« Simplicity is the ultimate sophistication.… »
– Leonardo da Vinci

CARNOT
REFRIGERATION

HFCs are among the most potent greenhouse gases emitted around the world".

- Catherine McKenna, Canada's Minister of Environment and Climate Change.

Environment and Climate Change Canada | Environnement et Changement climatique Canada

Year	Percentage Reduction from Baseline
2019	10
2024	40
2030	70
2036	80
2036	85

Table 1: Canada's HFC consumption phase-down — Percentage reduction from baseline (2011-2013)

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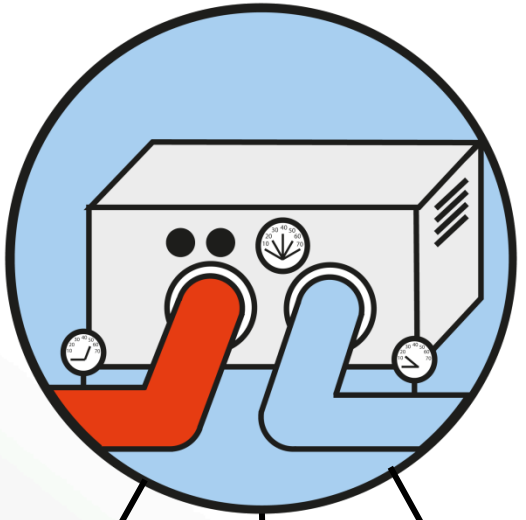
Carnot Refrigeration

Carnot
Supermarket

Carnot
Warehouse



Carnot Chiller

Aquilon™
Data Center

« See the possible where the others see the impossible »

Carnotrefrigeration.com
3368, Bellefeuille Street, Trois-Rivieres, QC G9A 3Z3 – Phone : 819 376-5958

https://www.youtube.com/watch?v=mMFkChrQeh8

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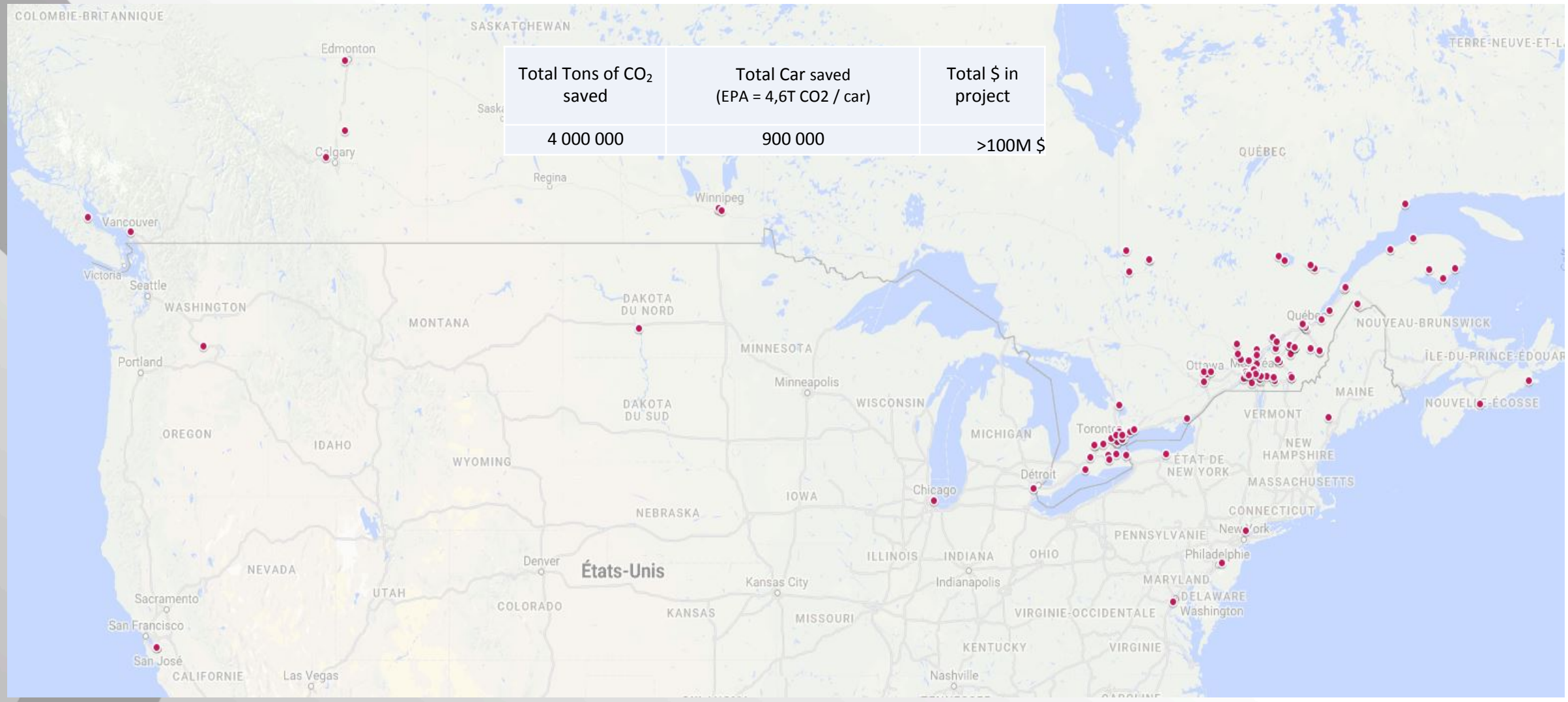
Total Tons of CO_2 saved	Total Car saved (EPA = 4,6T CO2 / car)	Total $ in project
4 000 000	900 000	>100M $



German Embassy Ottawa (Canada): Transcritical CO_2 Air conditionning chiller with Rain cycle Free cooling

Innovations:

- Rain Cycle free cooling
- Heat Recovery

Project description:

