Heatpump Project – Hoiho 7 MW_{th}

Heatpump Conference, Oct 2021

Introductions

- **Patrick Dempsey** – Asset Manager, Mechanical Utilities
  - Project Overview
  - Refrigeration Units/Skids

- **Jack Ballagh** – Senior Energy Engineer
  - Process Integration
  - Dairy Plant Considerations

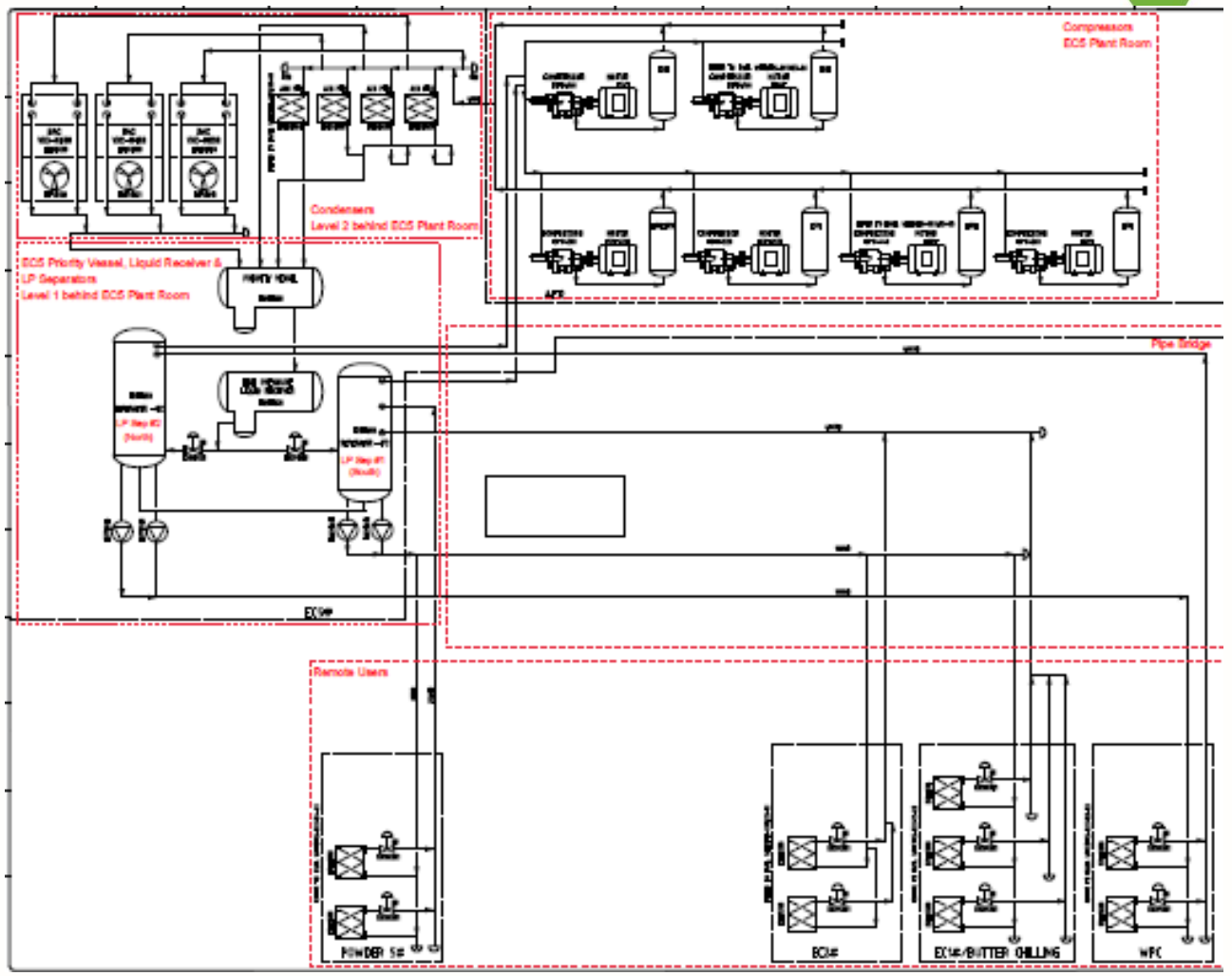
Agenda

- Project Background
- Heatpump Skids
