

Energy Saving with Water Misting System for Parallel Refrigeration System

Study Period: Sept to Oct 2012

Location: Tesco Store



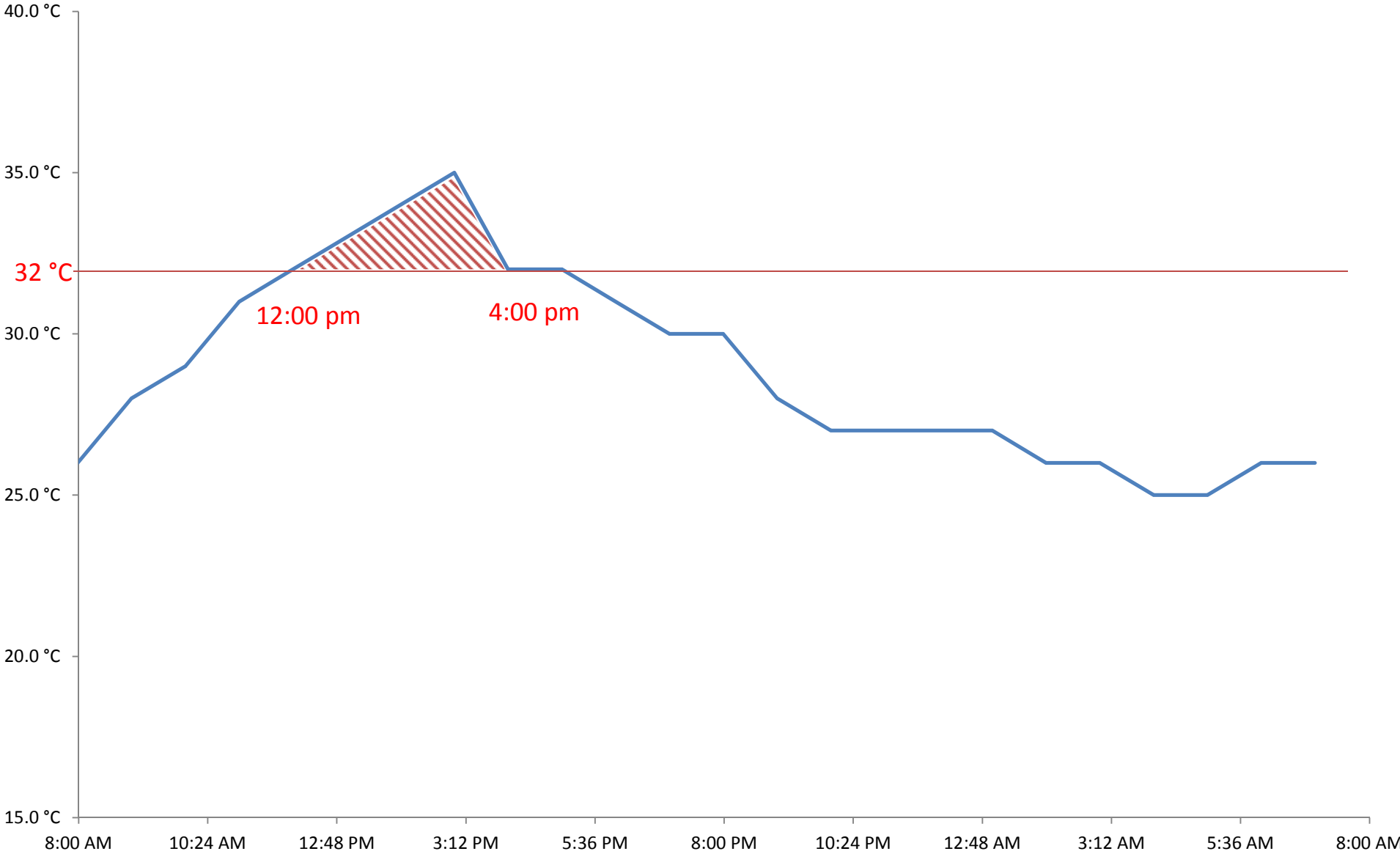
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TESCO

Background

- Energy cost
- Carbon footprint
- Condensing equipment insufficient for peak load without oversizing it

Ambient Temperature on Typical Day



Existing Solutions for High Ambient Temperature

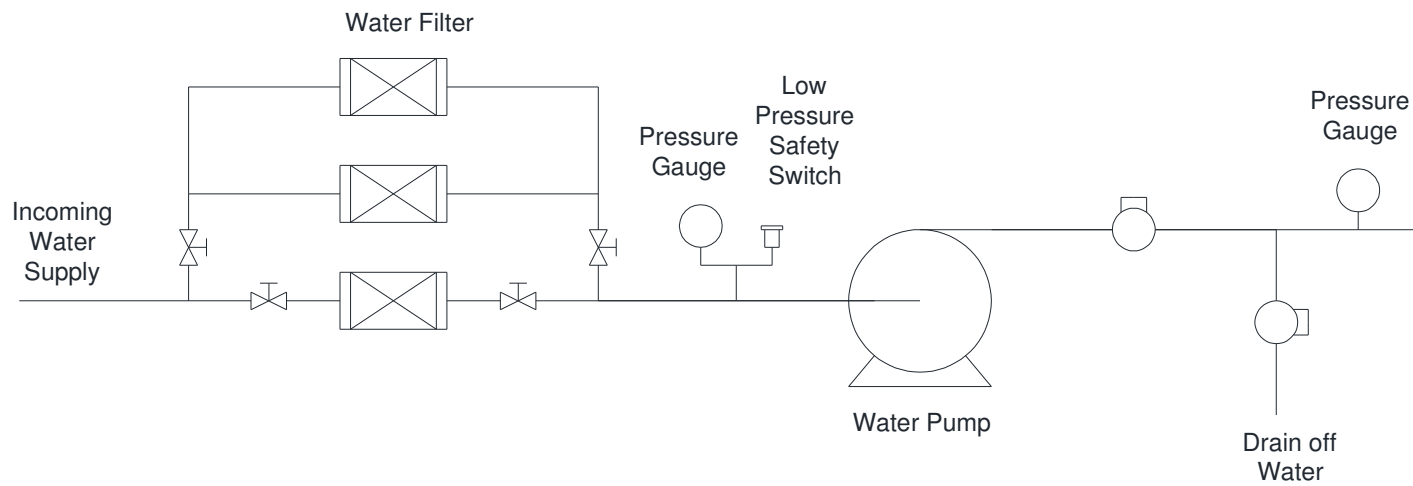
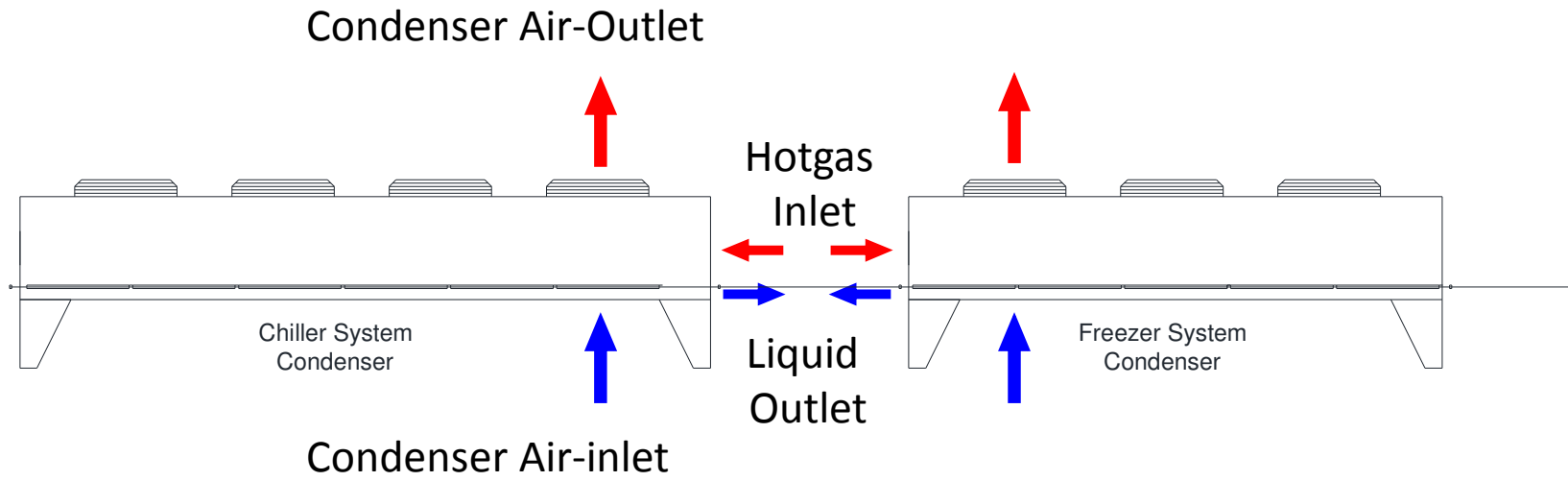
- Cooling towers and evaporative condenser
- Evaporative pad systems
- Sprinkler system
- Oversized condenser

Advantage of Misting System

- Increase condensing capacity during peak load
- No system stoppage during installation
- Cost effective
- Extend compressor life span
- Lower water cost
- Improved system performance

