

High  
Efficiency  
Solutions.



**CAREL**

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# High Efficiency in Commercial Refrigeration

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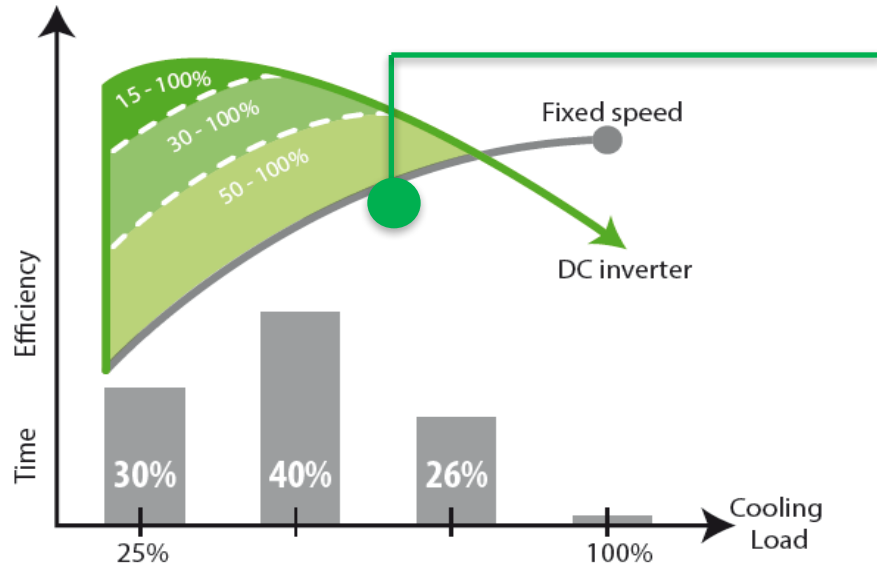
June 16th 2016

# DC Inverter Technology



# DC Technology

Compressors with DC motors allow for considerable energy savings by optimizing operation at partial loads.



A wider range of modulation (15-100%):

- Allows for the best operating conditions to be achieved
- Guarantees greater stability with fewer starts & stops
- Greater stability of temperatures

# DC Technology Comparison

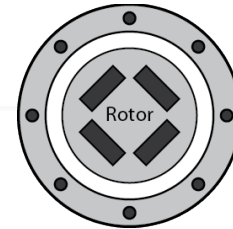


Technology	Savings
Inverter AC vs ON-OFF	Up to 9%
DC Power+ vs ON-OFF	Up to 25%
DC Power+ vs Inverter AC	Up to 15%

