

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?

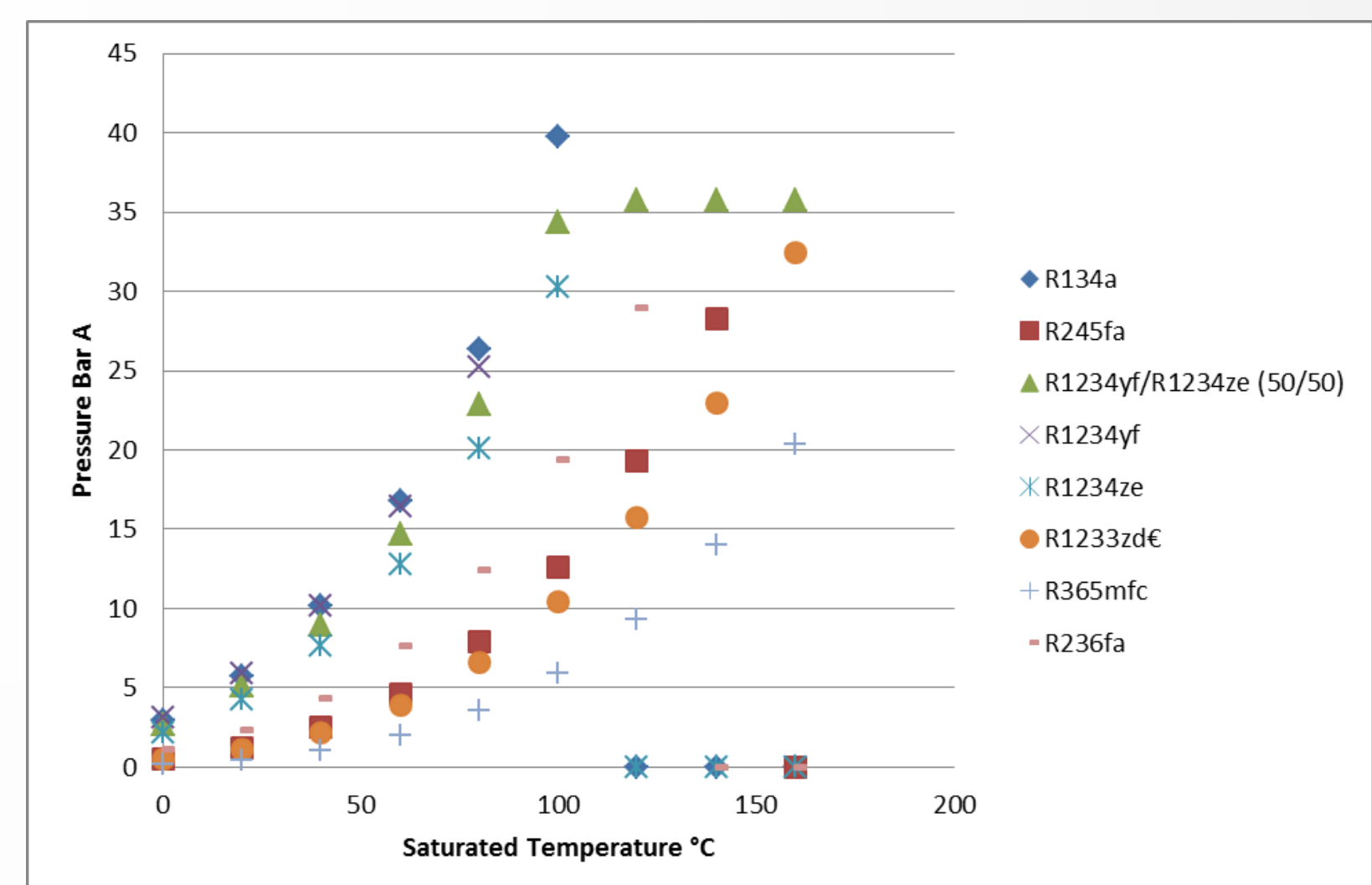
