

natural refrigerants in asia & the world

an overview of market and policy trends



Tokyo, February 3, 2015

Nina Masson, Deputy Managing Director

shecco

natural refrigerants world trends



north america: huge potential for NR in several applications still untapped



europa: new political momentum for the world leader of NR use in the food chain



china: incentives for NR use in domestic applications & heat pumps



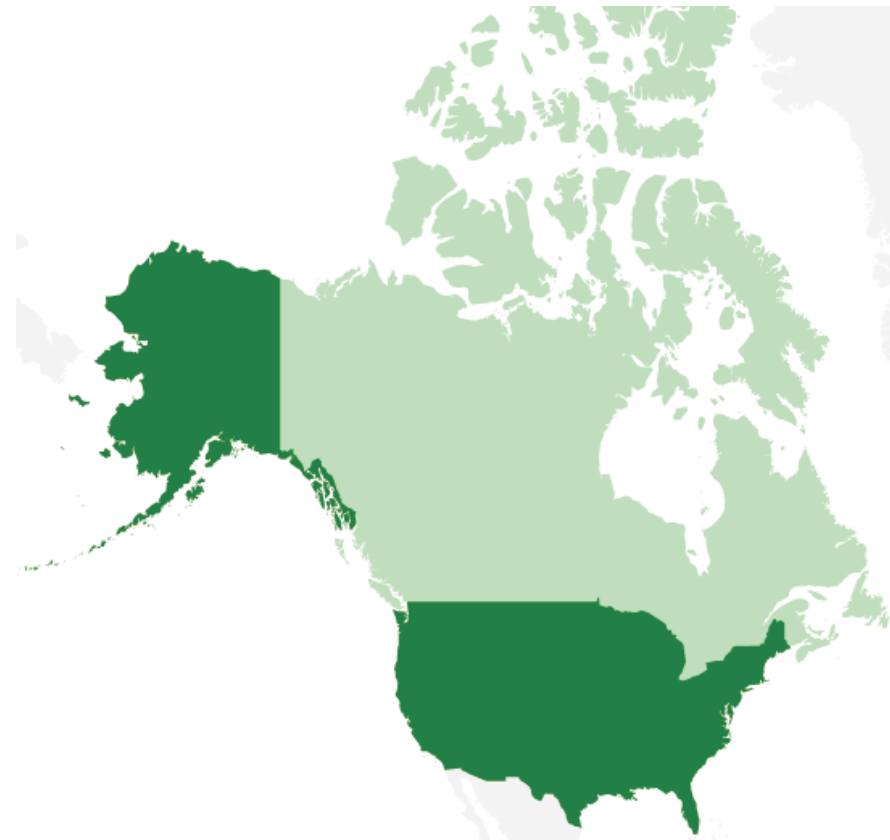
north america: huge potential for NR in several applications still untapped



north america: CO₂ TC / CO₂-HFC stores



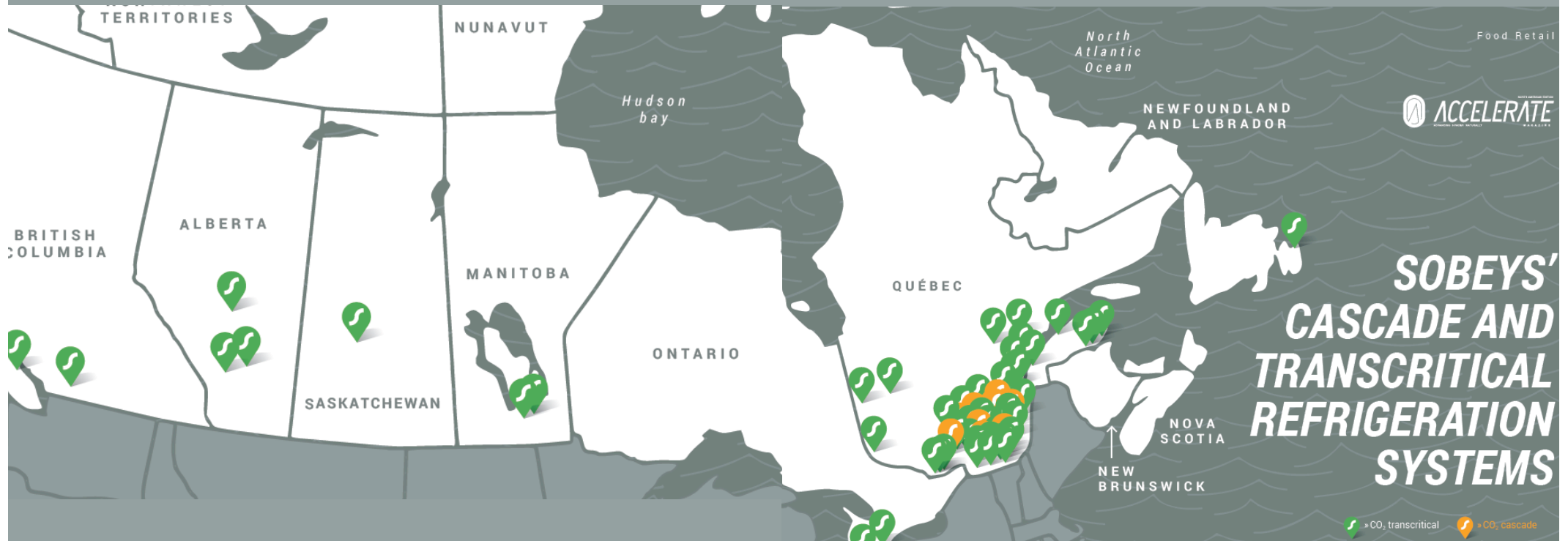
CO₂ TC stores 2015



CO₂-HFC / Secondary Systems, 2015



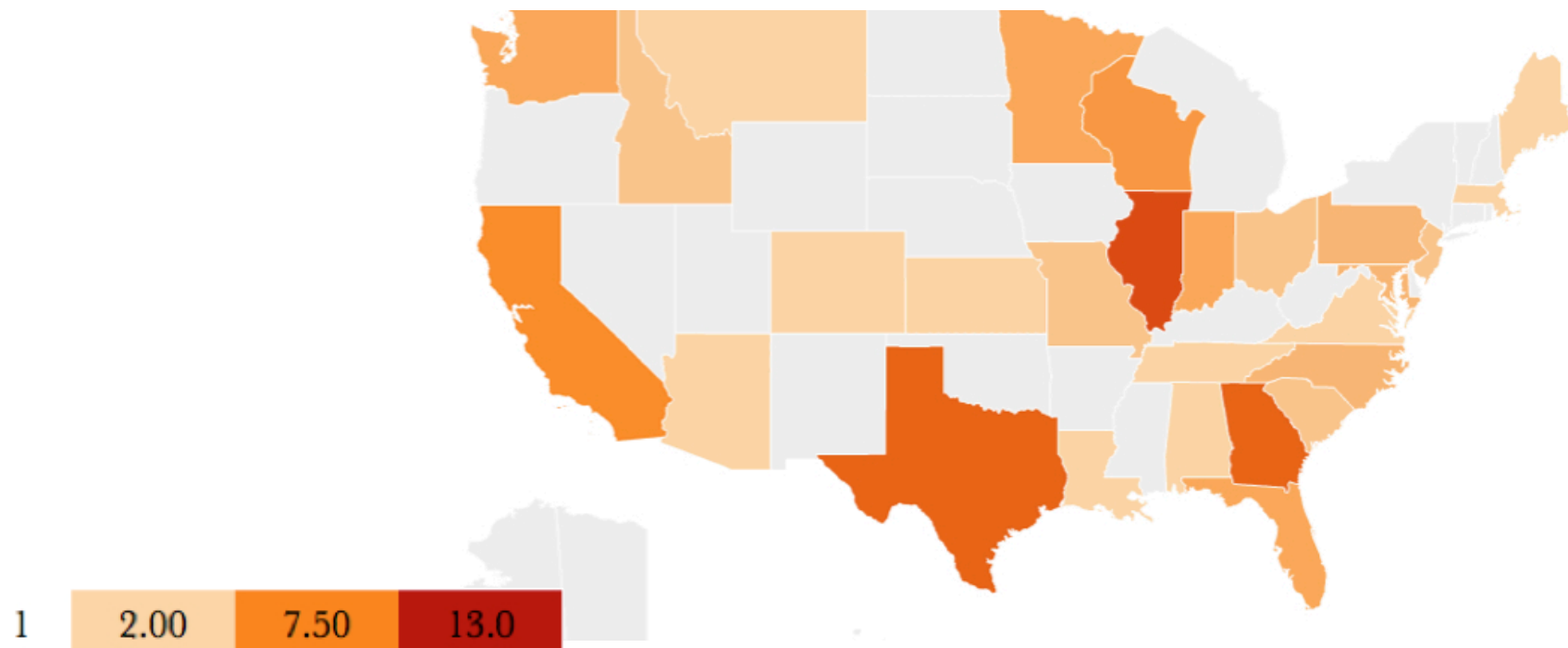
leading north american food retailer CO₂ TC



