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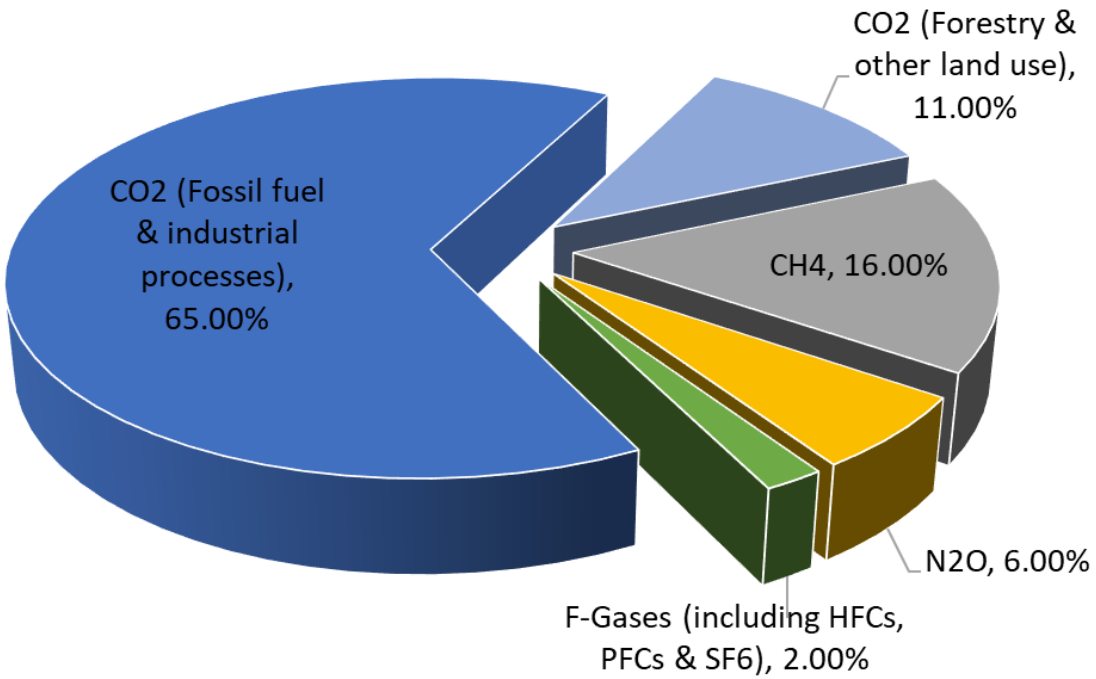
商业制冷及商用空调新冷媒解决方案

徐康
科慕化学市场拓展经理
4月 2021

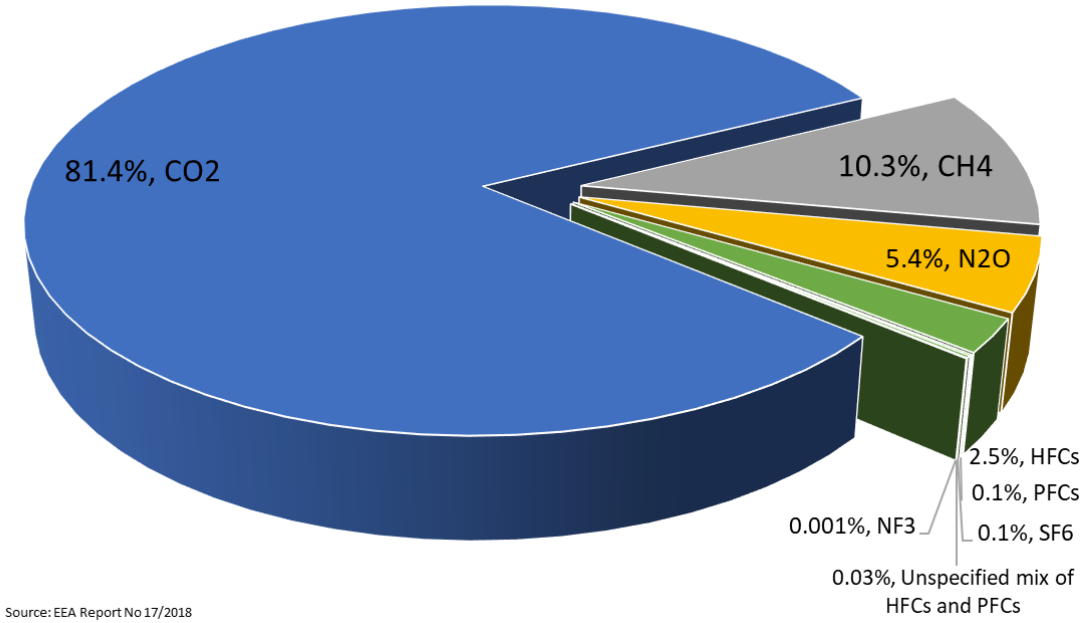
温室气体来源

2014全球温室气体排放（IPCC）



Source: IPCC (2014)

