

ENGINEERING
TOMORROW

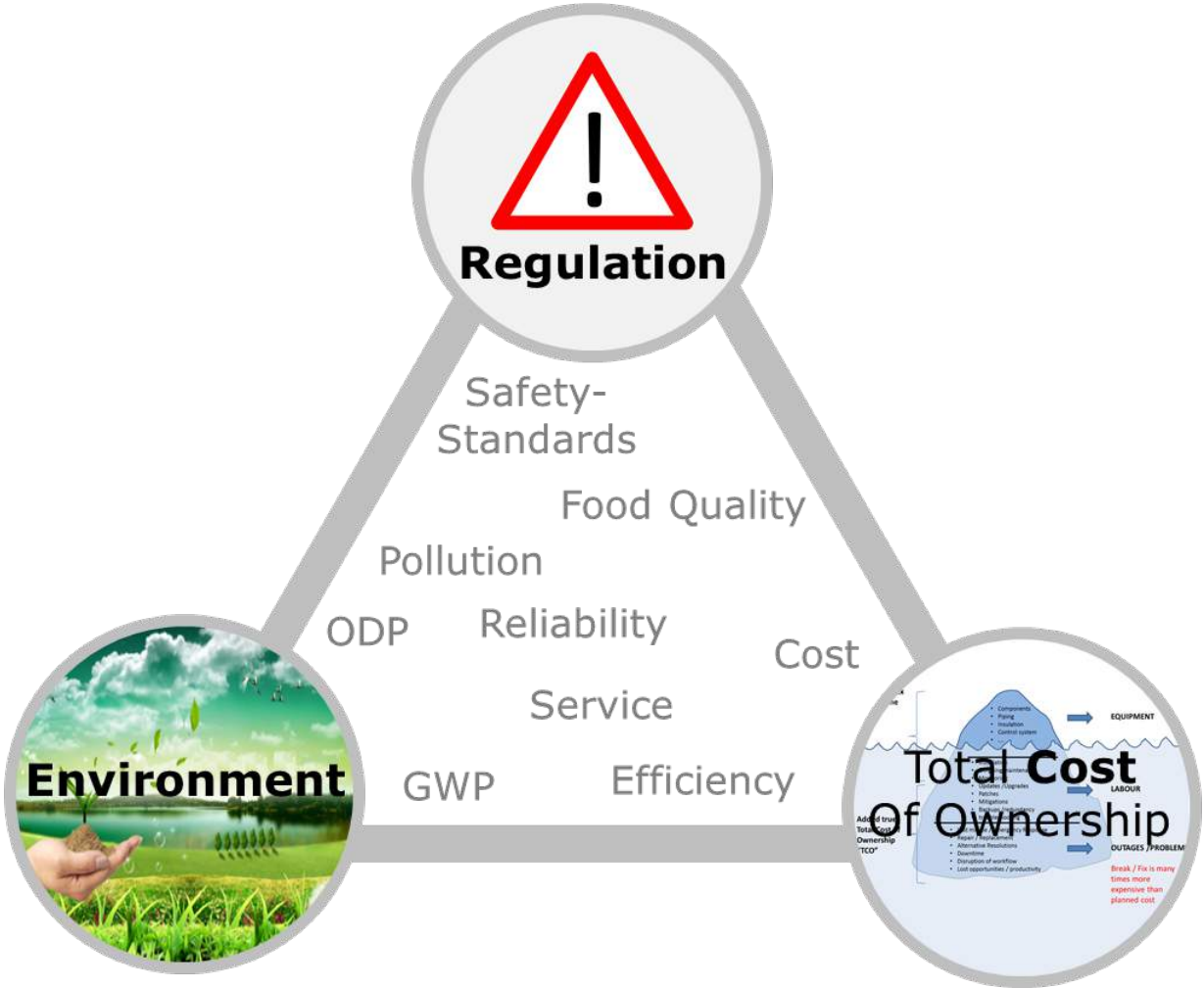


Refrigerants trends in Industrial Refrigeration **ATMOsphere Shanghai 7th April 2015**

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Industrial Refrigeration - Trends / Drivers



Industrial Refrigeration - Trends / Drivers

Regulation

Safety

- Reduce risk of personal injury
- Food & product quality
- Expand cold chain in emerging countries

