



Business Case for Natural Refrigerants

19-21/11/2018 – Lago di Garda



Natural refrigerant market trends - sheccoBase

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WHAT IS SHECCOBASE?

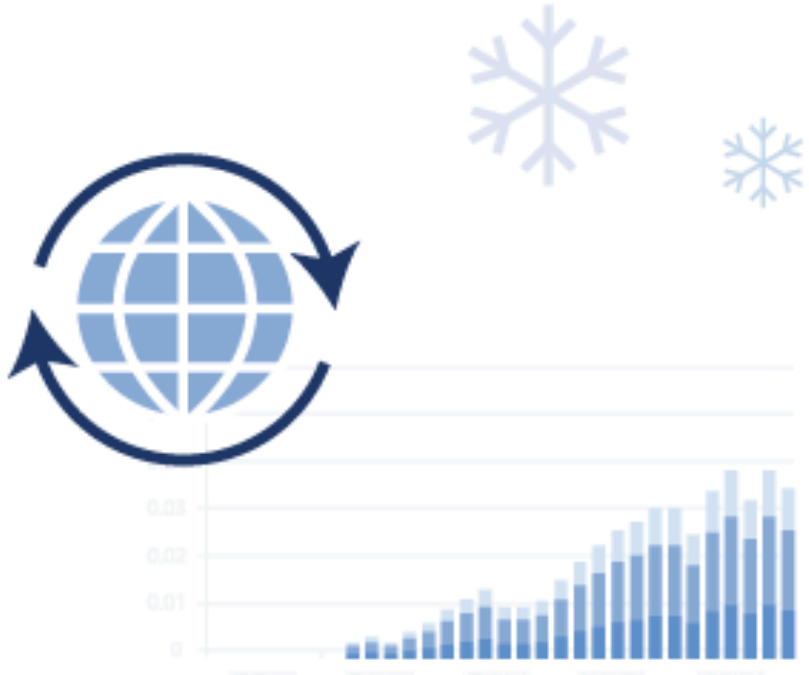


World's largest database on natural refrigerant-based technologies with millions of data points

Tailored information to enable strategic decisions

- key market / technology / policy trends with quantitative & qualitative data
- market leaders / competitors / potential partners
- leading end users
- policy audits, and more





shecco
Base



What questions would you like sheccoBase to answer for you?

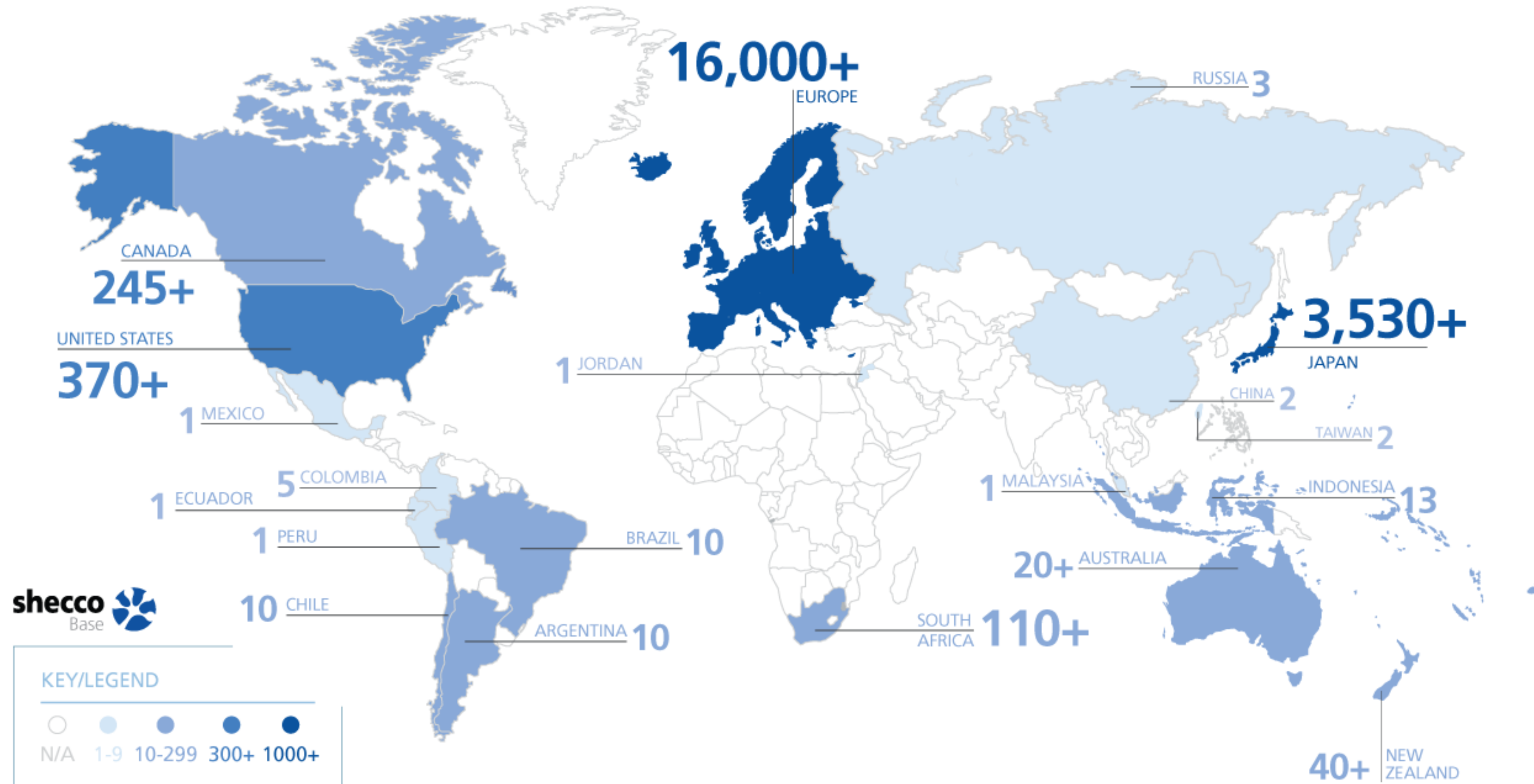
enter your questions in sli.do

COMMERCIAL REFRIGERATION



CO₂ transcritical stores in the world

October 2018



Jordan - Al-Salam supermarket opens **first CO₂ transcritical store** in Jordan

India - Indian Institute of Technology tests **first transcritical CO₂ system** in India