Methodology

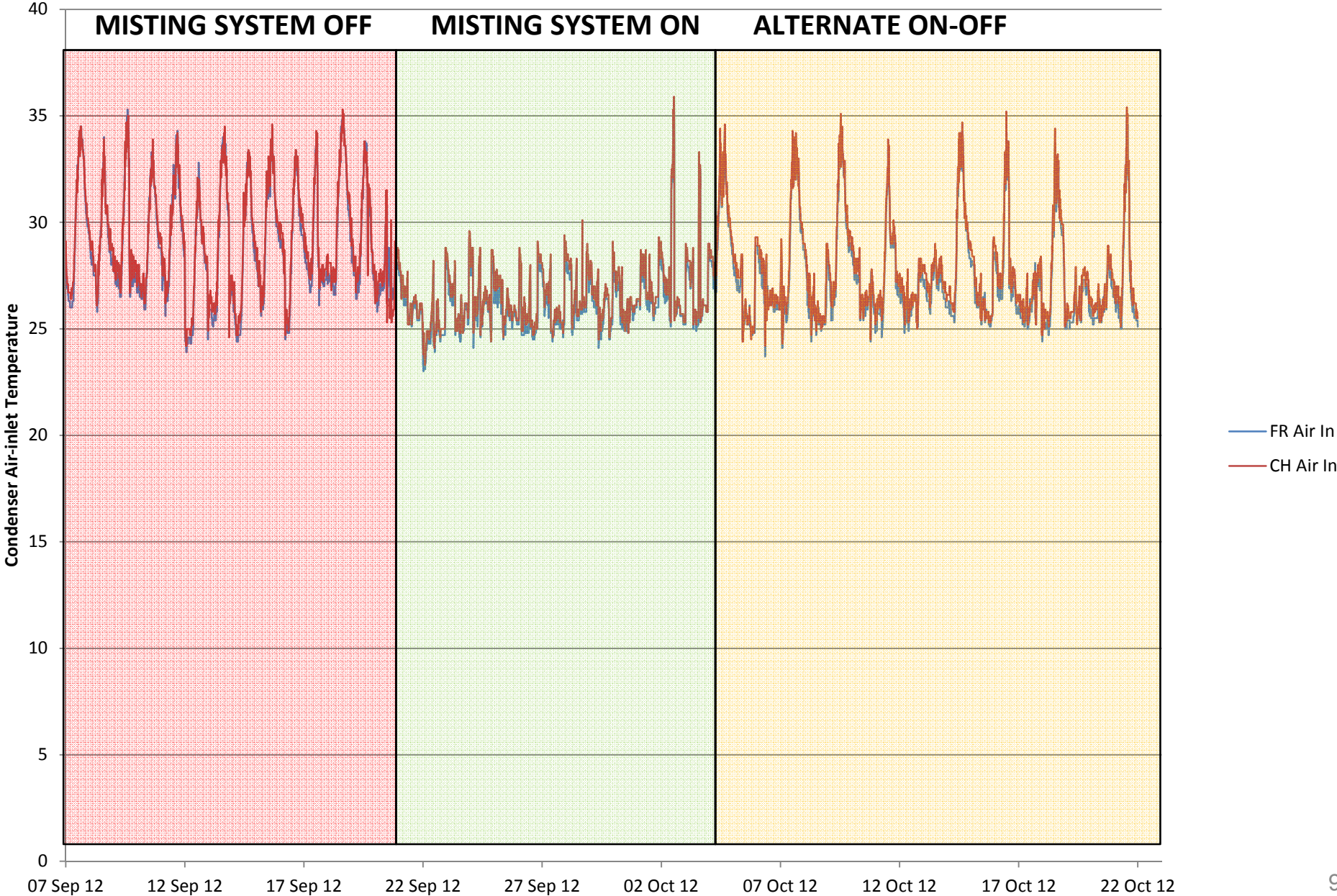
- Log parameters before commissioning of misting system
- Log parameters after the commission of misting system
- Alternately turn on and off misting system on daily basis
- Parameter to study:-
 - Temperature of condenser air-in
 - Temperature of liquid leaving condenser
 - Saturated condensing temperature
 - Saturated suction temperature
 - Compressor run operation time
 - Power consumption of system