2017欧洲温室气体排放（EEA No17/2018报告）



Source: EEA Report No 17/2018

在欧盟等世界发达地区，化石燃料和工业过程产生的二氧化碳排放量占温室气体排放总量的80%以上

未来制冷剂的选择需要平衡性能（冷量和效率）、安全性和可持续性，以及系统制造及维护的总成本

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科慕制冷剂在商业制冷领域技术路线图

Opteon™ Refrigerants			Non-flammable (XP Series) Class 1		Mildly Flammable (XL Series) Class 2L	
Current	**GWP**	**Application**	**Product**	**GWP**	**Product**	**GWP**
HFC-134a	1300 (1430)		**XP10** (R-513A)	573 (631)	**XL10** (R-1234yf)	< 1 (4)
HFC-404A	3943 (3922)	 	**XP40** (R-449A)	1282 (1397)	**XL40** (R-454A)	238 (239)
			XP44 (R-452A)	1945 (2140)	**XL20** (R-454C)	146 (148)
HFC-410A	1924 (2088)		**XP41** (R-463A)	1377 (1494)	**XL41** (R-454B)	467 (466)
					XL55 (R-452B)	676 (698)
HCFC-22	1760 (1810)		**XP20** (R-449C)	1146 (1251)	**XL20** (R-454C)	146 (148)
HCFC-123	79 (77)		**XP30** (R-514A)	2 (7)		
			MZ (R-1336mzz(Z))	2 (9)		

Note: GWP values AR5 (AR4)

欧洲低GWP冷媒方案评估项目-概述

- 成本 –安装及初投资, 10年生命周期成本
- 能效 –运行成本, 间接排放
- 可持续性 –合规 / 总排放

wave

Wheatlands Aire Valley Engineering Ltd. (WAVE) 提供独立公正的咨询服务，业务遍及英国及世界各地

ASDA
Save money. Live better.
Part of the Walmart Group

新方案与现有方案相比必须:

- 实现相同的冷量
- 达到或超过现有能效
- 匹配系统正常运行时间
- 为业主减少总成本
- 安装及维护操作简单

ALDI
ASDA Save money. Live better.
Proudfoot
Best Price MODERN WHOLESALE A Walmart Venture
FORTNUM &MASON EST 1707

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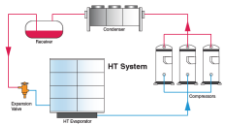
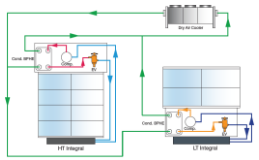
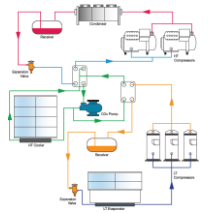
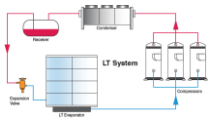
欧洲低GWP冷媒方案评估项目-系统选择

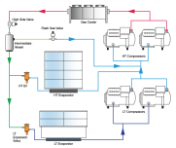
常规系统	更低 GWP (<1500 GWP) 不可燃系统
自携柜	水冷自携柜，风冷自卸柜 R-290
二次回路系统	R-290 / 乙二醇 (载冷系统) R-134a / R-744 MT (载冷)/ 复叠 LT 系统
低 GWP HFO	Low GWP (<250) HFO A2L Systems
CO_2系统	跨临界 R-744 增压系统











