

# Large Scale, Central Type, Low Charge NH<sub>3</sub> Refrigeration Plant

**Chillventa**

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**Maintaining Innovation**

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- **LOW NH<sub>3</sub> CHARGE**

- **LOW ENERGY CONSUMPTION**

- **LOW OCCUPATIONAL RISK**

- **LOW DIRECT EMISSIONS**

- **HIGH EXPECTATIONS**



# How Does Low Charge NH<sub>3</sub> Look?



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# How Does Low Charge $\text{NH}_3$ Look?



Lower ceiling = no sprinklers

Evaporator air supply



$\text{NH}_3$  inventory 850 kg



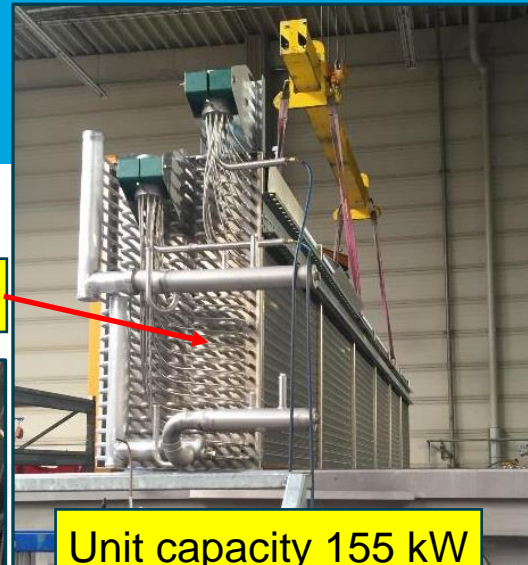
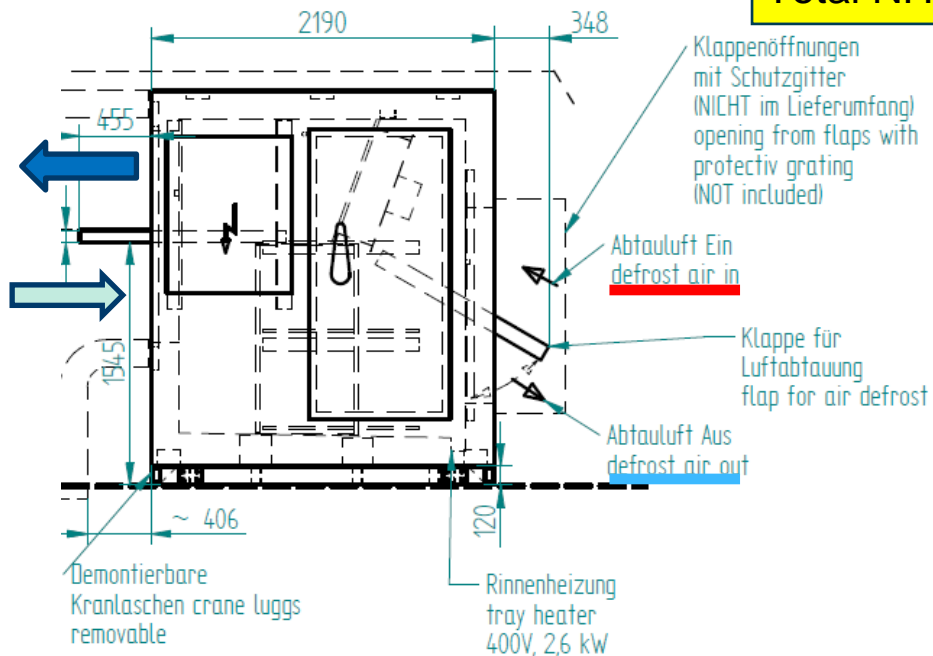




# How Does Low Charge NH<sub>3</sub> Work?

Valve stations and pipelines outside building

Total NH<sub>3</sub> operating charge 5 kg



Unit capacity 155 kW



Cold Storage Design Innovations Award Winner

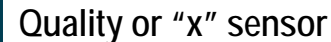
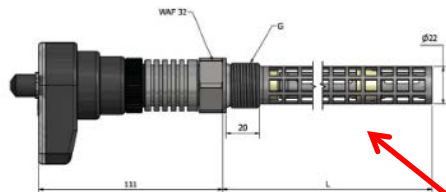


## Climate Suitable for Ambient Air Defrost?

- Ambient air defrost has been used in all parts of Australia
- Applied in minimum warehouse temperature of  $-30^{\circ}\text{C}$
- Melbourne latitude  $37^{\circ}, 47'\text{S}$  – penthouses;  $2^{\circ}\text{C}$  winter
- Perth latitude  $31^{\circ}, 57'\text{S}$  – alcoves; night temp.  $9^{\circ}\text{C}$



Singapore coordinates  
 $1.3521^{\circ}\text{ N}, 103.8198^{\circ}\text{ E}$



## Electronically controlled R717 injection based on refrigerant quality at evaporator exit





# How Large can a Low Charge NH<sub>3</sub> Plant be?

No technical limits

Refrigerated volume 114,000 m<sup>3</sup>

50/50% freezer/chiller

13,000 m<sup>2</sup> refrigerated area

500/600 kW LT/HT

750 kg NH<sub>3</sub> (0.7 kg/kW)

10 kWh/m<sup>3</sup>\*a (storage)

17 kWh/m<sup>3</sup>\*a (50 t/day)



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## How Small?