- Process Integration
- Q&A

Confidential to Fonterra Co-operative Group

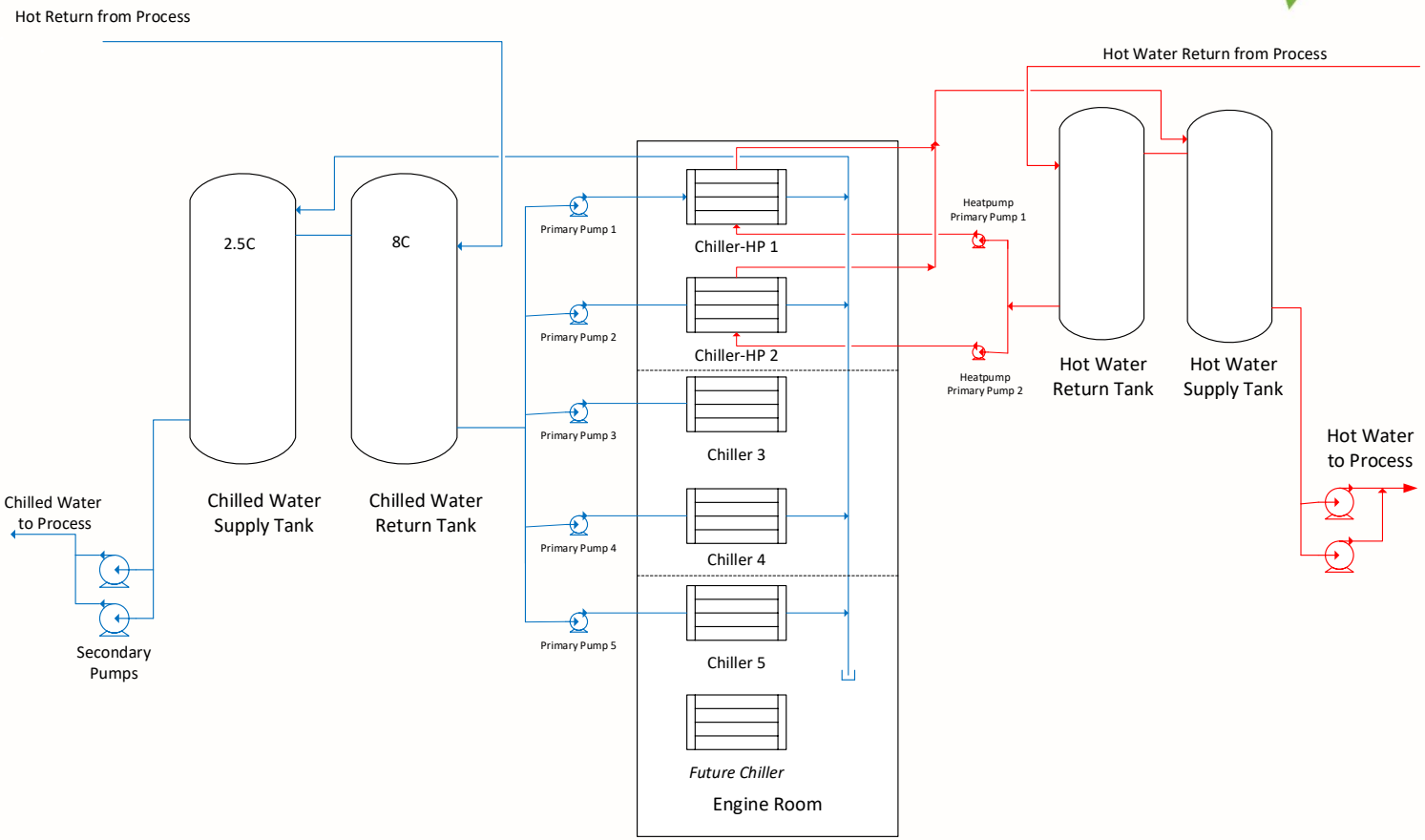
Background – Golden Opportunity

- Atypical plant
  - ~18 MWr water chiller plant
  - Pump-circ design, ~28t ammonia charge, 400m pipe runs
- Major Hazardous Facilities (MHF) Regs
  - Process Safety Analysis (PSA)
  - SFARIP assessment
- Aging Plant
  - Options: Maintain or Replace