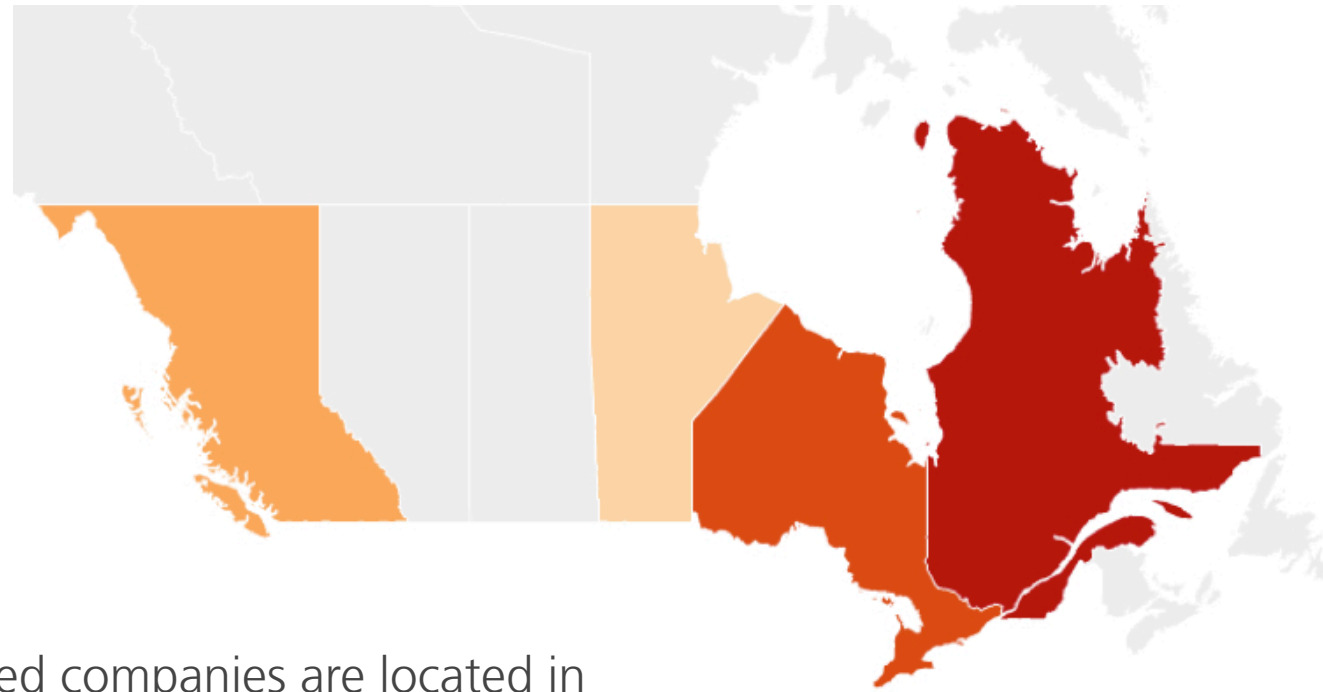
- ◎ Sobeys has 72 stores using CO₂ transcritical systems + 15-20 stores opening every year with CO₂ = the North American leader of transcritical installations
- ◎ in total there are more than 118 transcritical stores in North America (est. Feb 2015)

NR suppliers in the usa

- a growing industry is involved in offering NR solutions - with favourable regulatory change this momentum is expected to continue
- most NR companies are located in northern or southern States of the USA



NR suppliers in canada



- 1/3 of surveyed companies are located in Quebec where the strongest adoption of CO₂ in commercial and industrial applications can be seen = the growth of the NR industry is driven by end-user commitment

1

2.00

7.50

13.0

commercial availability of NR solutions - shecco analysis

REFRIGERATION	TODAY	2015-2020	2020-2025	2025-2030
Domestic Refrigeration	Orange	2016 (Green)	Green	Green
Commercial refrigeration - light	Orange	2018 (Green)	Green	Green
Commercial refrigeration - centralised systems	Orange	2018 (Green)	Green	Green
Industrial refrigeration - small	Orange	Green	Green	Green
Industrial refrigeration - large	Green	Green	Green	Green
Transport refrigeration	Red	Red	Orange	Green
AIR-CONDITIONING	TODAY	2015-2020	2020-2025	2025-2030
Single-Split (self-contained) AC	Red	2017 (Orange)	2022 (Green)	Green
Multisplit / VRF A/C	Red	Red	Orange	Orange
Chillers	Orange	Orange	Green	Green
Residential heat pumps	Red	Orange	2022 (Green)	Green
Commercial and industrial heat pumps	Orange	Orange	2022 (Green)	Green
Mobile air conditioning	Red	Red	2023 (Orange)	Orange

north america: policy trends

usa:

- President Obama launched a Climate Action Plan for domestic and international action on HFCs in Oct 2013
- US EPA SNAP proposal to **allow use** of 4 HCs in six AC&R applications (subject to use conditions) in June 2014
- US EPA SNAP proposal to **prohibit the use** of certain high GWP HFCs (incl. R134a) especially targeting commercial refrigeration in July 2014
- US government partnered up with several private companies to announce a **voluntary agreement** towards reducing HFC emissions
- **California**: considering HFC phase down, low-GWP requirements, high-GWP fee, proposal is expected later in 2015

canada:

- Intention to align with the USA on **limiting the use of HFCs**, incl. prohibition on use of high GWP HFCs (R134a) in commercial refrigeration

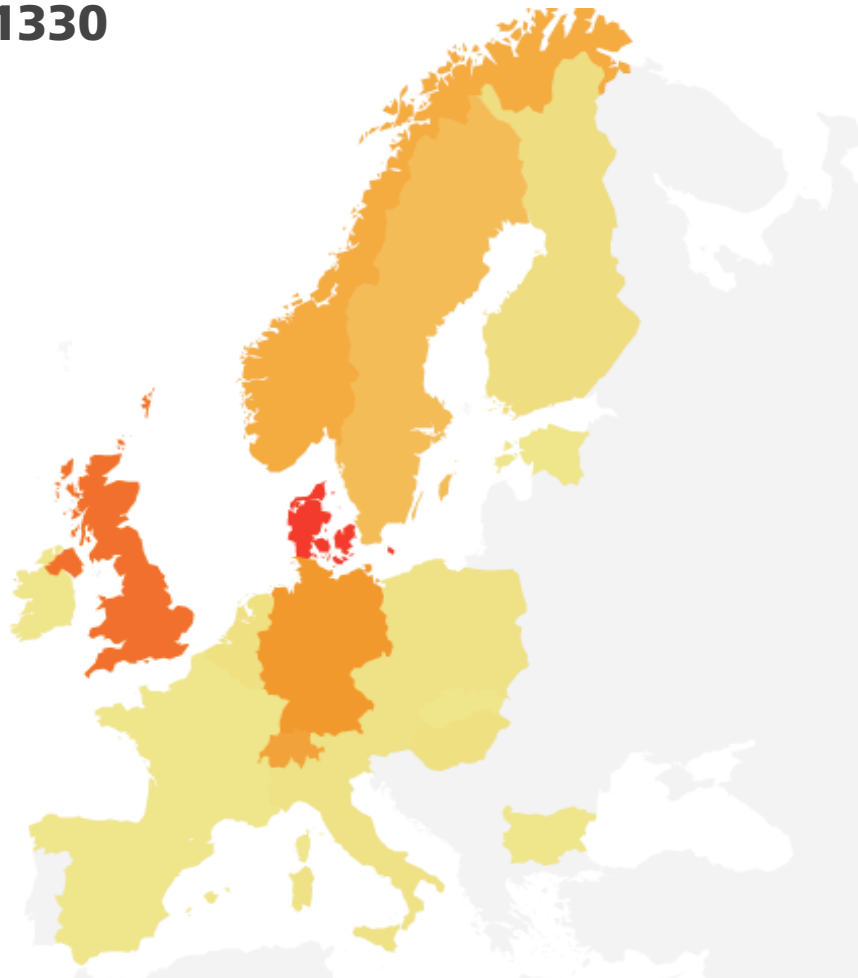
europa: new political momentum for the world leader of NR use in the food chain



