



Business Case for
Natural Refrigerants

11-12/04/2018 – Beijing

- LOW NH_3 CHARGE
 - LOW ENERGY CONSUMPTION
 - LOW OCCUPATIONAL RISK
 - LOW DIRECT EMISSIONS
- HIGH EXPECTATIONS



LOW CHARGE NH₃ CHINESE STYLE

Allen Hu, Shanghai Fortune Foodstuff Engineering Co. Ltd.

Nis Jensen, Scantec Refrigeration Technologies Pty. Ltd.



THE CHALLENGES:

- Global HFC phase-down
- Rising energy costs
- Increasing demand for refrigeration
- Increasing regulatory pressures for toxic/flammable refrigerants

THE SOLUTION:

- Low charge, central NH₃ systems featuring:
 - No NH₃ pumps
 - SH/X injection control
 - Dry suction lines
 - VFD's on everything
 - Superior part load efficiency
 - Simplicity
 - Low friction pipe lines
 - 30-50 times lower evaporator charge
 - 3-5 times lower system NH₃ charge
 - Minimization of risk to occupants
 - Energy use 40-70% lower
 - Proven technology & reliability

Lower ceiling = no sprinklers

Evaporator air supply

HOW DOES IT LOOK?



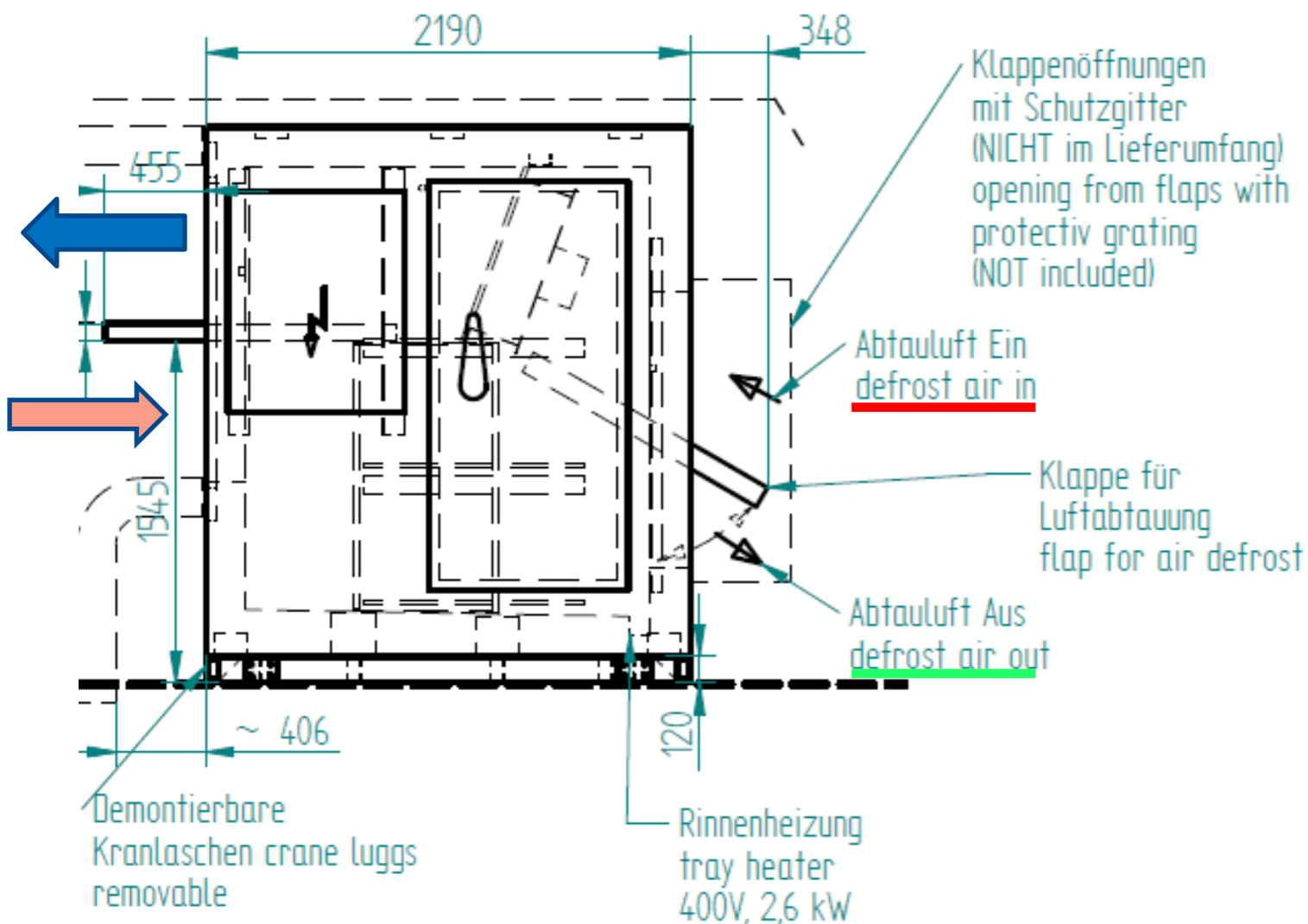
NH₃ inventory 850 kg



HOW DOES IT WORK?