Result and Discussion

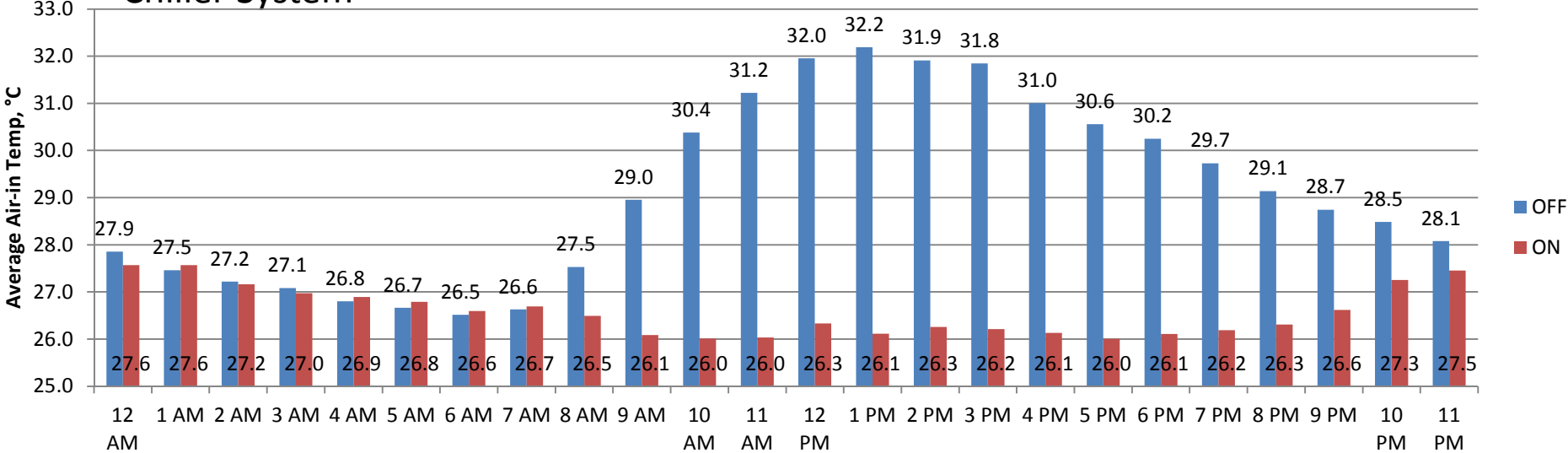


Comparison of Air-in Temperature

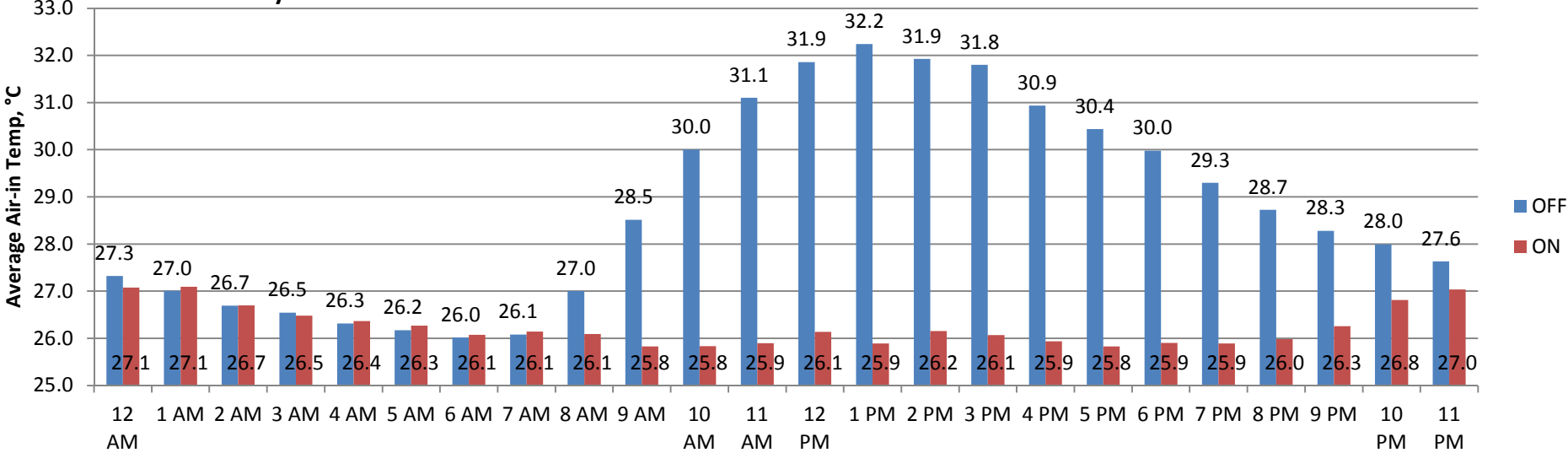


Hourly Average Air-in Temperature

Chiller System

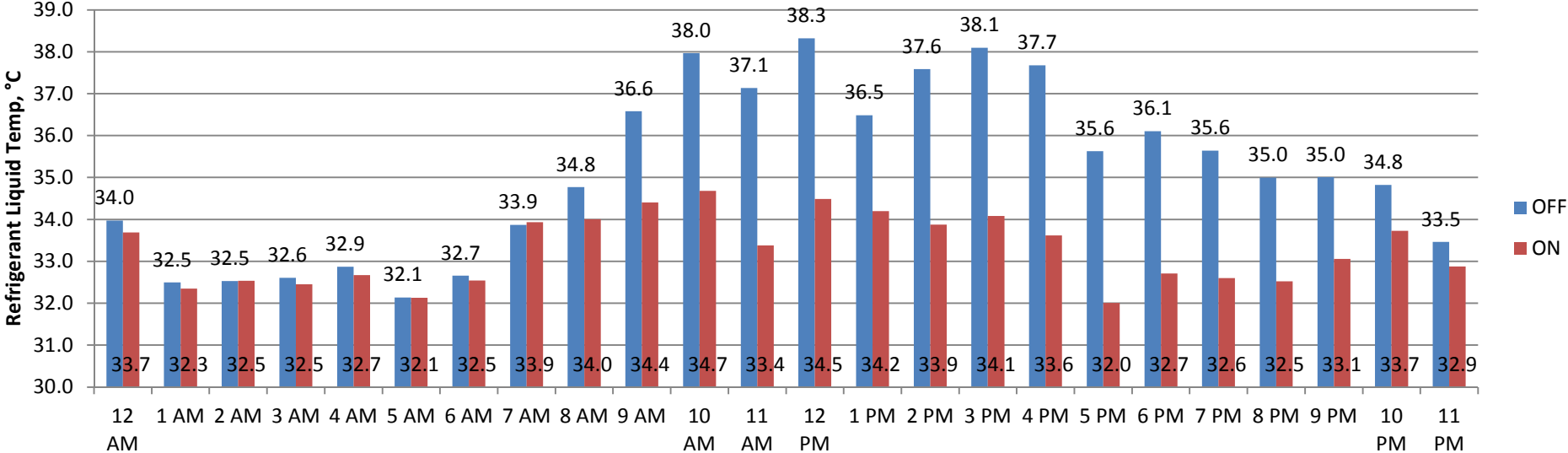


Freezer System

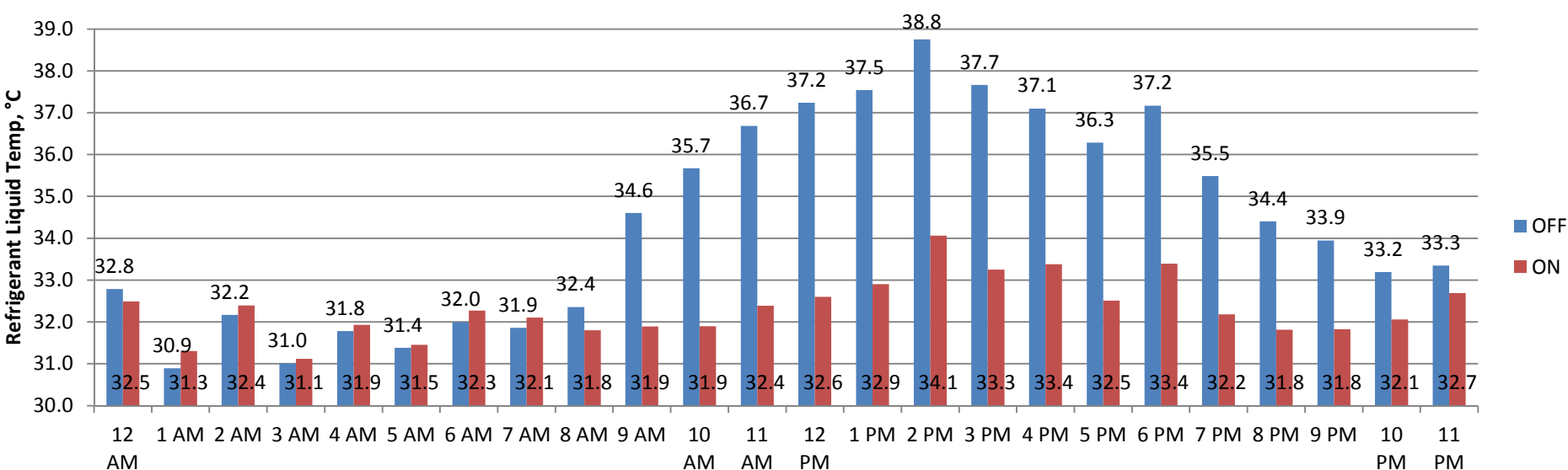


Comparison of Liquid Out Temperature

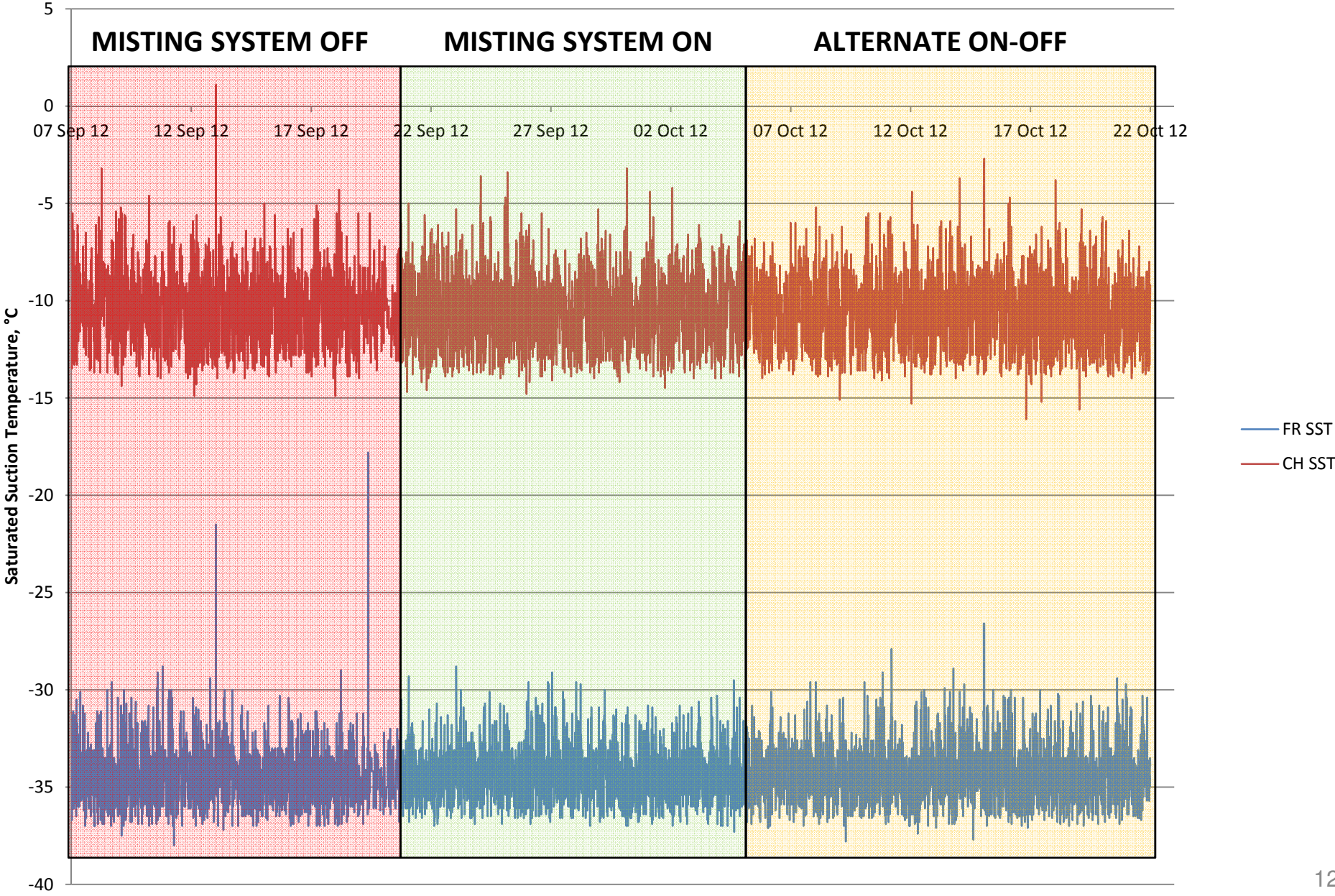
Chiller System



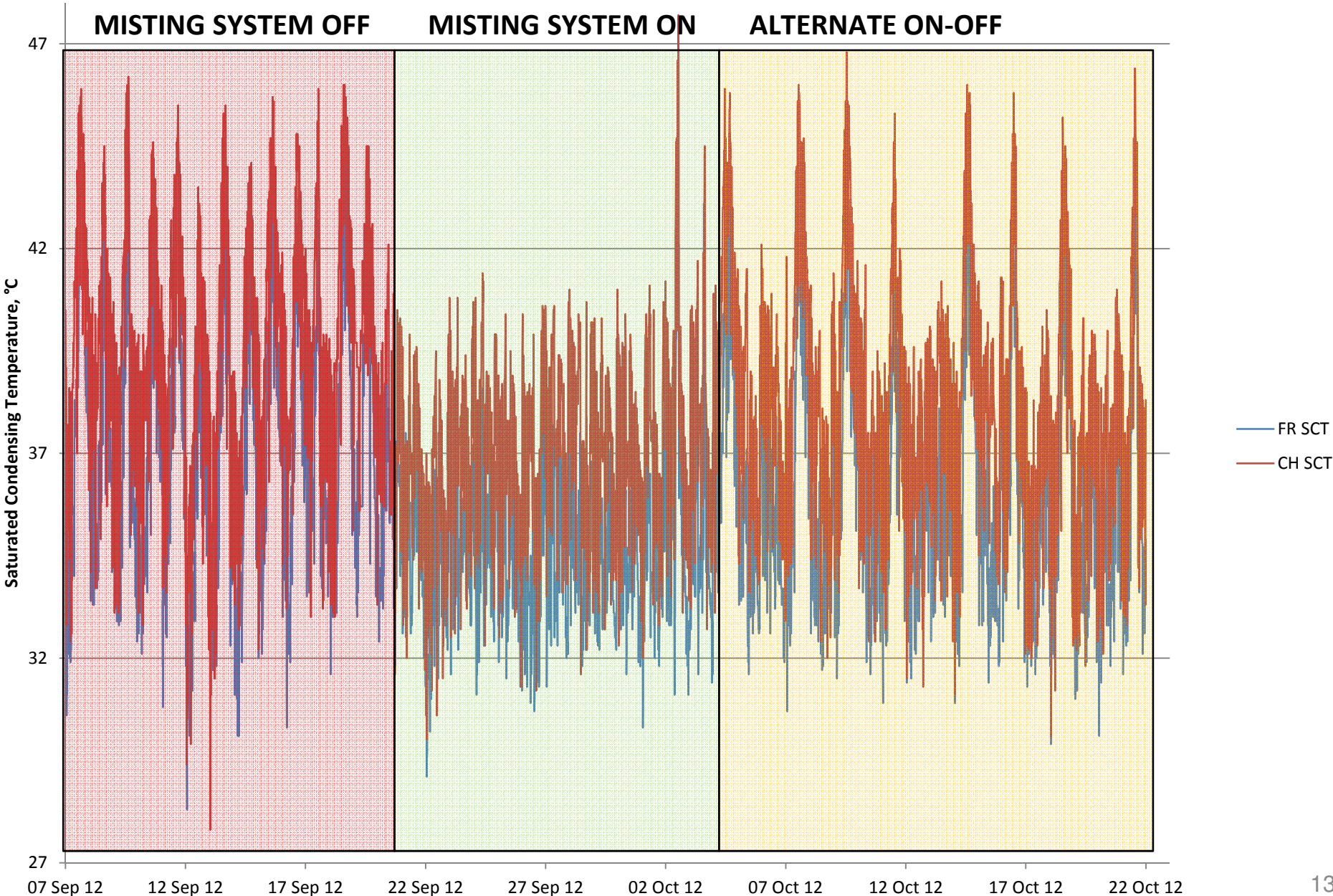