Environment

Refrigerants

- Natural refrigerants / low GWP & low ODP refrigerants

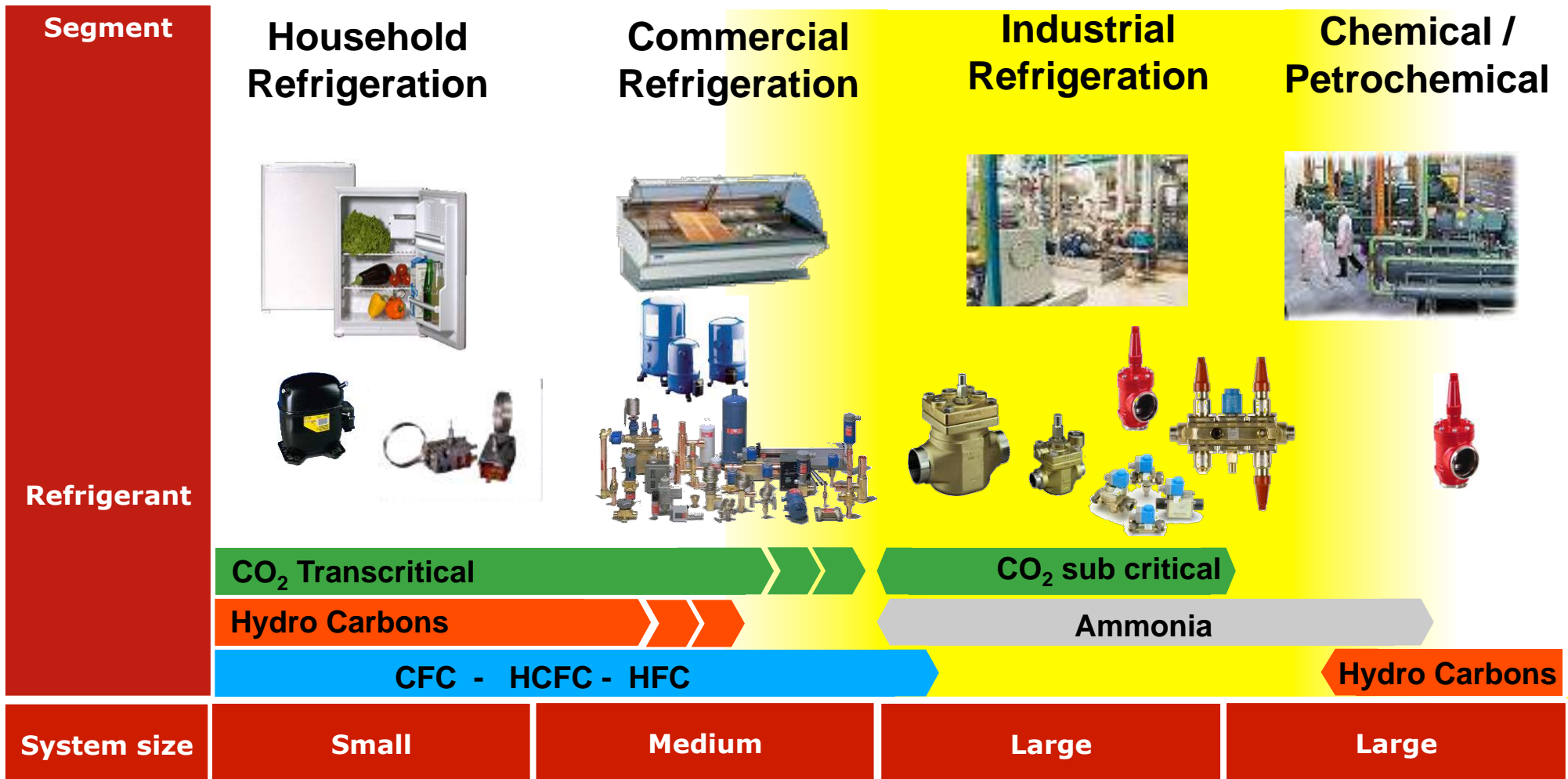
Sustainability

- Efficiency
- Low energy consumption.

