NH_3 DX – HOW SMALL IS TOO SMALL?

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euramm⊙n

refrigerants delivered by mother nature

Introduction

Topics to be covered in the presentation:

- Retrofit from HFC 404A to NH_3 dry expansion for small (5,250 m^3) facility
- Subtropical climate (Mackay, Central/North Queensland, Australia)
- HFC plant energy consumption recorded over five years
- NH_3 dry expansion plant energy consumption recorded over 7-8 months (2018/19)
- Energy performance comparision between HFC 404A and NH_3 DX
- Economic comparison between HFC, TC CO_2 and NH_3 dry expansion
- Prospects for NH_3 DX with respect to HFC substitution
- Return on higher capital cost of NH_3 DX versus TC CO_2

Previous Installation

Freezer

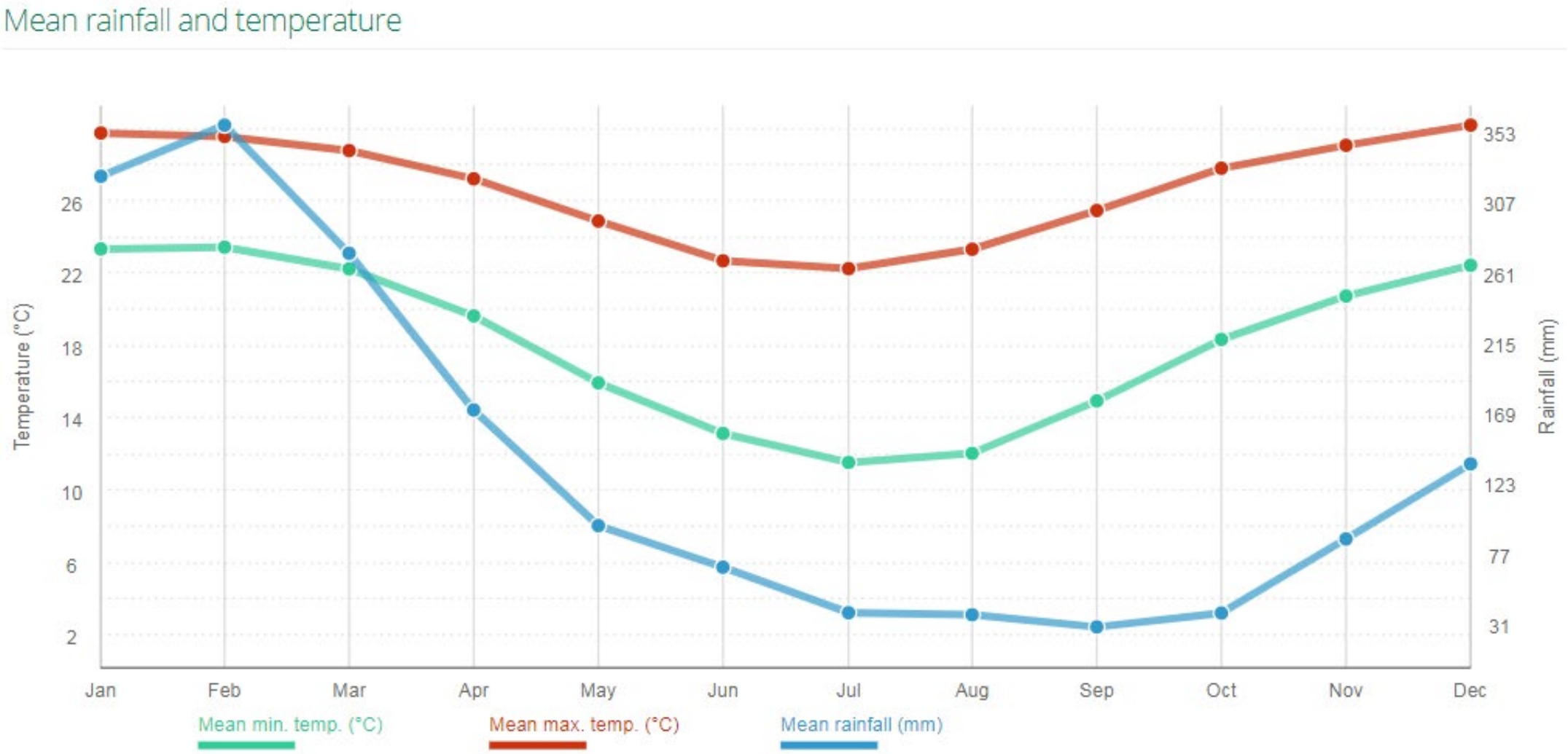
Air Cooled R404A Plant, single stage, electric defrost