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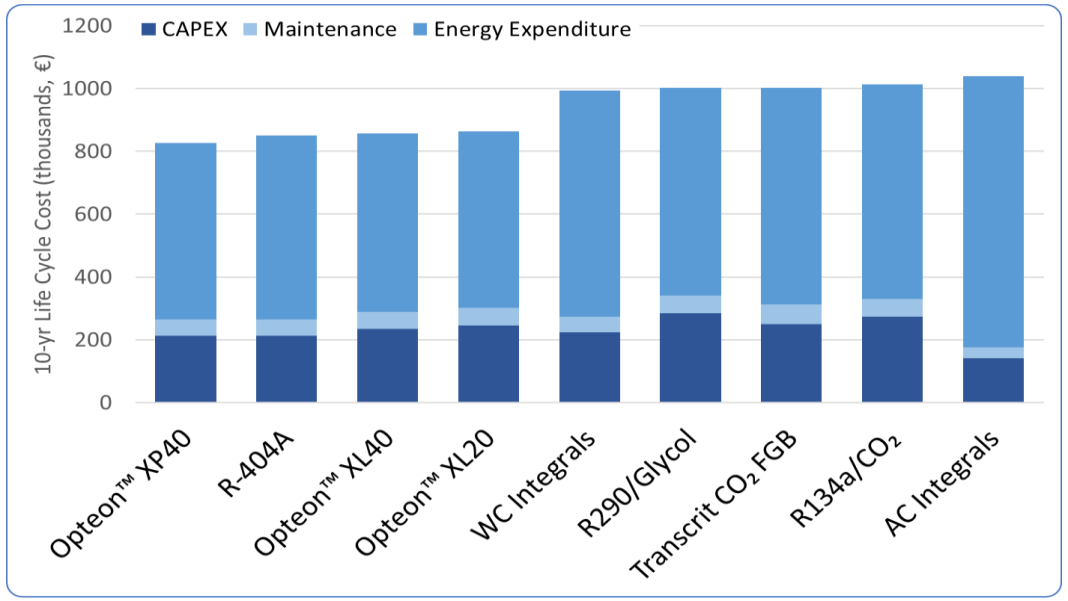
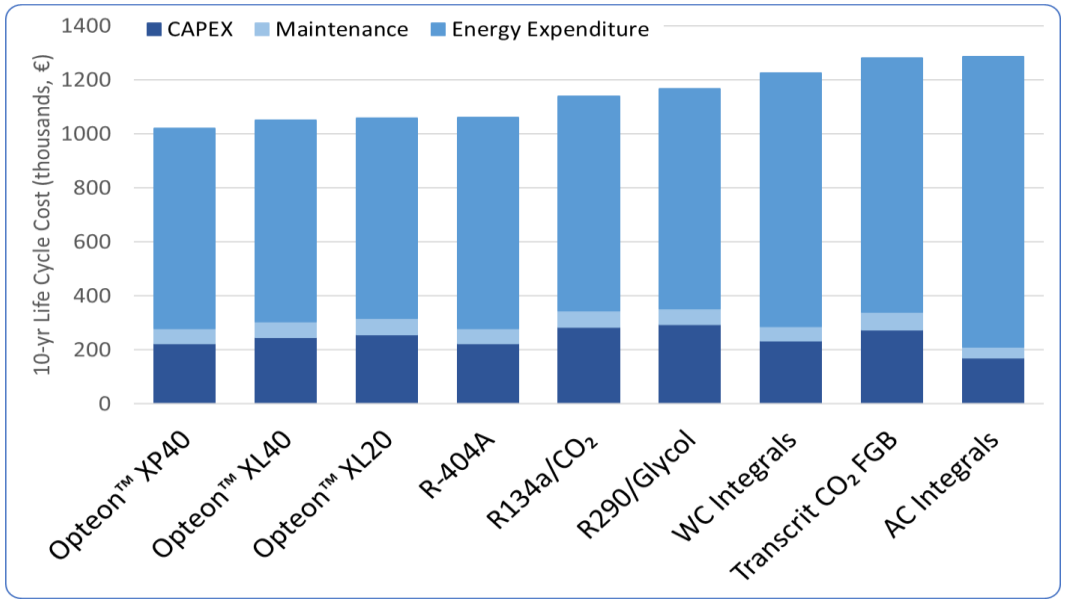
欧洲低GWP冷媒方案评估项目-成本分析

莱斯特, 英国



塞维利亚, 西班牙



2000平米超市

- ✘ **风冷&水冷自携柜 (R-290)** – 超低采购安装成本= 高/最高 10年全生命周期
- ✘ **跨临界 (R-744) 系统** – 10年全生命周期比 Opteon™ XP40 高21-26%
- ✘ **二次回路系统** – 10年全生命周期 12-22% Higher than Opteon™ XP40 Baseline
- ✓ **Opteon™ XL20 （R-454C）** - 10年全生命周期比R744跨临界或者水冷自携柜低16-22%

