

HEAT RECOVERY from REFRIGERATION



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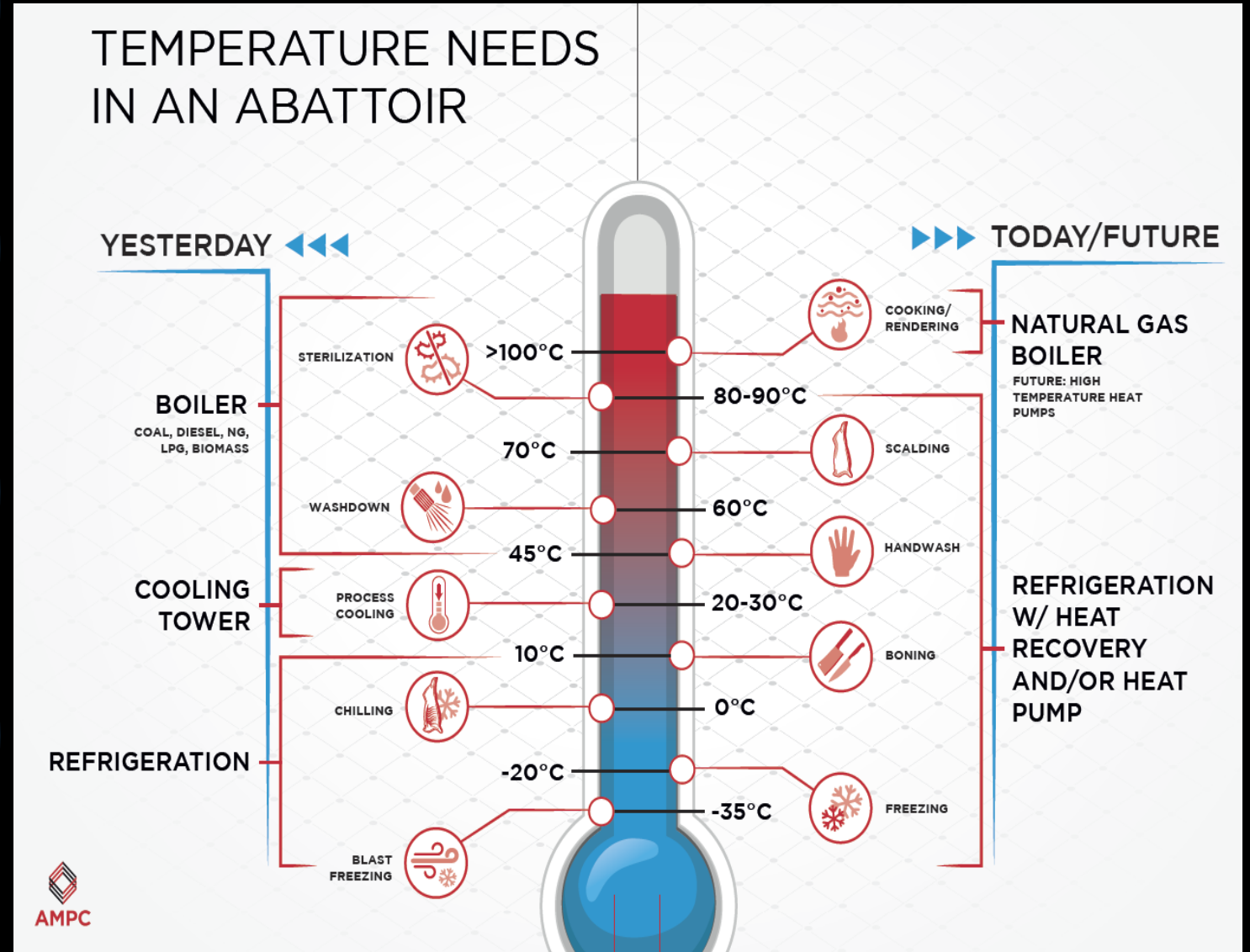
MINUS 40



