



GUIDE to Natural Refrigerants 2015

state of the industry North America & in the world



Nina Masson, Deputy Managing Director

shecco

looking back: the GUIDE 2013



first market overview report
for Natural Refrigerants in
North America

captured the first CO₂
refrigeration food store map
for Canada and the USA +
the situation for light-
commercial (food service)

featured an industry survey
to depict the state of the
industry today and future
expectations

... and more



<http://publications.shecco.com/publications/view/6>

why a GUIDE 2015?



dynamic market
developments in the last 2.5
years, in several sectors

efforts driven often by
influential brands in food
retail, consumer goods, cold
storage ...

more stakeholders involved
and active: components,
systems, contractors,
regulators, power utilities,
research ...





why a GUIDE 2015?

food service sector one of the exciting sectors to watch, with internal competition between NR

CO₂ commercial refrigeration market regarded as viable technology - on its way to becoming a standard

industrial refrigeration driven by low-charge NH₃ systems and future uptake of CO₂

GUIDE North America 2015



2nd edition to the 2013 GUIDE on market, technology & policy trends

most comprehensive overview of Natural Refrigerant use in North America - 2.5 years later

new design, more info graphics and interviews

as part of the Accelerate brand - as a Special Edition launched in August 2015

GUIDE North America 2015



feature chapters on:

Light-Commercial
Refrigeration

Commercial Refrigeration

Industrial Refrigeration

business directory

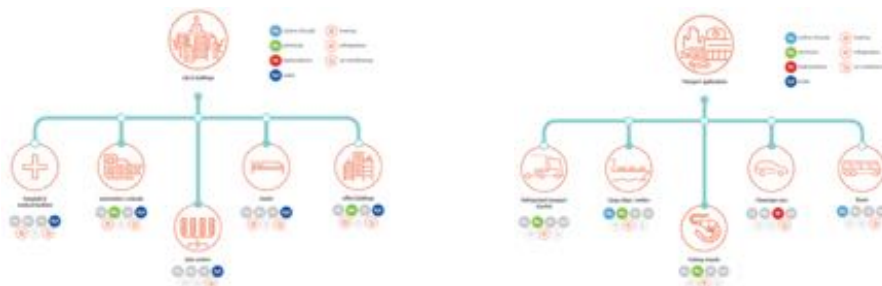
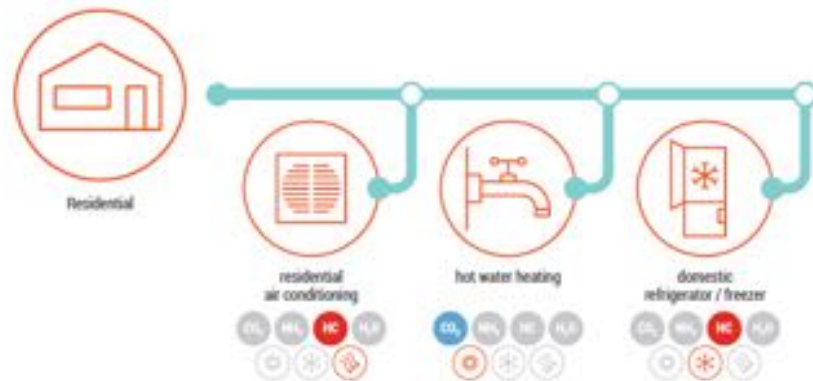
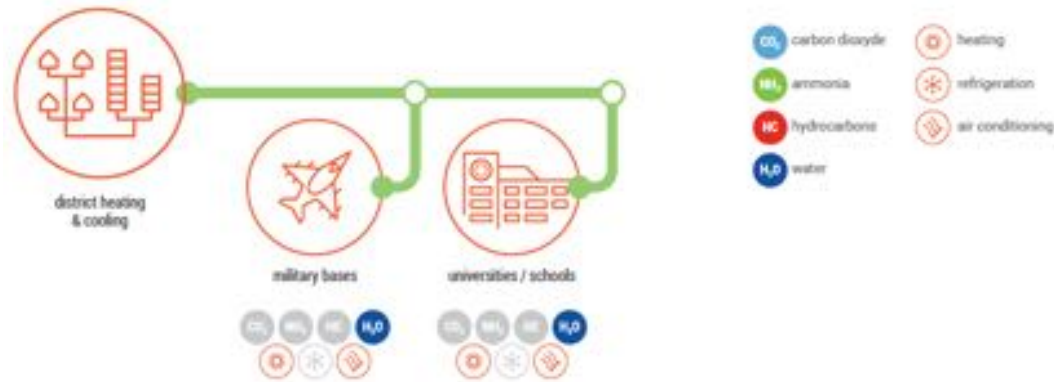
GUIDE North America 2015



supported by market leaders
for NR in North America

.... serving a variety of
applications

GUIDE 2015: ecosystems



“ecosystems” show the use of NR in 2015 in

city & buildings

industry, special applications & sports

food chain

... by refrigerant and end use

NR commercial availability 2015-2030 in the US



REFRIGERATION	2015-2020	2020-2025	2025-2030
Domestic Refrigeration	2016		
Light commercial Refrigeration (plug-in)	2018		
Commercial Refrigeration - centralized systems	2018		
Industrial refrigeration			
Road Transport Refrigeration			
AIR-CONDITIONING	2015-2020	2020-2025	2025-2030
Small room A/C (self-contained)	2016		
Multisplit / VRF A/C			
Chillers			
Residential heat pumps			
Commercial and industrial heat pumps			
Mobile air conditioning			

table showing per sector full commercial / semi-commercial / no commercial availability of NR technology in the USA

WANTED: your opinion - please use the evaluation form in your folder and return it to the registration desk

