



# Business Case for Natural Refrigerants

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June 12-14, 2018 – Long Beach



**R290 Ceiling Mount packaged system for closed water loop**

A case study: From Europe to US

**RIVACOLD**

## R290 Ceiling Mount packaged system for closed water loop

A new long term sustainable solution that combines the advantages of a natural refrigerant and a closed water loop system

**R290** NATURAL REFRIGERANT



WATER COOLED  
CLOSED LOOP SYSTEM



ENERGY  
EFFICIENT



EASY  
MAINTENANCE



## R290 Ceiling Mount packaged system for closed water loop

A new long-term sustainable solution that combines the advantages of a natural refrigerant and a closed water loop system

GREEN SOLUTIONS

**R290** NATURAL REFRIGERANT

- ✓ Low impact on environment
- ✓ Low cost of refrigerant charge



WATER CONDENSATION  
WATER LOOP SYSTEM

- ✓ No water waste
- ✓ Possibility of heat recovery
- ✓ Easy maintenance and maximum flexibility in store modification

...and...

- ✓ Low energy consumption and higher refrigerant capacity



## R290 Ceiling Mount packaged system for closed water loop

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ENERGY  
EFFICIENT



- 1 These products are equipped with high efficiency compressors, electronic fan motors, thermostatic expansion valves and hot gas defrost system. Fan coils and circuit are made and optimized by Rivacold.
- 2 Closed water loop with an unrestricted flow of cooling water yields a significant reduction in power consumption and increase in cooling capacity.

## R290 Ceiling Mount packaged system for closed water loop

Data from our case study: product efficiency at same reference conditions

Refrigerant	R404A	<b>R290</b>	R404A
Condenser type	Air cooled	<b>Water cooled</b>	Air cooled
Displacement (cc)	68	<b>3x27.8 (83.4)</b>	108

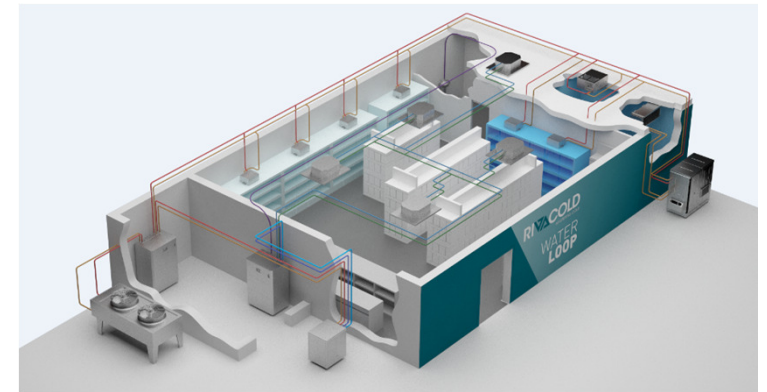
<b>Cop % to R290</b>	<b>26.0% - 16.5%</b>
<b>TEWI % to R290</b>	<b>29.1% - 27.3%</b>
<b>Annual energy saving (kW/h)</b>	<b>20.6% - 14.3%</b>
<b>Annual energy cost saving min (\$)</b>	<b>932 - 599</b>
<b>Emission reduction in Lbs of Co<sub>2</sub> (10 years)</b>	<b>47,911 - 43,851</b>

- ✓ Same annual capacity
- ✓ Similar working parameters



## R290 Ceiling Mount packaged system for closed water loop

- Unrestricted flow of cooling water yields a significant reduction in power consumption and increase in cooling capacity.
- Closed water loop at constant water pressure decrease losses down to 15 kpa
- Solenoid on water line reduces time and maximizes effect of hot gas defrost at low condensing temperatures.



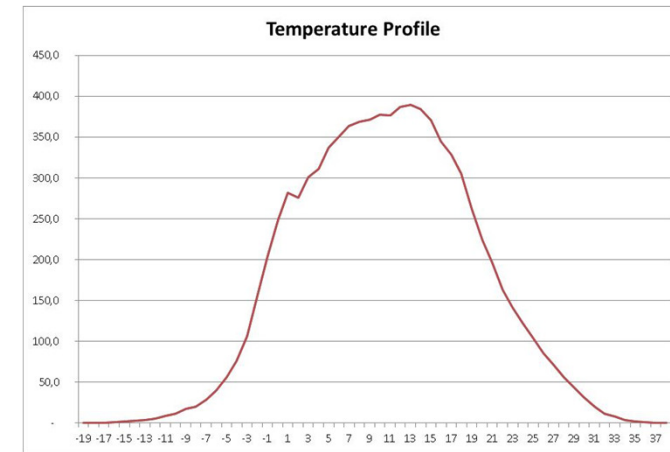
## R290 Ceiling Mount packaged system for closed water loop

