Heat Pump – Air-to-Air System: Applicant Guidance

We have created this guidance to outline what supporting information would make a high-quality air-to-air heat pump application.

Air-to-air systems use refrigerant pipework to transfer heat from an external unit to an internal unit and then directly to the air inside the space being heated. Air-to-air systems are appropriate low carbon heating solutions in some cases and can be implemented through PSDS with eligibility assessed on a case-by-case basis.

Eligible scenarios are:

1. When it has been evidenced with an options appraisal and feasibility study that the air-to-air system is the most appropriate solution for that building and that other eligible low carbon heating systems are not viable. A justification should be included when changing the distribution system and emitters from a wet to air-based system.
2. When replacing both heating and cooling systems.

If there is a new cooling load, only the proportion of the system replacing current cooling load will be eligible. The remaining value of the project covering the new cooling load will need to be funded by the applicant. This is due to the additionality criteria, please see the Guidance Notes for further detail.

Main types of air-to-air systems:

1. Single split – One outdoor unit is connected to one indoor unit by refrigerant pipework.
2. Multi split – One outdoor unit is connected to multiple indoor units with refrigerant pipework.
   - Typically, the indoor units are ceiling cassettes which are optimised for cooling.
3. Variable refrigerant flow/volume (VRF/VRV):
   - Type of multi split air-to-air heat pump.
   - Allows heating and cooling of different spaces at the same time by transferring heat from an area being cooled to an area being heated.
   - It is possible to get higher efficiencies than with multi split systems that can only cool or heat at one point in time.

Information you will need to provide with your application

Description of works: Provide background information on what system the air-to-air system is replacing, how it meets the eligibility and why it has been chosen for this site.

Applications Checklist	
1. Options appraisal and feasibility study for the replacement heating system that should include cost estimates for retrofit works and life-cycle costs. This needs to demonstrate the air-to-air system is the most appropriate solution for the building.	☐
2. Schematics and drawings of existing and proposed system	☐
3. Central controls need to be included - ensuring units are turned off when not required due to external temperature or occupancy. Controls should also be functional for fault interrogation.	☐
4. Please specify what redundancy has been built into your new heating system.	☐

Sizing New Heating System

The peak heat loss of the building needs to be calculated. This can then be used to size the new heating system.

- The peak heat load of the property needs to be calculated by measuring all the fabric and ventilation/infiltration heat losses for the coldest day of the year based on geographic location. As per CIBSE guides.
- Estimate of air change rates can be used for ventilation rate estimate.
- The calculation should account for the areas of the walls, floors, roof, windows and doors and their U-values.
- The peak kW rating of the heat pump needs to match the peak kW heat loss of the building.
- The kW rating of the system depends on the operating temperatures and the lowest winter external air temperature. Ensure you are considering these temperatures on the manufacturers specification when sizing your system.

Seasonal Coefficient of Performance (SCOP)

- SCOP of your system will need to be provided. This can be found in the manufacturers specifications and given at certain test conditions. The operating conditions of the system need to match the test conditions on the manufacturers specification for the given SCOP to be relevant to that site. These conditions will include the external air temperature at peak load at the coldest winter day and the indoor set point temperature.

Domestic Hot Water (DHW)

- Please specify how you propose to meet your DHW demand. Please provide details of this installation and the same level of supporting information as for your proposed heating system.

Cooling load

- Please specify the existing cooling load as well as the proposed cooling load that will need to be met by the new system.
- If there is a new cooling load, only the proportion of the system replacing current cooling load will be eligible. The remaining value of the project covering the new cooling load will need to be funded by the applicant.

Maximum vertical and horizontal pipe length

- Refrigerant systems are confined by a maximum vertical Pipe length above/below Unit, maximum pipe length horizontally as well as maximum total pipe length.
- Check the manufacturers specification to ensure your designed pipe length is within manufacturers specifications.

Adequate space around the external unit

- The manufacturer will give space requirement around the unit in the technical specification
- Ensure the proposed location for the external unit has enough space around it to locate the external unit.

Refrigerant Type

- A risk assessment must be undertaken regarding the refrigerant used; you should check whether the refrigerant is in F-Gas phase down over the project lifecycle.
    - Is the refrigerant being phased out in the lifetime of the system?
    - If so, then please specify why you have chosen to install a system utilising this refrigerant?
    - Have systems using alternative refrigerants been considered?
- Will a refrigerant leak detection system be installed?

Distribution Network Operator (DNO)

It is important that your Distribution Network Operator (DNO) is contacted to ensure that you can connect your heat pump to their network within the PSDS timeline. This could resolve some problems in the future as part of the PSDS scheme:

- Example 1: You may find the DNO has too much demand for the local network already and therefore deny your request for permission to connect your heat pump to the network.
- Example 2: Your heat pump may not be compatible with the current grid connection.
- Example 3: There could be delays in obtaining approval for this causing the project timescale to be delayed.
- Example 4: There can be long lead times for electrical upgrades at the sites that require them.

You will need to provide the DNO with details of your installation and typical loading vs your maximum demand.

Check list for air-to-air heat pump applications

Air-to-Air Heat Pump Applications Checklist	
1. Description of works: Provide background information on what system the air-to-air system is replacing, how it meets the eligibility and why it has been chosen for this site	☐
2. Calculation of heat pump sizing based on building peak heat loss	☐
3. Specification for the chosen heat pump to confirm the Seasonal Coefficient of Performance (SCOP) for given operating conditions	☐
4. Specify how you propose to meet your DHW demand	☐
5. Specify existing and proposed cooling loads	☐
6. Check manufacturers specification to ensure your designed pipe length is within possible parameters	☐
7. Ensure proposed location for the external unit has enough space around it to locate the external unit	☐
8. Risk assessment must be undertaken regarding the refrigerant used and specify whether you are installing a refrigerant leak detection system	☐
9. Indicate initial contact with Distribution Network Operator (DNO) for heat pump installation to local electricity network (include timeframe in project plan)	☐