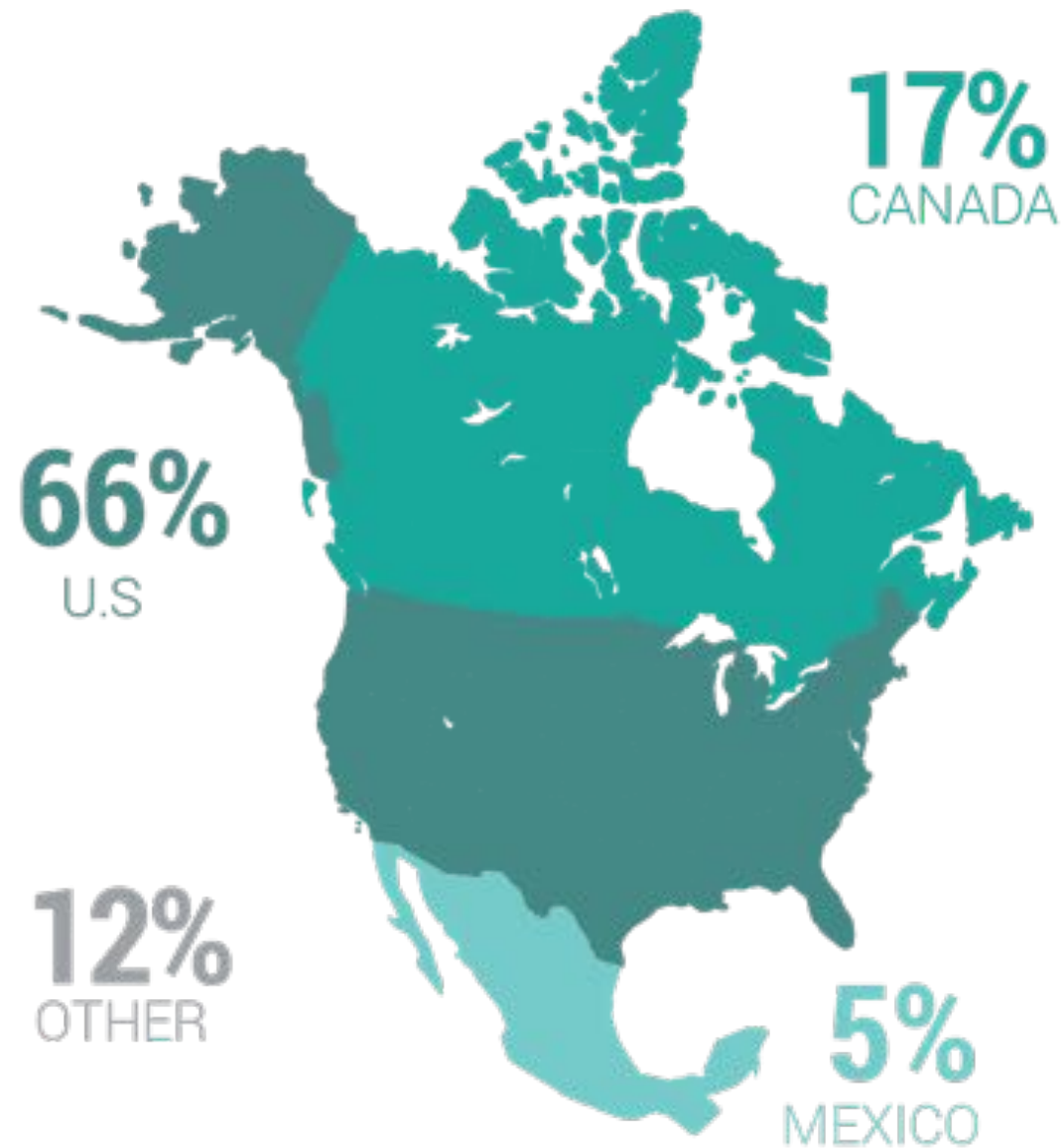
2015 survey: respondents

most respondents from the
USA

respondents from outside
North America also added
their view

=

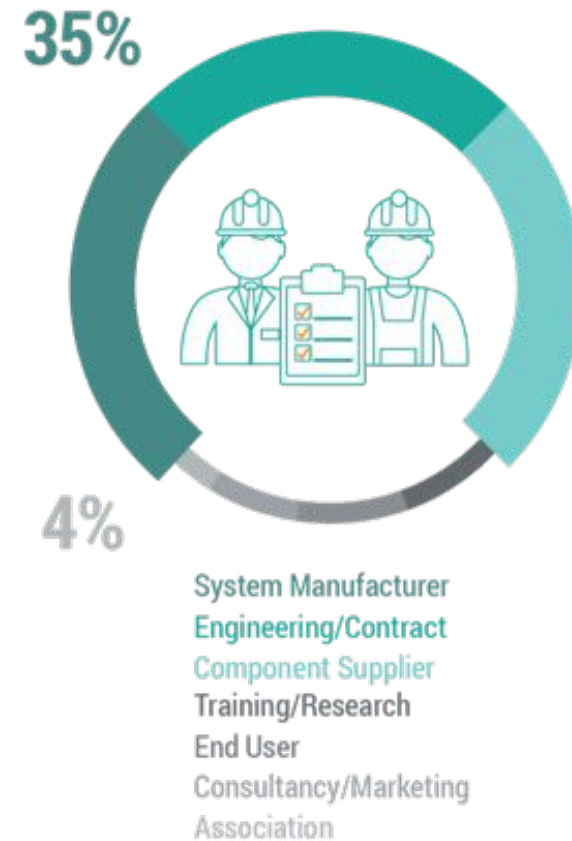
reflection of interest
increasing in NR business



2015 survey: respondents



large & small organizations represented the most



system manufacturers, contractors and component suppliers most responsive

2015 survey: respondents

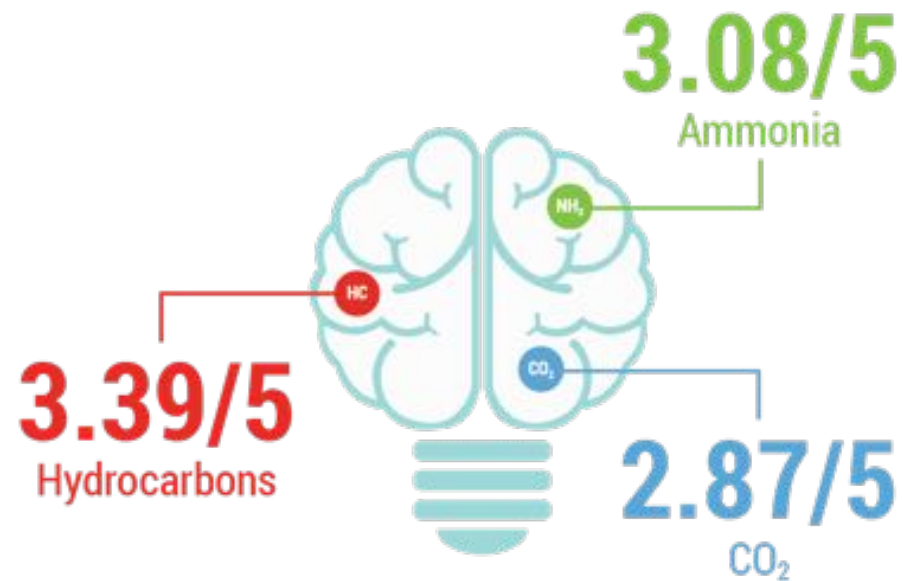


highest response rates from the commercial & industrial-sized applications

=

reflecting high dynamics for NR in larger sized equipment for refrigeration, air conditioning & heating

familiarity with NR



overall, familiarity with NR is above average, but there is room for improvement, especially for CO₂

hydrocarbons enjoy the highest form of familiarity among respondents in 2015

=

reflection of established or increasing HC use in all three countries

current use of refrigerants

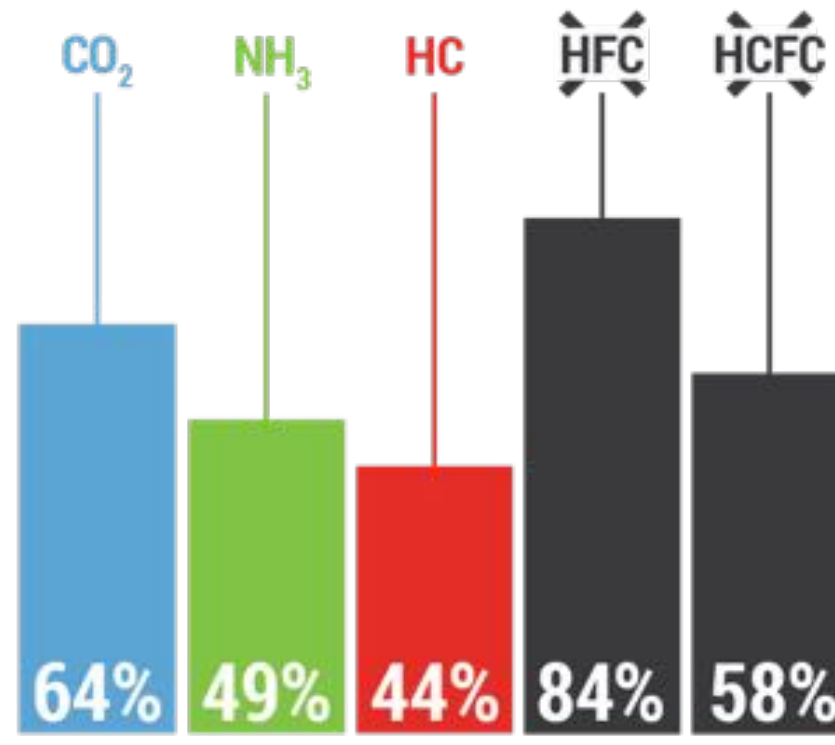


the use of fluorinated gases is still wide-spread in North America, and even HCFCs are used by more than half of the respondents

CO₂ enjoys the highest use among respondents among NR

=

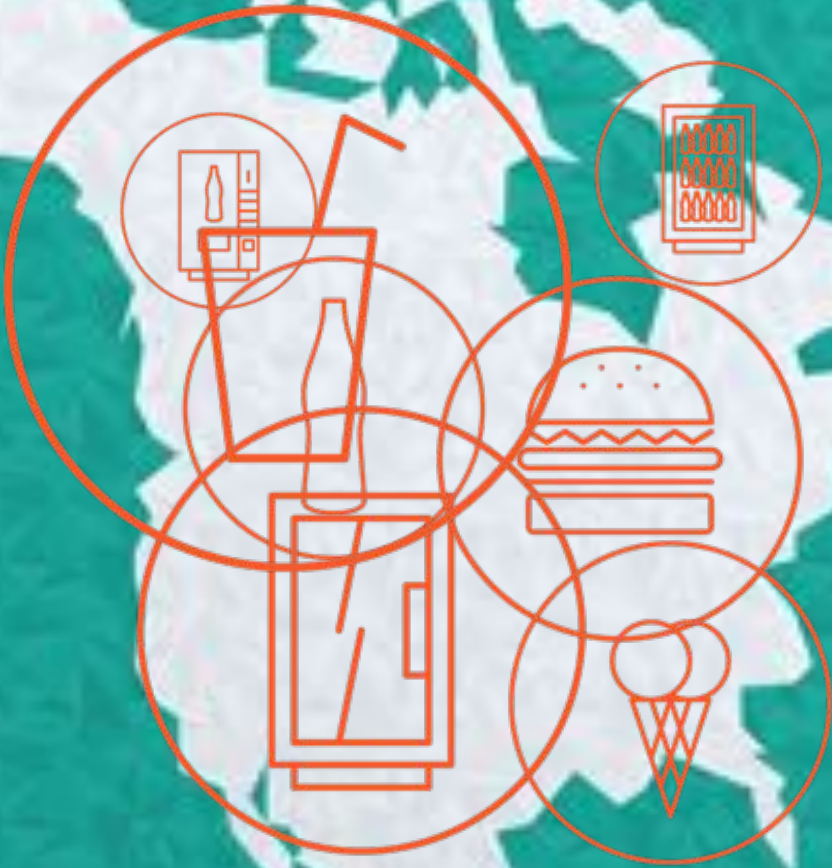
the “gap” between F-gases and Natural Refrigerants is shrinking





