NZ GEOTHERMAL WEEK 2023
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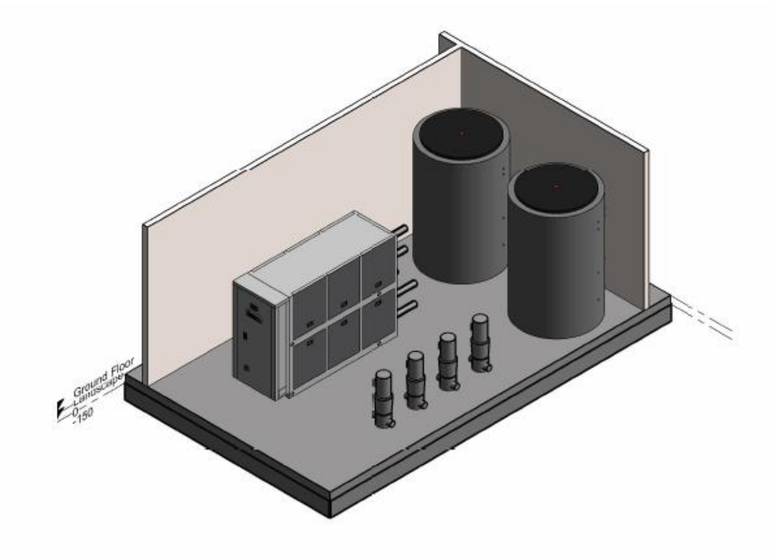
GEOEXCHANGE AUSTRALIA

GeoHeat for Horticulture Workshop

What if my Geothermal Isn't Hot or I want to Cool?



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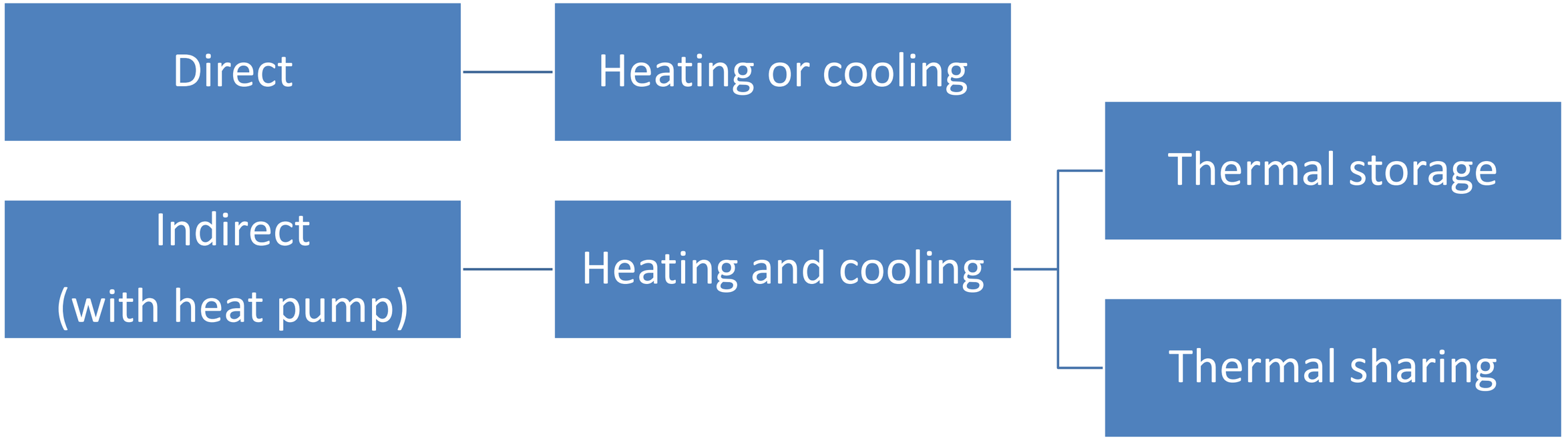
Electrification – Key Considerations