Russia - METRO opens **two CO₂ transcritical stores** in Russia

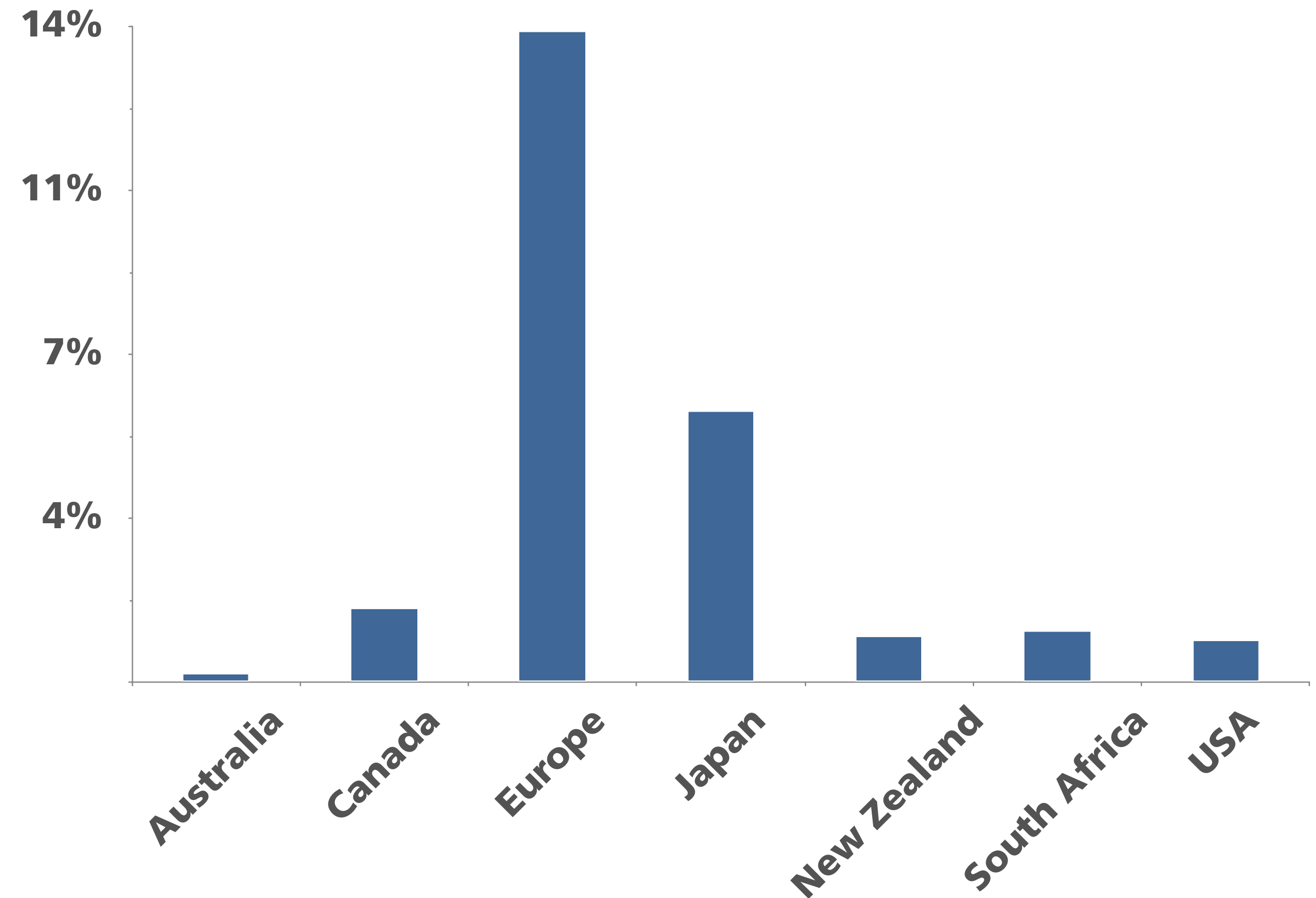


GLOBAL SHARE OF CO2 TC STORES

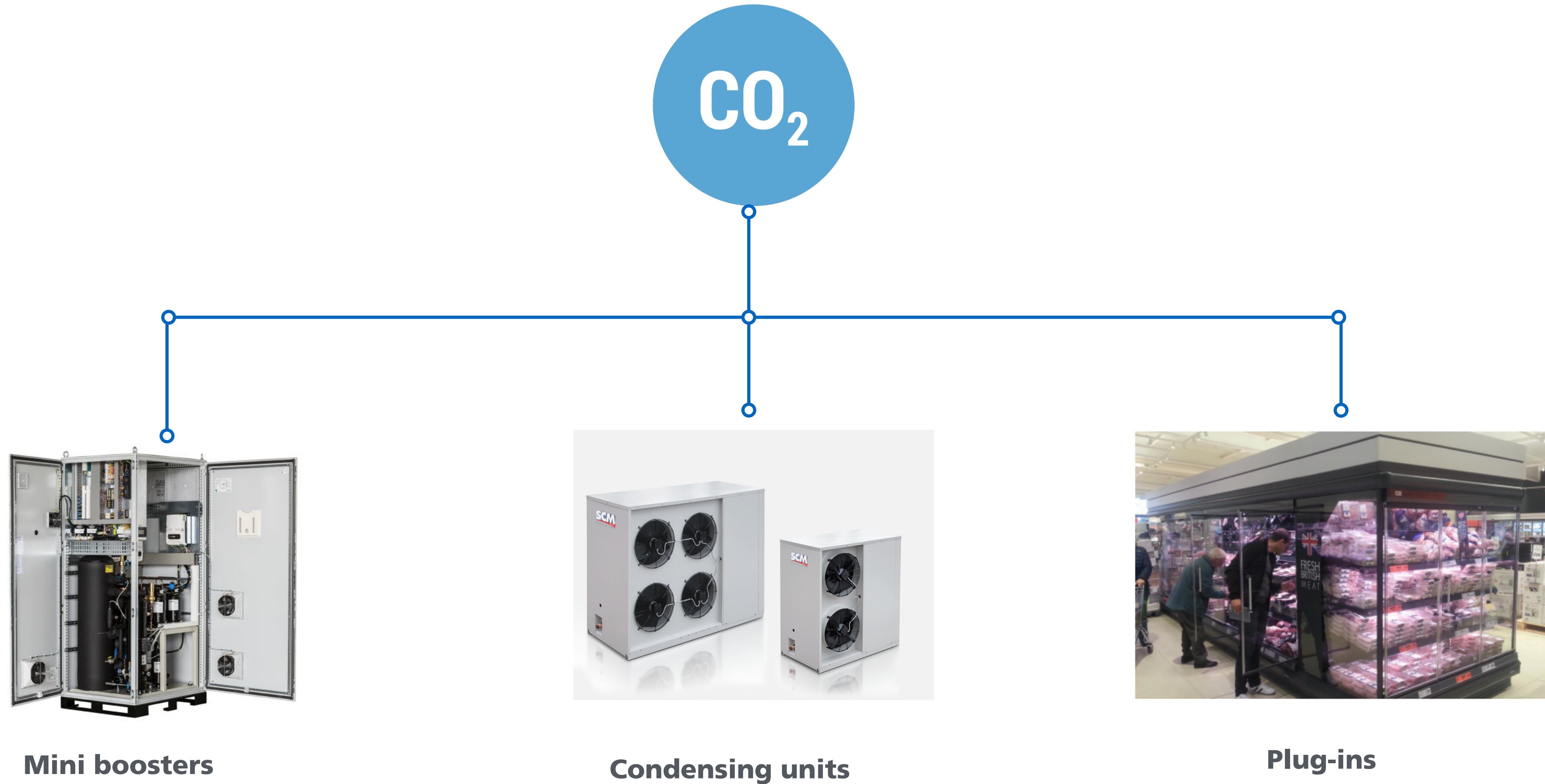
The market transition is still in its early stages.

CO₂ TC stores account for more than 10% only in Europe (excluding small stores).

Less than 10% of total stores in other major markets.



Europe: EU + Switzerland, Norway - food retail stores bigger than 400m²
 Japan: Supermarkets & convenience stores combined



Estimated **6,000+ stores** use condensing units / mini boosters today

More than 20 companies known to be providing CO₂ condensing units and mini boosters

4,000+ CO₂ plug-in showcases installed in supermarkets today



Global market estimate (August 2018)

= **2.5 million HC refrigerated display showcases**

In early 2017 there were about 1.5 million units

Increase of **HC charge limits** in industry standards is key for the future uptake of hydrocarbons



Innovative HC waterloop solutions are gaining ground in different parts of the world.