north america: growing appetite for NR in the food service industry

current



HC



HC



CO₂



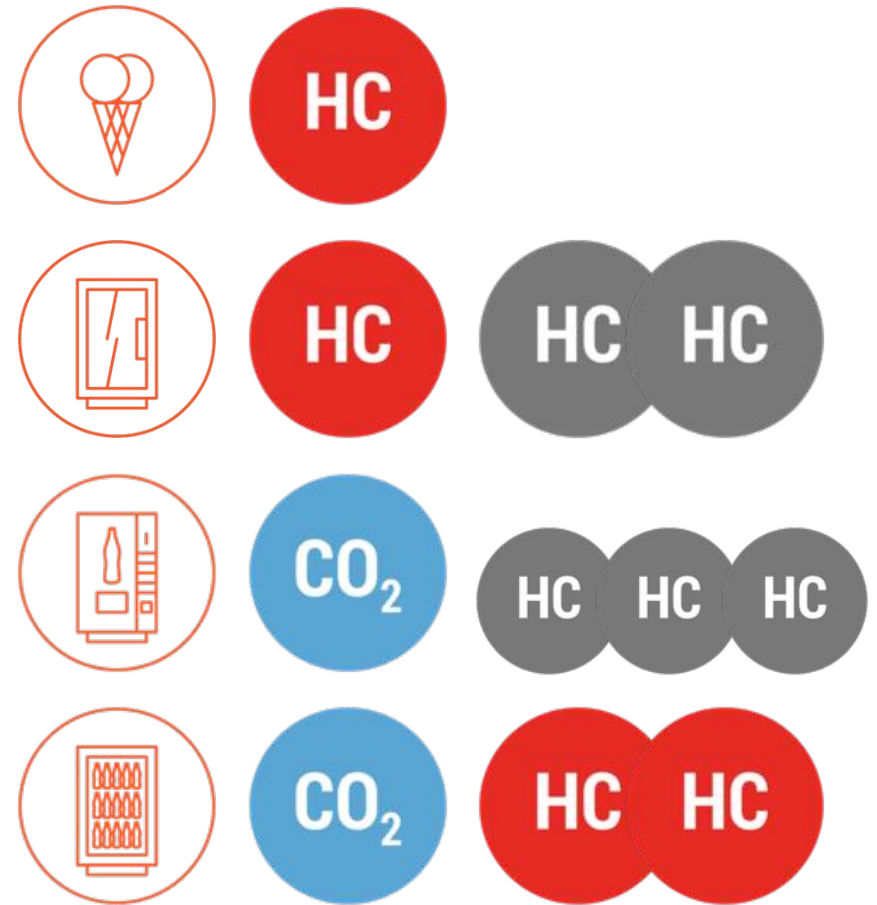
CO₂

HC

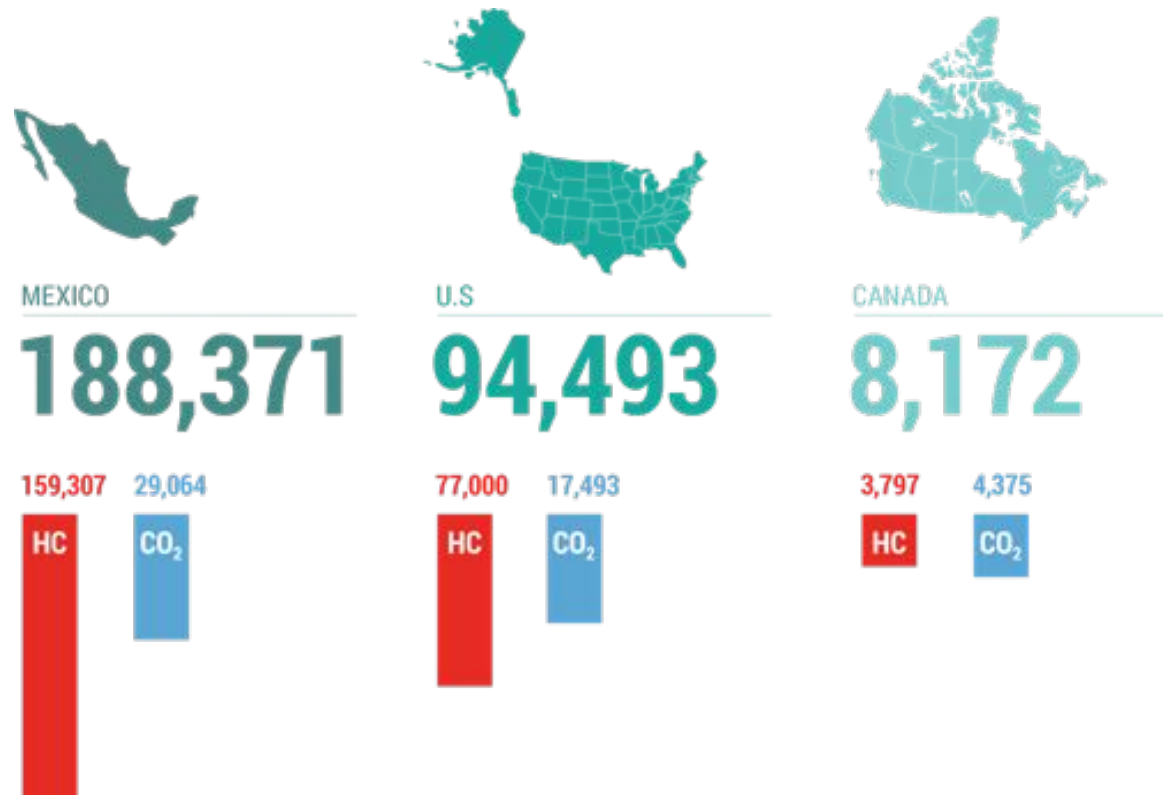
HC



north america: growing appetite for NR in the food service industry future



NR in the food service industry



before 2013, just 16,364 HFC-free units were placed across the three countries

today: 291,000+ HFC-free units placed in North America - 181,000 HC + 109,000 CO₂

the market in NA will further accelerate, with market & regulatory changes

= 17 times more than 3 years ago

north america: growing appetite for NR in the food service industry

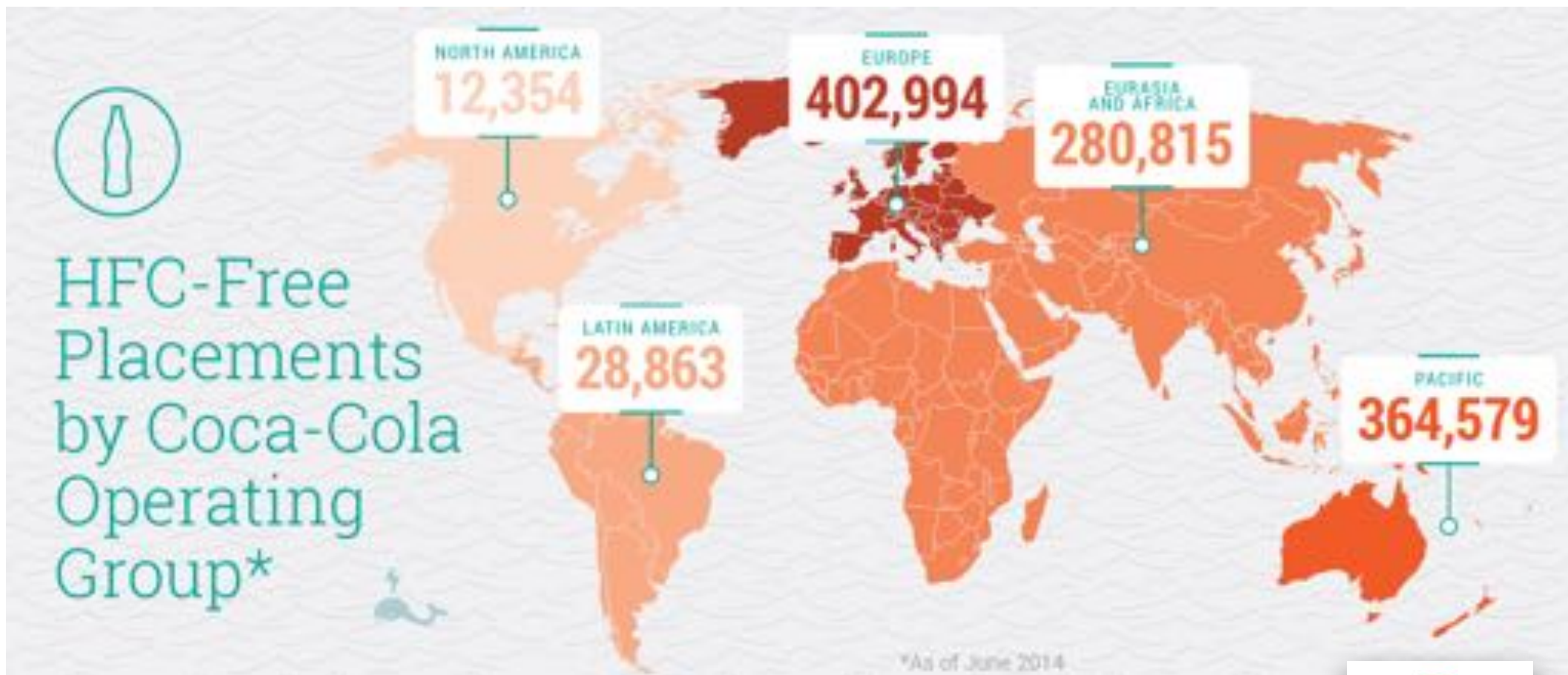
Red Bull: 100% HC procurement plan
for its Eco-Coolers
500,000+ HFC-free units worldwide

