

# Energy and Environmentally Friendly Cooling using Vapor Quality Control



Low  
Charge



Reduced  
Costs



Energy  
Efficiency



Reduced  
Global  
Warming

**HB**

**Products**





Charge is  
reduced by at  
least 75 %

## Low Charge Ammonia Systems with Reduced Regulatory Burdens

- In some countries the regulatory burden is a challenge if the charge is above a certain level.
  - USA 5 tons
  - Germany 3 tons
  - France 150 kg
- The DX ammonia systems typically have **less than a quarter of the charge** used in pump circulated ammonia systems. This inventory reduction applies to systems using hot gas for defrosting.

# Case Stories on Low Charge

- **Colmac Coil** has several case stories showing a reduction from 3.9 to 0.9 kg/kW (30 to 7 lbs/TR).
- A 64,000 m<sup>3</sup> (2,260,00 ft<sup>3</sup>) cold store project developed by **Scantec Refrigeration** has a charge of only 385 kg.
- If a chiller design is used, the charge can be reduced below 0.1 kg/kW. This is demonstrated on the Ecodesign chiller we have in house and which is described on our webpage.



# Reduced Global Warming Impact

- Global warming is impacted by the choice of refrigerant.
- Ammonia is a natural refrigerant without global warming impact.
- Systems based on synthetic refrigerant (HFC) have a considerable impact.





