

WORLD LEADING CO₂ TECHNOLOGY

Case Study: Transcritical CO₂ cooling and freezing system for Norwegian Ice Cream Manufacturer

Århus

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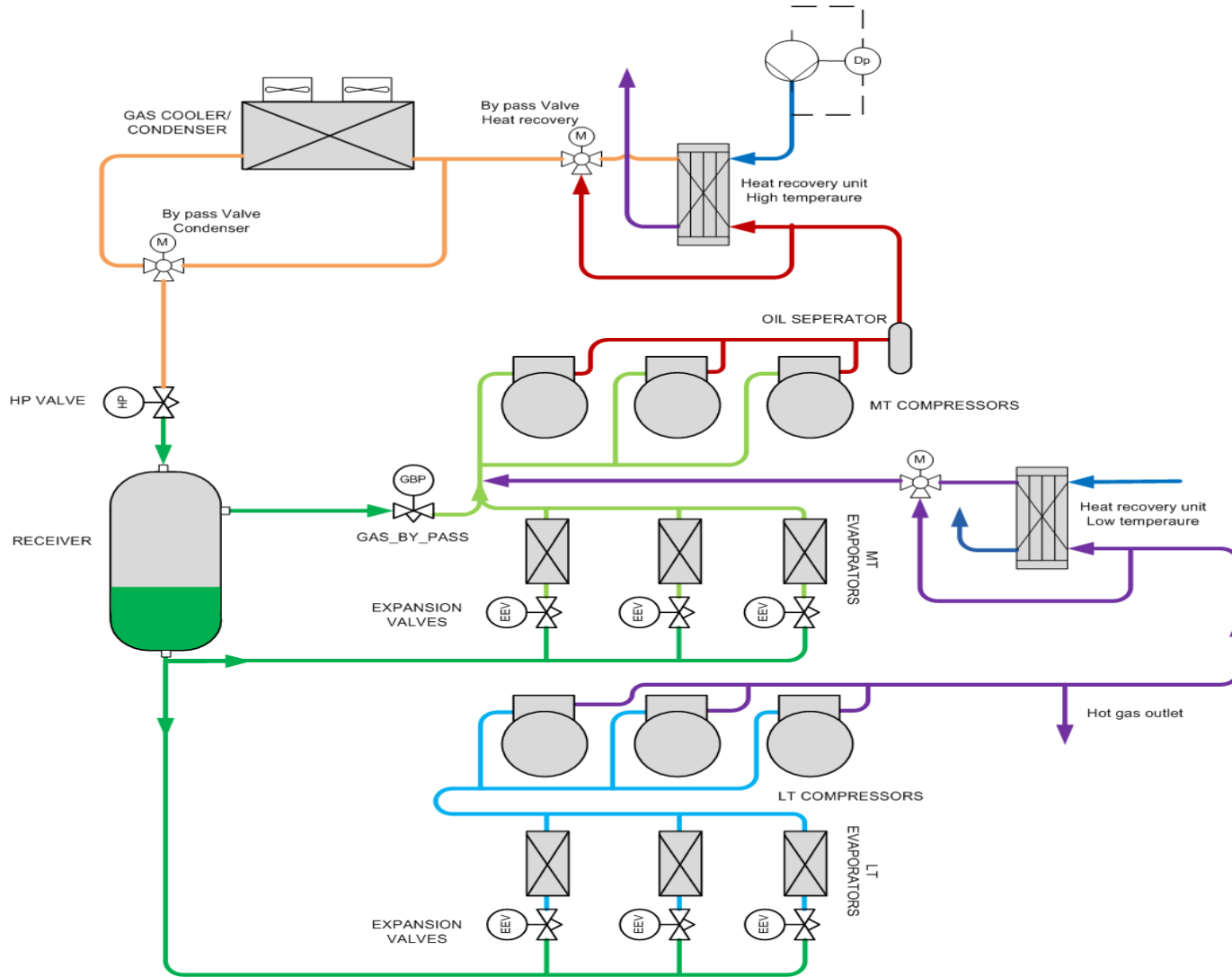
ADVANSORTM
by Hill PHOENIX



