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Complete
Renewable
Systems

Renewable Energy Information

produced by fmk architecture in association with
CRS–renewable energy specialists




FMK Architecture: 19 Grangeleigh Avenue, Ballymena, Co. Antrim, BT42 2AP. **t:** 028 2565 0846 / 0773 4722 129 / 0774 6327 074 **e:** fmkarchitecture@btinternet.com
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There are many sources of energy available in Northern Ireland which are not a type of fossil fuel.

These sources can be continually replenished, and are therefore called renewable energy sources.

Renewable energy sources offer a permanent supply of energy, at predictable prices and which do not contribute to the increasing concentration of CO2 in the atmosphere.

Because renewable energy sources are all around us, they offer an economy to Northern Ireland which is not based on foreign fossil fuel imports, but local, indigenous supplies.

Complete Renewable Systems

Introduction

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FmK Architecture provide an efficient, reliable and competitive service, whether your project is: Low-cost to High-end.... Traditional to Contemporary.... Or Simple to Complex....

FmK will strive to achieve greener architecture with greater sustainable design solutions; and to apply passive solar design wherever possible, in all projects.
FmK Architecture will endeavour to achieve and provide you with a friendly and professional service. FmK Architecture provide a complete service from concept to completion.

CRS: Complete Renewable Systems, are a fully qualified and registered installer of renewable energy systems.

CRS have been in the plumbing and heating business for 35years and specialise in the design and installations of geothermal, solar, underfloor heating, heat recovery ventilation and exhaust air heating systems. Our research has been carried out and tested with different systems and suppliers to enable us to provide the best products and best service.
Along with the renewable systems we also cater for domestic plumbing and heating.

Complete Renewable Systems

Company Profiles

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Types of renewable energy systems available to new-build and existing dwellings are:

Solar
Solar Thermal - Solar Hot Water (SHW)
Solar Electric - Photovoltaics (PV)

Heat Pumps
Ground Source (GSHP)
Air Source (ASHP)
Water Source (WSHP)

Biomass Boilers
Wood Pellet Boiler
Wood Chip Boiler
Wood Log Boiler

Wind Turbines

Fossil Fuels
Oil / Gas

Complete Renewable Systems

Energy Systems

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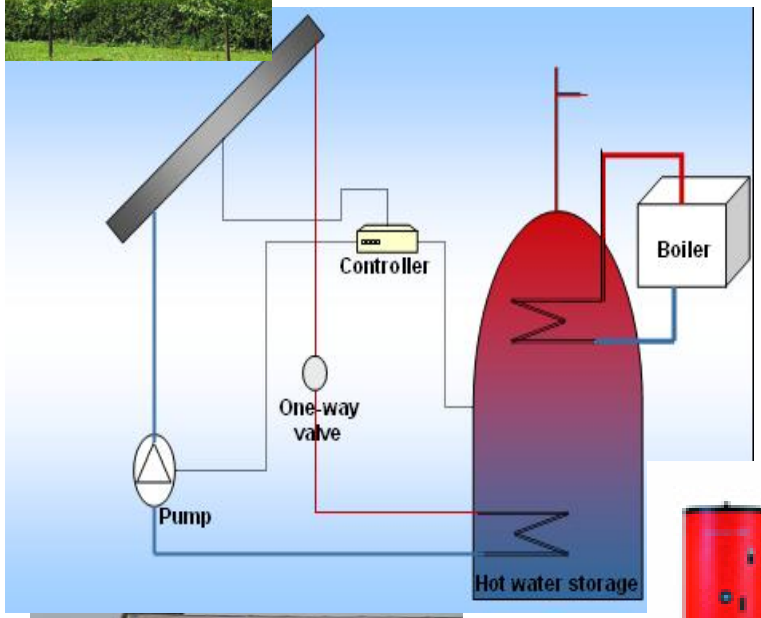
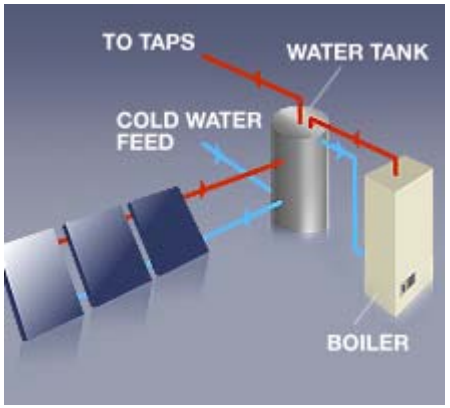
Solar Systems