# Energy Efficiency

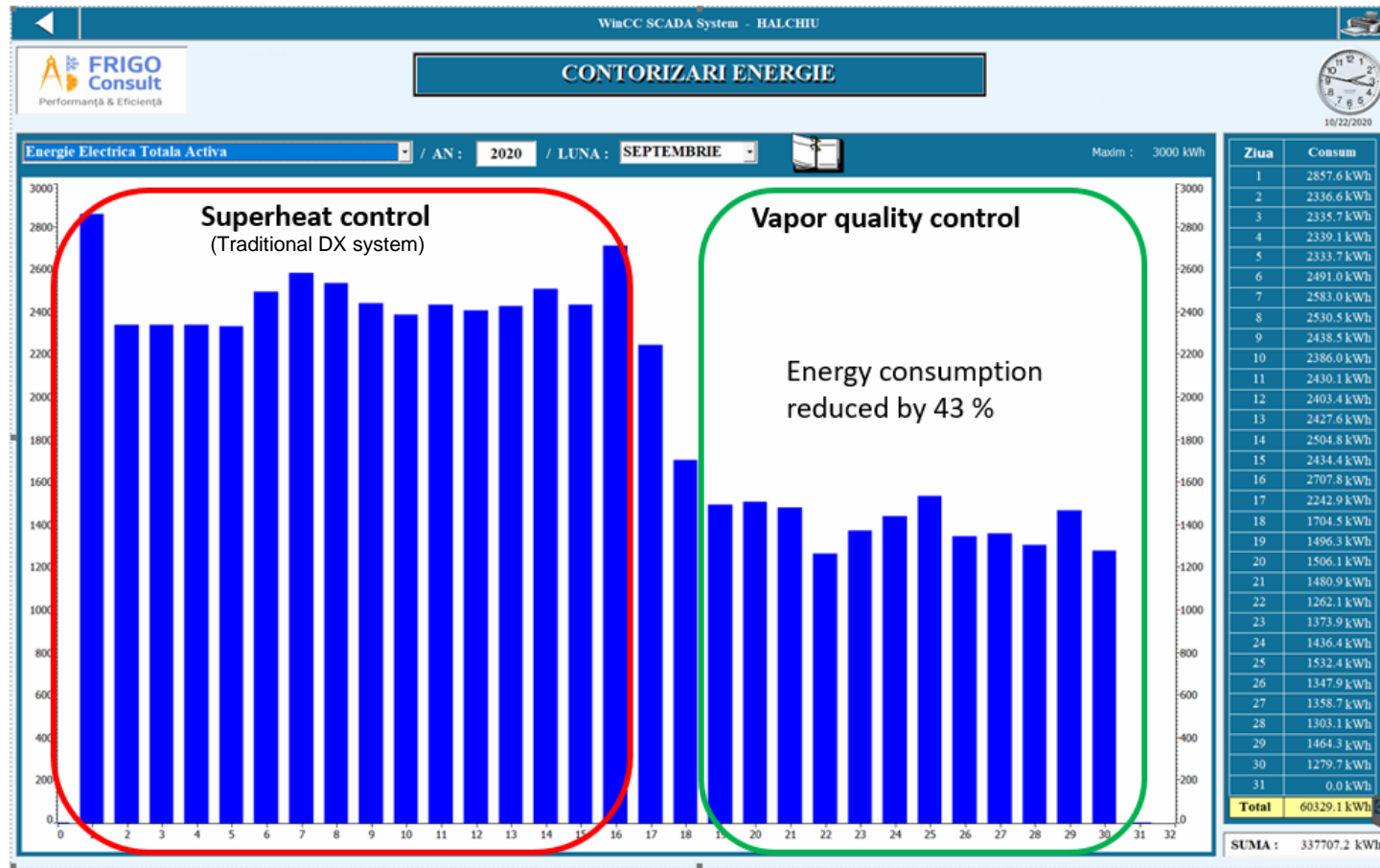
---

- **40 % reduced energy consumption** can be achieved by replacing super heat control with vapor quality control
- **46 % improvement of SEPR\*** for an ammonia DX chiller when operating with vapor quality control
- **70 % reduced energy consumption for cold store** replacing a DX system using synthetic refrigerant into DX ammonia with vapor quality control
- **10 to 25 % energy reduction** when replacing a pump circulated ammonia system with DX ammonia with vapor quality control

\*Seasonal Energy Performance Ratio



# 40 % Reduced Energy Consumption – The Halciu Plant



- The bar graph shows the daily energy consumption of the Halciu plant in Romania.
- Here vapor quality control, replaced superheat control in September 2020.
- The total energy consumption for the refrigeration system was reduced by 43%.



# 46 % Energy saving for Ecodesign Chiller

- Documented on an industrial chiller tested by Karlsruhe University 2016-2018.
- 46 % reduction of the Seasonal Energy Performance Ratio
- The chiller is manufactured by Fischer Kaelte Klima and fulfils the latest EU Ecodesign guidelines
- [Read the article here](#)