  - Lifecycle Total Cost of Ownership (TCO)



New Plant: Integrated Chiller-Heatpumps

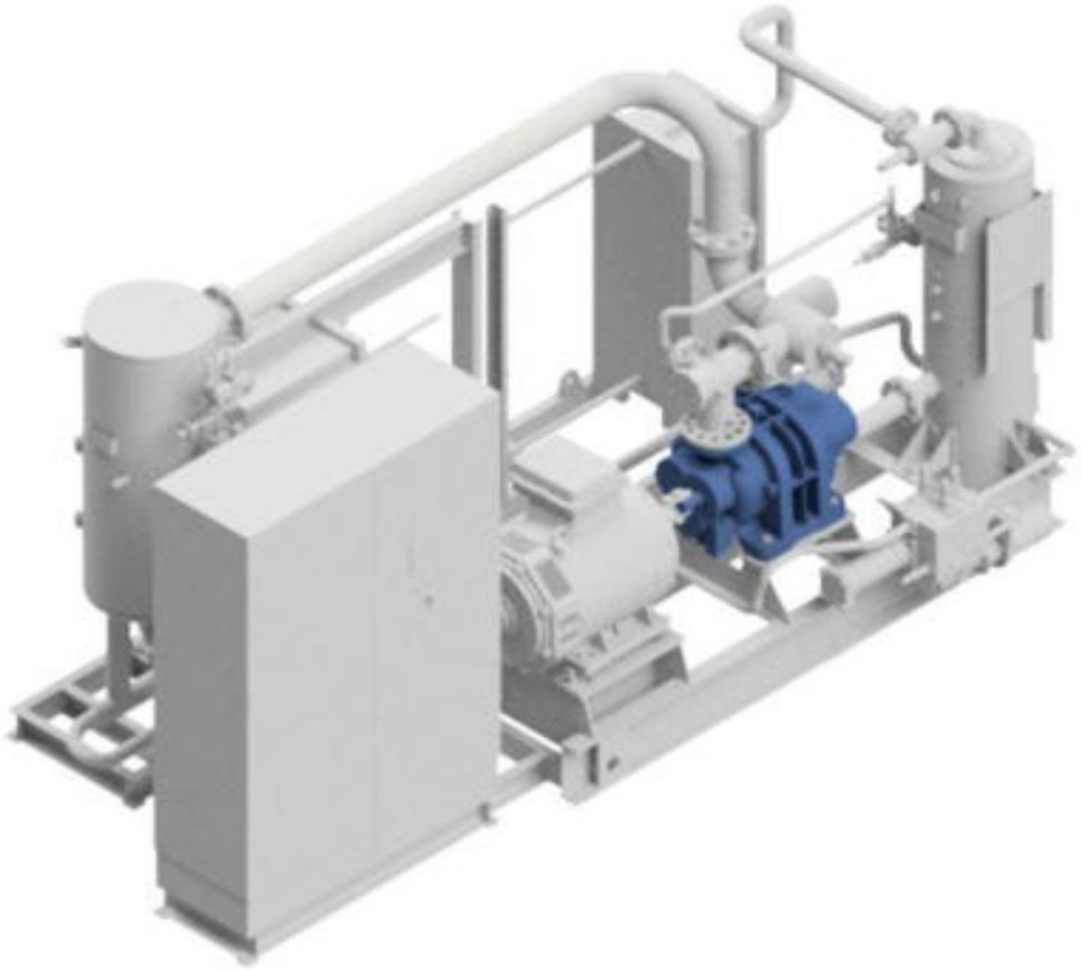
- New Refrigeration Plant
  - 15 MW_r @ 2.5C
  - 7 MW_{th} @70C
- 5 individual refrigeration skids/units
  - 3 x 3.5 MWr Chillers
  - 2 x 2.6 MWr / 3.7 MWth integrated Chiller-heatpumps
- New Water Reticulation Systems
- New Engine Room & MCC Room