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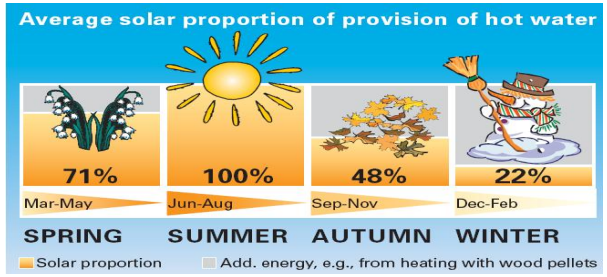
Solar Thermal – Solar Hot Water (SHW)

Solar Thermal Systems convert energy from the sun into energy used to heat water. Solar Panels can provide up to 70% of your annual domestic hot water needs. This water is distributed around the home for various uses. These include:
Domestic hot Water (Heating)
Washing (Dishes and Clothes)
Showers and Baths
Swimming Pools



Suitability of Solar Panels; is you dwelling suitable?

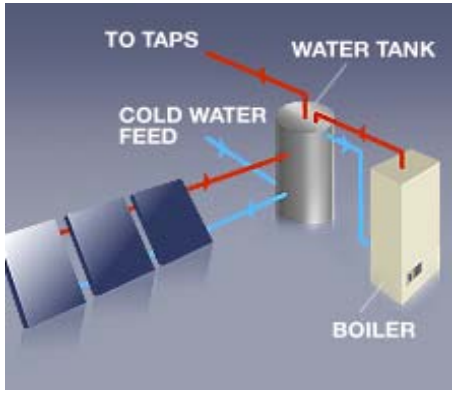
Roof Orientation – South facing or between SE & SW
Roof Size – Enough space for panels, typically 2-3m2
Roof Angle – Tilted between 20-50 degrees, ideally 30-40 degrees
Roof Structure – Strong enough to support panels
Shading – No shading to panels from trees, buildings etc.
Storage Space available – Space required for water storage tanks

These Solar Panels come in 3 different types of collectors:

Unglazed (not commonly used)
Flat plate
Evacuated Tube

Flat plate Solar Panels

Advantages/Disadvantages
Very robust system
Integrates into the roof line so provides superb aesthetic appeal
Used for hot water heating only, not space heating
Needs conventional water heating as back up
Large storage space required



Evacuated Tube Solar Panels

Advantages/Disadvantages
Noticeable on the roof line
Glass Tube can be fragile
Large storage space required
Used for hot water heating only, not space heating
Needs conventional water heating as back up
Higher initial cost compared to flat plate system but up to 20% higher efficiencies

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Solar Thermal – Solar Hot Water (SHW)

Installation and Running Costs

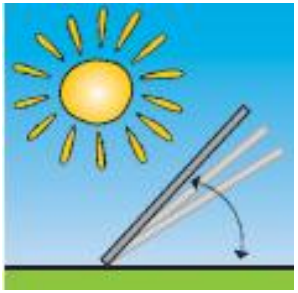
Sun light is free
Costs approx £9-12 per year to run pump
Depends on the size of the collector and the system to be installed
Flat plate: £2500–4000 installed for 4m2 system
Evacuated tubes: £3000–4500 for 3m2
Significantly less if there are multiples of installations in a development

Maintenance

Little maintenance required
Cleaning will improve efficiencies
Annual check required by house holder
Usually 5-10 year warranty
Lifespan of 25-30years
3-5 year check required by professional installer

Grants

Overall maximum of £400 or 30% of the relevant eligible costs, whichever is the lower.
Grants remain valid or 3 months for Installations on existing buildings and 6 months for buildings under construction.



