Domestic Heat Pumps: A Consumer Guide

In Ireland, we have a very temperate climate. There is heat energy available all around us from the air, the soil, ground water, rivers, streams and lakes. This natural heat energy can comfortably heat a building with assistance from a heat pump. Heat pumps are similar in operation to refrigerators. The main component of both is an electrical compressor (a device which increases pressure) which powers the cycle (either a refrigerant cycle, or in reverse, a heat pump cycle). In a heat pump, the compressor adds to heat collected from the surroundings so that it can be used in the heating system. Heat pump systems are typically made up of the following main components :

- *Collector (system used to collect heat from the surroundings)*
- *Heat pump unit and associated components*
- *Heat distribution system (underfloor heating or equivalent low temperature distribution system)*
- *Control system (weather compensation, thermostats, timers etc.)*

The collector can be "closed loop" where the same fluid (usually water and anti-freeze) always flows through the collector pipes or "open loop" where new water (e.g. from a well) flows through the heat pump.

Choosing a heat pump system. Which system is most suitable for me?

Heat pumps do not work in the same way as boilers. A heat pump cannot be simply "plugged-in" to an existing traditional heating system without first considering how the system needs be adapted to suit it. It is recommended for heat pump systems that underfloor heating is used as the distribution system. The reason why underfloor heating is suitable is because high temperatures are not required (the larger the surface area discharging heat, the lower the temperature needs to be). Underfloor heating uses a large mass of concrete (your floor) to store the heat, and this storage effect means the heat pump will not cycle (frequently switch on and off) which can shorten the life of the unit. Also, as the temperature output of a heat pump increases, the efficiency decreases.

If underfloor heating is not an option then you can ask your supplier if the system can be adapted to work with radiators. In this case, a particular control strategy should be designed for your system, which might include a buffer cylinder (large heating water storage tank) so that heat pump cycling can be avoided and performance optimised. The above is true irrespective of whichever heat pump type you choose.

The most common types of heat pump system are as follows :

- *Ground source* : Pipes are buried in the ground (horizontally or vertically), commonly referred to as "closed-loop" systems.
- *Air source* : Either wall or ground mounted (The "collector" for an air source heat pump is built-in to the unit itself).
- *Water source* : Water directly from a well, river etc. is used as the heat source, commonly referred to as "open loop" system.

See below a list of advantages / disadvantages of the three main types of heat pump :

Ground source heat pump system

Horizontal collector

- *Space is required for collector pipes laid in ground (1 –2 times heated house area)*
- *Trenches must be excavated to accommodate pipes (approx. 1m deep)*
- *Good efficiency due to stable soil temp.*

Vertical collector (or borehole system)

- *Added costs for drilling and preparation of borehole(s) and specialist machinery.*
- *Very high efficiencies can be achieved due to bore depth (up to 60m per bore).*
- *Boreholes take up very little space.*

Air source heat pump system

- *No collector required in ground (built-in)*
- *Useful for restricted spaces, e.g. urban areas and also for suitable retrofit situations.*
- *Efficiency less than ground source heat pump due to variable air temperature.*
- *Less expensive than ground source and water source heat pump systems.*
- *Technology constantly improving*

Water source heat pump system

- *Generally cannot collect and deposit water in the same well .*
- *Another well excavation downstream of collection well might be necessary for "dumping" the water.*
- *Drilling a second well is expensive.*
- *Very high efficiencies can be achieved due to temperature of ground water.*

Note : A water source heat pump generally refers to an "open-loop" system. A closed loop collector can also be laid in a stream etc. to collect heat.

Note : This buyer's guide focuses on low-temperature heat pumps (i.e. heat pumps which are commonly limited to approx 55° C, but are designed for operation in the region of 35 ° C. Heat pump systems are available which can produce high temperatures.

