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# Natural Refrigerants in the Commercial Refrigeration Industry

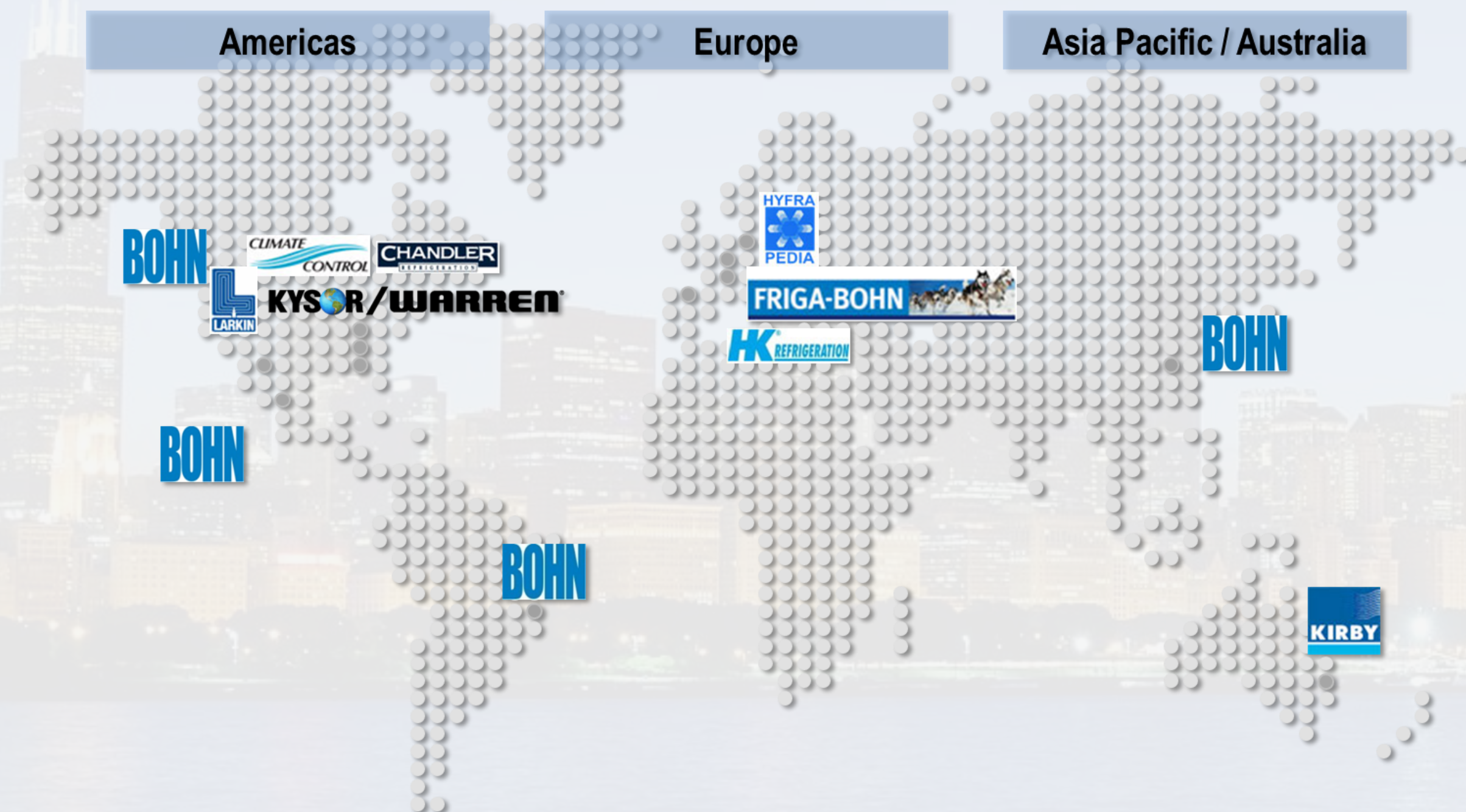
*Insight from a Global Provider of:  
Natural Refrigerant Solutions*

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## Company overview



- Operations in North America, South America, Europe, Asia, and Australia / New Zealand



- Natural refrigerant system applications
  - Food Retail (Supermarkets, Hypermarkets, etc...)
  - Food Service (Convenience Stores, Fast Food, etc...)
- Natural refrigerant system Installations
  - 249 HFC/CO<sub>2</sub> hybrid systems and counting
  - 11 transcritical CO<sub>2</sub> systems (additional in process)
    - Europe, North America & Australia
  - 2 ultra-low-charge ammonia-CO<sub>2</sub> cascade installed in the U.S.

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## #2 Latest NR projects

*Ammonia Cascade*

### Ammonia Cascade Supermarket

- Store Opening: September 2015
- GreenChill Platinum Certified
- 850 MBh of cooling capacity
- Ammonia (NH<sub>3</sub>) top cycle (53lb charge)
- CO<sub>2</sub> low temperature, direct expansion

### Benefits

#### Optimized LCCP

- HFC-free system
- Ultra-low ammonia charge
  - Typically 0.75 lbs./ton refrigeration
  - 45 to 100 lbs. per store
- Up to 20% reduction in total cost of ownership (TCO)



*Kysor/Warren Rooftop Ammonia Enclosure*

***First Practical Ammonia Design for Retail Environments***

*Based on the ultra low charge*

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## Main Challenges

- Technician skill level / Proactively expand educational programs
- National & Local regulatory codes
- Availability of component suppliers

## Necessary Next Steps

- Technician skillset
  - Expand and promote industry training to improve CO<sub>2</sub> and ammonia knowledge base.
- Regulatory Codes
  - Lack of harmonized standards (UL 1995, UL 471, UL 208...)
  - UL & building code standards not available for A2L (mildly flammable) refrigerants
- Component supplier base
  - Heatcraft is continuously looking for and qualifying new suppliers for alternative systems to improve system cost and payback.