- Office building
- Charge: 70 pounds of CO_2
- Two independent circuits
- Motor power 44,8kW
- 208/3/60
- Capacity: 106 kW (30TR per circuits)
  212 kW (60 TR total)

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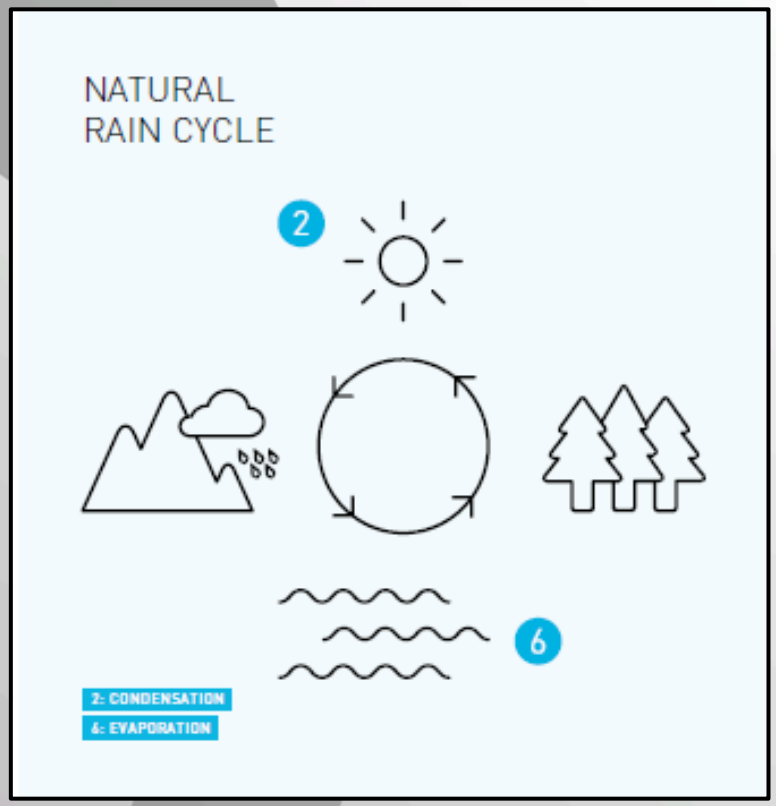
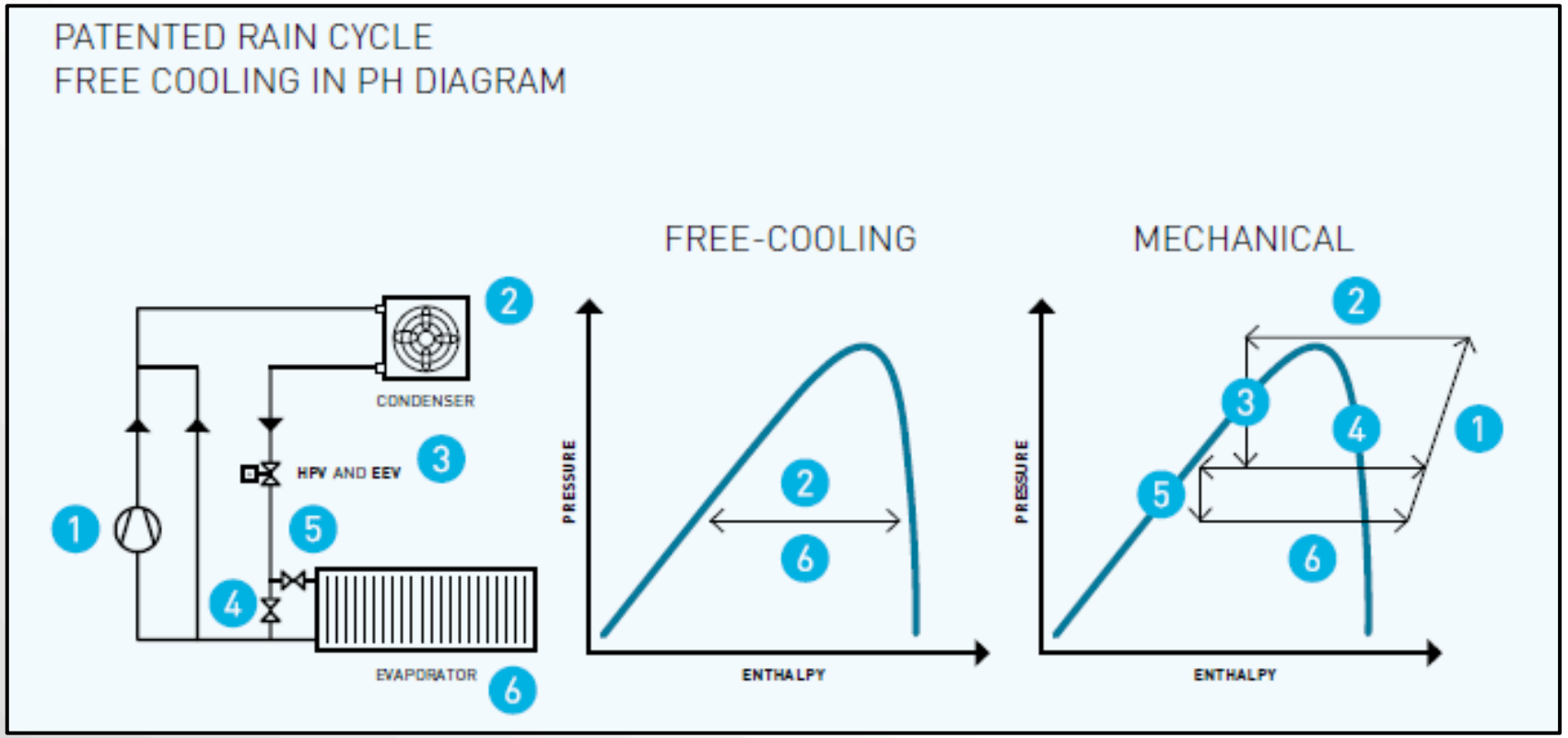
« Simplicity is the ultimate sophistication.… »
– Leonardo da Vinci





Around 24 C …. 30 psi for 1 C of temperature differential.