europa: CO₂ TC stores 2011-2013



1330



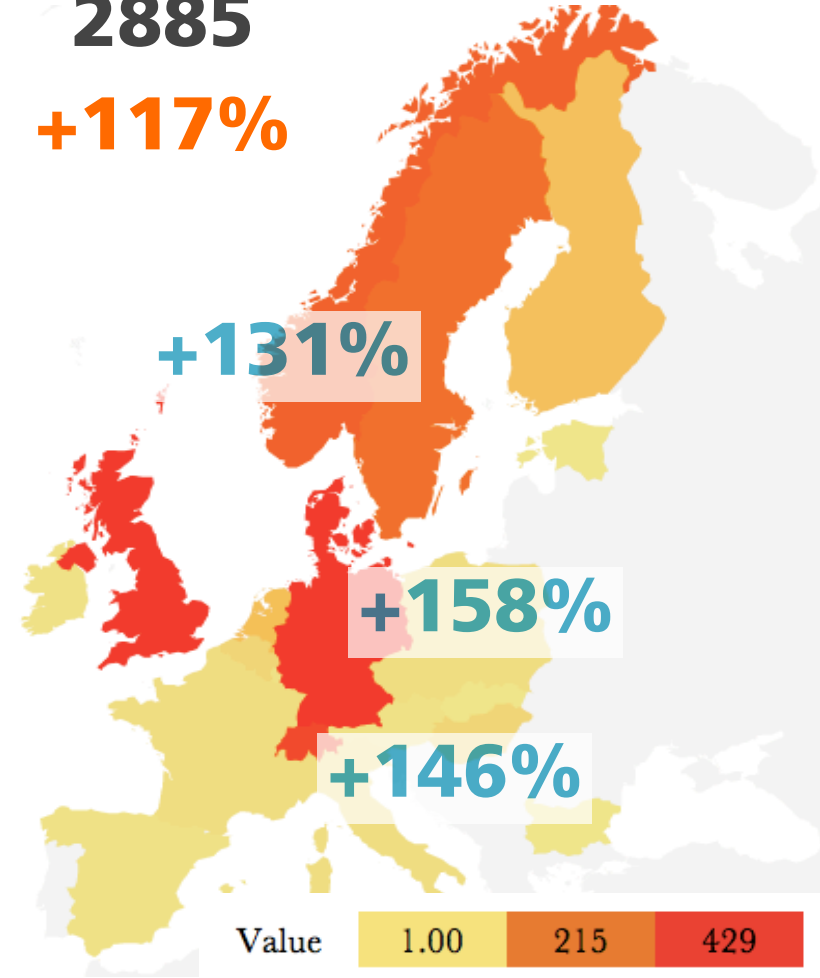
2885

+117%

+131%

+158%

+146%



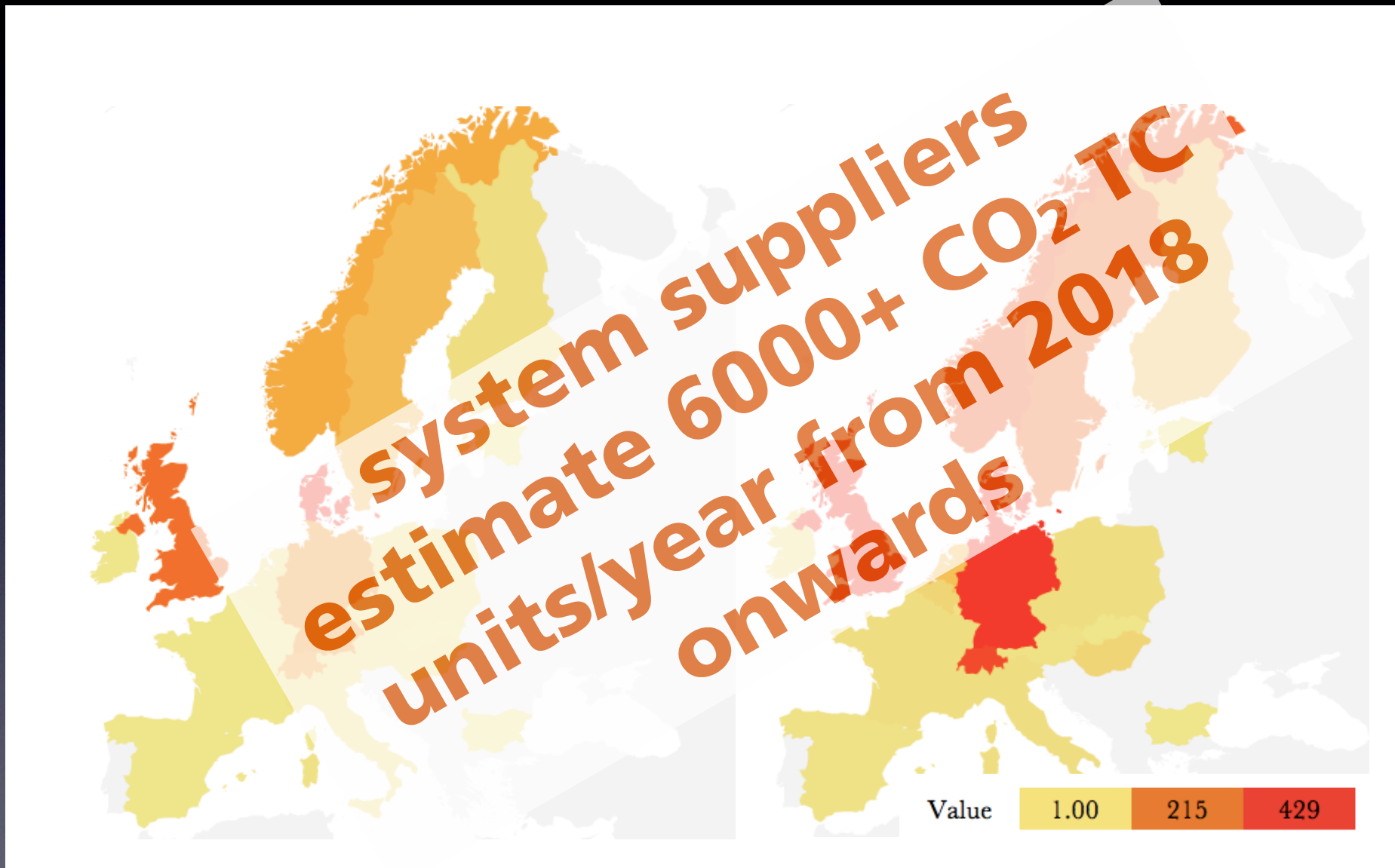
Value

1.00

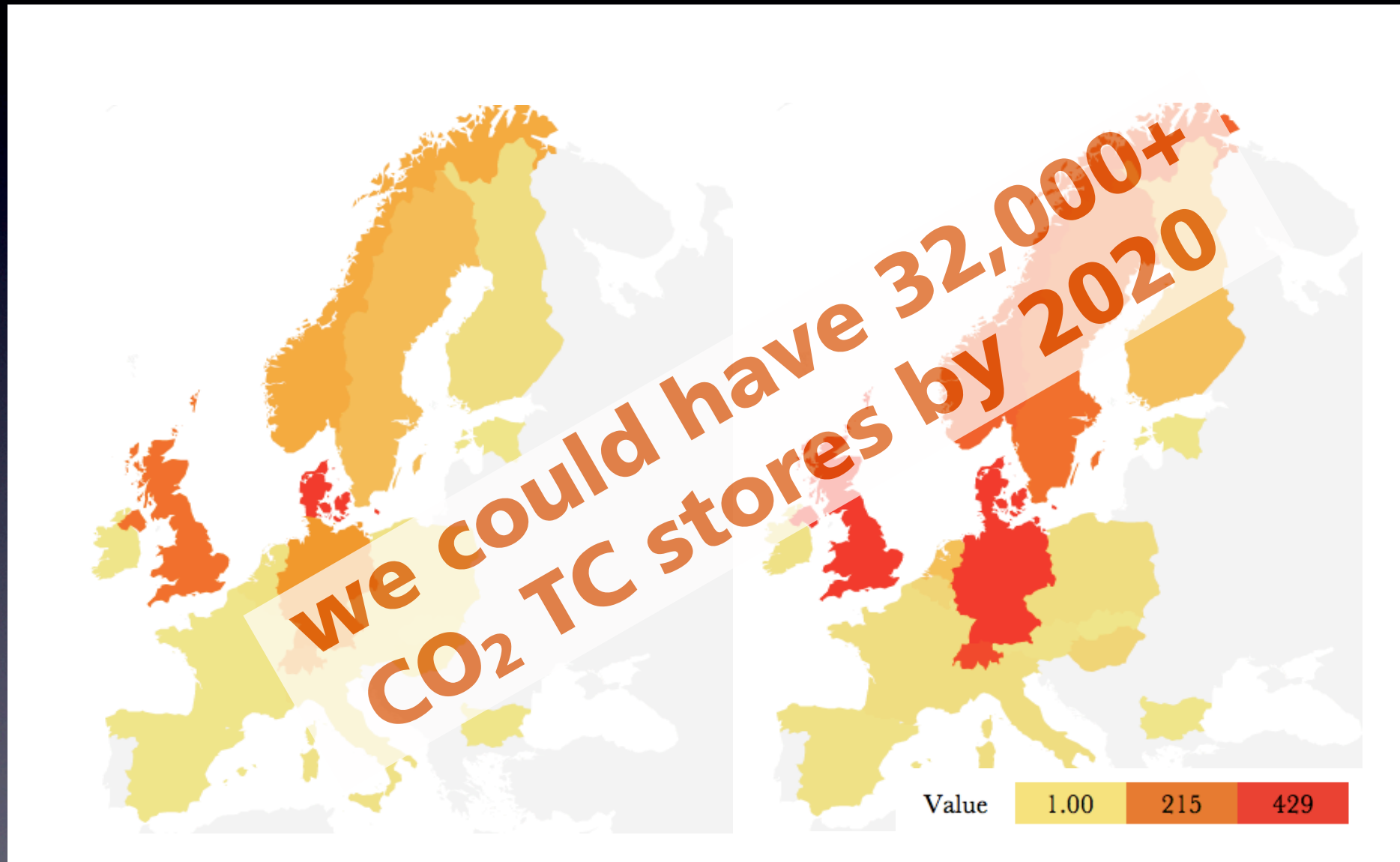
215

429

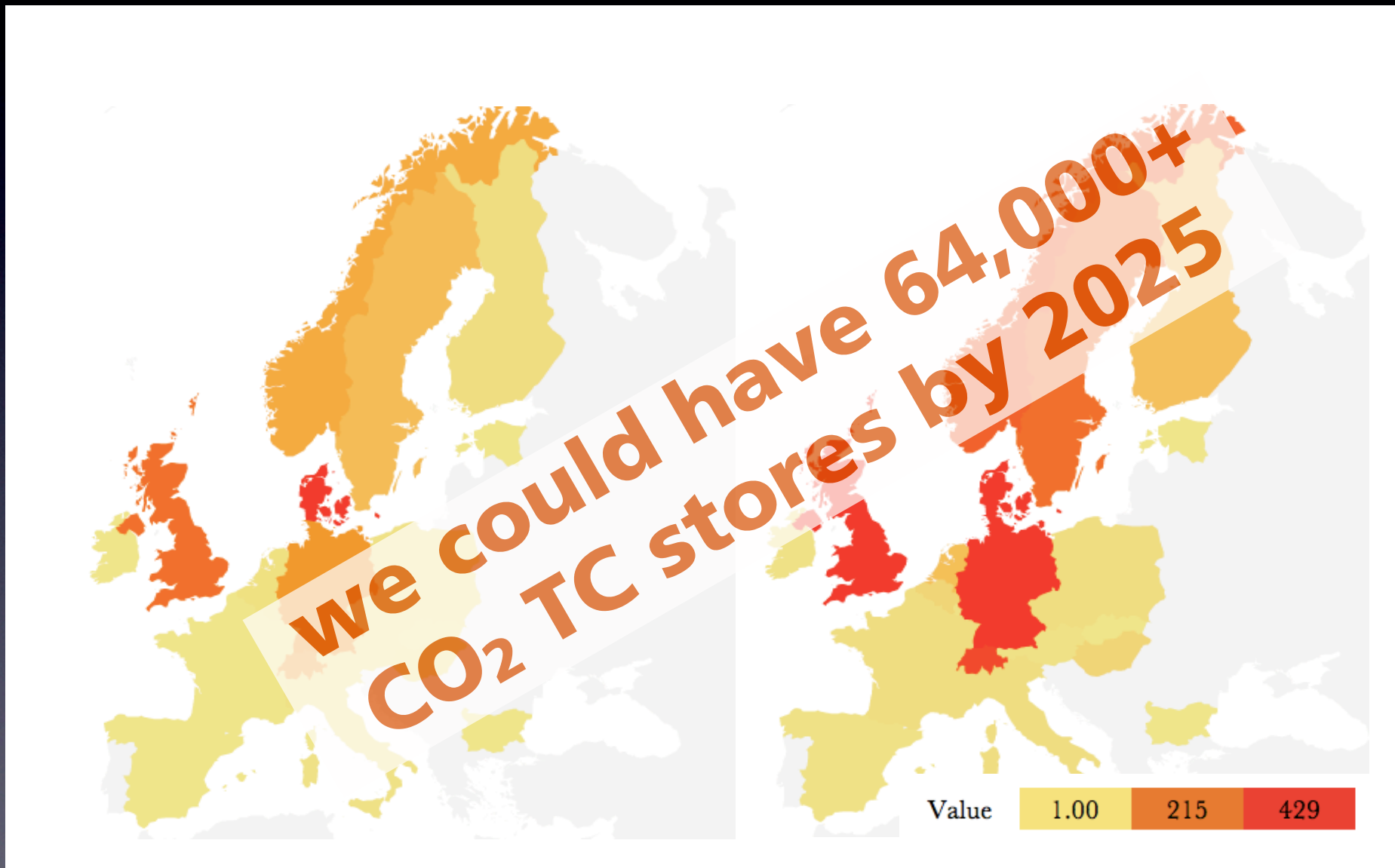
europa: CO₂ TC stores outlook 2020



europa: CO₂ TC stores outlook 2020



europa: CO₂ TC stores outlook 2020



NR refrigerant stores: europe brands



COOP Switzerland had 278 CO₂ TC stores by end-2013, so is expected to be well beyond 300 stores by now

as part of its enterprise mission, by 2023 it wants to be completely CO₂-neutral in its operations



NR refrigerant stores: europe brands



Aldi Süd opened its 300th store with CO₂ in end-2014 + 80% of its cabinets operate with HCs (propane)
- it plans to invest EUR 15 million to ensure 1,830 climate-friendly stores will be open by end-2015 + to fully replace all plug-in units with HCs

50% energy reduction as compared to traditional, non-optimised refrigeration systems



european food retail study



- study: "Natural Refrigerants in Europe: The Drivers and Challenges for European Food Retailers"
- supported by Carrier Commercial Refrigeration
- published: 8 September 2014
- http://www.carrier.com/carrier/en/us/news/news-article/natural_refrigerants_make_commercial_sense__carrier_study_says.aspx
- <http://publications.shecco.com/publications/view/carrier-foodretail-europe-report-2014>



european food retail study



- interviews with 50 leading food retailers in Germany, France, Denmark, Norway, the UK + other mainly Western and Northern European countries
- retailers that agreed to be mentioned:

METRO GROUP
MADE TO TRADE.

coop
Norge

**Dansk
Supermarked**



MIGROS

TESCO



willingness to reduce investment cycles to promote the uptake of more environmentally-friendly refrigeration

