will always vary according to summer hot water demand and how the building previously heated its water - the savings will be highest and the payback quickest if the solar system is displacing electricity or oil rather than gas.	The cost of installing a typical domestic SWH system is around £4,800 (including VAT at 5%). Prices, per unit of heat generated, will reduce as the system size goes up. Installation costs can sometimes be reduced if combined with other roof work.	A typical 3 bed property would need approximately 3-4m^2 of roof space facing east to west, through south. Usually, the hot water tank will need replacing for a larger, 200 litre tank with two heat exchangers. Most combi boilers are not compatible with SWH.	Planning permission isn't required for most domestic SWH systems, as long as they're below a certain size - you should check with your local authority, especially if your home is a listed building, or in a conservation area or World Heritage Site. Permitted unless panels protrude more than 200mm when installed.

GROUND SOURCE HEAT PUMPS	It's often possible to produce all the space heating that a building needs and much of the water heating.	When replacing a non-gas central heating system, ground source heat pumps can provide significant financial and economical savings – especially for well insulated buildings. You can estimate how much money you could earn through RHI using the Department of Energy and Climate Change (DECC)'s RHI payment calculator.	Installing a domestic system will cost around £9,000 - 17,000. Running costs will depend on a number of factors - including the size of the home and how well insulated it is.	Depends on the system size. A home typically needs a trench 75-100m long and 1-2m deep. Vertical systems based on deep bore holes are possible and take up much less space, but they are much more expensive. The pump itself is a fridge sized box.	Domestic ground source heat pumps are generally allowed as permitted developments, but check with your local authority to find out whether you need planning permission or not.
AIR SOURCE HEAT PUMPS	Air source heat pumps primarily provide space heating. They can also be designed to include water heating but this is not common practice as it will reduce the efficiency of the system somewhat.	When replacing a non-gas central heating system, air source heat pumps can provide financial and economical savings – especially for well insulated buildings. You can estimate how much money you could earn through RHI using the Department of Energy and Climate Change (DECC)'s RHI payment calculator.	A domestic system will cost around £6,000 - 10,000 to install. Running costs will vary depending on a number of factors - including the size of the building, how well insulated it is and what room temperatures are desired. Air source pumps can be slightly noisy. Larger systems vary widely in cost.	For a domestic system, a box (similar to an air conditioning unit) is placed on the exterior of the building. The heat is either piped to a heating system or distributed directly into the rooms via fans. As with ground source, air source heating is best for well insulated properties.	Domestic air source heat pump systems will be classed as Permitted Development if: • there is no wind turbine at the property • the external unit is less than 0.6 m^3 in size • the unit is more than 1m from the edge of the property • it is not on a pitched roof, or near the edge of a flat roof • it meets additional criteria if in a conservation area, World Heritage Site etc. You must always check with your local authority.

	HOW MUCH HEAT?	INCOME	COST	SPACE	PLANNING PERMISSION
BIOMASS	A large pellet boiler system could easily produce enough space and water heating for a standard home. Wood chip boilers are more powerful still and best suited to large buildings with plenty of space, such as community buildings and farms.	A medium sized community building with an annual heating requirement of 75,000kWh could potentially pay back the cost of conversion from oil to wood chip in just a few years. The RHI reduced payback periods yet further. You can estimate how much money you could earn through RHI using the Department of Energy and Climate Change (DECC)'s RHI payment calculator.	A pellet stove will cost around £4,300 including installation. Installing a new log stove will usually cost less than half this, including a new flue or chimney lining. An automatically fed pellet boiler for a typical domestic home would costs around £11,500 including installation, flue, fuel store and VAT at 5%. Manually fed log boiler systems can be slightly cheaper. Pellet costs depend mainly on the size and method of delivery. Buying a few bags at a time makes them expensive. If you have room for a large fuel store that will accept several tonnes of pellets at a time, delivered in bulk by tanker, you can keep the cost down to around £190 per tonne in most parts of the UK. Logs can be cheaper than pellets, but costs depend on the wood suppliers in your local area, as they cost a lot to transport. You can search for wood fuel suppliers in your area at www.nef.org.uk/logpile/	Wood has a low energy density, so the building needs plenty of storage space. A large old house with a total water and heating demand of 25,000kWh would require roughly ten cubic meters of wood pellet storage or 38m^3 for wood chip. The building also needs space to house the boiler and hopper (generally about double the size of an oil boiler) and a flue.	You must check with your local authority in case other conditions apply, but in general wood burning boilers and stoves are permitted as long as: • flues on the rear or side elevation of the building are no more than 1m above the highest part of the roof • in a conservation area or a World Heritage site, the flue is not be fitted on the principal or side elevation if it would be visible from a highway • the building is not listed or in a designated area (in which case you may need permission for internal alterations too)

Source: NEF tables with information from The Rough Guide to Community Energy and www.energysavingtrust.org.uk. Figures accurate at time of writing (2012).