# #4 Lessons Learned

*Pulling the Industry to Change*



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F-gas (E.U.), effective May 20, 2014



Commercial Application	GWP Limit	Date
Self-contained refrigeration	2,500	2020
Stationary refrigeration	2,500	2020
Self-contained refrigeration	150	2022
Centralized refrigeration	150	2022
– except top side of cascade	1,500	2022

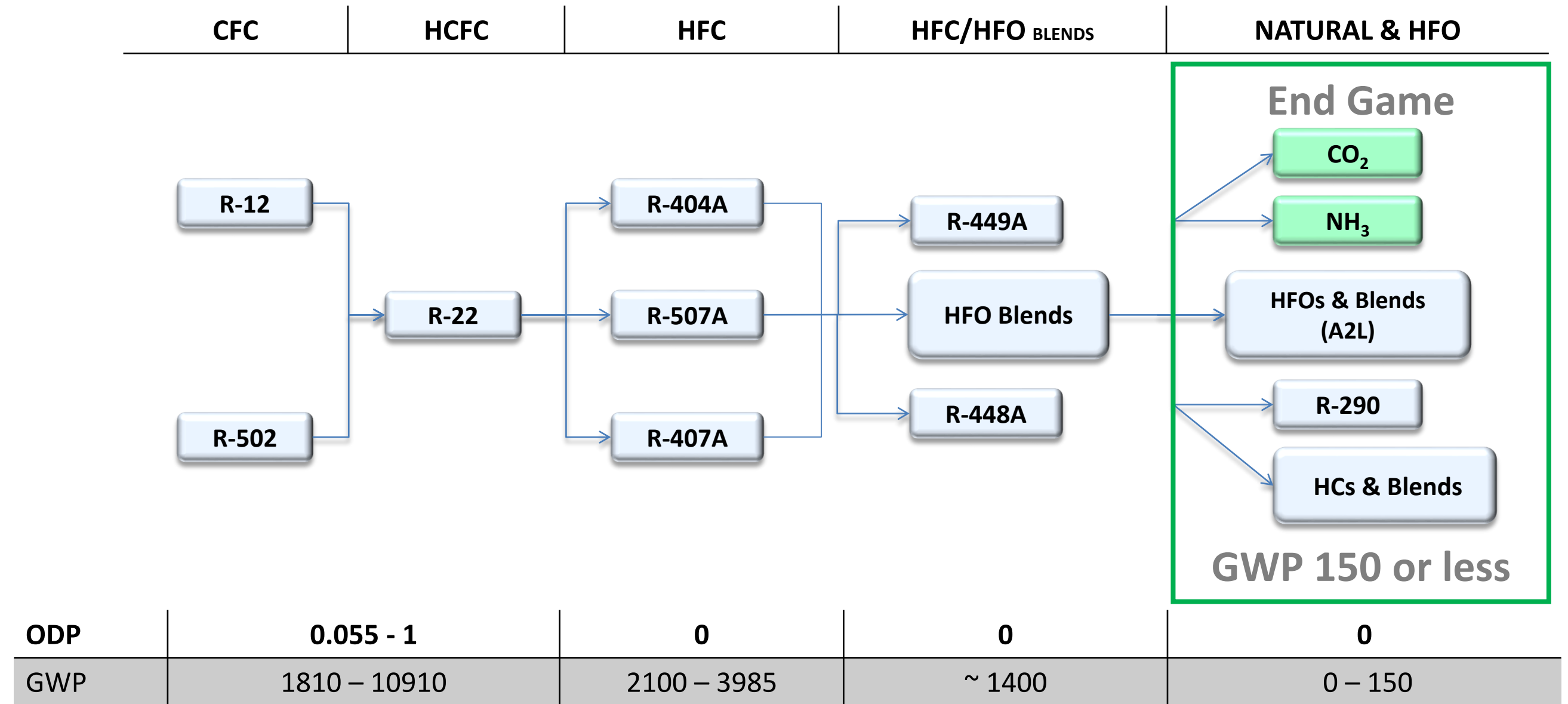
California Air Resources Board (CARB)  
 Short-lived Climate Pollutant Reduction  
 Strategy – Proposed April 2016



Commercial Application	GWP Limit	Date
Non-residential refrigeration	150	2020

# #5 Future Plans

The Move Away from HFC's



## Next Projects

- Additional transcritical CO<sub>2</sub> installations
- Transcritical CO<sub>2</sub> in cold storage application

## New Technologies

- Ejector Cycle
- Non-Traditional Refrigeration Technologies

**Natural refrigerants are immune to regulatory mandated GWP caps**



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Thank you very much!