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www.nie-yourenergy.co.uk/renewablegrants.php

SPF website provides information on the vast majority of makes and models of solar panels.
It allows you to compare the output of each system and view photos of them. www.solarenergy.ch

The average domestic system reduces carbon dioxide emissions by around 400–600kg per year, depending on the fuel being replaced.

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Solar Electric – Solar Photovoltaic's (PV)

Solar PV's converts energy from the sun into electric current. This can be used to provide electricity where there is none, or can be used to feed extra electricity into the main grid supply. This electricity can be used around the home for lighting and appliances. PV systems can be stand alone or grid connected.

PV technology is constantly developing, although current efficiencies are between 20 – 35% depending on the system. Solar PV's can produce up to 50% of your domestic electricity demands.

PV systems can be used for homes, offices, public buildings or remote sites where grid connection is either unavailable or too expensive.

Suitability of Solar PV's; is you dwelling suitable?
Roof Orientation – South facing or between SE & SW
Roof Size – Enough space for panels, typically 10-20m2
Roof Angle – Tilted between 20-50 degrees, ideally 30-40 degrees
Shading – No shading to panels from trees, buildings etc.

These Solar Panels come in many different types of collectors:
Stand-alone units
Roof - Tiles, Panels etc
Cladding
Louvres

Advantages/Disadvantages
Integrates into the building - superb aesthetic appeal
Very proven and robust system
Cost efficient
Extremely low maintenance - fit-and-forget technology
Can be connected to the Main Grid Supply to earn you money
Simple to install using standard trade skills, provides material cost savings
Needs conventional water heating as back up
Lifespan of 30 years or more
Your own clean power source that helps reduce global warming
Reduces your electricity bills, since daylight is free
Increases the value of your property
Silent in operation
Increases your awareness of electricity use
New carbon neutral homes are free from stamp duty

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Solar Electric – Solar Photovoltaic's (PV)

The awareness of PV technology is rising and there is an increasing number of systems beginning to appear.
As concern rises for the need of 'clean' electricity and more individuals and businesses keen to implement such systems, a larger number are being connected to local electricity networks, this is known as embedded generation.
In such a system the grid acts as the 'storage' facility. During the day electricity generated can either be used immediately (which is normal for PV applications on offices or commercial buildings) or it can be sold to an electricity supply company (more typical of domestic systems where the occupier may be out during the day). In the evening when the solar system is not able to generate the electricity required power can be bought back from the network.

Installation and Running Costs
Sun light is free
Costs for installing a solar electricity system vary greatly
Average system costs between £8,000 and £20,000, depending on its size and type

Maintenance
Extremely low maintenance - fit-and-forget technology

Grants
Maximum of £2000 per kW of installed capacity, subject to an overall maximum of £2500 or 50% of the relevant eligible costs, whichever is the lower.
Homeowners in Northern Ireland can apply to the Low Carbon Buildings Programme for a grant for PV.
NIE will now top this up with an additional 15%
(or £900 per kWp, whichever is less, capped at £4500).

Energy Saving Trust -
www.energysavingtrust.org.uk
UK wide - Low carbon buildings programme -
www.lowcarbonbuildings.org.uk
Environment and Renewable Energy Fund -
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The average domestic system reduces carbon dioxide emissions by around 400–600kg per year, depending on the fuel being replaced.

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Biomass Systems

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Biomass Systems

These are high efficiency boilers which burn wood based fuels only. These boilers work as a normal boiler, where they burn the fuel to generate energy. This energy is then used to heat the dwelling and provide domestic hot water. Biomass boilers can be up to 90% efficient. Economies are based on fuel displaced and heat demand.