Chiller-Heatpumps - GEA Grasso

- Specifications:
  - Open-drive Screw Compressor
  - No Economiser, but utilises subcooling
  - Const. Variable Volume Control
  - Oil & Desuperheater Heat Recovery
  - ~500 kg NH3 charge
  - Footprint: 3.2 x 8 x 3.8 m (w x L x h)

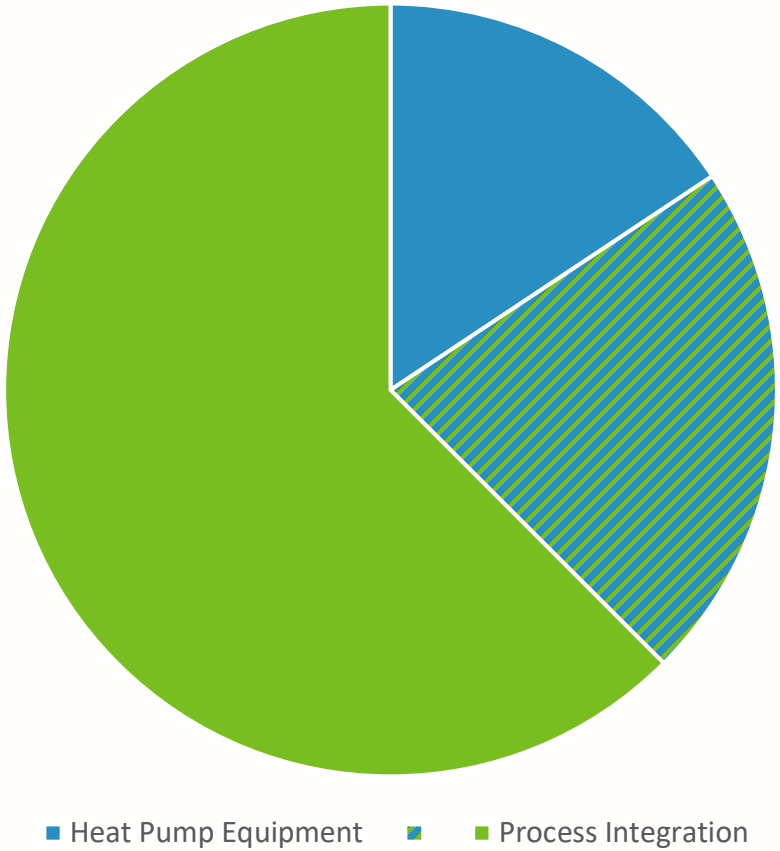
- Performance:
  - 2.6 MW_r @ 8C in & 2.5C out
  - 3.7 MW_{th} @ 35C in and 70C out
  - Chilling COP = 2.3 @ 100%
  - Heating COP = 3.3 @ 100%
  - Combined COP = 5.6 @ 100%