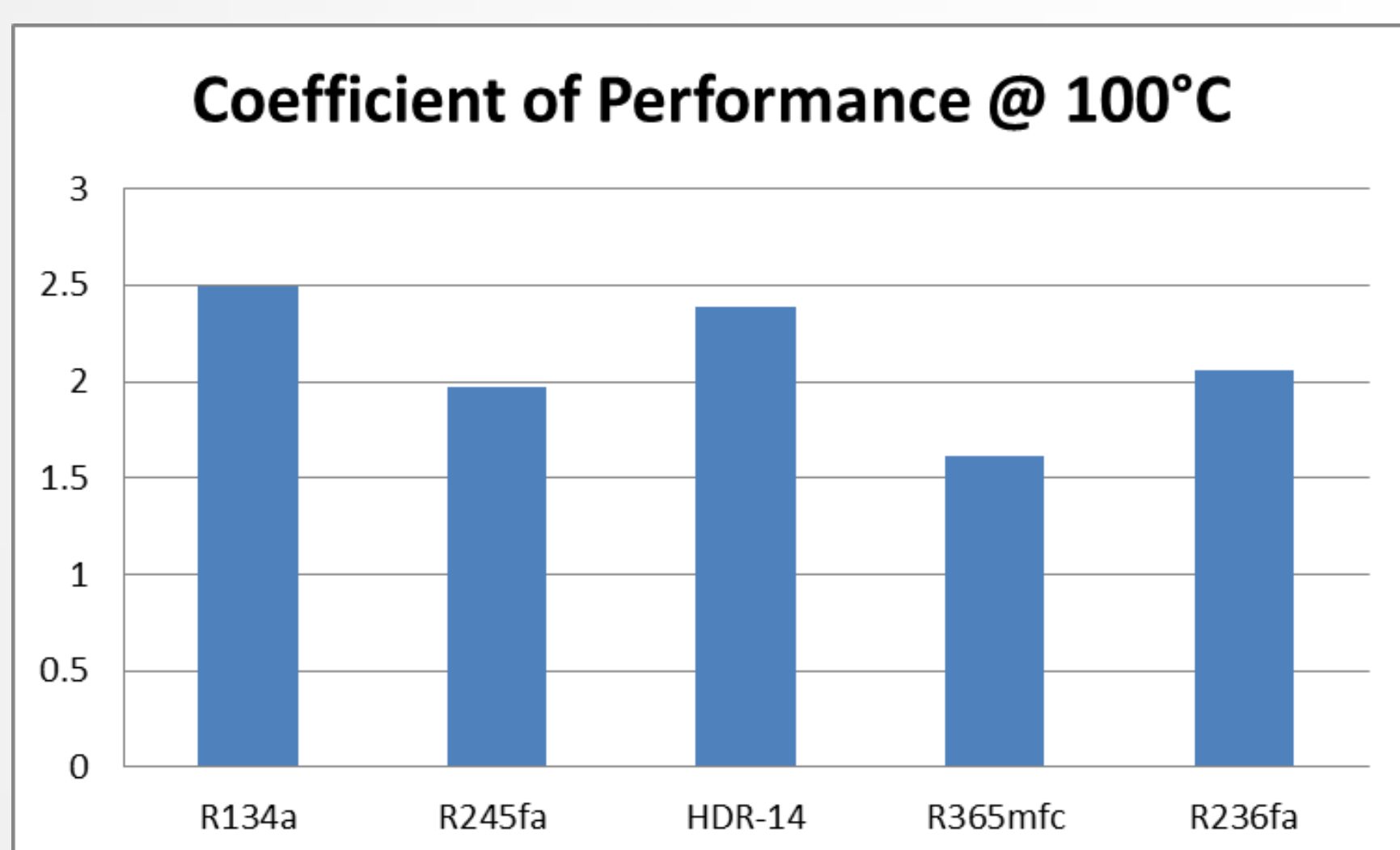
- Ability to upgrade heat from lower temperature source to higher temperature sink.