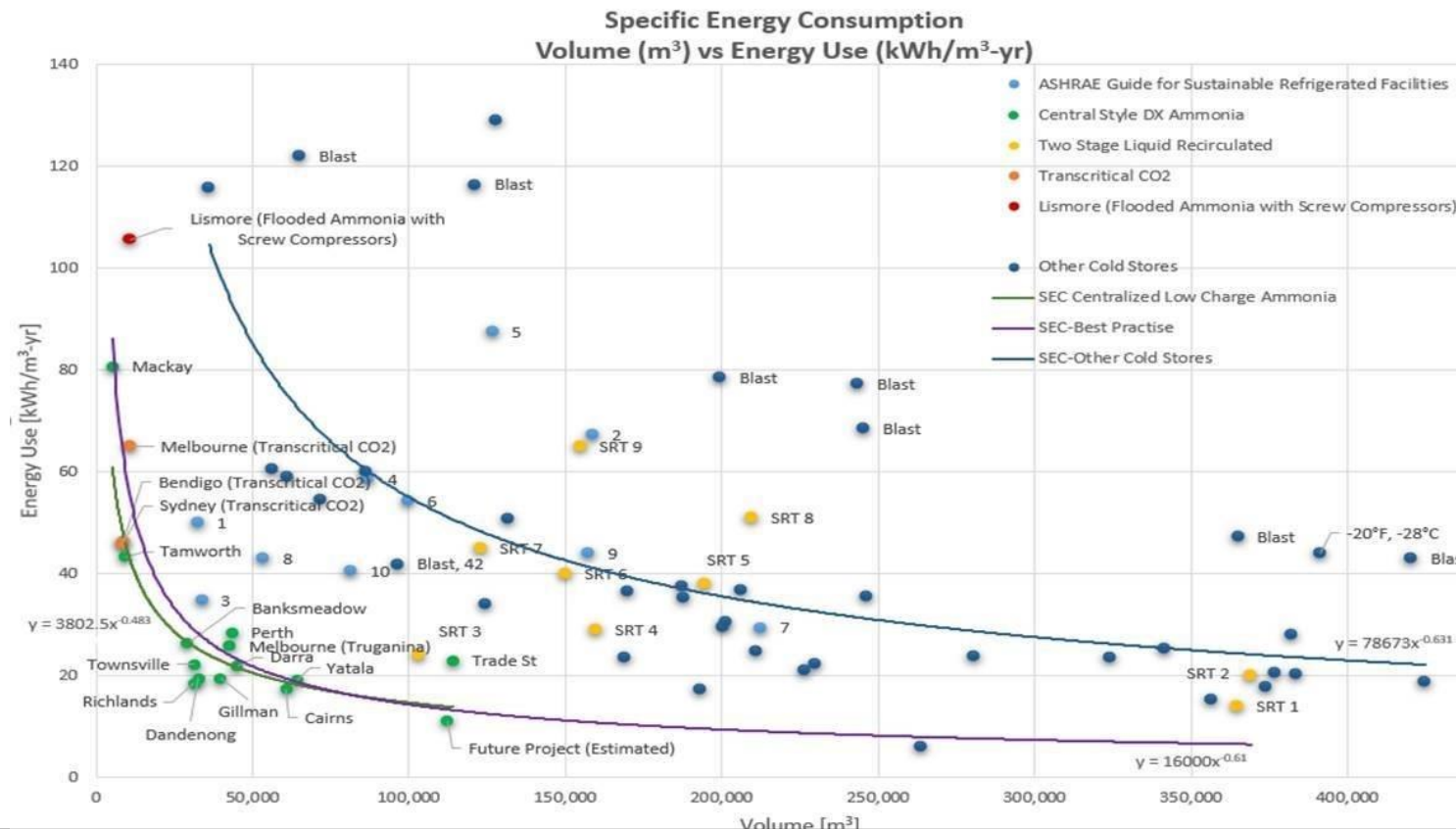
## **70% reduced energy consumption for cold stores**

---

- 70% energy reduction compared to HFC DX systems delivered by Scantec Refrigeration
- Specific energy consumption (SEC ) values below 20 kWh/m<sup>3</sup>/year
- Documented by several projects done by Scantec Refrigeration Technologies



# Reduced Energy Consumption for Cold Stores



- The specific energy consumption (SEC) for refrigerated warehouses is usually recorded as annual energy consumption [kWh/a] divided by refrigerated volume of the warehouse [m<sup>3</sup>].
- On the graph annual energy consumption per cubic meter is plotted versus the volume.
- The green dots, below the green line are all DX ammonia systems using vapor quality control.**
- The yellow and blue dots are typical pump circulated systems using ammonia.
- Typically the energy consumption of the pump circulated systems are 1.4 to 8 times larger than the DX ammonia system.

# Economic & Environmental Benefits

- Reduced energy consumption has an economic benefit. The typical simple payback period is 3-6 years when replacing an industry standard HFC based system. The payback period depends on unit electricity cost

## Environmental benefits is split in two:

- Reduced CO2 emission coming from the energy consumption will depend on the source of electricity
- Global warming is impacted by the refrigerant if lost. Ammonia has no global warming impact if the charge is lost. For HFC plants the impact is considerable

Data for 20,000 m3 cold store	HFC refrigerant flooded single stage	DX ammonia with vapor quality control
SEC*	80	20
Annual energy consumption	1600 MWh	400 MWh
Annual CO2 emission EU average	457 tons	114 tons
Electricity cost based on EU average	192,000 €	48,000 €
CO2 impact for the charge**	4782 tons	0

\* SEC is Specific Energy Consumption defined as the annual energy consumption measured in kWh per cubic meter cold store per year

\*\* calculated based on a charge of 1200 kg R404a with a GWP of 3985



# Reduced Maintenance Costs

- Less complex system
- The vessels are smaller, no pumps are required for circulation, liquid management issues are eliminated.