Unilever has 133,245 units in North
America
2 million worldwide

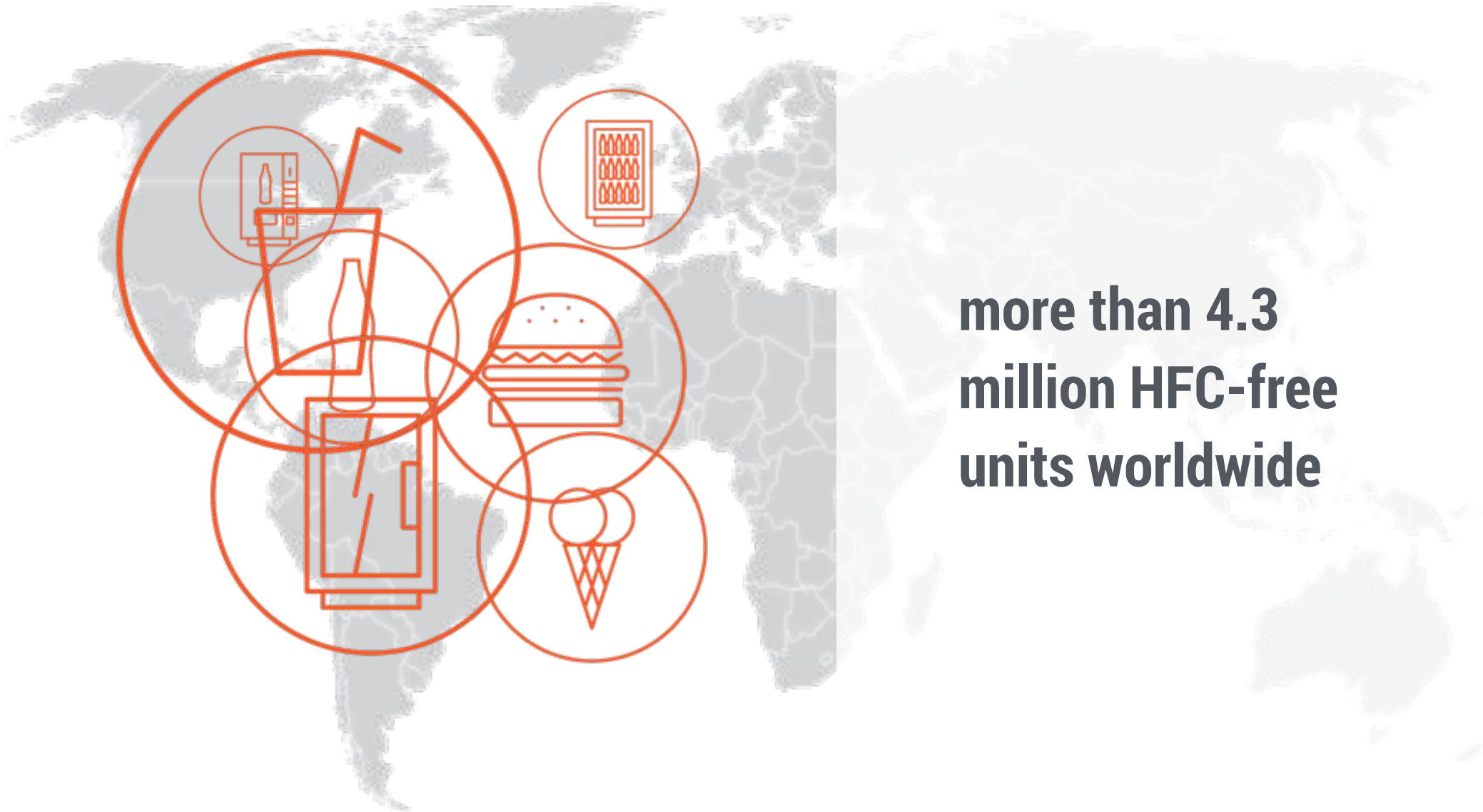
PepsiCo have committed to
purchasing only HFC-free coolers,
vending machines and fountain
dispensers by 2020 in the US
240,000 HFC-free units worldwide



north america: growing appetite for NR in the food service industry



light-commercial refrigeration in the world



**more than 4.3
million HFC-free
units worldwide**

north america: growing appetite for NR in the food service industry



McDonald's Propane Refrigeration Equipment Deployed in Europe, 2010-2013



MEAT FREEZERS

3,811



ICE MACHINES

688



FROZEN FRY DISPENSERS

2,802



BLENDED ICE MACHINES

1,614



JUICE DISPENSERS

503



BEVERAGE SYSTEM CHILLERS

9



McDonald's deployed close to
9,500 units of HFC-free units in
Europe (2012/13 CSR report)

the unofficial number for
2014/15 is more around 13,500
HFC-free units in Europe

this is 2% of the total unit
fleet of 700,000 = huge
further market potential

food service: company profiles



<p>Coca-Cola Reduce the carbon footprint of "the drink in your hand" by 25% by 2020.</p> <p>"Over the past decade we have invested more than \$100 million to make our coolers better for the environment. And we have significantly reduced our overall carbon footprint"</p> <p>Founded: 1886 Headquarters: ATLANTA, USA Fleet that use natural refrigerants: 1.4 MILLION Refrigerant of choice: CO₂ Placements in North America: 12,354</p> <p> </p>	<p>Unilever Cut the environmental footprint of making and using its products by 50%.</p> <p>"Nearly 1.5 million cabinets running all over the globe, which is ahead of formal targets. In the United States, hydrocarbons were prohibited and Unilever succeeded in gaining formal approval."</p> <p>Founded: 1929 Headquarters: ROTTERDAM, NETHERLANDS & LONDON, UK Fleet that use natural refrigerants: 1.4 MILLION Refrigerant of choice: HYDROCARBONS Placements in North America: 133,245</p> <p> </p>
<p>Red Bull Complete 100% global procurement of hydrocarbon eco-coolers</p> <p>"As early adopters of this technology, we have seen a significant decrease in energy usage. Less harm to the planet while increasing profit to our accounts' business is clearly a win/win. Our hope is that as our use of this technology grows, the overall light-commercial refrigeration market will convert with us."</p> <p>Founded: 1987 Headquarters: FUSCHL AM SEE, AUSTRIA Fleet that use natural refrigerants: > 500,000 Refrigerant of choice: HYDROCARBONS Placements in North America: 59,948</p> <p> </p>	<p>PEPSICO All point-of-sales equipment to be HFC-free by 2020.</p> <p>"I believe all of us need to take action now. PepsiCo has already taken actions in our operations and throughout our supply chain to 'future-proof' our company—all of which deliver real cost savings, mitigate risk, protect our license to operate, and create resilience in our supply chain."</p> <p>Founded: 1898 Headquarters: NEW YORK, USA Fleet that use natural refrigerants: 240,000 Refrigerant of choice: HYDROCARBONS & CO₂ Placements in North America: n/a</p> <p> </p>

GUIDE 2015 contains short profiles of leading consumer goods brands

global fleet using NR

NA fleet using NR

refrigerant of choice

WANTED: updated figures + new end-users interested to be added

light-commercial refrigeration

nearly all experts in the light-commercial refrigeration sector still work with HFCs

those using Natural Refrigerants mostly use HCs

=

the NR food service sector is one of the most dynamic ones

+

from being non-existent a short while ago it now already features “internal competition” between NR

42,9%

CO₂

71,4%

HC

95,2%

HFCs



light-commercial refrigeration



a very strong majority thinks that NR will gain market share in North America's food service sector by 2020