There are an **estimated 1,900+ stores globally, 1,700+ in Europe**

According to manufacturers, waterloop solutions have:

- lower energy consumption - around **25%** reduction in running costs (compared to HFCs)
- faster installation & low maintenance costs
- competitive advantage in warm climates
- flexible store layout changes
- lower total cost of ownership

Main challenge to overcome: R290 charge limits



MIGROS

Waitrose

TESCO



coop compact



Woolworths
Australia's fresh food people



TOKO MING JEN

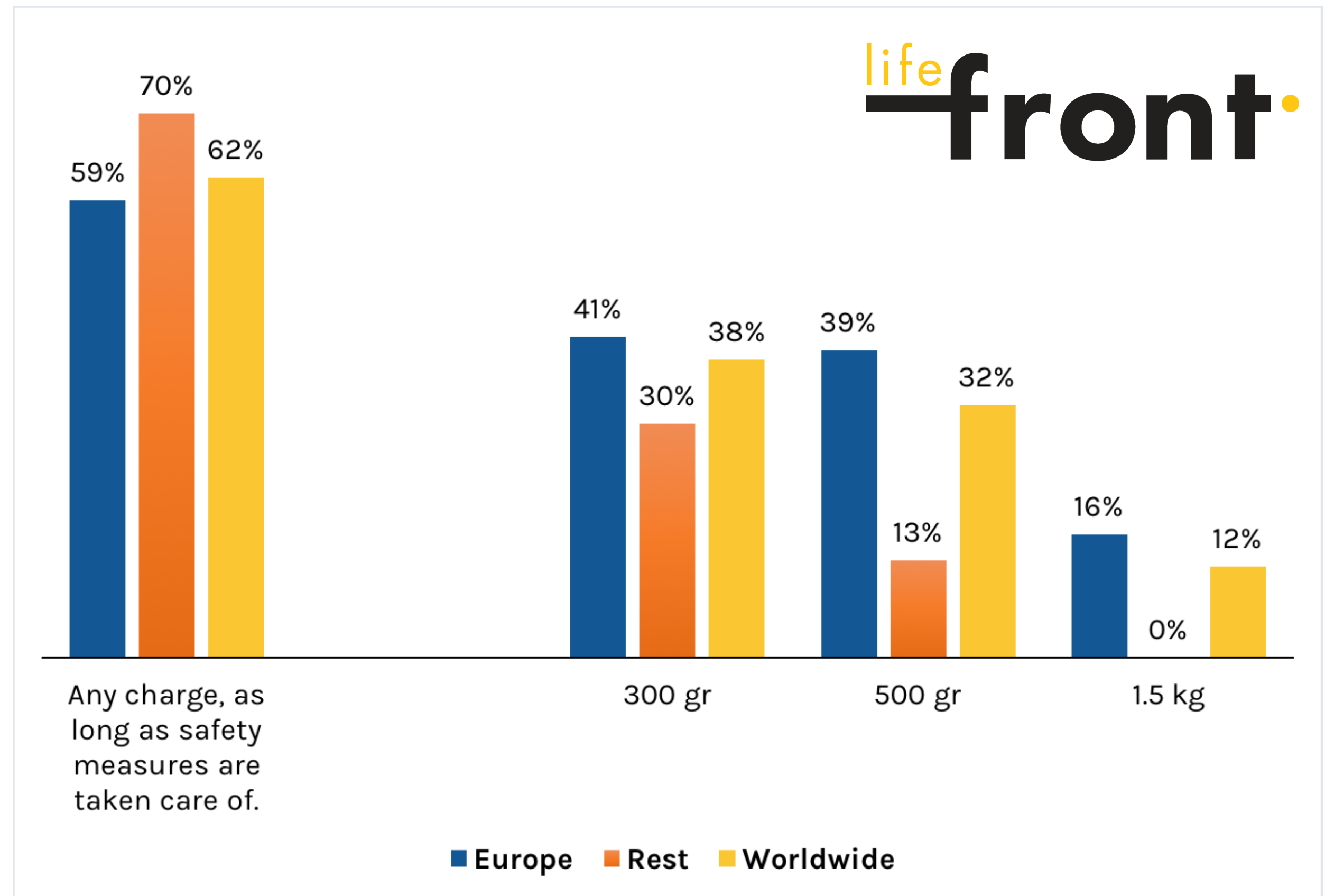
NETTO



Up to what charge limit would you be comfortable to work with?

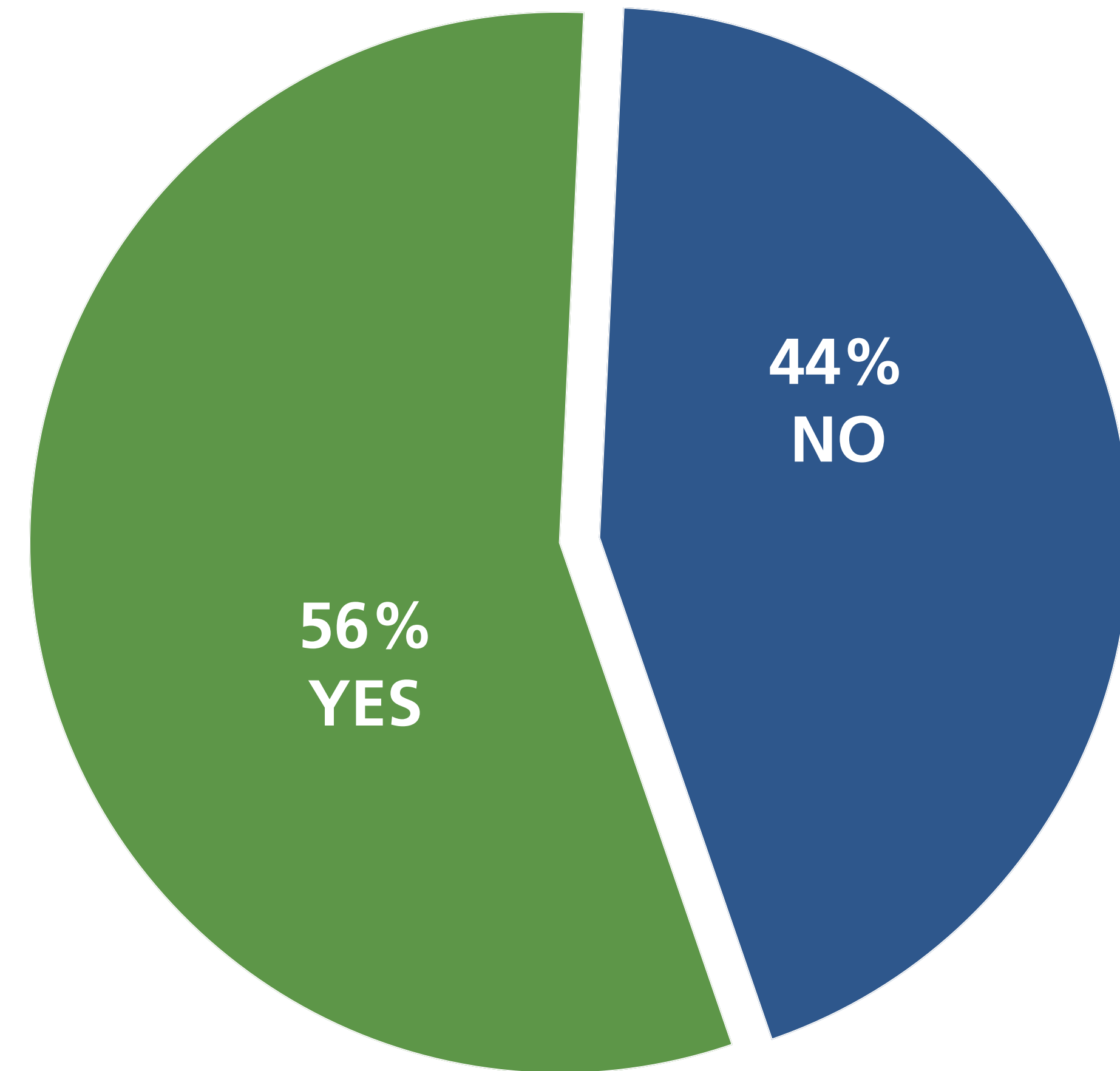
Large majority of experts is open to working with higher HC charge limits (per refrigeration circuit)