Freezer System



Comparison of SST

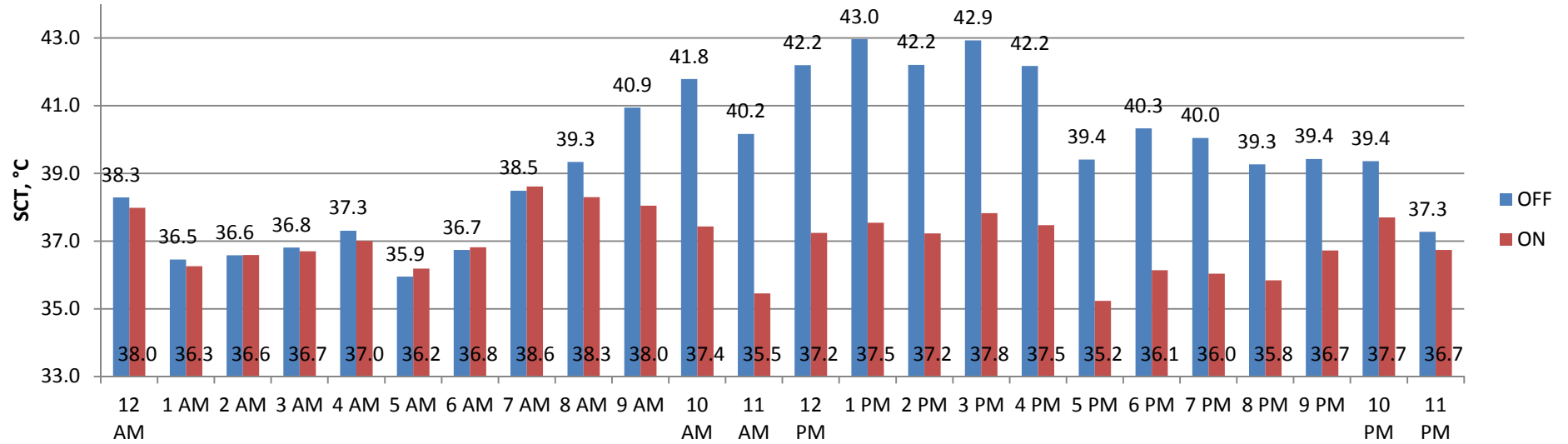


Comparison of SCT

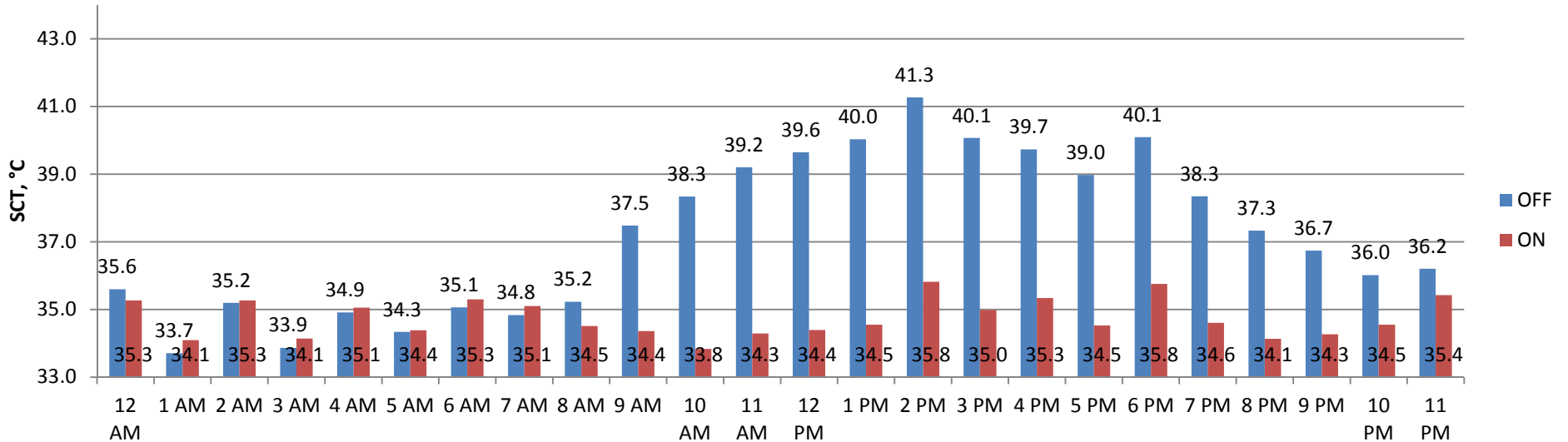


Comparison of SCT

Chiller System

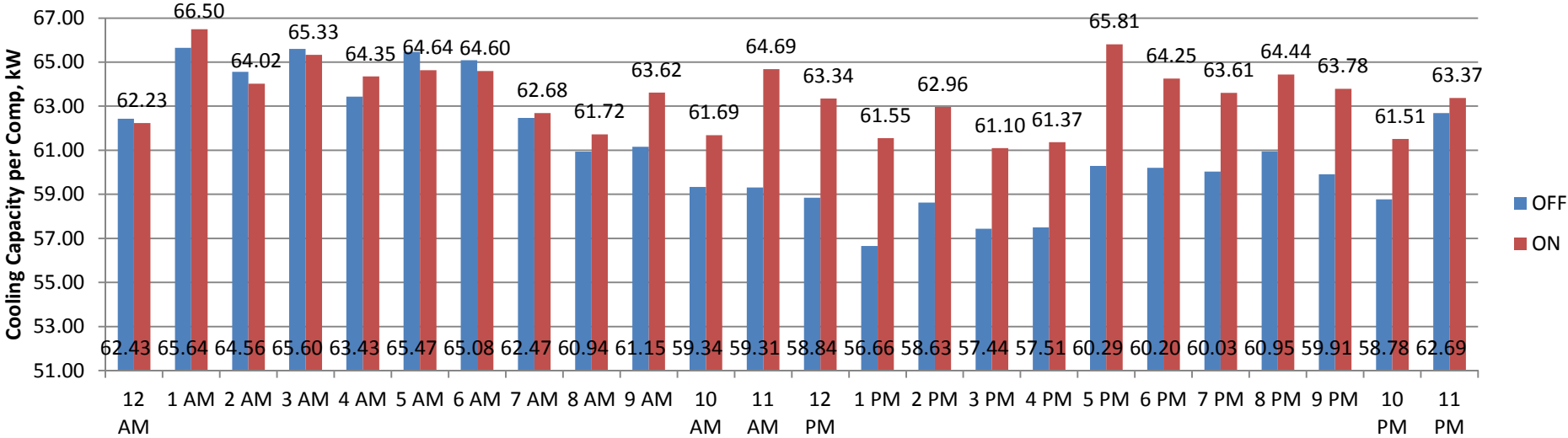


Freezer System

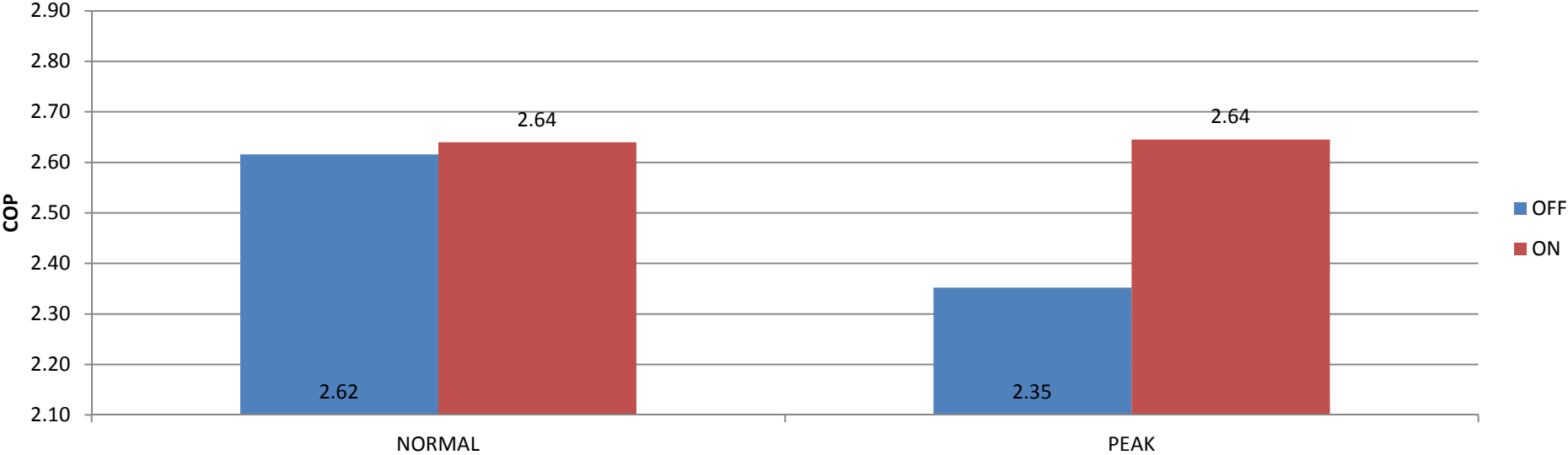


Cooling Capacity and COP (Chiller System)

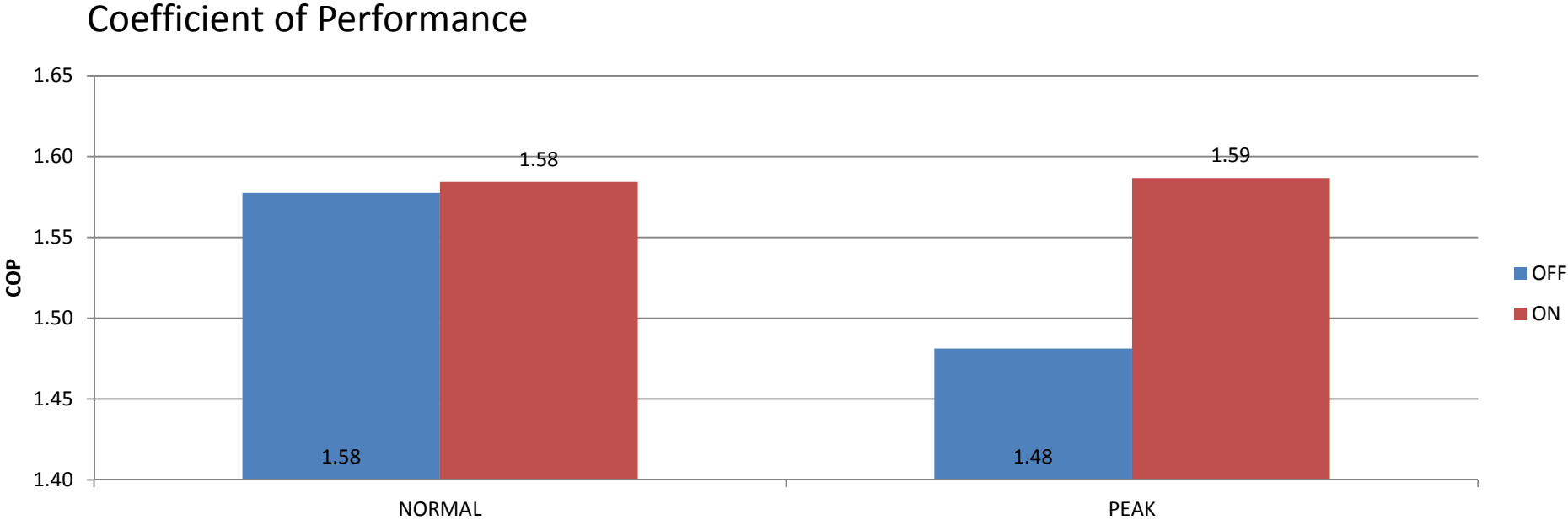
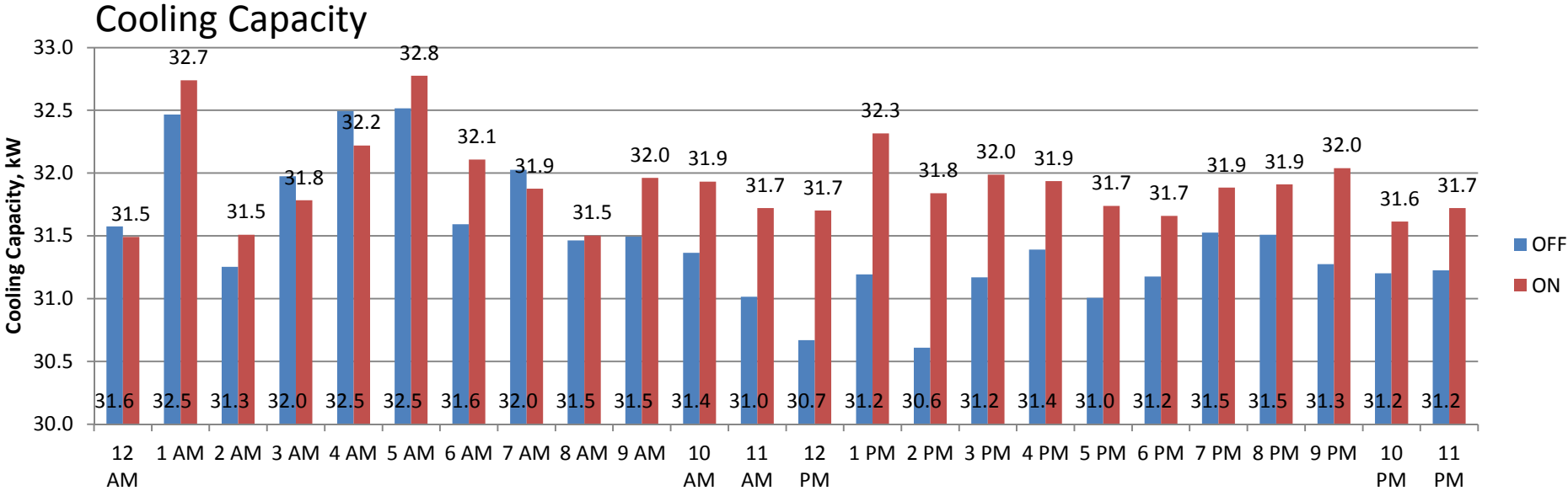
Cooling Capacity



