

MAKING MODERN LIVING POSSIBLE



# Case-Study: Fakta Supermarkets

## Energy savings of Second Generation CO2 Refrigeration Systems




One Company

Focused on Climate & Energy



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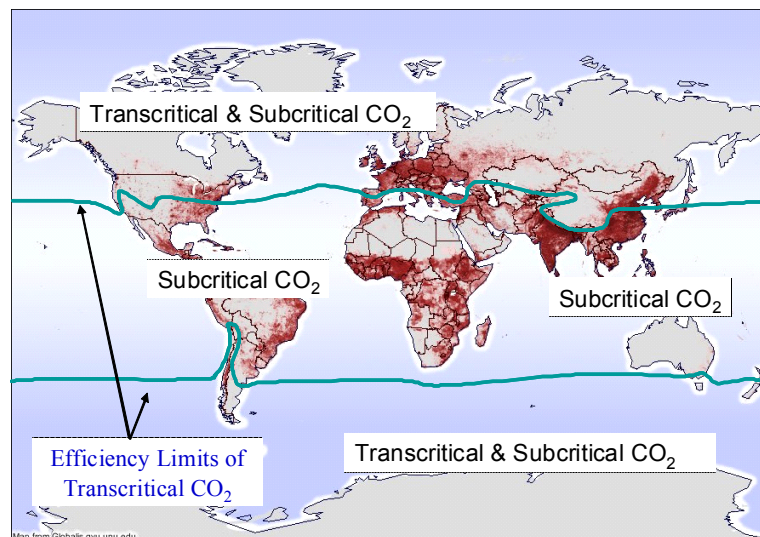
# Agenda

-  **1 CO<sub>2</sub> as a Refrigerant**
-  **2 Fakta Case study**
-  **3 Conclusion**

	CO2
Non-flammable	😊
Low toxicity	😊
GWP/ODP	😊
Pressure and Temperature	😞
Efficiency	😊 / 😊

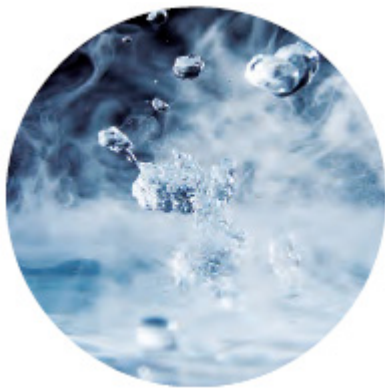
## CO2 as refrigerant

- Non-toxic, Low GWP, Non-flammable
- Energy efficient under the right circumstances – however – observe the limits for outdoor temperature



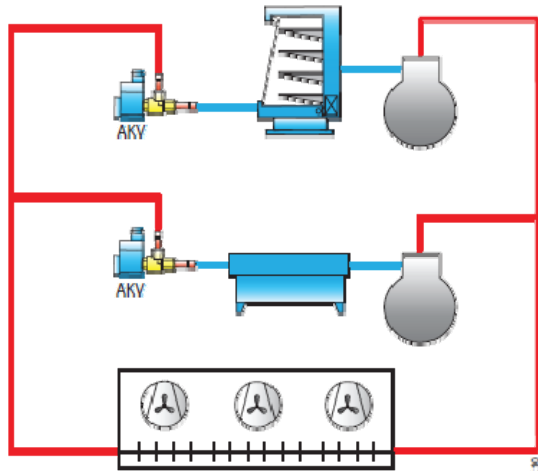
- Systems and components have improved during the last decade – and since technology is new, compared to HFC systems, improvement is more rapid

## About Fakta:



- Fakta: Danish supermarket chain, part of Coop Danmark. The largest retail company in Denmark.
  - Fakta has been working with lowering the energy consumption for the past 15 years, first on there HFC scroll packs and later on there transcritical packs
  - More than 15 years of experience in data collection in order to optimise energy consumption and temp quality
- Fakta was one of the first movers on CO<sub>2</sub>
- More than 378 stores in Denmark. 61+ are transcritical CO<sub>2</sub> systems of which 32 are 1<sup>st</sup> generation systems
- The goal is to install more than 40 CO<sub>2</sub> 2<sup>nd</sup> gen systems in 2011 in Denmark
- Cabinets, packs and gas cooler are standardized, but installation differs from site to site