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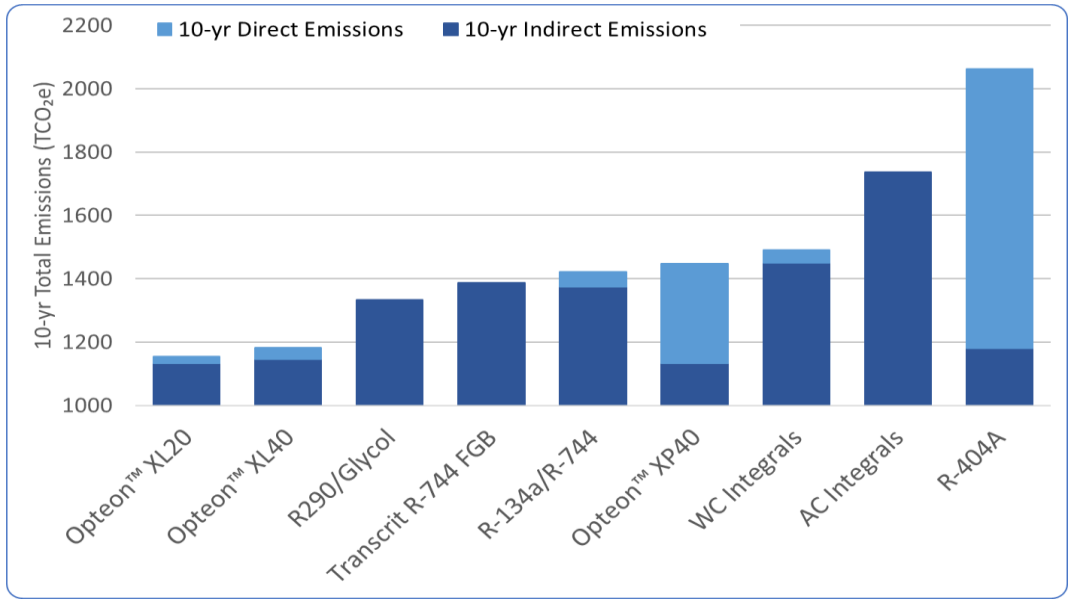
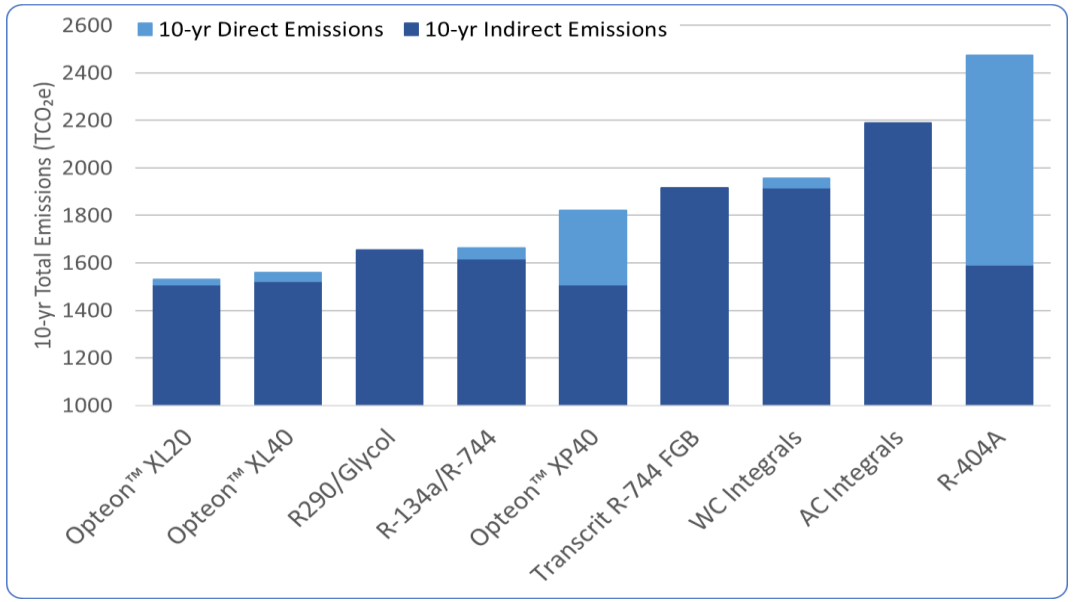
欧洲低GWP冷媒方案评估项目-环境影响分析

莱斯特, 英国



塞维利亚, 西班牙



2000平米超市

- ✘ **风冷&水冷自携柜（R290）** - 10年总排放最高
- ✘ **R-744 跨临界系统** – 比Opteon™ XL 20(R454C)系统高出25%的排放量
- ✘ **二次回路系统**-比Opteon™ XL 20(R454C)系统高出6-21% 的排放量
- ✓ **Opteon™ XL20 （R-454C)系统**- 比R744跨临界或者水冷自携系统低20-29%

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科慕制冷剂在商业空调领域技术路线图

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Note: GWP values AR5 (AR4)

Opteon™ XP10 (R-513A) 制冷剂应用研究项目

项目背景：

- 基加利修正案正对HFCs生产和消费削减
- 多边基金针对中国现有R22螺杆机组生产线的淘汰
- R134a在中国将来的替代方案选择
- 《绿色高效制冷行动方案》的推行
- 中国制冷协会，三所高校及七家国内外企业参与

项目概述：

- 工质研究，物性分析
- 兼容性研究
- 系统主要零部件优化
- 整机测试与优化

ASHRAE #: R-513A
组份: R-1234yf/134a
组份比例: 56/44

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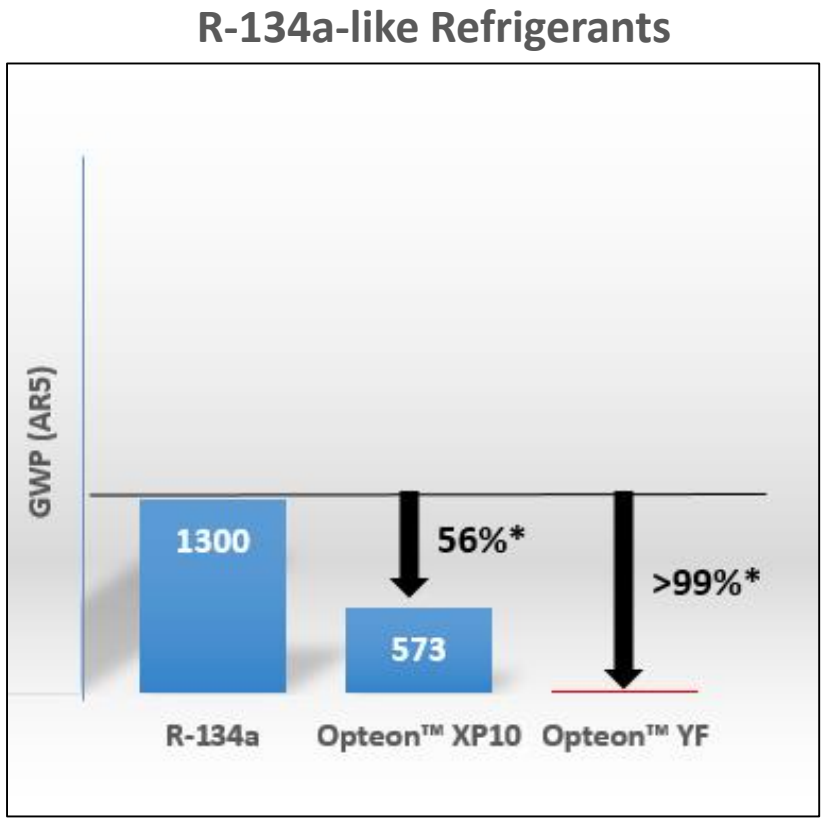
R-134a 与 Opteon™ XP10 (R-513A)理论性能比较