Previous Installation

Ante Room

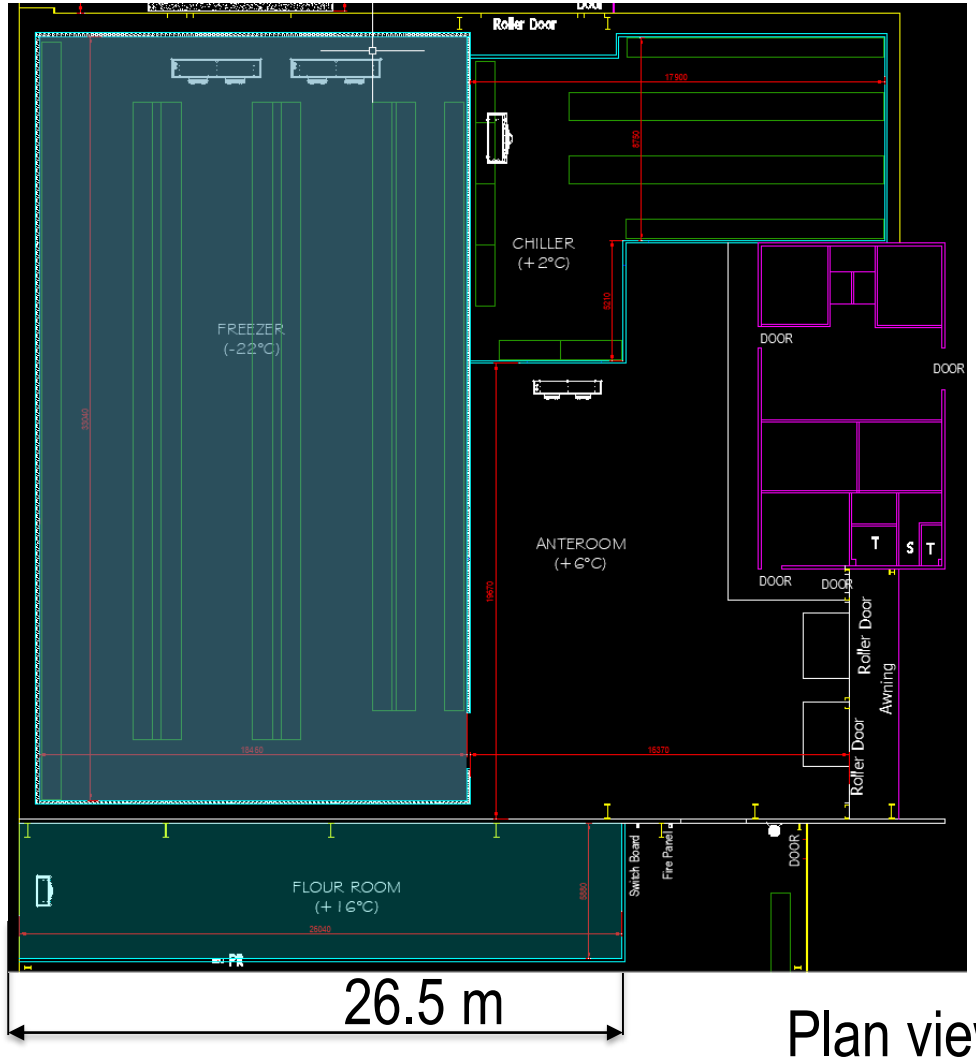
Ceiling Cavity

Climate in Mackay, North Queensland



Schedule of Rooms and Heat Loads

Design heat loads	LT	HT
Refrigerant temperature, °C →	-32	-7
Freezer, -24°C	45.2	
Chiller, 0-2°C		17.6
Flour room, 16°C		11.0
Ante room, 6°C		20.2
Total, kW	45.2	48.8