Biomass Boilers come in 3 different types:
Wood-Log Boiler
Wood-Pellet Boiler
Wood-Chip Boiler

Wood - Log Boilers
There are many different types of log boilers. The most efficient being the Log Gasification Boiler. This type of boiler uses the gasification process to achieve an efficiency of approx 90% when burning seasoned timber which a moisture content of 20%. Log boilers are usually installed in conjunction with a large hot water tank / buffer tank which acts as a thermal store.
The boiler is thus able to burn its charge of logs at a constant rate over a relatively short period, whilst heating is available on demand throughout the day.
Depending on the heating demand the boiler may only need to be filled once per day.
This type of system is ideally suited to anyone who has easy access to timber and is prepared to fill the boiler manually.

Wood - Pellet / Chip Boiler
The wood pellet boiler works on the same principle as the log boiler. The main advantage over the log boiler is loading of the fuel. This can be done automatically thus removing the labour required to look after the system. Wood pellets are a clean, organic product manufactured using the by-products of sawmills and other mechanical wood processing plants. Pellets consist of compressed sawdust, cutter chips and other such wooden material, which has been reduced into wood pulp and then shaped into smooth cylinders.
Pellet heating systems are ideal for small houses, even in built-up areas. Designs must allow for a suitable pellet store in the building. One cubic meter of loose pellets weighs approximately 650 kg. Each tonne of pellets requires approximately 1.5 m3 of storage space. In practice, the volume of the pellet store built in the house should be at least 6-7m3.

Advantages/Disadvantages
Very low running cost - Lower running costs than oil / gas
High Efficiency (90%)
Easy to use
Carbon Neutral
Can be used with underfloor or conventional radiators
Needs to be cleaned every 6-8 weeks
Manual feeding of the boiler
Fuel suppliers available locally
Boiler house adjacent to fuel store
Access for deliveries, 15–20m max for blown-in pipe
Storage required space for timber logs / pellet silo / storage facility
Requires a larger amount of space for system setup than typical oil / gas boiler

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Biomass Systems

Suppliers

Balcas: 028 6632 3003 / www.balcas.com
Laragh, Enniskillen, BT94 2FQ
RJ Robinson: 028 9268 9004
40-42 Ballygowan Road, Hillsborough, BT26 6EJ
Carlisle Fuels: 028 97561122 / www.carlislefuels.com
209 Belfast Road, Ballynahinchm BT24 8UR
Green Energy Solutions: 028 3888 1228 / www.greenenergyltd.com
30 Ballynabragget Road, Waringstown, Craigavon, BT66 7SH
Winters Engineering: 028 8289 8414 / gavinwinters@ireland.com
21 Shaneragh Road, Dromore, Tyrone, BT78 3EJ
Darren Fitzpatrick: 028 4377 1718
15 Circular Rd, Castlewellan, BT34 5LS
Treescapes: 077 7381 8174
Clarendon Dock, Pilot Place, Belfast, BT1 3AG,
Rural Generation: 028 7135 8215 / www.ruralgeneration.com
65-67 Culmore Road, Derry, BT48 8JE
NI Kedco Energy: 077 1094 2786 / nisales@kedco.co.uk
31 Reservoir Road, Banbridge Co Down BT32 4LZ
Northern Tree services: 028 9262 1217 / www.northerntree.com
Horsepark House, 1 Horsepark, Magheragall, Lisburn

Logs delivered by the tonne or truckload
Chips delivered by tonne
Pellets usually have a minimum three-tonne delivery
1-tonne dump bags and 10-25 kg bags are also available

Maintenance
Wood boilers require cleaning every 6 – 8 weeks, removal of ash
Wood-chip boilers may need blockages to be cleared
Wood-chips to be loaded into storage area
Need serviced once a year
Clean burner and flue as per manufacturer's instructions
Grease moving parts