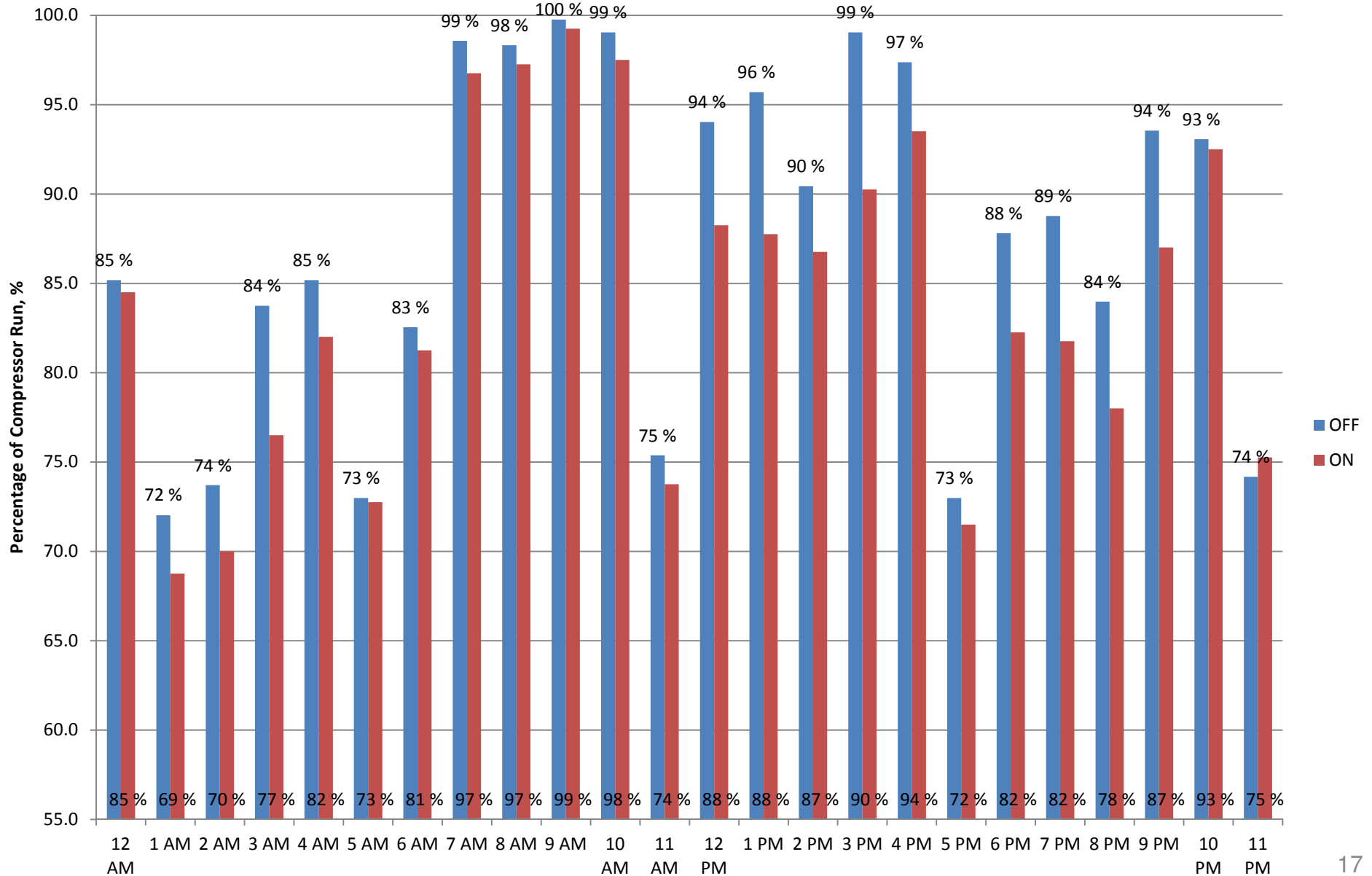
Coefficient of Performance



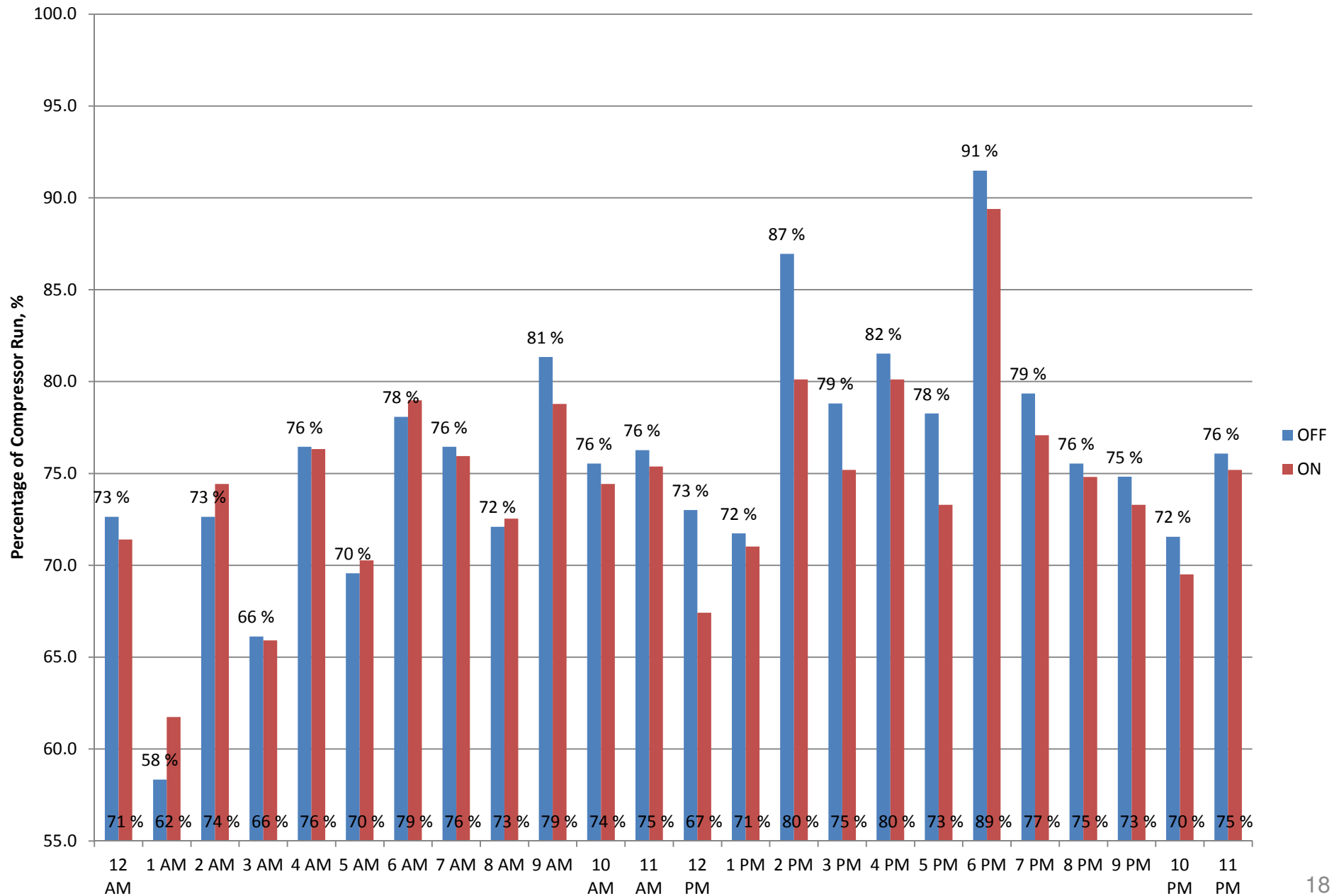
Cooling Capacity and COP (Freezer System)