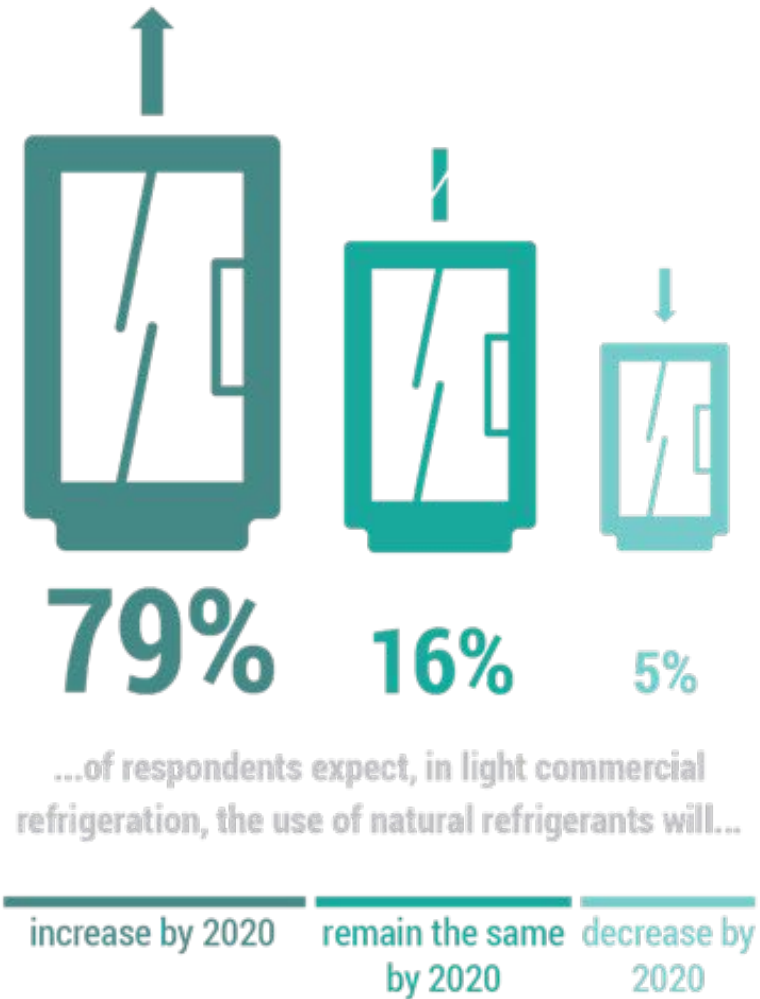
=

the trend will accelerate.... with the

2015 EPA SNAP approval of HCs in various uses

2016 proposed de-listing of high-GWP gases

2017/18 DOE energy efficiency standards



industrial refrigeration - trends



the R22 phase-out schedule starts taking effect on end-users not yet using NH_3

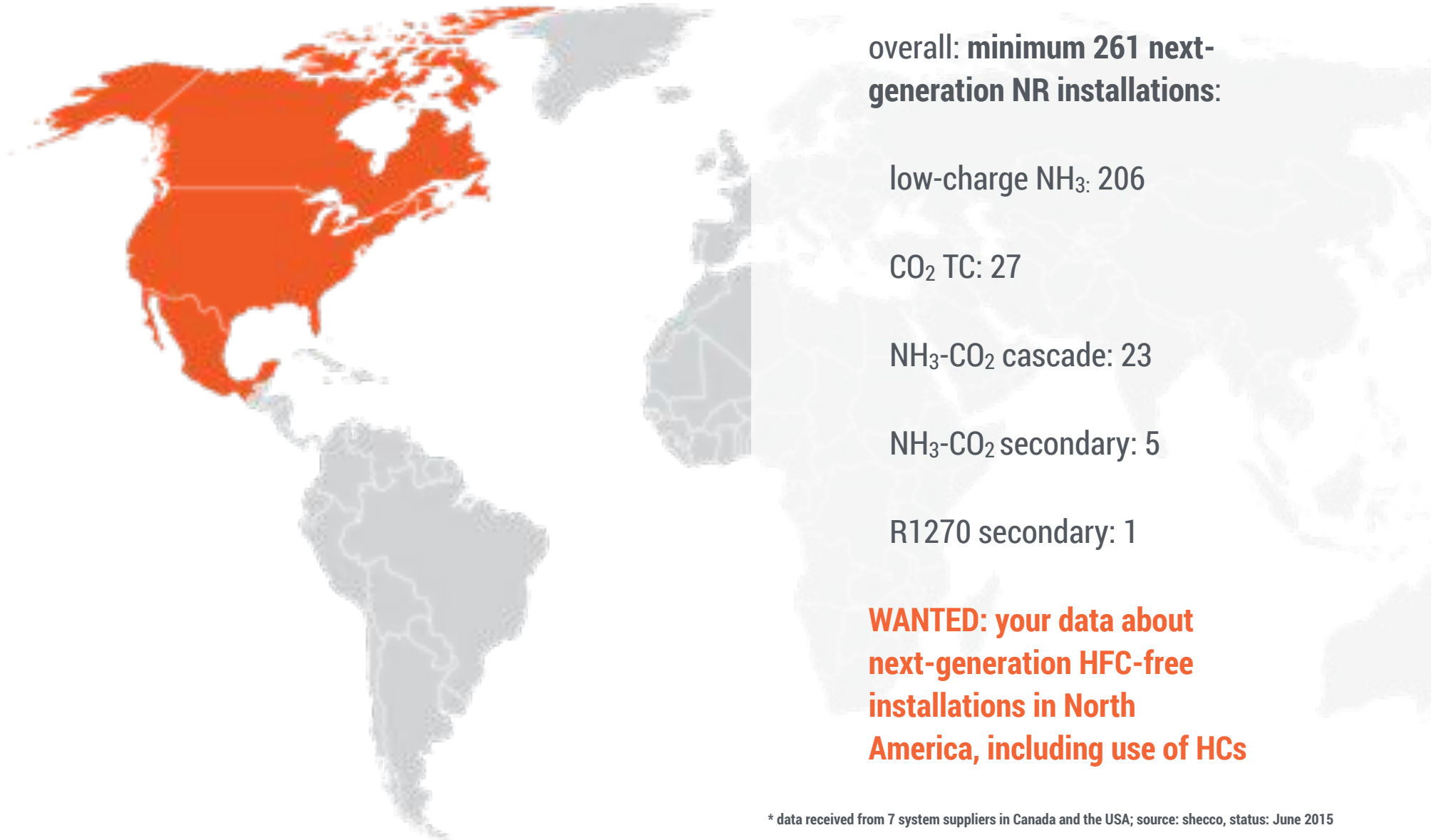
move towards low-charge NH_3
= no charge limits apply + less refrigerant costs

use of CO_2 in cascade /
secondary NH_3 - CO_2 systems

use of CO_2 transcritical
systems

move towards more energy-
efficient equipment

industrial refrigeration - draft numbers*



overall: minimum 261 next-generation NR installations:

low-charge NH₃: 206

CO₂ TC: 27

NH₃-CO₂ cascade: 23

NH₃-CO₂ secondary: 5

R1270 secondary: 1

WANTED: your data about next-generation HFC-free installations in North America, including use of HCs

* data received from 7 system suppliers in Canada and the USA; source: shecco, status: June 2015

CO₂ secondary / cascade stores in NA



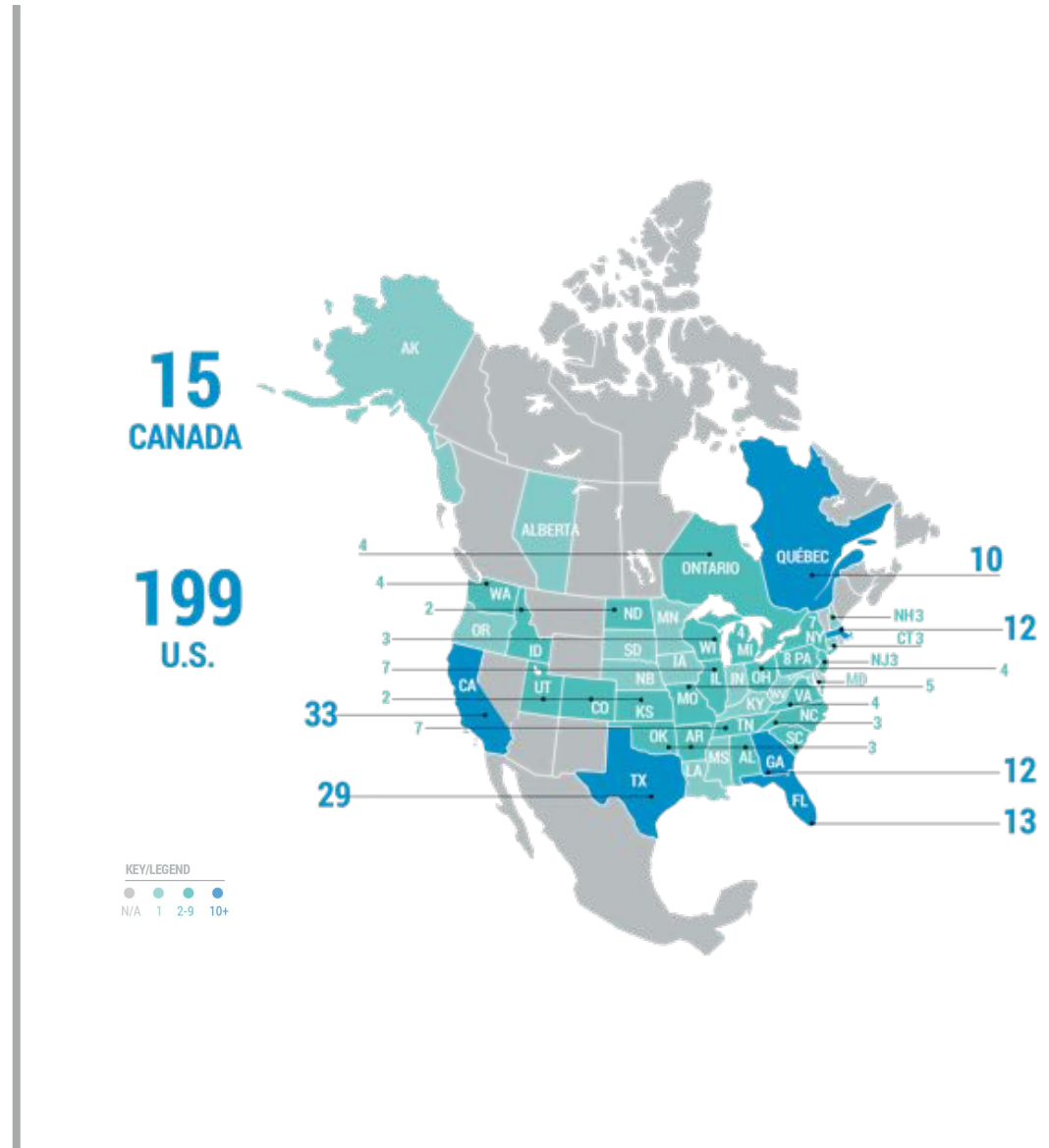
the US is hitting the 200 mark for CO₂ secondary / cascade stores as we speak

the most proactive States: California, Texas, Florida, Georgia - but the use is now spread across most US States!