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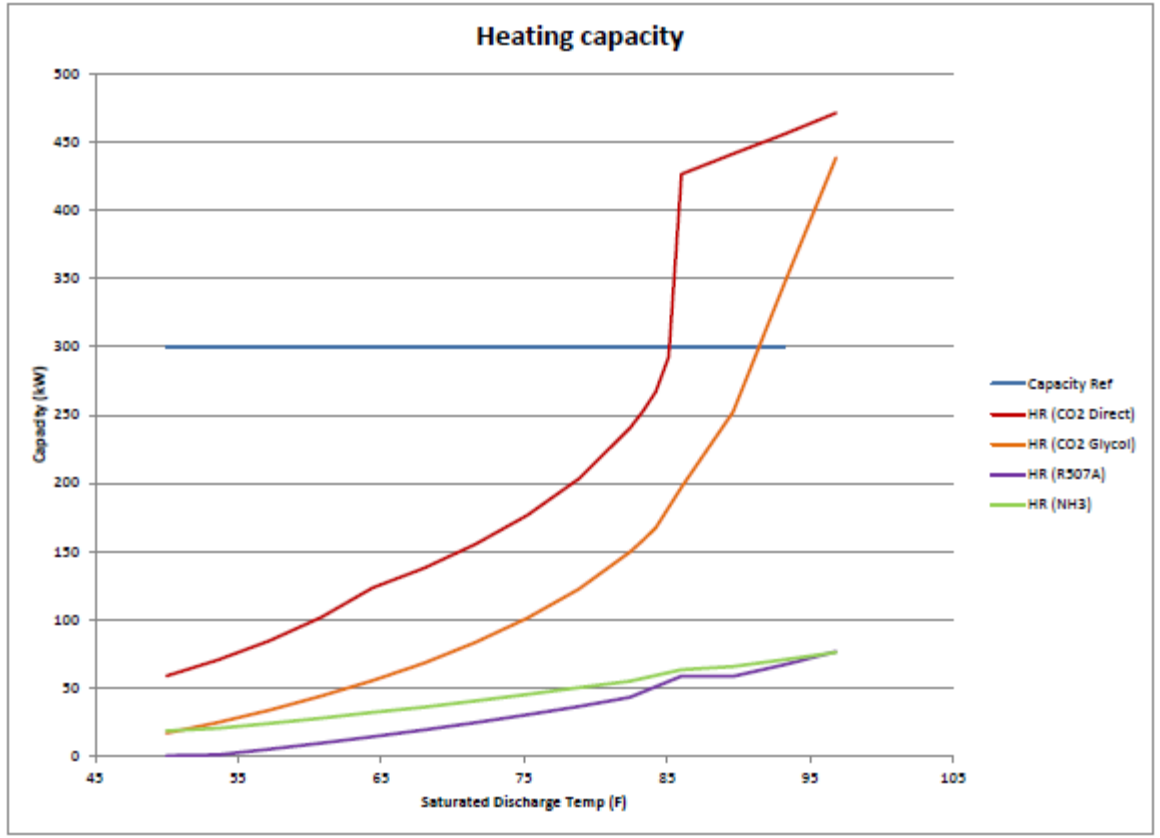
CO2 Efficient Heat Reclaim

Refrigerant	Cond. Temp (F)	Heat rejection Ratio		Impact on Heat Reclaim potential
		Sensible (HG desuperheating)	Latent (Condensing)	
CO2	87,7	73%	27%	Lot of sensible energy available: High heat reclaim potential even at low cond. temp. **100F Glycol** can be heated with **75F Cond CO2**: Very high combined COP
	85	65%	35%	
	75	43%	57%	
	65	32%	68%	
R507	120	26%	74%	Limited sensible energy available: Condensing temp must be **higher** than heated media to get decent heating capacity **100F Glycol** needs to be heated with **+105F Cond HFC / NH3**: Limited combined COP
	105	21%	79%	
	85	16%	84%	
	65	13%	87%	
NH3	120	20%	80%	
	105	20%	80%	
	85	18%	82%	
	65	13%	87%	



