OAK RIDGE National Laboratory | BUILDING TECHNOLOGIES RESEARCH AND INTEGRATION CENTER

Evaluation “Distributed Scroll Booster” Technology for Supermarket Refrigeration

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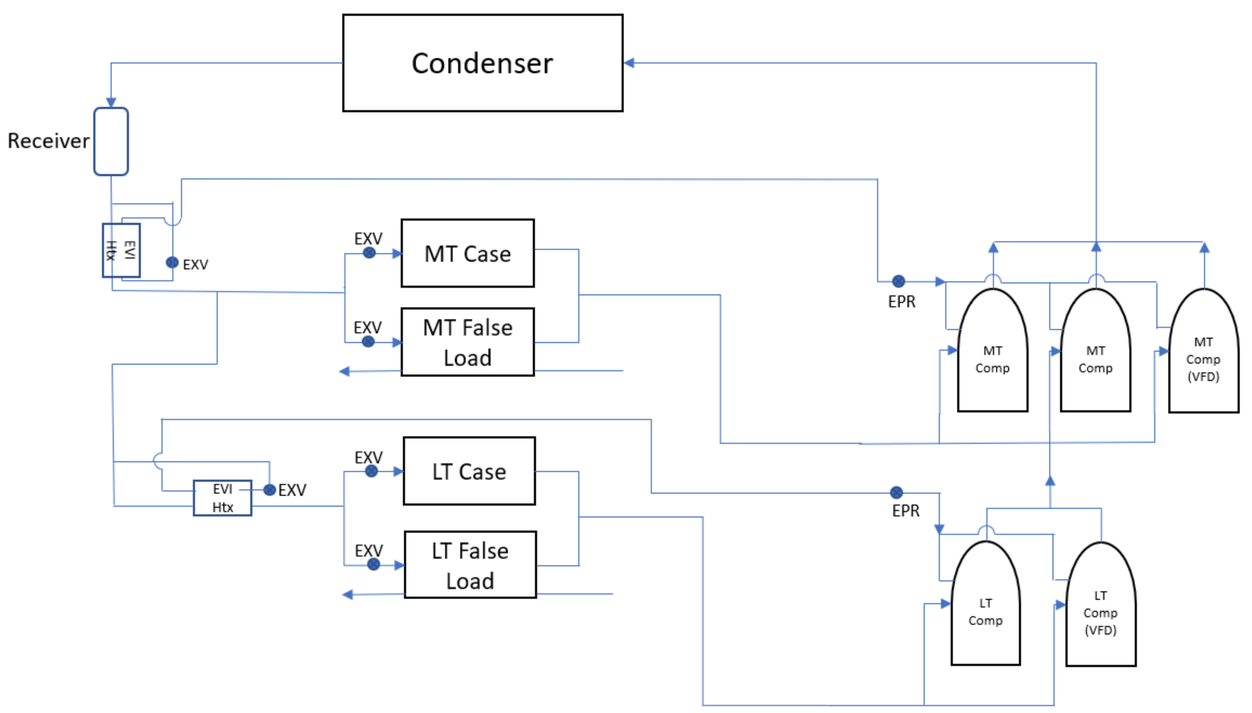
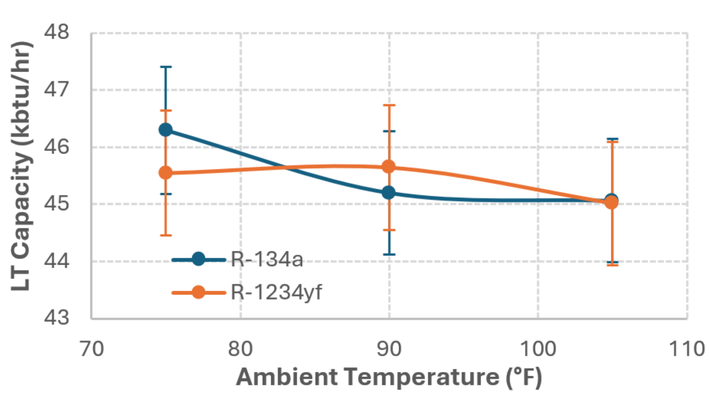
Objective and Outcome

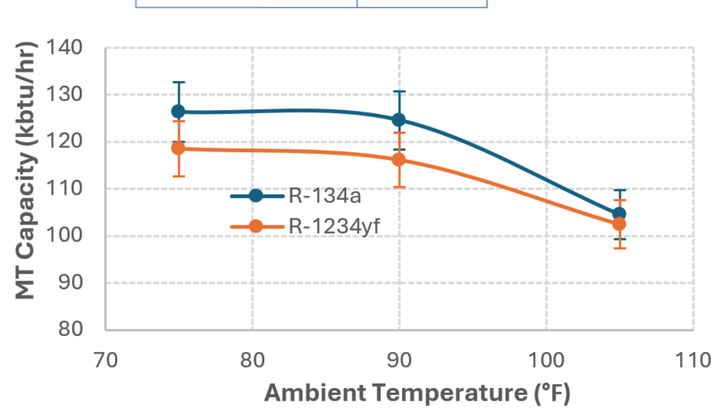
- Enable Distributed Scroll Booster systems using ultralow-GWP refrigerants (GWP < 1) for supermarket refrigeration
- Reduce overall GHG emissions by at least 60% in supermarket refrigeration systems