Industry is getting ready for increase in allowed charge size under international standards

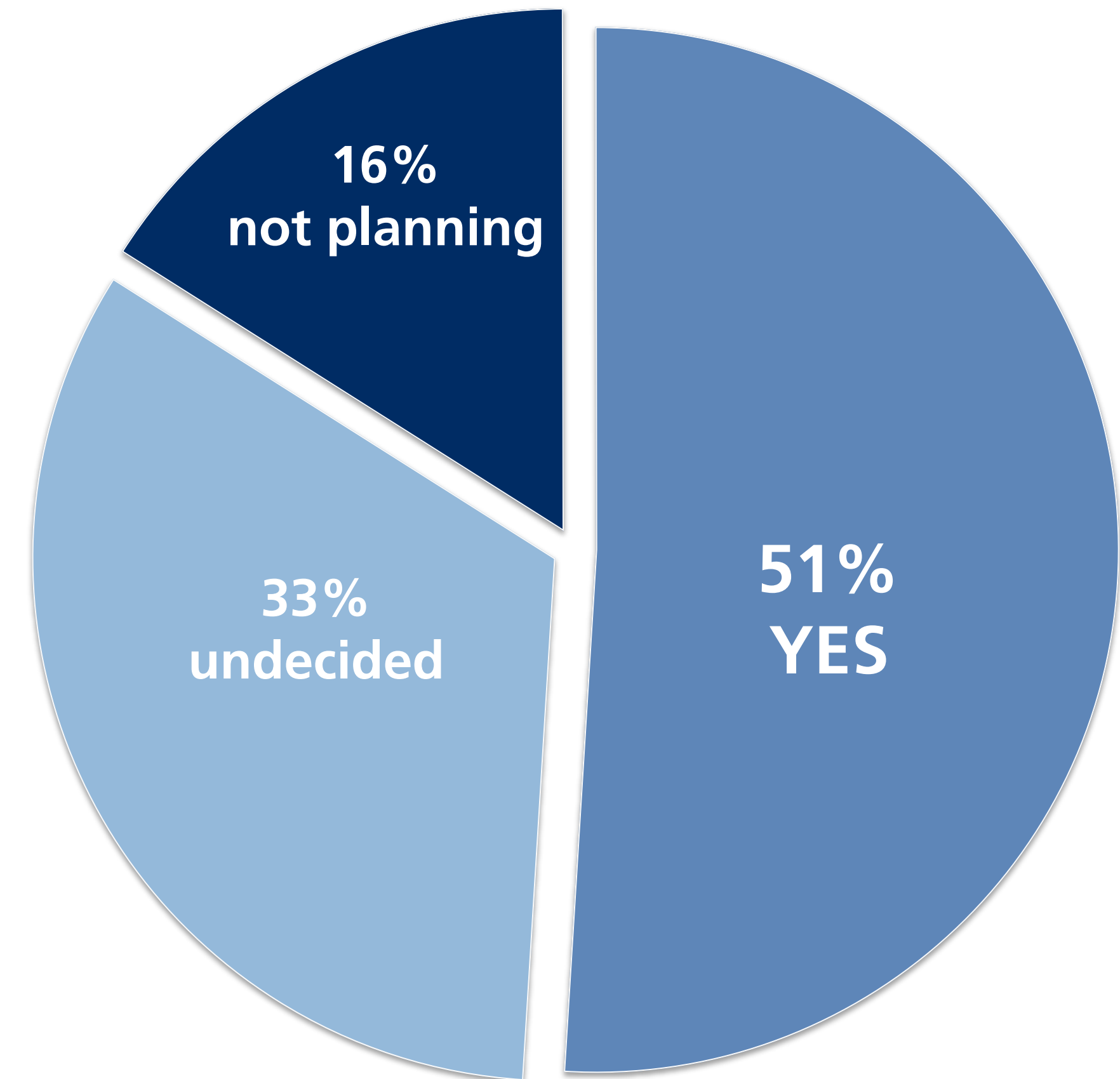


Online survey conducted for LIFE FRONT project

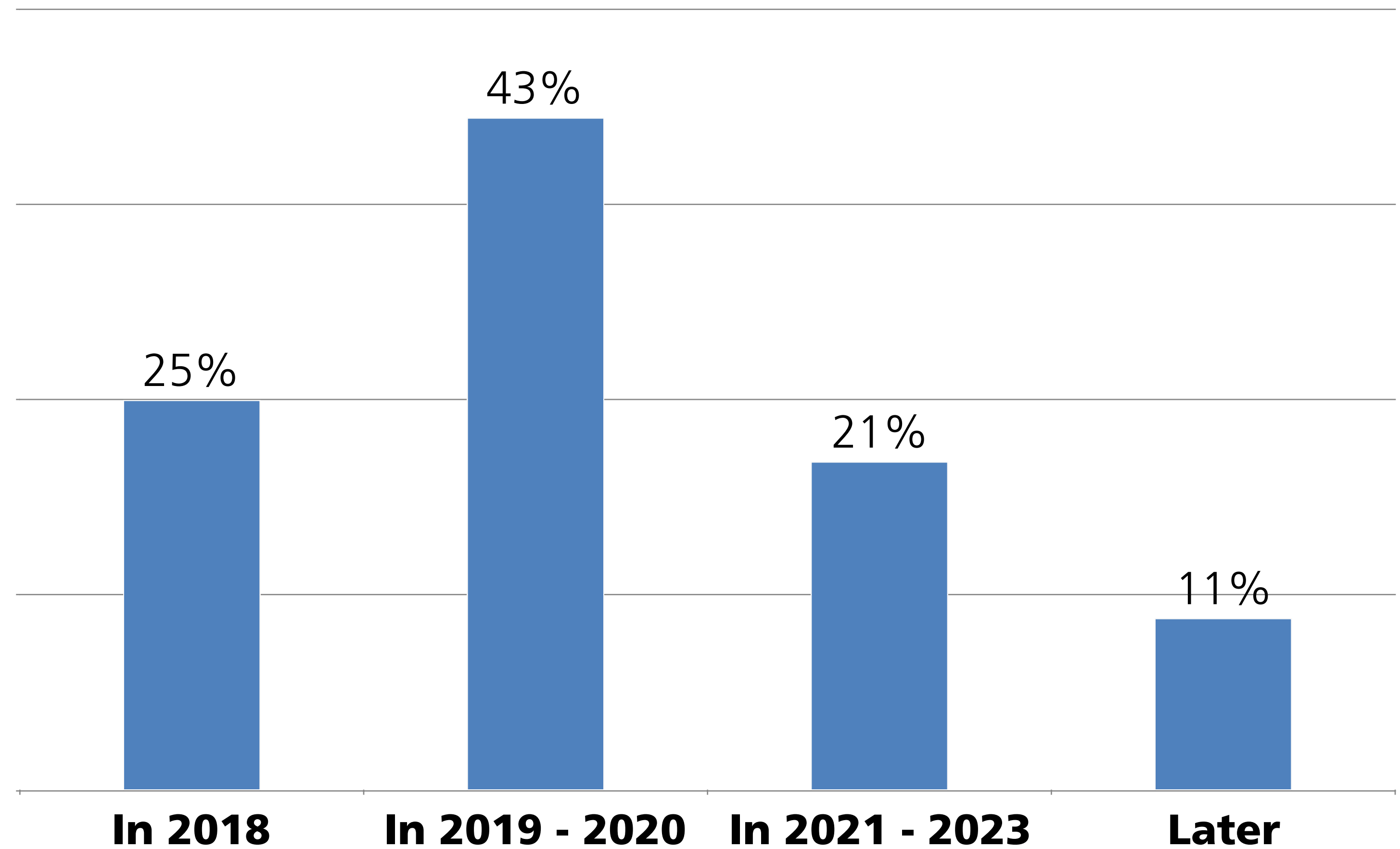
Do you work with HCs?