Canada stays at a low 15 stores, with Québec taking 10 out of those

=

higher share of CO₂ cascade solutions in the south (warm ambient temperatures)



CO₂ secondary / cascade stores 2012 vs 2015



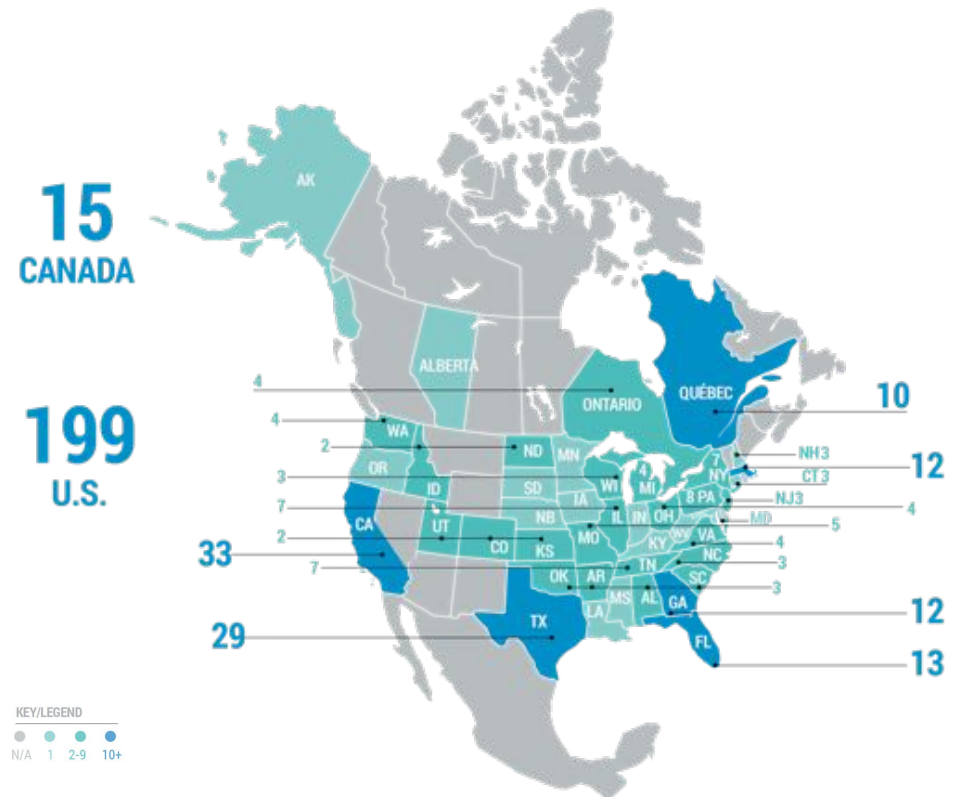
end-2012 vs mid-2015

Canada had 3 CO₂ secondary / cascade stores

+ 12 stores

the USA had 56 CO₂ secondary / cascade stores

+ 143 stores



CO₂ transcritical stores in north america

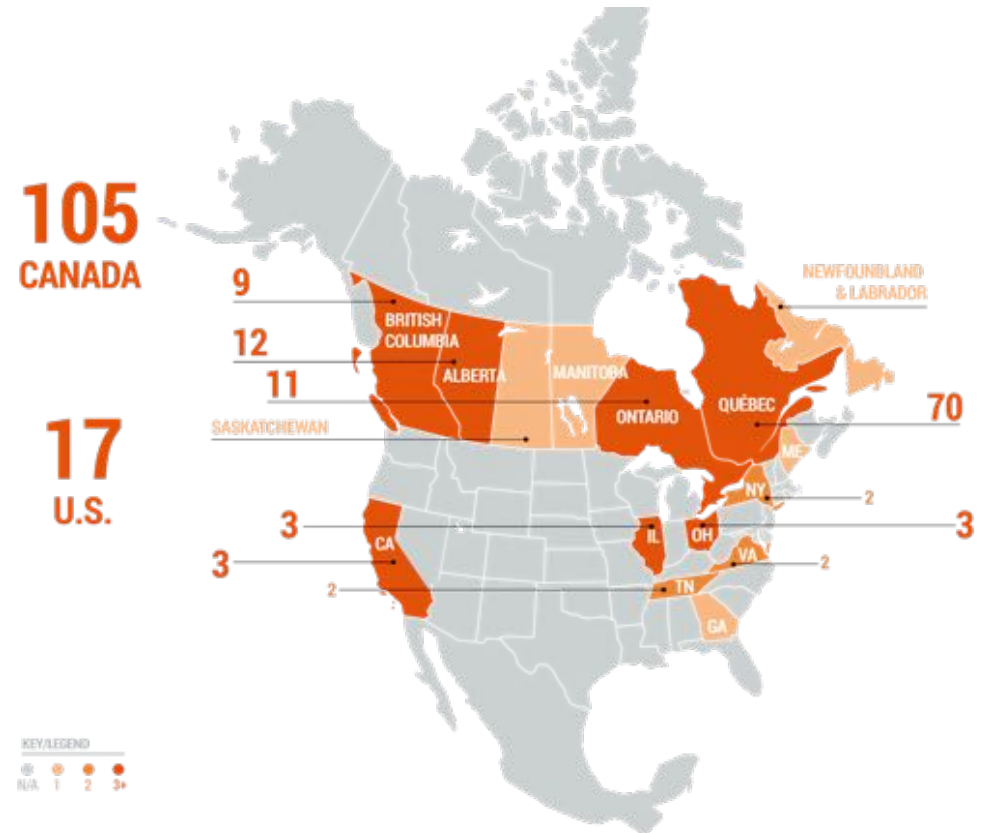


with more than 100 stores
 Canada increases its North American CO₂ TC leadership - Québec takes a strong 70 out of that (driven by Sobey's 63 stores)

the most proactive US States: California, Illinois and Ohio - the use is concentrated in the West and the East

=

the picture for CO₂ TC solutions is inverse from CO₂ secondary / cascade: the north leads