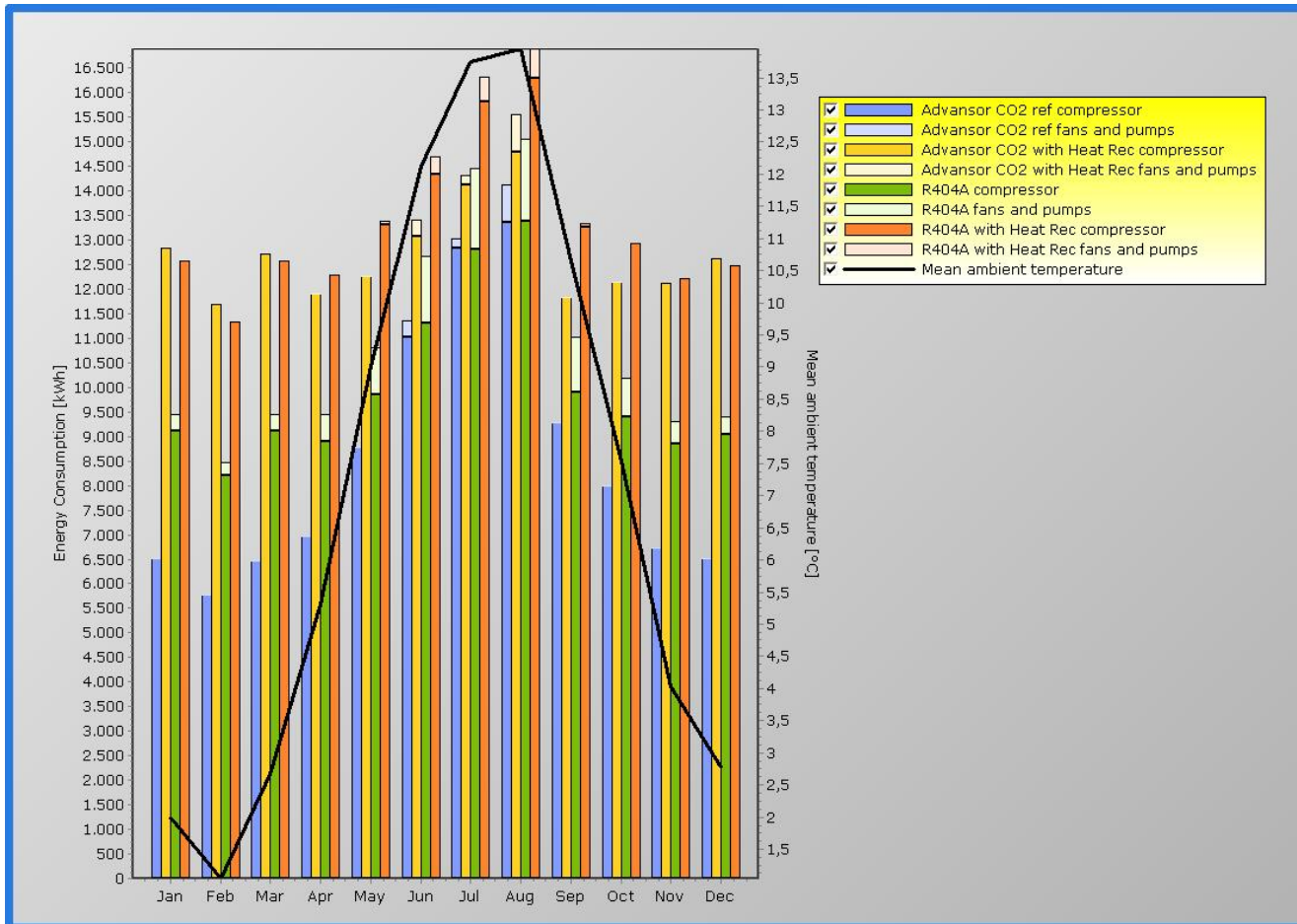
- 100kW at -7°C
- 220kW @ -38°C
- 150 kW heat recovery
- Hot gas defrost
- Fully green solution
- Production and storage