# Overview of Systems

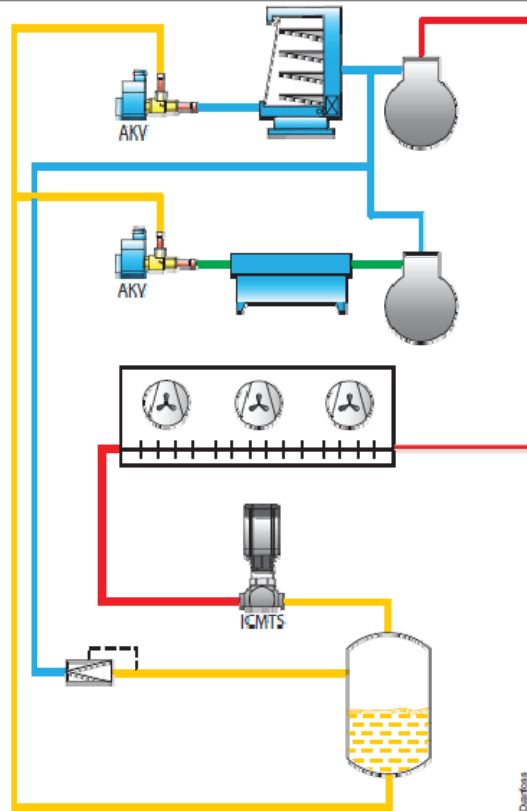


## HFC-404A

Parallel scroll system with very good load adaptation

- 148 in operation
- 10 selected for study

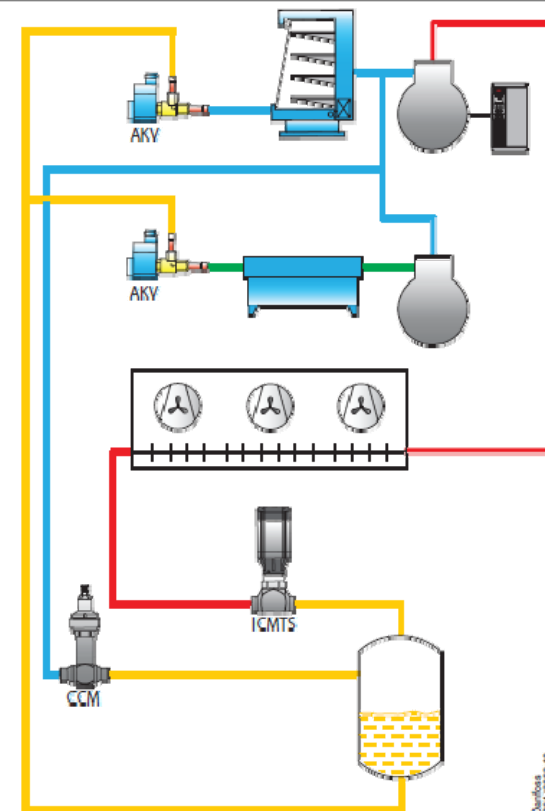
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## 1<sup>st</sup> gen CO<sub>2</sub> (2007)

- Booster system
- 2 compressors for MT
- 2 compressors for LT
- Mechanical gas by pass
- First 10 selected

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## 2<sup>nd</sup> gen CO<sub>2</sub> (2010)

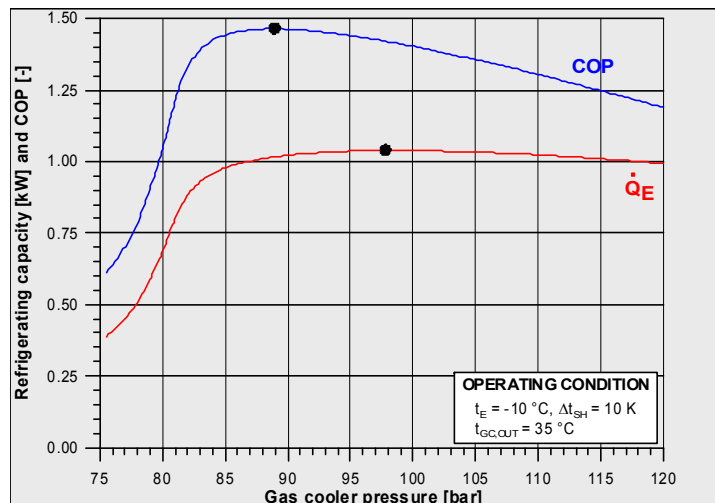
- Improvements
  - Inverter on 1 MT comp.
  - CCM gas by pass valve
- First 10 selected

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## More Details...