Installation and Running Costs
Very low running cost - Lower running costs than oil / gas
Cost dependent on source of fuel

Grants
Wood-pellet fed room heater / stoves:
Overall max of £600 or 20% of the relevant eligible costs, whichever is the lower

Wood-fuelled boiler systems:
Overall max of £1500 or 30% of the relevant eligible costs, whichever is the lower

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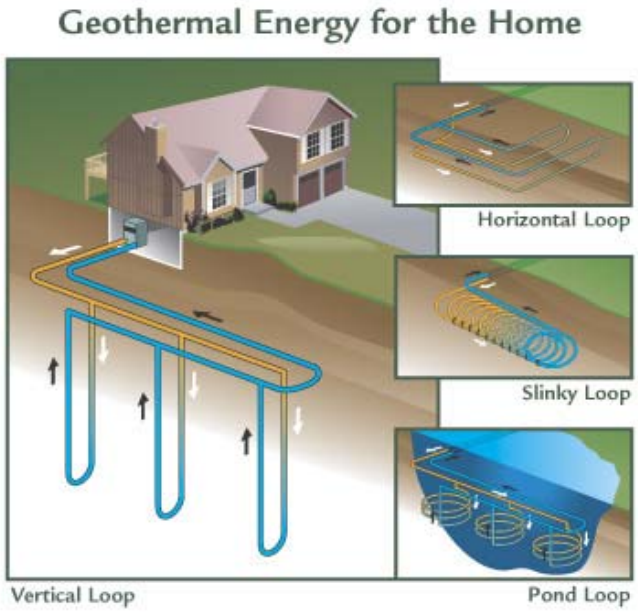
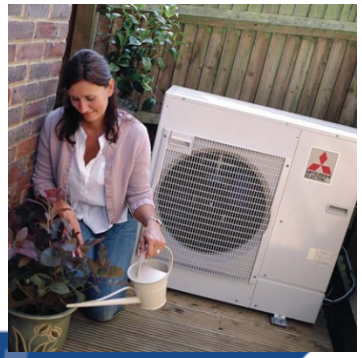
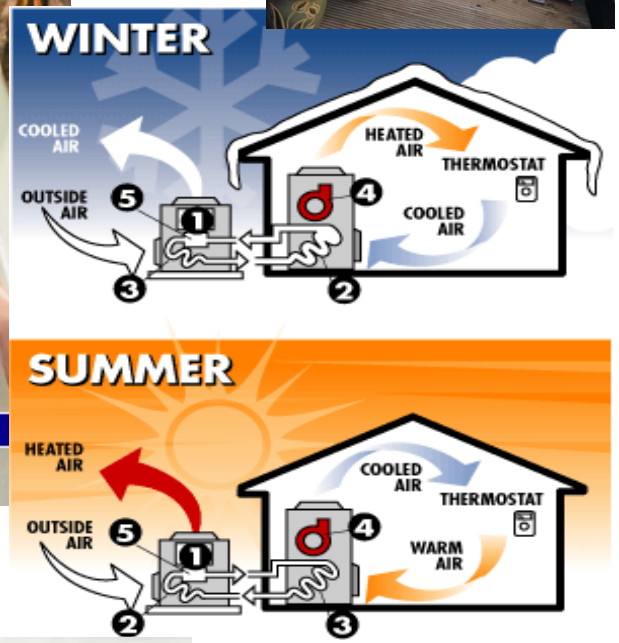
Heat Pump Systems







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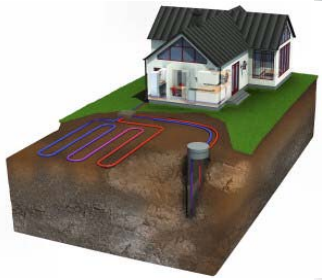
Heat Pump Systems

A heat pump extracts heat from one area then pumps it to another area.
These systems use solar heat stored in the ground, Air or Water.

