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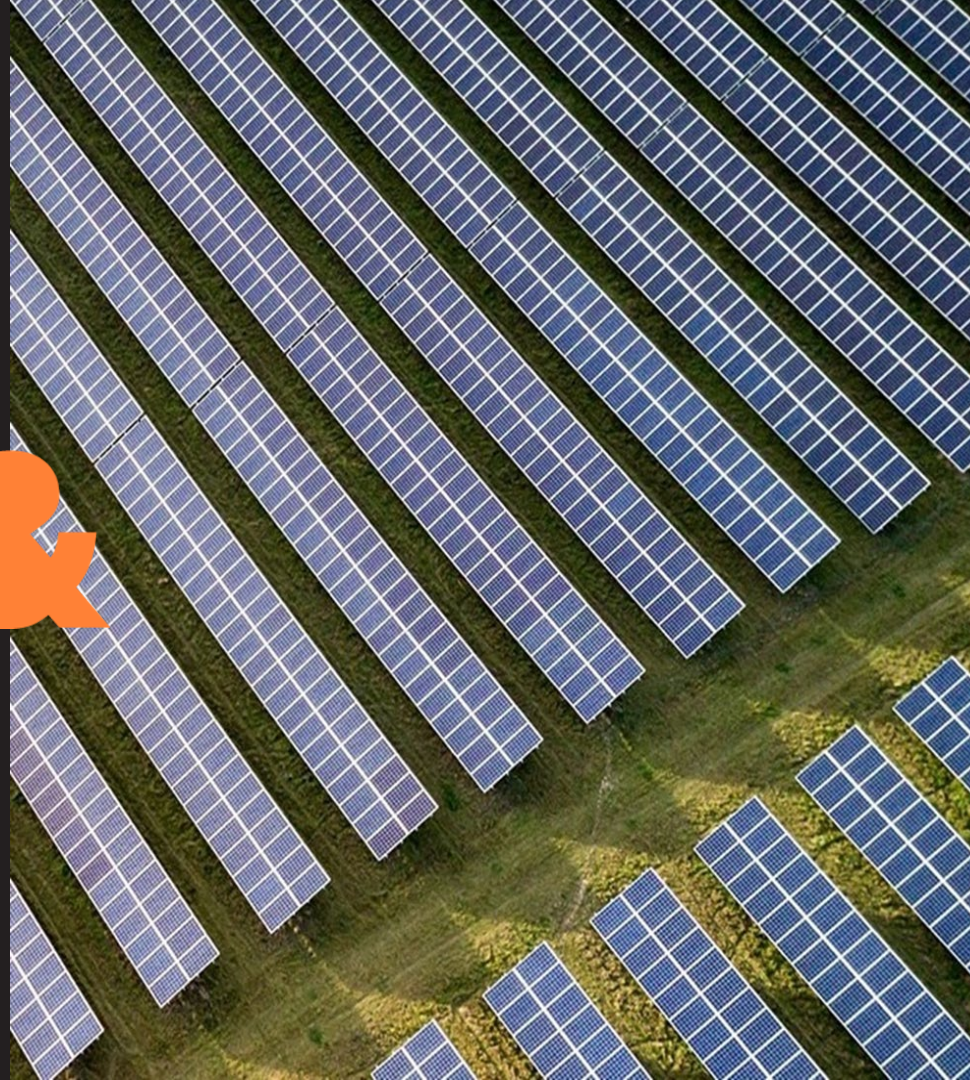
Specialist Knowledge.
Practical Solutions.

Electrification of process heat



Prepared by – Robert Nicholson
Date – 23 July 2019

Why electrify?

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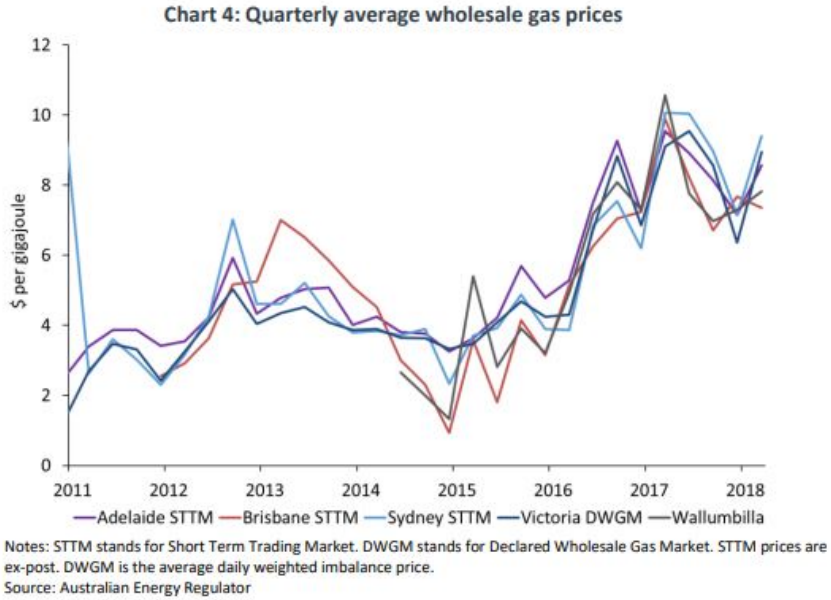
- Process heat traditionally gas sourced – boilers
- Gas prices steadily increasing over the last decade
- Adaptation of technology
- Improve energy productivity



Process heat – then and now

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- Historically has been designed purely on providing utility where heat (or cooling) is needed
- Few consideration given on heat recovery between processes. Some perceived barriers
  - Risk of having process streams interacting with another
  - Energy *was* cheap and heat recovery equipment *was* not
  - Heat recovery expertise was (and still is to a large extent) rare in process design engineers
  - As a result, heat recovery tends to be **opportunistic** as opposed to **holistic**

