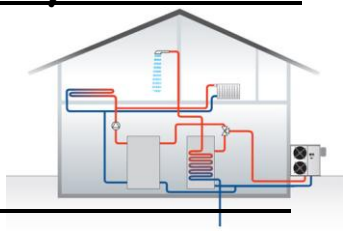
Waterford Energy Bureau-Energy Efficiency/*Renewable*

Energy Fact Sheet No.7



Heat Pumps

Introduction

The burning of fossil fuels to meet our demand is resulting in the emission of vast amounts of greenhouse gases. Irish households consume the equivalent of 2.4 million tonnes of oil every year for their energy needs outside transport. This represents 25% of the total final energy consumption in Ireland. Burning fossil fuels like coal, oil, peat, gas etc provides the vast majority of that energy. This results in the emission over 6,000 thousand kilo-tonnes of carbon dioxide a year, the main contributor to green gases emissions.

Today Heat-Pumps can help us to reduce our energy consumption for space heating and hot water production (which is over 80% of the energy you use at home) between 40 – 60%.

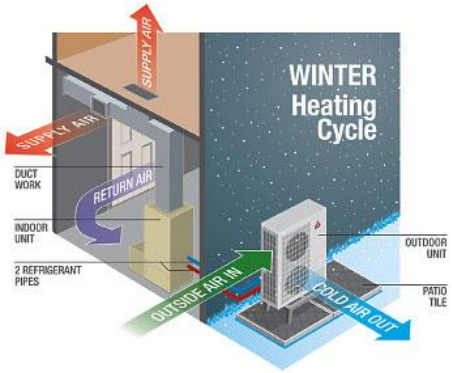
A Heat-Pump is a renewable energy technology that extracts heat from low temperature sources (e.g. air, water and ground), upgrades it to a higher temperature and releases it where it is used for space and water heating.

The Heat-Pumping cycle can be divided in three steps:

Step 1: A fluid with a boiling point lowers than the heat source temperature serves as a medium for transport. It is called the working fluid or refrigerant. As the working fluid extracts the heat from the source through a heat exchanger, its temperature rise and it evaporates.

Step 2: Then a compressor compresses the evaporate fluid. Consequently, the pressure and the temperature of vapour increase.

Step 3: Finally, heat is transferred via heat exchanger from the evaporated fluid to the heat distribution fluid (water or air) in the condenser. As it releases its heat, the working fluid temperature decreases to such a degree that it condenses. After passing through the expansion valve, the fluid regains its initial liquid, low-temperature and low pressure state. It then flows back to the evaporator where the process starts all over again.



Energy is needed to activate the Heat-Pump cycle and to compress the vapour for the production of useful heat. The efficiency of this process is expressed by the ratio between the useful heat delivered by the condenser and electrical load of the compressor this ratio is called the Coefficient Of Performance (COP). Typically heat Pumps have a COP of 3.5:1.

The performance of a Heat-Pump system is affected by several factors, which include;

- The climate (annual heating and cooling demand and peak loads);
- The temperature of the heat source and the heating distribution system;
- The auxiliary energy consumption;
- The Heat-Pump control.

The choice of the heat source is of vital importance for the Heat-Pump, as it will directly influence its application, efficiency (COP) and operating costs. Renewable heat sources that can be used by Heat-Pumps are air, water and ground.

The main factors that will affect this choice are:

- Its availability: quantity and location relative to heat load.
- Its cost: installation, operation and maintenance.
- Its temperature: level and variation of output temperature required.

Ambient air, the most common heat source for Heat-Pumps, and is free and widely available. However air source Heat-Pumps achieve on average 20 – 40% lower seasonal efficiency than ground-source or water source Heat-Pumps. This is mainly due to the rapid fall in capacity and

performance with decreasing outdoor temperatures.

Heat Pump Systems

Air to Water Heat-Pump:

An air source Heat-Pump uses external air to provide domestic heating and hot water. Heat is extracted from external air, amplified by the refrigerant gas and transferred around through radiators or hot water tank. This is the most common form of Heat-Pump.

Ground Source to Water Heat-Pump:

A ground source heat pump extracts low levels of heat from soil through geo-thermal pipes and is then amplified by the refrigerant gas. It costs slightly more to install than an air source Heat-Pump but ground source Heat-Pumps have an extended lifespan and has a higher efficiency due to fairly constant ground temperatures.

Water to Water Heat-Pump:

A water source Heat-Pump uses a lake, pond or river as its source of heat energy. A water source Heat-Pump has the same cost of a ground source but it has the highest efficiency of all heat-Pumps due to constant temperatures found in a body of water.

Air to Air Heat-Pump:

The air source heat pump extracts the heat from an external mass of air and transfers it to the pumps indoor unit compressor. The compression results in a rapid rise in the coolant and thereby transferring the heat energy into the room.

Costs

Heat Collectors Source	Costs
Horizontal ground source	€2,500 - 5,000
Vertical ground source	25-75 €/m of boreholes
Water collector	€3,000 - €6,000
Heat-Pump Unit	Costs
Capacity 10kWh	€4,500 - €6,000
Capacity 15kWh	€5,000 - €6,500
Installation	€1,000 - €2,000
Control Unit	Costs
Channel and hot water control	€300 - €1,500
Hot water heating kit	Costs
(excl. Cylinder)	€600 - €1,000
Under floor heating	Costs
Incl. Material installation, finish	5 - 30 €/m^2

The capital cost for a complete Heat-Pump system is made up of the equipment cost of the Heat-Pump unit, the heat source collector, the heat distribution system and installation.

Better Energy Homes Scheme	
Energy Efficient Measures	Grant Value
Heat-Pump Systems	
Air to Water	€3,500
Ground Source to Water	€3,500
Exhaust Air to Water	€3,500
Water to Water	€3,500
Air to Air	€600

The following table presents a comparison of the costs related to different heating systems delivering 20,000 kWh for space heating and domestic hot water production in a typical 180m^2 houses in Ireland.

Heating Systems	**Initial Investment Vat incl.**	**kWh/Year**	**Operation Costs**
Electric Storage	€6,350	20,000	€1,700
Oil/Boiler	€7,650	28,000	€2,240
Air to Water Heat - Pump	€9,000	20,000	€800

In brief your heating bill can be reduced by as much as 40-60% if you opt for a Heat-Pump. This will result in hundreds of Euros of savings a year.

Recommendations on appointing a Heat-Pump installer

- It is advisable when installing Heat-Pumps in existing houses that installation levels are increased to match 2011 Building Regulation standards in order to reduce building heating requirement and heat-Pump size.
- It is recommended to visit an installation that the Heat-Pump contractor completed at least 12 months previously to attain the level of satisfaction of the client, prior to appointment of contractor.

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