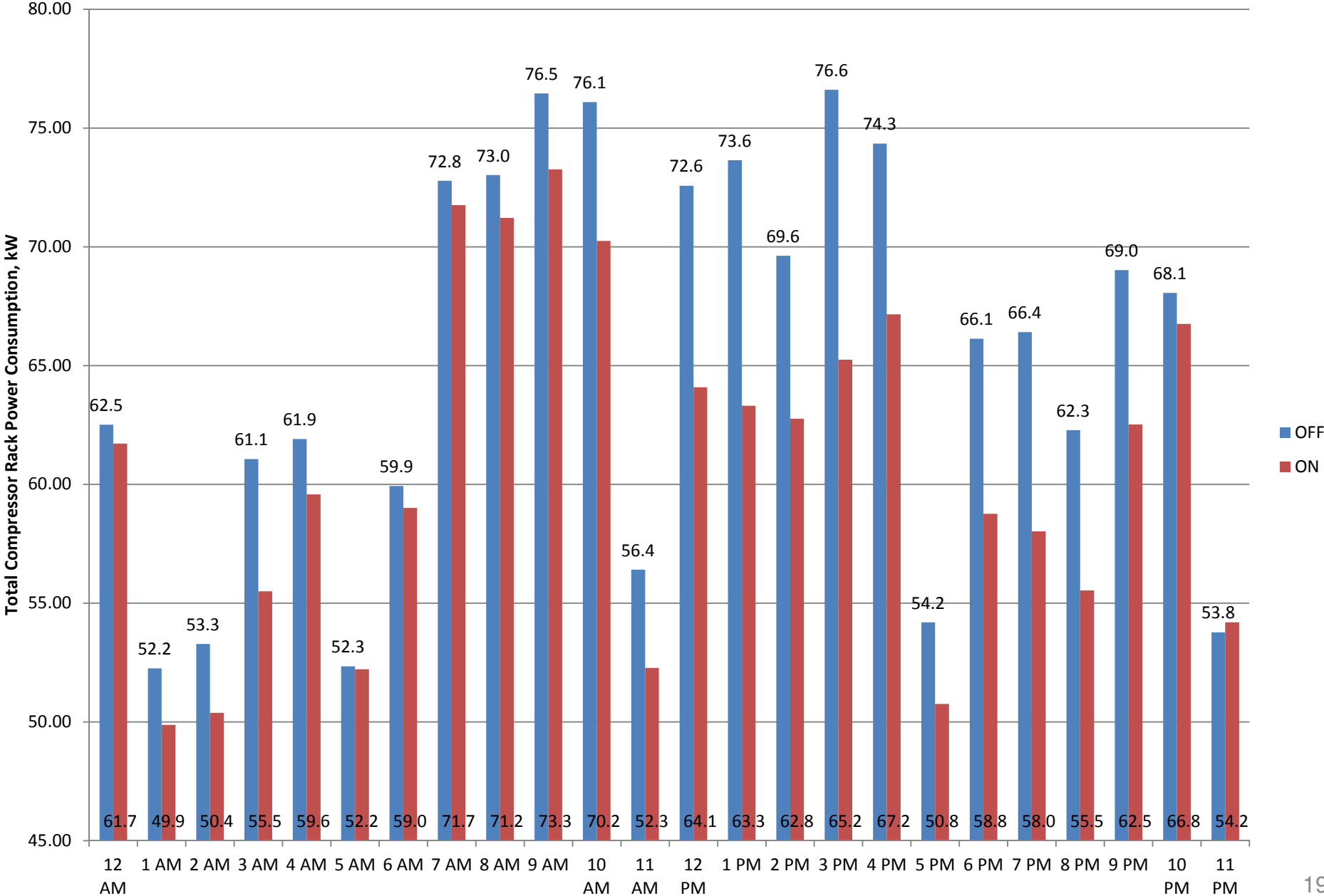
Average Compressor Run Time (Chiller System)



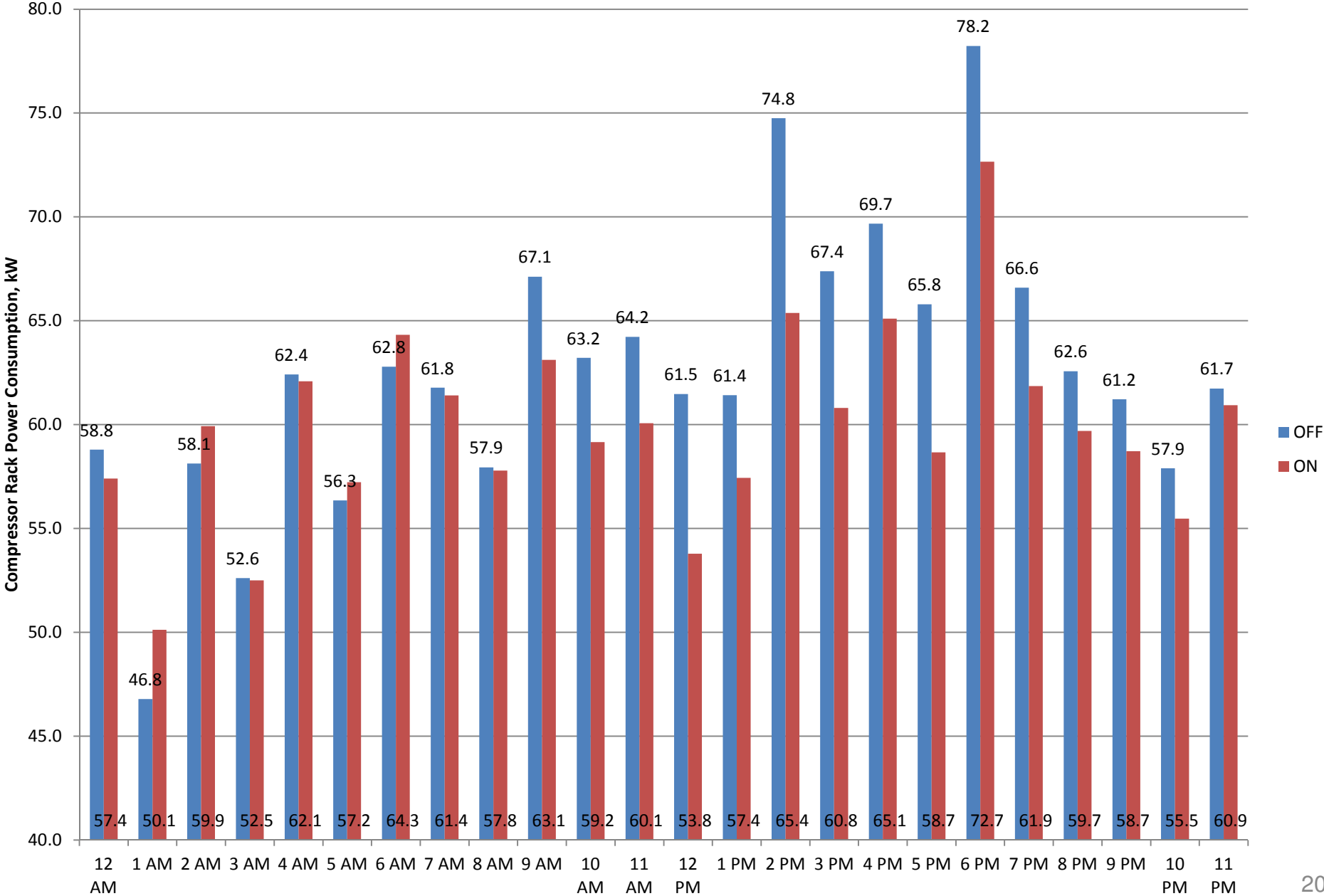
Average compressor Run Time (Freezer System)



Compressor Power Consumption (Chiller)



Compressor Power Consumption (Freezer)