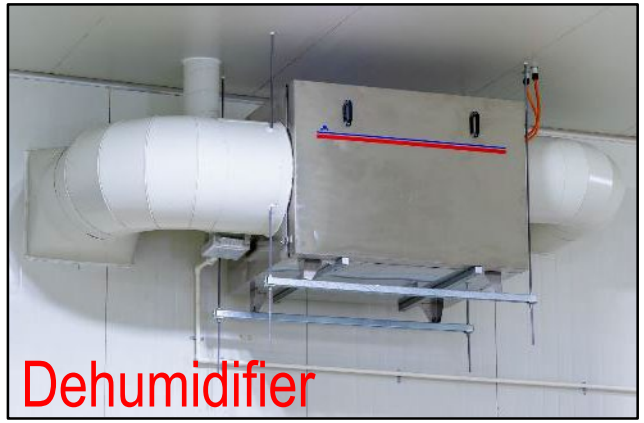
Plan view

New NH_3 DX System

NH_3 Inventory <250 kg

New NH_3 DX System

SCADA System

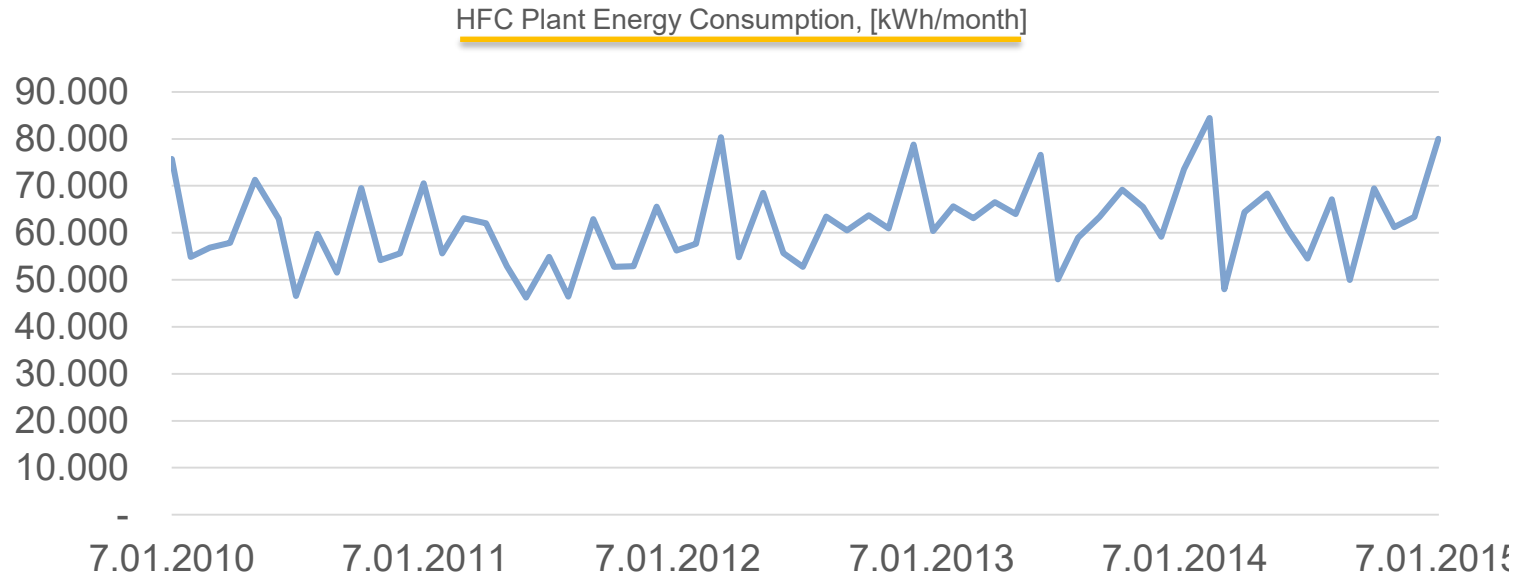


Dehumidifier

ScanPAC Interior

NH_3 detection

Energy Savings



Specific Energy Consumption (SEC) Comparison:

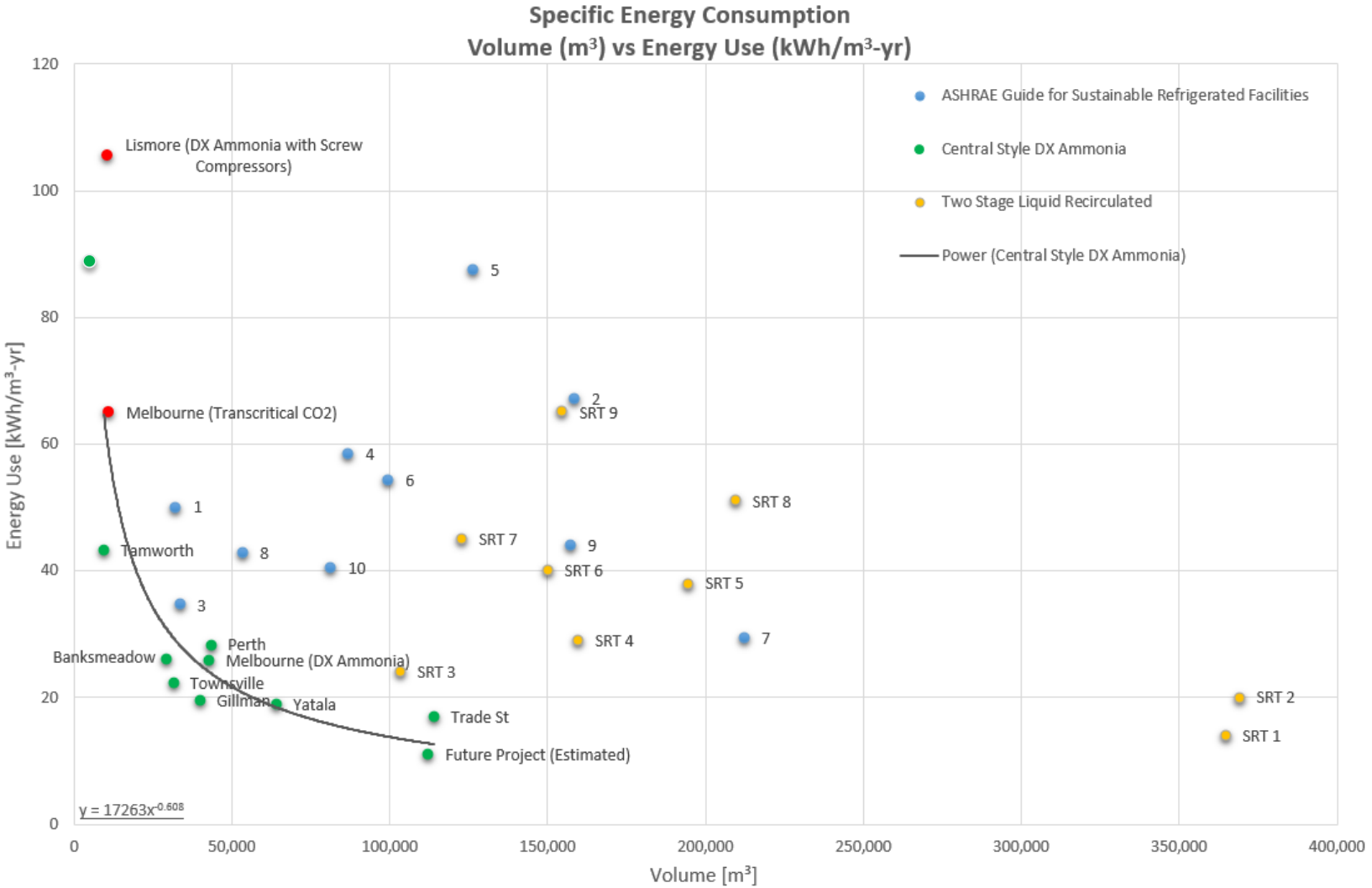
HFC, kWh/m^3*a	206
NH_3, kWh/m^3*a	88
Saving, %	**57**

NH_3 Readings:

Start date 3.10.2018; reading 5,107 kWh
End date 18.1.2019; reading 141,303 kWh } 1260 kWh/day

From 18.1.2019 to 9.5.2019 1207 kWh/day

Energy Savings



1-10: Reindl & Jekel IRC, March 2010, Industrial Refrigeration Energy Efficiency Guidebook, University of Wisconsin, Madison. ASHRAE 2018, Guide for Sustainable Refrigerated Facilities and Refrigeration Systems

Energy optimized central dual stage LR with screws

Centralized Scantec low charge NH_3

As described

Economics

Refrigeration Plant Concept	Capital Cost [%]
Centralized, low charge NH_3 system	100
TC CO_2 system, warm glycol defrost & SCADA	71
TC CO_2 system, electric defrost & SCADA	62
Replacement HFC, electric defrost, no SCADA	45

Simple pay-back for differential investment ~four years

Future Prospects for Centralized Low Charge NH_3

- Well positioned for conversion of refrigerated warehouses from HFC to NR's

- Prospects in the supermarket industry (significant psychological hurdles)

- Multiplexing of ScanPAC's with minimal energy performance penalty

- Integration of LOGAS defrost in single ScanPAC/evaporator configuration will keep NH_3 inventories low without the energy penalty of electric defrost

- HFC to NH_3 conversions potentially cash flow neutral from day one

- Water cooled condensers/dry coolers will reduce NH_3 inventories further

Discussion

- Replacement HFC not considered
- Energy use of TC CO_2 (el defrost) ~40% higher p.a. than NH_3 DX
- Energy use of TC CO_2 (el defrost) ~15-20% less p.a. than HFC
- Capital cost difference TC CO_2 (el defrost) vs. NH_3 DX returned in 4 years
- NH_3 DX eliminates direct emissions and minimizes indirect emissions
- NH_3 DX is in this FNQ situation (5,245 m^3) very viable

MAKE NH_3 EVEN GREATER

eurammon is always available as a sparring partner for questions on refrigeration with natural refrigerants

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