If NOT, do you plan to start working with HCs?



If YES, when?



INDUSTRIAL REFRIGERATION

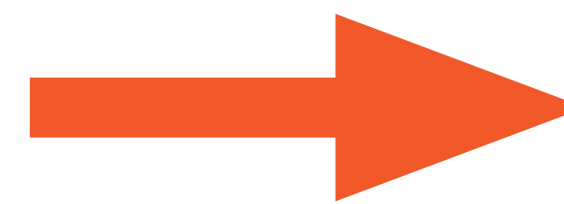
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market traditionally dominated by **ammonia** and HFCs

NR cutting edge technologies becoming strong trend and competing:

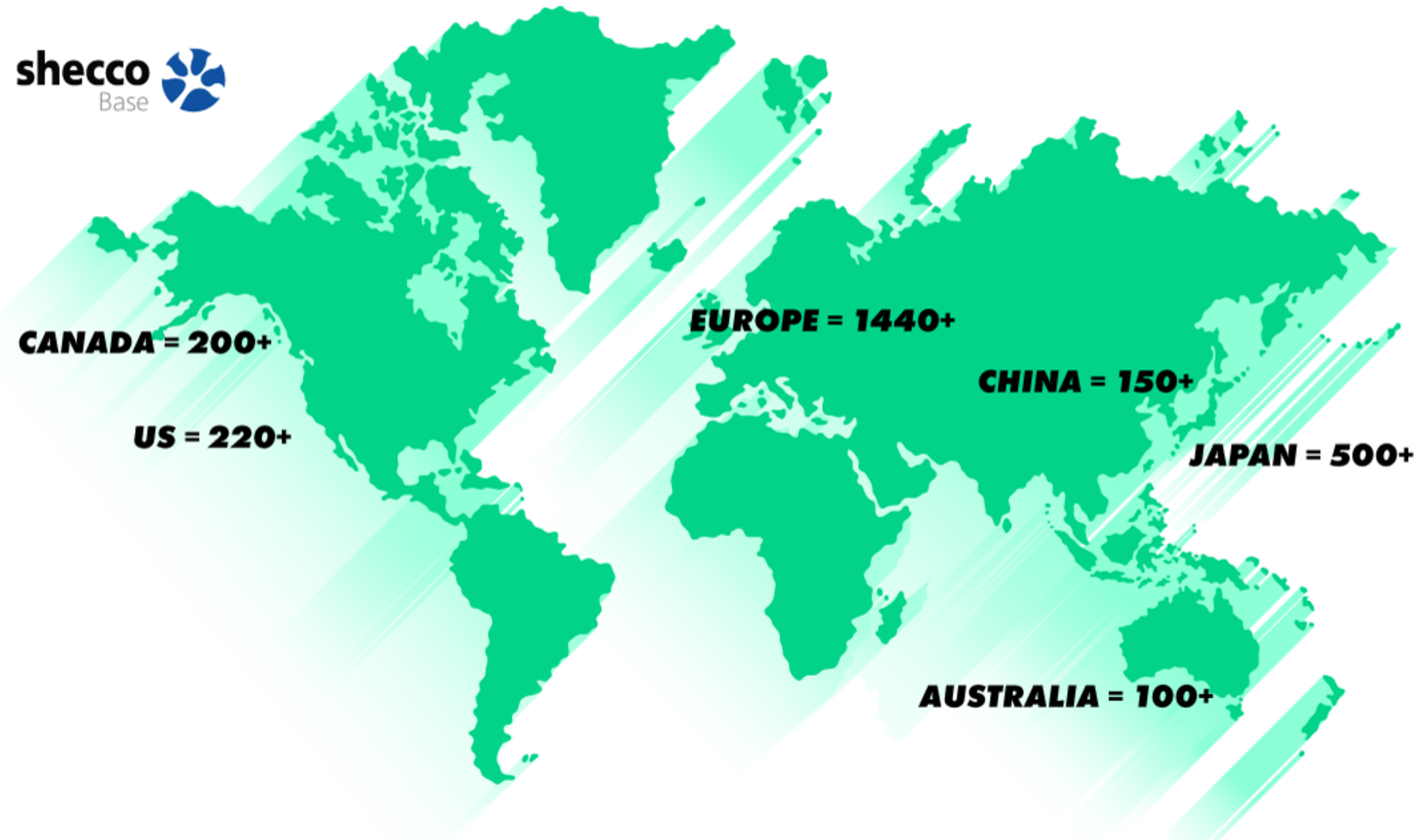
- **low-charge ammonia**
- **NH₃/CO₂ cascade & secondary**
- **CO₂ transcritical**
- **HC & air-based systems**



Key drivers:

- increased safety - lower risk
- higher efficiency
- easier servicing
- return on investment for the end user
- growing competition - prices pushed down, technology becoming more available