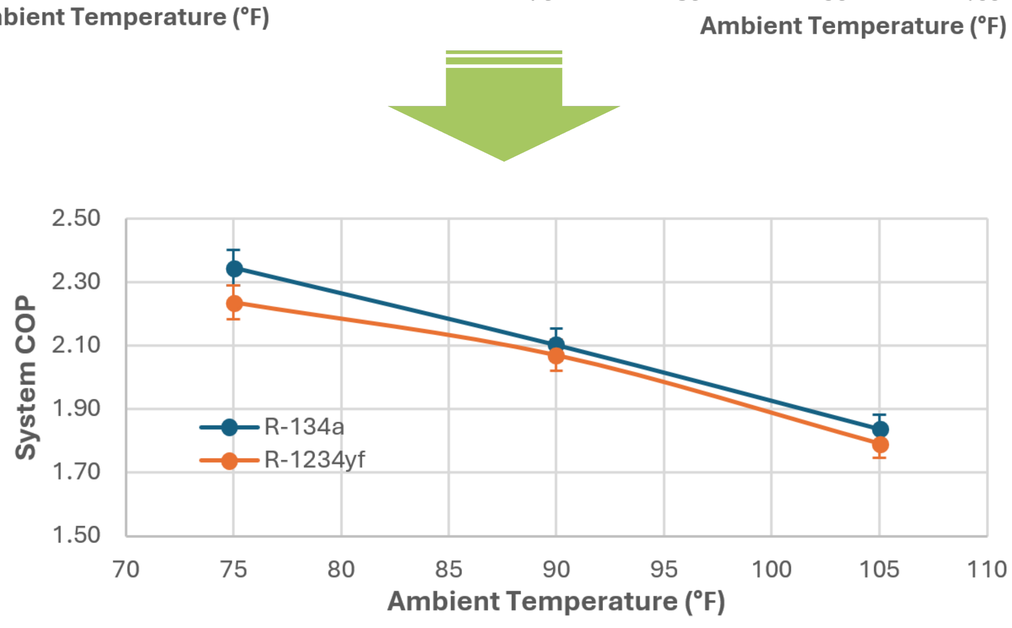
Performance Evaluations

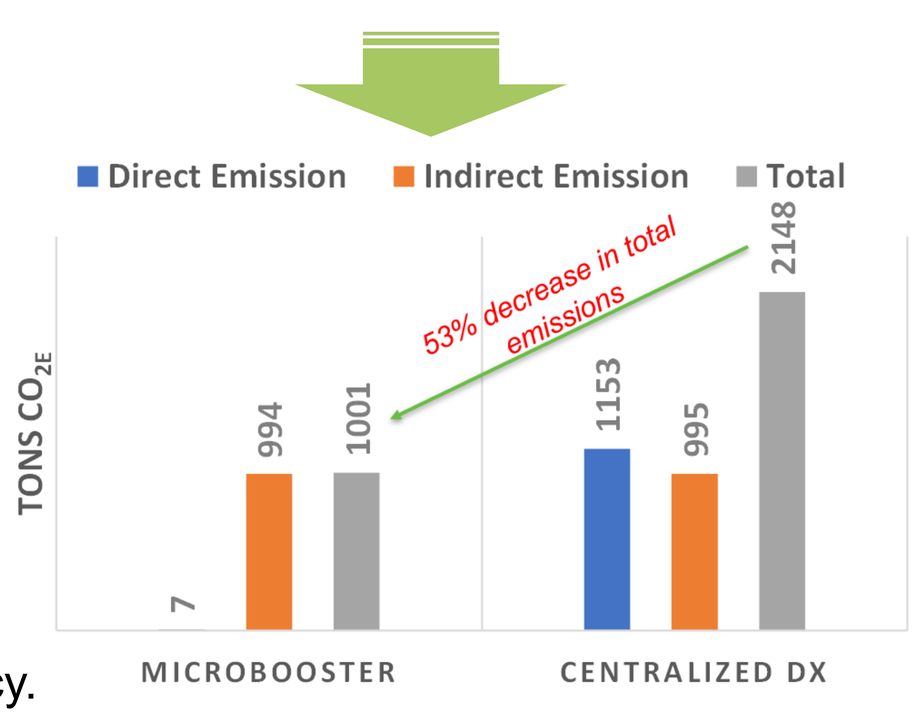
- **Refrigerants:** R-134a (baseline), R-1234yf
- **Main components of the system**
  - Low-temperature load (frozen goods): 28%
    - ➢Glass door cabinet for frozen goods + false load
  - Medium-temperature load (fresh goods): 72%
    - ➢Open display case for fresh food + false load
  - Scroll compressors and a microchannel air-cooled condenser
- **Operating conditions**
  - Outdoor temperatures: 75°F, 90°F, 105°F (±2°F)
  - Indoor conditions: 70°F (±2°F) @ 60% rel. humidity
- **Results (R-1234yf vs. R-134a)**
  - Low-temperature capacity is within uncertainty (±2.4%)
  - Medium-temperature capacity: R-1234yf up to 4% lower than R-134a
  - System efficiency: R-1234yf slightly lower than R-134a (within uncertainty [±2.4%] for most points)
  - Overall, R-1234yf and R-134a show similar performance because results are within or close to experimental uncertainty (±2.4%)
  - Life Cycle Climate Performance (LCCP) evaluation: The Distributed Scroll Booster system with R-1234yf reduces overall GHG emissions by 60% vs. traditional central DX











Main Findings

- R-1234yf demonstrates promising performance as a viable alternative to R-134a in supermarket refrigeration systems. It shows similar efficiency with lower GHG emissions
- Further optimization of system settings (subcooling) and components (condenser) can further improve R-1234yf efficiency.