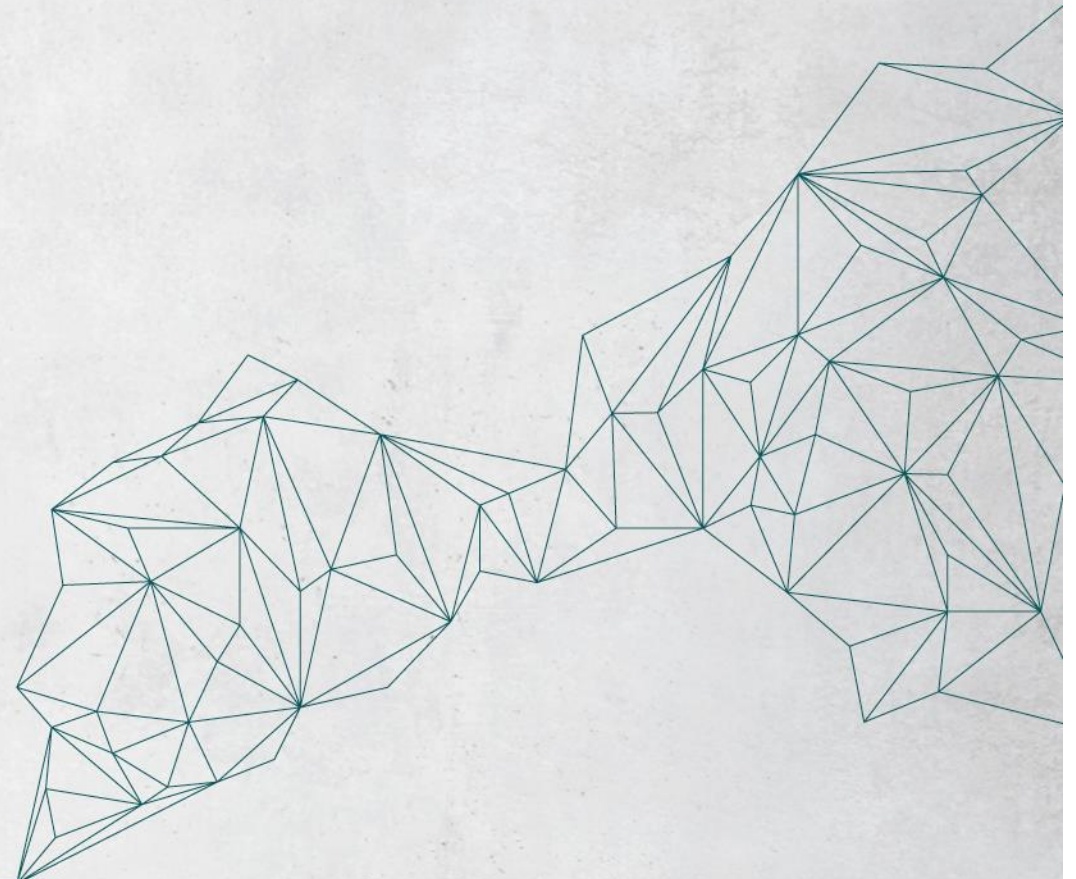


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Andreas Uitz

Department Manager Global Product Management

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Semi-Plug-in (SPI)  
Technology in the  
energy crisis?

If not now, when?



ENERGY CRISIS



Headquarter in Austria



4 Factories



33% market share global



64% market share in Europe



+115 supplied countries



+4.700 customers



+1.400 employees



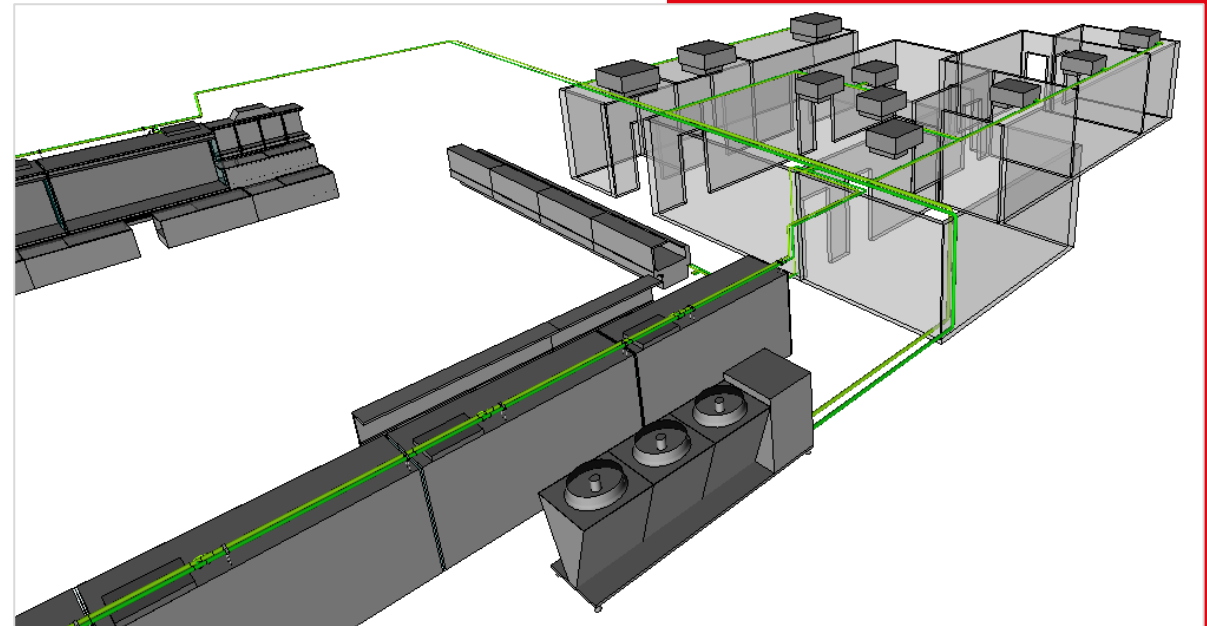
**AHT**  
*a member of **DAIKIN** group*

