



19 & 20 April, 2016 – Barcelona

AirConditioning and Ammonia – a contradiction?

AC session – ATMOSphere Barcelona

WOLFGANG DIETRICH - GEA BERLIN



GEA is a global leader in equipment and process technology providing innovative solutions for smart food processing and for a more efficient use of energy resources.



Dairy Farming



Dairy Processing



Food



Beverages



Revenue
EUR 4.5bn (FY14)



Operating EBIT Margin
11.4% (FY14)

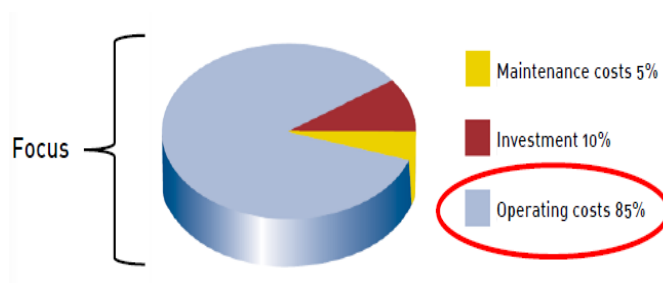


Employees
>18,000 (Dec14)



Market Cap
>EUR 9.0bn (Apr15)

- Investment - Equipment; constructional expenses: safety installations
 - Compact components thanks to Ammonia (Refrigerant with highest volumetric cooling capacity)
 - Removing of wasted heat from electrical components crucial factor for ventilation of machinery room
 - Additional safety equipment for Ammonia negligible; high warning potential (5ppm you will already smell; TLV 50ppm)
- Lifetime (25 years) - maintenance; spare parts; possibly re-investment
- Operational costs - electrical consumption; part load behaviour of the equipment
- Defined as **Total Costs of Ownership**



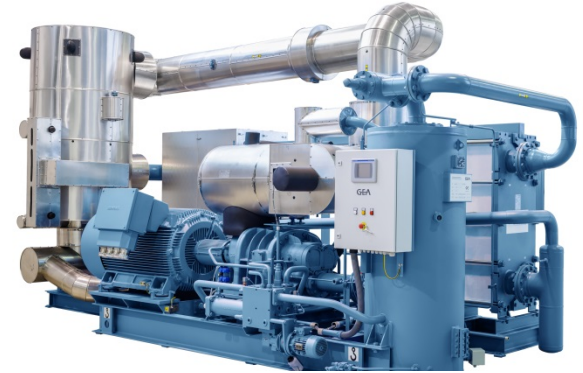
Air conditioning of an IT Hub – reliability first - followed by efficiency

- The challenge
 - Supply of 4MW cooling capacity for a centralized IT service provider of a banking corporation
 - Compact solution on base of NATURAL REFRIGERANT inquired ; limited space available
 - 1% maintenance related to investment in max., long lifetime (min. 20years), minimized content of refrigerant
 - Highest efficiency in full load and especially in partload (ESEER >8,5)
- The solution
 - **Provide high efficient industrial chiller based on Ammonia as refrigerant; ESEER 8,8**
 - **BluAstrum screw compressor based compact chiller – 5m² for 1000kW cooling capacity only**
 - **60 % less service costs to former solution; extended maintenance on site only at 50.000 operating hours, ammonia content appr. 60g NH₃/kW capacity**
 - **Stepless capacity adjustment by VSD between 15-100% for 10% lower electrical consumption - lowering of operating costs!**



The Blu-Chiller – Ammonia technology at its best

- Available for years and still existing – the modular Ammonia chiller
 - Industrial chiller using Ammonia; modular design; wide capacity range (300 - >6000 kW); evaporation temperatures down to -35°C
 - highest capacities and flexibility in foreground; relatively high ammonia content
 - Normally fixed speed operation; capacity adjustment by capacity slide;
 - Disadvantage: Efficiency in part load limited; full load operation preferred
- **The new approach – High efficient Compact-Chiller**
 - Industrial Ammonia chiller in an outstanding design; available within a limited capacity range (550-1750 kW)
 - Simple, very efficient, optimized dimensions – 5m²/1000 kW; low ammonia content (60-80g/kW)
 - Fully welded heat exchanger; combined evaporator/liquid separator;
 - lowest sec.refrigerant out -15°C
 - State of the art control equipment; developed sequence control if more than one chiller



