

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 of 11 million tonnes of carbon dioxide, 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) by more than 60%, with a payback period of around five years on additional equipment cost.

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

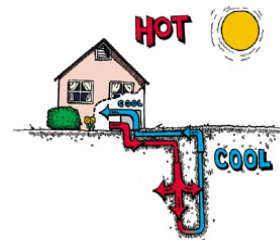
The Heat-Pumping cycle can be divided in three steps:

Step 1: A fluid with a boiling point lower 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 rises and it evaporates.

Step 2: Then a compressor compresses the evaporated fluid. Consequently, the pressure and the temperature of the 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).



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, 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.

Costs

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.

Heat Collectors Source	Costs
Horizontal ground source	€2500-€5000
Vertical ground source	25-75 €/m of boreholes
Water collector	€3000-€6000
Heat-Pump unit	Costs
Capacity 10 kWh	€4500-€6000
Capacity 15 kWh	€5000-€6500
Installation	€1000-€2000
Control Unit	Costs
Channel and hot water control	€300-€1500
Hot water heating kit	Costs
(excl. cylinder)	€600-€1000
Under floor heating	Costs
Incl. material, installation, finish	30-50 €/m ²

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 180m² houses in Ireland.

Heating Systems	Initial investment VAT incl.	kWh/Year	Operating costs
Electric Storage	€6,350	20,000	€ 1,700
Oil/Boiler	€7650	28,000	€2,240
Ground Source Heat-Pump	€12,700	20,000	€600

Greener Houses Scheme Phase III Grants	
Heat-Pump - Vertical Ground	€ 3,500
Heat-Pump - Horizontal Ground	€ 2,500
Heat-Pump - Water to water	€ 2,500
Heat-Pump – Air Source	€ 2,000

In brief your heating bill can be reduced by as much as 40-60% if you opt for a Heat-Pump. This mean hundreds of euro saved every year.

Recommendations on appointing a Heat-Pump installer

- When installing a ground water source Heat-Pump it is advisable to source a number of quotations from contractors, who have significant expertise in geo thermal Heat-Pumps.
- It is imperative to ask for a guarantee on the Heat-Pump and installation in case of malfunction and request a Heat-Pump that meets European Standards certification prior to installation.
- Heat-Pumps are ideally suited to night operation whereby the Heat-Pump tops up the heating system in the house via under floor heating at cheap night usage electrical tariff rate. The night preheat/top up results in the heat being transmitted into the house during the day keeping an ambient temperature in the house.
- It is advisable when installing Heat-Pumps in existing houses that installation levels are increased to match 2008 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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