Natural Refrigerants: Global market trends

ATMOsphere Australia

Sydney

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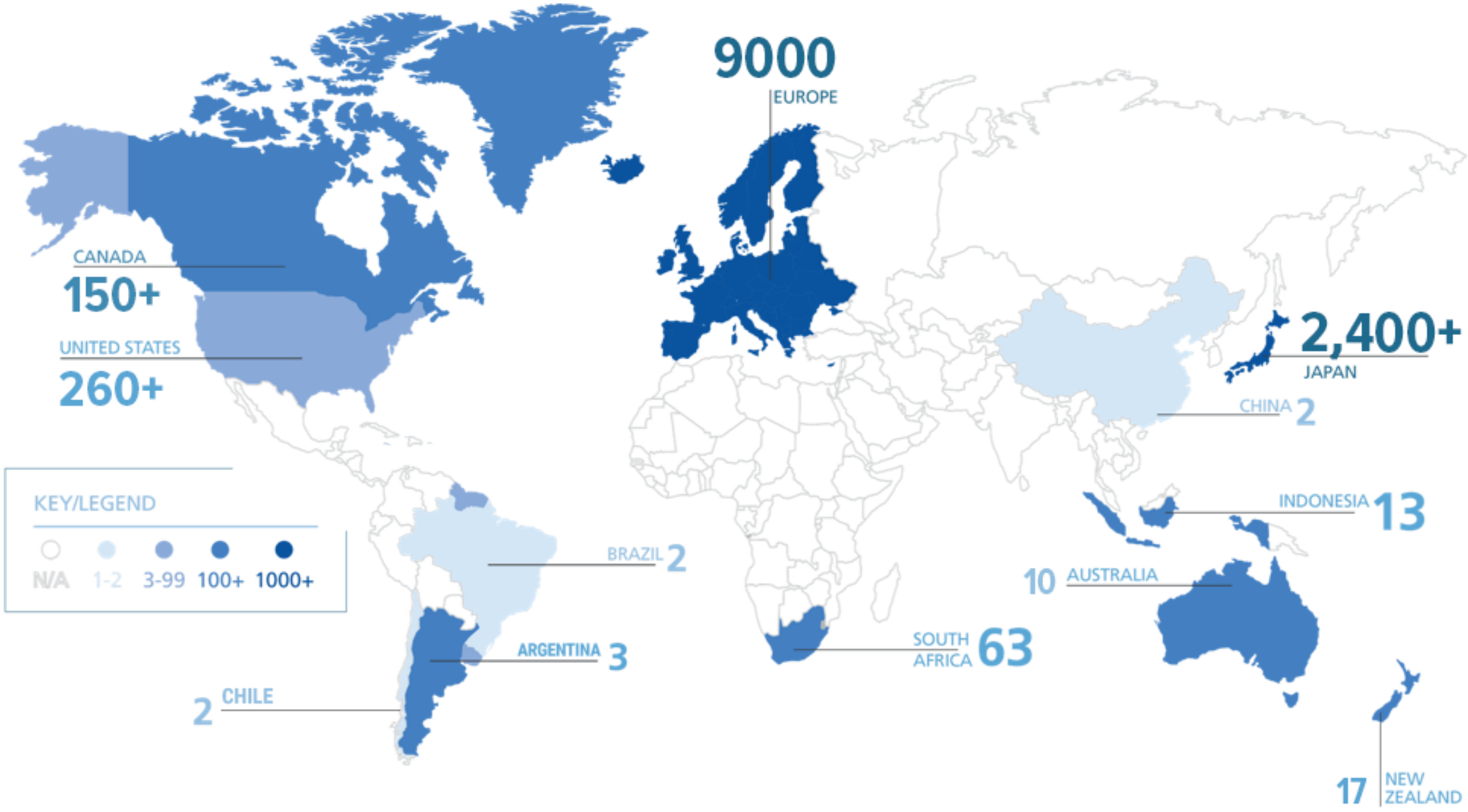
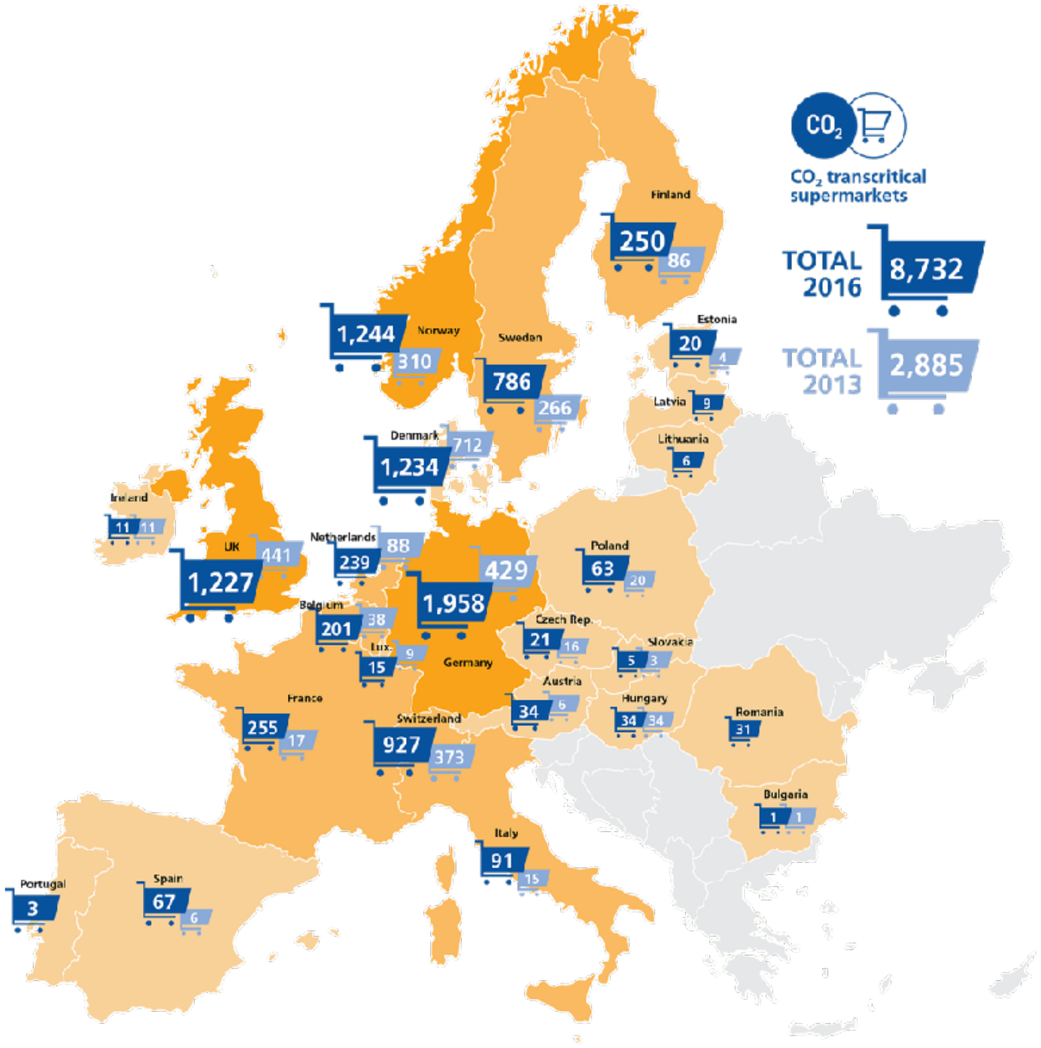
COMMERCIAL REFRIGERATION