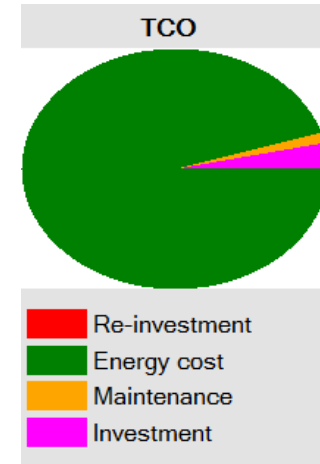
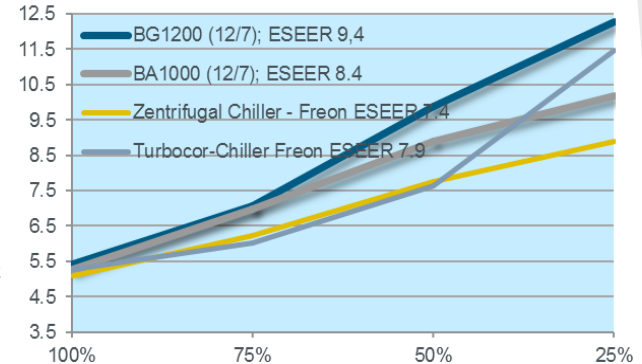
The project – efficiency requirements on top

- Project requirements

- Selection needs to provide best and defined efficiency in full load and part load
- Required profile based on ESEER – part load steps but at from ESEER definition different part-/full load shares (more shares between 100-50% expected)
- Cold water outlet evaporator at 13°C / constant volume flow / watercooled condenser
- High condensing temperature due to intended heat recovery / (MEG 35) 47°/52°C

-and the results

- BluAstrum 900 – screw based ammonia chiller with M-ESEER of 7,5
- Compact dimensions with customized Power panel fits to available room
- Enclosure for perfect design, touch protection and 4 dB(A) noise reduction
- 6,5% lower TCO then traditional HFC solution, resulted from lower Pe
- Stable and trouble-free operation since 2013; service costs by 40% reduced