There are 3 main different types of heat pumps available:
Ground source
Water source
Air source



Ground source (GSHP)

These are attracting greatest interest at present since it promises to deliver the best year-round energy efficiency. The ground source heat pump extracts heat stored in the ground. This is sometimes referred to as "geothermal", however, the heat is mostly from the solar gain, and not from the earth's core.
At depths of 2m and more, the ground temperature does not deviate very much from the average summer/winter surface temperatures (around 9 -12C in the UK depending on location). At this depth, there is an enormous store of heat that can be usefully tapped for heating in the winter.
The most practical way of extracting this energy is to bury a large amount of pipe in the ground. This pipework can be laid in the following ways:
Horizontal – usually 1.5-2m deep
Vertical
Slinky

Water source (WSHP)

A river or small stream can be utilised, and, in the past systems using copper coils in the water have been used. Pumping river water through a heat pump is another option, and can give very good results, but heat pump units require water at temperatures above 5 to 8°C (varying depending on type).
Whilst delivering very high-efficiencies for much of the time, this system will fail to operate in the middle of winter during lower temperatures- just when you need the most heat, so a back-up heat source will be needed. For those lucky enough to have a spring / pond, this is a much more stable and better heat source. This is an opportunity not to be overlooked, offering excellent efficiencies.

Air source (ASHP)

The air source system however will be less effective for heating in winter since the air temperature fluctuates and can become very cold. Furthermore, at low air temperatures, ice will form on the heat-exchanger requiring a mechanism of reverse-heating to melt the ice. This process is not as wasteful as maybe first thought, but it still contributes to a reduction in efficiency.
Air source units are being improved all the time, and are a simpler and cheaper option to install. But there is no way getting around the fact that the air is coldest when you need most heat for the house.

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Heat Pump Systems

Advantages/Disadvantages

Can be reversed for cooling
Large COP (Co-Efficient of Performance) of 3–4
Lower running costs compared to Oil, Gas
Low environmental impact
Relatively low maintenance costs
Best in homes with a low heat demand – Highly insulated
Suitability of ground type - Soil type determines heat transfer
Not every site is suitable for heat pump
Ground space required for trench or borehole
1.5m min soil depth required
Not 100% renewable
High start up electricity load
Requires a larger amount of space for system setup than typical oil / gas boiler
Relatively low heat output: Best suited to underfloor heating systems rather than radiators
Large initial set up cost

Maintenance

GSHP is low in maintenance as systems have few moving parts
Keep the filters and heat exchanger clean and monitor the refrigerant levels
40-year lifetime

Grants

Maximum of £1200 or 30% of the relevant eligible costs, whichever is the lower

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Installation and Running Costs

Typical Horizontal system - £6,000–10,000
Vertical borehole - £1400–1700 per kW installed
Horizontal slinky - £700–1250 per kW installed
Electricity to run compressor and circulation in ground loop
Economy 7 will probably be the most appropriate tariff
Some electricity companies may offer a heat pump tariff
A well designed system will reduce CO_2 emissions by 30–35%
Air source - £4000 – 7,000

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Wind power Systems








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Wind Systems

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Wind Power Systems

Wind power has been harnessed for over 2,000 years and is one of the most promising renewable energy resources for electricity generation. Wind energy produces electricity without harmful emissions and this is why today, emphasis is being placed on development of wind energy.

Wind turbines are probably the best known of all the renewable energy technologies in Northern Ireland. There are now in excess of 100 small-scale wind turbines installed in Northern Ireland. This uptake is due to the fact that Northern Ireland has the second best wind resource in Europe; second only to Scotland.
With such a resource, wind energy must surely be encouraged in order to take Northern Ireland beyond being another location for installing wind turbines, to being a world class centre for wind technology. These range from large wind farms across the province to small single turbines, suitable for households.