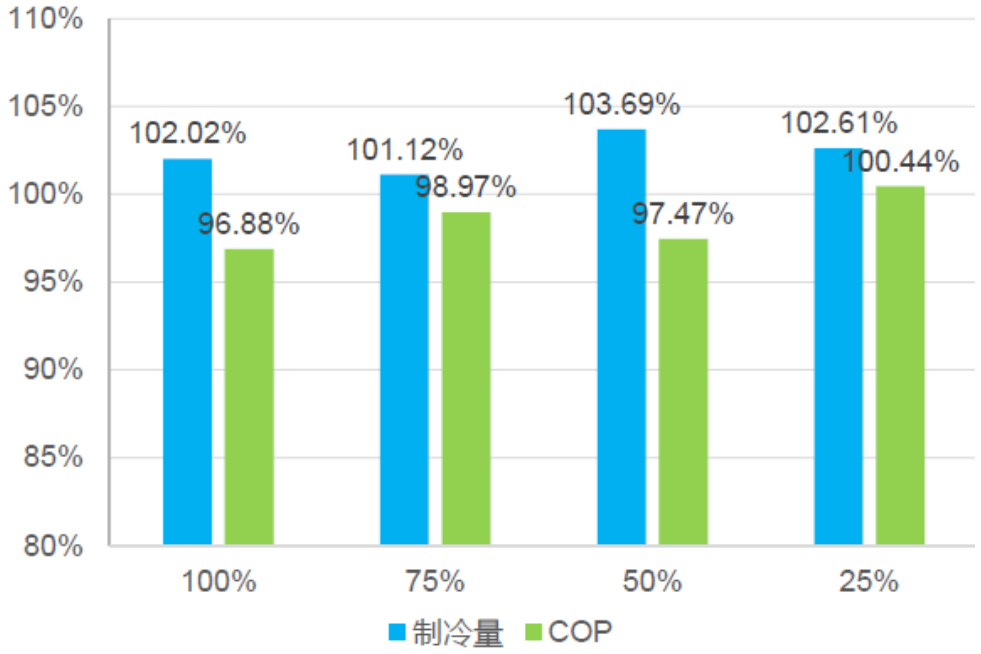


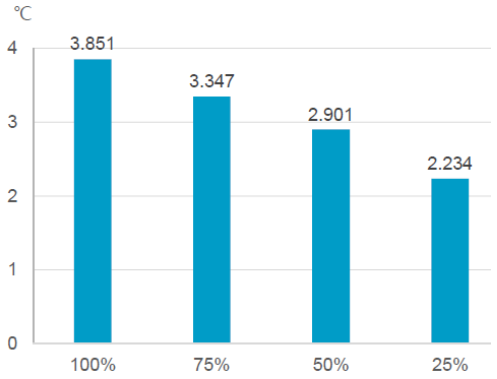
- 理论循环计算

制冷剂	R-134a	XP10(R-513A)	R-134a	XP10(R-513A)
制冷能力 vs R-134a	100%	+2.22%	100%	0%
能效 vs R-134a	100%	-1.81%	100%	-3.5%
质量流量 (kg/s)	100%	+18.4%	100%	+18.4%
排气温度 (℃)	50.2	46.2(-4)	66.7	61.2(-5.5)
排气压力 (bar.g)	8.1	8.65(+0.55)	12.1	12.7(+0.6)
吸气压力 (bar.g)	2.6	3(+0.4)	2.6	3(+0.4)
计算工况	水冷：冷凝温度 36℃/蒸发温度 6℃/过冷2 K/过热5K/压缩机效率 0.75		风冷：冷凝温度 49.7℃/蒸发温度 6℃/过冷2 K/过热5K/压缩机效率 0.75	