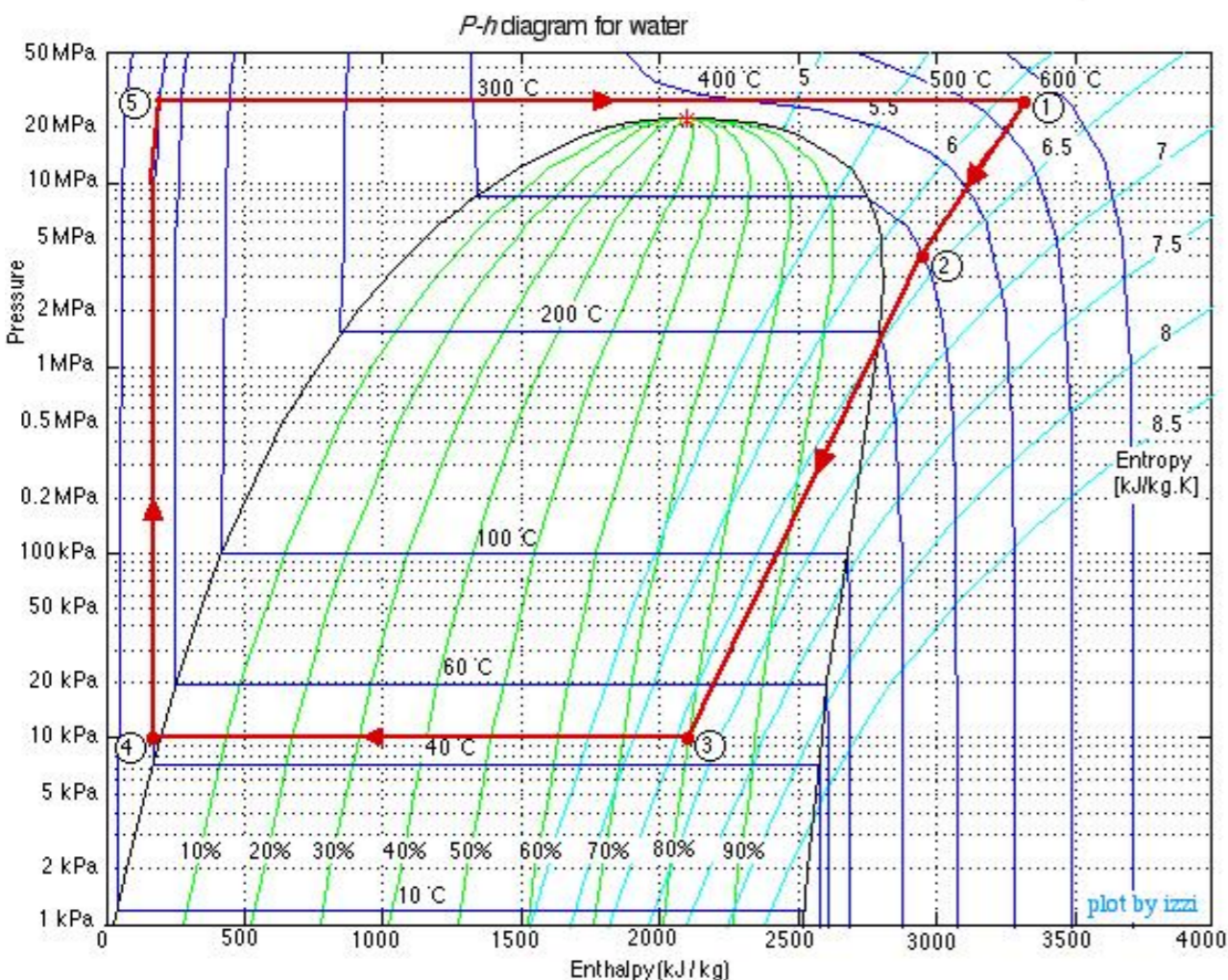
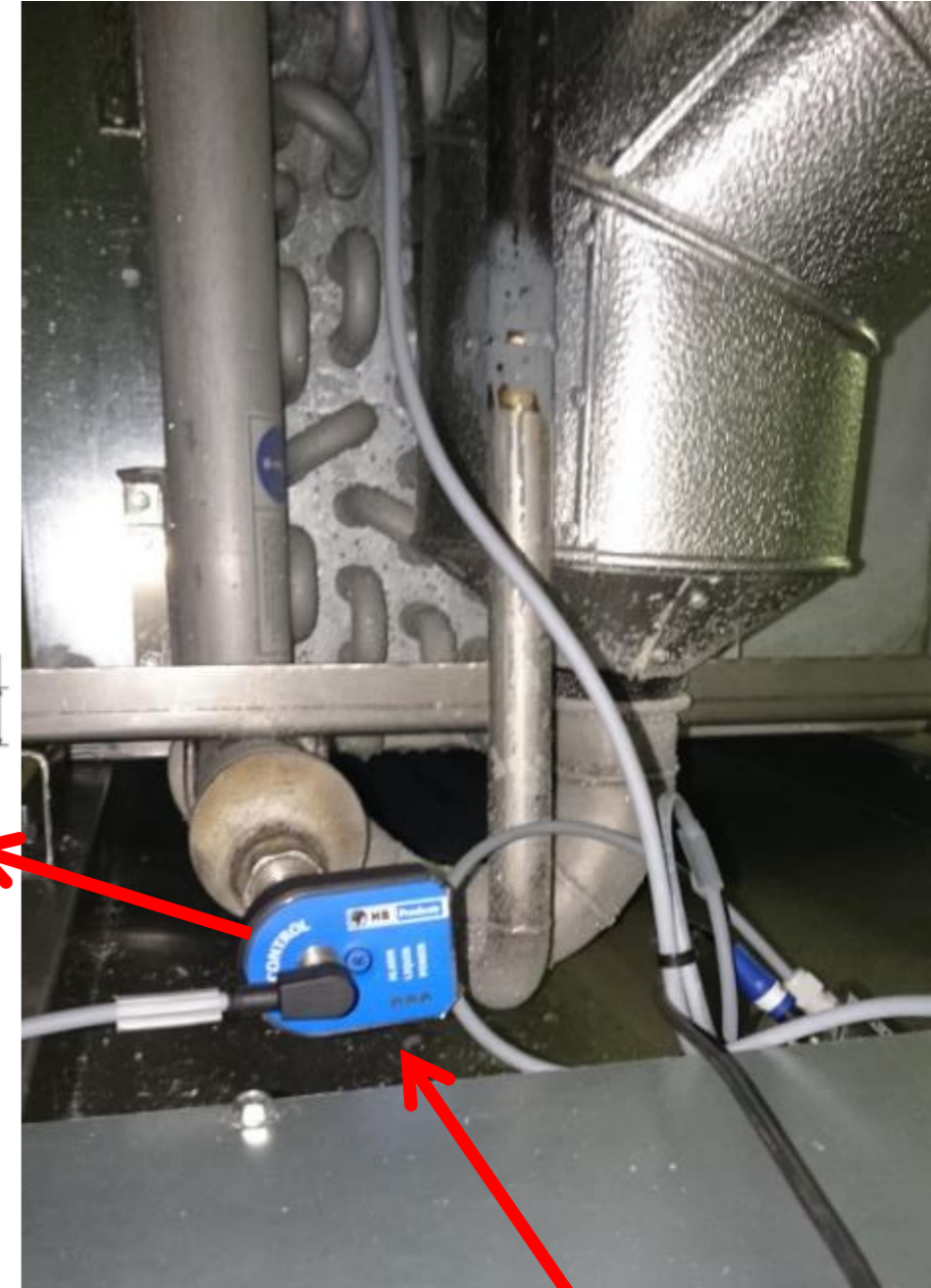
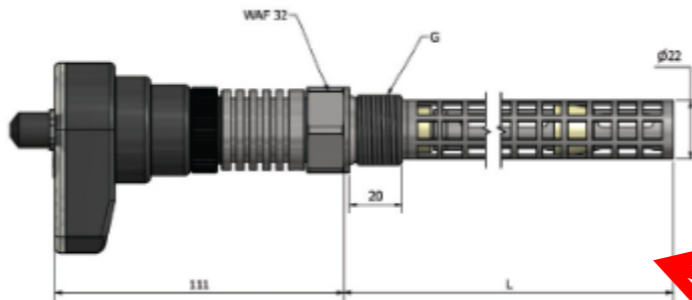
Total NH₃ operating charge 5 kg