Production, planning, sales, installation, service & maintenance for commercial refrigeration technology since 1983.

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## Introduction

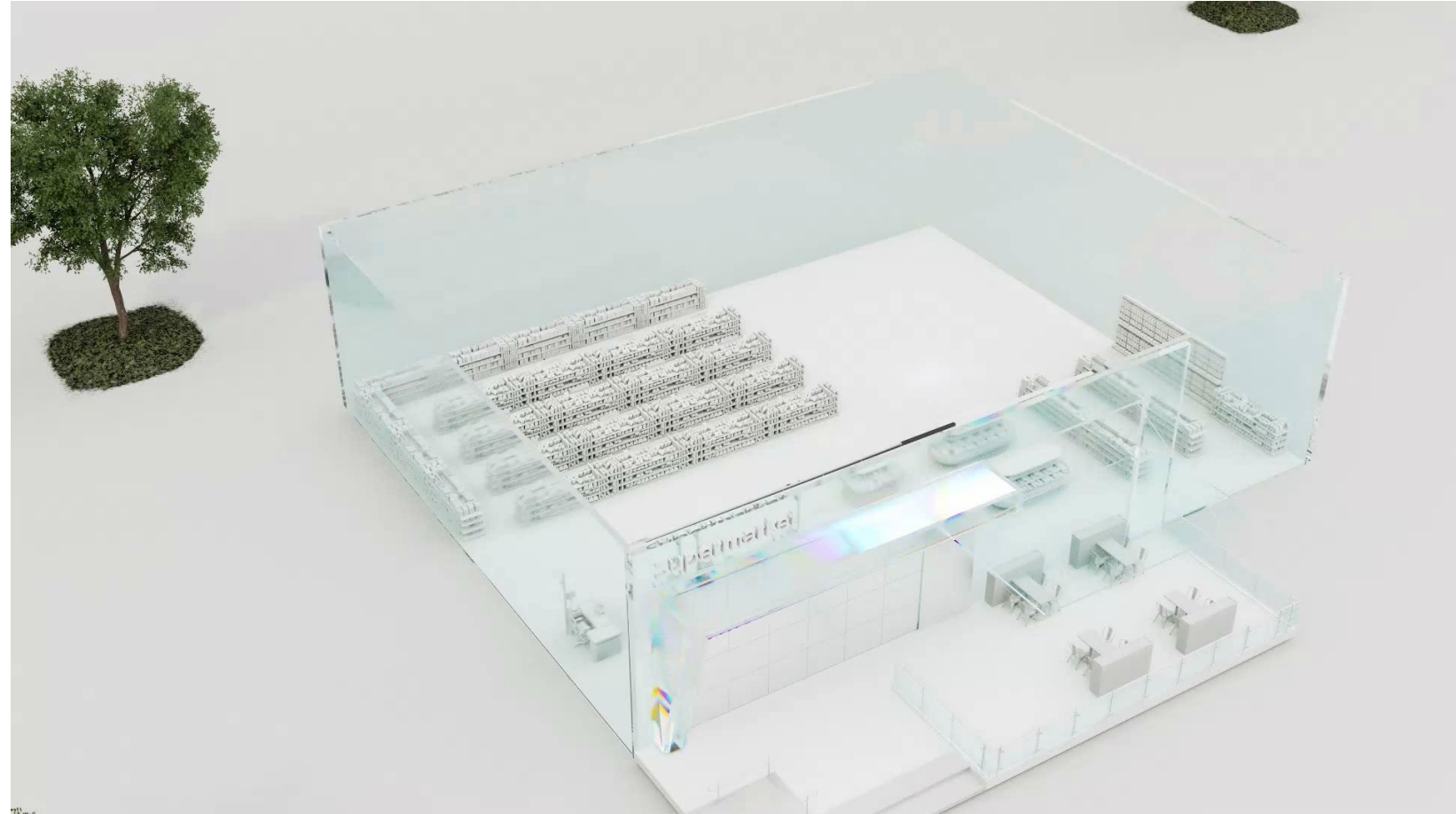
- \_ More than 12 years of experience with SPI
  - \_ Complete portfolio with natural refrigerants since 2002
  - \_ Several thousand SPI systems in operation
  - \_ More than 6,000,000 devices produced
  - \_ Optimal for all climate zones (EU, MEA, NAM, LATAM, APAC)
  - \_ Increase in providers at Euroshop 2023
- = System consideration under the new framework conditions