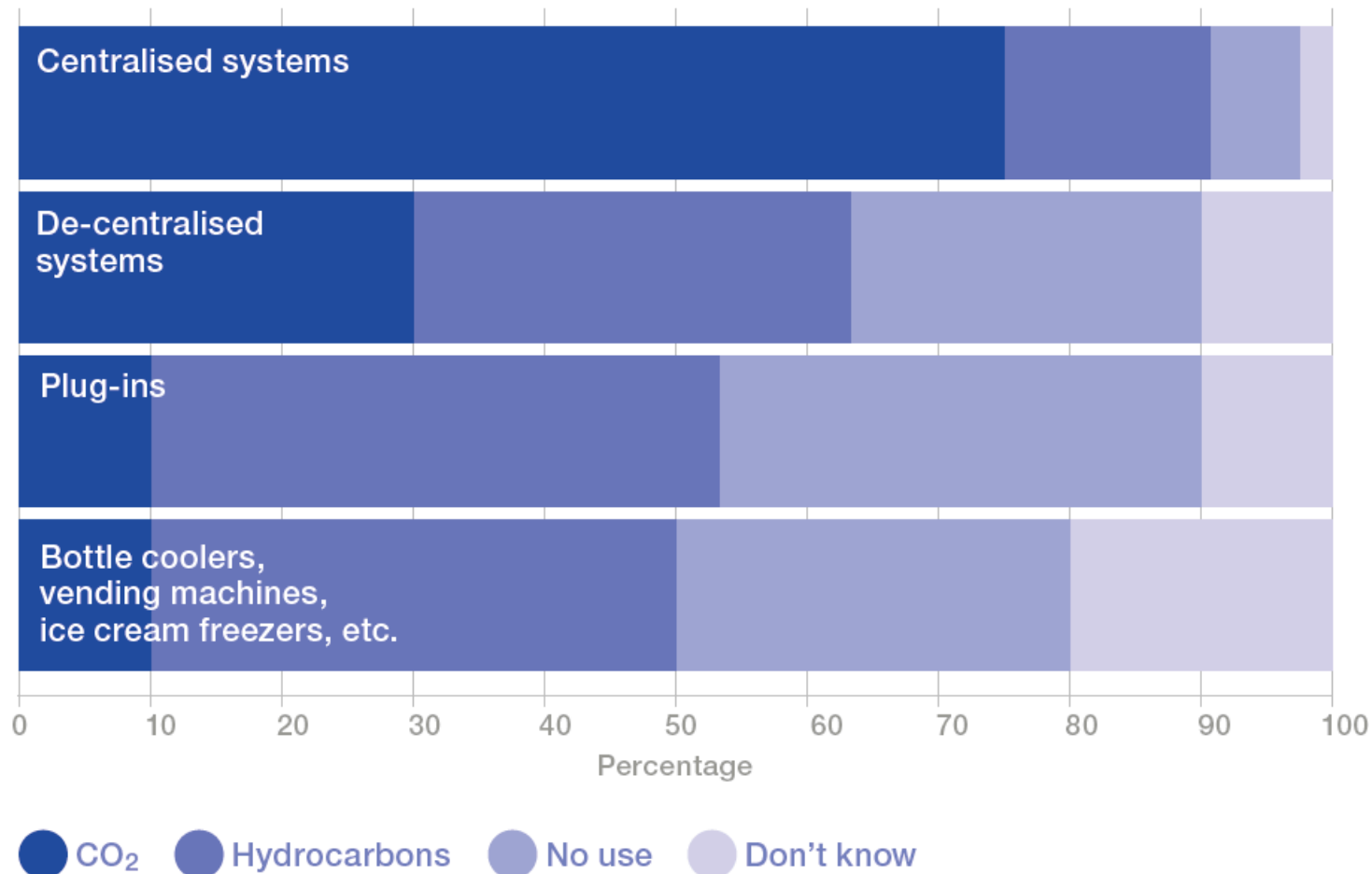


- 1 No 48.3%
- 2 Yes, by less than 2 years 27.6%
- 3 Yes, by more than 2 years 24.1%

food retailers are willing to reduce investment cycles for more sustainable refrigeration

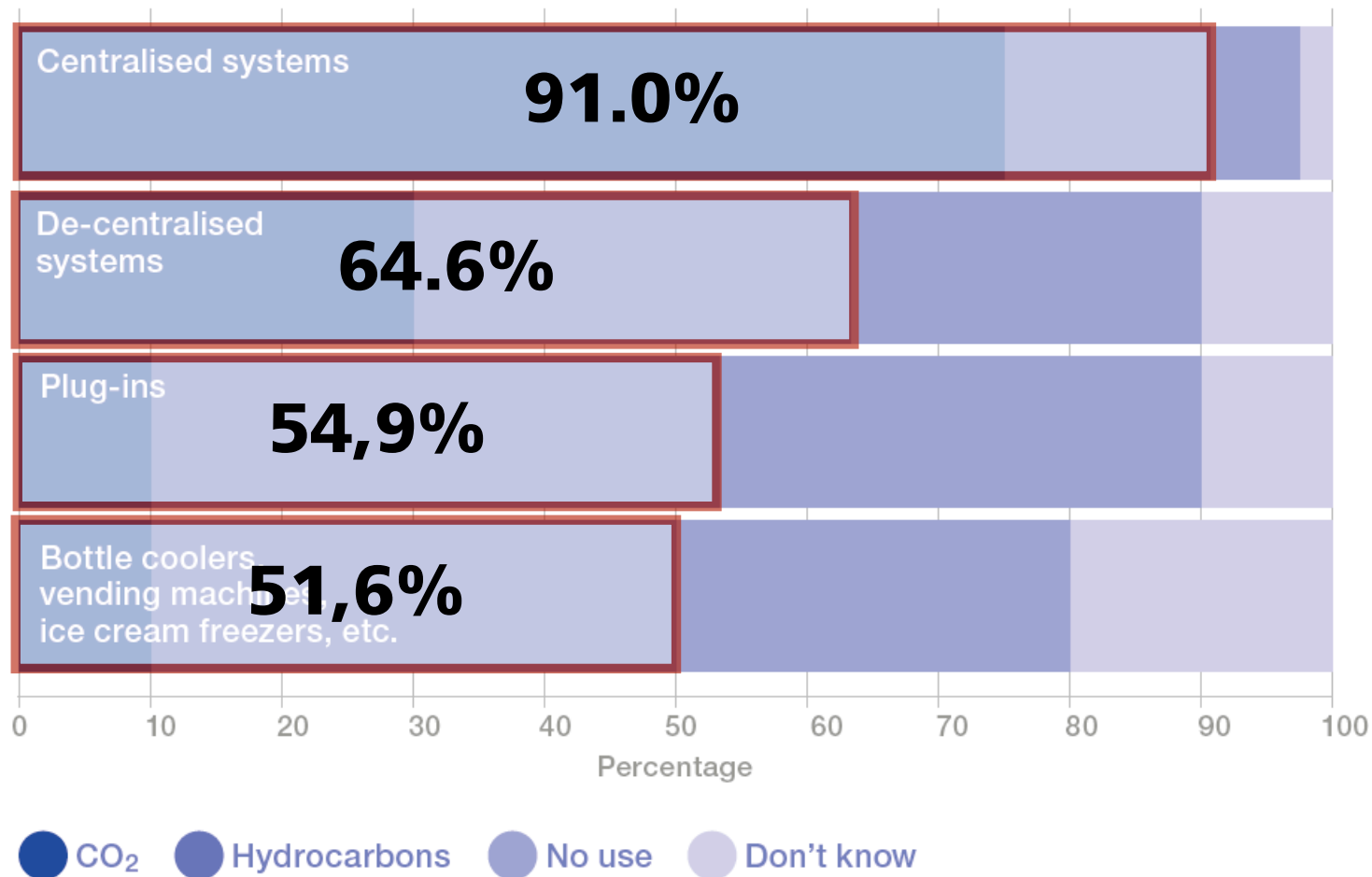
- more than half (52%) would be willing to reduce their normal investment cycles to promote the uptake of more environmentally-friendly refrigeration technology
- half of this group would even be willing to reduce investment cycles by more than 2 years
- the average investment cycle for refrigeration systems in surveyed food retailers is mostly between 9-15 years

use of natural refrigerants among western & northern european food retailers



source: Carrier / shecco: "Natural Refrigerants in Europe: The Drivers and Challenges for European Food Retailers"; Oct 2014

use of natural refrigerants among western & northern european food retailers



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Europe: impact of F-gas bans in centralised refrigeration systems as of 2022



the market has anticipated policy change and has reacted in time

- more than 3 out of 5 food retailers (64%) anticipated upcoming bans on the use of HFCs to adapt their refrigeration strategy and use non-fluorinated (natural refrigerant) gases