CO₂ transcritical stores 2012 vs. 2015



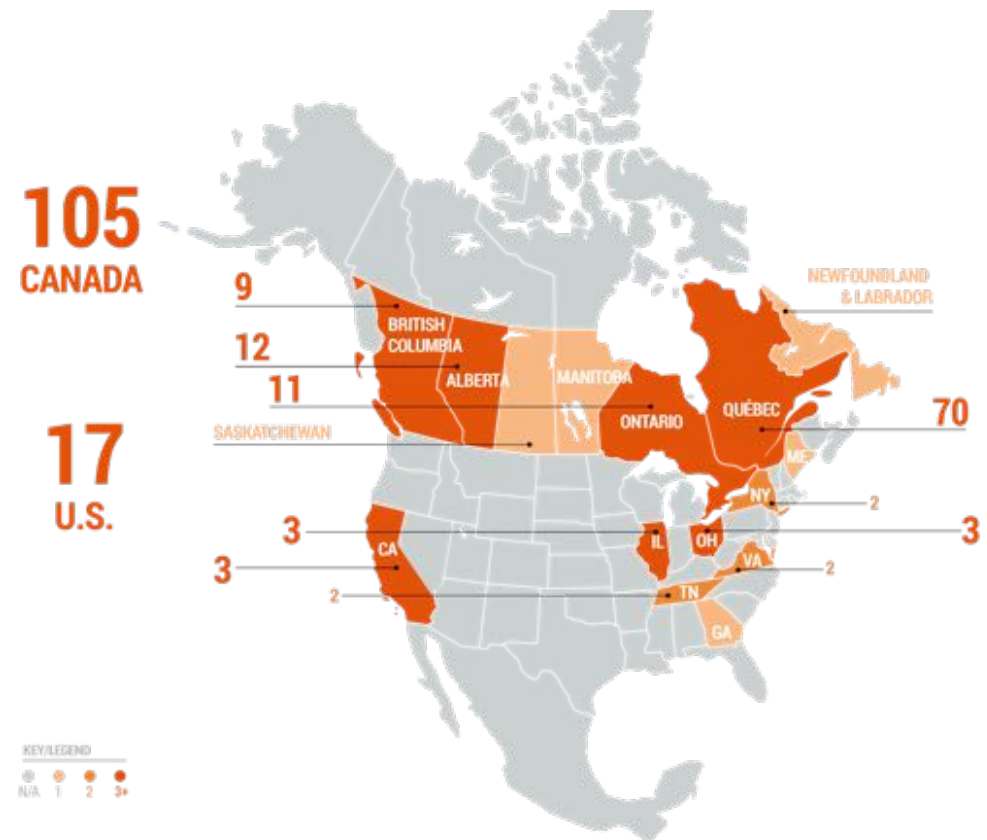
end-2012 vs mid-2015

Canada had 37 CO₂ TC stores

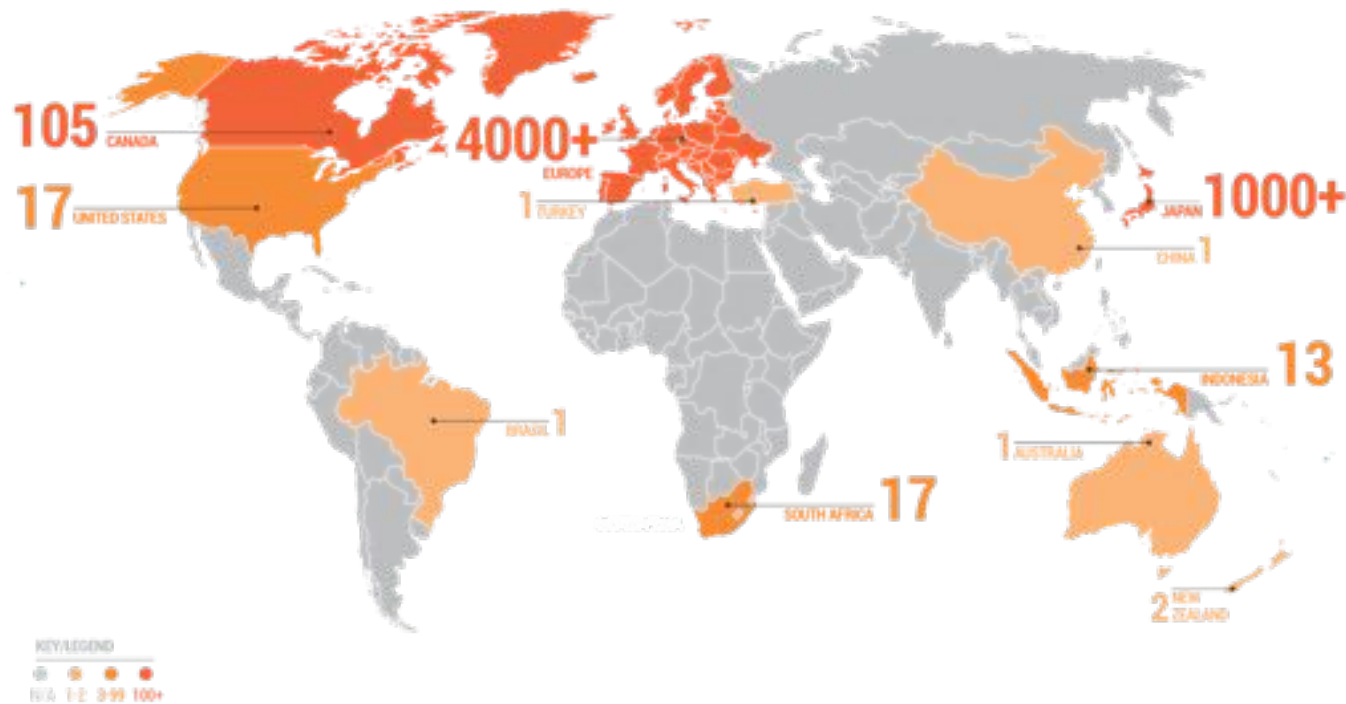
+ **68 stores**

the USA had no CO₂ TC store

+ **17 stores (and more now planned)**



CO₂ transcritical stores in the world



Europe continues to build the CO₂ TC market year on year - up from 1,300 in 2011 to 4,000+ units in 2014/15 (= conservative estimate!)

the next challenge now tackled: the move to southern climates

three hot spots have emerged: Europe, Asia (mostly Japan) and North America

... with different technology focus (CO₂ TC vs. CO₂ cascade), store formats (large vs. CVS) & retailer commitment

South Africa and Indonesia stand out ... again as a result of individual food retailers' drive to go CO₂

CO₂ stores in china



8 CO₂ stores in China - 1 TC

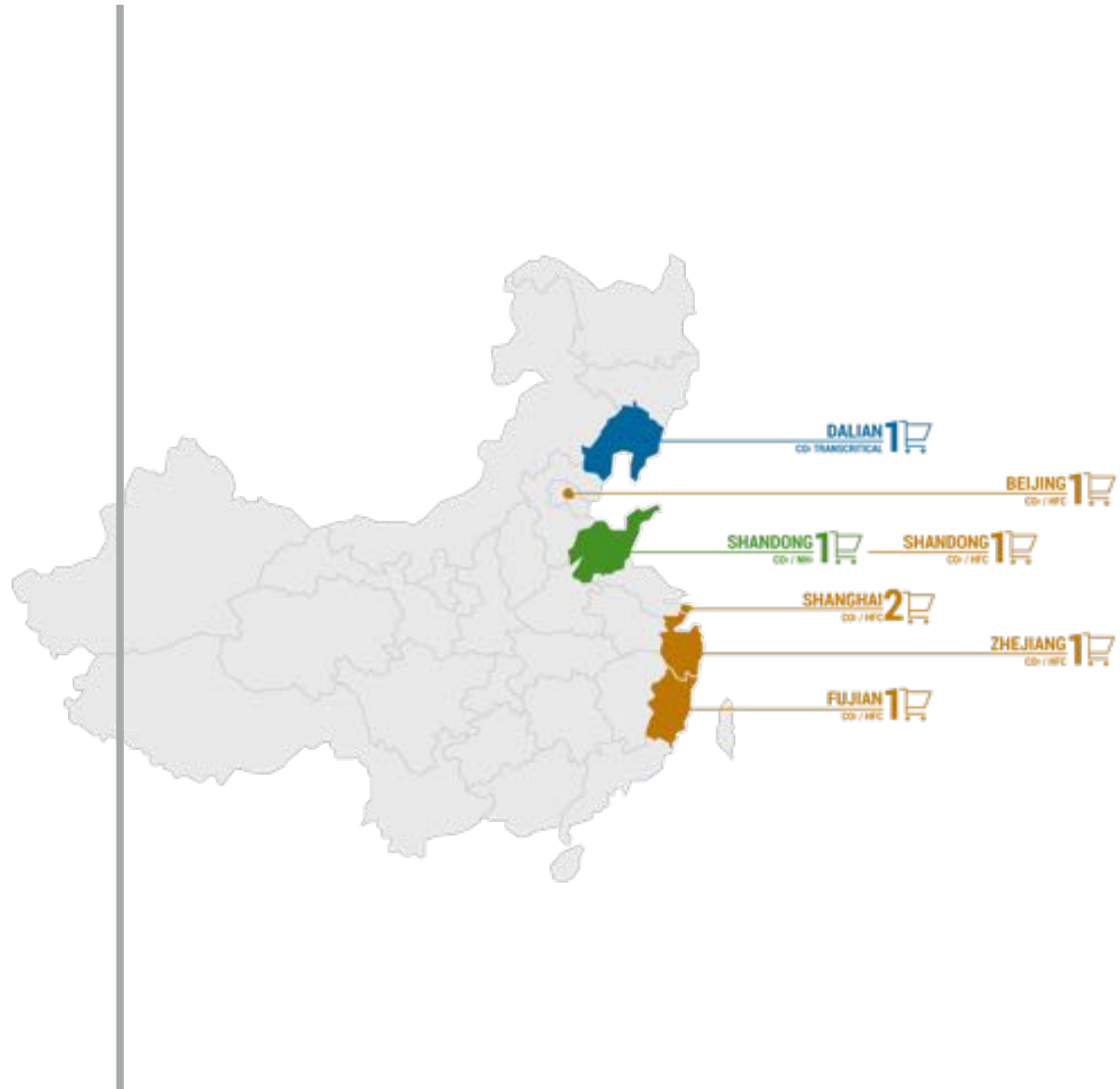
2015/16: min 17 CO₂ hybrid stores planned (Metro)

NR uptake is driven by global food retail brands - now: Tesco, Metro

80% of components for CO₂ refrigeration systems now available in China



CO₂ is still in the developing stage... but is expected to gain traction in the next few years



CO₂ transcritical stores in japan



1,000+ CO₂ TC stores

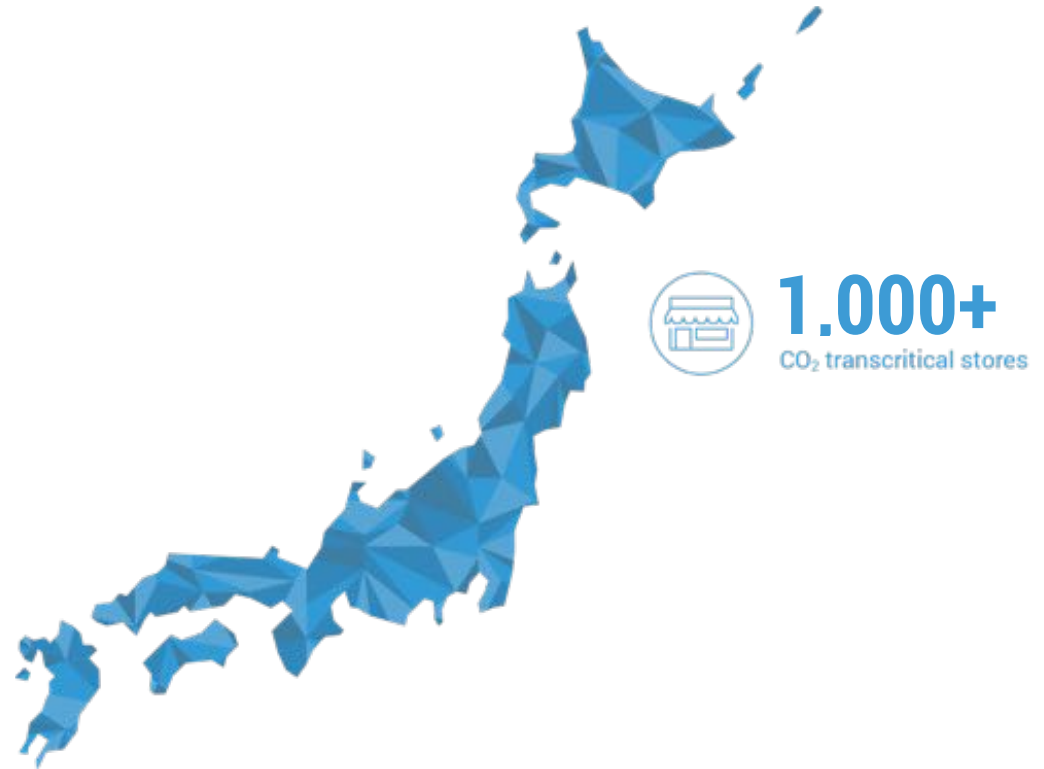
25+ brands using R744

up from 180 in early 2014 =
400%+ increase in one year

= Japan as the world leader
for R744 use in C-stores

Lawson: "CO₂ now standard
technology for CVS, even in
sub-tropical climate" = 13
stores in Indonesia

training of 900 technicians =
maintenance activities down
from 250/month in 2012 to
below 10/month across all
stores