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## Technological Foundations:

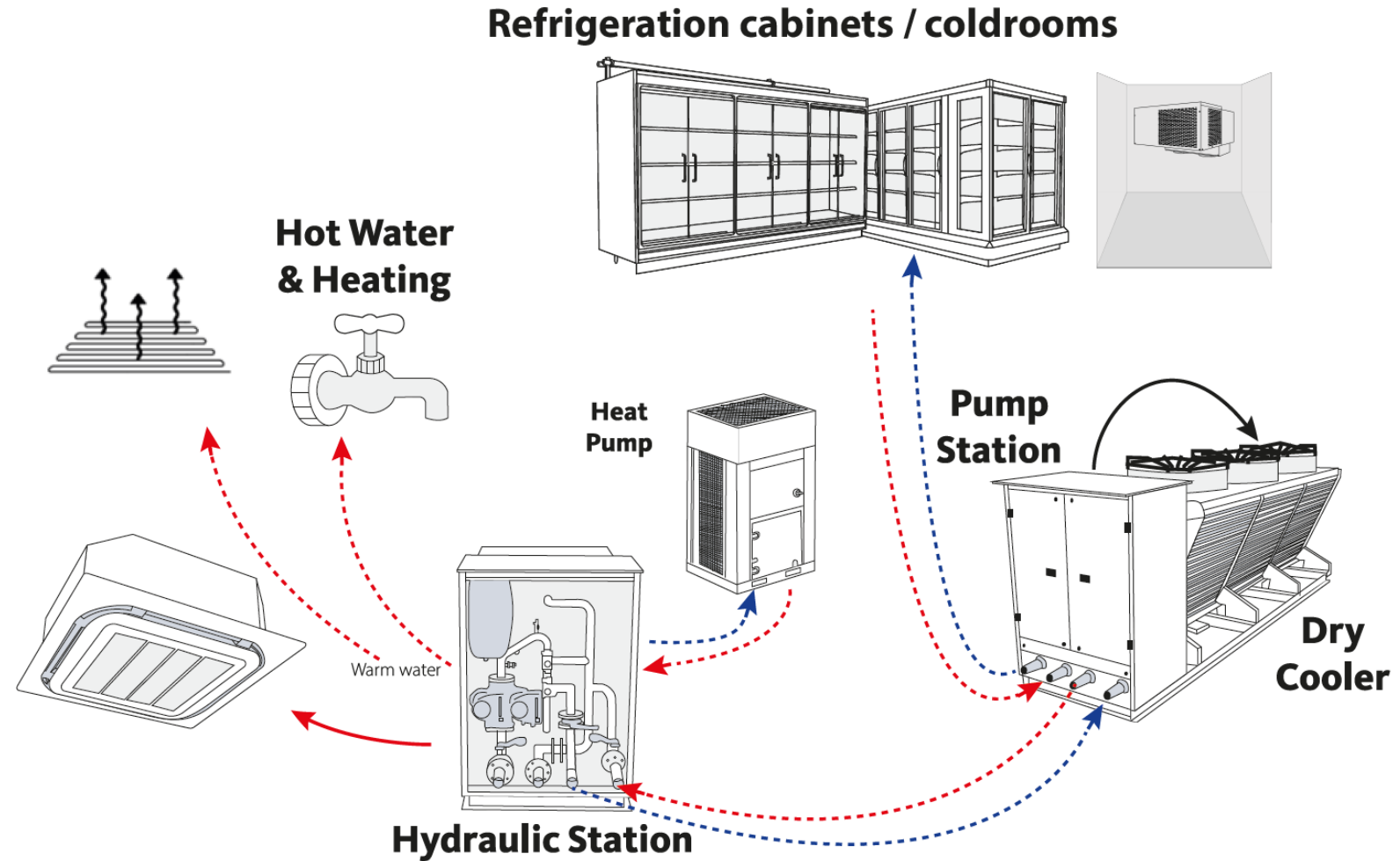
- Refrigerated furniture & refrigeration room units with hermetically sealed refrigeration circuits
- Refrigerant R290 propane
- Polypropylene glycol-water mixture (water loop) for the removal of process waste heat
- Thermal energy can and will be used for heat recovery



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## Heat recovery & temperature operating range

- Temperature operating range typically between +9 °C and +48 °C.
- By using heat recovery heat pumps, up to 60°C can be achieved.
- Suitable for summer peak temperatures (=> no failure).
- Heating purposes with concrete core activation.
- Process waste heat for efficiency improvement.