At 85 Outlet Gas, CO2 provides 1.5 x refrigeration capacity in heat reclaim

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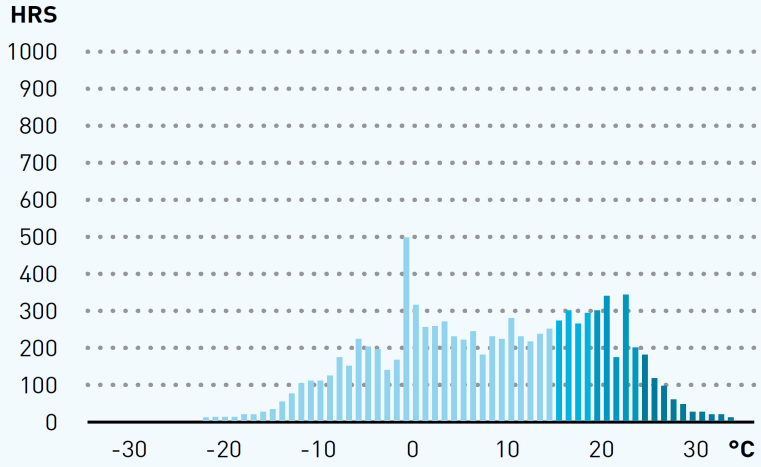
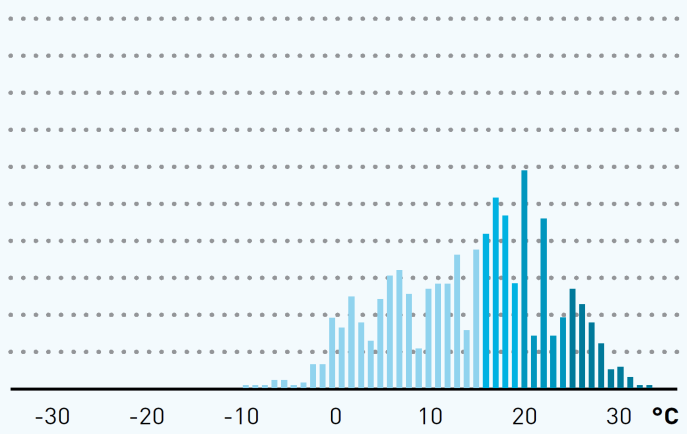
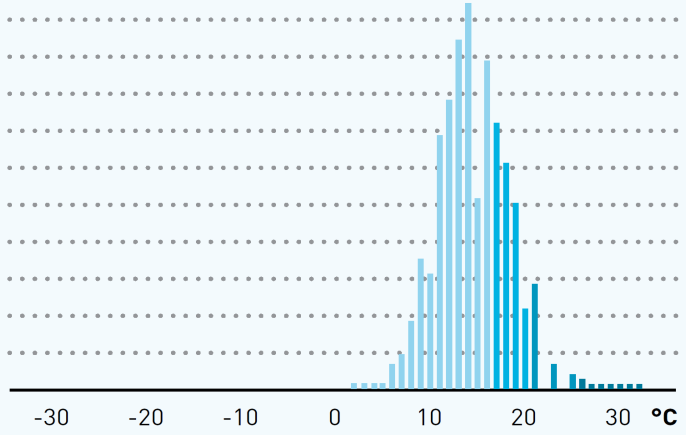
CO_2 ADVANTAGES : Rain Cycle Free-Cooling™



MONTRÉAL



NEW YORK

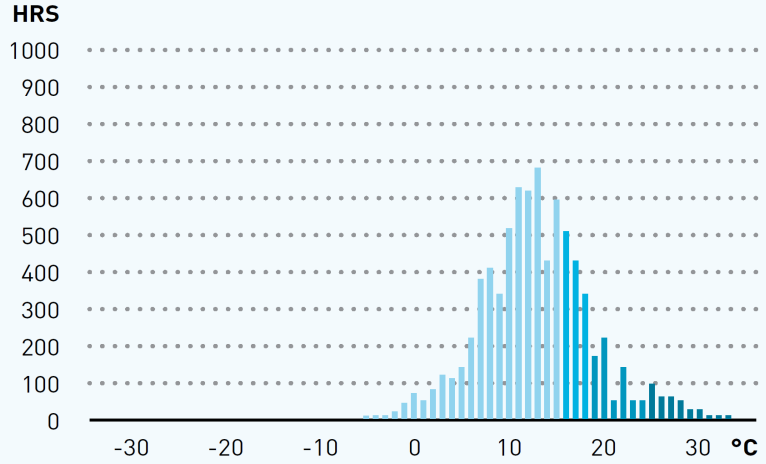


SAN FRANCISCO

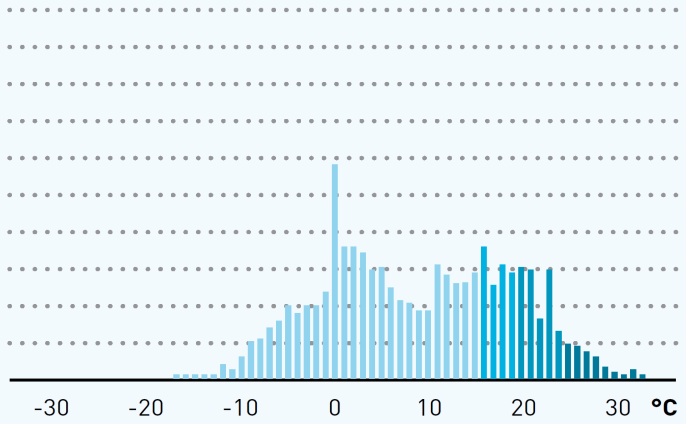
FREE COOLING OPERATION
MECHANICAL MODULATION
SUBCRITICAL OPERATION
TRANSCRITICAL OPERATION

kW [kW] TOTAL POWER CONSUMPTION FOR 80% LOAD
pPUE POWER UTILISATION EFFECTIVENESS

Notes: Data for *Aquilon-15 17.2 TR (60.5 kW)*, model shown above, based on fluid temperature of 75°F (24°C) and outdoor temperature of 95°F (35°C). Data for models *Aquilon-50 50 TR (175 kW)* and *Aquilon-30 30 TR (100 kW)* also available upon request.