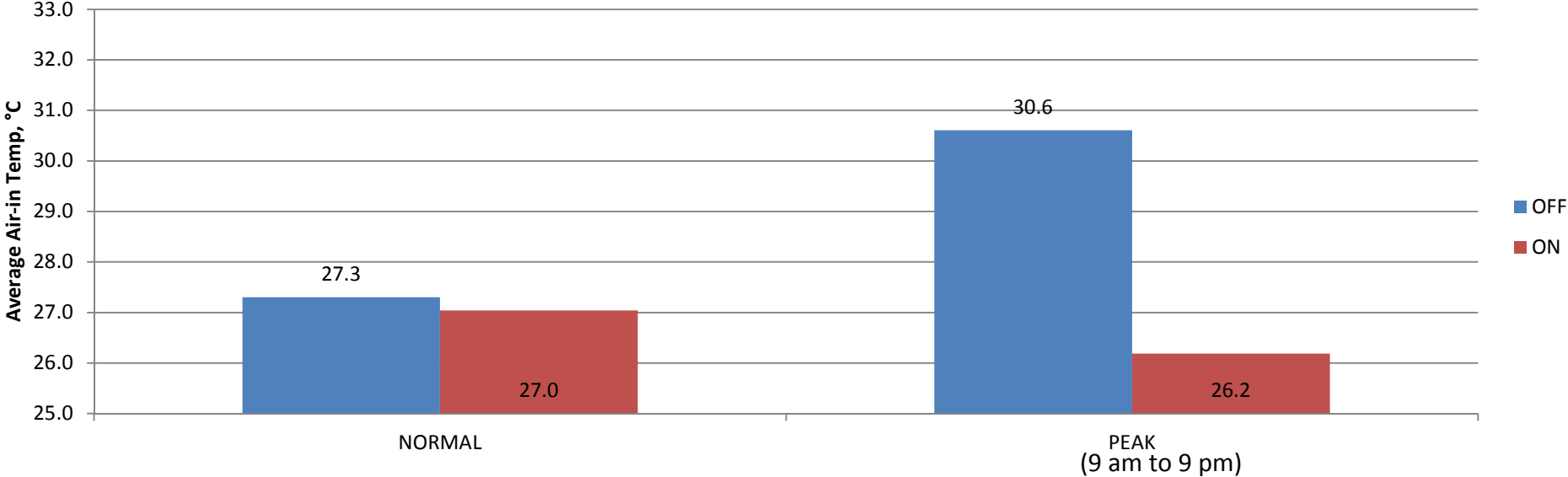


Conclusion

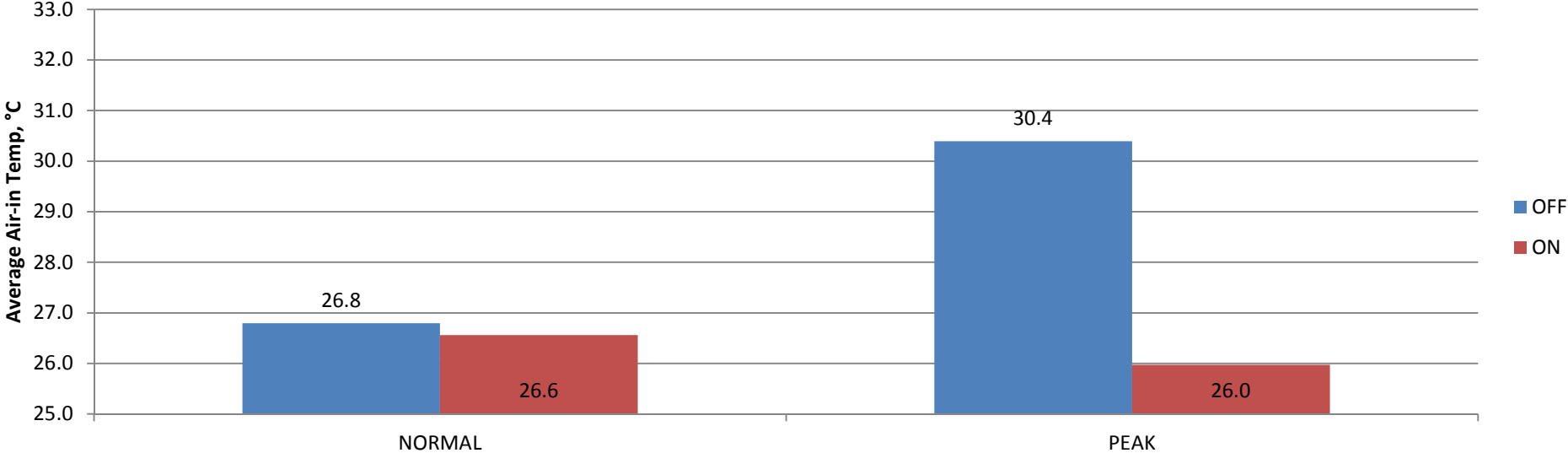


Condenser Air-in Temperature

Chiller System

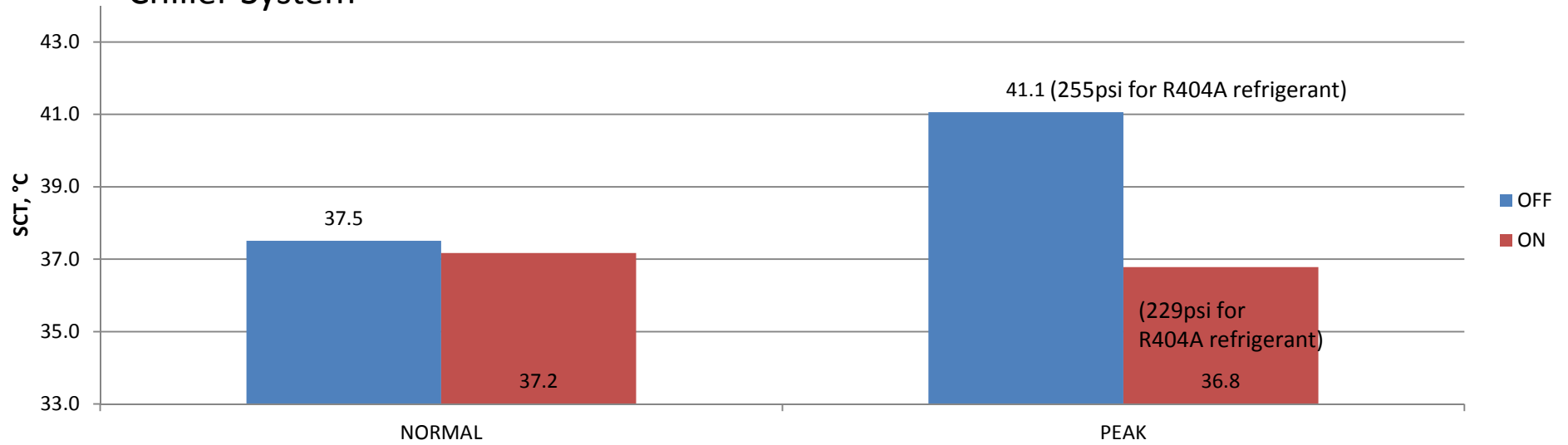


Freezer System

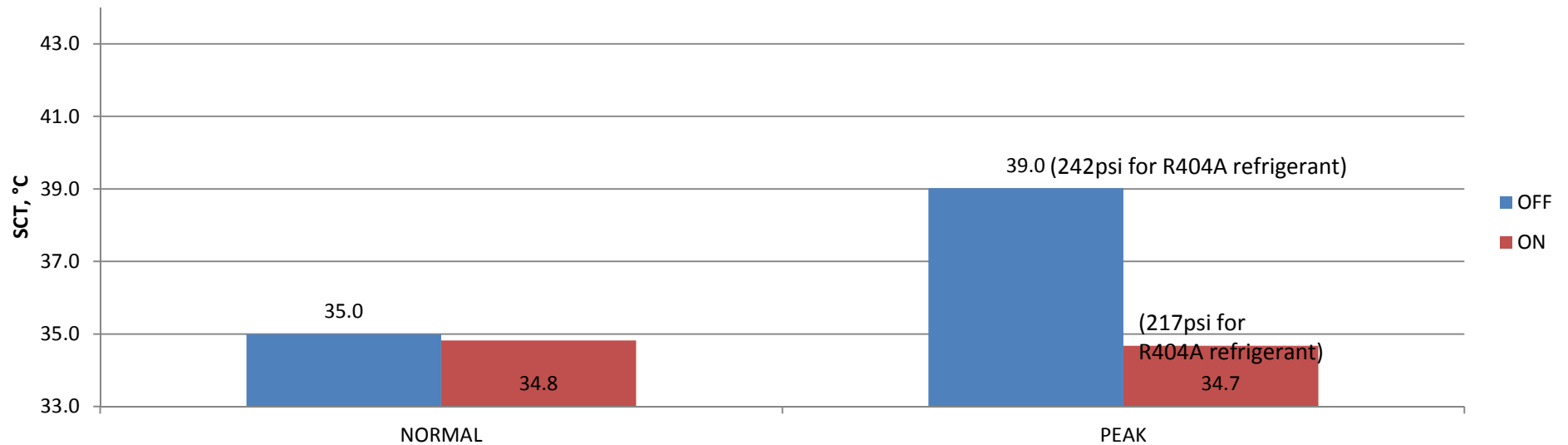


SCT

Chiller System

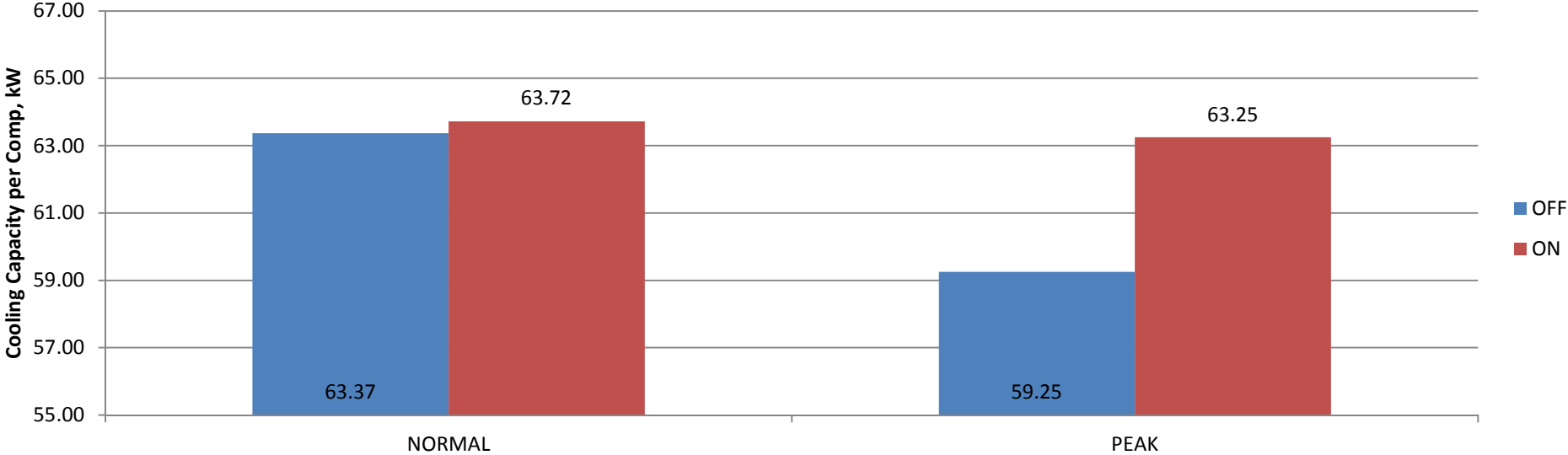


Freezer System

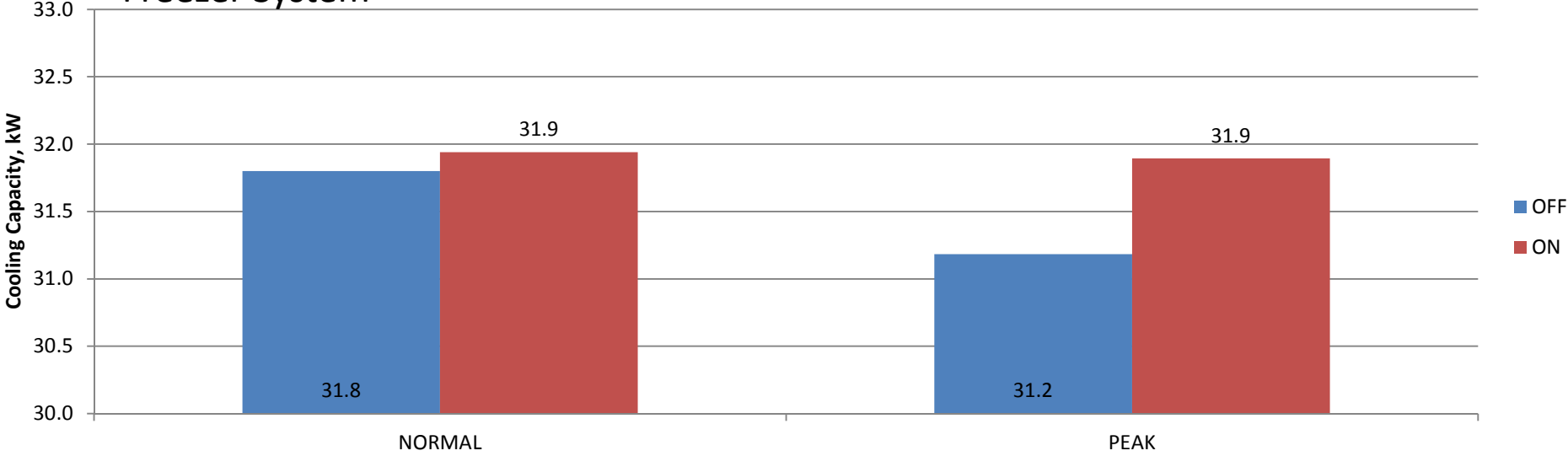


Cooling Capacity

Chiller System

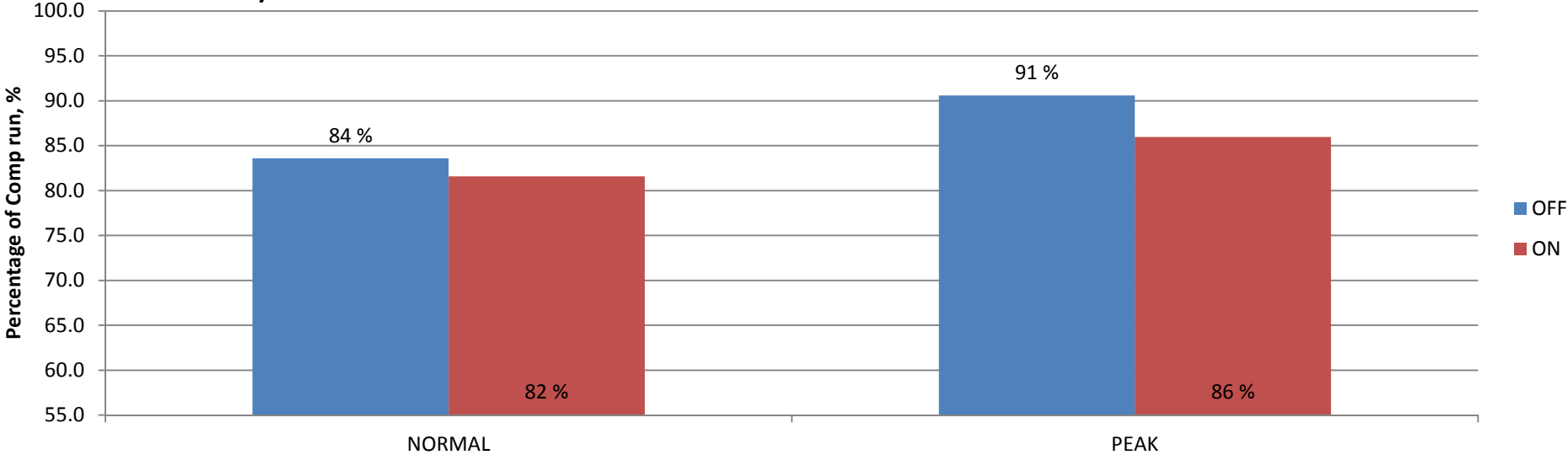


Freezer System

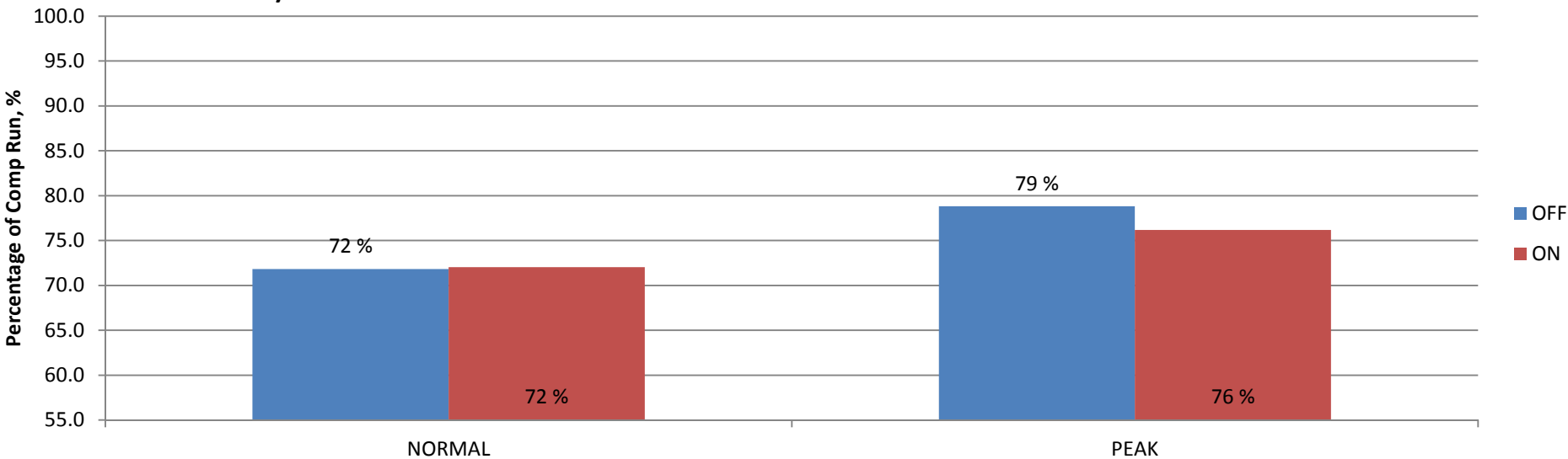


Compressor Run Time

Chiller System

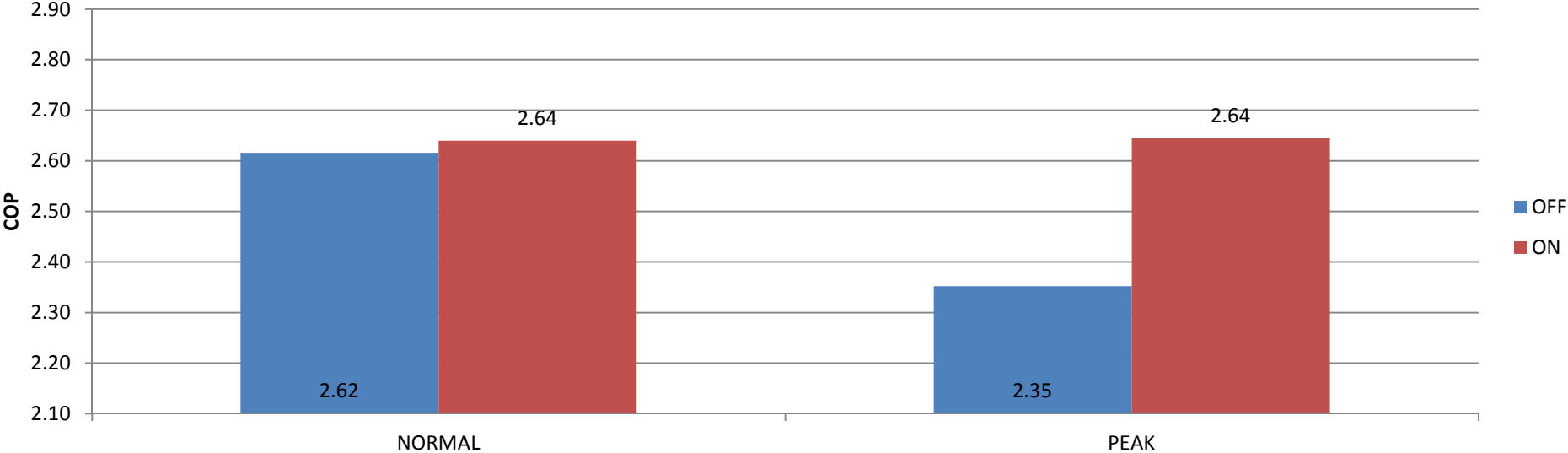


Freezer System

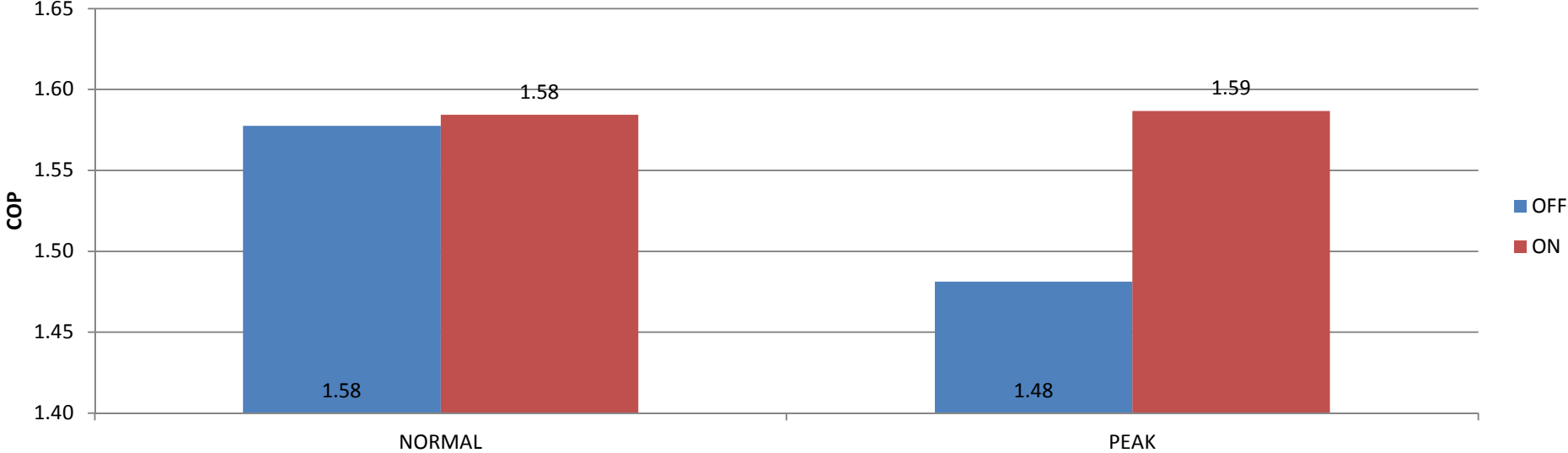


COP

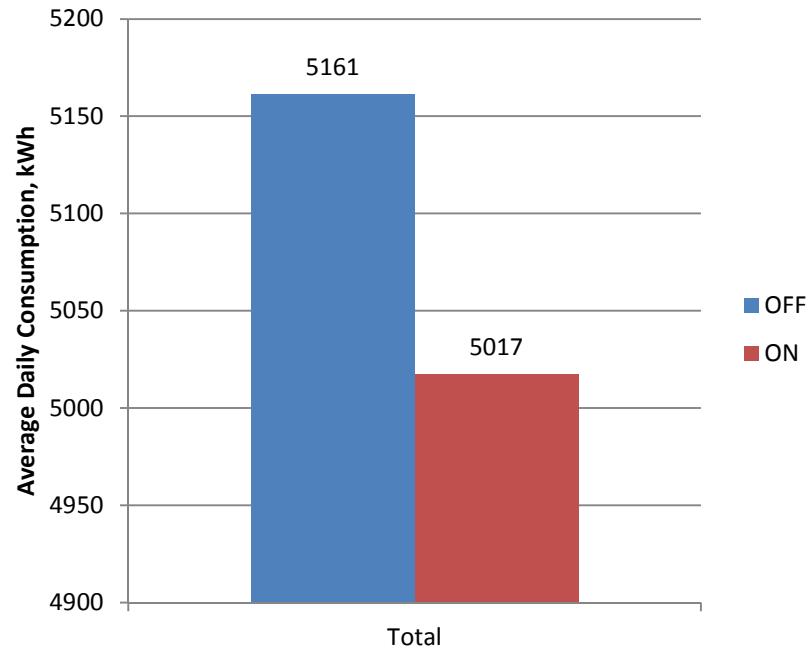
Chiller System



Freezer System



Overall Saving



	kWh	RM (RM 0.32/kWh)
Daily Saving	144 kWh	RM 46.08
Annual Saving	52,560 kWh	RM 16,819.20

Water Consumption & Maintenance

Average Pump Run	11.4 hour a day
Water Consumption	0.04 m ³ /hour
Monthly Water Consumption	13.68 m ³ /month
Water Tariff (RM 2.28/m ³)	RM 31.19/month (RM 374 per annum)
General Maintenance Cost	Approx. RM 1,000 per annum
Net Saving	RM 15,455 per annum

Conclusion

- SCT reduced by 4.3 °C during peak load for chiller and freezer system
- Cooling capacity increased by 6.8% and 2.2% for chiller and freezer system respectively during peak load
- Compressor run time reduced by 4.6% and 2.6% for chiller and freezer respectively during peak load
- Compressor COP increased from 2.35 to 2.64 for chiller system, and 1.48 to 1.59 for freezer system during peak load
- Power saving of 25,560 kWh per year (2.8%) or a net saving of RM 15,455
- Lower discharge pressure, lower maintenance for compressor

Future Study

- Install system with high condensing temperature problem
- Install misting equipment on system with EC fan and compressor unloader