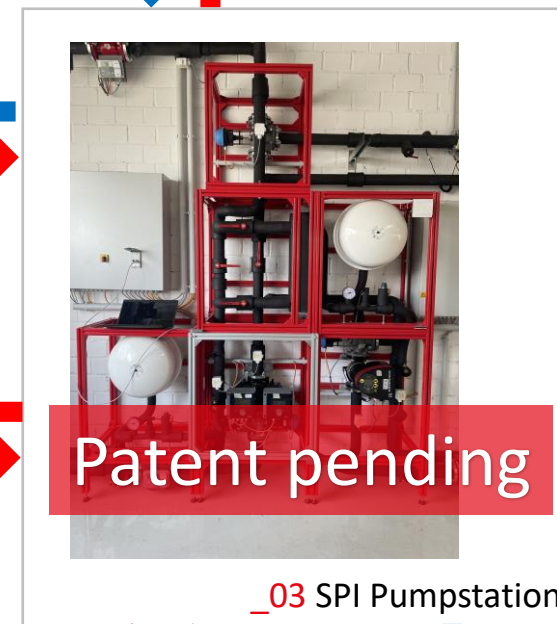
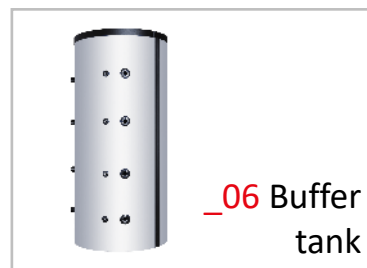
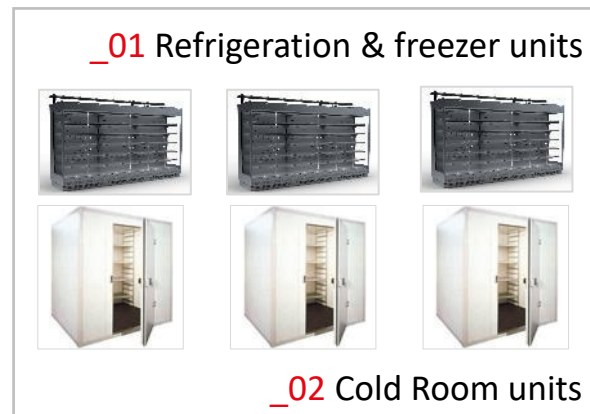




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## AHT SPI system General setup

- \_01 Refrigeration & freezer units
- \_02 Cold Room units
- \_03 Modular SPI Pumpstation
- \_04 Dry cooler
- \_05 Fan coils & Air handling units
- \_06 Buffer tank
- \_07 Heat Pump



### OSSM – One Stop Shop Manager

This box, developed by AHT, is a control unit that coordinates the thermal/cooling energy and sends signals to the components based on collected sensor information and predefined settings.



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## Energy efficiency & sustainability

- High operational safety
- Leakage risk < 1% \*
- Comparable or better energy efficiency