Michael Bellstedt
CEO Minus 40 Group

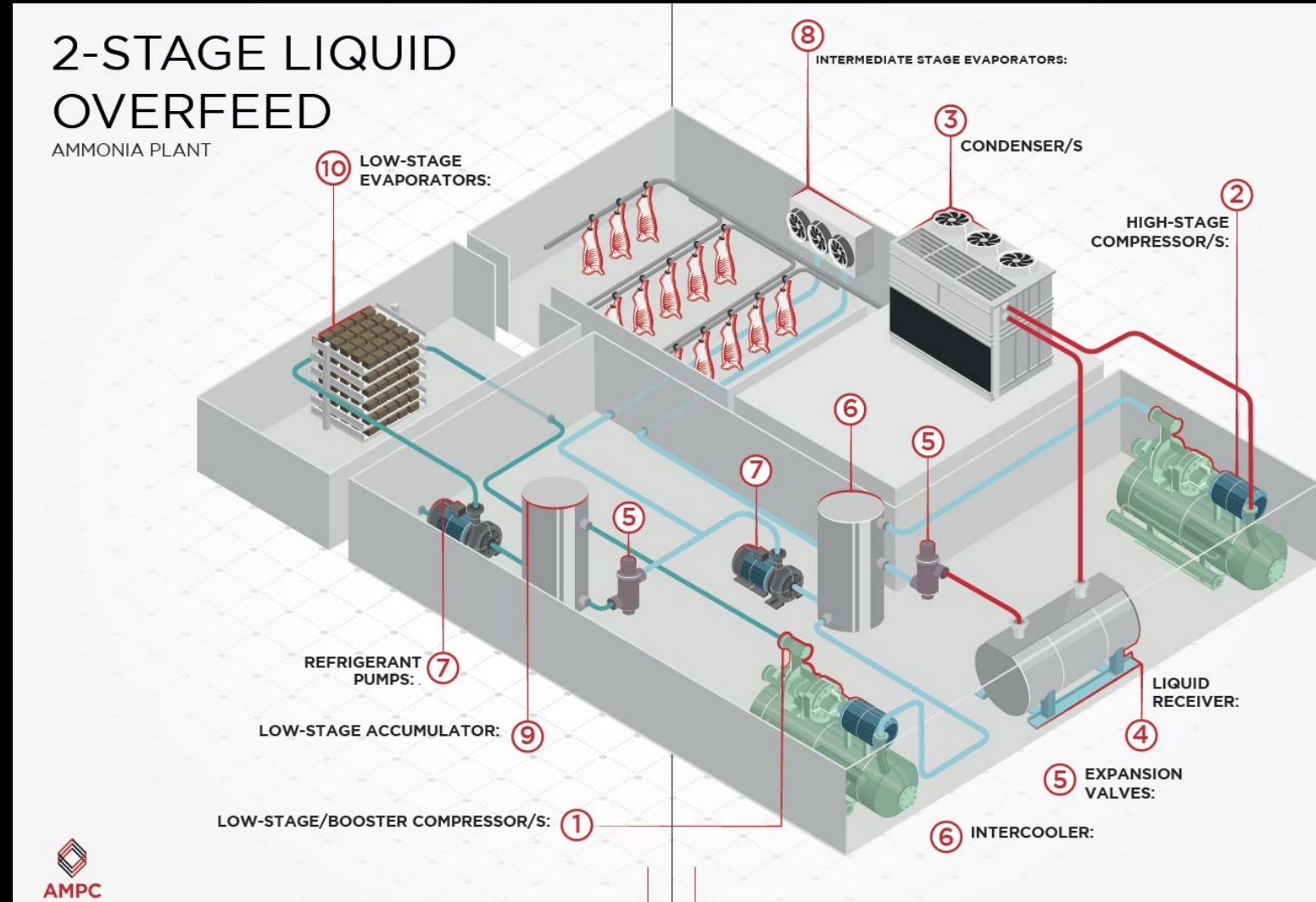
Temperature needs in an Abattoir

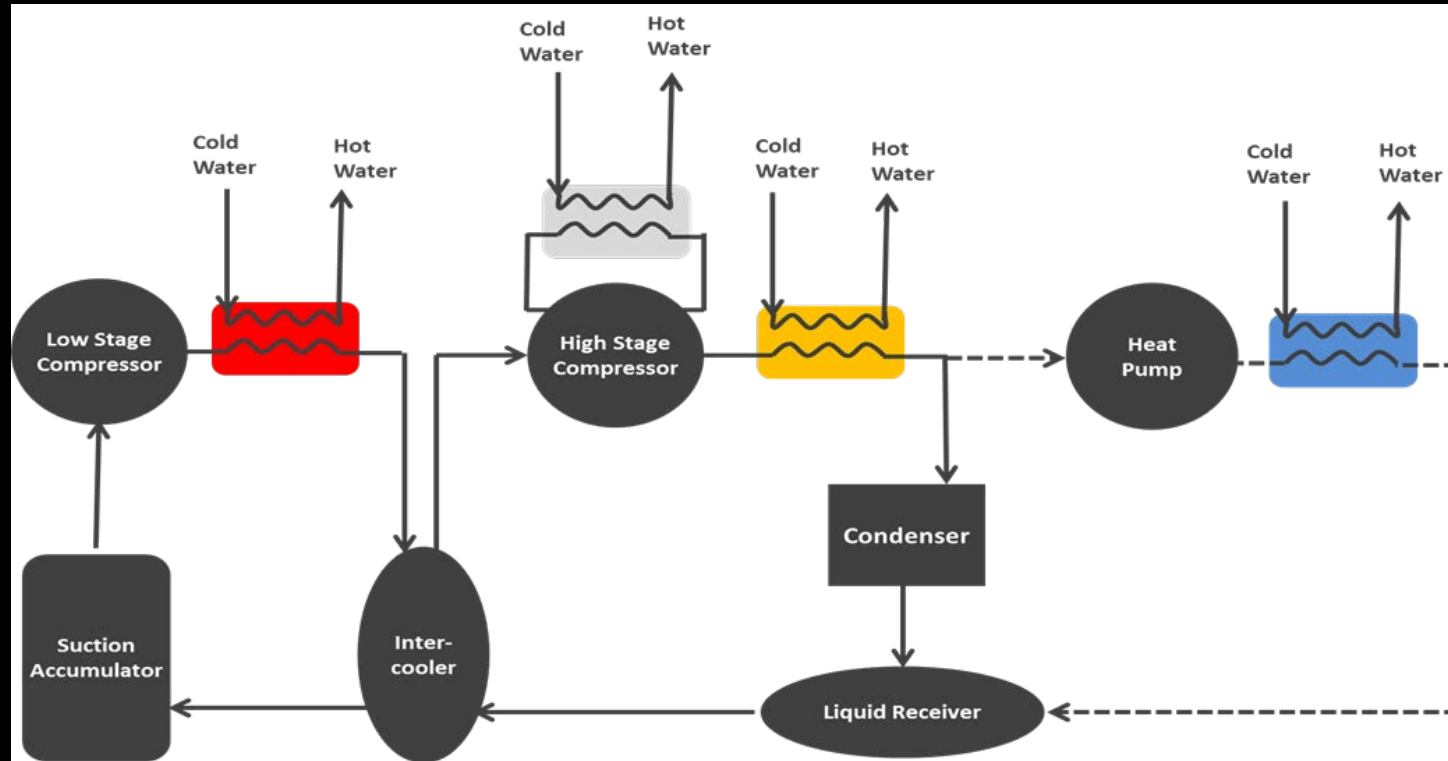
- Traditionally everything $>45^{\circ}\text{C}$ needed a boiler. Today this is changing
- Heat recovery from refrigeration can provide for Handwash and Washdown (60°C)
- Scalding and Sterilizer requires heat pump (ammonia) or heat recovery from full CO_2
- Cooking and Rendering needs to wait until high temperature heat pumps are market-ready