# Investment

- Refrigeration systems using ammonia has a larger Investment/CAPEX than DX systems using HFC/HFO refrigerants.
- OPEX is lower due to a considerable energy saving. The extra capital cost is typically returned in 3-5 years
- Total system cost must be calculated individually.







# Use experienced contractors

- DX ammonia systems has a lot of advantages but also includes lot of traps for inexperienced contractors.
- DX ammonia systems are not common due to lack of suitable components, but experienced suppliers are addressing this.

# Track Record Low Charge DX Systems with Vapor Quality Control

The reference list includes more than 30 systems



**Reference list: For large projects using vapor quality sensor**

Large projects and demonstration projects

Project name	Year	Refrigerant	Location	Application	Sensor type	Saving or SEC*	Charge	Contractor	
Bidvest, Melbourne	2014	R717	Melbourne, Australia	DX Cold store, 42600 m3	rod style	25,8	450 kg	Scantec Refrigeration Technologies	
NXTCOLD	2014	R717	L.A. USA	Cold stores	rod style	50%		LA cold stores	
Bidvest Gillman	2015	R717	Adelaide, Australia	DX Cold Store, 39,749 m³	rod style	19		Scantec Refrigeration Technologies	
Bidvest, Townsville	2015	R717	Townsville, Australia	DX Cold store, 31,344 m³	rod style	22,2		Scantec Refrigeration Technologies	
Lite N Easy, Banyo	2015	R717	Brisbane, Australia	Food Processing Facility	rod style	-		Scantec Refrigeration Technologies	
Bidvest, Yatala	2016	R717	Brisbane, Australia	DX Cold Store, 60,543 m³	rod style	19	385 kg	Scantec Refrigeration Technologies	Includes blast freezer and office A/C with NH <sub>3</sub>
Mutual logistics	2016	R717	Bourg-en-Bresse	Extension of cold store by 8000 m2 - pump system	rod style	-	-	Clauger	6X150 kW evaporators
Claus Soerensen	2016	R717	Vejle, Denmark	CR control in cold store	rod style			Danish technology institute	
Bidvest, Port Melbourne	2016	R717	Melbourne, Australia	DX Cold Store, 23,173 m³	rod style	-	280 kg	Scantec Refrigeration Technologies	ScanPAC
Havi, Dongguan	2017	R717	Dongguan, China	DX Cold Store, 36,600 m³ expandable by a factor of two	rod style	-	850 kg	Scantec Refrigeration Technologies	
Bidvest, Banksmeadow	2017	R717	Sydney, Australia	DX Cold Store, 29,294 m³	rod style	25	285 kg	Scantec Refrigeration Technologies	ScanPAC
Ingham's	2018	R717	Brisbane, Australia	Distribution centre for poultry, 114,140 m³	rod style		750 kg	Scantec Refrigeration Technologies	
Transvia	2018	R717	Transvia, Romania	Chilling line, poultry industry, CR 1.1 30 evaporators	rod style		-	AB Tehnic	
Test Chiller	2018	R717	Karlsruhe, Germany	Industrial chiller DX equipped for testing	Strainer, type	46%	4 kg	Fischer Kaelte Klima	Vapor quality versus superheat measurement
Bidfood, Richlands	2018	R717	Brisbane, Australia	DX Cold Store, 31,094 m³	rod style	18	350 kg	Scantec Refrigeration Technologies	
Bidfood, Cairns	2019	R717	Cairns, Australia	DX Cold Store, 41,258 m³	rod style	17	370 kg	Scantec Refrigeration Technologies	

