High temperature heat pumps – Heat recovery and upgrading from industrial processes

Rationale:
- Current UK Status
  - There is 48 TWh/yr from industrial waste heat sources, i.e. around one sixth of overall industrial energy use.
  - The most common heat sources are below 250°C.
  - The most desired heat sinks are in the range 250-500°C.
- From: The potential for recovering and using surplus heat from industry Final Report for DECC. Element Energy, 2014

Why a Heat Pump for Heat Recovery?
- Ability to upgrade heat from lower temperature source to higher temperature sink.

Applications of Current Technologies
- Process heat networks, Preheating, Distillation, Cooking, Bleaching Paper, Pasteurisation

Current Working Fluids for Compression Heat Pumps
- R245fa, R600a, R717, DR-2, SES36, R744
- Different fluids require different cycles and fluids

Previous Research at Ulster
- Advanced Heat Pumps developed under EU programmes – The Resorption Cycle
  - A hybrid system utilising both ammonia and water appears to be a particularly suitable working fluid for high temperature heat pump applications because of the reduced pressure when compared with for example, pure ammonia.

Current research (i-STUTE)
- Development of High Temperature Heat Pumps with new working fluids
  - Facilities
  - Test bed based on R134a equipment to assess alternative refrigerants
  - Challenges
  - Is R134a the correct choice for the majority of high temperature options?
  - Equipment availability
  - Need to extend the current range beyond 160°C
  - Use of alternate cycles e.g. air, steam etc and end-user acceptability