SEATTLE



TORONTO

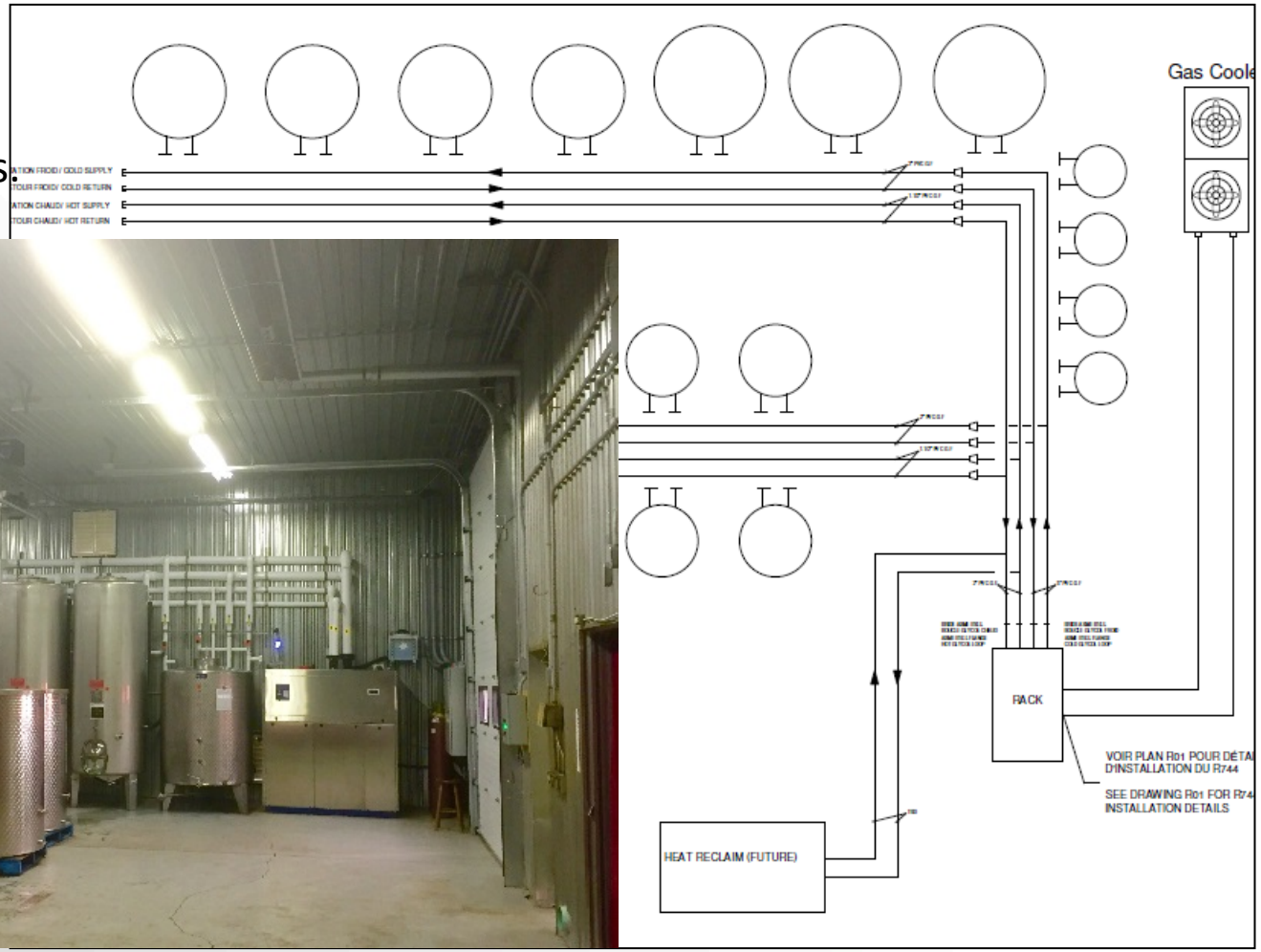
Marynissen Winnery (Canada): Transcritical CO_2 chiller with heat recovery

Project description:

- Winnery
- Charge: 70 pounds of CO_2
- One independent circuits
- Motor power 44,8kW
- 208/3/60
- Capacity: 106 kW (30TR per circuits)

Innovations:

- Heat Recovery for fermentation process



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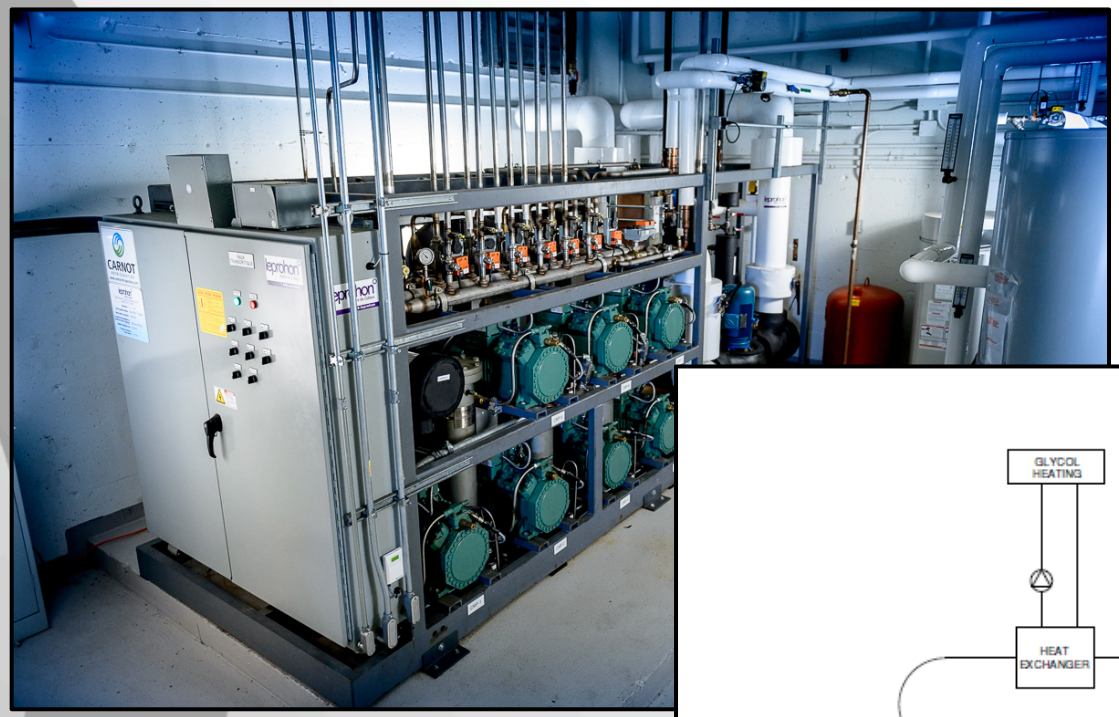
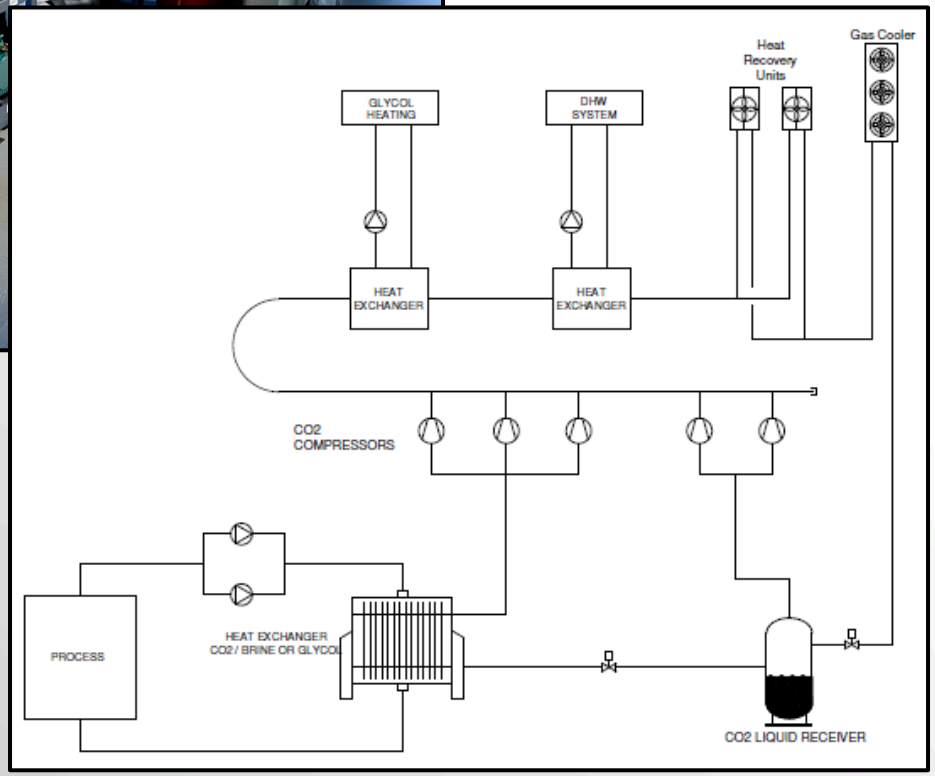
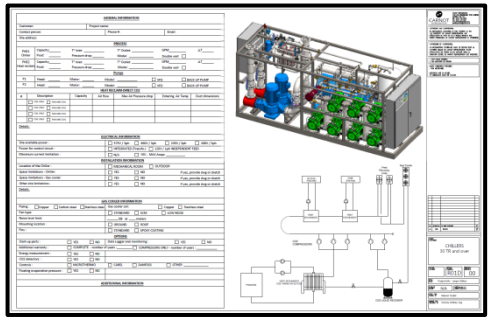
CO_2 TC Liquid Chillers :