Schematic design



Simulation of energy consumption – PackCalculation II (www.ipu.dk)



Energy summary

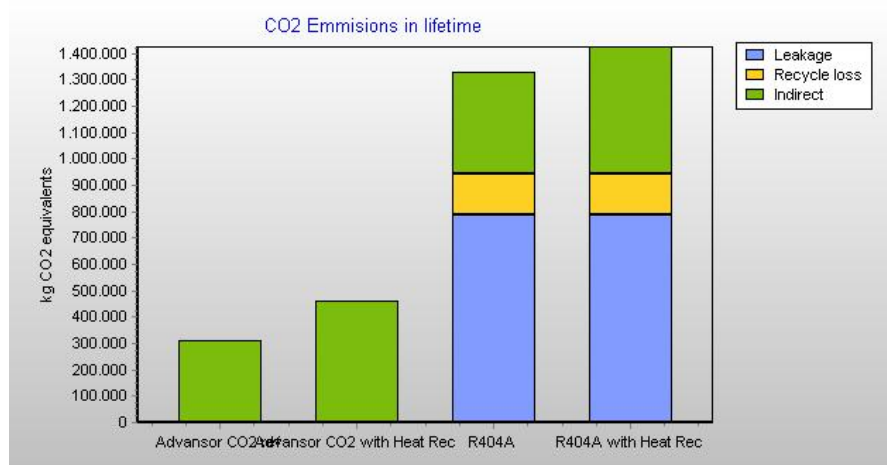
	Advansor CO2 ref (reference)	Advansor CO2 with Heat Rec	R404A	R404A with Heat Rec
Average COP				
LT [-]:	3,13	3,13	1,86	1,31
MT [-]:	5,12	3,18	3,51	3,00
Total [-]:	3,80	2,56	3,03	2,44
Total energy consumption				
LT [kWh]:	22,127	22,127	37,305	52,767
MT [kWh]:	81,398	131,287	92,425	108,211
Total [kWh]:	103,525	153,414	129,73	160,978
HeatRecovery				
Total [kWh]:	0	351,585	0	465,445
Savings				
Yearly energy savings [kWh]:	-	-49,89	-26,205	-57,453
Yearly energy savings [%]:	-	-48,2	-25,3	-55,5

Additional saving from hot gas over electrical defrost: approx
27,000 kWh / year

Emissions overview

	Advansor CO2 ref (R744)	Advansor CO2 with Heat Rec (R744)	R404A (R404A)	R404A with Heat Rec (R404A)
Refrigerant charge [kg]	400	400	400	400
Recycle rate [%]	90	90	90	90
Leakage rate [%/year]	8	8	5	5

	Leakage [kg CO2]	Recycle loss [kg CO2]	Indirect [kg CO2]	Total [kg CO2]
Advansor CO2	320 (0,1%)	40 (0,0%)	310.574 (99,9%)	310.934
Advansor CO2 with Heat Rec	320 (0,1%)	40 (0,0%)	460.243 (99,9%)	460.603
R404A	784.400 (59,0%)	156.880 (11,8%)	389.190 (29,3%)	1.330.470
R404A with Heat Rec	784.400 (55,1%)	156.880 (11,0%)	482.933 (33,9%)	1.424.213



Lessons Learned

- ***Diplom is : Benefits of choosing Advansor's CO₂ refrigerant system:***
- ***No impact on the environment***
- ***No tax on the refrigerant (approx €140 savings per kg)***
- ***More energy efficient system design compared to HFC404A***
 - ***R744, overall cheaper and more efficient solution***
- ***Shorter defrost time: 50% reduced time***
 - ***Higher production output***
- ***Reduced carbon footprint from direct and indirect emission***
- ***All good features of CO₂ refrigerant is implemented in this system 😊***