- they are well-positioned to combine long term legislative compliance with investment security, independent of upcoming F-gas rules

- without exception, all food retailers have already heard about the upcoming HFC bans and have developed an appropriate strategy

europa: policy trends

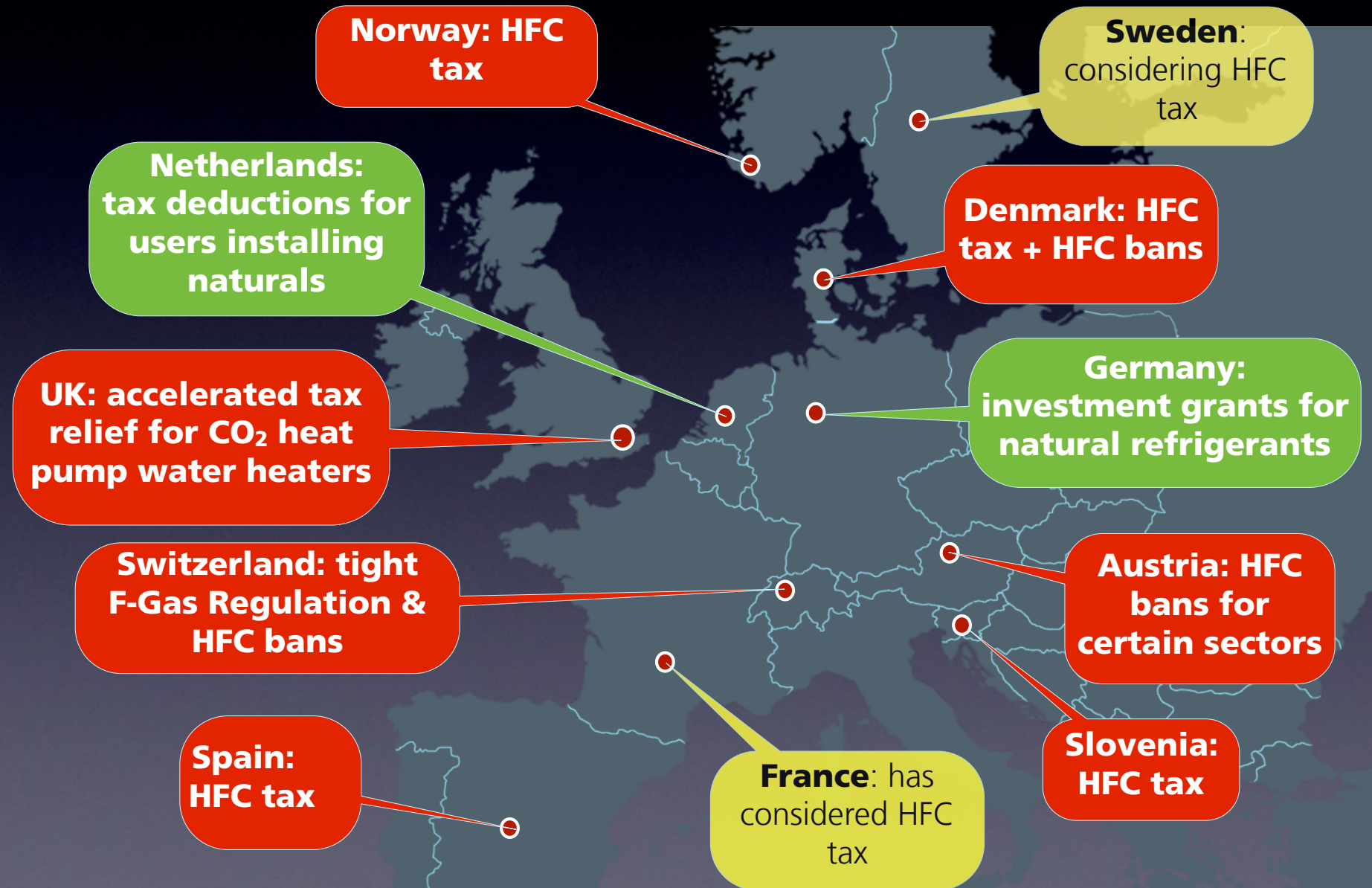
EU F-Gas Regulation - effective as of January 2015:

- Gradual **phase-down of bulk HFCs** measured in tonnes of CO₂eq) placed on EU market by 79% by 2030 compared to average levels in 2009-2012
- **Bans on high GWP HFCs** in new equipment for different sectors (incl. domestic, commercial refrigeration, movable and split AC)
- **Servicing ban on HFCs** with GWP > 2500 (by 2022 for virgin refrigerants, by 2030 for recycled & reclaimed)
- **Training & certification** needs to include information on alternatives to HFCs

HCFC phase out - effective as of January 2015:

- It is **no longer legal** to use recycled or reclaimed R22 to service equipment in the EU