Refrigerated volume 5,250 m<sup>3</sup>



46/54% freezer/chiller  
1,264 m<sup>2</sup> refrigerated area  
45/49 kW LT/HT  
Replaces ten year old  
HFC plant  
Projected electricity cost  
savings \$8,000/month

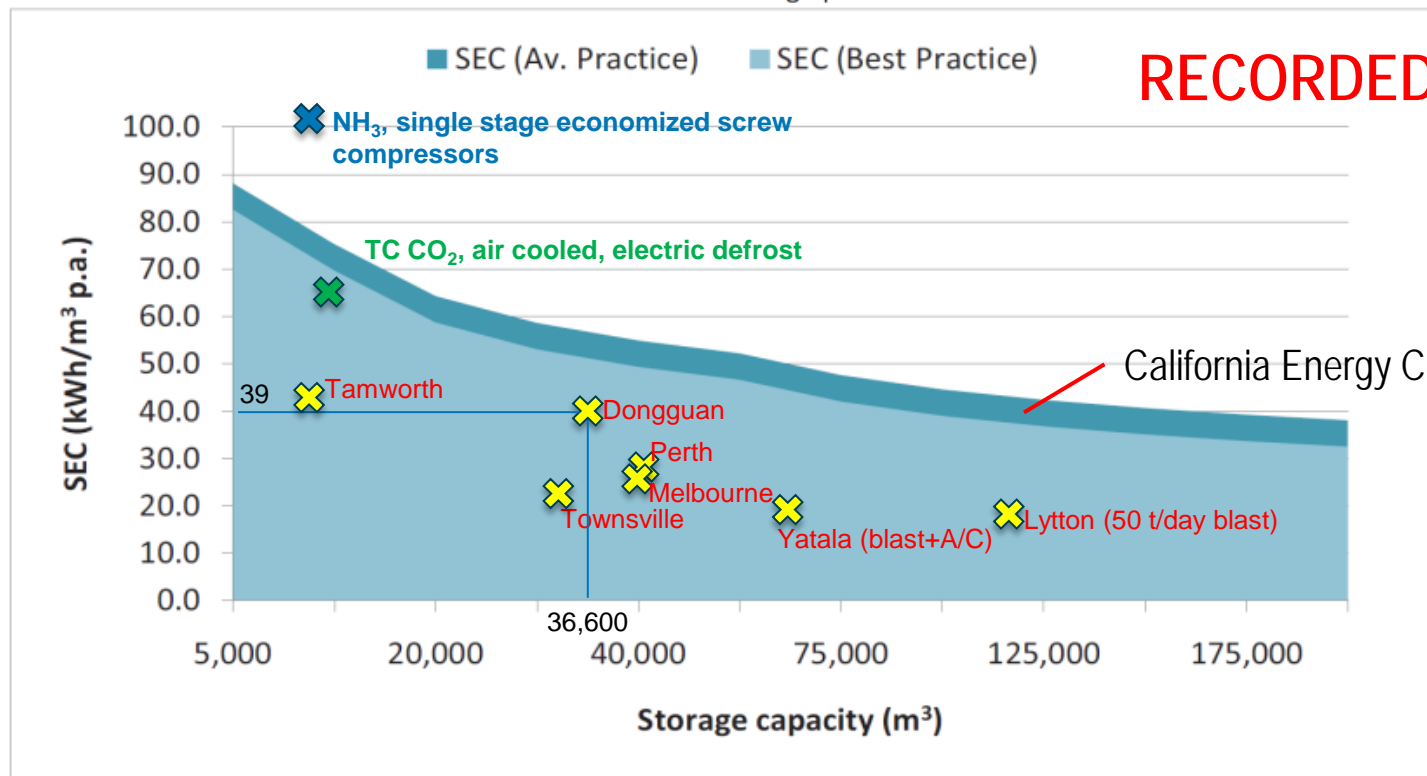


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# How Energy Efficient?

$$\text{SEC (kWh/ft}^3\text{)} \text{ average practice} = 38.978 \times \text{storage volume}^{-0.2275}$$