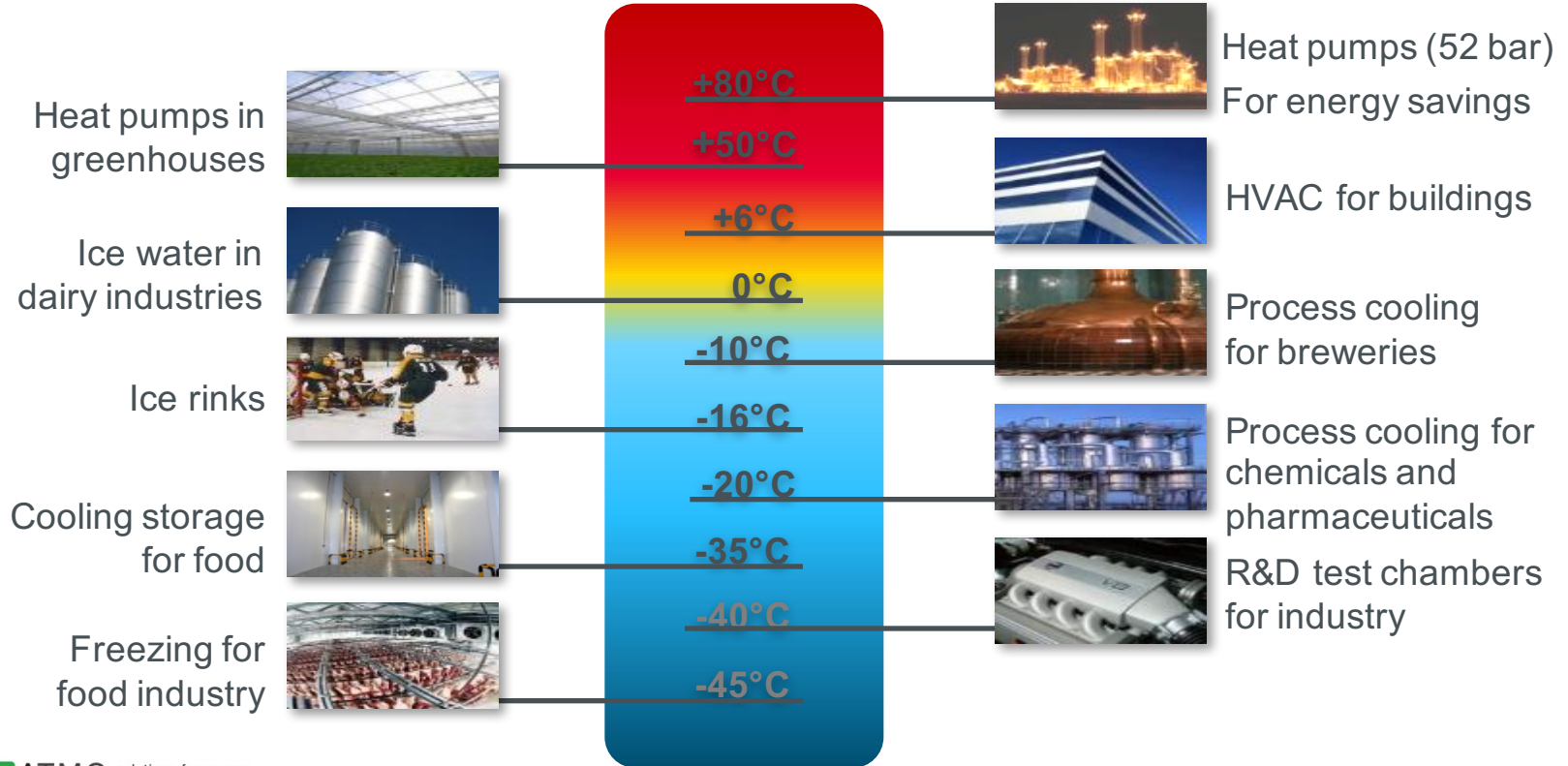


Local Installation / look into the machinery room



- Limited space requires special execution for power panel
- Ammonia detection system installed
- EN 378-3 is the guideline for the machinery room
- Air changes determined by motor heat to reject

What are Ammonia chiller able to cover - temperature scale & applications

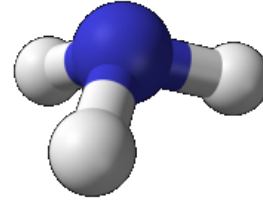


AC by using Ammonia – state of the art technology combined with a future proof refrigerant



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- A simple molecule – made in huge quantities
- Ammonia combines several advantages
 - ⚡ no GWP; future proof; always available; relatively cheap
 - ⚡ High volumetric capacity leads to lower mass flow compared to HFC's and HFO'S – smaller pipes and valves
 - ⚡ Up to 100% better heat transfer coefficient (U-value) reduces heat exchanger sizes and boosts efficiency
 - ⚡ High warning potential (5 ppm) if leaking; not more dangerous than other gases they displacing air



Planning guide

Chillers with screw and reciprocating compressors
(Translation of the original text)

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3.4 Installation in buildings



Fig. 24 Installation on 1st basement floor

Installation on 1st basement floor
By separate access to the machinery room in this hotel (installation on 1st basement floor) the installation is permitted in a class C area with unlimited charge. There are also no restrictions for basement floors, if all remaining requirements on machinery rooms are observed.
See also EN 378-1:2012-06, 3.2 and Appendix C as well as EN 378-1:2012-06, 4.2.



Fig. 25 Installation on 2nd basement floor

Installation on 2nd basement floor
The machinery room has no separate access in the figure "Installation on 2nd basement floor". Hence, the room with access to the machinery room may be occupied solely by authorized instructed personnel in accordance with installation area class C EN 378.



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