HUSSMANN®

Enabling Excellence in Food Retailing

LMP

ATMOsphere AMERICA

business case

natural refrigerants

25-26 June 2015 — Atlanta, Georgia

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State of the Industry

Building Confidence in Natural Refrigerants

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- *Enabling excellence in food retailing requires diversity in our product offerings. The Hussmann team realizes there is not one solution to fit all customers needs. We strive to provide the right solution to meet their needs. As such Hussmann has added natural refrigerant options to their portfolio.*

- *In 2012 Hussmann began development of the Micro-Distributed System Architecture using R290 and in May 2013 started up the first store.*

- *In September 2014 Hussmann formed an alliance with LMP to expand our offering with the "**Purity**" Trans-critical Booster System. LMP supports Hussmann's vision of positively impacting the lives of consumers by transforming the future of food retailing. CO_2 systems is one such transformation that is having a growing impact.*

- *Throughout 2015 Hussmann will continue to align the case and coil products for supporting CO_2 offering and later this summer Hussmann will be delivering their first trans-critical store.*

Latest NR projects

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- ***Supplied CO2 technology for University of Dayton Ohio (Emerson)***
- *Subcooling effects with the EPRIE in Knoxville Tennessee*
- *Built CO2 trainers for USA and Canada (School training)*
- ***Blast spiral freezers using R744***
- *Data centers prototype ready to go*
- ***Dehumidification technology using R744***
- ***Developed for North American (N.A) market***
- ***Over 40 Transcritical systems working in N.A.***
- *Integration with all controllers*
- *In Texas we supported an additional Micro-distributed site where 88 freezer doors rejecting 250,000 BTUs were successfully supported with only 170 oz. of R290*
  - *To date, the actual efficiency is better than anticipated from the lab results.*

Latest NR projects

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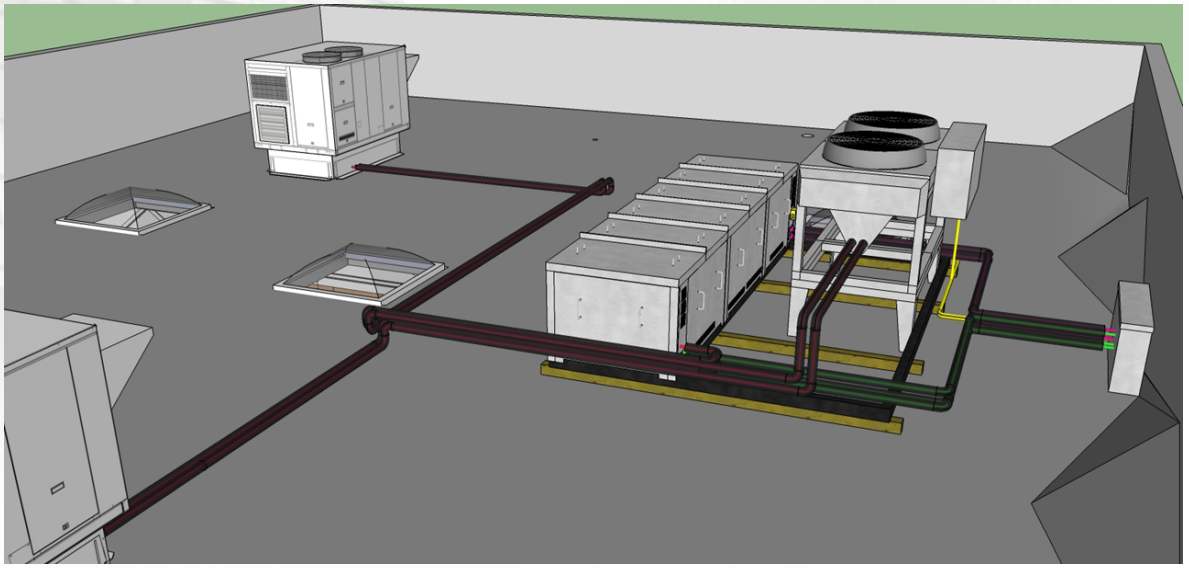
- *First outdoor CO2 system being installed late summer .*
  - *Lower cost / No house / Reduced Install labor.*
  - *Easy access with remote controller panel inside the store.*
  - *Doesn't take up indoor space.*
  - *Short easy runs for direct CO2 heat reclaim.*