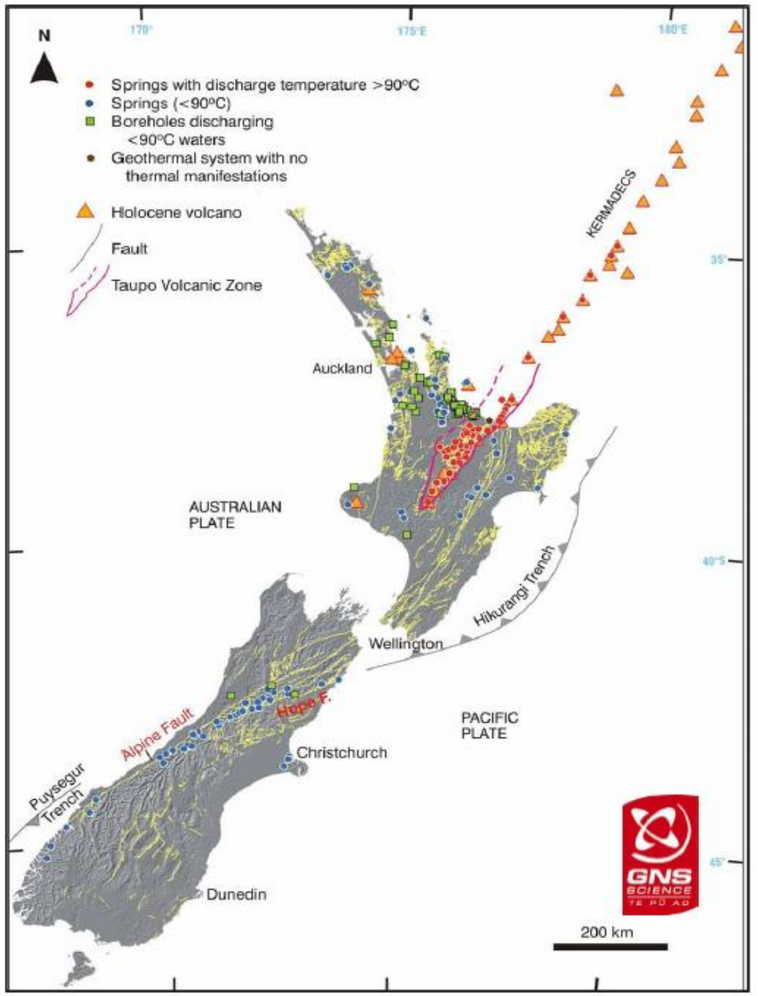
- Heat loads:
  - Boilers are typically oversized - sometimes comically so
  - Identify other efficiencies – thermal and electrical
- Power Supply:
  - Could be determining factor of heating system selection
  - Decision to invest in electrical energy or thermal energy
- Output temperatures matter but not always as much as you think
  - High temperature heat pumps: 130C now and 180C not far away
  - Low temperature application
- Plant Location – Heat pumps and thermal storage
  - Air source heat pumps - outdoors for air flow / ventilation
  - Ground source heat pumps - indoors for longer life
- Available sources of renewable thermal energy

Renewable Thermal Energy



Mapping ‘Not’ Geothermal

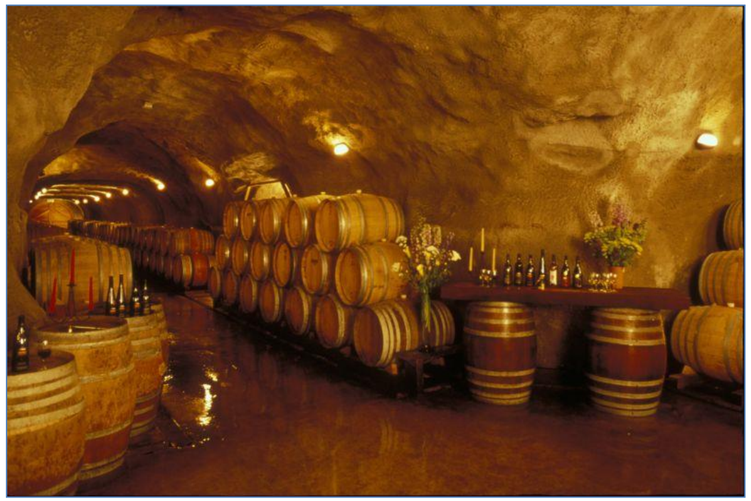
- Ignore the colours. All about the grey!
- Geology and hydrogeology determines what is possible
  - Rock type
  - Depth to groundwater
  - Groundwater flow rates
- Greater flexibility than ‘geothermal’



