Putting your money where your must is

A review of winery refrigeration economics

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Adrian Dickison Technical Director Beca Ltd FIChemE
Richard Fouhy Senior Mechanical Engineer Beca Ltd MIPENZ CPEng PMP PMI IntPE

First things first….

Thanks to;

- Martin Tucker, Johnson Controls NZ
- Graeme Marr, Johnson Controls AU
- Lindsay Fourie, Aggreko
- Clifton Madgwick, Chemiplas
- Denis Gunn, Links Winery

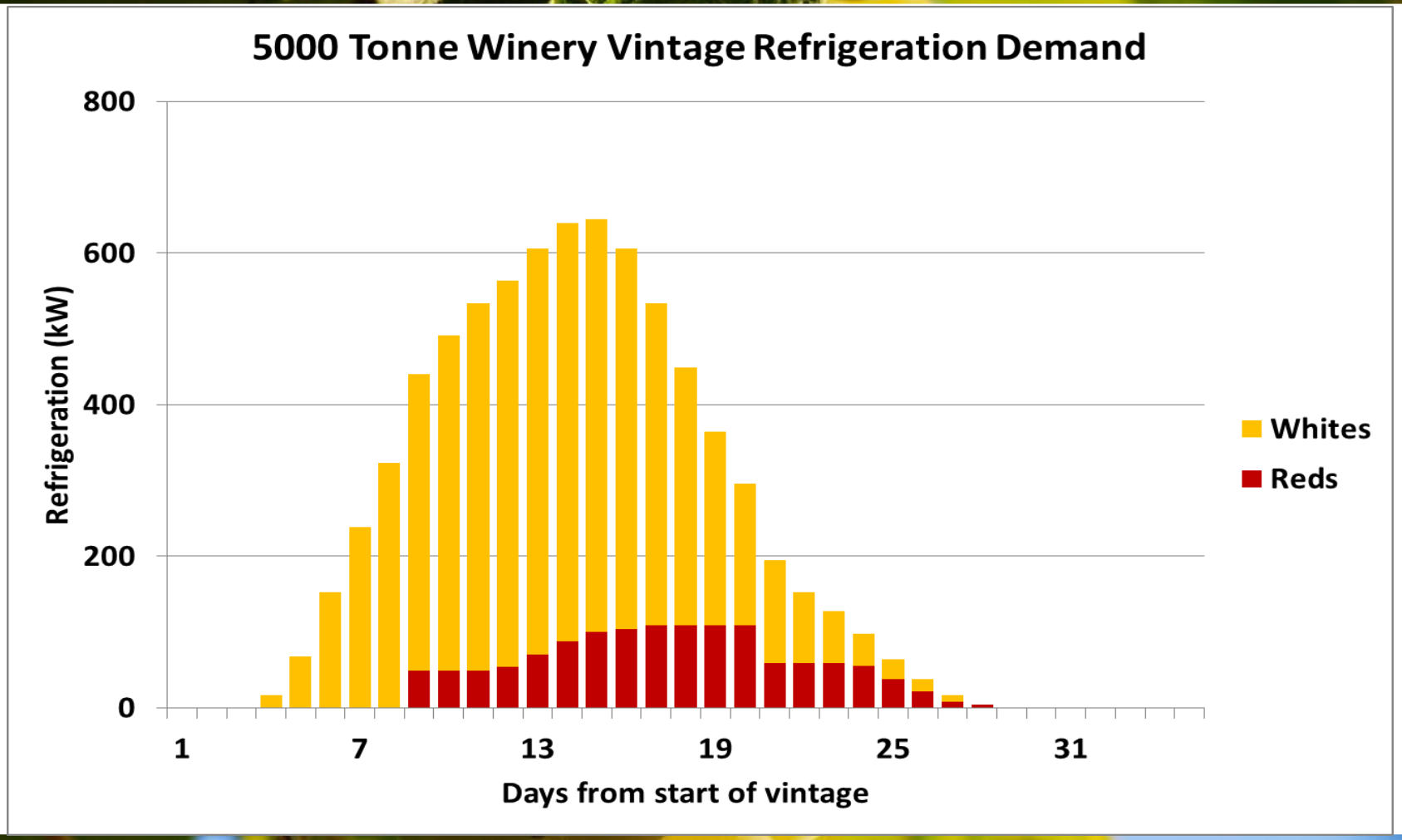
Creating Solutions CHEMIPLAS

Johnson Controls

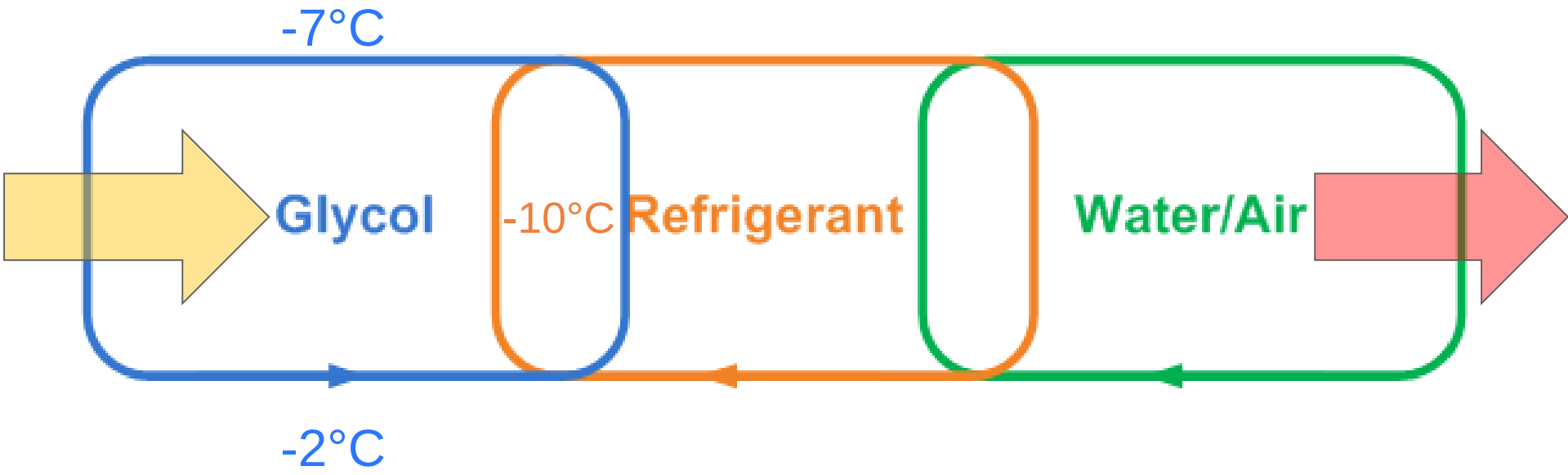
aggreko New Zealand & Pacific

Beca

Design Basis – 5000 Tonne Vintage



Design Basis