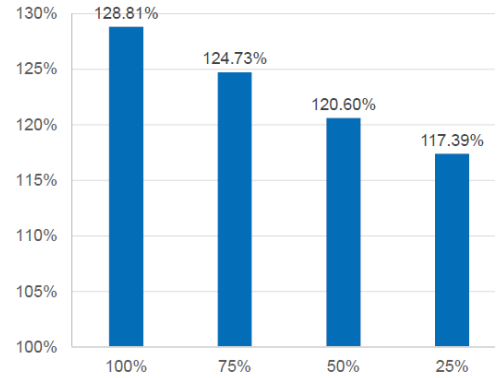
R-134a 与 Opteon™ XP10 (R-513A)实测性能比较

- A公司定频螺杆机组测试情况 （以R-134a性能为基准）





排气过热度



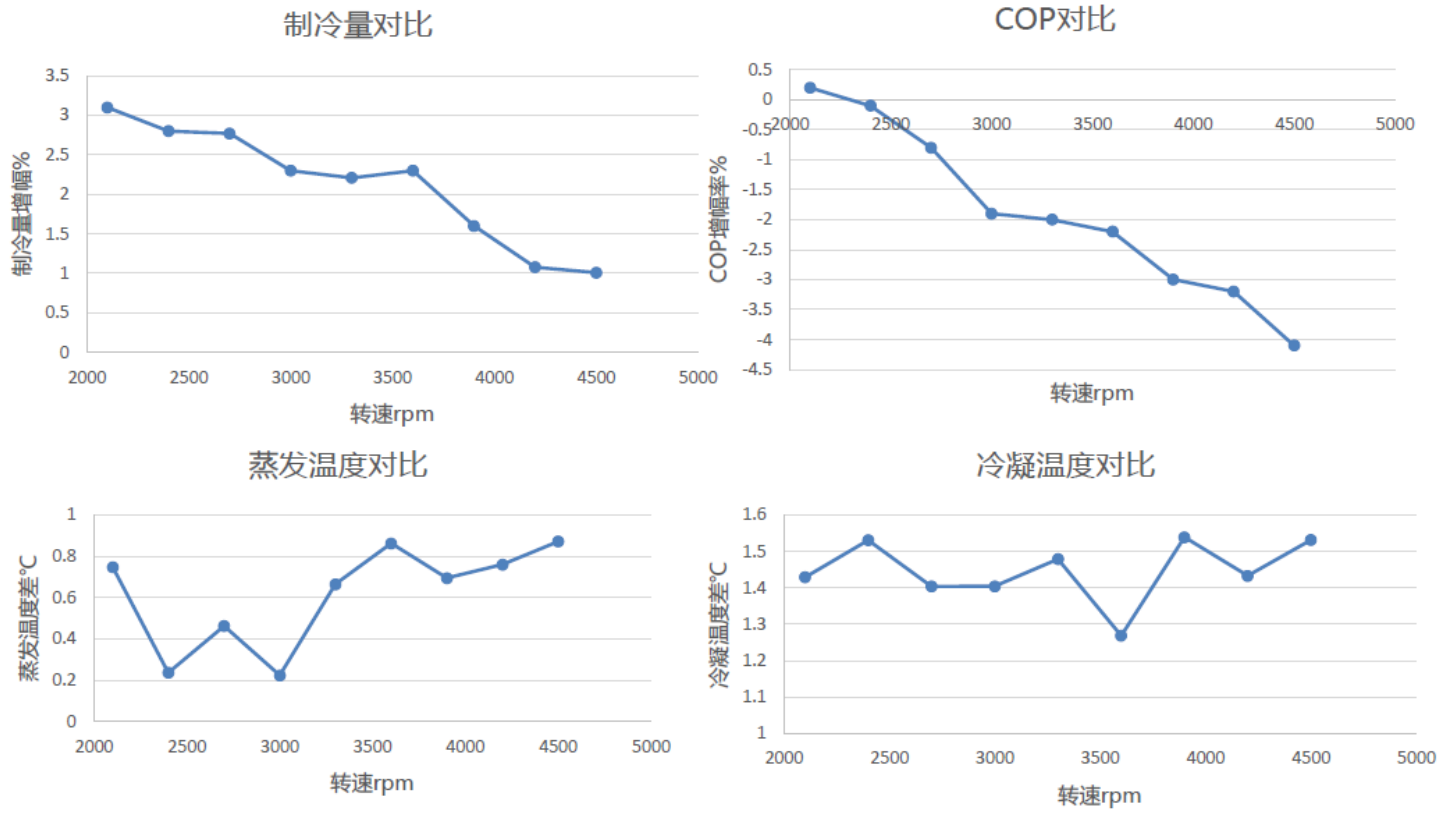
膨胀阀开度

测试基于： GB/T 18430.1-2007; GB/T 10870-2014
额定和IPLV工况

- R513A制冷量相比R134a变化+1.12%~+3.69%
- R513A COP相比R134a变化-3.12%~+0.44%
- R513A 排气过热度 偏低3K左右
- R513A 电子膨胀阀开度大20%左右