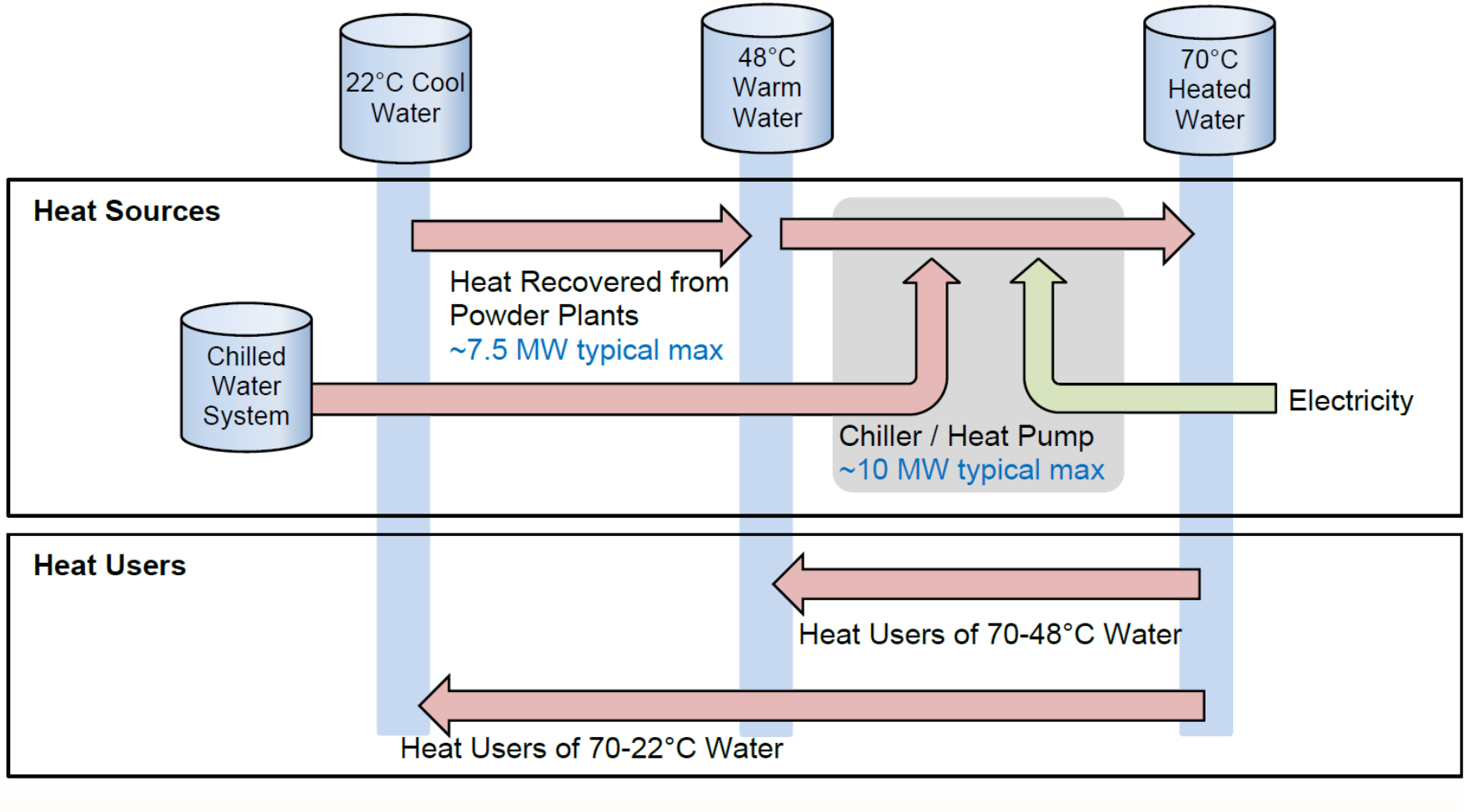
Why Is Process Integration Important?