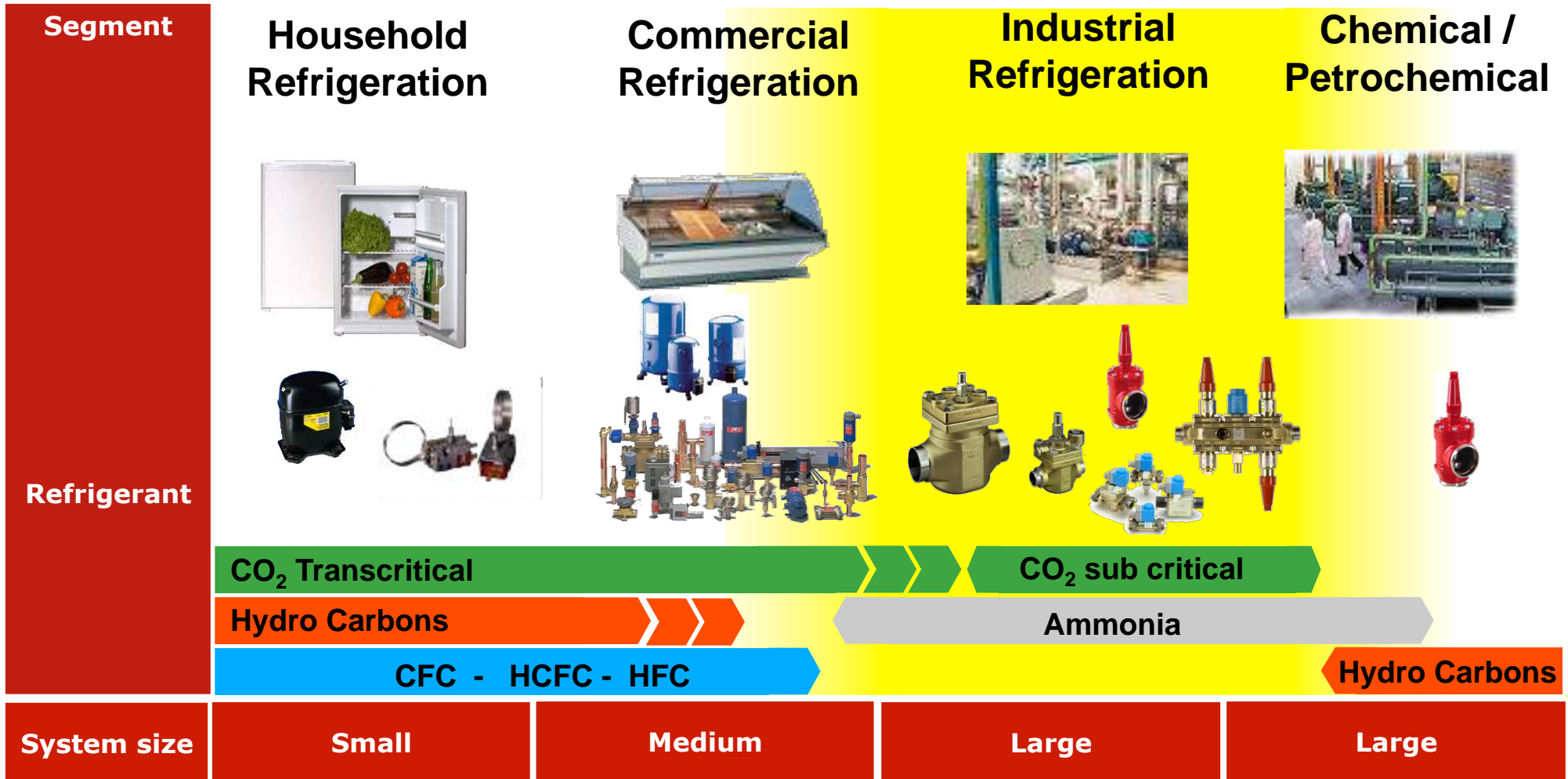
Cost and profitability

- Efficiency
- Energy saving
- Reliability
- Reduce down time
- Productivity

Refrigerant trends today



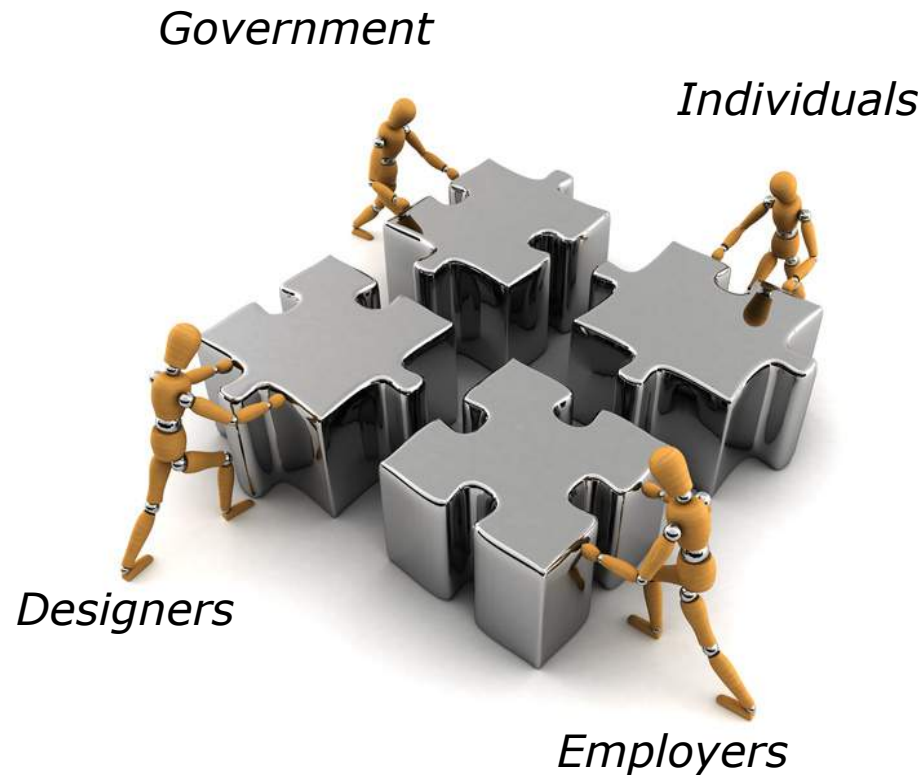
Refrigerant trends tomorrow



CO₂ Transcritical move to Large systems
Ammonia move to Medium systems
CFC – HCFC – HFC reduce from Large systems

Refrigeration Safety

Cooperation



- Ensuring Safety
 - Clear guidelines
 - Regulations
 - Understood, documented and followed by stakeholders:
 - Government bodies
 - Plant owners
 - Plant operators
- End Users want “State of the Art” Refrigeration Plants
 - Proper design
 - Safe and reliable components
 - Good control strategies
 - Proper maintenance and repair