Electro-technologies for process heat

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- **Heat pumps**
  - Conventional, ammonia (or other refrigerant based) for temps <60°C
  - Med - High temp, CO_2 refrigerant machines for up to 95°C
  - High temp available – 120^{o}c +
  - Other heat pumps, such as Mechanical Vapour Recompression
- Reverse Osmosis (or other membrane based technology) – for dewatering
- UV for food preservation
- Ohmic heating and microwaves for cooking
- For some applications, an electric boiler may be more efficient due to quick start up and shut down capabilities

Industrial process heat pumps

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- Good for existing plants that have in built inefficiencies that are structural and expensive to remove
- Allows for heat sinks and heat sources to be linked, providing heat recovery without traditional heat exchangers
- Works well especially in food processing – many cold and hot streams in processes that can take advantage of simultaneous heating/cooling capabilities of heat pumps
- Can work without a waste heat source (using air) though usually less effective.

Heat pump advantages

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- High COP ~ 4 – 5 heat energy conversion
- Productive heat source – when and where you need it
- Input energy can easily be renewable – e.g. solar
- Reduction of $CO_{2\text{-}e}$ emissions
- Reduction of input energy costs
- Possible improved product output
- Reduced plant maintenance

Case study – Brewery

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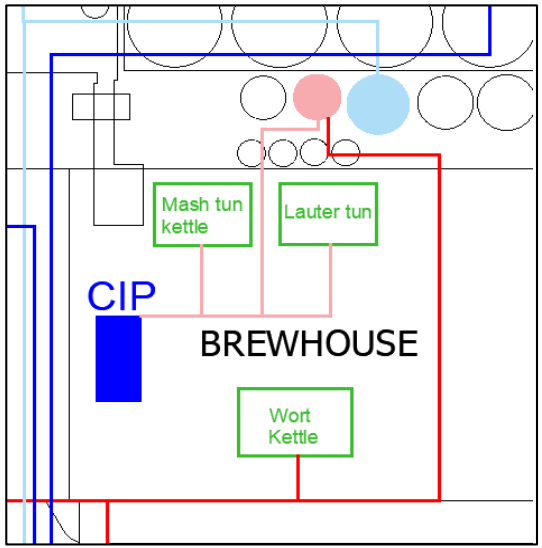
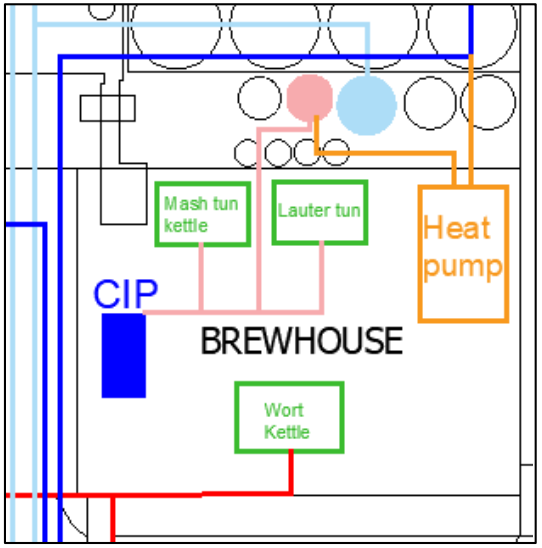
- Chilled and hot water lines run throughout the Brewhouse, each provided for by hot and cool utilities
- Heat pumps proposed to link the heat sink of hot water line with heat source of the chilled water lines (brine/ethanol loop)





Case study – Brewery

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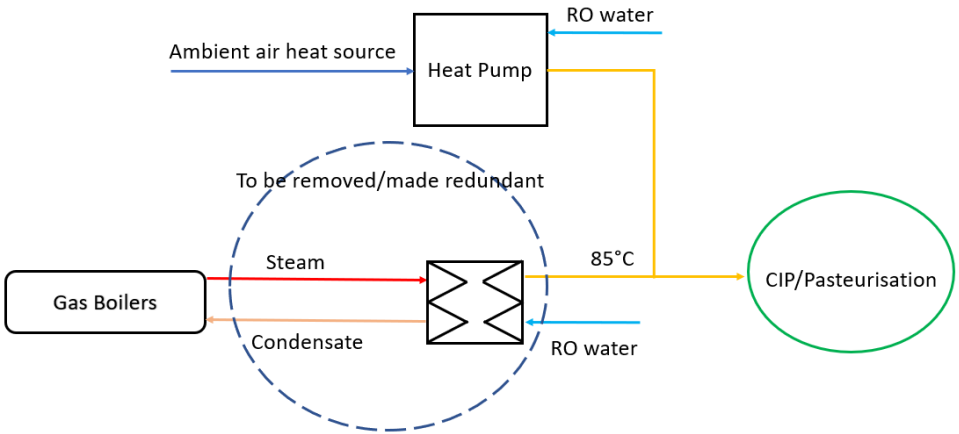
- Air sourced heat pump as no utility provided heat source
- Heat recovery opportunity from pasteurisation run off water



Case study – Brewery

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- Strong business case

Heat Pump Financial Figures	Annual Savings (ex GST)
Capex for system	$2,400,000 - $2,600,000
Energy cost savings	$459,000
Simple payback period	**6 years**
NPV (15 years, 8% discount rate)	**$2,100,000**
Other savings (high uncertainty, not included in financial analysis):	
Gas savings from reduction in usage times of boilers	$113,000
Steam transmission loss savings	$18,000

Other process heat optimisation strategies

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- Improve existing heat recovery opportunities
- Thermal storage
  - stratified tank
  - high temperature salts from solar thermal
- Renewable hydrogen

Why pitt&sherry?

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Your customer experience with us will be great.

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