CO_2 TC STORES GROWING GLOBALLY (FEB 2017)



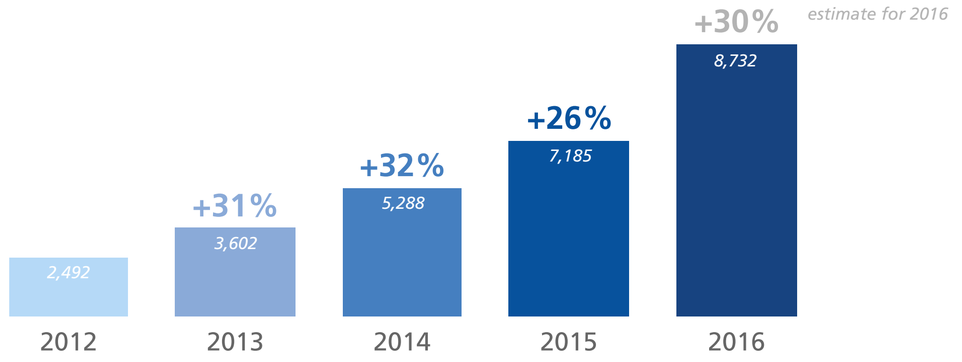
CO_2 TC STORES IN EUROPE (MID 2016)



Number of CO_2 stores in the EU, Norway, Switzerland has **tripled** in the last 3 years = **8% of the overall market share** in the food retail market