“all-natural” store in japan



SAVE-ON: first-ever
“all-natural “ store in Japan,
using CO₂ TC technology for
wall side cases + R290
cabinets

energy savings: 77% as
compared to HFC units



GUIDE China 2015

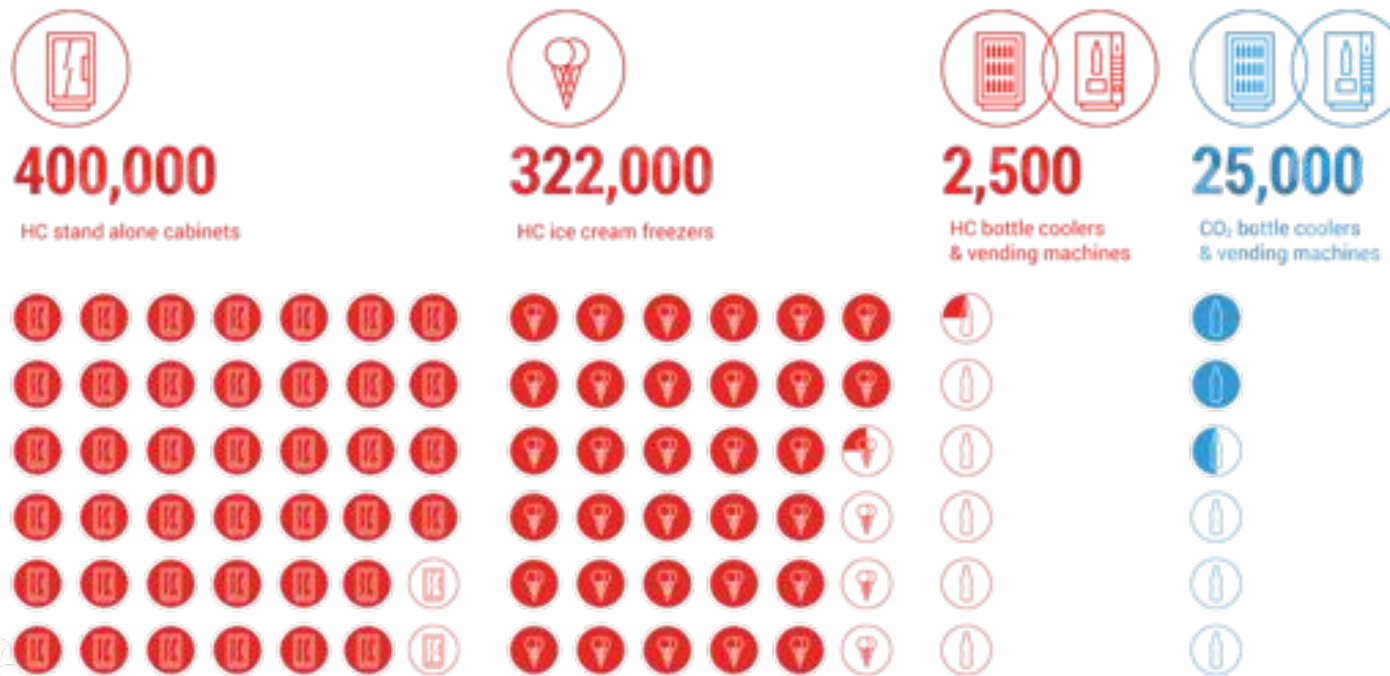


largest-ever survey about
NR in China =
1,000+ responses

overview of NR
technology, market &
policy trends

in cooperation with
Chinese Association of
Refrigeration

light-commercial refrigeration in china



at least 750,000 HFC-free units are placed in China today - global brands fast-track the use

85% of the Chinese industry expects an increase in NR use for that sector by 2020

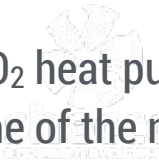
the outlook for HC is rated slightly more positively than for CO₂

CO₂ heat pumps in china

the trend for CO₂ heat pumps
for commercial use
accelerates the trend for
R744 in other applications

today, more than 300 trials
are running under partly
extreme conditions

=



CO₂ heat pumps have become
one of the most dynamic
markets for NR in China...
aiming at 50,000 heat pumps
by 2020?*



300+

CO₂ transcritical
commercial heat pumps
(13 suppliers)

industrial refrigeration - CO₂ projects in china



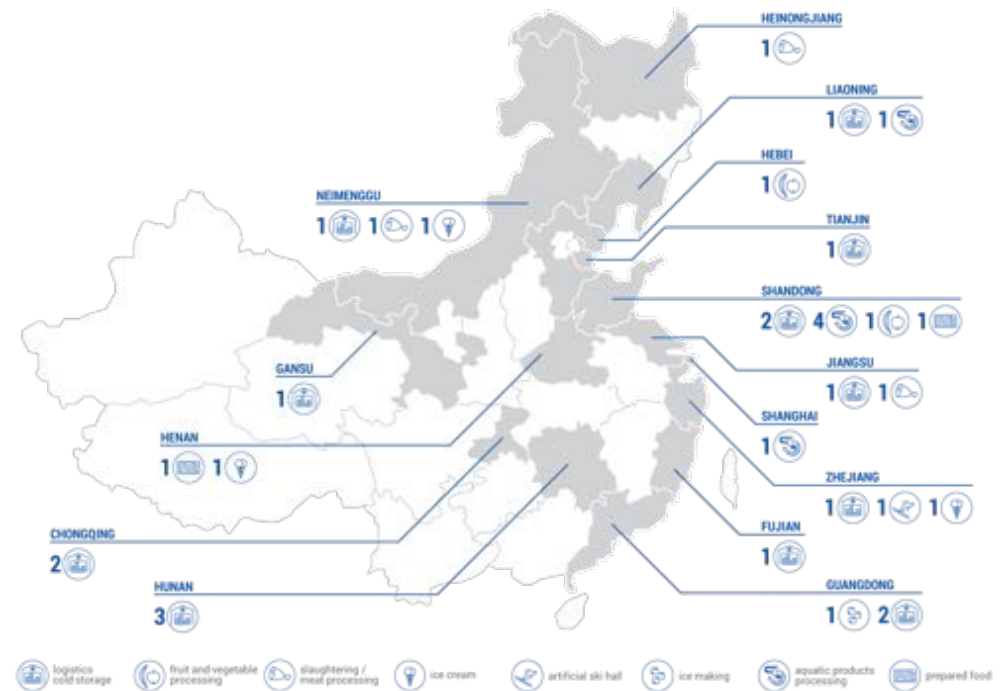
more than 30,000 end-users use NH₃ systems

by 2017, China will most likely surpass the capacity of the US cold chain, currently at 115 million m³ of space

by december 2015, 34 CO₂ cascade / secondary projects will be completed in China's industrial refrigeration sector

=

NH₃ and CO₂ in industrial refrigeration were ranked 2nd and 3rd out of 11 applications



GUIDEs in 2015



GUIDE TO NATURAL
REFRIGERANTS IN CHINA -
STATE OF THE INDUSTRY 2015



<http://publication.shecco.com/publications/view/2015-guide-china-natural-refrigerants>



GUIDE TO NATURAL
REFRIGERANTS IN JAPAN -
STATE OF THE INDUSTRY 2015
SPECIAL EDITION ACCELERATE MAGAZINE



OCT 2015



GUIDE TO NATURAL REFRIGERANTS
IN NORTH AMERICA -
STATE OF THE INDUSTRY 2015
SPECIAL EDITION ACCELERATE MAGAZINE



SEP 2015

GUIDE Training



2016

= reference tool for the HVAC&R industry and end-users to find the best method and provider of training

analyse the training situation per refrigerant, application, industry sector

provide an overview of training providers per country, incl. topics and type of refrigerants covered, type of course etc.

shecco - useful links



Industry Platforms:

<http://www.hydrocarbons21.com>

<http://www.R744.com>

<http://www.ammonia21.com>

<http://www.R718.com>

ATMOsphere conferences, side-events & network meetings:

<http://www.ATMO.org>

shecco Publications, incl. GUIDEs

<http://publications.shecco.com>

Accelerate Magazine

<http://accelerate.shecco.com>

contact details:

Nina Masson

nina.masson@shecco.com

office: +32 2 230 3700

mobile: +32 473 468 194

mobile: +49 160 9944 6449