Valve stations and pipelines outside building



HOW DOES IT WORK?

Electronically controlled refrigerant injection based on refrigerant quality at evaporator exit

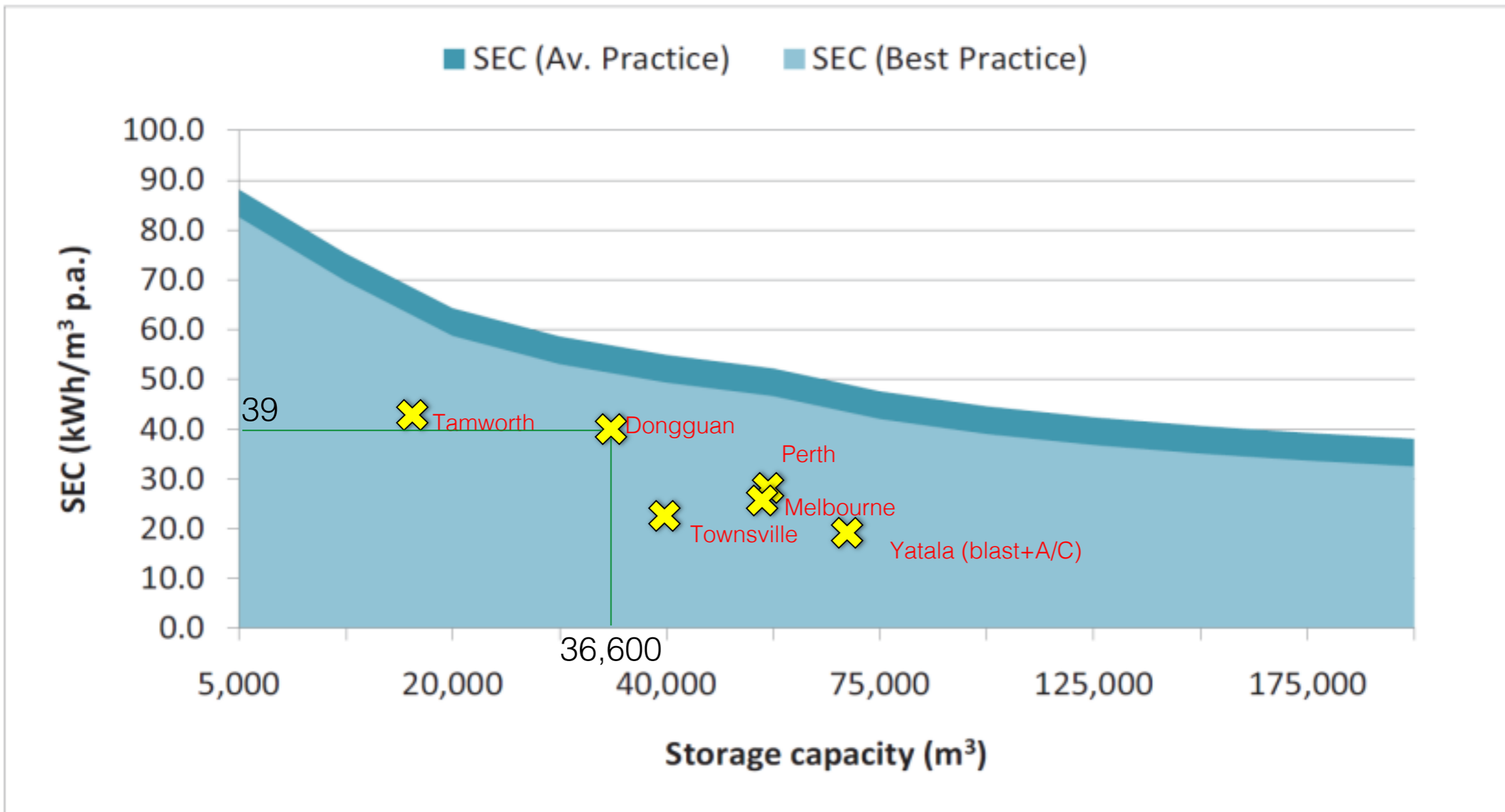


The dielectric spectroscopy (capacitance) measurement method uses the difference in dielectric properties of gases and liquid

Quality or “x” sensor

HOW DOES IT PERFORM?

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



HOW DOES IT PERFORM?

Previous conversions of large scale industrial plant from liquid overfeed R22 to liquid overfeed NH₃ indicate SEC reductions of 20 to 40%.

Switching from liquid overfeed NH₃ to low charge NH₃ results in SEC reductions of 15 to 35% depending on plant layout. This is a result of the removal of liquid from wet return lines and risers.