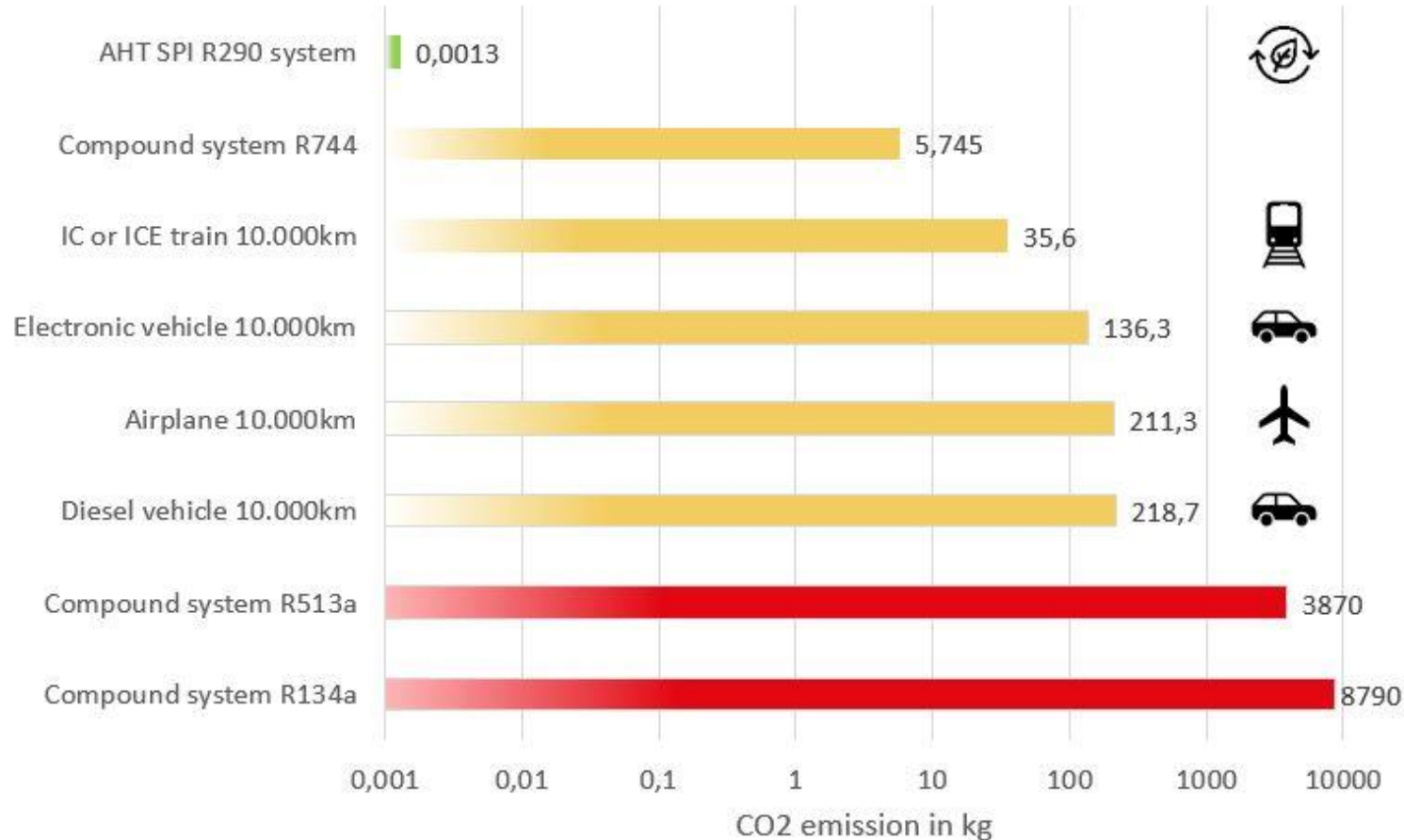
• System redundancy  
• Lowest leakage rates  
• Low refrigerant filling volumes  
• No machine room required

## Advantages of the SPI Technology

- Flexibility
- Simple and fast installation
- System redundancy
- Lowest leakage rates
- Low refrigerant filling volumes
- No machine room required



## Comparison of CO2 emissions in kg per year



### Estimated Environmental Impact

For the calculation, a cooling system with 50 linear meters of vertical display cases have been considered.

The assumption is a typical Remote system using R744 (CO<sub>2</sub>) versus an AHT Semi-Plug-In System consisting of Vento cabinets using R290 refrigerant connected to a glycol loop (also called *water loop*).

Important to mention that due to work pressures, in case of a critical failure of the remote cooling system, the refrigerant will be released into the environment.

Remote system with 150kg R134a = 8790 kg CO<sub>2</sub> emission per year.

Remote system with 150kg R513a = 3870 kg CO<sub>2</sub> emission per year.

Remote system with 150kg R744 = 5,745 kg CO<sub>2</sub> emission per year

AHT SPI system with 6,3kg R290 = 0,0013 kg CO<sub>2</sub> emission per year.

**This comparison shows, that an AHT SPI R290 system generates 99,9% less CO<sub>2</sub> emission than a R134a remote system. 99,9% less CO<sub>2</sub> emission than a R513a remote system. 99,9% less CO<sub>2</sub> emission than a R744 remote system.**