R-134a 与 Opteon™ XP10 (R-513A)实测性能比较

- B公司变频螺杆机组测试情况（以R-134a性能为基准）

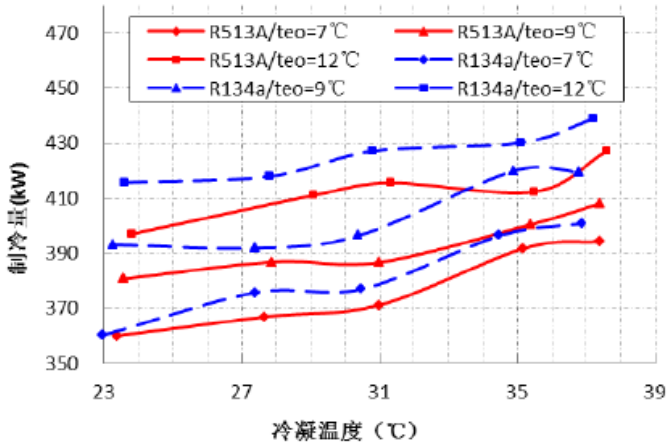


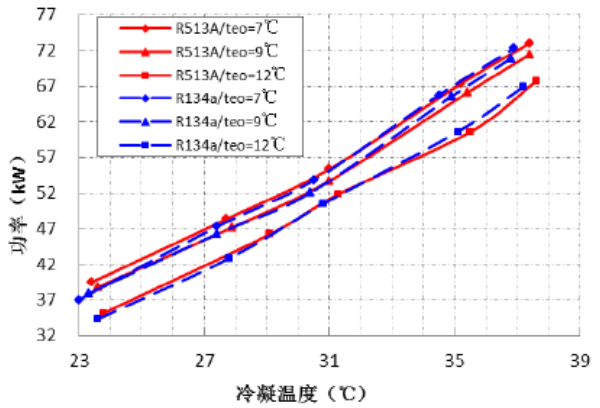
- R513A制冷量相比R134a变化+1%~+3.1%
- R513A COP相比R134a变化-4%~+0.25%

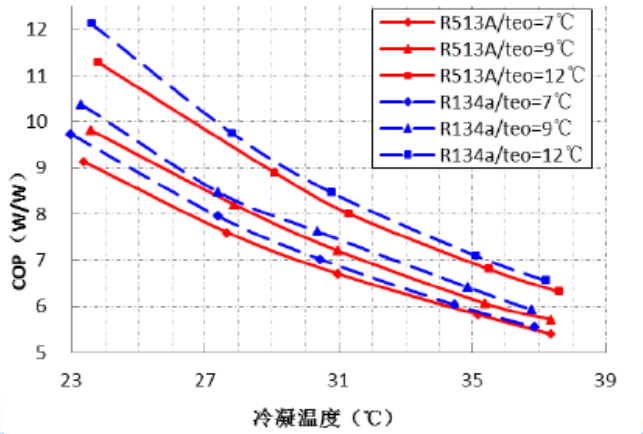
测试基于： GB/T 18430.1-2007; GB/T 10870-2014
定冷冻出水、冷却进水温度、定水流量，变转速对比