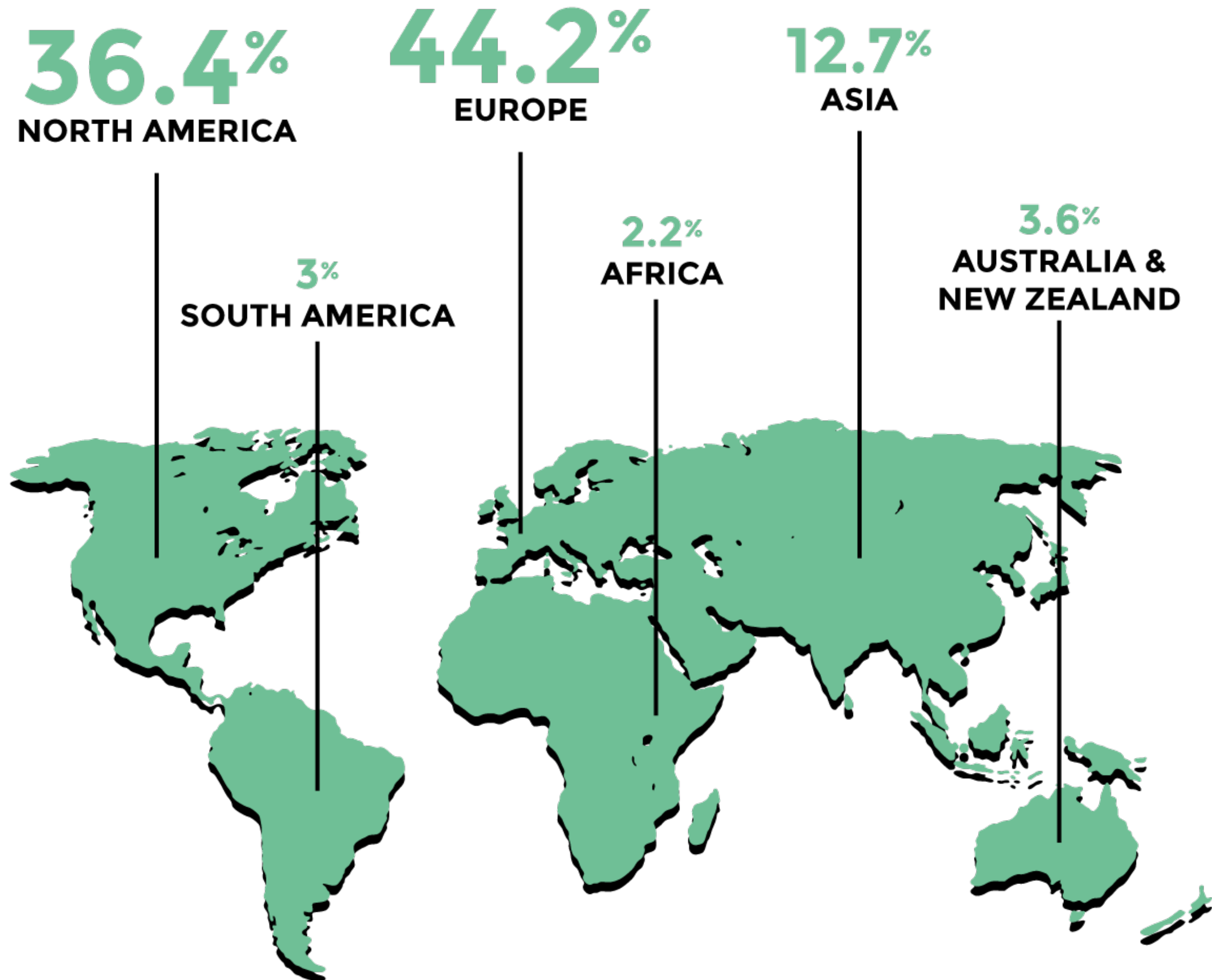
Low charge ammonia installations around the world



*Ongoing data collection under the 'World Guide to Low-Charge Ammonia' project

Which world region do you expect to experience the fastest growth in low charge ammonia installations in the next 5 years?

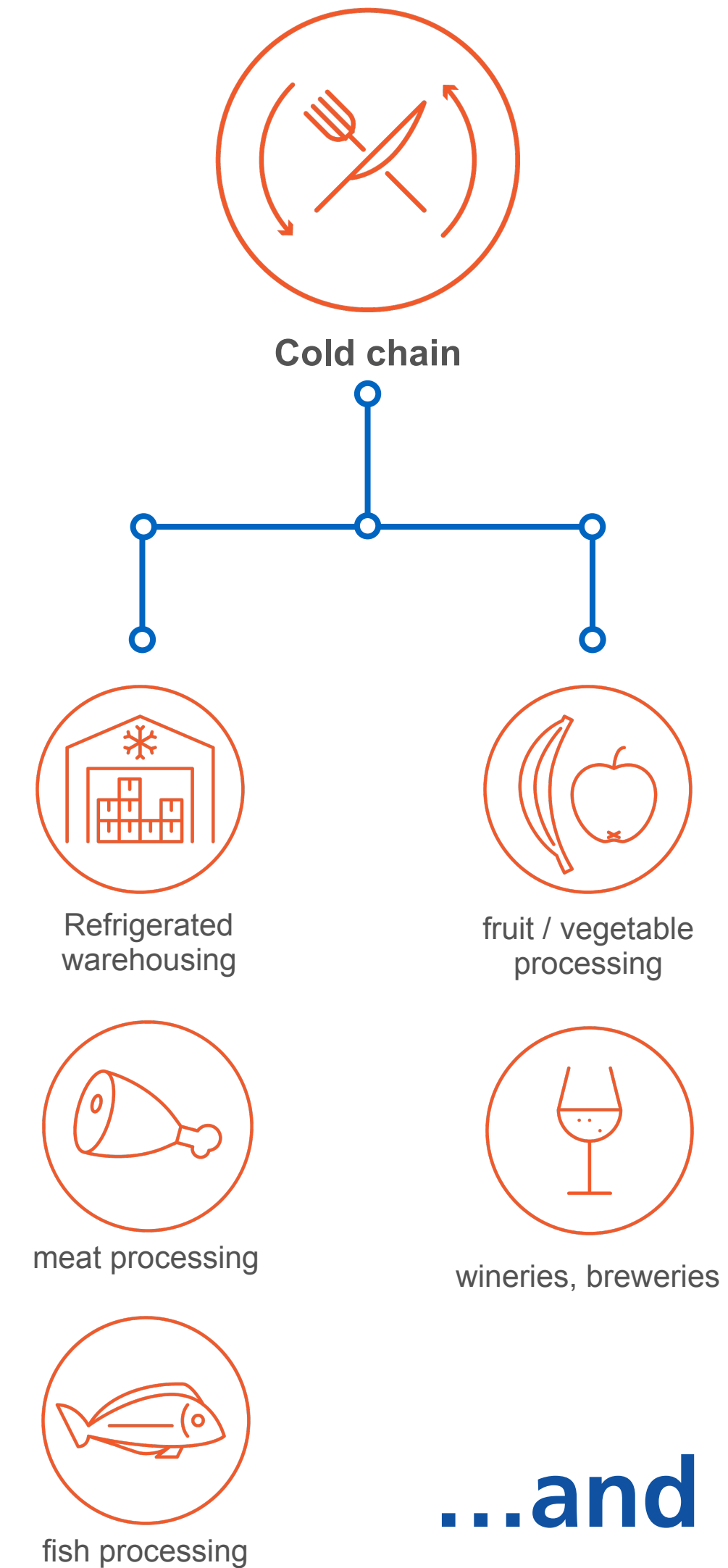
44.2% of respondents expect Europe to experience the fast growth



*Global survey conducted under the 'World Guide to Low-Charge Ammonia' project

CO₂ transcritical - **gaining grounds** in industrial refrigeration in different parts of the world:

- bigger capacity compressors + other components for larger applications becoming available from several key suppliers
- technology especially suitable for small industrial ref (below 300kW) where HFCs were traditionally been used, but also used in larger installations



...and more

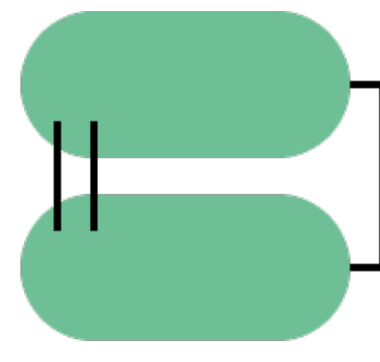
More than **25 companies** known to be providing CO₂ transcritical systems for industrial applications