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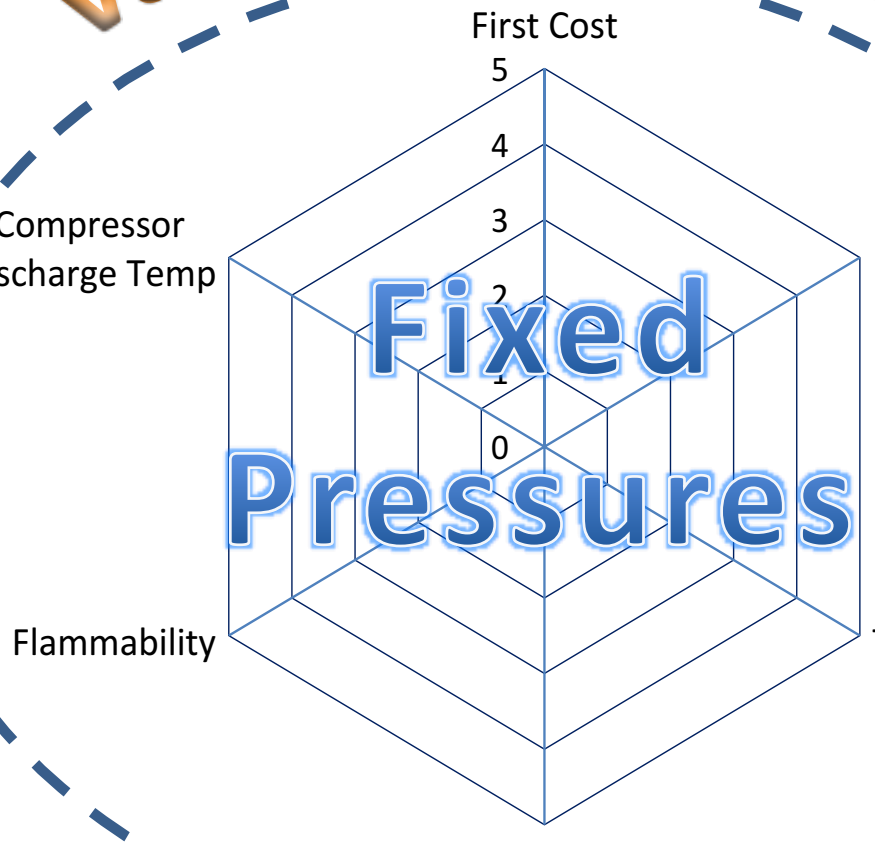
Refrigerant Uncertainties

Underling pressures in the selection of NR

Variable Pressures

- DOE/EPA Reg.
- State of The Economy
- Climate / Region $$$
- Technical Support
- Availability
- Perceived Safety



Fixed Pressures

Design Around an Achievable ROI

Easing The Pain

Building confidence and Reasonable ROI

*Retailers are in business to make a profit, therefore we need to address areas to make NR options affordable by **focusing on the variable pressures** where we have some control.*

- *Safety: Real or Perceived.*
  - ***Understanding NR Benefits**: Accessible, Clean, Convenient, Efficient, Portable, Safe*
  - ***Understanding NR properties**: Handling, Flammable, High Pressures, Detection*
  - *Mfgs can lessen the likelihood of product abuse though cannot fully eliminate it. **"Purchasers control the products"***
  - *Develop strong, clear and **appropriate warnings**.*
  - *Training in conjunction with **maximizing communications** with known customers.*
  - *Strive for **robust product specifications** that exceed industry standards.*
- *Climate Variables*
  - *The farther south, the **higher the first cost** for TC/CO2 systems.*
  - *Don't sugar coat it. At the current cost for the technology to operate TC in southern climates, it is probably unlikely any ROI can be achieved. Subcritical CO2 systems however can **prove out a ROI** if applied correctly.*
  - *Remember the goal is to **reduce carbon emissions and pollution**, not displace it.*

System efficiency should always be considered.

Easing The Pain

Building confidence and Reasonable ROI

- *Technical and Aftermarket Support*
  - *Mfgs need to work closely with suppliers to ensure **all components availability** is in a timely manner.*
  - *A **detail list of all critical components** should be provided with instructions on how to obtain replacement parts.*
  - ***Long term reliability** on compressor will set a new standards. Booster and Cascade systems operate at a moderate compression ratios; therefore, compressors aren't stressed to the extend compared with a single stage DX system.*
  - ***Margins containment** on aftermarket components should be considered as to not discourage the NR technology.*
- *Design For Success*
  - ***Improve education** in three main areas: "Selecting the right NR system design", "Taking a retailer's current spec and converting it to apply to NR" and "What to expect after start up".*
  - *ROI's may not be obtainable if the systems design does not **take advantage** of the inherent benefits of CO2.*
  - ***Utilized heat reclaim**. Letting all the heat be discharged from the gas cooler is a waste.*
  - *Strongly **consider the use of hot gas defrost**. Free defrost and added subcooling.*
  - *Consider mechanical subcooling. In many cases it can have a significant impact on the efficiency, peak load shedding and compressor HP used.*

Future plans

Where do we go from here?

- *Enhancing the Micro-Distributed.*
  - *Expanded equipment options and electronic close loop control integration.*
  - *Great alternative especially in southern climates .*

- *Continue to improve the cost point for converting to CO2.*
  - *Upcoming DOE regulation helps with overcoming the technology leap to EEV and case controllers as they will be required to meet new regulations.*
    - *This will help leverage the supply chain.*
  - *Continue educating in the three key areas on how to design a store plan for success.*
    - *TC CO2 is not always the best option. Hybrid/Cascade options may be better choices in some climates. Reducing and not displacing emissions should be the goal.*
  - *Expect as much as 15 -20% of the N.A industry to utilize NR options in the next 10 years.*
  - *Increase collaborative efforts on best practices.*

We must work together.

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