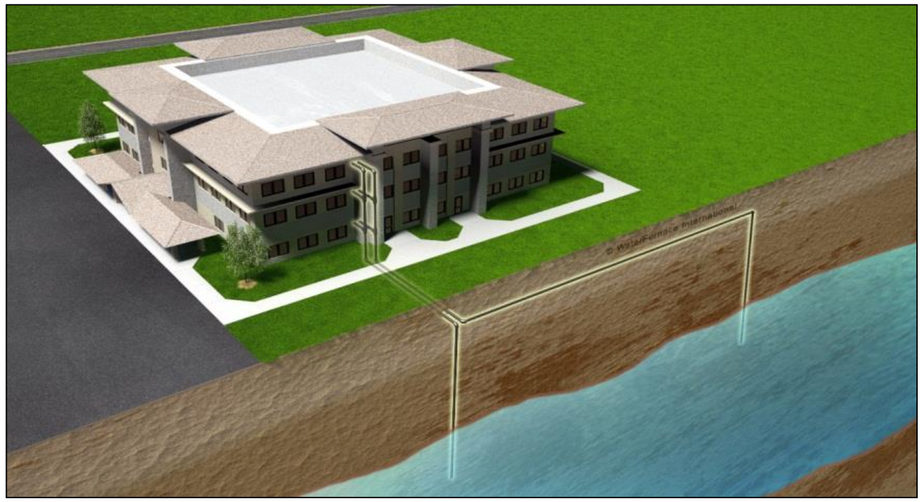
From: Reyes, A.G. and Christianson B.W. (2006) Mineral waters. In: Graham I. (ed) GSNZ Monograph. Faults from www.gns.cri.nz.

Indirect Renewable Thermal Energy

- Indirect Thermal energy
  - Requires a heat pump
  - Temperatures tend to be a function of **average ambient temperature**
  - Heating and cooling – seasonally and simultaneously
  - Thermal storage is possible