Refrigeration System – 750 kWR



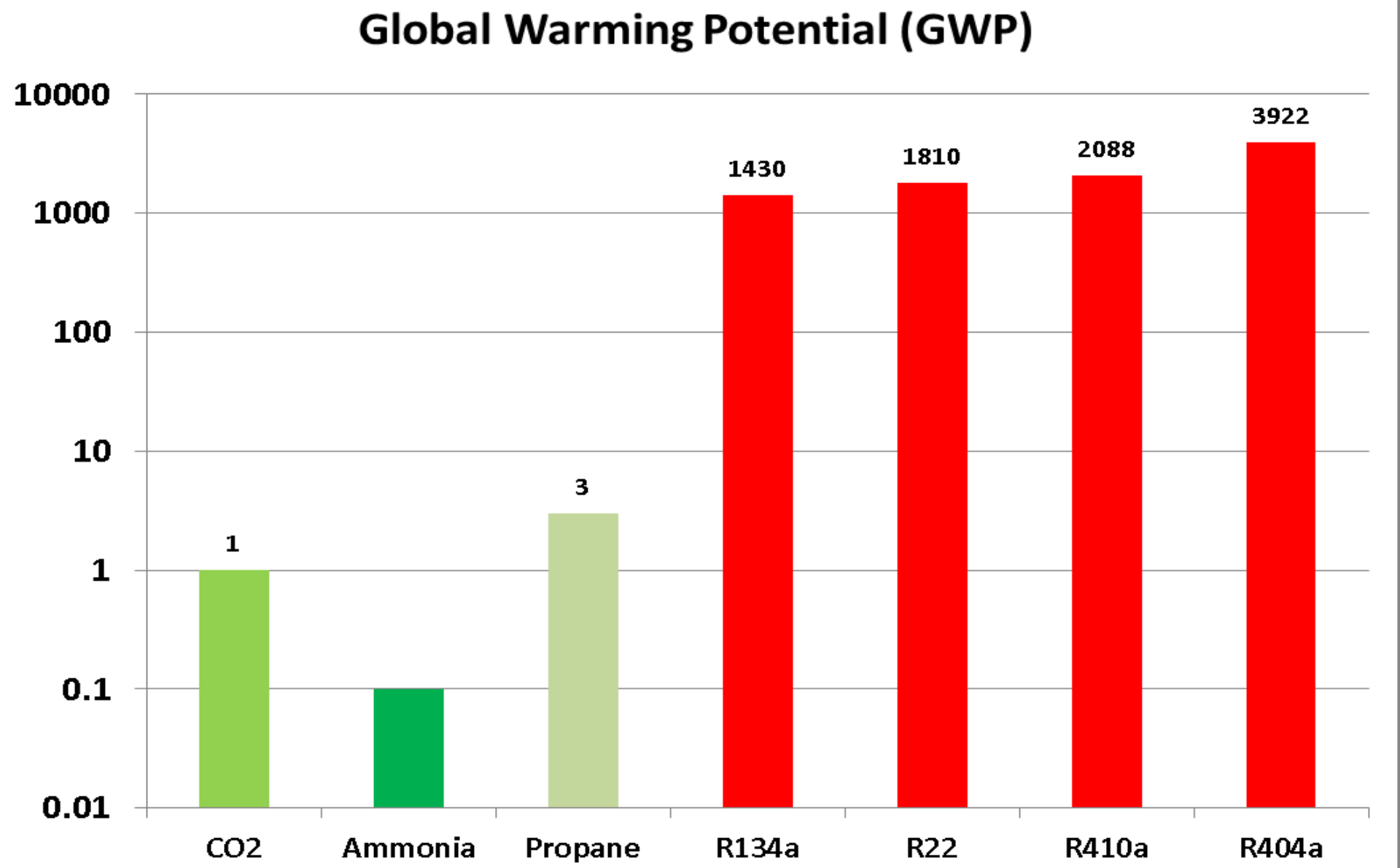
Design Basis – Economics

- Vintage period – 5 weeks
- Fully-owned plant
  - Lifespan
    - 30 years for stick-built
    - 15 years for packages
  - Interest rate: 7%
- Rental plant
  - 3 year contract term
  - 6 week rental period each vintage
  - Diesel cost: $1/L (for generator)

Refrigerant Choices

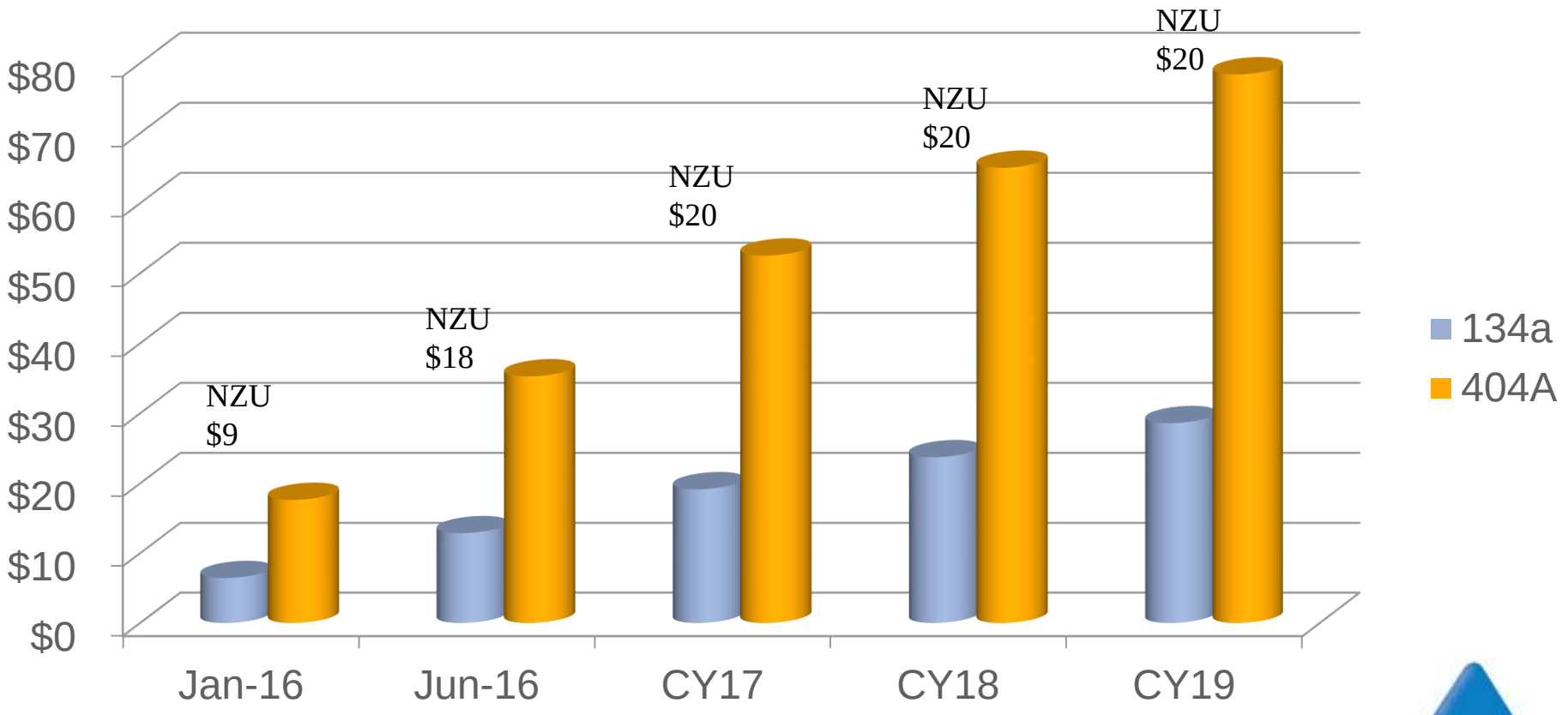
- **Synthetics (HFCs)/(HFOs - in the future)**
  - **R410A**
  - **R134a**
  - **Plus an "alphabet soup" of other options**
- **Naturals**
  - **Ammonia (R717)**
  - **Propane (R290)**
  - **CO_2 (R744)**
- **IT NEEDN'T BE AS SCARY AS HALLOWEEN!**