Location

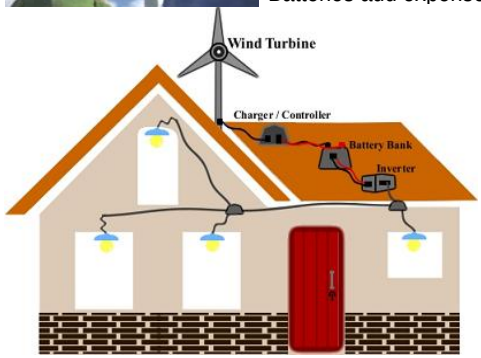
Wind speed and direction will determine the most suitable position for a wind turbine. Wind speed increases with height, so turbines will give a greater output if placed at a higher level. Turbines are best placed away from buildings and trees.
Contact an accredited installer to arrange a site survey in order to assess the suitability of your location. We recommend that you contact more than one installer.

Types

Stand-alone systems
Grid-connected systems

Stand-alone systems

Good for a home that is not connected to the national grid
Charge batteries to provide power when the wind is not blowing
Use a dump for excess power when the battery is fully charged (air or water heating)
Batteries add expense and require maintenance



Grid-connected systems

Need permission from the electricity distribution company to install the turbine.
Connection to a high technical standard
To sell electricity you need to install an export meter
Limits on the size of the wind turbine
You will have to pay the costs of upgrades to the network
Upgrades may require planning permission
The turbine must be shut down if there is a power failure on the grid.
Current EU legislation / Protect maintenance personnel / Not a backup in a power cut.

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Wind Power Systems

Available power
If wind speed doubles, power in the wind increases by a factor of eight
If the wind speed increases from 2m/s to 4m/s you will get eight times as much electricity produced from the same turbine

Annual wind speed
At least 4m/s annual average wind speed at hub height
Better if 5-6m/s annual average wind speed at hub height
Commercial wind farms need 6.5–7m/s annual average wind speed at hub height

Siting a wind turbine
Maximise wind speeds
Put as high above the ground at possible
Tower heights 6–15m for domestic systems
Avoid turbulence / Open spaces are best
Not in hollow surrounded by trees
Site as close to point of use as possible / Cabling is expensive
There are energy losses in long cables
Minimum of 40m for buildings

Planning permission required
Points to consider:
Visual impact
Proximity of dwellings
Some noise
Conservation area
Listed buildings
This process can take 4 months or longer so start as soon as possible

Common turbine sizes
2.5kW - Will provide wind power for general loads around the house. Most popular size for domestic use.
6kW - Annual output should generate sufficient power for domestic loads in addition to an excess suitable for grid connection.
15kW Appropriate for larger farms, schools, community schemes. Suitable for grid connection.
20kW Appropriate for larger farms, schools, community schemes. Suitable for grid connection.

Maintenance
Installer will provide information on maintenance costs
Expect costs of approx. £100-200/year but depends on the system.
The installer can also provide training in basic maintenance

Grants
The grant offer is valid for 4 months on existing buildings and 6 months on new build projects

Maximum of £1000 per kW of installed capacity, subject to an overall maximum of £2,500 or 30% of the relevant eligible costs, whichever is the lower.

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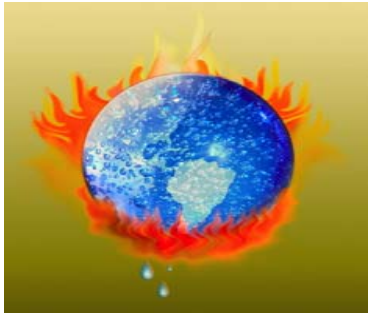
Fossil Fuel Systems—LPG / Gas / Kersone

Oil / Gas Heating

The standard Oil or Gas heating systems have been developing over this past number of years. The current building regulations state that any oil or gas boiler must be at least 90% efficient. Thus the condensing range is required if this is the heating system chosen. They look the same as conventional boiler however they use the flue gases exiting the boiler to heat the water further thus giving the boiler a greater efficiency.

