GROUND & WATER SOURCE HEAT PUMPS

	Advantages	Disadvantages	Indication of Costs	Ideal for	Combine with	BEWARE!
Ground/ Water Source Heat Pump Ability to transfer latent heat from ground or water to a heating system. COP from 1:4 to 1:6 depending on ground or water For heating, cooling and hot water	• Excellent in new builds with underfloor heating • Properly designed, will deliver full heating and hot water needs. • Can be designed to integrate with other efficient systems (solar, wood, wind) in the future • Low maintenance following installation	• Borehole-drilling very expensive • In retro-fits, installation costs and space requirements can be problematic • Design is critical. Improperly sized systems (eg heat pumps and thermal stores, insufficient ground loop), result in poor performance and high running costs • Require adequate storage space	£10k+ Watch out for hidden extras; Some companies leave out critical features from their estimates to make the price look cheaper. See Beware! **Running Costs*** New Build: Comparative reduction of up to 66% Existing: Expect to reduce running costs by 60%+ * depends on fuel type replaced **Payback Time** New build: 2-5 yrs Existing: age-dependant but shorter all the time	New builds Old buildings with high heat loss in regular use (eg church, community hall) Public buildings (village halls, schools, sales rooms). Buildings with swimming pools	Required Thermal Store Optional Underfloor heating Wall heating Cooling or Double-finned or Victorian Radiators + Solar Panels + Wood-burning stove/biomass	Inadequate design Insufficient size heat pump and buffer tank Insufficient quantity ground loop A properly designed heat pump system should include a buffer tank which allows for individual room control which is required by Building Regs. This buffer tank should not require an electric immerser to bring the system up to temperature. Many systems rely on electric immersers to supplement heat output which will increase running costs Require plenty of space (eg a plant room) Low temperature system so low temperature heat delivery must be planned

AIR SOURCE HEAT PUMP

	Advantages	Disadvantages	Indication of Costs	Ideal for	Combine with	BEWARE!
Air Source Heat Pump Ability to transfer latent heat from air to a heating system Expected COP 3.5 For heating, cooling and hot water	• Ideal for retro-fit or where space is limited for installation of ground loops • Suitable for exterior placement (saves internal space)	UK-wide combination of low temperatures coupled with high air moisture content can considerably reduce their efficiency. If you live in a high-frost area with moist air, efficiency will suffer	£10k+ **Running Costs** Geography dependent. Potentially low (up to 60% savings) **Payback Time** Potentially similar to ground source *IN THE RIGHT CONDITIONS*	Geographical areas that enjoy low-moisture, above-freezing temperatures Retrofitting Buildings with inadequate exterior space	Required Thermal Store Optional Underfloor Heating Wall Heating + Solar Panels + Wood-burning stove/biomass	Inadequately sized systems in combined low temp/high moisture climate conditions could result in high running costs Some machines are very noisy (planning restrictions in place) – check decibel levels with manufacturer

SOLAR THERMAL

	Advantages	Disadvantages	Indication of Costs	Ideal for	Combine with	BEWARE!
Solar Thermal Using the sun for hot water heating	• Can provide up to 80% hot water requirements • Increased efficiency when incorporated with thermal stores with (for eg heat pumps). Excess heat can be dumped in the thermal store • Low maintenance	• Performance dependent on UK weather. Don't rely on them for year-round hot water (never mind heating) solutions • Long payback is further lengthened if integrated with other higher energy efficient systems (eg heat pump)	£2,500 upwards **Running Costs** Very low (the cost of small circulation costs and control) **Payback Time** Relatively poor – approximately 10 years	New builds Retro-fits	Thermal Store + Heat Pumps + Biomass	Hard sales with no technical back-up – everyone's jumping on this bandwagon – lower panel cost is being compensated for by sky-high installation costs