Refrigerant Choice



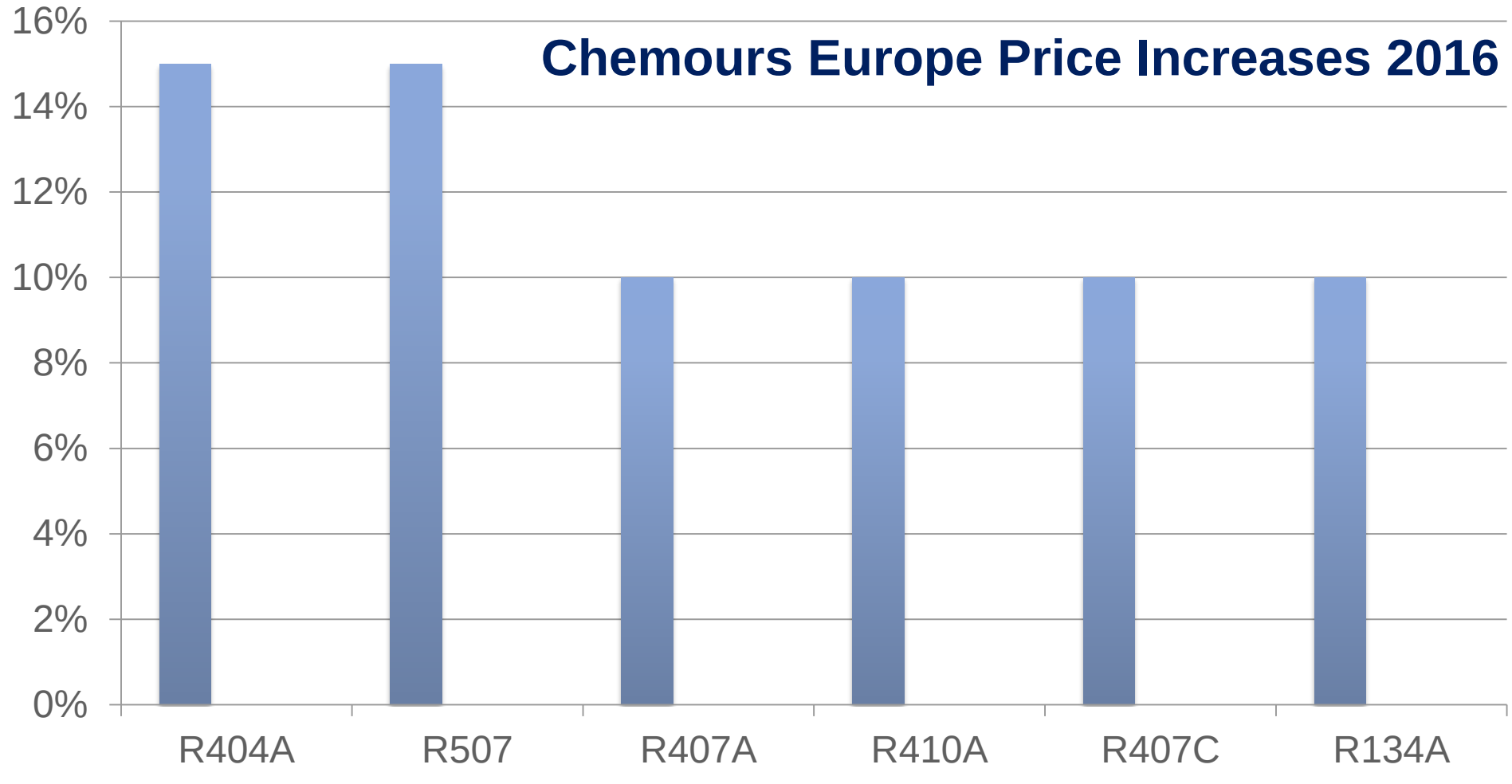
NZU Carbon Price

Impact of Carbon / kg of refrigerant



CHEMIPLAS

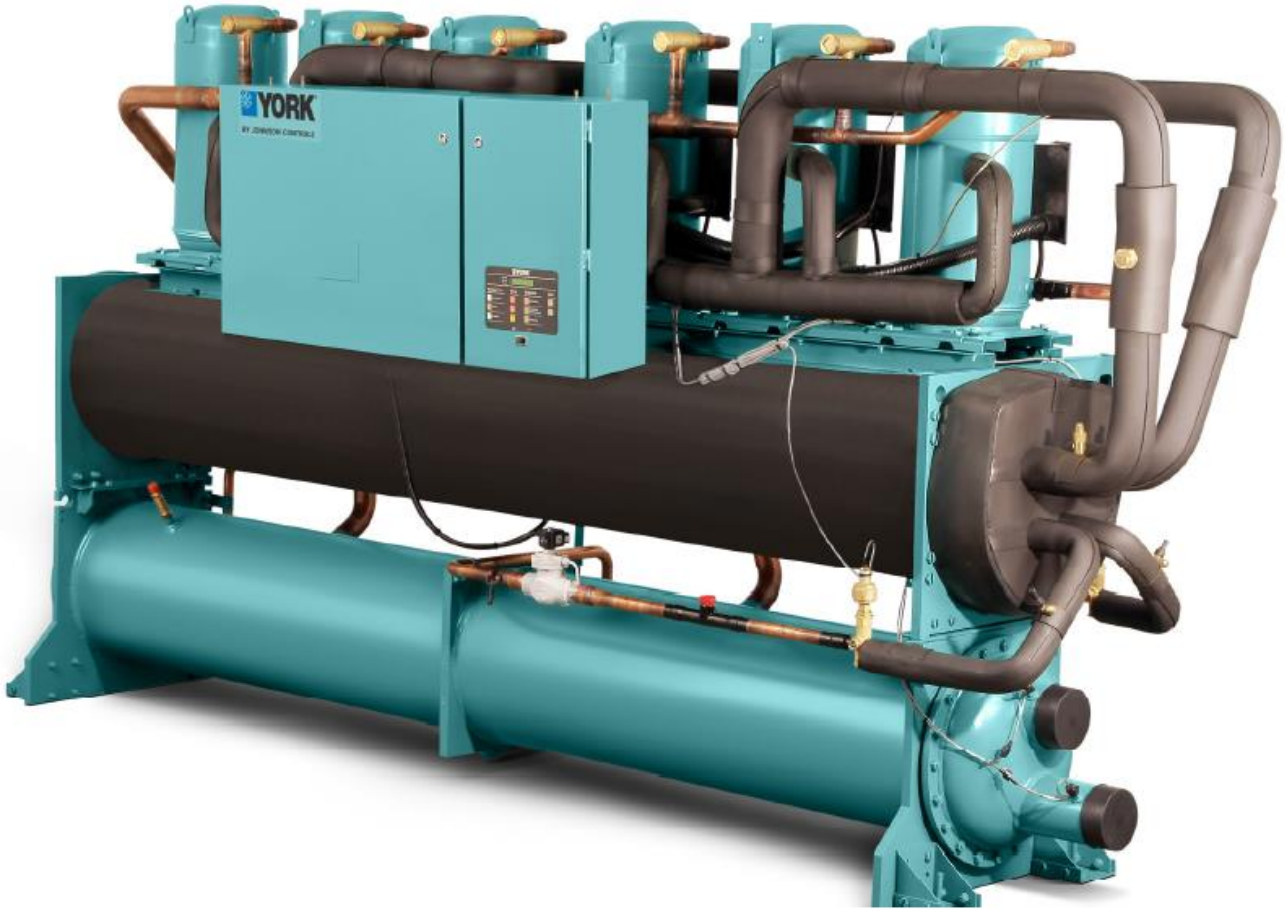
A pricey future for synthetics



Equipment
Traditional Ammonia Engine Room

Equipment

R410a Water-Cooled Scroll



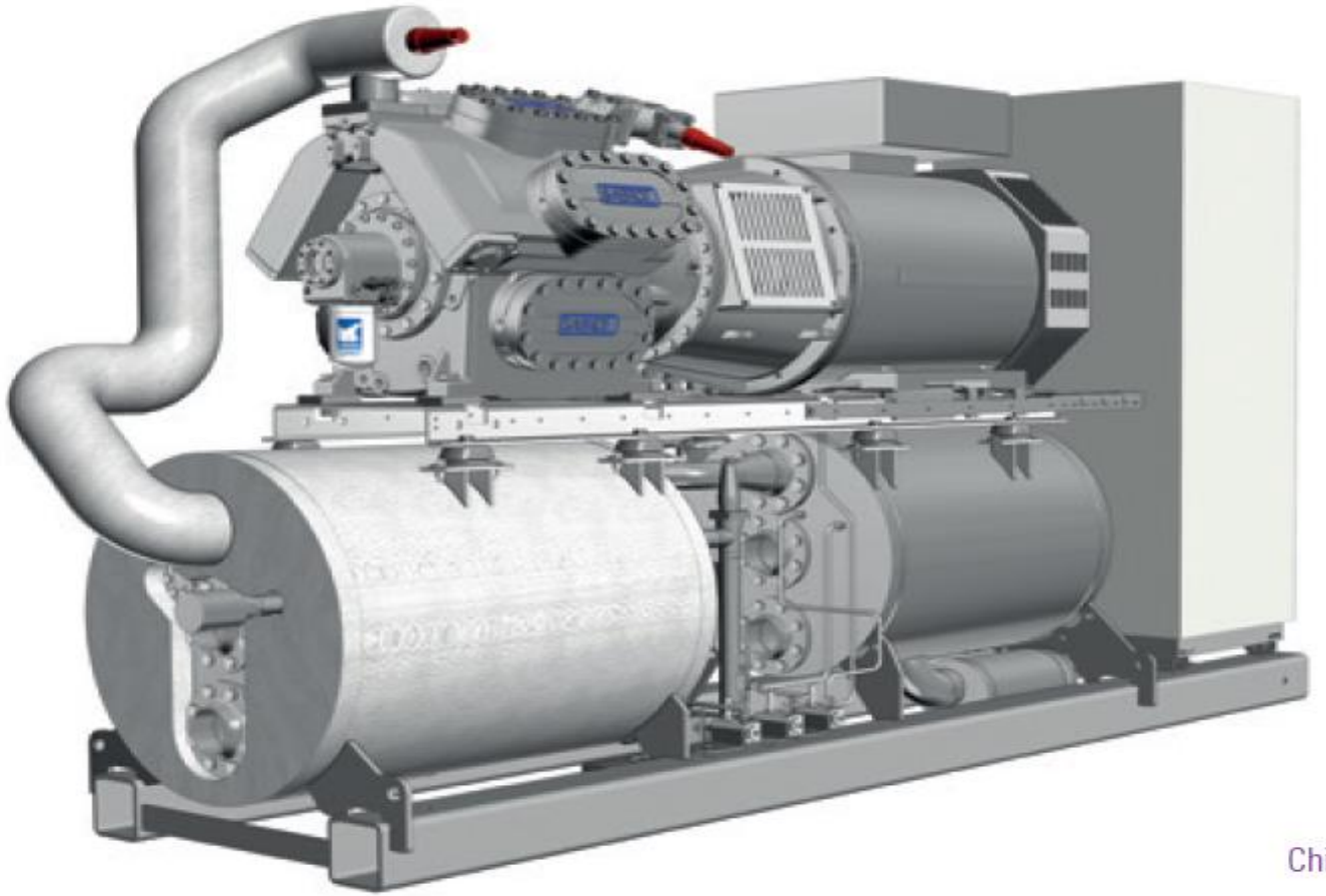
Equipment

R134a Water-Cooled Screw

Equipment

R134a Air-Cooled Screw

Equipment
Ammonia Water-Cooled Recip.