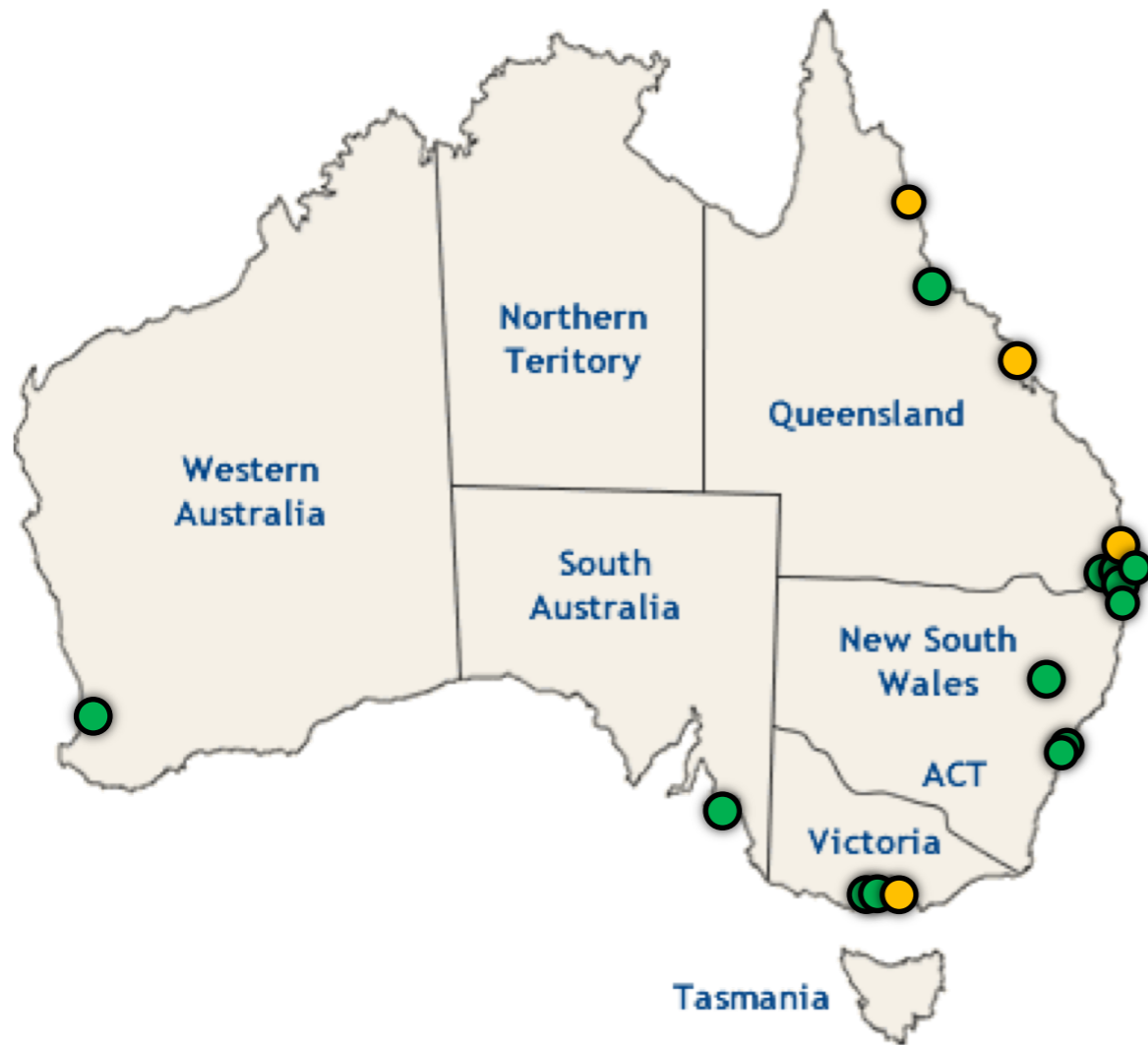
Sources:

Jensen, S. and CZYCZELI, S. (2008). CONVERSION FROM HCFC22 TO NH₃ – PRACTICAL EXPERIENCES FROM A LARGE DISTRIBUTION CENTER. Gustav Lorentzen Conference, Copenhagen, Denmark

Jensen, S. and Forbes, M. (1996). CONVERSION FROM R22 TO R717. PRACTICAL EXPERIENCES FROM THREE INDUSTRIAL PLANTS. Gustav Lorentzen Conference, Aarhus, Denmark

GCCA; 13-15 June, 2017, Chicago – R. Watters, AMS

HOW WELL IS IT ACCEPTED?



- Completed
- Under construction

HOW WILL THE FUTURE BE?