Data from our case study: efficiency from a actual water loop application

Refrigerant	R404A	<b>R290</b>
Condenser type	Air cooled	<b>Water cooled</b>
Displacement (cc)	108	<b>3x27.8 (83.4)</b>

<b>Cop % to R290</b>	<b>35.4%</b>
<b>TEWI % to R290</b>	<b>37.3%</b>
<b>Annual energy saving (kW/h)</b>	<b>4,744 (26.1%)</b>
<b>Annual energy cost saving min (\$)</b>	<b>1,091</b>
<b>Emission reduction in Lb of Co<sub>2</sub> (10 years)</b>	<b>59,823</b>

Stuttgart (DE)  
N° of hours x °T amb



✓ Comparison made only with 108 cc compressor because more efficient than 68 cc



## R290 Ceiling Mount packaged system for closed water loop

A real application: European supermarket

This product is only one of a series that can be installed in a supermarket.

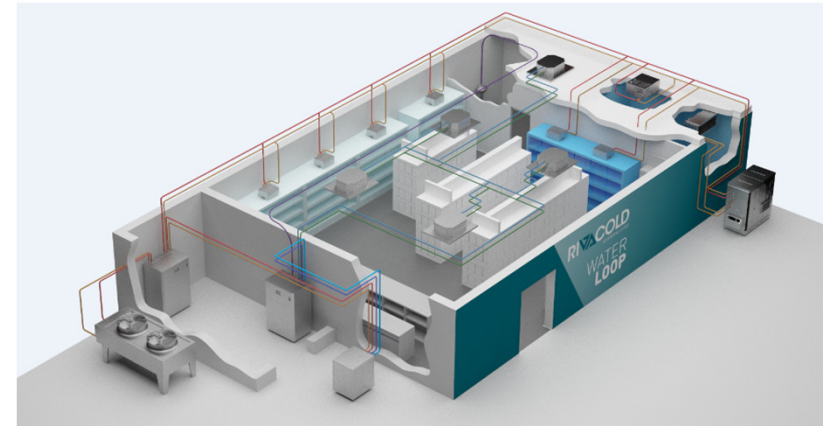
Supermarket considered in case study has **5 low temperature units for a 6900 ft<sup>3</sup> cold room**

**Total Efficiency\*: 22,534 kW/h** → **\$5,183**

- ✓ same supermarket has 2 medium temperature cold rooms and 1 high temperature cold room
- ✓ applications in 94 supermarkets

**= GREAT EFFICIENCY**

(\*) water pump consumption included. Cost is related to avg European Kwh



## R290 Ceiling Mount packaged system for closed water loop

A real application: a European supermarket

This product is only one of a series that can be installed in a supermarket

Supermarket considered in case study has **5 low temperature units for a 6900 ft<sup>3</sup> cold room**

**Total TEWI Impact\* : 287,500 Lbs of CO2 equivalent**

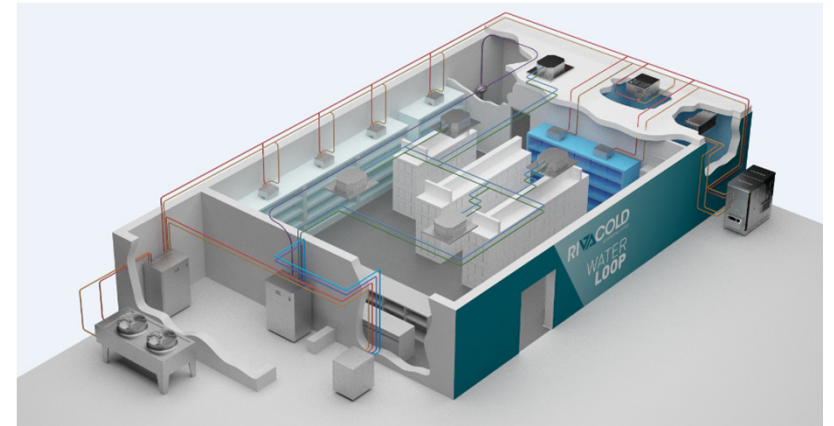
**→ 28 passengers vehicles (at EPA standards)**



- ✓ same supermarket has 2 medium temperature cold rooms and 1 high temperature cold room
- ✓ applications in 94 supermarkets

**= GREAT SUSTAINABILITY**

(\*) water pump consumption included.





**ATMO**  
sphere

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**Thank you very much!**