ChillPAC 108

Equipment

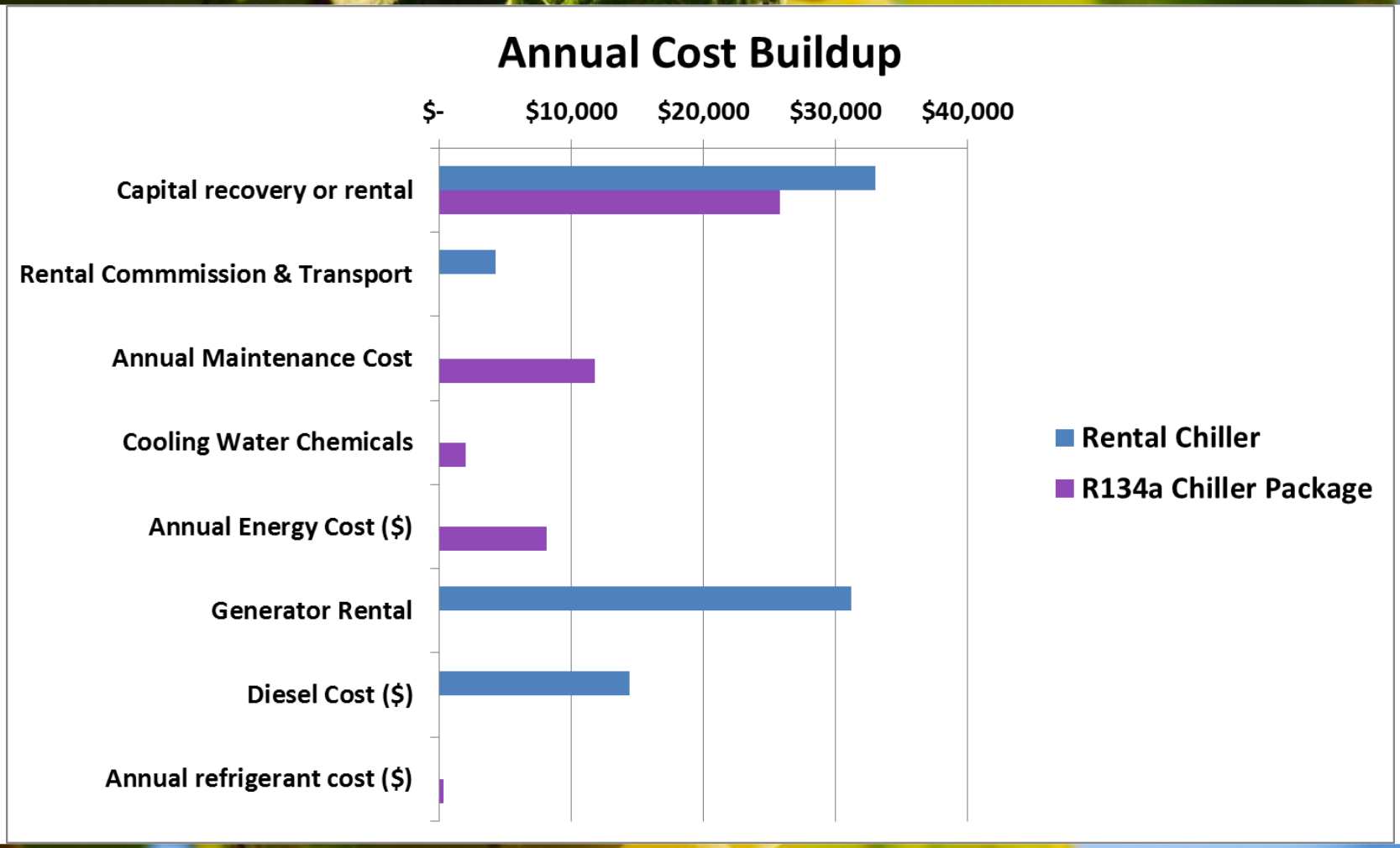
Propane Air-Cooled Recip. Package

SABlight air-cooled chiller

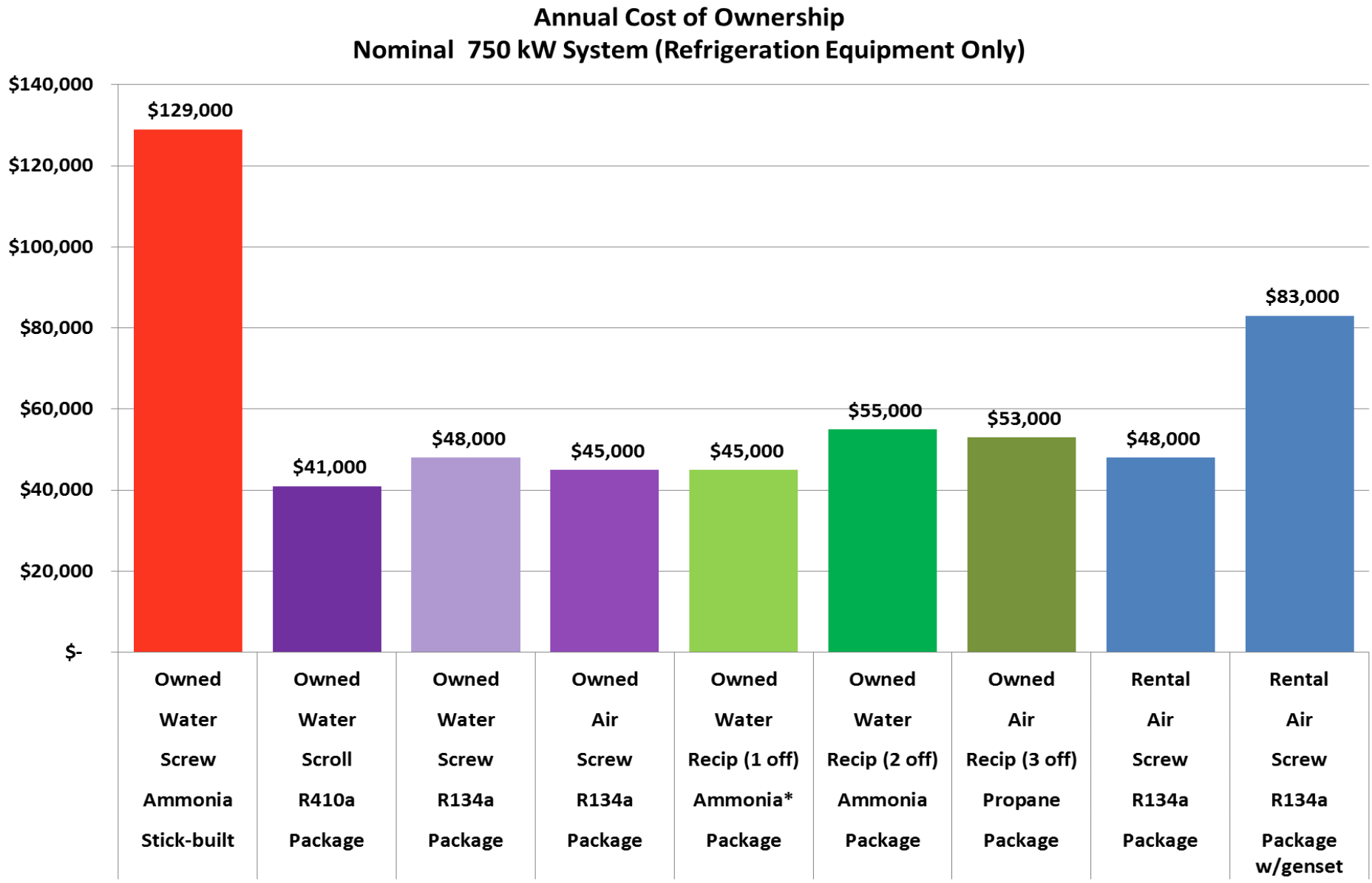
Equipment

Rental R134a Screw Air-Cooled