All major compressor manufacturers claiming to offer **large-capacity compressors**, with some aiming to push limits even further

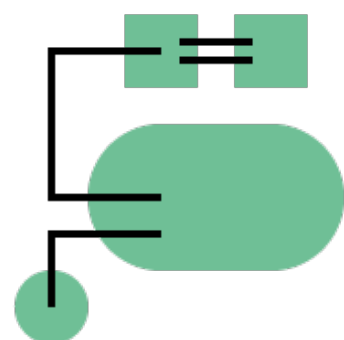




Low charged packaged ammonia systems



NH₃ + CO₂ cascade systems



Traditional ammonia systems

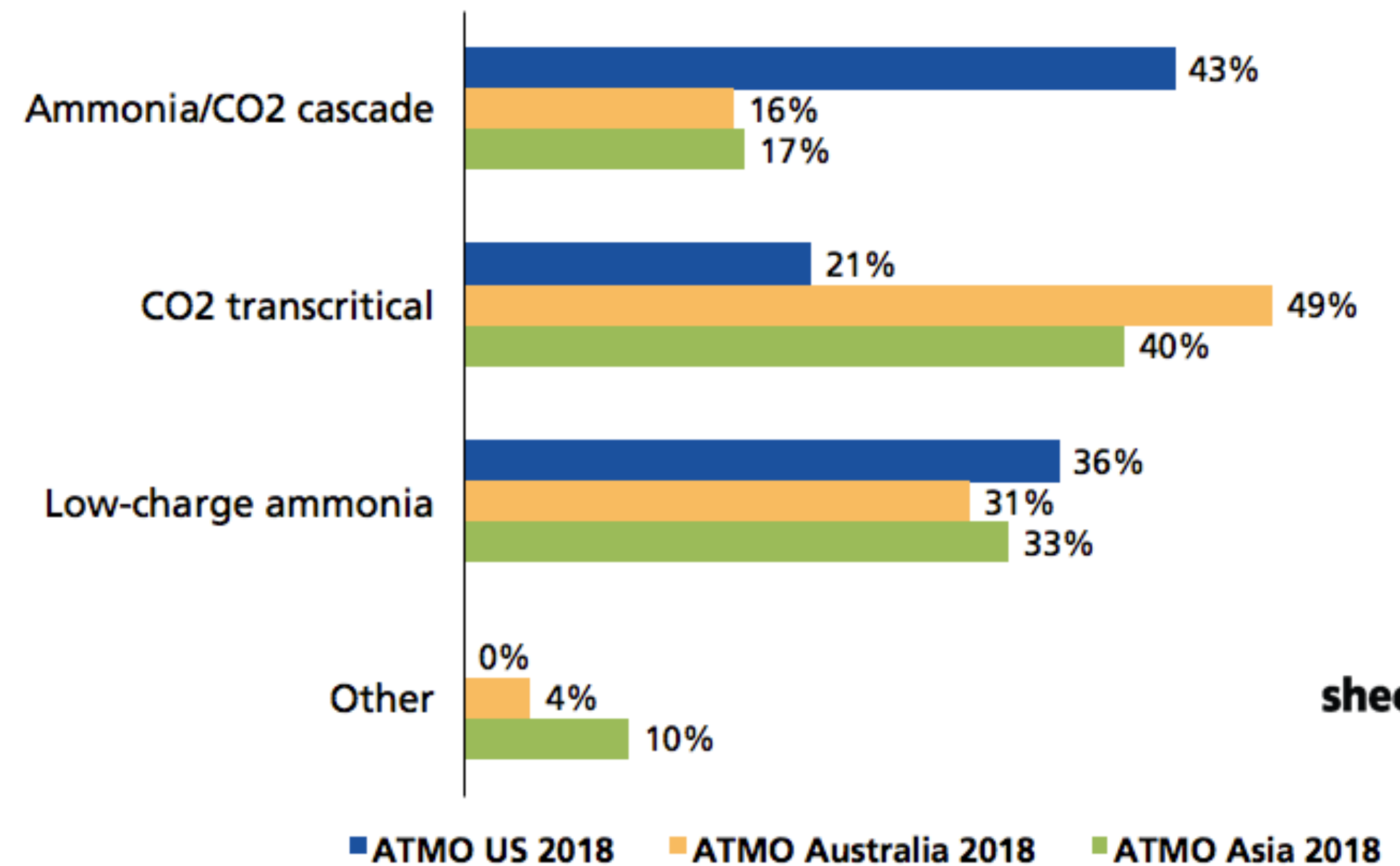


Transcritical CO₂



Other

Which natural refrigerant-based technology holds the biggest potential for industrial refrigeration over the next 5 years?