Advantages/Disadvantages

Ease of Use
High Efficiency (90%)
Uses fossil Fuels
Fuel cost will only rise in future
Fairly high running cost



Cost Overview of all systems

Heating System		Installation Cost	Fuel Cost	Running Cost (per year)	Grant Assistance
Heat Pump					
	Ground source	£13,000	11p kW	£1,100	Y
	Air source	£12,500	11p kW	£900	Y
	Water Source	£16,500	11p kW	£800	Y
Biomass					
	Log	£7,500	-	-	Y
	Chip / Pellet	£8,750	£145 / tonne	£1,015	Y
Fossil Fuel					
	Oil	£2,500	45p / Ltr	£1,100	N
	Gas	£1,250		£1,200	N

Standard 1½ Storey 2800 ft² with Underfloor Heating — Prices correct as Jan '09

This is an approximate guide to the system costs.

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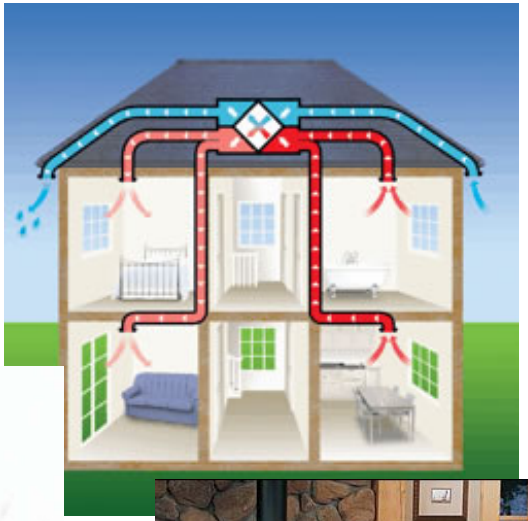
Additional Systems



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Additional Systems

Domestic Heating can be controlled by a number of different ways.

The most common and efficient is a central controller which controls a section or room of the house independently to suit the particular room usage. Also this system controls the hot water in the house to suit the user. Much more complex system are however available which adjust the heating to the outside temperature.
These controls are all designed with the user in mind for control and comfort.

Underfloor Heating

Underfloor Heating is now most commonly used in Self build homes. There are numerous advantages with underfloor heating:
Energy efficient system
Uniform heat distribution with no cold spots
Compliments renewable heating systems
Low Maintenance
Long life expectancy 50 - 100 years
Individual thermostatic room control
Freedom for interior design (no unsightly radiators)
Healthy and Hygienic

Range Cooker

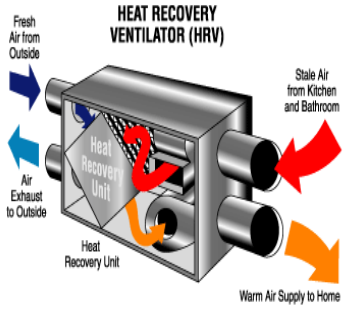
The AGA cooker or its equivalent is often used in domestic dwellings. These can be integrated into the heating system to provide hot water along with its cooking facilities.
This can be expensive to run and will require a fuel source such as oil or Gas.

Wood Burning Stove

The wood burning stove is becoming very popular.
It is available in many different design and functions.
The stove itself can be integrated into the heating system of the house to provide Hot Water or as a back up to the heating system. However the efficiency of this type of stove is approx 30% with most of the heat going up the chimney.
These are better used as secondary systems, used mainly as a room-heater only.

Ventilation Systems

Within an air tight a mechanical ventilation or heat recovery system can be used to 'Recover' the heat lost throughout the house and put it into the areas of the house which it is needed.
This removes the need for trickle vents on the windows and cleans the air as it distributes it throughout



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