Sizing and Design

- Will the heat pump meet all my heating needs? *The heat pump output is matched to the heat requirement of the dwelling. Every house is different, so it is recommended that you first contact a BER assessor to accurately assess the heat requirement of your dwelling.*
- How much will a heat pump cost to run per year? *This differs from dwelling to dwelling. Factors include the electrical input power required, number of running hours per year required and the cost of electricity to run the system. It makes sense therefore to first of all address any obvious energy loss areas before investing in a heat pump system.*
- Will the heat pump produce hot water? *Heat pumps commonly need backup (e.g. an electrical immersion) to produce the temperatures required for hot water (60 °C minimum recommended storage temperature). Ask your supplier if there is an immersion function in the heat pump, and how much it is likely to cost per year to run.*
- Will the proposed installation comply with building regulations?
  - *Contact a BER assessor or qualified architect to ensure that the heat pump system will meet the renewable energy provision of Part L 2008 for new dwellings.*

Equipment Specifications

- Is the heat pump registered for the Greener Homes Scheme/Building Regulations Part L 2008? *Go to* www.seai.ie/greenerhomes
- Is it listed on the HARP database (Home Heating Appliance Register of Performance – for BER ratings)? *Go to* www.seai.ie/harp
- How efficient will the heat pump be under normal operating conditions? *A heat pump's efficiency is often referred to as a " Coefficient of Performance" (COP). A COP describes the performance of a heat pump at fixed indoor and outdoor temperatures and therefore does not give a true view of annual performance during operation. A more useful measure of heat pump performance is the Seasonal Performance Factor (SPF), which describes the overall performance over a long period of time. The HARP database (see above) lists SPF's for heat pumps.*
  - *E.g. If the SPF is 3.0 for a particular heat pump, then for every unit of electrical energy that is consumed by the heat pump (and all associated components) over the year, then three units of heat are produced.*
- How will the heat pump system be controlled? *It is important that an intelligent weather compensation control system is used. Time and temperature control of each "zone" is necessary. Example zoning might be as follows : zone 1= living area, zone 2 = bedroom area, zone 3= hot water (i.e. three main zones). A typical control system might include : Main programmable time and temperature thermostat in each zone, external temperature sensor, pipe temperature sensor, central computer unit which controls all pumps / valves based on information it receives from the programmable thermostats. The system can "learn" the characteristics of your dwelling and intelligently adapt itself based on weather conditions to ensure that a particular zone or zones are heated to the required temperature at the set time.*

Installation / Commissioning / Operation / After-sales and Service

- What qualifications and experience do the supplier/ installer have? *Installation of a heat pump system is a job for an experienced qualified expert. Ideally, one supplier / contractor should be chosen for a start-to-finish job. Check if there are there references available for both the supplier and installer. Is the installer registered with SEAI to install heat pump systems? see* www.seai.ie/greenerhomes
- Has the supplier / installer set up the system to operate optimally and have they provided you with all the necessary instructions to understand the system and monitor it? *A full handover of the system is necessary, including instructions on how to programme the system.*
  - *E.g. A dwelling is unoccupied from 8.00 am - 6.00 pm, so 21°C is not required during this period. Whole house is therefore set back to an economic temperature. Your supplier will advise as to what this temperature is. The temperature is set to return to 21°C in the living area zone from 6.00 pm -11.30 pm when the occupants return, leaving the bedroom zone at the "set-back" temperature. At bedtime , the living area temperature is set back again from (11.30 pm - 8.00 am) and the bedroom area temperature increased as it is now occupied.*
- What is the warranty on parts / labour, and who do I contact for service / maintenance / troubleshooting / emergencies? *Heat pumps should have a minimum warranty of 2 years. Get confirmation from the very start as to who is responsible for the above four items.*

Costs / Payment / Payback

What will the system cost, fully supplied and fully installed : *Heat pump system costs can vary from below €10,000 to over €20,000 depending on the system type (including VAT and installation costs). Ensure you find out exactly what the price includes.*

Visit www.seai.ie for information on energy saving, renewable technologies and available funding programmes.
For technical information on heat pump systems , email : renewables@reio.ie or call 023-8842193
Sustainable Energy Authority of Ireland, Renewable Energy Information Office, Unit A, West Cork Technology Park, Clonakilty, Co. Cork.