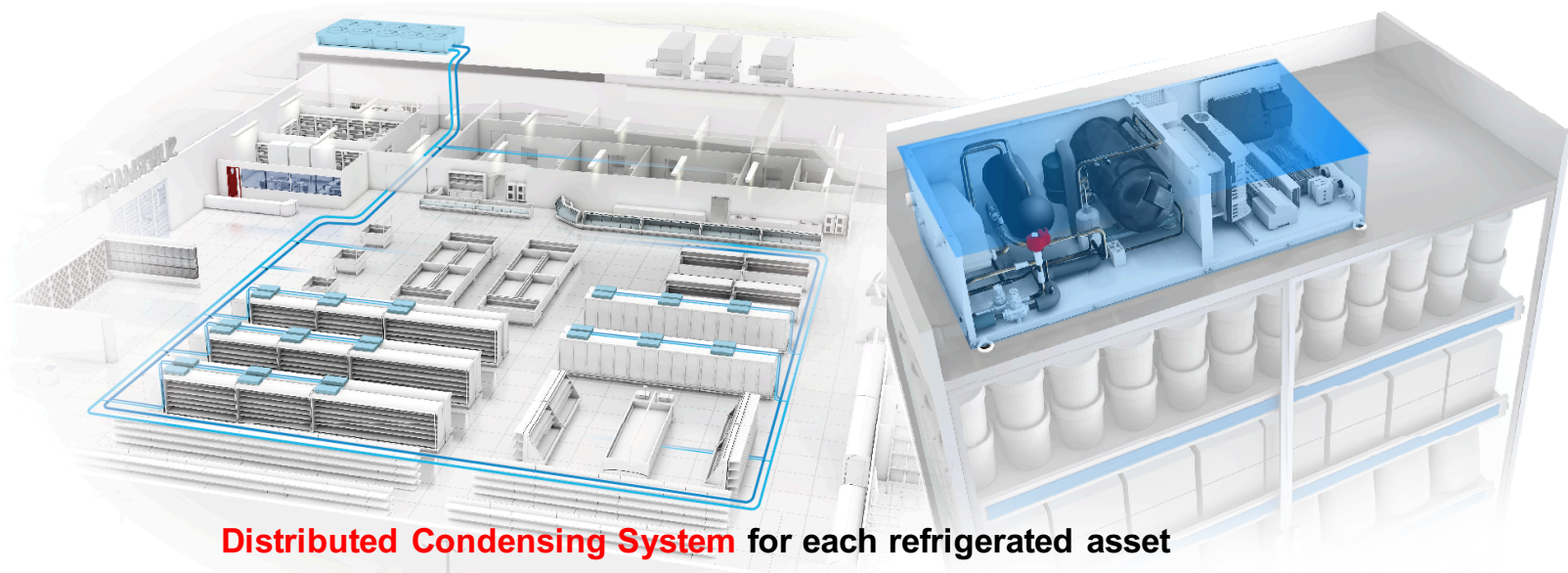
**Electrical Efficiency Improvement**

**4-5%**

*BLDC vs AC Induction Motors*



# DC Waterloop, Heos sistema



**Distributed Condensing System** for each refrigerated asset

Condensing Units equipped with **DC inverter** and modulating **EEV** technologies

**Water-cooled** condenser on-board connected to a **water loop system** for condensing heat management

Providing **simple installation / maintenance** and **low ambient impact**

# Heos : Energy Efficiency

25%  
Energy savings

## Power+ DC Inverter and DC Compressor

- Wide range of modulation
- Better energy efficiency at partial loads
- Reduced energy losses with permanent magnet



power+



## Heos Controller

HEOS controller

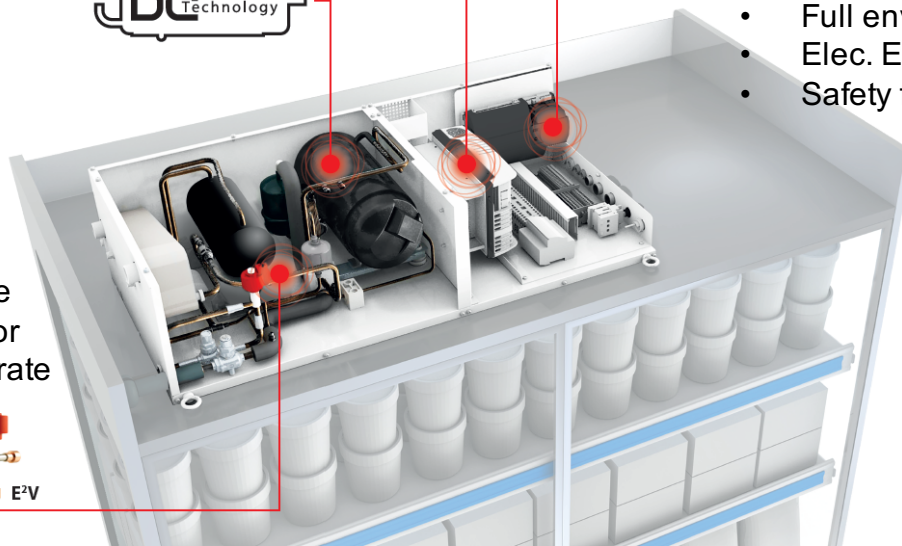
- DC compressor management
- Full envelope control
- Elec. Exp. Valve management
- Safety features and preventive actions