Capacities : 15 TR (50kW) → 300 TR (1 000 kW)





Technical Brochure



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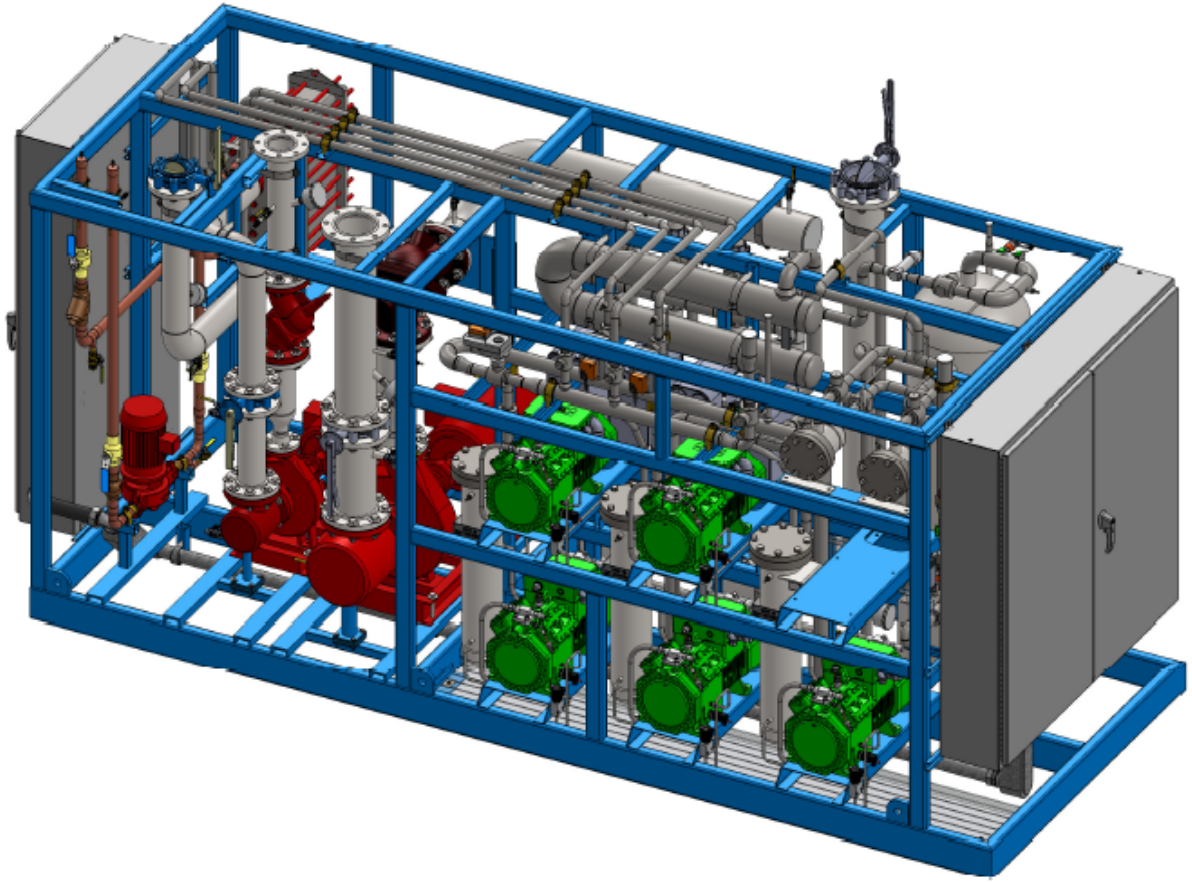
CO_2 TC Chillers / Heat Pump