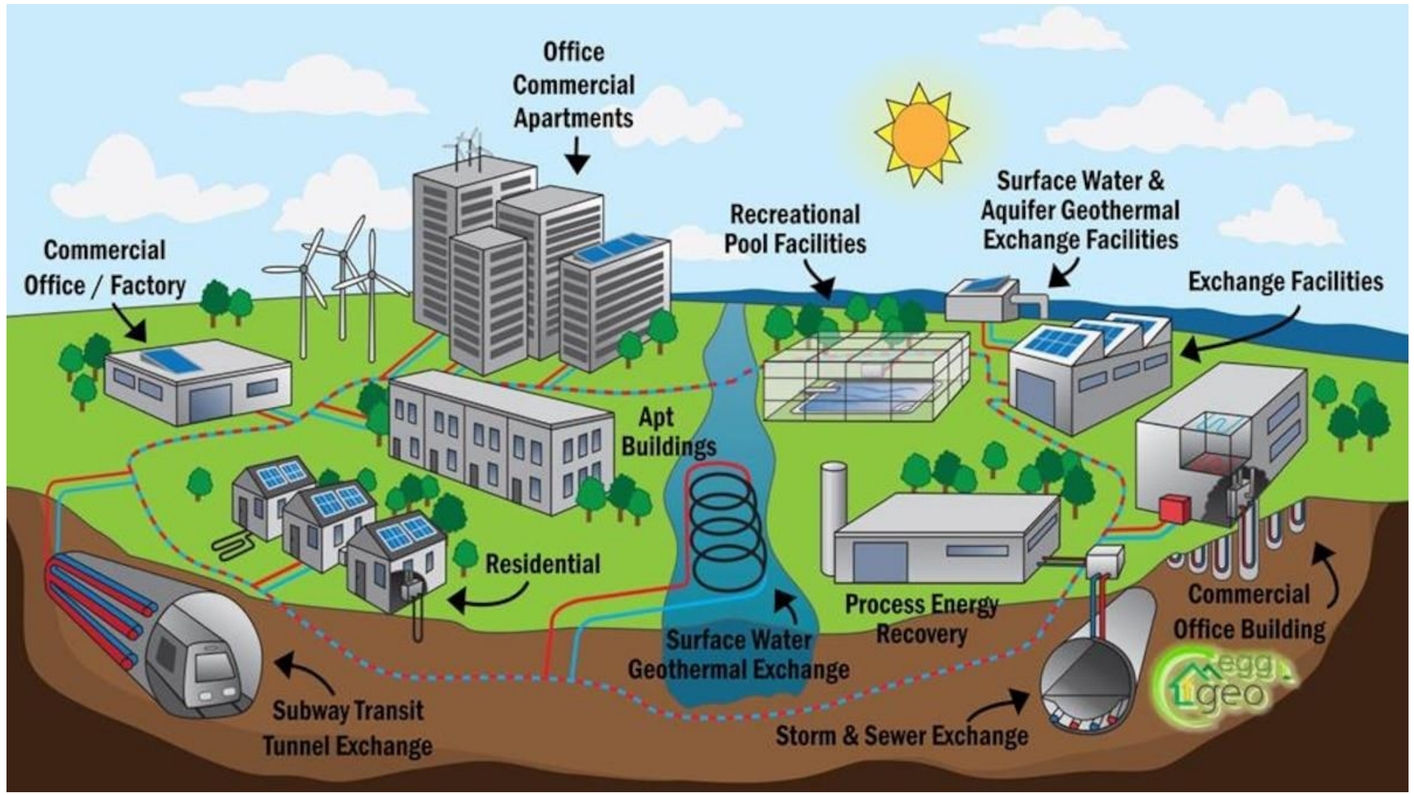


Sources of Renewable Thermal Energy

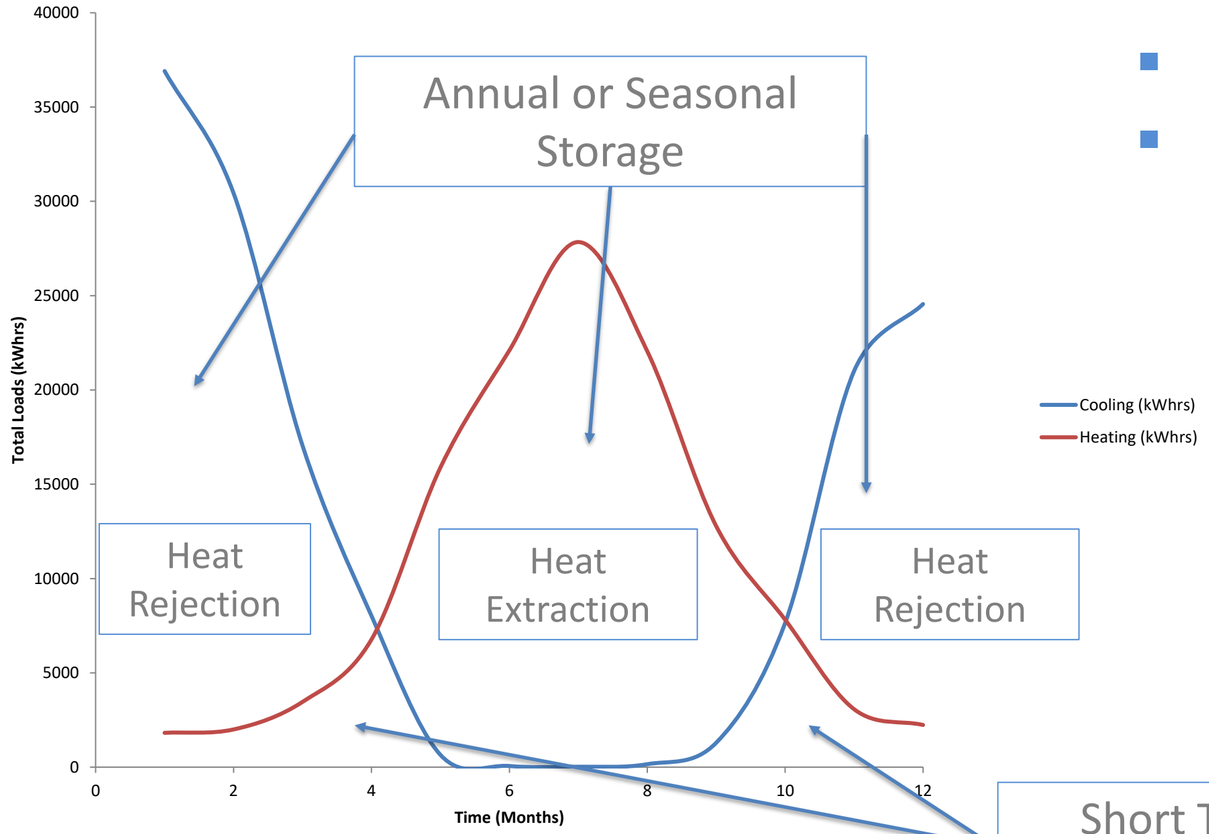


Resource Stacking and Thermal Sharing

- Resource Stacking: Irrigation system dual functions as source of thermal energy
- Sharing thermal energy between buildings / applications:
  - Data centre heats swimming pool
  - Data centre heats greenhouse
  - Cold store heats greenhouse
- District Thermal Energy System
  - Beyond site boundaries