Typical two-stage ammonia plant

- Most medium and large abattoirs in Australia have two-stage liquid overfeed (pump circulated) ammonia refrigeration systems.
- Several heat recovery and heat pump integration options exist for 2-stage ammonia



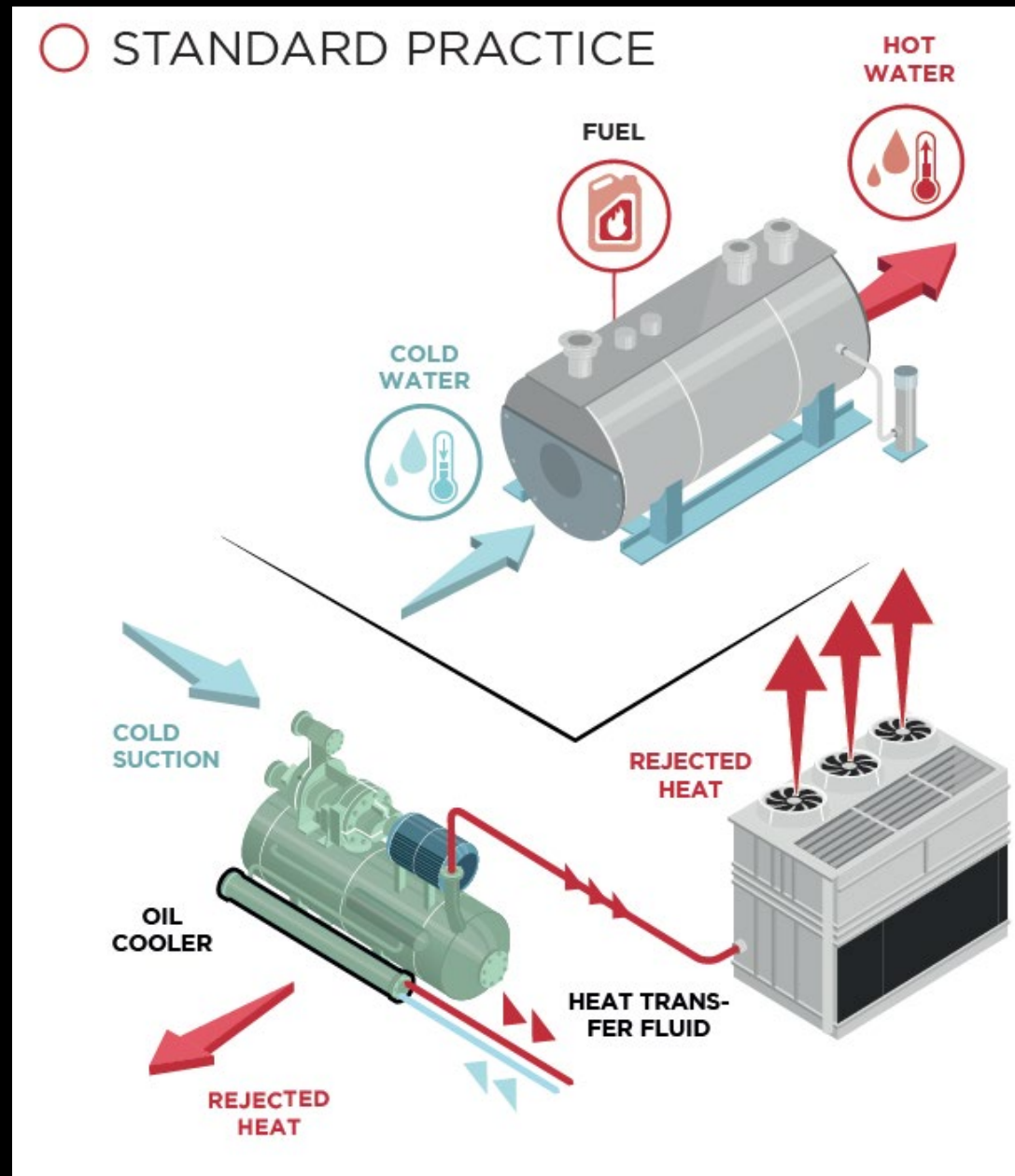


Heat recovery from 2-stage ammonia

- Heat recovery generally feasible from
 - Low stage compressor discharge (this actually saves power)
 - High stage discharge (power neutral if designed carefully)
 - High stage oil cooling (power neutral)
- An integrated heat pump provides more heat (but uses power)