Refrigerated Food Industry



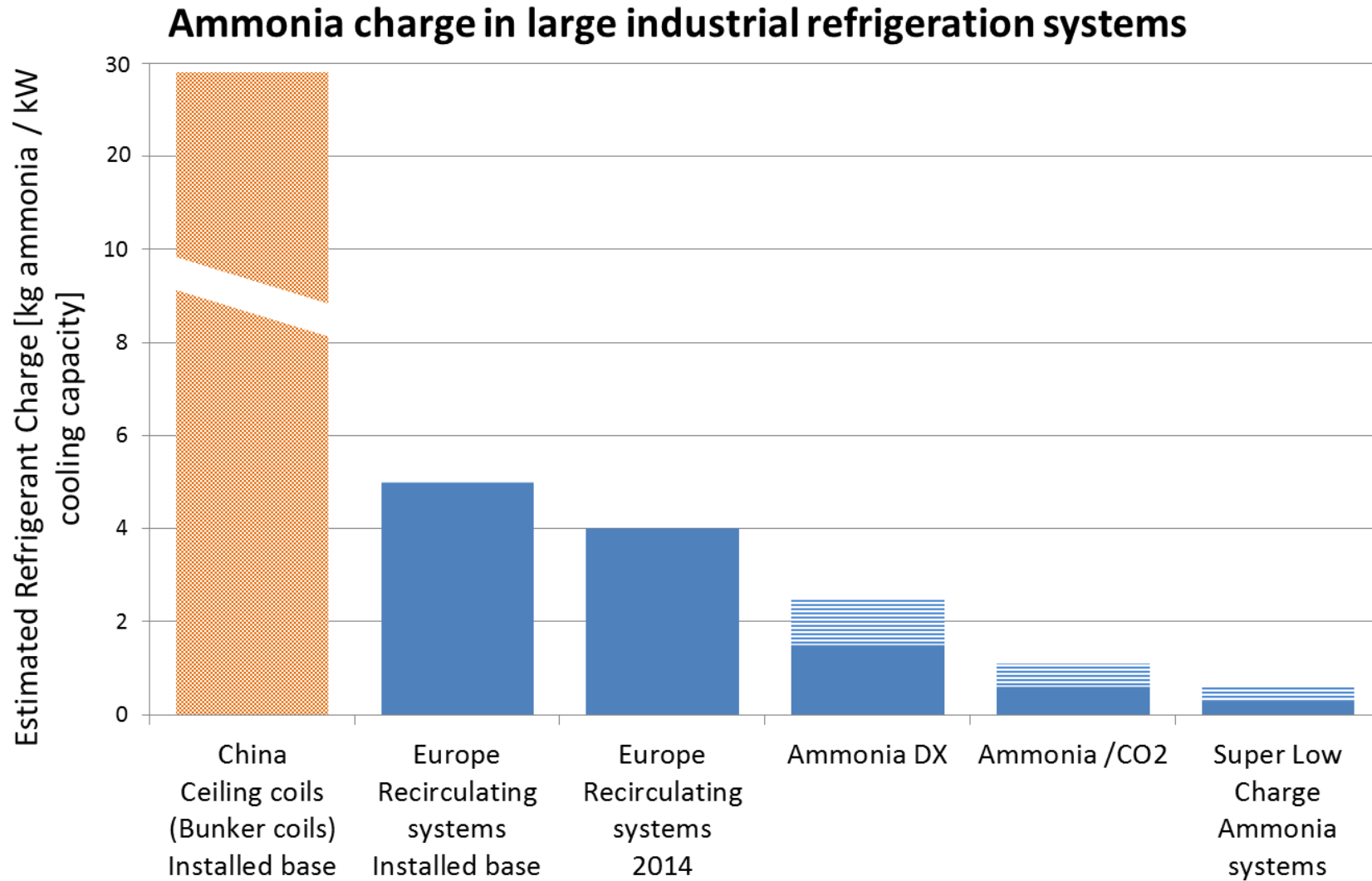
- What is important?
 - Minimizing Risk: End-users demand for high quality components and “state of the art” controls.
 - Implementation: Installation in accordance to design and standards with qualified contractors.
 - Invest in Safety: Empower and train employees to operate and maintain the equipment.
 - Continuous training and development: Good habits develop over time and ensure positive results.

Technology Considerations



- Long Term Investment
 - Safety and Efficiency:
 - New materials
 - Advanced valves (no flanges)
 - Efficient compressors and heat exchangers
 - Reliable and safe systems
- Making the Right Choice
 - Natural Refrigerants:
 - The solution today and tomorrow
 - Refrigerant Choice Considerations:
 - Plant location (rural vs. city)
 - Products to be refrigerated
 - Process involved
 - Ammonia charge reduction:
 - Electronic Direct Expansion Technology
 - Growth of NH₃/CO₂ systems

Trends in Ammonia charge



Safety Improvement Solutions

- Current situation in China
 - Mainly manual system
 - less than 30% new systems are automatic
- Automatic controls
 - Reduce human error during operation
 - Less operators, less risk
 - Remote monitoring and control
 - Positive trend in China to improve automatic control



Manual System



Automatic System

Grand Farm

大庄园

Ammonia Refrigeration – a large contributor to the Chinese meat industry



The largest CO₂ food processing & cold storage project in China – Zhangzi Island



Three Gorges Logistics Park Customized automated control solutions



Trend

of food is lost due to poor refrigeration system performance and during transportation

Danfoss

A customized industrial refrigeration automated control solution for the Three Gorges Logistics Park

Conclusion

- Ammonia is the most dominant refrigerant within industrial. It is a well-proven and effective refrigerant with a long experience, however its toxicity needs to be addressed, system design and location evaluated carefully.
- Safety is crucial, thus “state of the art” standard, guide lines and management system need to be full filled.
- Low charge systems is a must in many locations in order to minimize risk.
 - Design systems with reduced charge.

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Thank you!