## Comparison of CO2 emissions

\*Source leakage rate: VDKF LEC-Daten 2014-2018

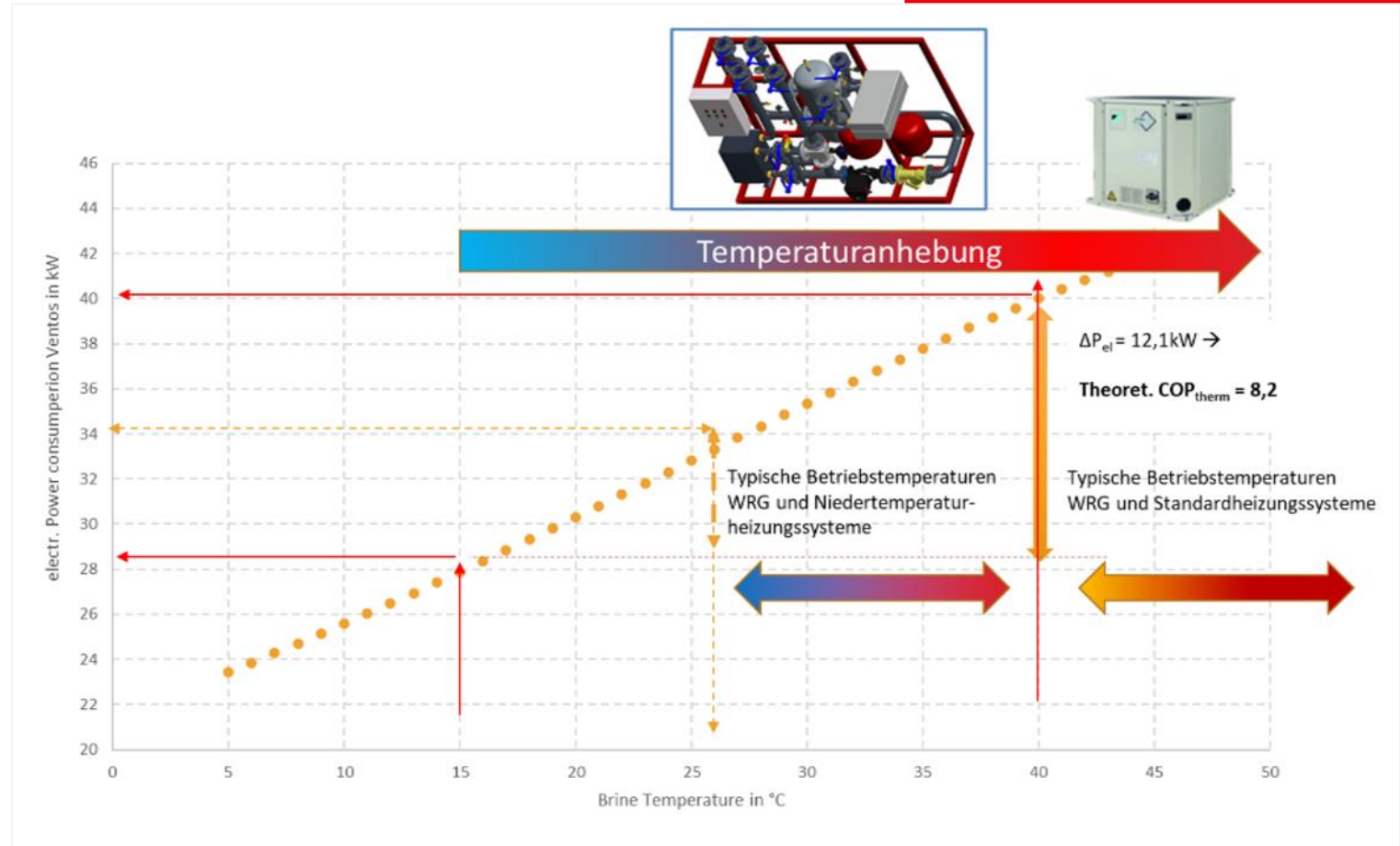
Source vehicles: <https://www.quarks.de/umwelt/klimawandel/co2-rechner-fuer-auto-flugzeug-und-co/>

Source GWP: <https://www.ipcc.ch/report/ar6/wg1/#FullReport>

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## More Advantages

- Very good energy efficiency
- Conceptual advantages in heat recovery
- Fail-safety





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## Further Advantage – skill shortage