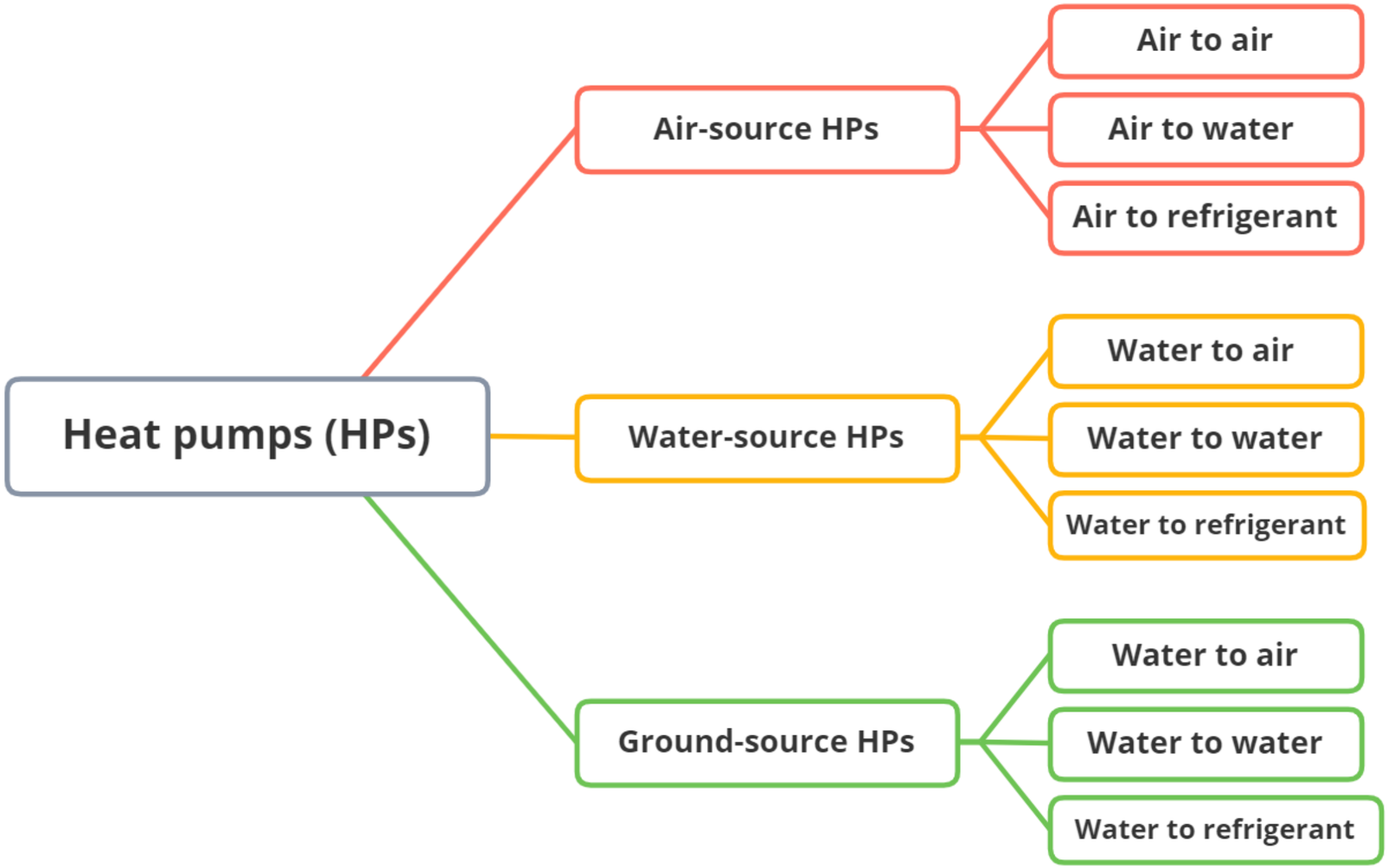


Thermal Storage: Mixed Heating and Cooling



- Standard: Hot / cold storage after heat pump
- Ground as a thermal battery
- Case Study - Western Victoria
  - Cool 1 Heat 4