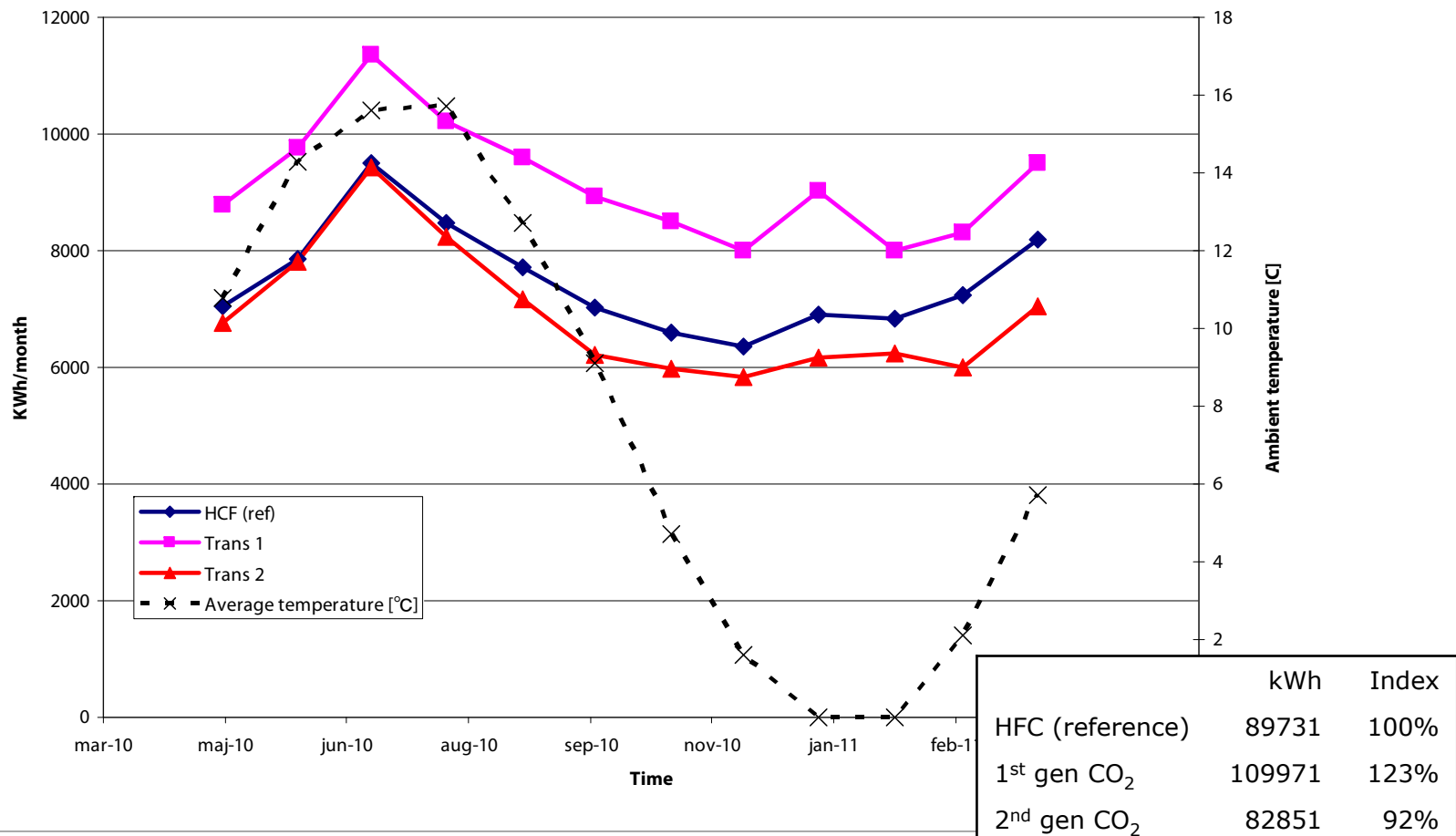
- System conditions are very similar:
  - Capacity: 9 kW on LT and 28 kW on MT
  - Equivalent opening hours
  - The stores are identical on most parameters
  - Installation differs (but pressure drops doesn't)
  - Geographically small area, no climate differences
  
- HFC: Parallel scroll system with very good load adaptation. 148 in operation
  
- CO2 1<sup>st</sup> generation (2007-2010) :
  - Transcritical Booster
  - Mechanical gas bypass.
  - Piston Compressors, 2 for LT (33%/67%) & 2 for MT (33%/67%)
  - 32 systems in operation
  
- CO2 2<sup>nd</sup> generation (2010 -... ) :
  - Transcritical Booster
  - CCM gas bypass valve
  - Piston Compressors, 2 for LT (33%/67%) & 2 for MT (33%/67%). AKD Inverter on MT.
  - 29+ systems in operation



# Results

(10 stores average for each system type)

Energy consumption Fakta



## Solutions ready going forward



- CO<sub>2</sub> supermarket systems minimize both direct and indirect emissions:
  - CO<sub>2</sub> systems in Fakta consumes less energy than the HFC packs used earlier
  - 2<sup>nd</sup> gen CO<sub>2</sub> systems shows 20 % better energy performance than 1<sup>st</sup> gen CO<sub>2</sub> systems
  
- Still room for improvement:
  - New generations of valves, compressors and controls will show further improvements
  - System architecture and control strategies will also improve
  - Additional improvements in overall efficiency to be expected when heat recovery systems are implemented as part of the system.





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