Complete and Integrated Solution

- Process or HVAC chilled water loop
  - Water; glycol; brine
  - Down to -40°F (-40°C) process temp.
  - Cooling EER (COP) up to 240+ (71+)
- Process or HVAC hot water loop
  - Water; glycol; brine
  - Up to 170°F (77°C) process temp.
  - Combined EER (COP) up to 55 (16)
- Direct CO2 to Domestic hot water loop
- Reduced foot print
- Full redundancy on key components
- Optional integrated pump skid
- Optional Patented Rain Cycle (Free Cooling)



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CO_2 TC Chillers / Heat Pump

Performance Data – Heating unit

CARNOT HEAT PUMP

Cooling Capacity	Fluid Temperature (°F)		Heating Capacity	Supply Temperature			
TR	Inlet	Outlet	(°F)	60°F	90°F	120°F	150°F
100	55	45	EER	28,5	14,0	8,8	5,1
			Capacity	1451	1880	1613	947

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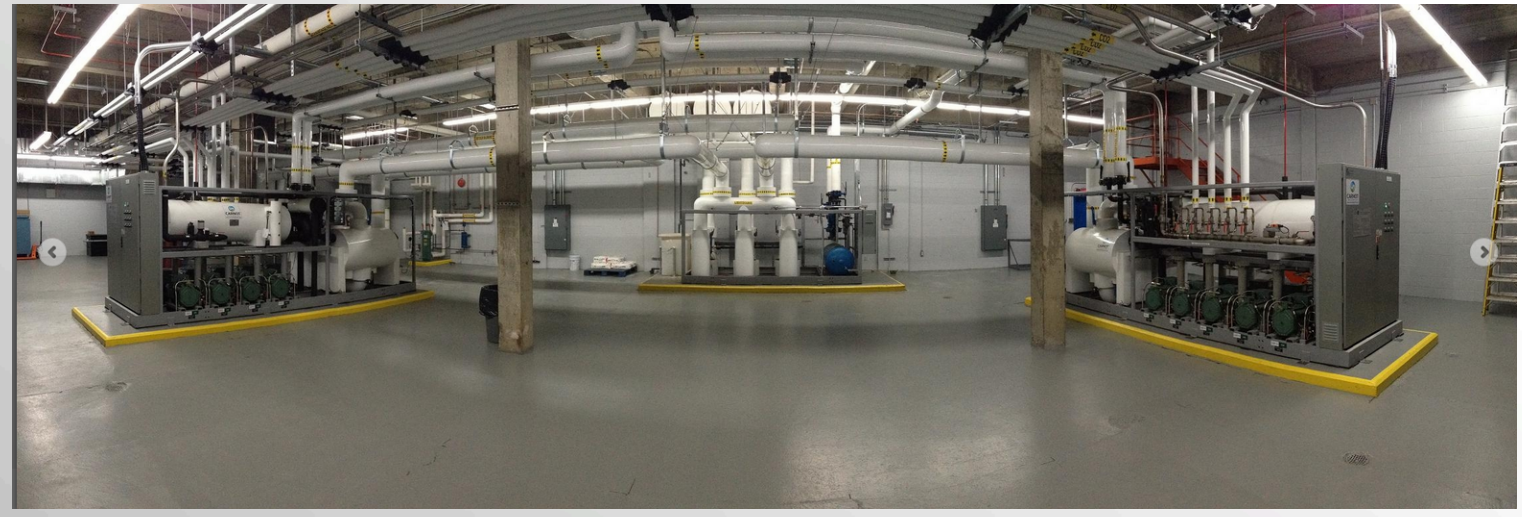
Before

After



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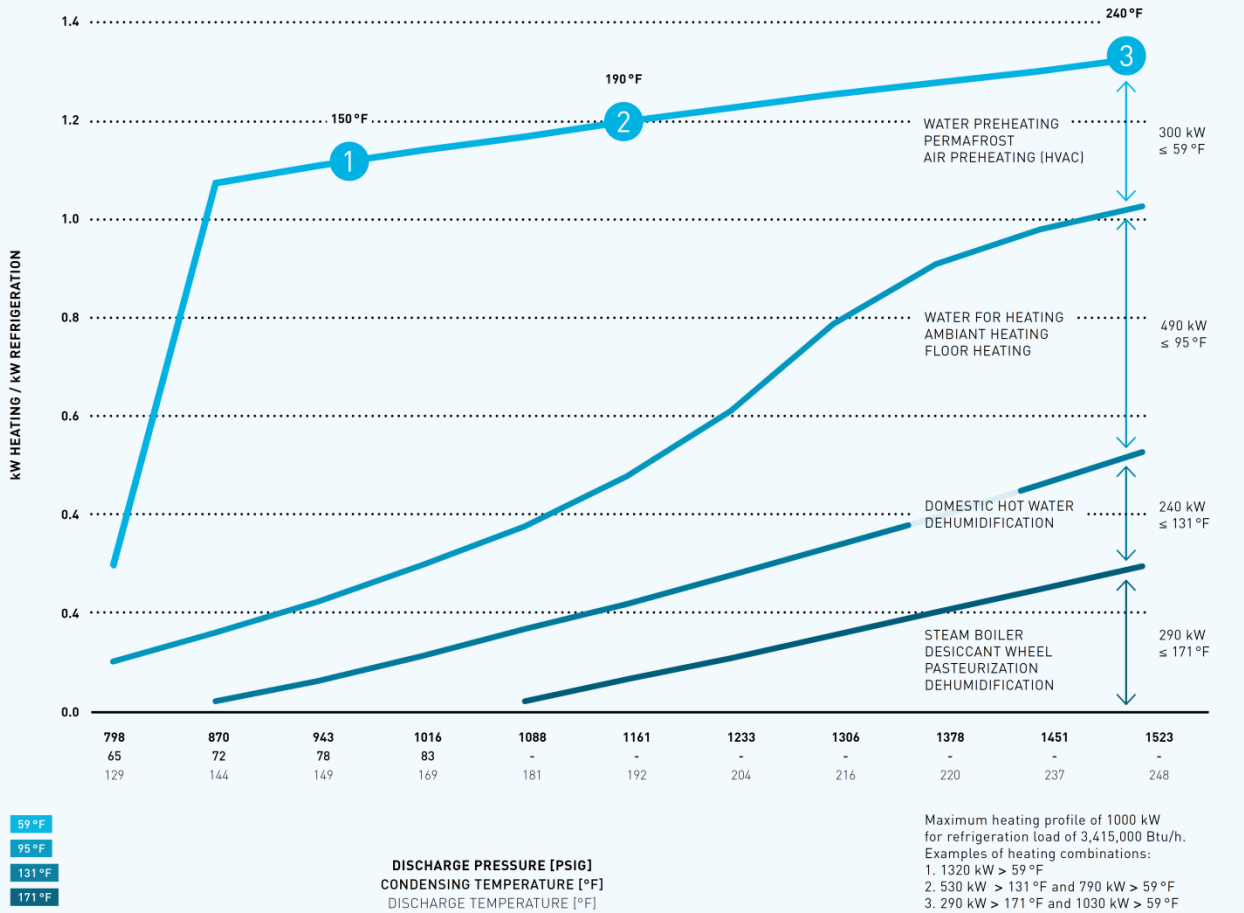
CO_2 ADVANTAGES : Heat Recovery