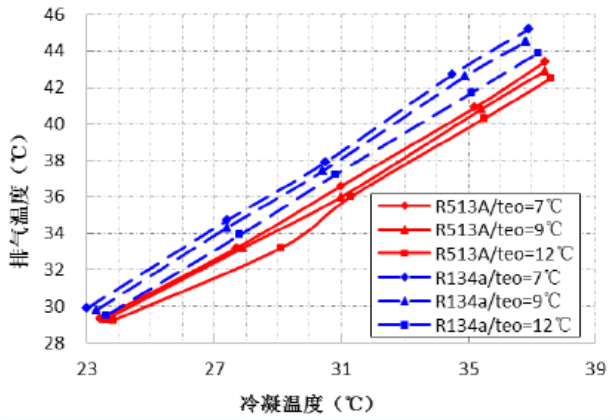
R-134a 与 Opteon™ XP10 (R-513A)实测性能比较

- C公司磁悬浮离心机组测试情况（以R-134a性能为基准）







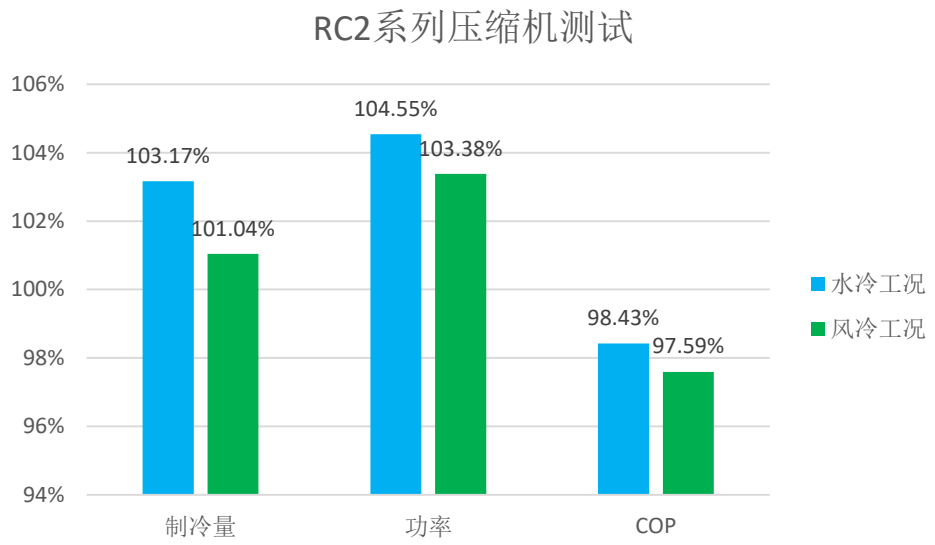


- R513A与R134a冷媒充注量相当
- R513A在变工况条件下相比R134a制冷量下降2.44%，能效低4.75%

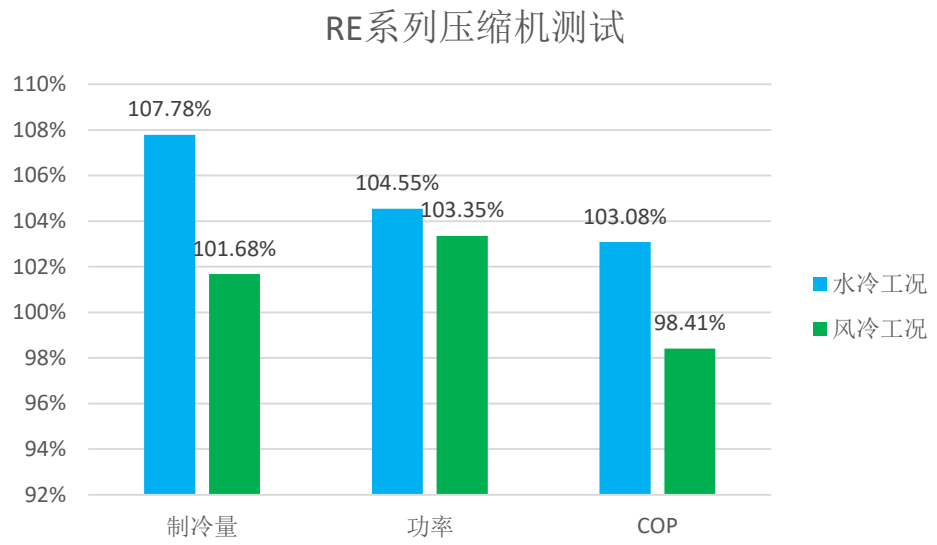
测试基于： GB/T 18430.1-2007; GB/T 10870-2014

R-134a 与 Opteon™ XP10 (R-513A)实测性能比较

- D公司螺杆压缩机测试情况（以R-134a性能为基准）



风冷工况：蒸发温度5.8℃、冷凝温度49.7℃、过冷2K，过热1K
水冷工况：蒸发温度6℃、冷凝温度36℃、过冷2K，过热1K



- R513A制冷量相比R134a变化+1.04%~+7.78%
- R513A COP相比R134a变化-2.41%~3.08%

测试基于：水速基准3m/s 饱和冷凝温度38℃

Opteon™ XP10 (R-513A) – 国外品牌冷水机组认证

TRANE

Ingersoll Rand Introduces the EcoWise™ Portfolio of Products as Step to Achieve its Global Climate Commitment

Davidson, N.C., January 26, 2015 – Ingersoll Rand (NYSE:IR), a world leader in creating comfortable, sustainable and efficient environments, is pleased to announce another milestone in achieving its climate commitment, a roadmap to significantly reduce the environmental impact from its operations and product portfolio by 2030.

Trane Sintesis™ air-cooled chiller is energy efficient and quiet, and offers customers the choice of operating with a next generation, low GWP refrigerant – **Opteon™ XP10 (R-513A)** or with R-134a. Product will be available in North America and Latin America with next generation refrigerant option in June 2015.

Carrier

United Technologies

Carrier AquaEdge® 19XR, 23XR and AquaForce® 30XV and XA Chillers are Available With Lower Global Warming Refrigerant Solutions

CHARLOTTE, N.C. - Feb. 9, 2018 - *Legacy R-134a as well as the newer R-513A refrigerants are both supported in Carrier chillers.* As part of Carrier's commitment to delivering a comprehensive commercial product line that supports the drive for lower global warming refrigerant solutions, **Carrier AquaEdge® 19XR water-cooled centrifugal chillers, 23XR water-cooled screw chillers and AquaForce® 30XV/XA air-cooled screw chillers are compatible with both R-134a as well as lower global warming potential (GWP) option R-513A.**

Johnson Controls

Johnson Controls Advances Environmental Sustainability with Chiller Platforms Compatible with Low GWP Refrigerants

MILWAUKEE – (Jan. 20, 2016) – Johnson Controls is advancing its White House Council on Environmental Quality commitment by enhancing HFC product lines to be fully compatible with the non-flammable, low-GWP refrigerant – Opteon™ XP10 (R-513A), manufactured by The Chemours Company. York centrifugal and screw chillers ranging from 125 to 6,000 tons (440 to 21,100 kW) are compatible with R-513A.

DB DUNHAM-BUSH

Chemours™ Opteon™ XP10 Refrigerant Specified by Dunham-Bush for DCLCG Series Of High-Efficiency Direct-Driven VFD Water Cooled Centrifugal Chiller

WILMINGTON, Del., April. 11, 2017 – Chemours Fluorochemicals (Chemours) today announced the selection of **Opteon™ XP10 (R-513A)** low global warming potential (GWP) refrigerant by **Dunham-Bush for use in its DCLCG Series Of High-Efficiency Direct-Driven VFD Water Cooled Centrifugal Chiller for the Asia Pacific market.**

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Thank you!