Business as Usual

- Boilers burn some type of fuel and turn cold water to hot water or steam.
- Independently, the refrigeration plant is rejection heat to the environment, partly at usable temperatures.



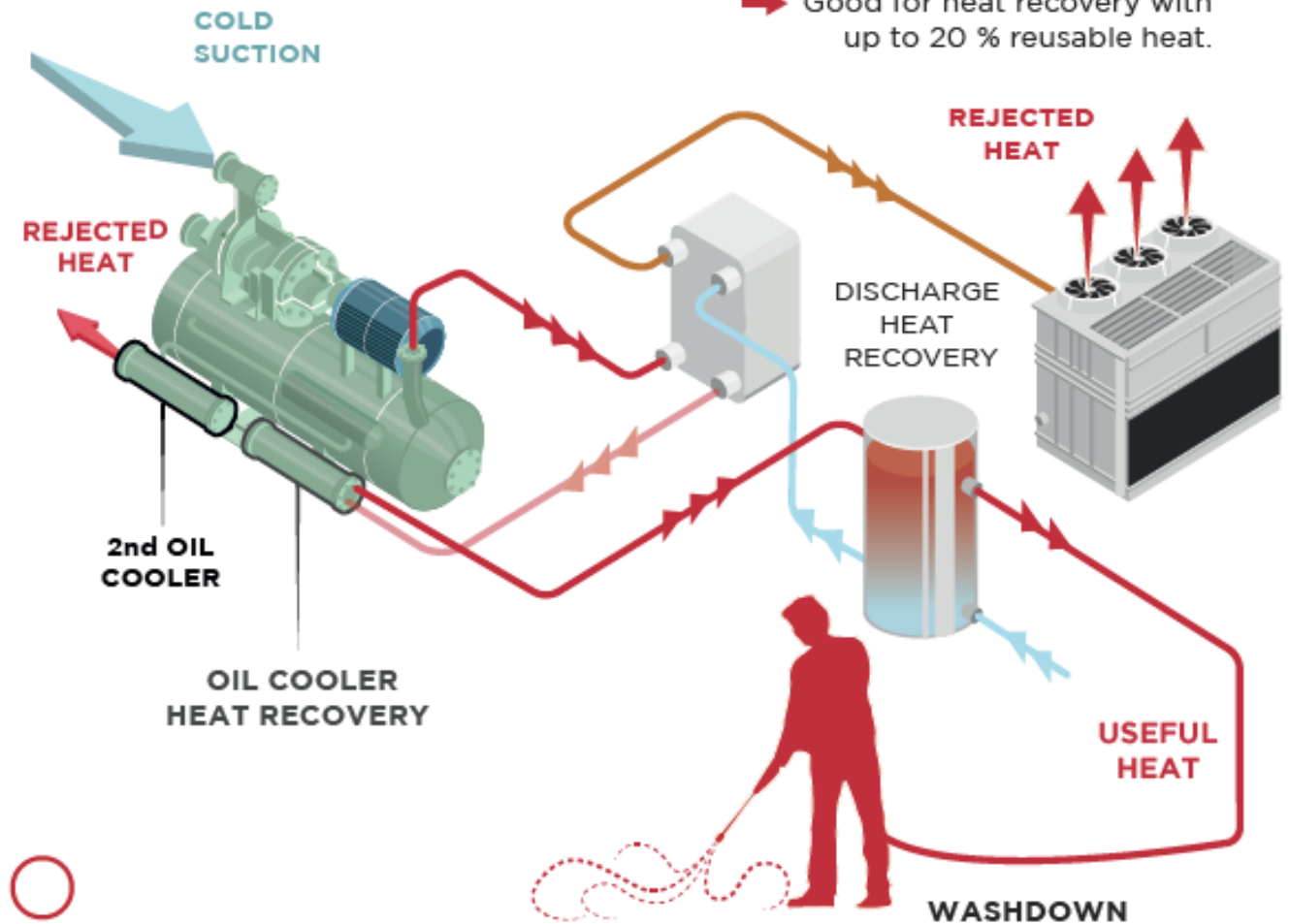
Maximum heat recovery from high stage

- A stratified hot water tank takes in cold water at the bottom
- Cold water is first pumped into desuperheater, taking up all superheat and some condensing heat.
- Warm water then supplied to oil coolers and heat to usable temperature (>60°C)
- This water fed to top of tank and not mixed with cold at the bottom
- Wash water drawn off the top of the tank.
- Remaining heat rejected from 2nd oil cooler and condenser
- VSD on pump + good PLC control needed.

TURN WASTE TO PROFIT

NH₃ has **high discharge temperature**

→ Good for heat recovery with up to 20 % reusable heat.