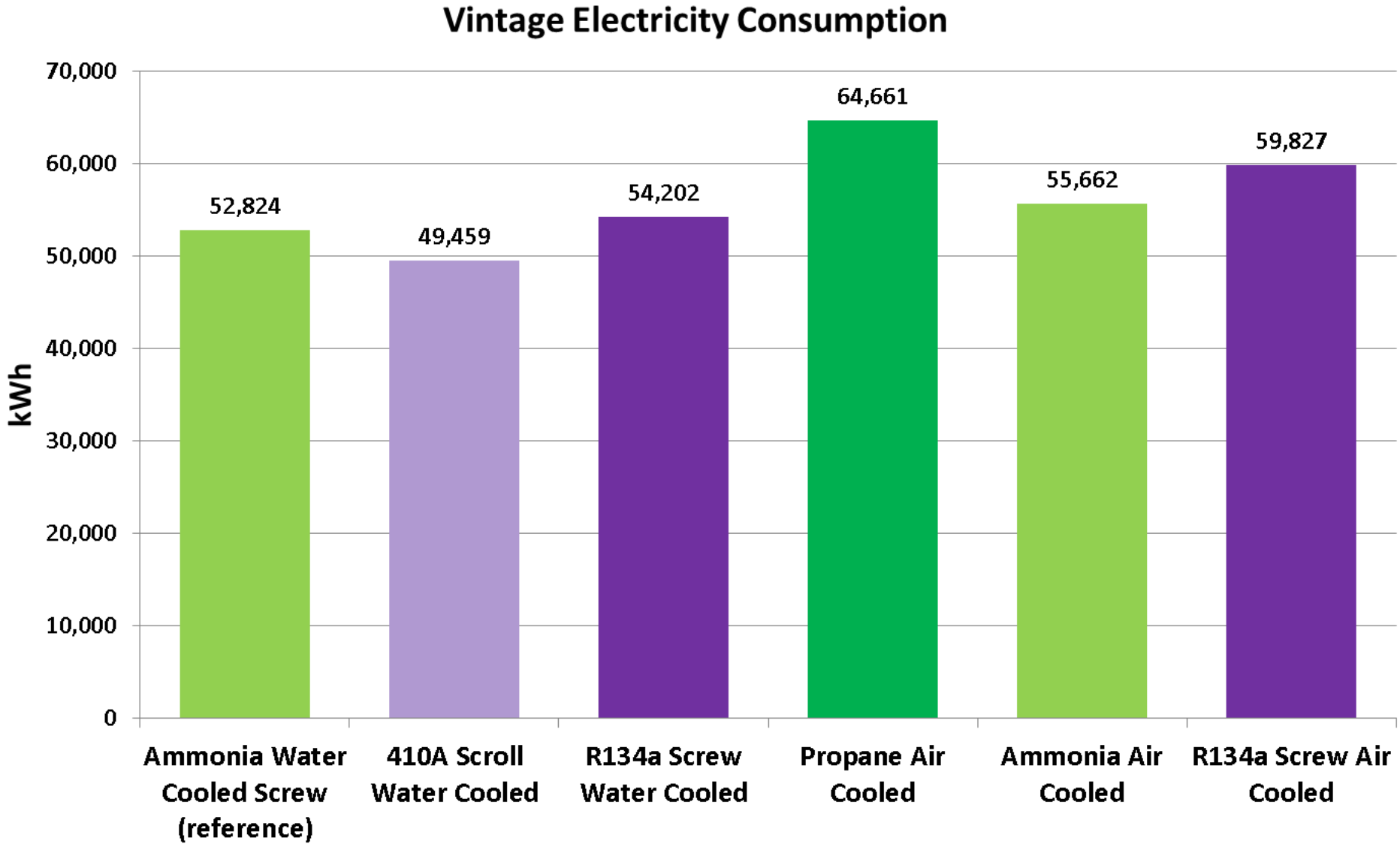
Cost Calculation



Summary - Annual Cost of Ownership

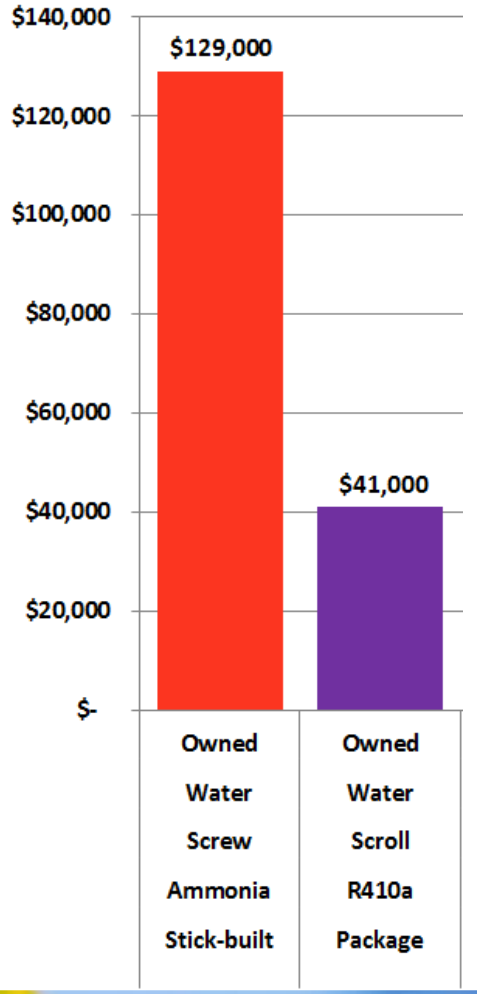


Analysis - Electricity



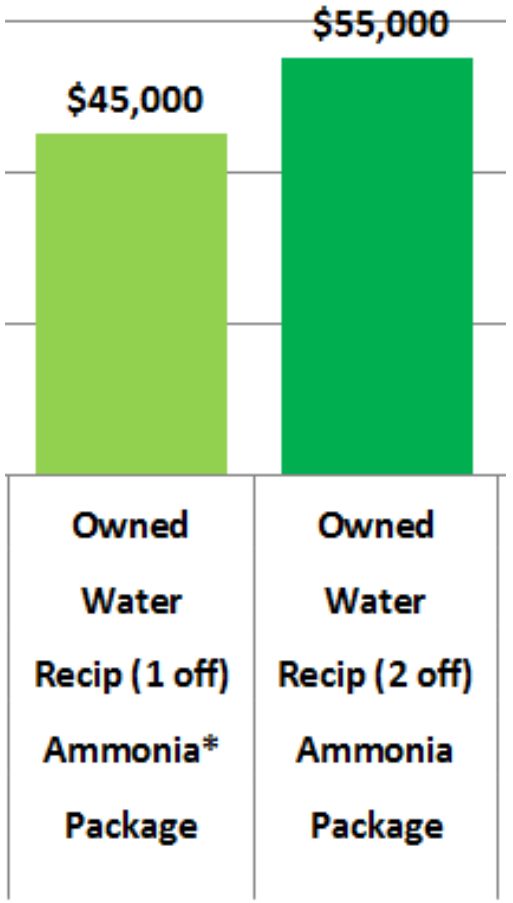
Analysis – Plantroom?