Categorisation of Heat Pumps



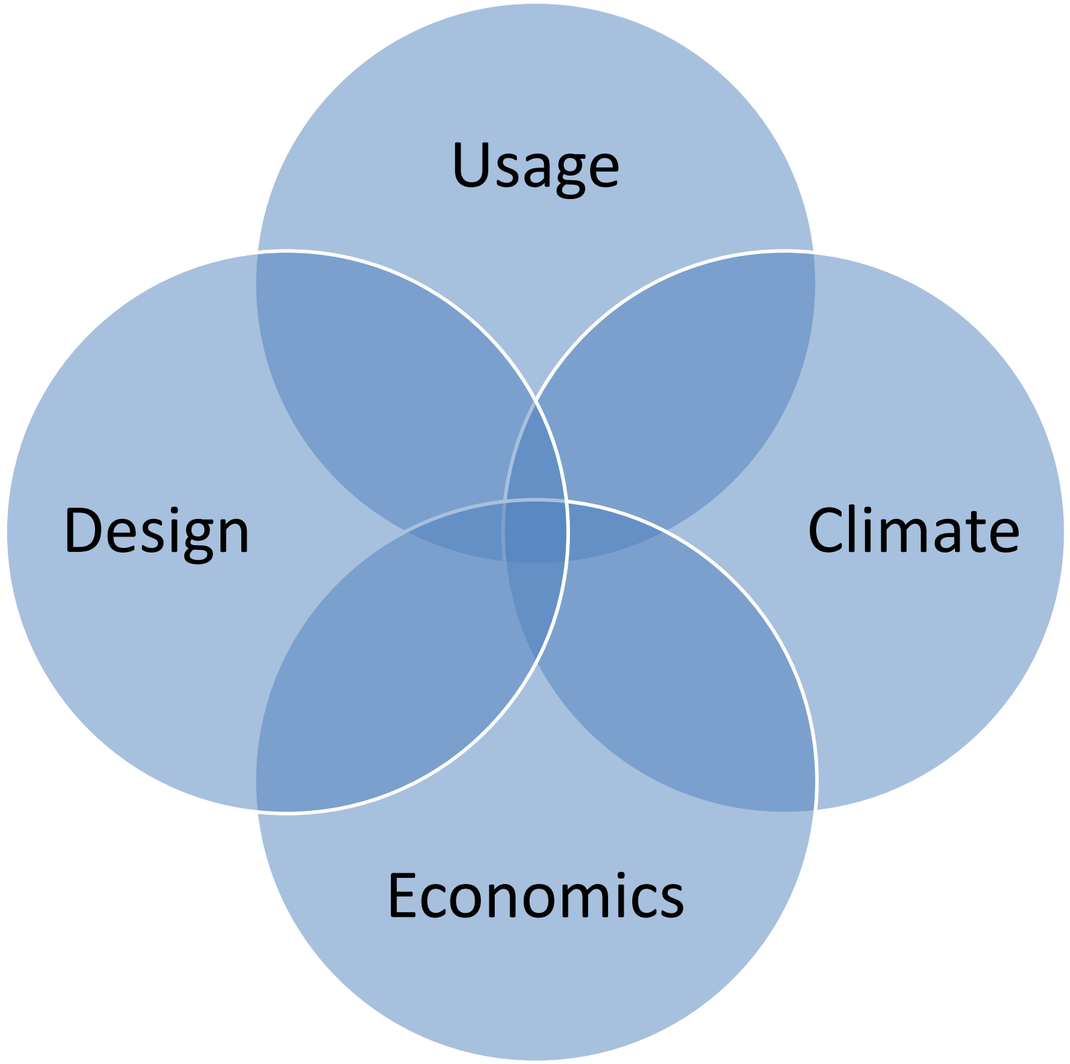
Case Studies

- Direct (35C) and indirect (heat pump) for WA aquatic centre
- Glasshouses in western Victoria
  - Cooling in 1 glasshouse = heating in 4 glasshouses
- Not just horticulture:
  - Poultry
  - Aquaculture

Case Study: 500 kW Heat Pump System

ASHP and GSHP Peak Operating Comparison at 45C Output					
Scenario Description	**Source Temperature**	**Full Load Amps**	**Input (kWe)**	**Output (kWth)**	**COP**
Air sourced heat pump	0C	270A	166	451	2.7
GSHP (Closed Loop)	0C	191A	117	386	3.3
GSHP (Closed Loop)	5C	197A	121	457	3.8
GSHP (Open Loop)	10C (ambient)	204A	125	528	4.2
GSHP (Open Loop)	15C (ambient +)	207A	127	600	4.7
GSHP (Open Loop)	20C (geo enhanced)	209A	128	672	5.3

Applications: Is there a Sweet Spot?



- **Usage**
  - Run time of HVAC systems
  - Mix of heating and cooling
- **Climate**
  - Local climate with relative extremes
  - Mix of heating and cooling
- **Finance**
  - High energy costs (electricity and gas)
  - Cost of heat exchanger – can vary widely
  - Building owner invested in operating costs
  - Revenue generating option / thermal utility
  - Carbon credits
- **Practicalities / Design**
  - Suitable location for the GHX
  - Other benefits associated with building (cost, acoustics, space, structural, rooftops etc)

Thank you for your time – Questions?

- Takeaways:
  - Thermal is energy too – and it can be renewable
  - ‘Geothermal’ doesn’t need geothermal
  - ‘Geothermal’ can (be) cool - and makes the system more efficient

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