# Fact Sheet



## Heat Pumps and Radiators

## Facts at a glance:

**Heat pumps and radiators**
If designed correctly heat pumps can effectively heat a building using radiators.

**Flow temperatures**
Radiators require a higher flow temperature of around 50°C, which will reduce the efficiency of the heat pump.

**On-demand**
Radiators are a on-demand system and can cause disruptions on the electrical supply. It is therefore important that 'smart starts' on single phase units are fitted to limit this effect.

**Off-peak Tariffs**
As radiators have a small amount of water content they have a small stored energy content and hence are not suitable for operation on off-peak tariffs.

**Radiator and Underfloor Mixes**
It is possible to use a mix of radiators and underfloor however the system needs to be run at the radiator flow temperature and there will be a delay between the system being turned on and heat being emitted from the radiators.

**Radiator sizes**
Due to the lower flow temperatures radiator sizes might need to be increased.

The ideal application for any heat pump is a well insulated new build property with a wet underfloor heating system and sufficient land to bury the ground arrays.

However heat pumps can also be used effectively for buildings using radiators however there are a number of considerations which need to be taken into consideration.

**Flow temperatures**
For a radiator to provide heat the flow temperature into that radiator needs to be in the region of around 50°C. If the building is well insulated, then at this flow temperature the system should meet the target temperatures as laid down in the Building Regulations (18°C average throughout, 21°C in the living room at an external ambient flow temperature of –3°C). If 50°C is insufficient, then the insulation needs to be increased and larger radiators used.

At these higher flow temperatures of around 50°C, the efficiency of the heat pump decreases as the compressor now has to do more work to raise the temperatures higher. Coefficient of Performance figures which are normally quoted at 4 for underfloor systems (as they only require 35°C due to there large heat emitting area) drop to around 3, i.e. an efficiency drop of around 25%.

For first floors, two storey dwellings generally have a joisted first floor construction. Where suspended timber floors are present, any underfloor heating pipework, typically installed within the joist void, would need to be embraced by a steel heat transfer plate which not only increases cost but also slows the build programme. Since the flow temperature into these

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underfloor circuits would need to be increased to around 45°C (to drive the heat through the overlying chipboard and final floor finish), in these cases there is no greater operating efficiency than if the heat pump was serving radiators.

As mentioned above, due to the inlet temperature to the radiator being 50°C, which is lower than a normal oil or gas boiler, any radiators might need to be oversized to provide the required heat, alternatively the levels of insulation within the property would need to be increased.

**On-demand**

Radiators are an "on-demand" based system, which means that the heat pump will "cycle" on and off several times per hour. Each time a heat pump starts, like many other appliances such as computers and washing machines, some disruption is caused on the electricity network, which usually consists of "flicker" on tungsten filament bulbs. Kensa heat pumps are supplied complete with smart starts which limit the current draw on the electrical supply. This will not completely remove the disruption but will reduce it. If a heat pump is to be connected to radiators it is therefore essential to consider the robustness of the power supply to the building.

**Off-peak tariffs**

Due to the low thermal mass of a radiator the stored energy within it is low. This limits a radiators effectiveness when used with off-peak tariffs. For underfloor systems which are mounted in screed, the screed acts as a large thermal store. This is heated up during the off-peak periods and then releases this heat slowly during the peak periods. Due to the large amount of stored energy this temperature drop is minimal, this drop is not generally noticed by the occupants. With radiators as they are an on-demand form of heating they cannot be effectively used with an off-peak tariff.

**Underfloor and radiator mix**

Due to the cost and complexity of installing underfloor in a joisted system, many people specify radiators on upper floors and underfloor in screed on the ground floor. While it is possible to run the two systems together, the heat pump will have to be operated at the higher flow temperature required by the radiators so there are no efficiency gains due to lower flow temperatures. Even underfloor mounted in joisted floors will need to be run at around 45°C to provide heat into the room to drive the heat through the floor boards and floor coverings.

The main issue with a mixture of underfloor and radiators is that the large amount of screed that the underfloor is mounted in acts as a heat sink, meaning that the radiators will not become warm until the screed is up to temperature. This means there will be a delay between the heating being turned on and the radiators feeling warm. This is more pronounced on initial start up and once the heating system has been turned on for a number of days the delay decreases.