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

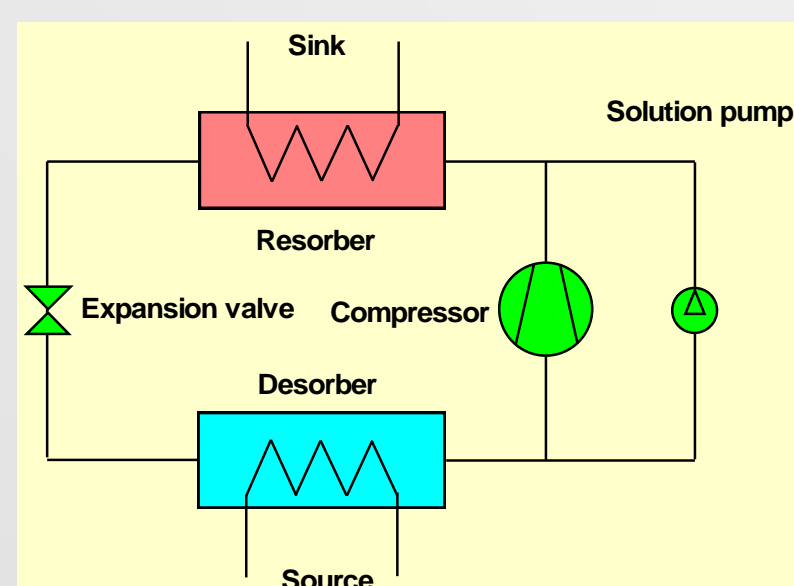


Previous Research at Ulster



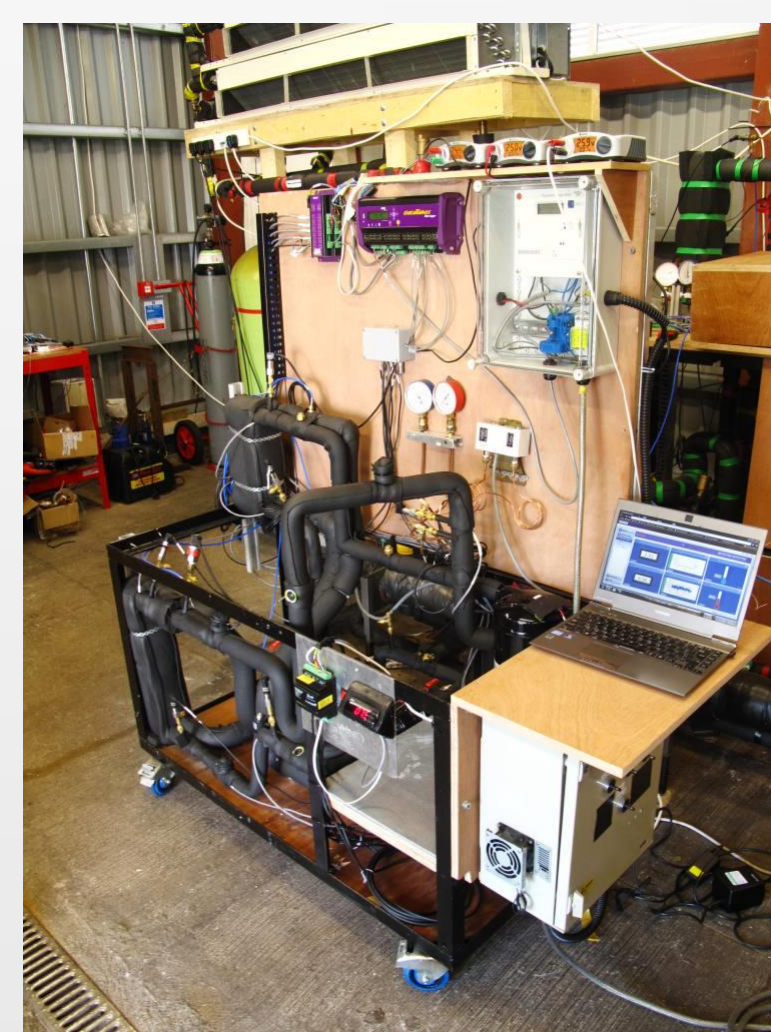
Advanced Heat Pumps developed under EU programmes – The Resorption Cycle

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