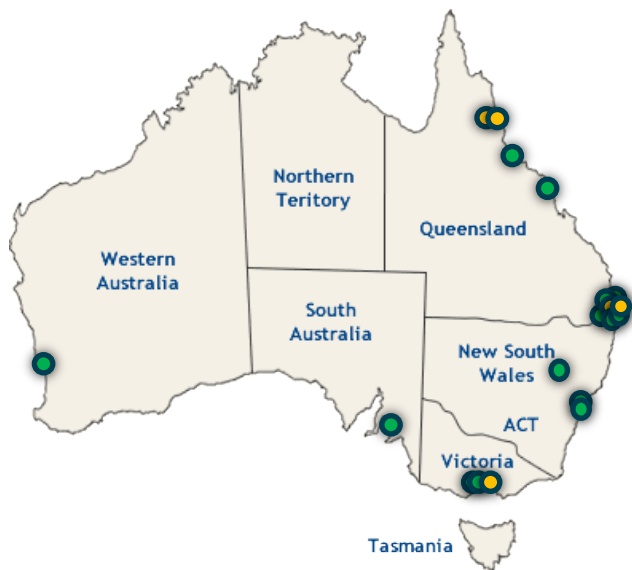


RECORDED VALUES

California Energy Commission 2008



# How Is the Market Acceptance?



- Completed
- Under construction





# How Is the Future Likely to Be?



Smaller tubes for reduced  $\text{NH}_3$  inventories



$\text{NH}_3$  DX S&T's



Factory  
Packaging for  
Mobility and  
Safety

304SS piping for low friction, high corrosion  
resistance, low leakage probability

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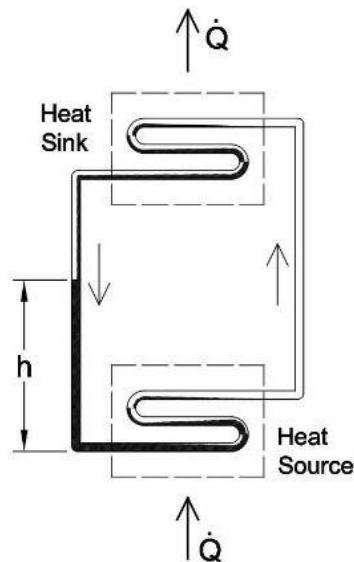
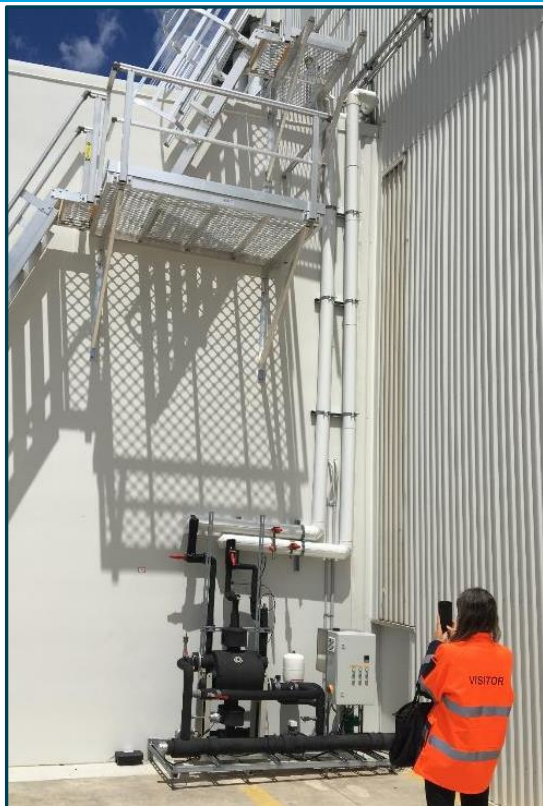
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$\text{NH}_3$  DX  
PHE's



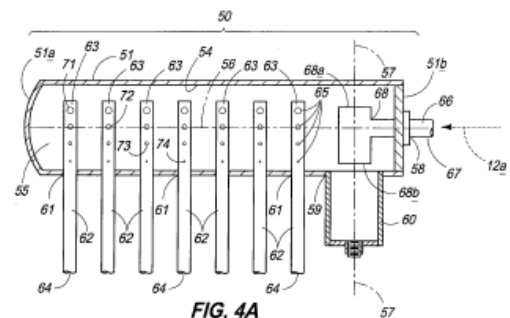
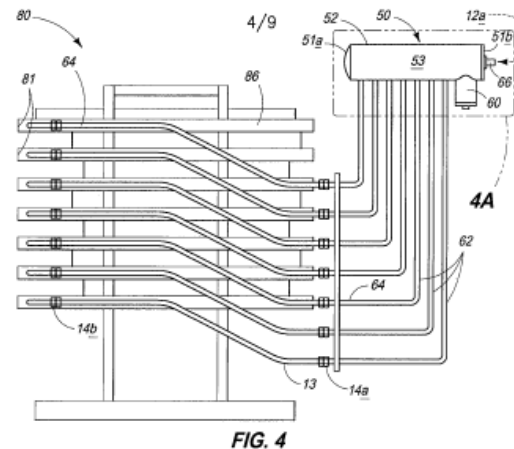


# How Is the Future Likely to Be?



Secondary loop defrost for further  $\text{NH}_3$  inventory minimization, prevention of liquid hammer, energy efficiency and better defrost efficiency

Low Charge  
Plate Freezers





# Thank You

## ONCE YOU GO AMMONIA YOU NEVER GO BACK



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