Despite earlier claims that there are no viable solutions for warmer climates, the **number of new installations is growing steeply in Southern Europe**

Growth of CO_2-based stores



CO2 SUBCRITICAL MARKET IN CHINA (FEB 2017 UPDATE)

- Currently **32 subcritical CO_2 supermarkets** in China (HFC/CO_2 cascades) - south east region
- Majority operated by Metro China, first ever installed by Tesco
- 5 contractors able to handle CO_2 installations
- **Market opening up to CO_2 TC** - discussion about subsidy for retailers from the Gov

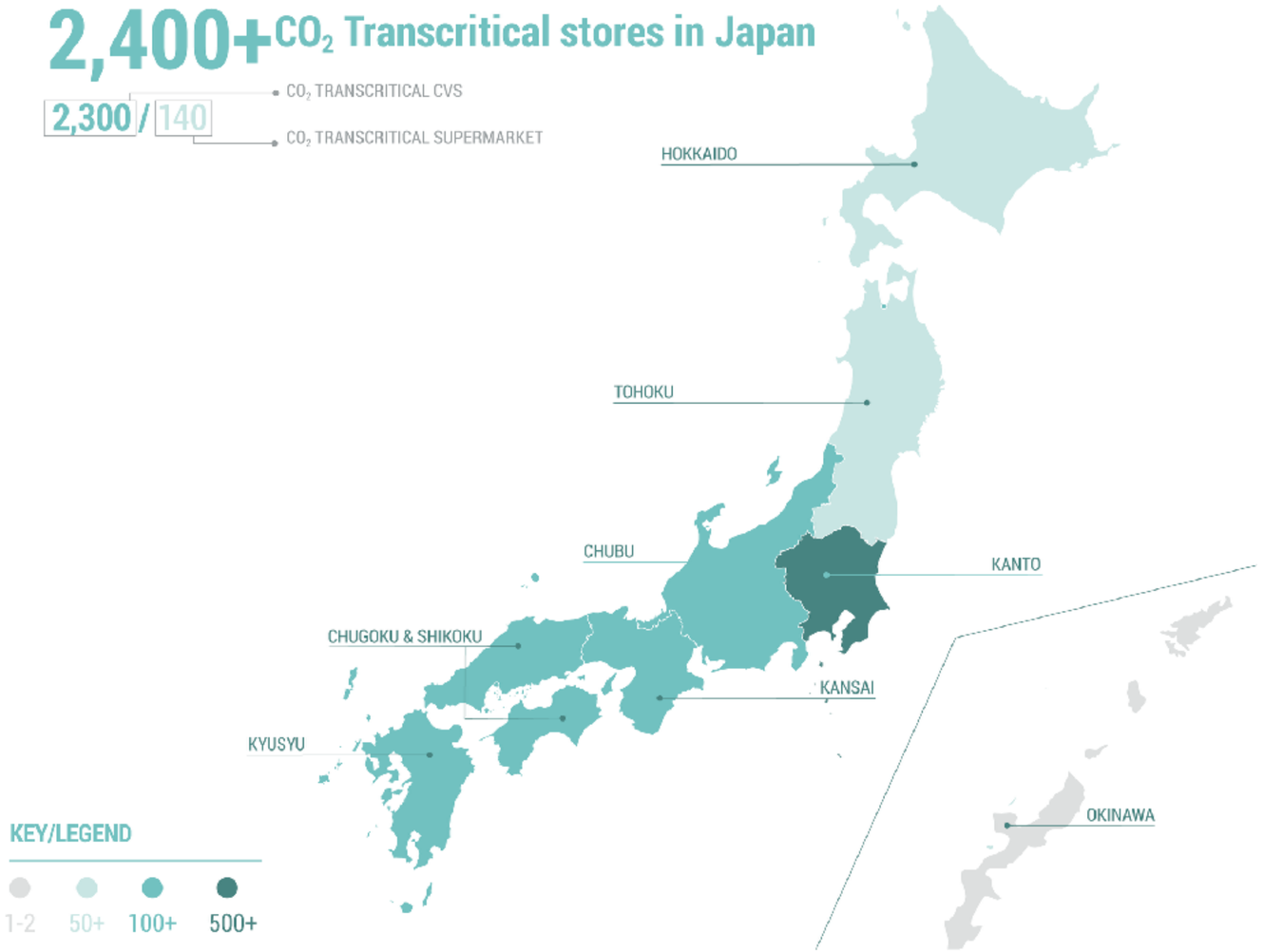
CHINA: LIST OF RECOMMENDED SUBSTITUTES FOR R22