## Electronic Expansion Valve

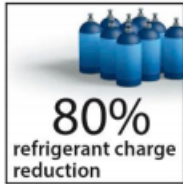
- Stable evaporation temperature
- Advanced sync with compressor
- High efficiency at variable flow rate



E2V

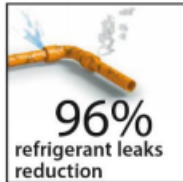


# HeOS : Environmental Respect



## Refrigerant Charge Reduction compared with traditional system

- No long copper refrigerant lines
- No compressor rack
- No large receivers



## Refrigerant Leak Reduction with hermetically-sealed circuits

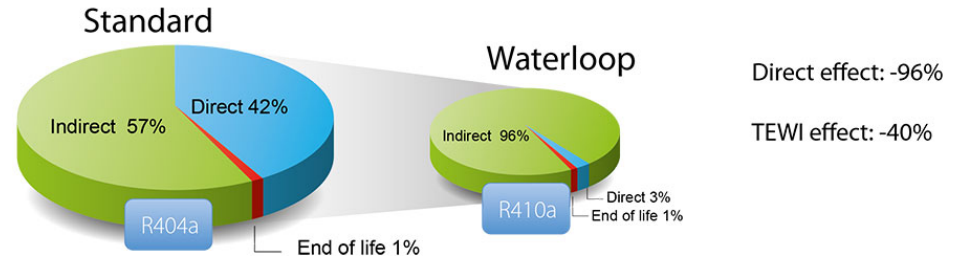
- No brazing in the field
- Factory-tested units
- Built with a controlled, repeatable process

## TEWI Reduction

$$\text{TEWI} = \text{GWP (direct, refrigerant leaks)} + \text{GWP (indirect, emissions)}$$

Natural refrigerant  
Same leaks, GWP= 1

Energy efficiency



# Heos : Flexibility



## Wider sales area

- No need for compressor rack

## Flexible sales area & easy layout change

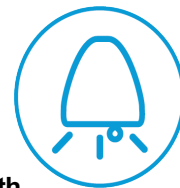
- Easy installation or removal of new/promotional cases
- Simple to move cases inside the supermarket

## High investment recovery

- Critical refrigeration components integrated locally at the refrigeration asset

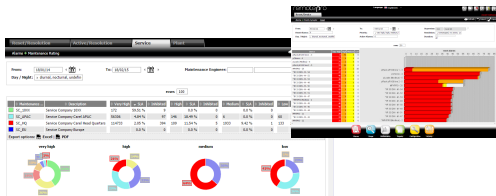


# HeOS : Reliability and Usability



## Centralized Alarm Management with System Network

- Preventive actions for optimal working conditions
- Safety procedures to strongly reduce installation down-time



## Easy set-up and Optimization

- Wizard start-up procedure for a simplified unit configuration
- Pre-setting of the main parameters and probes to reduce configuration time

## Oil Return and Recovery Procedures

- Advanced software functions such as speed boost and oil recovery washing

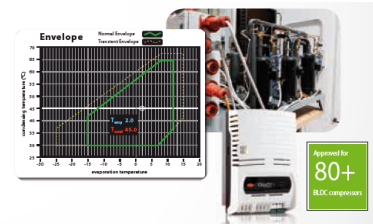


## Extremely Fast Commissioning

- Preconfiguration of the systems at the factory (refrigerated cases and condensing unit)
- Optimised default parameters with extensive laboratory tests

## Optimal Compressor Management with Power+ inverter

- Detailed qualification process
- Perfect control of compressor envelope
- Safety procedures



## Intuitive Service Tools

- Different access profiles for different users
- Simplified menu for a easy navigation
- PGD and pLD PRO terminal with full information displays at the refrigeration asset

# Conclusions

- **DC inverter technology is ready for the commercial refrigeration market**
- Considerable **energy saving** results can be achieved with **DC technology**
- DC technology together with **CAREL E2V valves and advanced control algorithms** act to increase energy savings further
- Improvements in operational stability provide **optimum food preservation** with more stable product temperature and **reduce the ambient impact**
- Natural refrigerants inside high efficiency solutions is the CAREL next step

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