Europe: policy action at the national level



china: incentives for NR use in domestic applications & heat pumps

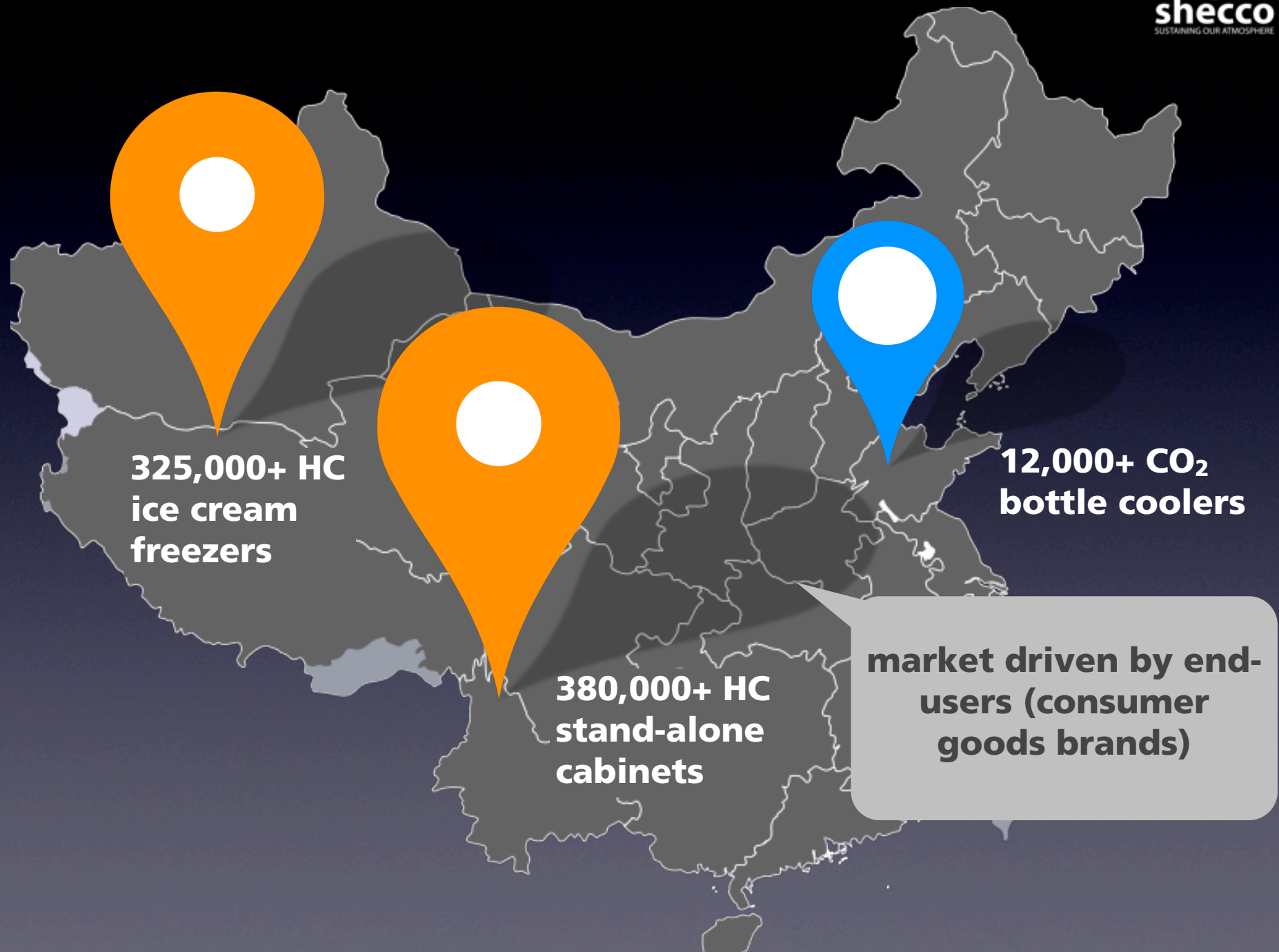


china: CO₂ supermarkets



- there are **7 CO₂** supermarkets in China - only one CO₂ transcritical store

china: light-commercial applications



china: CO₂ heat pumps



**160+ CO₂ TC
commercial heat
pumps
(7 suppliers)**

**most suppliers still in
testing phase - early
market growth
expected**

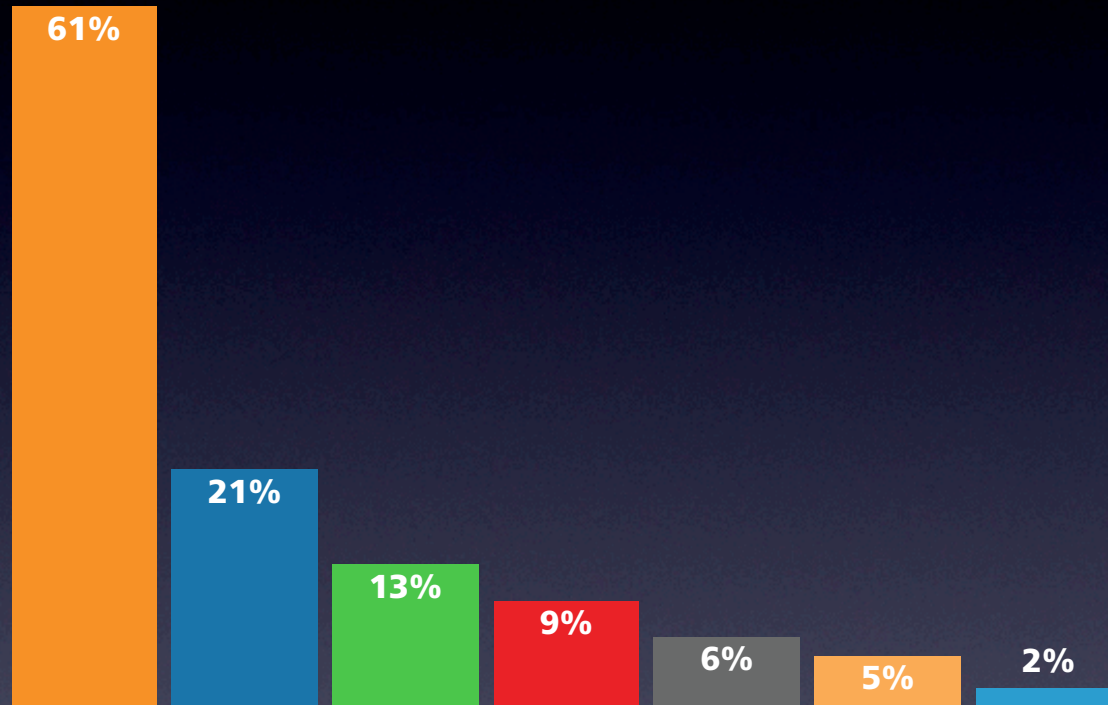
GUIDE China 2015 - industry survey



- in cooperation with Chinese Association of Refrigeration
- survey launched in Chinese and English = largest survey about NR so far
- first-ever publication to give a comprehensive overview of NR technology, market & policy trends



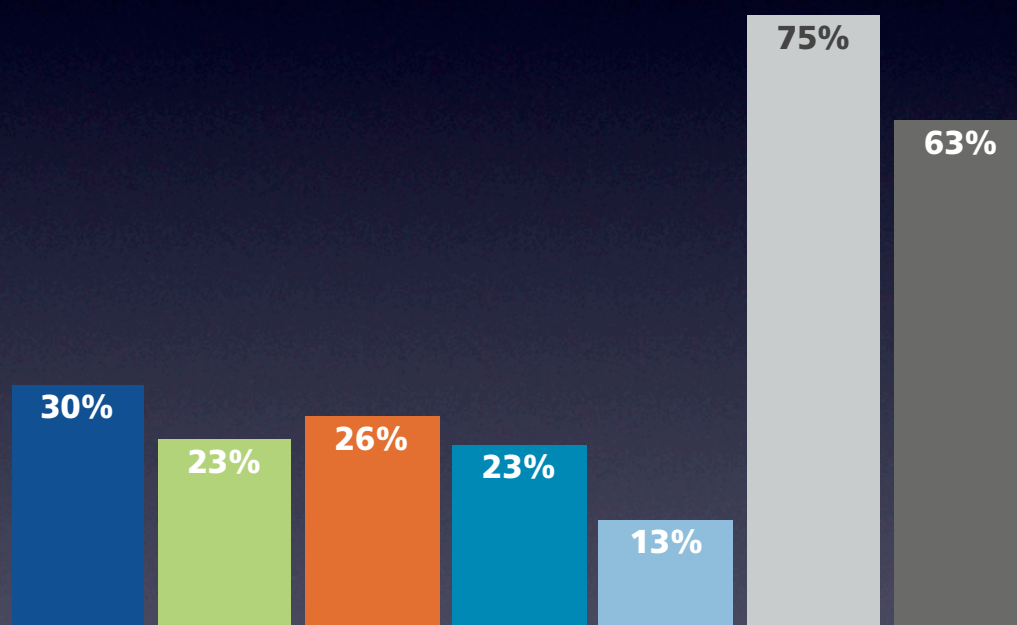
china: survey participants



- System Manufacturer
- Engineering / Contractor
- End-User
- Consultancy / Marketing
- Component / Refrigerant Supplier
- Training / Research
- Association

- 944 respondents so far
- most respondents represent system manufacturers and component suppliers = strong industry perspective
- 6% end-users represented

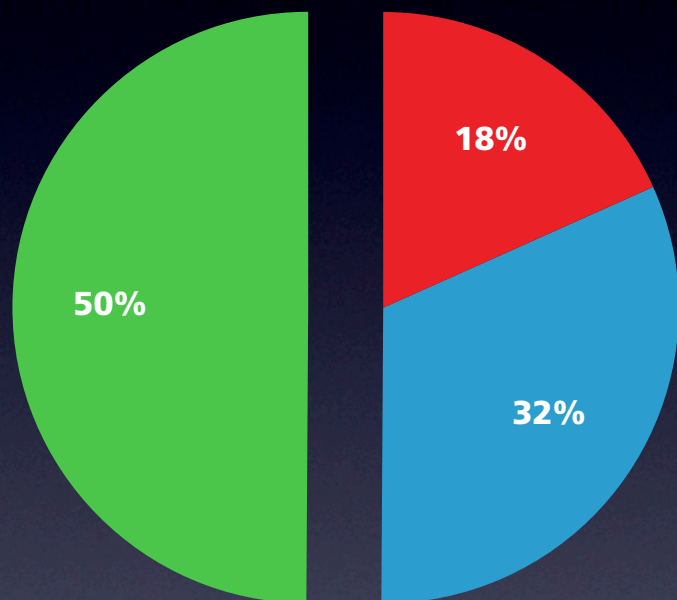
china: use of natural refrigerants vs f-gases