Natural Refrigerants recommended by MEP/FECO China in majority of targeted HVAC&R segments

- **R290** - Room air conditioner, Heat pump water heater, Stand-alone refrigeration system
- **R600a** - Stand-alone refrigeration system
- **CO_2** - Domestic heat pump water heaters, industrial or commercial heat pump water heaters, Industrial or commercial refrigeration system (refrigerant or secondary refrigerant)
- **NH_3** - Cold storage, condensing unit, industrial refrigeration system

FECO

CO_2 TC STORES IN JAPAN (FEB 2017)



HYDROCARBONS GROWTH - AHT

Plug-in Units in Supermarkets with R290: A reality today

Market estimate by early 2017:

1,500,000+ units worldwide

Figures reported by AHT (market leader) by 2017:

- over 300,000+ units manufactured per year

KEY TREND: CO_2 BECOMING MAINSTREAM IN RETAIL

Strong investment of large food retail groups = CO_2
Transcritical systems becoming the norm in Europe, N. America, Japan.

Efficiency and reliability are increasing, and prices are going down.

Case Study: Aldi Süd reaches 1000th installation:

- Strategic decision in 2010: Exclusive focus on natural refrigerants

- Now: Over 54% of all Aldi Süd's stores globally are running on CO_2

Source:

r744.com/articles/7423/aldi_sud_proud_to_install_1_000th_co2_system

CASE STUDY WITH HYDROCARBONS – COLRUYT

Belgian retailer **Colruyt** targeting **100% hydrocarbons for refrigeration**. Exclusive use of hydrocarbons as of 2017

Based on:

- Medium capacity chiller (2,5kg of R290 charge) + secondary glycol loop

- Standalone chest freezers (R600a)

Reported:

- High energy savings

- Reduced leakage rate to approx 5%

Source: hydrocarbons21.com

(http://hydrocarbons21.com/articles/7438/colruyt_pursues_100_fossil_fuel_free_stores)

CASE STUDY WITH HYDROCARBONS - WHOLE FOODS

Whole Foods pushes the propane envelope

The organic/natural food retailer Whole Foods Market, which has installed small-charge propane cases in many stores, is the first in the U.S. to test a centralised propane/CO_2 cascade system

Source: Accelerate America

(http://acceleratena.com/sites/action/AA1610/read/s_main)

Three low-temperature propane chillers

KEY TREND: CO_2 RACK SYSTEM

10+ suppliers providing CO_2 solutions - highly competitive market

KEY TREND: CONDENSING UNITS / SMALLER SYSTEMS

Europe traditionally working with large capacity CO_2 racks

Recently several manufacturers introduced small systems

Competition increasing: more efficiency, lower prices

EUROSHOP 2017 – KEY TRENDS & INSIGHTS

- On-the-spot **survey to 33 companies**, including major players of the sector
- **Ejectors**, **parallel compression** and **waterloop systems** identified to be the main technology trends,
- Approximately **15-20% increase in production** of natural refrigerant systems expected for the period 2017-2018
- **R290 dominating plug-ins**, showing the greatest potential
- Even higher growth expected by 2020 and beyond, with a few companies claiming that they will be ready to have their **entire production moving to only natural refrigerants**
- **Regulation** and mainly **customer demand** are the reasons for the expectations, especially for Europe

EUROSHOP 2017 – KEY TRENDS & INSIGHTS

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COMPANIES GOING TOWARDS HC – TRUE MANUFACTURING

- True Manufacturing (Global)
  - **Committed to move entire manufacturing to 100% HC (R290) by 2019**
  - Heavy investments in R&D over the last five years
  - Currently 2/3 through the transition from R134a and R404A to R290
  - Partly motivated by regulation (**F-GAS, US DOE, US SNAP**)
  - HC systems cheaper to run and more cost effective than HFC counterparts (**25+% more efficient**)
  - 327 HC base models that meet DOE's 2017 standards
  - T-23-HC single door commercial refrigerator consumes 1.27kWh daily (DOE's limit: 2.27kWh daily) => 31.76$ energy costs saved over a year (at 10cents/kWh)

INDUSTRIAL REFRIGERATION

02

LOW CHARGE AMMONIA – STRONG UPCOMING TREND

Low-charge Ammonia systems are becoming a strong trend for industrial refrigeration, traditionally dominated by HFCs/ large Ammonia installations with big refrigerant charge

Key drivers:

- increased safety- lower risk

- higher efficiency

- easier servicing (more compact units)