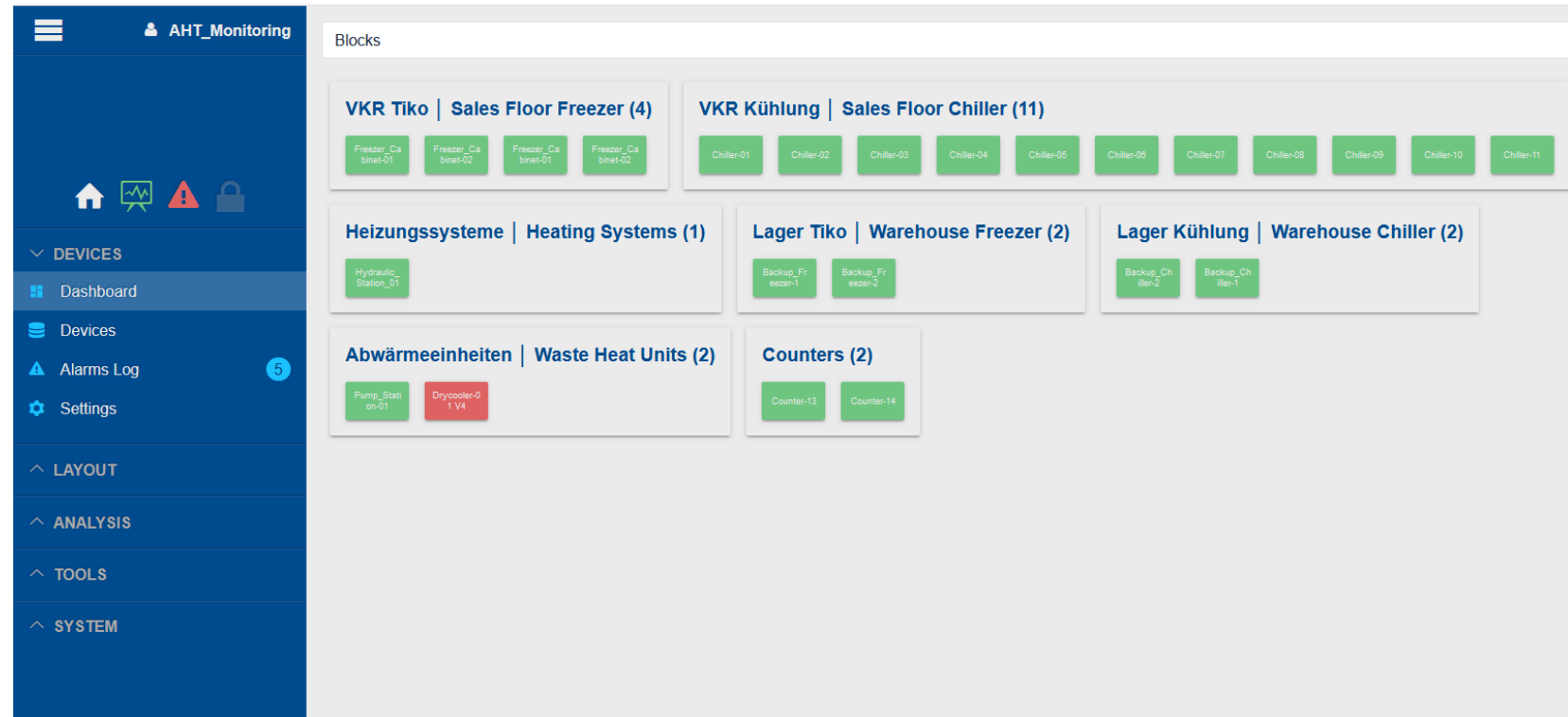
- No refrigeration technicians required for installation
- Electricians & installers
- Easy servicing due to simple technology
- Certified AHT CoolPoint partners



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## Flexibility & Scalability

- One Stop Solution
- Expansion with air conditioning and heating components
- Control technology from a single source
- Monitoring & supervision (AMS)
- Additional components



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## Central element: SPI refrigeration system

- Display refrigeration units / storage refrigeration room central elements
- Exceed ERP guideline
- Optimally optimized refrigeration cycles
- Adapted to EU operating conditions
- Demand-driven performance control



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## Direct comparison: SPI vs. CO<sub>2</sub> system

- Location: Germany – both markets within a 10 km radius
- Approximately the same size sales and storage area
- Same owner
- Same equipment:
  - Approx. 60 linear meters of refrigerated shelving
  - Approx. 27 linear meters of freezer shelving
  - Approx. 12 linear meters of freezer chests
  - Approx. 12 linear meters of freezer overhead cabinets
  - Approx. 10 linear meters of service counters
  - Approx. 67 m<sup>2</sup> of normal cooling room area
  - Approx. 10 m<sup>2</sup> of deep-freeze room area