■ Carbon dioxide ■ Ammonia ■ Hydrocarbons ■ Water ■ Air ■ HFCs ■ HCFCs

- ⦿ today, a clear 3/4 majority still uses HFCs; more than 60% still even use HCFCs
- ⦿ among NR, carbon dioxide is currently the most popular choice (30% use it), followed by hydrocarbons

china: future plan to use NR solutions



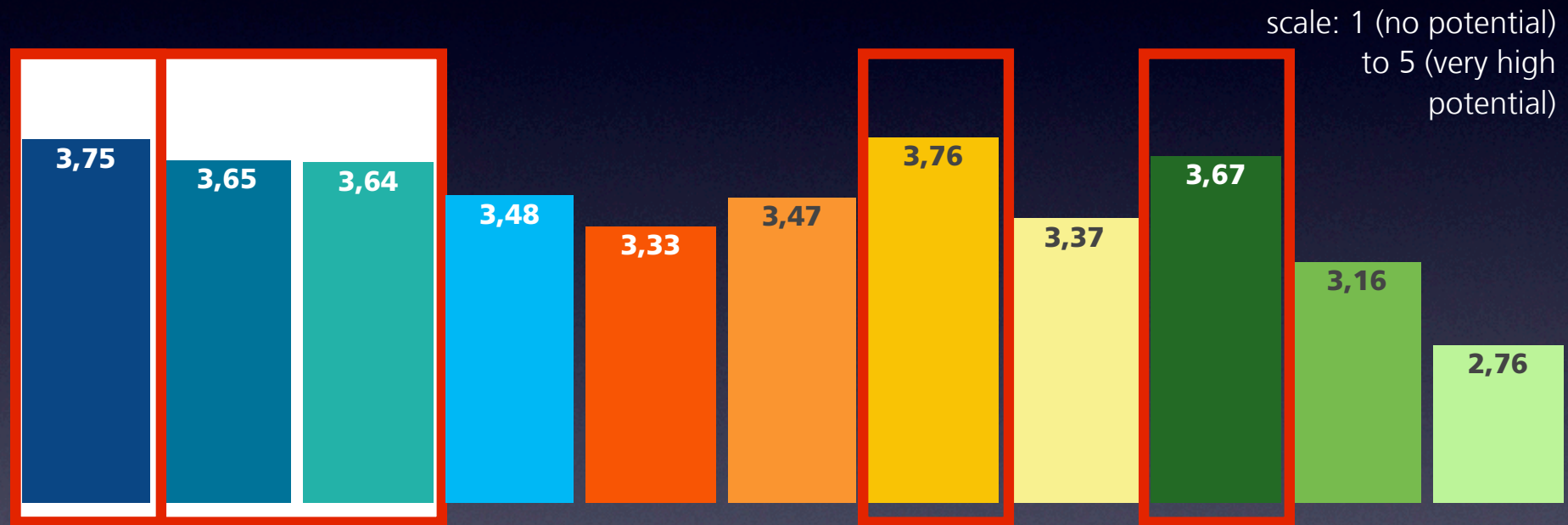
● no ● don't know ● yes

- half of all respondents (49.9%) say that they will provide products or services with natural refrigerants in the future
- another 32% is not sure yet = large untapped potential for more communication about NR technology and its business case
- only 18% have currently no plan to provide NR products or services
- in 2020, there will be a big shift towards CO₂ when 35% want to start using it; another 29% plan to use hydrocarbons in five years from now

NR potential in china 2020, by application



- highest potential for HCs in domestic refrigeration, CO₂ and ammonia in industrial refrigeration, and for CO₂ in commercial refrigeration and heat pumps

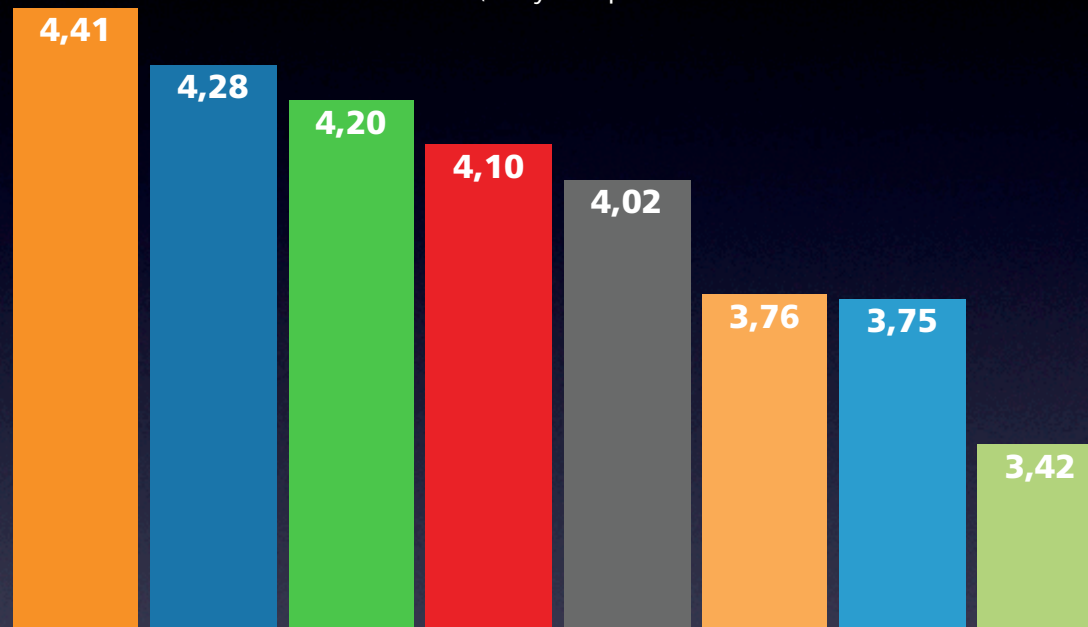


- CO2 Refrigeration industrial
- CO2 Heating residential / commercial
- HC Refrigeration commercial
- HC Refrigeration domestic
- Ammonia Refrigeration industrial
- Ammonia District heating
- CO2 Refrigeration commercial
- CO2 Refrigeration light-commercial
- HC Refrigeration light-commercial
- HC Air-conditioning residential
- Ammonia Refrigeration commercial

drivers for NR industry in china



scale: 1 (not important) to 5
(very important)



- National regulation restricting HFC use
- Global agreement on HFC phase-down
- Review or introduction of standards to enable NR use
- Financial incentives for manufacturers / end users
- Higher availability of components for NR systems
- Higher availability of training & safety programs for HVAC&R industry
- Higher awareness of NR technology, knowledge sharing
- Voluntary industry / end user commitment to phase out HFCs / HCFCs

- government policy will be key in NR market growth: restricting HFC use is the most important driver = "very important"
- a global agreement on HFC phase-down, better standards for NR, financial incentives = "important"
- no strong belief in voluntary action by HVAC&R industry or end-users

china: policy trends



- China introduced a new Environmental Protection Law for 2015
 - revised version after 25 years
 - stricter monitoring and enforcement system, also at the local level
- national government strategy for natural refrigerants (HCFC phase-out plan)
 - conversion of 3 compressor production lines with R290 technology
 - conversion of 18 RAC production lines with R290
 - 1 project using CO₂/NH₃ in industrial refrigeration
- expected for 2015: a new government strategy on CO₂ and NH₃ in the cold storage industry

china: energy label & top runner



- ◎ **Energy Efficiency Label:** introduced in Jan 2015; applied to air-source heat pump water heaters
- ◎ **Top Runner label:** introduced in Jan 2015; applied to 1) domestic appliances incl. room A/C; 2) high energy consumption industries and 3) public buildings - criteria: has to be level 1 in energy efficiency rating + use energy-saving components + consider the overall life cycle perspective + be a commercialised product
- ◎ will be reviewed twice a year; now in testing stage that will lead to expansion to other equipment / industries

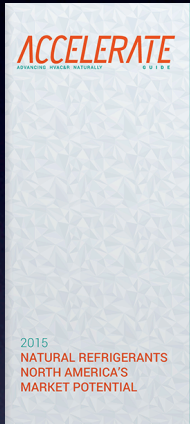


- ◎ target: increase public awareness among end-users = encourage industry to invest in energy-efficient technology
- ◎ Top Runner label can be integrated in the Energy Efficiency Label to show the highest-performing ones

GUIDEs 2015



**Accelerate America -
Special Edition GUIDE
(June 2015)**



**GUIDE China - April
2015 (China
Refrigeration)**



**Accelerate Japan
- Special Edition
GUIDE (June
2015)**

**talk to us for adding your
data and company**

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>

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contact details:

Nina Masson

nina.masson@shecco.com

office: +32 2 230 3700

mobile: +32 473 468 194

mobile: +49 160 9944 6449