Project name	Year	Refrigerant	Location	Application	Sensor type	Saving or SEC*	Charge	Contractor	
Bidfood, MacKay	2018	R717	Mackay, Australia	DX Cold store, 5,245 m³	rod style	71% (HFC to R717)	250 kg	Scantec Refrigeration Technologies	
Blenners Transport	2019	R717	Brisbane, Australia	DX Cold store, 45,324 m³ expandable to 61,000 m³	rod style	23	450 kg	Scantec Refrigeration Technologies	
Howe Farming Enterprises	2019	R717	Walkamin, Australia	Vegetable Processing facility, 31,183 m³	rod style	-	480 kg	Scantec Refrigeration Technologies	
Bidfood, Dandenong	2019	R717	Melbourne, Australia	DX Cold Store, 32,799 m³	rod style	19	300 kg	Scantec Refrigeration Technologies	DX Shell & Tube glycol/NH <sub>3</sub> heat exchanger
Bidfood, Colmslie	2020	R717	Brisbane, Australia	DX Cold Store, 30,457 m³	rod style	-	350 kg	Scantec Refrigeration Technologies	
Godden Foods	2020	R717	Ormeau, Australia	DX Cold Store, 27,000 m³	rod style	-	320 kg	Scantec Refrigeration Technologies	
Blenners Transport	2020	R717	Brisbane, Australia	DX Cold Store Extension, 18,648 m³	rod style	-		Scantec Refrigeration Technologies	
Fernhurst	2020	R717	Melbourne	DX Cold Store with blast freezing, 70,135 m³	rod style	-	450 kg	Scantec Refrigeration Technologies	Isolierkühler with automatic ambient air defrost, cold lake air distribution, in-rack blast freezers
TFC	2020	R717	Emstek, Germany	DX cold store, 34 evaporators	rod style	15%	2200 kg	Kältetechnik Dresden + Bremen GmbH	
Quality Food Services	2018	R717	Brisbane Australia	DX Ammonia Cold Store, 54,646 m³	5 x Rod style	-	1,100 Kg	Tri Tech Refrigeration Queensland Pty Ltd	
Lago Cold Stores	2018	R717	Brisbane Australia	DX Ammonia Cold Store, 80,770 m³	32 x Rod style	40%	4000 kg	Tri Tech Refrigeration Queensland Pty Ltd	
Lago Cold Stores	2019	R717	Brisbane Australia	DX Ammonia Cold Store Expansion, added 27,066 m³	18 x Strainer Style	40%	Added 230 kg	Tri Tech Refrigeration Queensland Pty Ltd	Includes Carton Blast Freezer
Lindsay Transport	2020	R717	Sydney Australia	DX Ammonia Cold Store, 29,000 m³	3 x Strainer Style	-	470 kg	Tri Tech Refrigeration Queensland Pty Ltd	
John Dee	2020	R717	Warwick Australia	ASRS Cold store	1 x Strainer Style	-	-	Tri Tech Refrigeration Queensland Pty Ltd	DX Ammonia/Ammonia PHE for HP Liquid Subcooling
Halchui	2020	R717	Halchui, Romania	Freezing storage 250 kW 7 evaporators	7 strainer style	43%		AB ethnic Romania	43% achieved when switching from SH to vapor quality

\*SEC is Specific Energy Consumption defined as the annual energy consumption measured in kWh per cubic meter cold store per year

November 2020



# Vapor Quality Control the Key to Energy Efficiency

- Vapor Quality Control is a patented technology which can control and optimize the evaporator in a refrigeration system.
- With Vapor Quality Control superheat is eliminated which increases the efficiency.
- [Read more about Vapor Quality Control here](#)



# Contact Us



HB Products  
Bøgekildevej 21, 8361 Hasselager  
Denmark



+45 87 47 62 00



[info@hbproducts.dk](mailto:info@hbproducts.dk)



[www.hbproducts.dk](http://www.hbproducts.dk)