- return on investment for the end user

KEY TREND: INDUSTRIAL APPLICATIONS WITH CO_2 & NH_3

INDUSTRIAL REFRIGERATION WITH CO2 & NH3 IN CHINA

- **Estimated 100+ refrigeration projects in industrial sector with CO_2 & NH_3**

INDUSTRIAL REFRIGERATION WITH CO_2 & NH_3 IN JAPAN

the market is changing, from a strong reliance on R22 to a renewed uptake of (lower charge) NH_3 systems

Estimated **450+ installations** use secondary NH_3-CO_2 systems

BUT: the use of CO_2 transcritical systems still faces restrictions through the High Pressure Gas Safety Act

CO_2 IN INDUSTRIAL APPLICATIONS – CASE STUDY

World's biggest CO_2 industrial plant
(vegetable processing plant in the Netherlands by Advansor for Staay Food group):

- 3,36 Megawatt (MW) total cooling capacity
- 7 transcritical CO_2 racks
- 45 Bock compressors (28 medium temp., 14 parallel, 3 frost)
- 600 kW of heat recovery, providing "free" heating for the office facilities
- Installation in 2016, in operation since early 2017
- Lower capital, installation & maintenance costs.

Source:

http://www.r744.com/articles/7124/advansor_to_deliver_world_s_biggest_co_sub_2_sub_system_so_far

Evaporating capacity of system
- 0,53 MW at -7 °C,
- 1,87 MW at -5°C,
- 0,78 MW at 0°C and
- 0,03MW at -28°C.
- 0,15 MW of cooling for AC purpose.

FIRST NH_3/CO_2 SYSTEM IN ARGENTINA

System installed at a **Carrefour** distribution centre in Buenos Aires.

First of its kind in Argentina, and second in Latin America

- Ammonia - CO_2 - brine system
- Installation began in 2016, running since 19 Jan 2017
- Biggest in the region: 14,000 m^2
- High cooling and freezing efficiency; low pressure system with a high coefficient of heat transfer
- Lower cost of installation
- Another installation planned for a 3,000 m^2 Arca Continental ice cream facility in Mexico

AUS: LOW CHARGE AMMONIA DX AND CO_2 IN INDUSTRIAL

F. Mayer *reaping rewards of innovation*

Industrial refrigeration veteran from Strathbrook is banking on natural refrigerant technologies to deliver efficiency and sustainability goals for customers across Australia. Accelerate Australia & NZ visits gourmet food firm F. Mayer to find out more.

"In the end, it comes down to reliability, efficiency and capital costs."

Spotlight on Australia: *Innovations shaping change in 2017*

Accelerate Australia & NZ looks ahead to the next twelve months and beyond, hearing from local vendors about the technological innovation, policy developments and evolving standards that are creating new opportunities for natural refrigerants in industrial applications.

LOW-CHARGE AMMONIA TAKING HOLD DOWN UNDER

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AIR CONDITIONING

R290 AIR-CONDITIONING, IS IT COMING?

R290 AIR-CONDITIONING, IS IT COMING?

INDIA – GODREJ APPLIANCES

- **Godrej Appliances**
  - Replaced CFC, HFC and HCFC as early as 2002
  - Efficient and green ACs using R290; first in the world
  - **India's first ACs with 7-star performance**
  - **300,000+ units sold since launch**
  - Earliest brand to opt for voluntary energy labelling of its refrigerators

JAPAN – RESEARCH – LOW-GWP HIGH EFFICIENCY AC

- **Japanese Government (METI) & New Energy Development Organisation (NEDO)**

  - 4 companies participating in the research projects to develop technologies for high energy efficiency low-GWP based small and mid-size air-conditioning systems

  - DENSO - development of **CO_2 (R744) AC system with high efficiency ejector**

  - MITSUBISHI ELECTRIC - development of **HC based room air-conditioning system**

高効率低GWP冷媒を使用した中小型空調機器技術の開発

三菱電機株式会社	自然冷媒を適用したルームエアコンの研究
株式会社デンソー	高効率エジェクタを使用したCO_2冷媒空調システムの開発

HC&NH BASED HEAT PUMPS & WATER CHILLERS

- HC based water chillers introduced by several companies targeting **commercial air-conditioning** and **process cooling applications**

- RSA Cooling - water chiller for outdoor installations, and are available with **cooling capacity from 3,0 to 15,0 kW**

- HC water chillers in Australia, **reliable performance at 45C** days this summer

R718 WATER CHILLER

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SHECCO USEFUL LINKS

Industry Platforms:

www.hydrocarbons21.com

www.R744.com

www.ammonia21.com

shecco Publications, incl. GUIDEs

http://publications.shecco.com

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