HYBRID SYSTEMS

	Advantages	Disadvantages	Indication of Costs	Ideal for	Combine with	BEWARE!
Hybrid Electric Boiler/Air Source Heat Pump These combine an electric boiler with a small air source heat pump which is integrated with a heat recovery ventilation system to help it gain some additional heat. Expected COP – 2.6	• Stand alone unit • Takes up less space due to integrated tank • Initial costs appear lower	High running costs More like an electric combi-boiler disguised as a heat pump. V small compressor which doesn't deliver high savings Heat pump insufficient to provide full heating. Electric immersers are relied on to top up outstanding heat/hot water requirements. For the hybrid system to generate 10kW of heat,it will require 8.2kW of electricity. A heat pump with a COP of 3.7 will only require 2.7kW of energy.		We can't recommend them	<u>Required</u> Air ventilation system must be included	Be careful. The maximum amount of heat you can recover in this way is limited. Typically these units under optimum conditions can supply about 1.5KW. Any additional heat to heat your house will have to be delivered by an electric boiler (typically 6-8kW). So if your heat loss was 10kW and 1.5kW of that was being supplied by this system (with a COP of 1:2.6) the immerser will have to deliver 8.2kW to generate 10kW. If this was generated with a standard heat pump with a COP of 3.7, the actual nergy consumption would only be 2.7kW

HEAT RECOVERY/VENTILATION SYSTEMS

	Advantages	Disadvantages	Indication of Costs	Ideal for	Combine with	BEWARE!
Heat Recovery Ventilation Systems A central fan unit draws stale damp air and replaces it with fresh dry from outside. Air is filtered and pre-warmed via a heat exchanger (or electric element) before being blown into dry areas	Can help reduce overall heat loss in a building	High installation costs – network of special ducting required Difficult to retro-fit in an existing building	Relative cost-effectiveness will depend on its efficiency level (how much the energy consumed for space heating is recycled). A well insulated and fully air-tight house = efficient. House with leaks, trickle vents and airbricks= highly inefficient Least costly option = individual extractor fans in wet areas and passive vents	New build in compliance with Revised Part L Building Regs which emphasises building air-tightness	Heat Pumps Other energy efficient systems	In themselves, they're fineCombination systems offered as a solution such as the Hybrid systems which have high electrical heat input requirements

BIOMASS

	Advantages	Disadvantages	Indication of Costs	Ideal for	Combine with	BEWARE!
Biomass In domestic context, heating supplied in the form of logs, wood chips or wood pellets (reconstituted sawdust).	• Good for retrofit • Can reduce standard boiler CO2 emission by up to 50%. Boilers account for about 60% domestic carbon production	• Not carbon neutral due to fuel production & transport costs • Sustainability of fuel source still in question • Ongoing costs of fuel • Size – takes up space (machine, hopper or fuel storage unit)	£3000+ (stove) £3000+ (hopper if required) £2000 + for thermal store	Can be used in a stove to complement existing heating or biomass boiler.	<u>Required</u> Thermal Store Fuel store/hopper (required) <u>Optional</u> Heat Pump + Solar Panels	Watch pricing – usually doesn't include Thermal Store & Hopper Be conscious of fuel source costs Require plenty of space

SOLAR PV

	Advantages	Disadvantages	Indication of Costs	Ideal for	Combine with	BEWARE!
Solar PV Ability to create energy from the sun's radiation (turn light (photo) into electricity (volts)	• Potentially free electricity • Theoretically surplus electricity can be sold back to the grid. ▪ Low maintenance ▪ Long lifespan	Initial investment costs currently very high Payback Currently high due to initial capital costs. Dependant on electricity prices	Budget for about £5,000 per kW installed (A standard house has a 3-4kW capacity). Prices are expected to decrease. But it's calculated that even at these costs, investment in a domestic PV system will fix the price of householder's electricity at 12p to 15p per kWh for the next 40 years.	New & existing builds with sufficient solar gain - particularly in urban areas.	Anything generated by electricity	

WIND

	Advantages	Disadvantages	Indication of Costs	Ideal for	Combine with	BEWARE!
Wind Energy harnessed from wind can potentially provide most of a building's power requirements	• Potentially free electricity • Theoretically surplus electricity can be sold back to the grid.	Planning is required Wind speed database only gives an average figure; doesn't factors which affect wind velocity (trees, buildings etc). You will probably need to obtain a survey Ongoing regular maintenance required	In the region of £4k per kW	Windy sites Hilltops	Anything generated by electricity	Watch out for gimmicks (small models) Success is dependent on local topography, turbine height above ground, turbine size and local wind speeds Steer clear of roof-mounted turbines; consider pole-mounted turbine away from the building for smaller systems