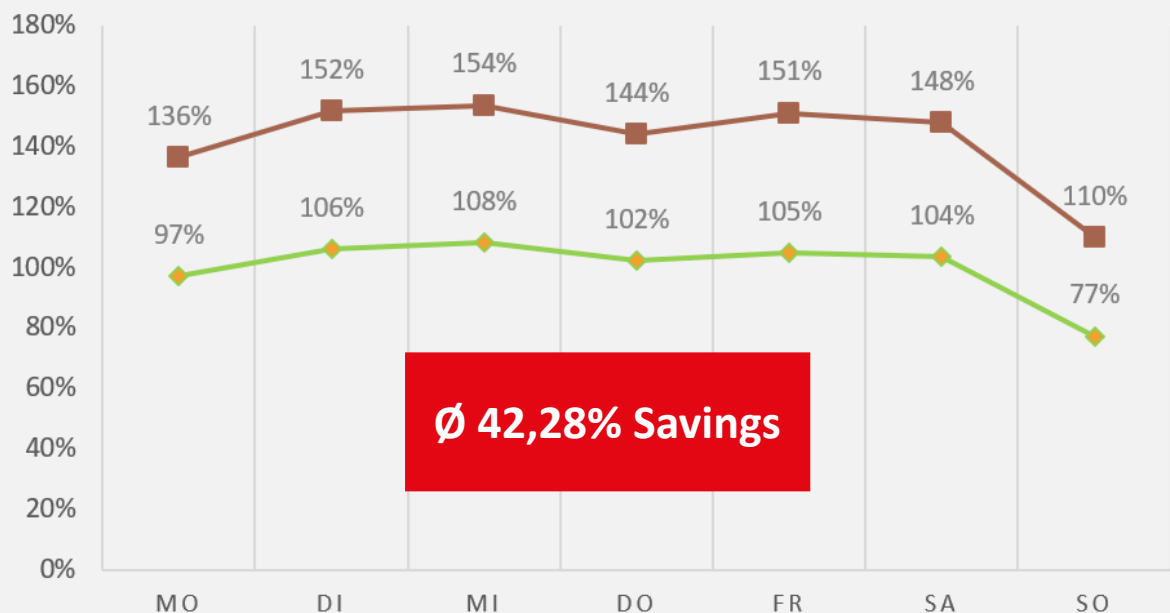


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## Direct comparison: SPI vs. CO<sub>2</sub> system

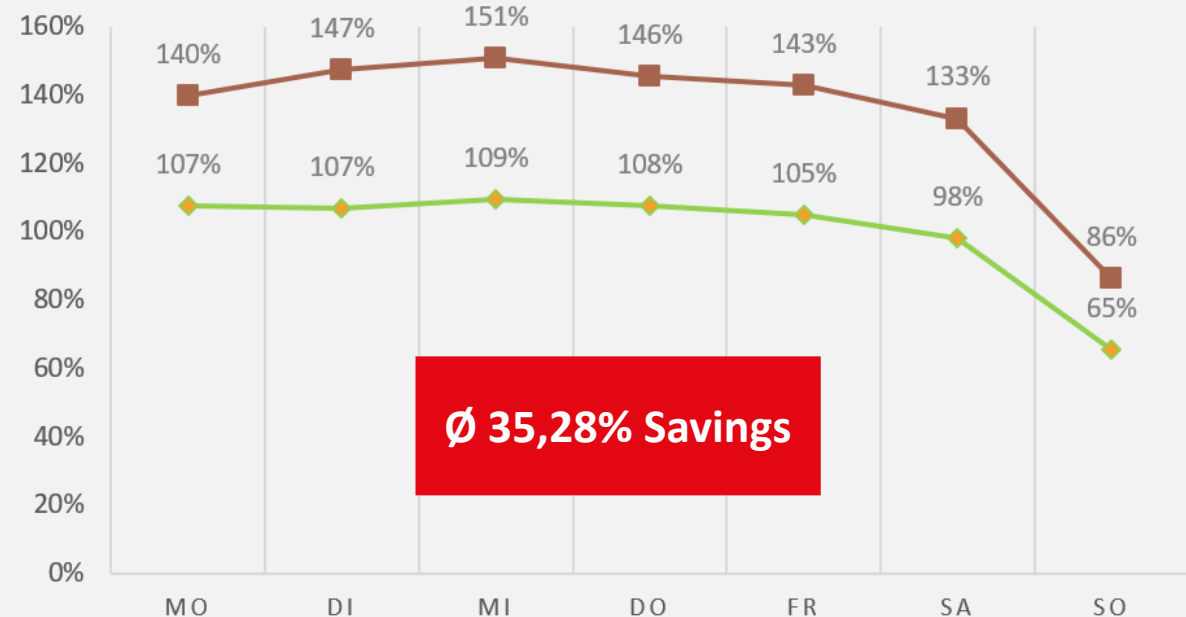
ENERGY DEMAND FOR COOLING & HEATING CW9  
100% = weekly average SPI System

—◆— SPI R290 CW9 daily consumption —■— CO2 CW9 daily consumption



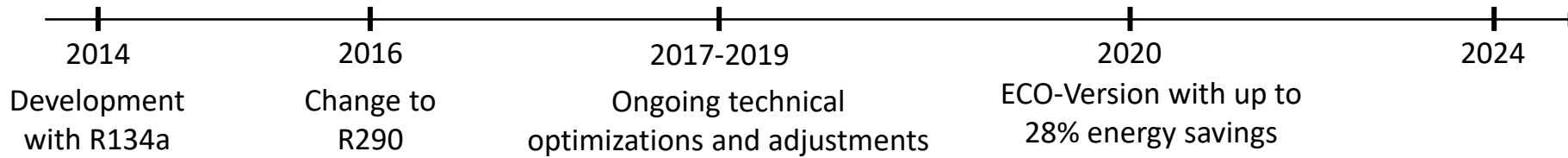
ENERGY DEMAND FOR COOLING & HEATING CW8  
100% = weekly average SPI System

—◆— SPI R290 CW8 daily consumption —■— CO2 R744 CW8 daily consumption



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## Development



- Up to 40% better energy efficiency (compared to Eco)
  - 6% more TDA
- Most energy-efficient device on the market



VENTO



BOREA

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**AHT**  
*a member of* **DAIKIN** group

### Future outlook & efficiency improvement

- Refrigerant charge according to IEC60335-2-89 to below 494g
- Efficiency increase of 20-40% in display refrigeration units

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Thank you for your attention!



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