

# Basic selection criteria for natural refrigerants

Joachim Schadt / Secon GmbH / 14.09.2022

***SECON***

# Feasibility



	Hydrocarbons R290/R1270/R600a	Ammonia R717	CO2 R744	Water R718
Process Cooling 12°C - 20°C	++ R290	0	--	++
Air Conditioning 6°C - 12°C	++ R290	++	0	-
Medium Temperature -15°C - +5°C	++ R290/R1270	++	++	--
Low Temperature -30°C - -15°C	0 R290/R1270	++	++	--
Heat pumps 35°C - 60°C	++ R290	++	0	0
Booster heat pumps 65°C - 95°C	+ R600a	+	+	++

# Evaluation criteria

	Hydrocarbons R290/R1270/R600a	Ammonia R717	CO2 R744	Water R718
Disadvantages	Flammability	Toxicity	High pressures Oxygen displacement	Limited application range
Purchase costs	medium	high	medium	very high
Maintenance costs	medium	high	medium	low
Efficiency	high	high	high	high
Ambient temperatures	50°C no water required	40°C for higher temp. Water required	43°C for higher temp. Water required	40°C water always required

Almost all applications can already be covered efficiently, safely and economically with natural refrigerants!

# Use cases - Supermarket

- **Product cooling**
  - MT (diary, fresh meat products, convenience products, beverage, vegetables)
  - LT (frozen meat, bakery products, convenience products)
    - R744 condensing units transcritical (separate units for MT and LT)
    - R744 racks/booster transcritical (ratio between MT and LT!)
    - R290/R1270 chiller (MT) + subcritical CO<sub>2</sub> dx (LT)
    - R290 waterloop systems
    - R290 Plug-in cabinets (MT/LT)

# Use cases - Supermarket

- **Air conditioning and heating**

- AC (human comfort, quality control)

- Heating (human comfort)

- R290 chiller (air- or water-cooled -> if heating is required -> reversible units)

- R744 or R290 All-In-One-Systems (cooling + HR + HP)

- Heat recovery of refrigeration units

# Recommendations

- Optimize System temperatures
  - Plan enough space for the cooling systems
  - Avoid water consumption (evaporative condenser/ adiabatic gas cooler or adiabatic dry cooler)
  - Consider a certain redundancy and options for extension
- Request the supply of safety concept (-> risk analysis) including installation conditions
  - Specify not only capacities and temperature levels, but also get binding values for delta t (evaporator + condenser)
  - Ask for system limitations and system requirements



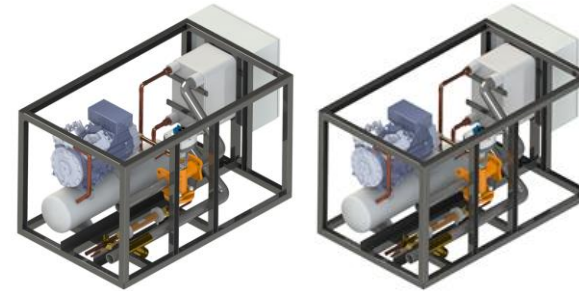
# Modular systems

## Compact chiller (R290/R1270)



MT: 15-40 kW  
AC: 25-60 kW  
HP: 35-65 kW  
Charge max. 2.5 kg

## Smart-Freeze (R744 dx)



Subcritical (-30°C/0°C)  
LT: 3-25 kW





- **Joachim Schadt**
- CEO, Secon GmbH, Gondelsheim (Germany)
- [j.schadt@secon-gmbh.com](mailto:j.schadt@secon-gmbh.com)