Hard to defend a full traditional plantroom approach



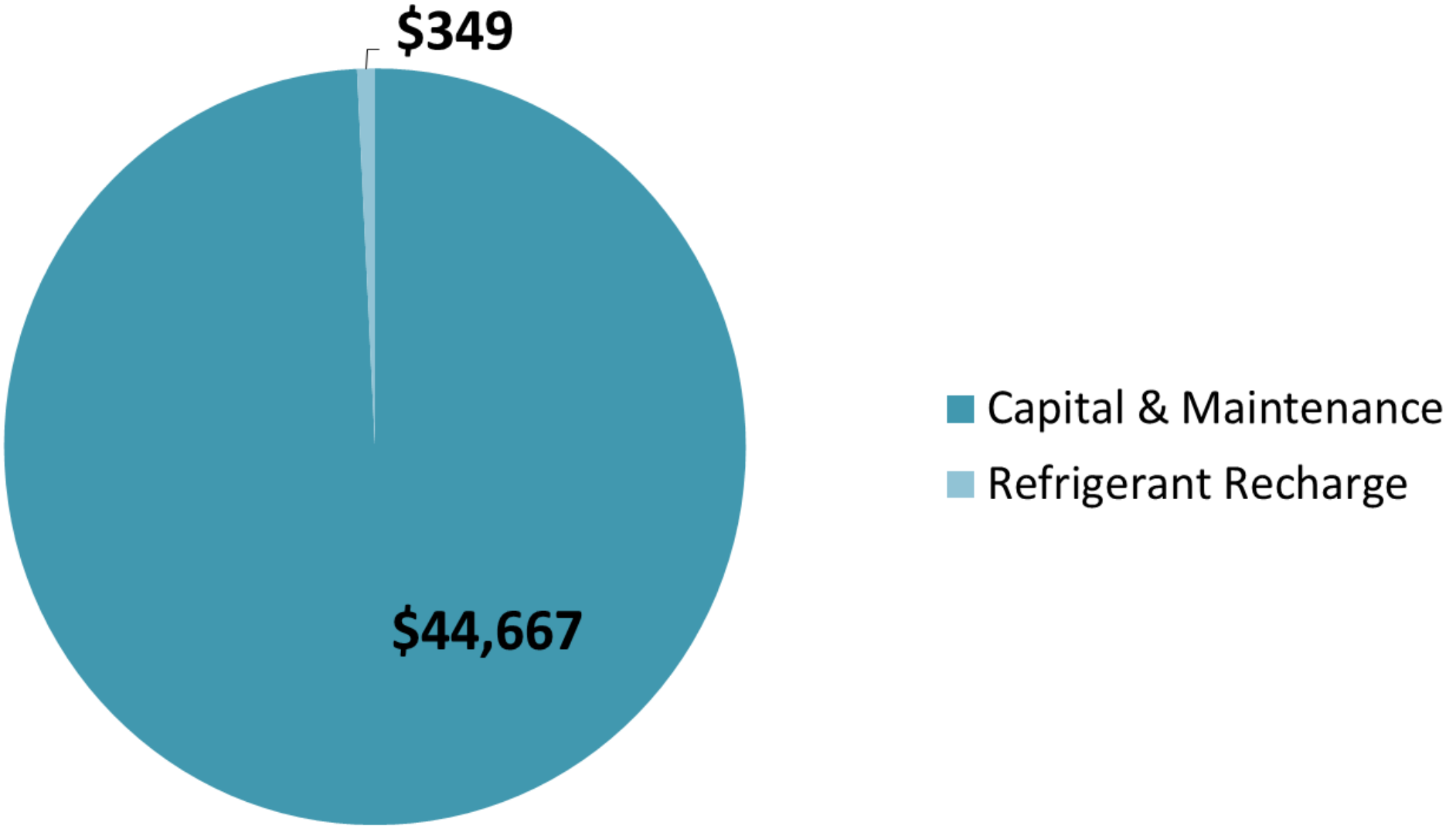
Analysis – Chiller Sizing

When selecting a chiller you may want to play with the capacity “sweet spot” and change glycol storage volume



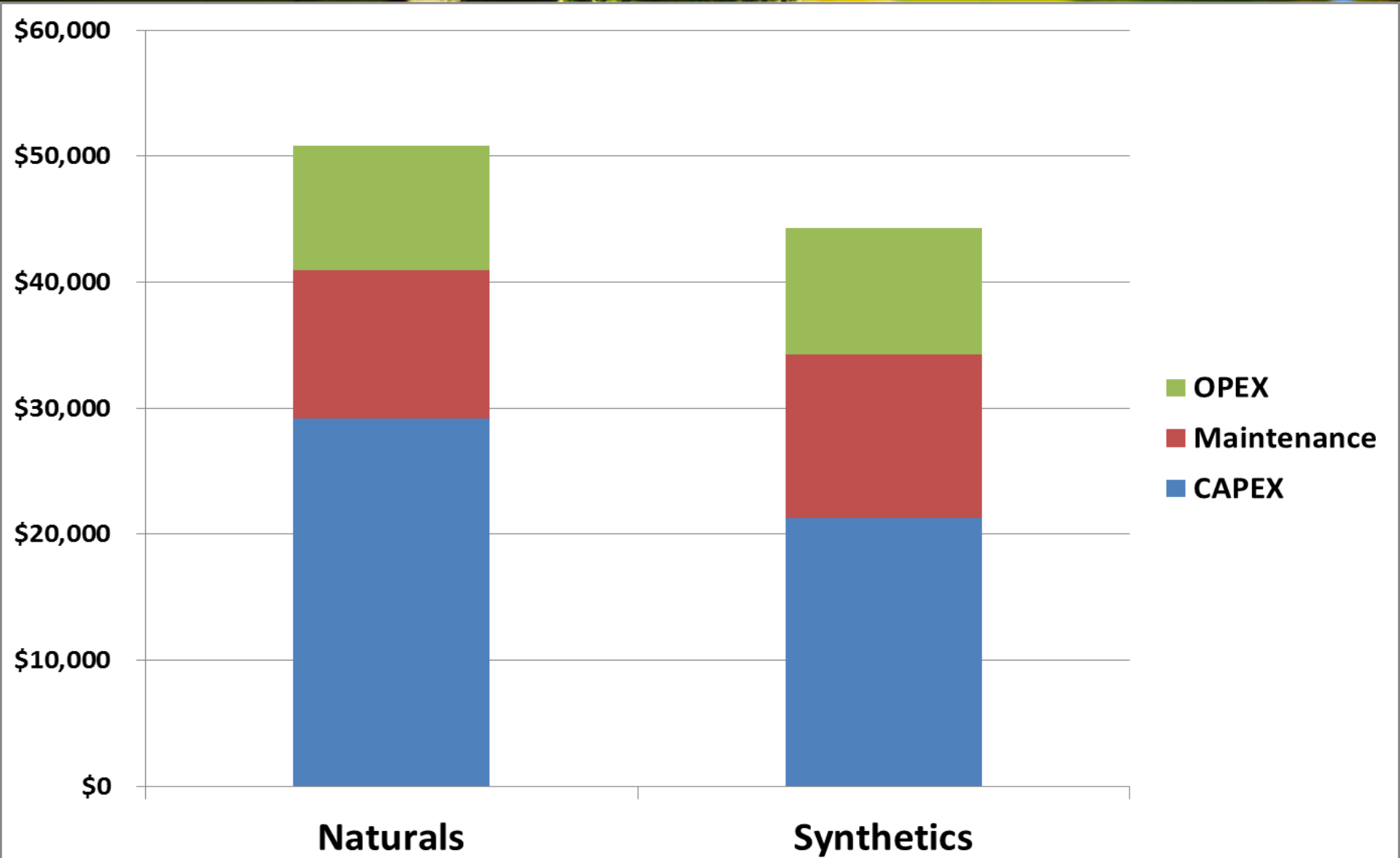
Analysis: Refrigerant & Carbon Pricing

does it matter?



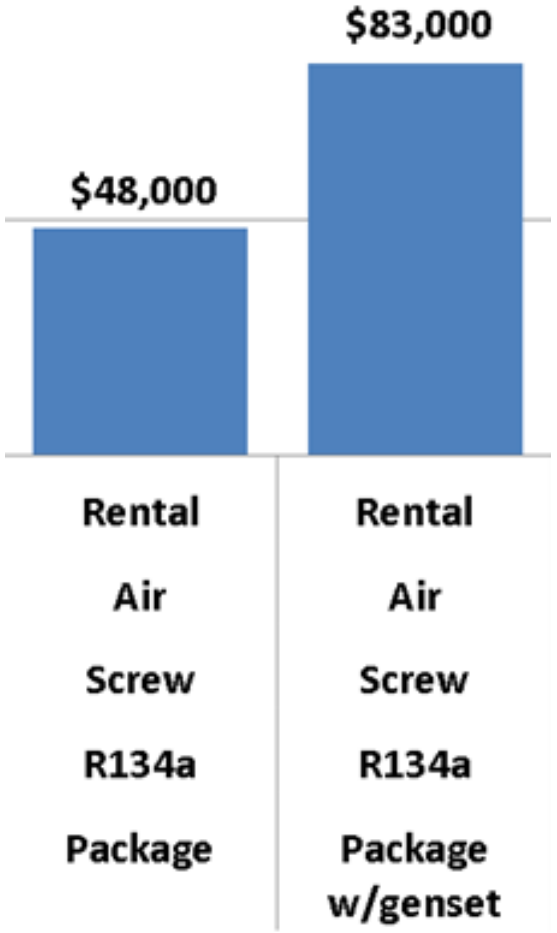
Analysis: Natural or Synthetic

does it matter?



Analysis: Own or Rent?

- Rentals are competitive with ownership
- You'll still need some baseline capacity
  - Cold stabilisation etc.
- Best to put in electrical supply capacity when building your facility to support a rental chiller



Summary

- Package equipment is cost-effective
- Carbon Tax and Refrigerants are ok, for now
- The premium for natural not too big
- If you plan to rent a chiller, put in your own electrical infrastructure if you can

Gas is greener on the natural side of the fence!