RCINTELLIGENT IS A SMARTER WAY TO USE THE REJECTED ENERGY OF YOUR PROCESS.

HEAT RECOVERY AVAILABLE WITH
CARNOT CO_2 TRANSCRITICAL SYSTEMS



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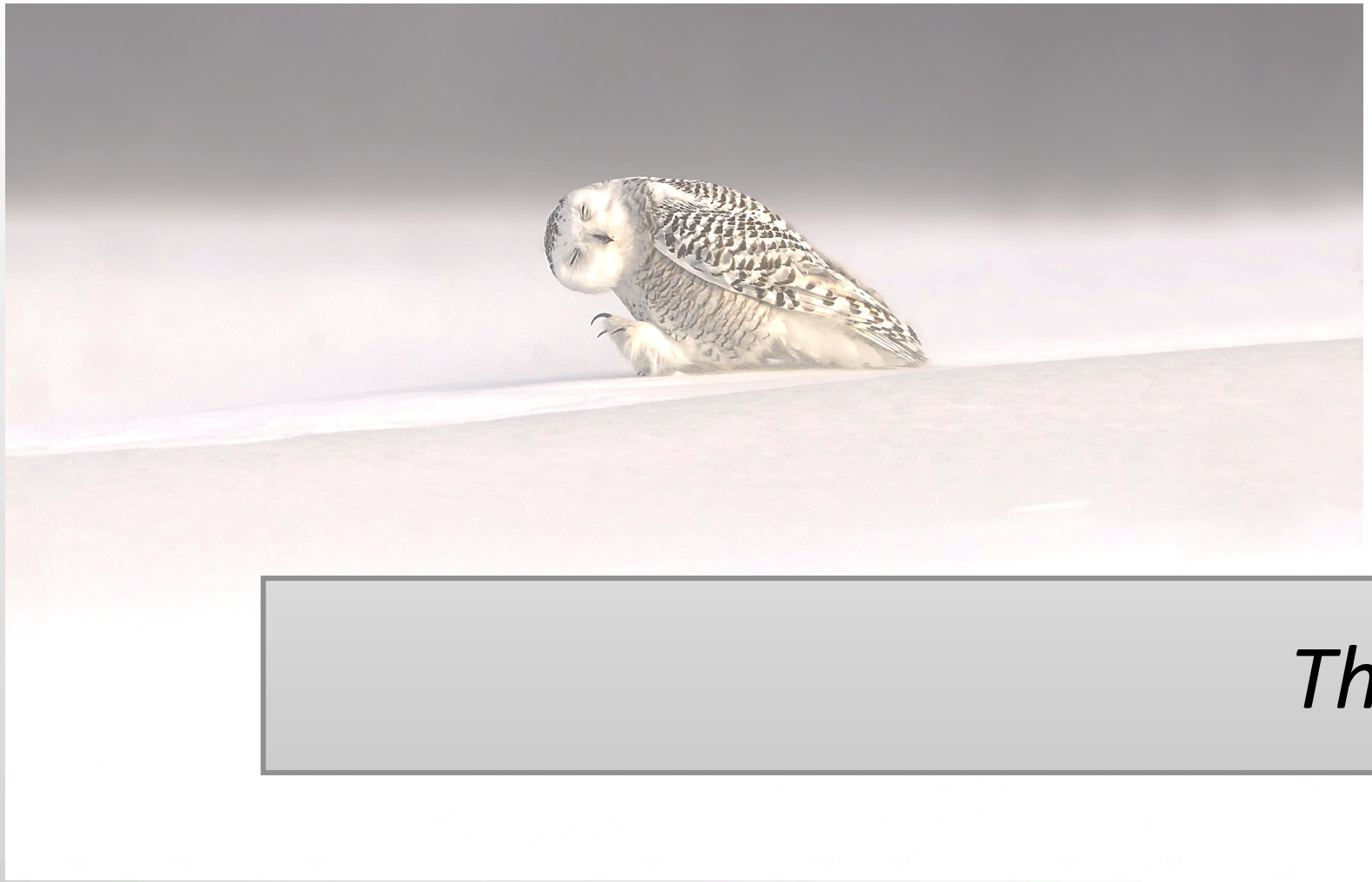

Thank you

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