How heat pumps integrate into the existing processes affect most of the main performance drivers of heat pump projects

- Process Integration makes up a large portion of the capital costs of heat pump projects
- Integration affects the utilization of the heat pumps, based on alignment of heat sources and heat sinks
- It has an important influence on the COP, based on how well the heat sink and source temperatures match



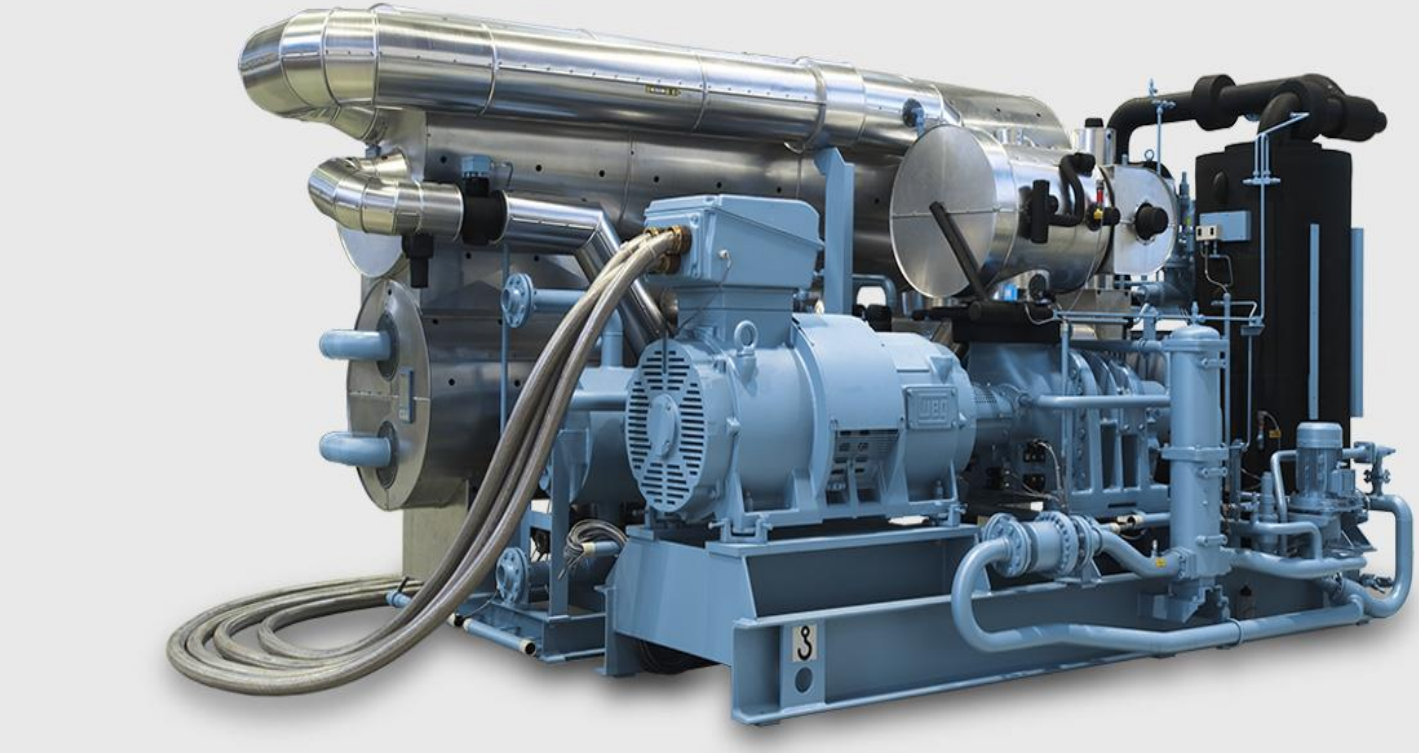
Typical Integration Solution



Principles of Integration

1. Direct Heat Recovery is the ideal solution so should be done first
2. In the dairy industry there at lots of heat loads at lower than steam temperatures that are ideal for ammonia heat pumps
3. Heat pumps should not lift temperature further than necessary to protect COP
4. Segregating these loads needs to be balanced against economies of scale (small loads can be too expensive to chase)
5. Larger sizes of heat pump also tend to benefit from economies of scale

Available Solutions



Q&A