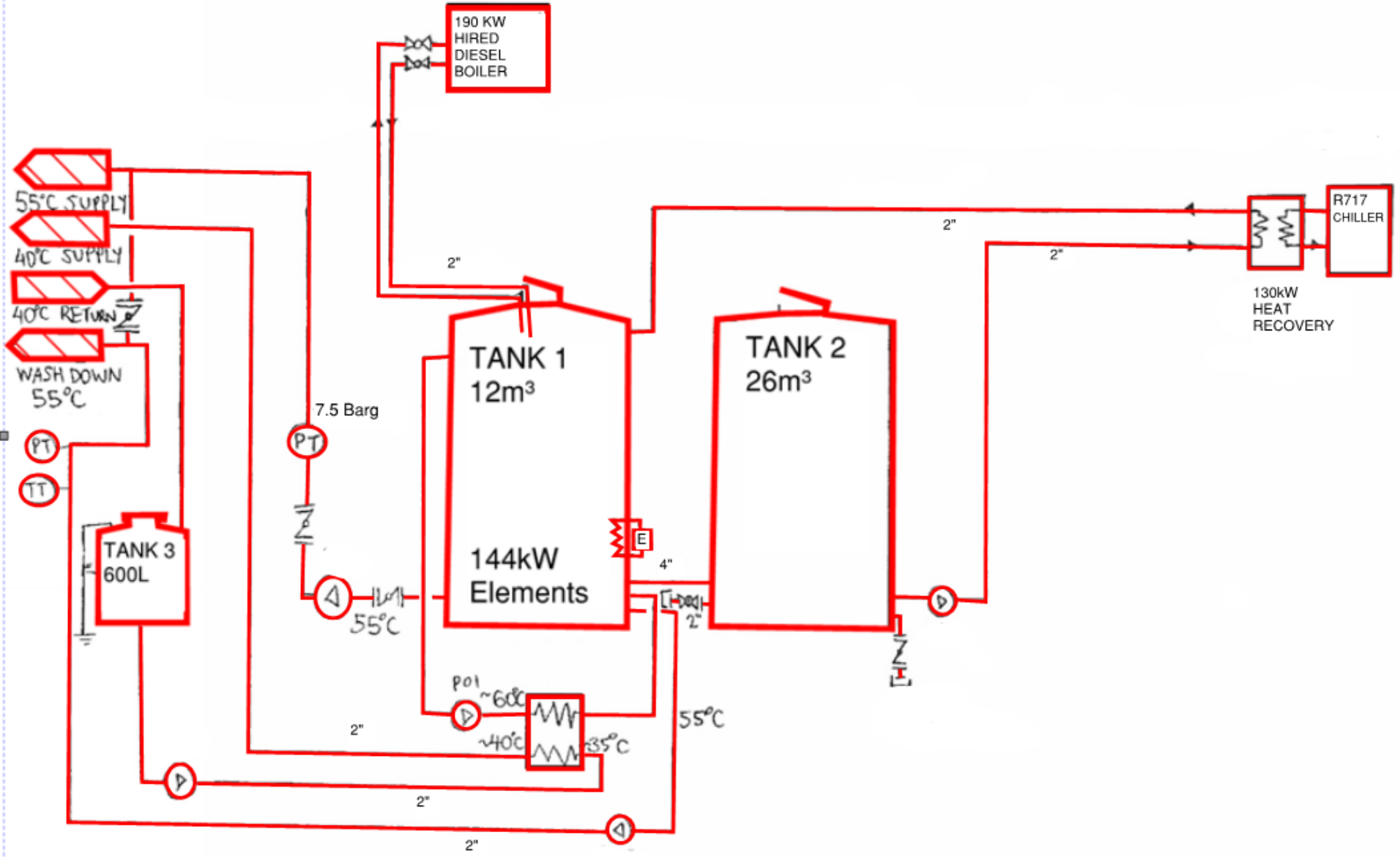
Case Study:
Cloudy Bay Hot Water Upgrade

Case Study: Cloudy Bay Hot Water Upgrade

- **Brief**
  - Existing 4,000t Processing Winery
  - Jackson Road, Marlborough
  - Winery includes bottling line
  - To potentially expand 60% by 2025
  - Boiler, heat pumps and solar options evaluated