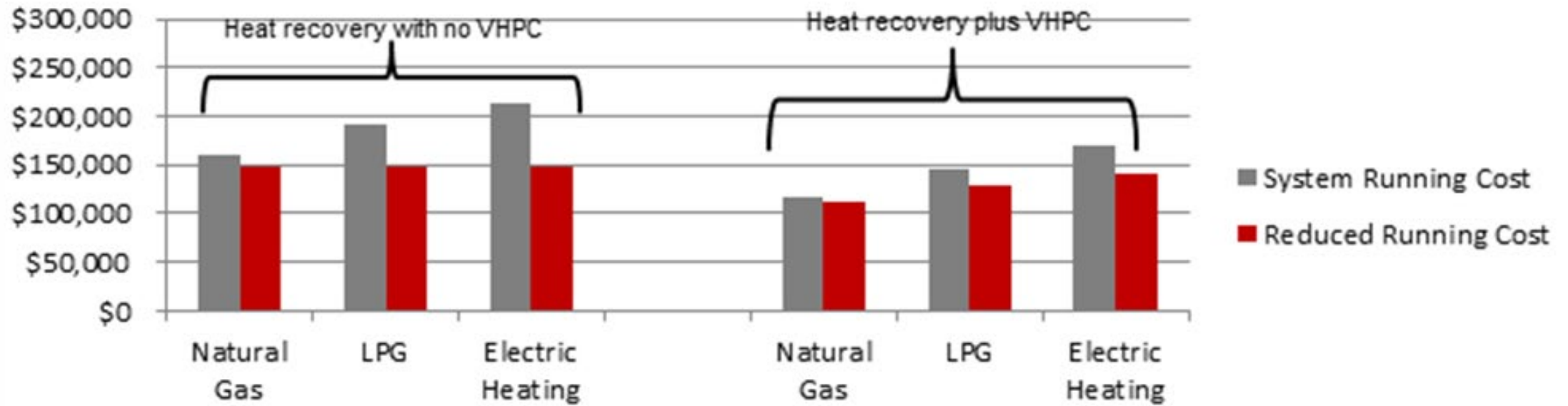




Pork industry example

- Plate heat exchanger as desuperheater
- Insulated vertical stratified tank
- Compressor with two oil coolers
- Another view of desuperheater

Site 1



Effect of Variable Head Pressure Control

- VHPC reduces hot water available in winter, but saves a lot of compressor power.
- Even though this reduces savings, still better than doing only heat recovery.

Summary

Two-stage ammonia plants can provide wash-down water

Heat pumps needed for scalding or sterilizer water (or if more washdown water is needed)

Heat recovery can be maximised by drawing heat from discharge gas and oil

Less heat available in winter with VHPC

Do heat recovery first, then assess heat pump needs after that!

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