



Tecumseh Products Company

Innovative Hydrocarbon Solutions
Beer Cooler Application

Beer Cooler - Case Study

SYSTEM

- Refrigerant R134a
- Refrigerant Charge 320g
- Capillary Tube (D=1.93mm, L=1.4m)

EVAPORATOR

- Copper coil immersed in water
- D = ½ in
- L = 13.2m
- Agitator (propeller)

CONDENSER

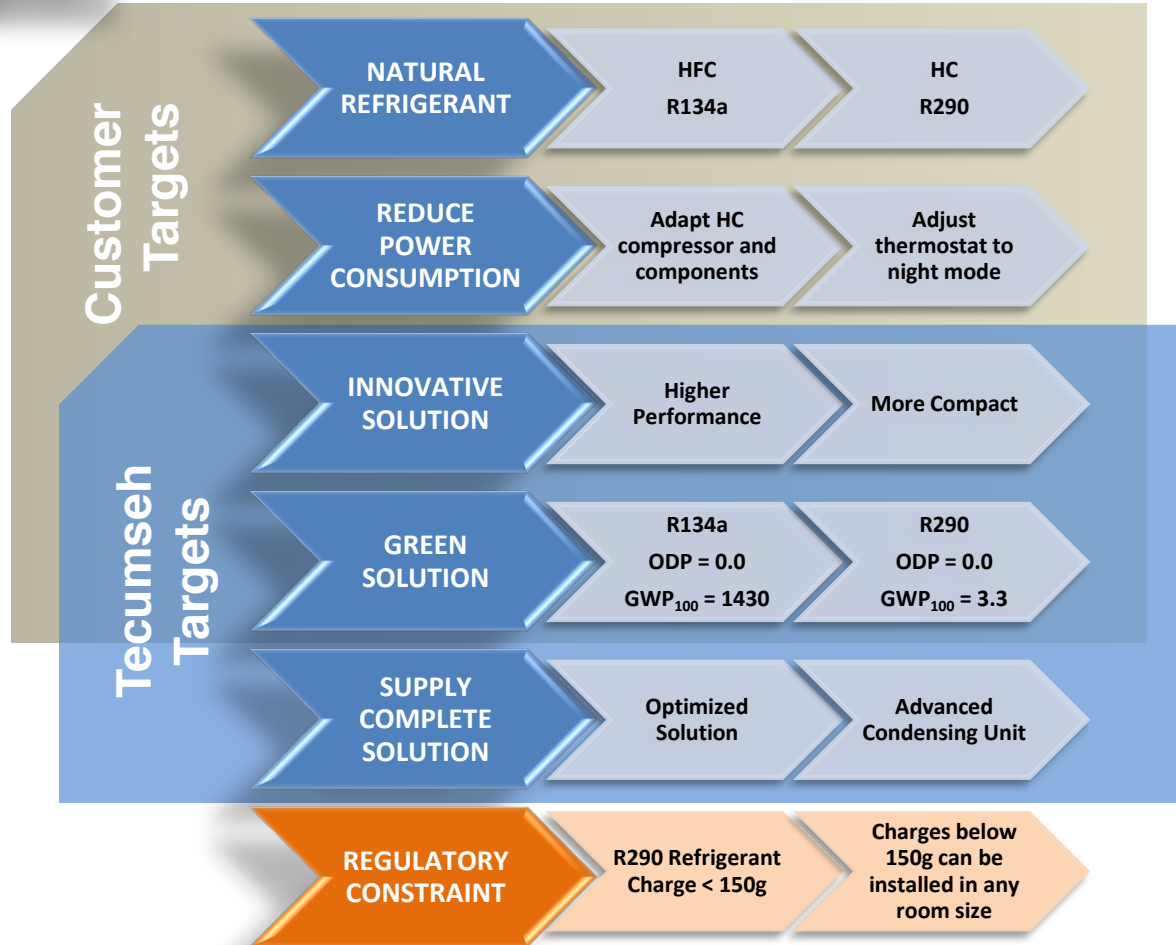
- Tube (Cu) and Fin (Al)
- Fan (forced convection)

COMPRESSOR

- Reciprocating Compressor
- Tecumseh CAJ4461Y (AE²4460U)



Advantages / Targets



Evaluation Criteria

Original system (R134a) Results

TIME
60min

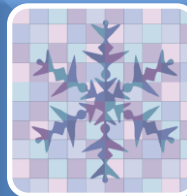
COOLING CAPACITY
1122W
(3832 BTU/h)

Condensing Unit
CONSUMPTION
7903 Wh/day



PULL DOWN

- Time to Water Temperature Reduction
- From 25C (77F) to 3C (37F)
- Time is measured



CONTINUOUS RUNNING

- Electric heater keeps $T_{\text{water}} = 3\text{C}$ (37F)
- Capacity & Power are Measured



NORMAL CYCLING

- Thermostat Set Temperature: $T_{\text{water}} = 3\text{C}$ (37F)
- Electrical Heater in the water (580W)
- Consumption is measured

Evolution of the Conversion

	Original	Intermediate 1	Intermediate 2	Final
Compressor	CAJ4461Y	AE ² 4460U	AE ² 4460U	AE ² 4460U
Refrigerant	134a	R290	R290	R290
Refrigerant Charge [g]	320	189	149	148
Condenser	Finned Tube	Finned Tube	Finned Tube	Micro Channel
Capillary Tube Diameter [mm]	1.4	1.2	1.2	1.2
Capillary Tube Length [cm]	193	220	190	190

CONTINUOUS RUNNING TEST
 * T_{WATER} kept at 3C (37F) by the heater

Cooling Capacity [W]	1122	+16%	1298
Condensing Unit Power Input [W]	615	612	574
COP [W/W]	1.8	+33%	2.4

PULL DOWNTTEST
 * T_{WATER} reduced from 25C (77F) to 3C (37F)

Time [min]	60	-13%	52
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CYCLE RUNNING TEST

- Water Temperature Set Point 3C (37F)
- Electrical Heater in the Water (580W)
- Ambient Temperature 25C (77F)

Gas Return Temperature [C]	25.6	-	21.3	19.8
Running Time [%]	57.5	-	54.6	50.7
Condensing Unit Consumption [Wh/day]	7903		6129	
TOTAL Consumption [Wh/day]	8521	-	7825	6733



- A significant reduction of 22% of System Energy Consumption was achieved using HC (R290) refrigerant.
- Green Solutions can improve System Performance (+16% in this case).
- Charge reduction and more efficient compressor allowed for a more compact system solution.
- The maximum limit of 150g of R290 Refrigerant Charge was achieved, in addition to a COP increase of 33%.
- Tecumseh application expertise and certified labs, applied in close collaboration with customer engineers, enabled a winning solution.



Thank you!