Case Study: Winery & Plant Room

Cloudy Bay Existing Hot Water System



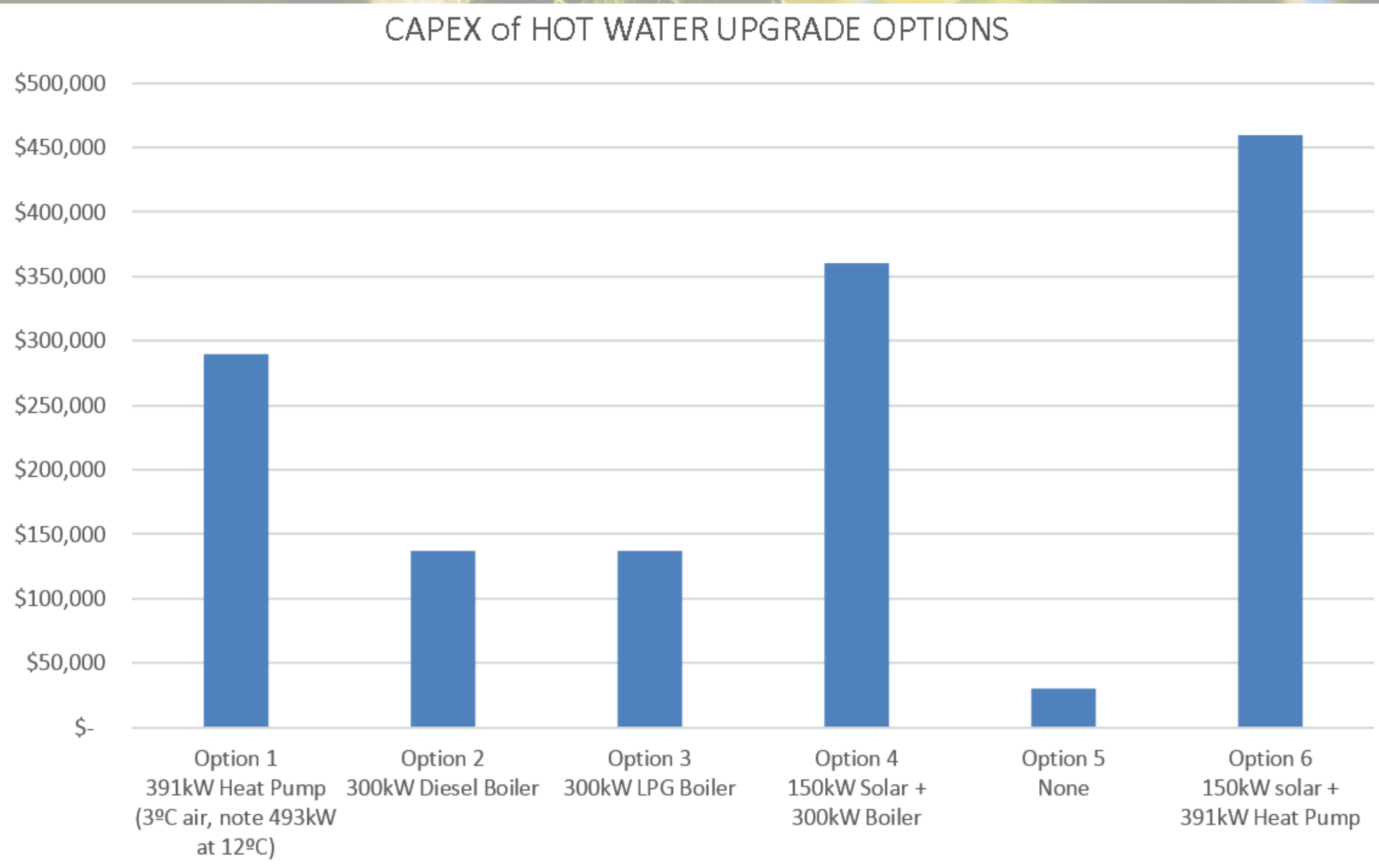
Step 1: Evaluate current system

Evaluate System Against Engineering Best Practice

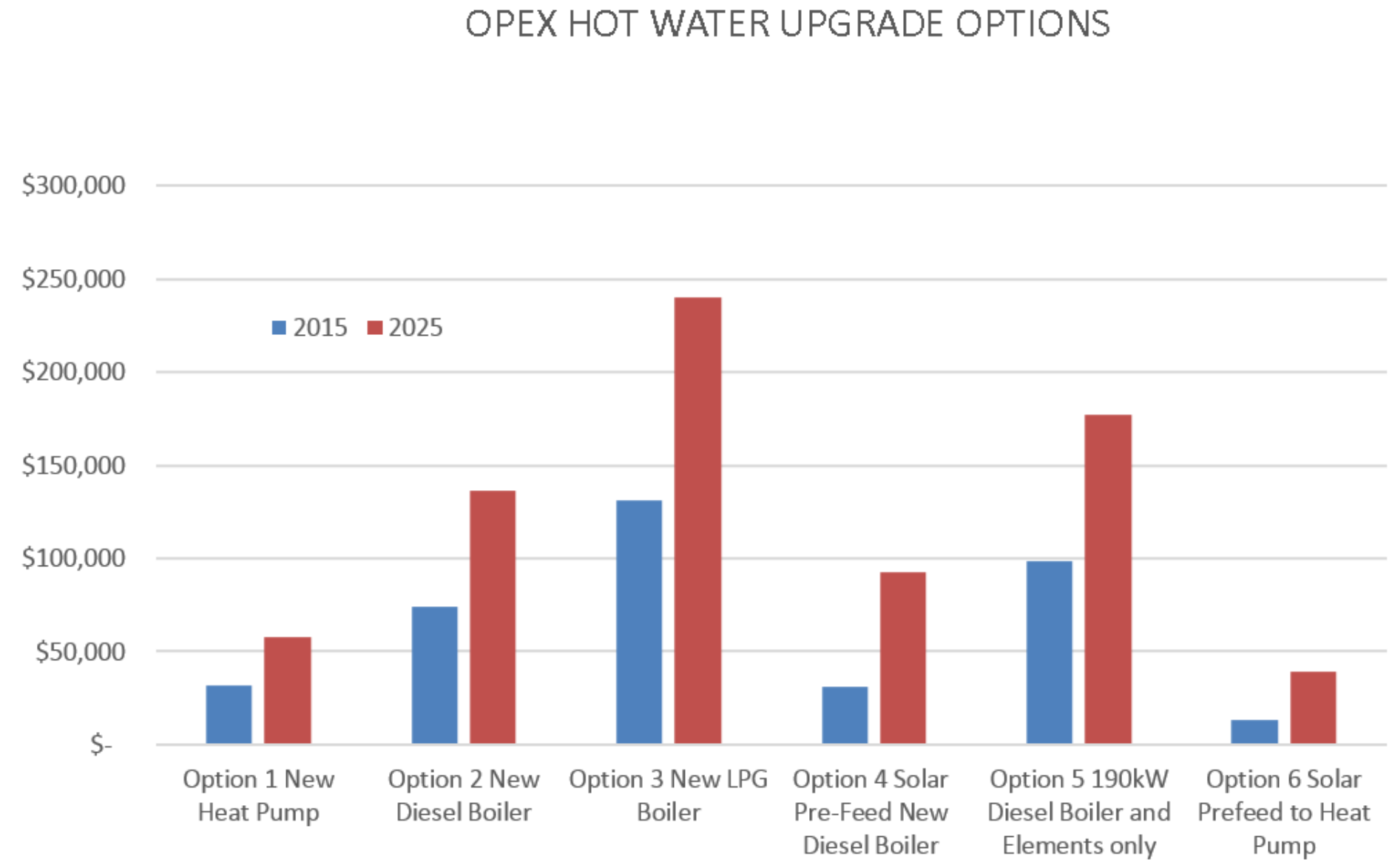
Step 2: Evaluate Demand

- **Demand:**
  - 480kW – 550kW Requirement for 2025

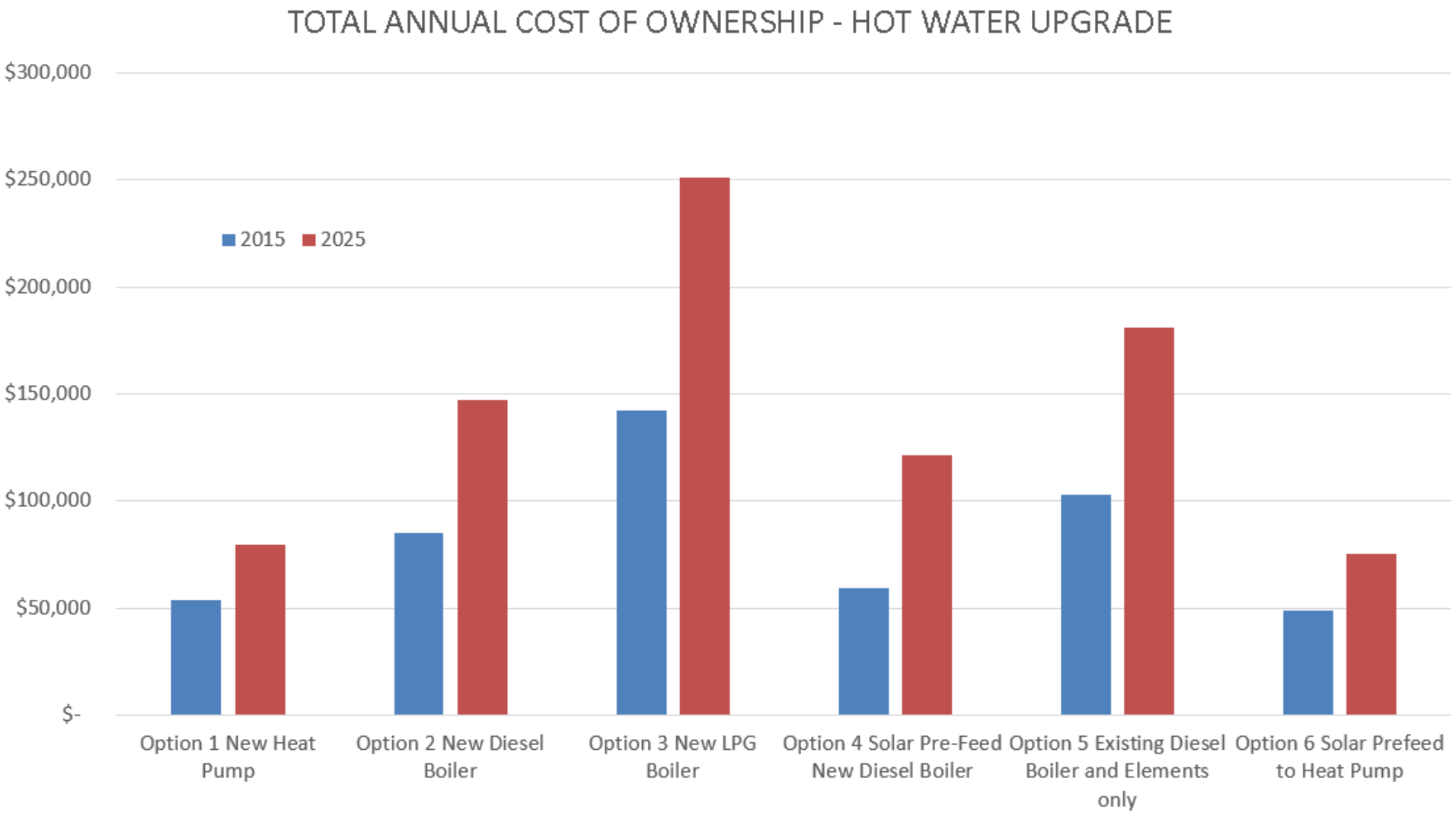
Step 3: Review Capital Costs



Step 4: Review Opex Costs



Step 5: Evaluate Total Annual Cost of Ownership



Factors for Evaluation

- **Heat Pumps**
  - No cooling towers availability so air cooled requirement
  - Limited land available
  - Peak COP in summer
  - Frost control system
  - Marlborough temperature range is suitable
  - Not hygienic
  - Noisy
  - COP air cooled units at 2.6-3.3 at 12ºC
  - Availability in a power cut

Step 6: Supplier's Offers

	York	Black Diamond Technologies	Carrier	Active Refrigeration
Unit Price	$106,400	$128,240	$101,547	$390,000
Model	YLPA0435BE	NS2201XH**V**00	Carrier's offer had a maximum temperature output of 50°C and is therefore not suitable.	N6HK
Power Output*	483kW @ 12°C 391kW @ 3°C	460kW @ 12°C 365kW @ 3°C		561kW @ 12°C 484kW @ 3°C
COP*	3.30 @ 12°C 2.69 @ 3°C	2.61 @ 12°C 2.17 @ 3°C		4.03 @ 12°C 3.24 @ 3°C
Noise Level	95dBA (91dBA option)	96.5 dBA	93 dBA	Not Specified
Refrigerant	R410a	R134a	R410a	Ammonia
Lead Time	10 – 12 weeks	12 – 16 weeks	12 weeks	Not Specified
Additional Comments	Additional noise reduction available for $7,900 (reduces noise to 91dBA)	Maximum temperature of 54°C @ 12°C Amb*		
Conclusion	Good efficiency with shortest lead time and lowest price.	Lowest efficiency, longest lead time.	Not technically feasible for this application.	High efficiency, very high CAPEX, lead time unknown.

Case Study: Cloudy Bay Winery Hot Water Upgrade

- **Summary**
  - Total Annual Cost of Ownership of solar pre-feeding a heat pump was the most cost effective. Our client preferred heat pump installation due to:
    - Reduced capital cost
    - Site constraints
    - Roof access issues
    - Additional maintenance for solar system