Live polling responses during ATMOsphere 2018 conferences

*Global survey conducted under the 'World Guide to Low-Charge Ammonia' project

HEAT PUMPS & AC

04

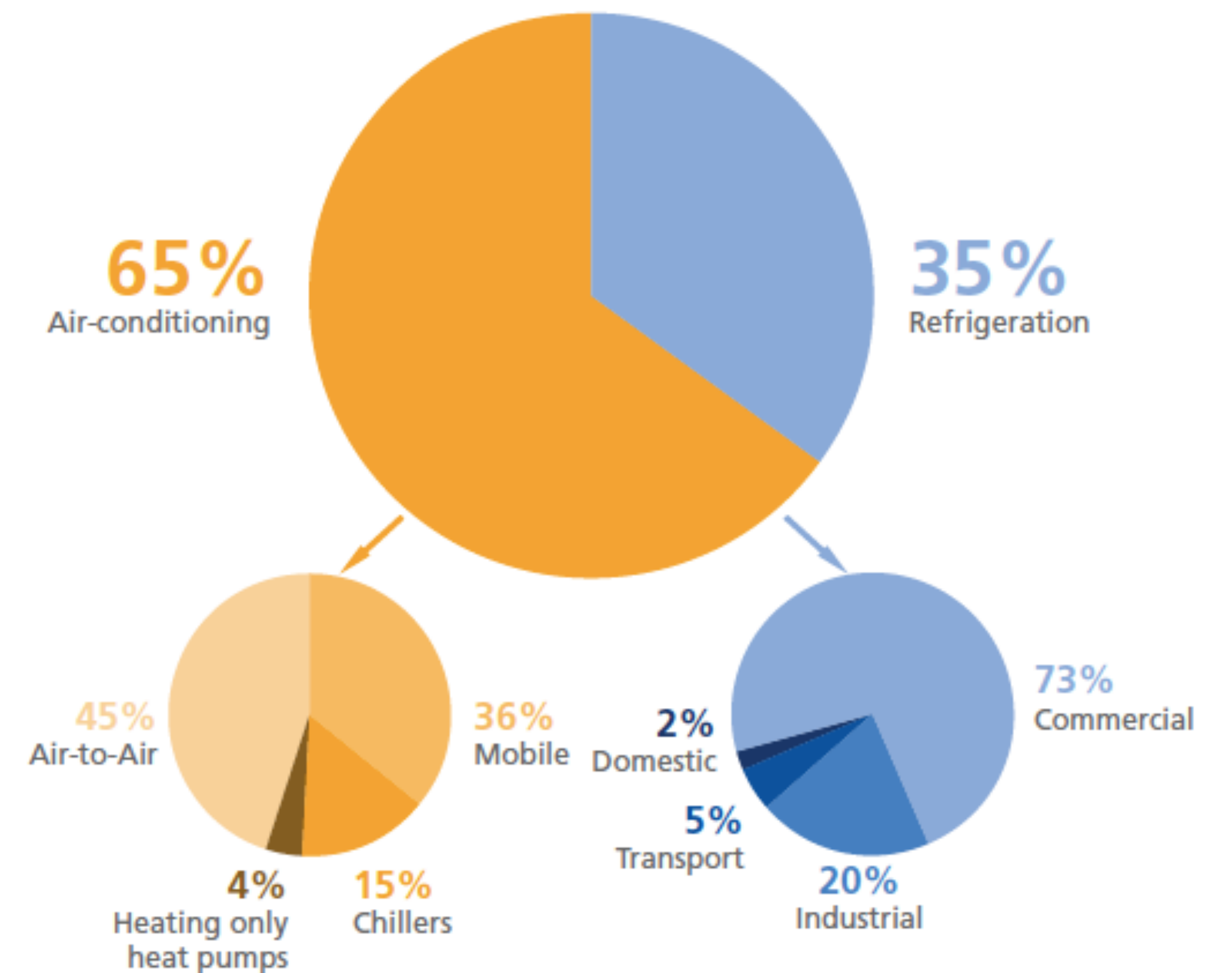


Globally, the **need for air conditioning is set to increase** due to rising temperatures and a growing middle class.

Today, less than 1/3 of households own an AC. By 2050, this could grow to 2/3.

Energy efficient ACs could save as much as USD 2.9 trillion in investment, fuel and operating costs.

UNEP: 65% of HFC use comes from AC (in CO₂e)



Supply of split and window RAC units comes **predominantly from Asia**

India: Split AC represents 80% of total AC units sold in India

- Currently **600,000+ R290 units installed** in the market
- Major leader: Godrej Appliances

China: Market share of 85%, 100+ million AC units / year

- 20 RAC production lines converted to R290 - **potential to make 6 million R290 RAC units per year**
- But only < 10,000 R290 units installed
- Major players: Midea, Gree, Haier, TCL,...

= active policy support, update of safety regulations, and stronger industry commitment are needed to unlock full R290 RAC market potential



R290 portable AC: EU F-Gas Regulation bans the use of HFCs with GWP > 150 in portable AC as of 2020

At least 8 manufacturers, estimated number of HC-based portable AC units in Europe: **200,000+**

All new products are expected to use R290 within the next 2 years

R290 heat pumps (residential): At least 15 manufacturers and more planning to introduce new products, but current production volumes are low

Estimated **220,000+** HC residential units installed in Europe



Growing interest in HC based water chillers targeting **commercial air-conditioning** and **process cooling applications**.

Growing number of manufacturers: 25+ mostly in Europe... and many new players



CO₂ heat pumps: targeting **commercial hot water supply, air-conditioning applications**

- globally estimated **15,000 commercial CO₂ heat pumps** (majority in Japan & China)

CO₂ chillers: refrigeration & air-conditioning applications

- limited number of suppliers / installations for the moment, but high potential for the future



TRANSPORT & MOBILE AC

04



Maersk Line (Colombia) testing **100** refrigerated shipping containers fitted with Carrier Transicold's NaturaLINE CO₂ refrigeration system

MSC Mediterranean Shipping announced it will lease **2,000** containers using Carrier Transicold's NaturaLINE CO₂ refrigeration system

Source: r744.com



Some major automotive manufacturers are turning towards **CO₂ for mobile air conditioning systems**

Estimated number of CO₂ MAC units in the market: **12,000 -15,000**

CO₂ also holds biggest potential for vehicles with electric powertrains



Mercedes-Benz



Volkswagen

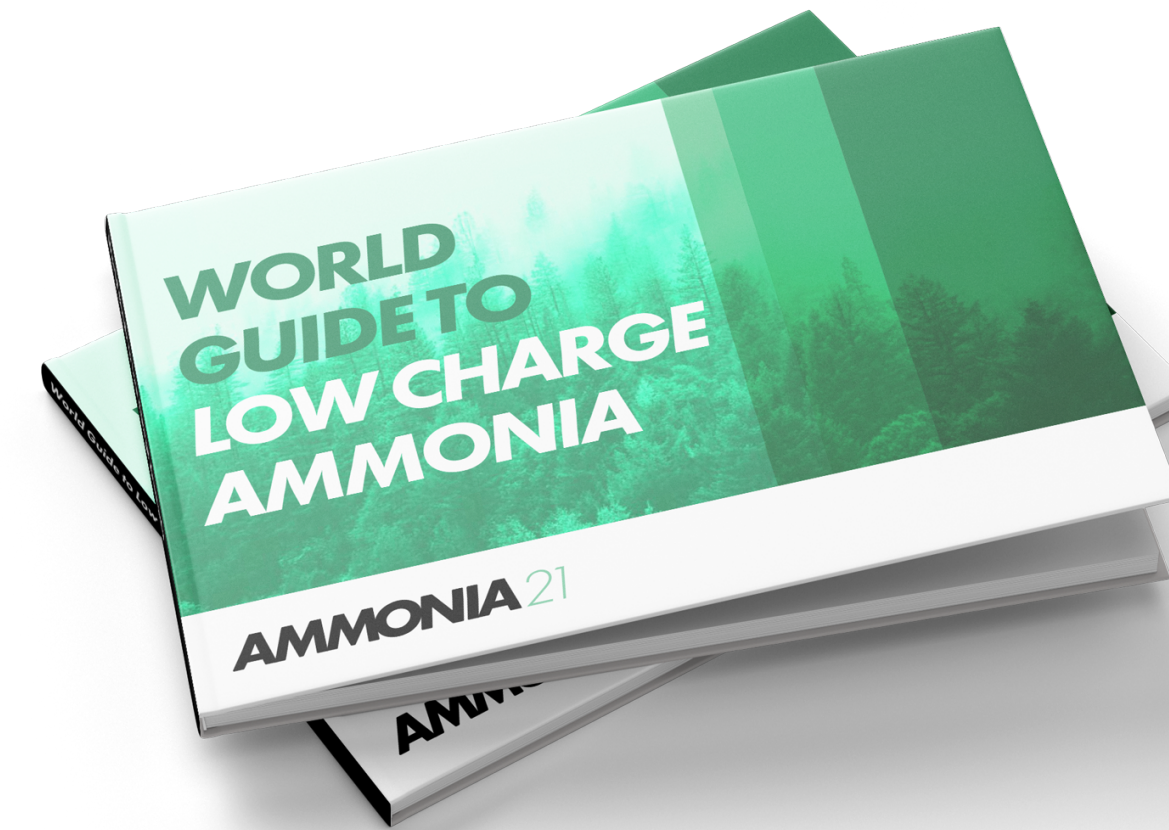


UPCOMING 2019 GUIDES



First comprehensive guide to the low charge ammonia industry

- Market analysis
- Technology trends
- Case studies
- Code & standards updates
- New applications for ammonia



Report on CO₂ transcritical technology used in convenience stores, supermarkets and industrial refrigeration.

Report will be **free**, distributed online and in print (on demand)

- Market analysis
- Technology trends
- Case studies
- Policy updates





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Thank you