Smaller tubes for lower NH₃ inventories



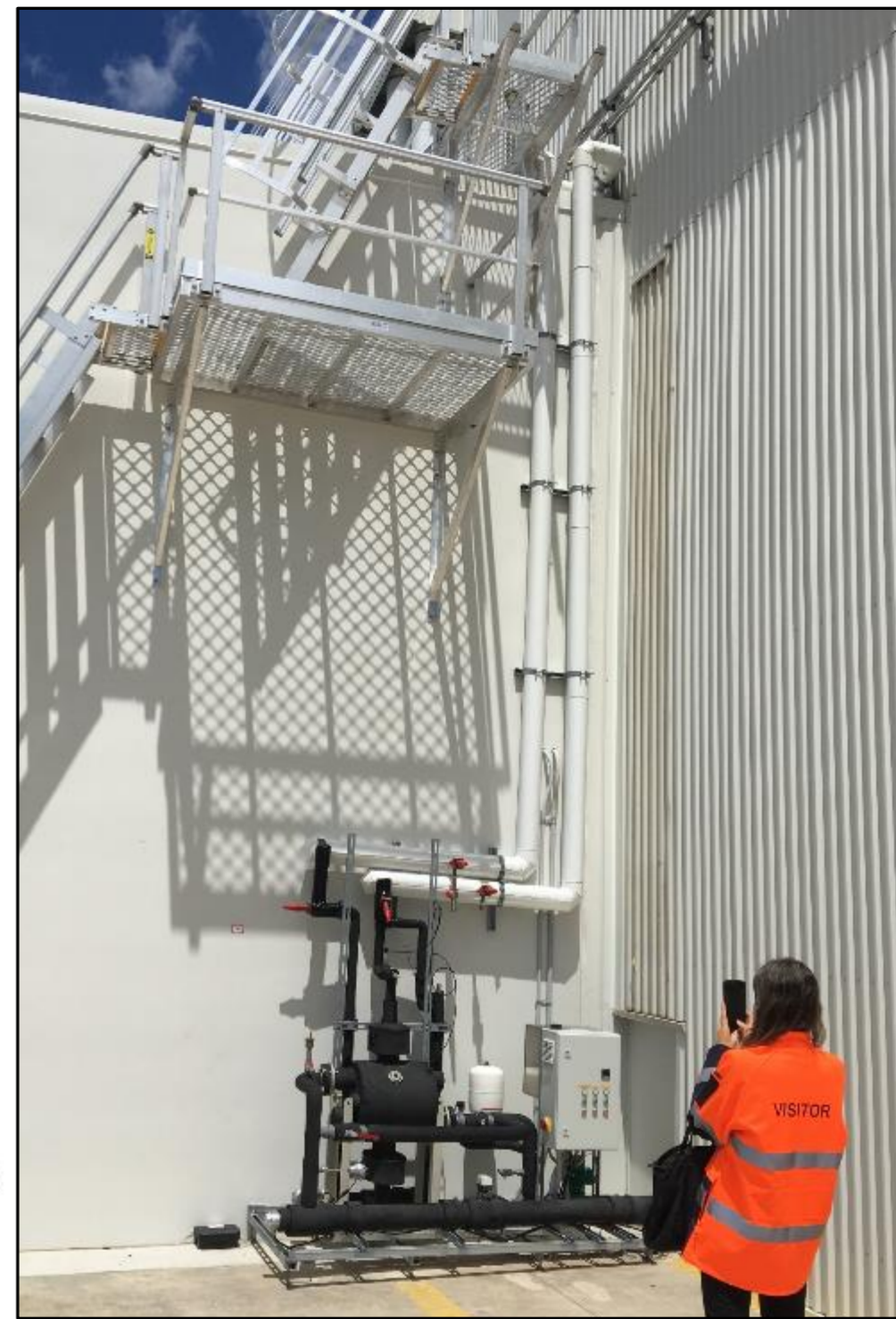
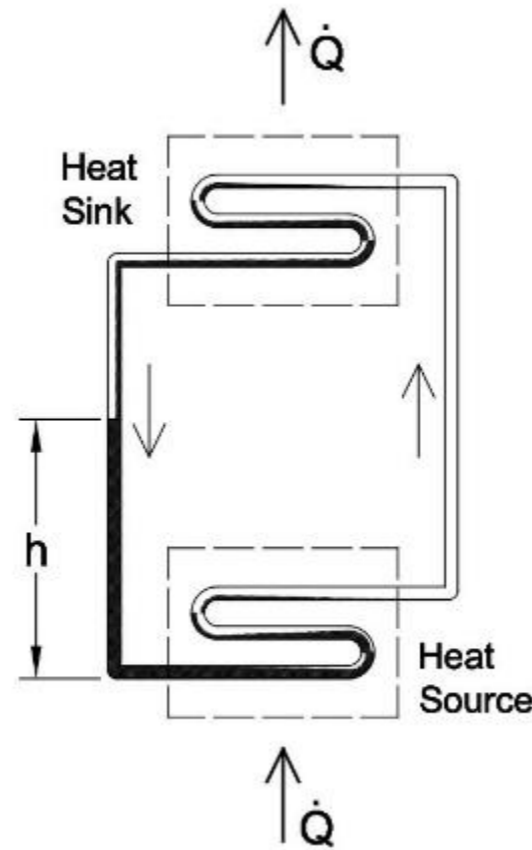
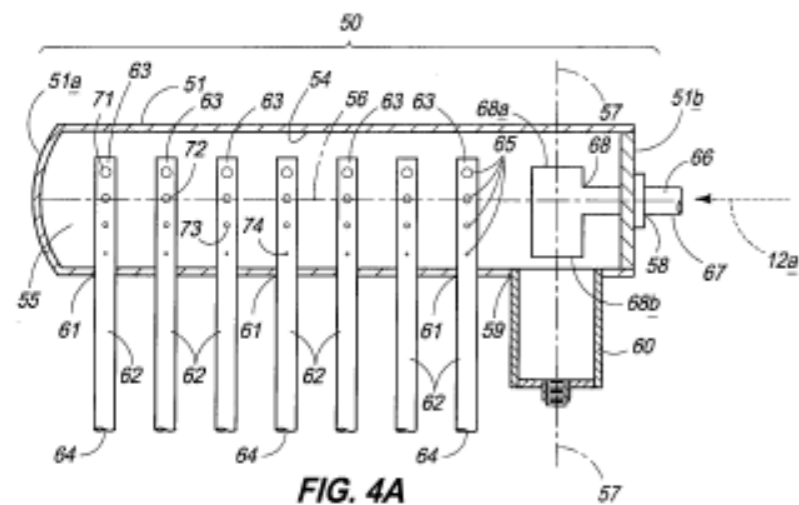
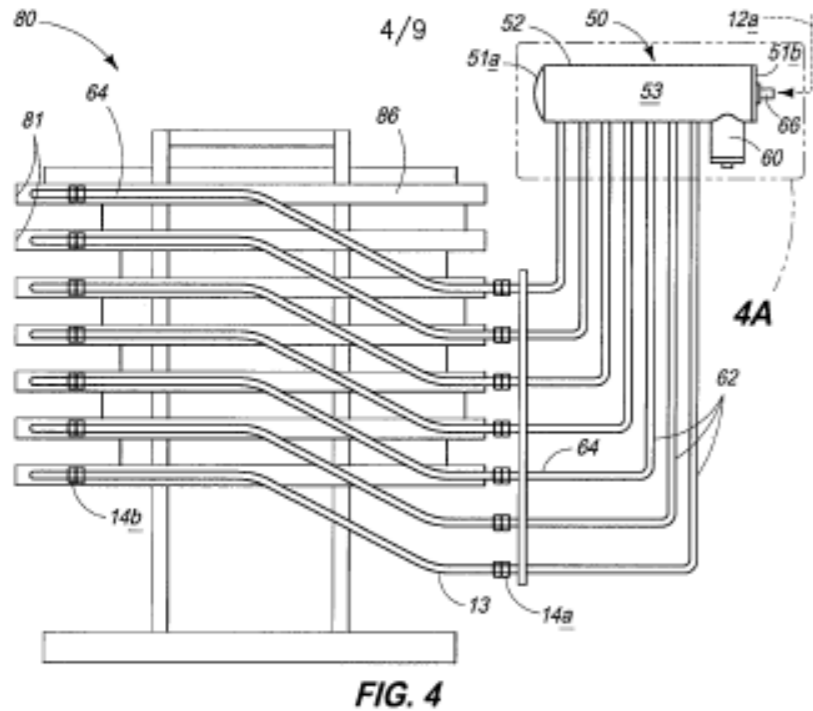
NH₃ DX
PHE's

304SS for low
friction and
durability



HOW WILL THE FUTURE BE?

Low Charge Plate Freezers



Secondary loop defrost for further NH_3 inventory minimization, prevention of liquid hammer, energy efficiency and better defrost efficiency



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Scantec is pleased to work with Shanghai Fortune Foodstuff Engineering Co. Ltd. on future low charge NH_3 projects in China. Following the success at Dongguan, enquires for new projects are welcomed

Thank you very much!

Allen Hu: allen.hu@163.com

Nis Jensen: nisjensen@scantec.com.au