

Locating Your Data Center in Colorado:

Advantages of the Rocky Mountain Climate

Presented by: Tim Chiddix, PE

June 8, 2010

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Data Center Baseline Model

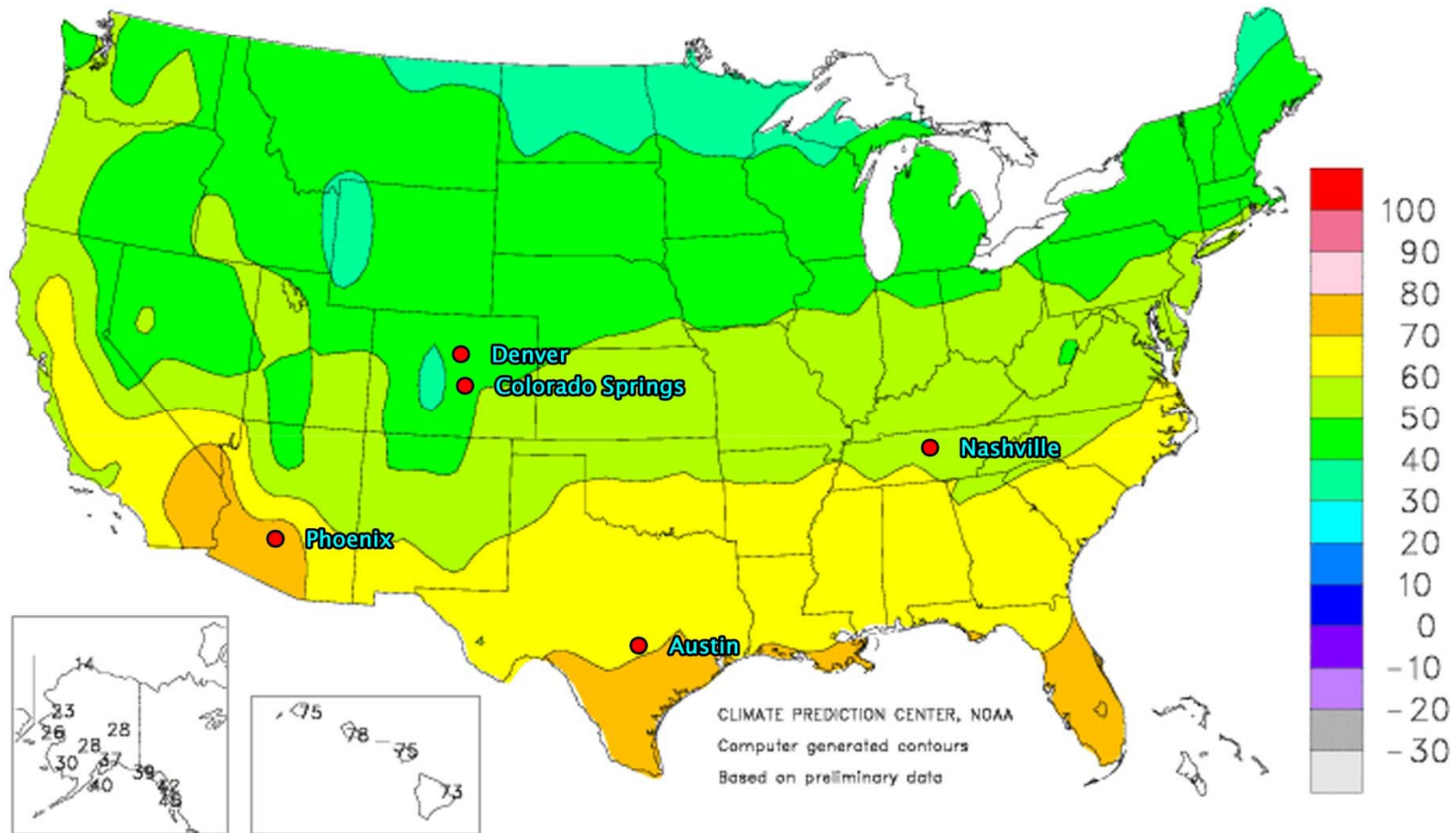
- New greenfield facility
- 45,000 sq ft of raised floor
- 5.6 megawatts of server load
- Local utility information obtained based on June 2010
- Local hourly weather data for each location



Cities Studies – Average Temperature

Average Temperature (°F)

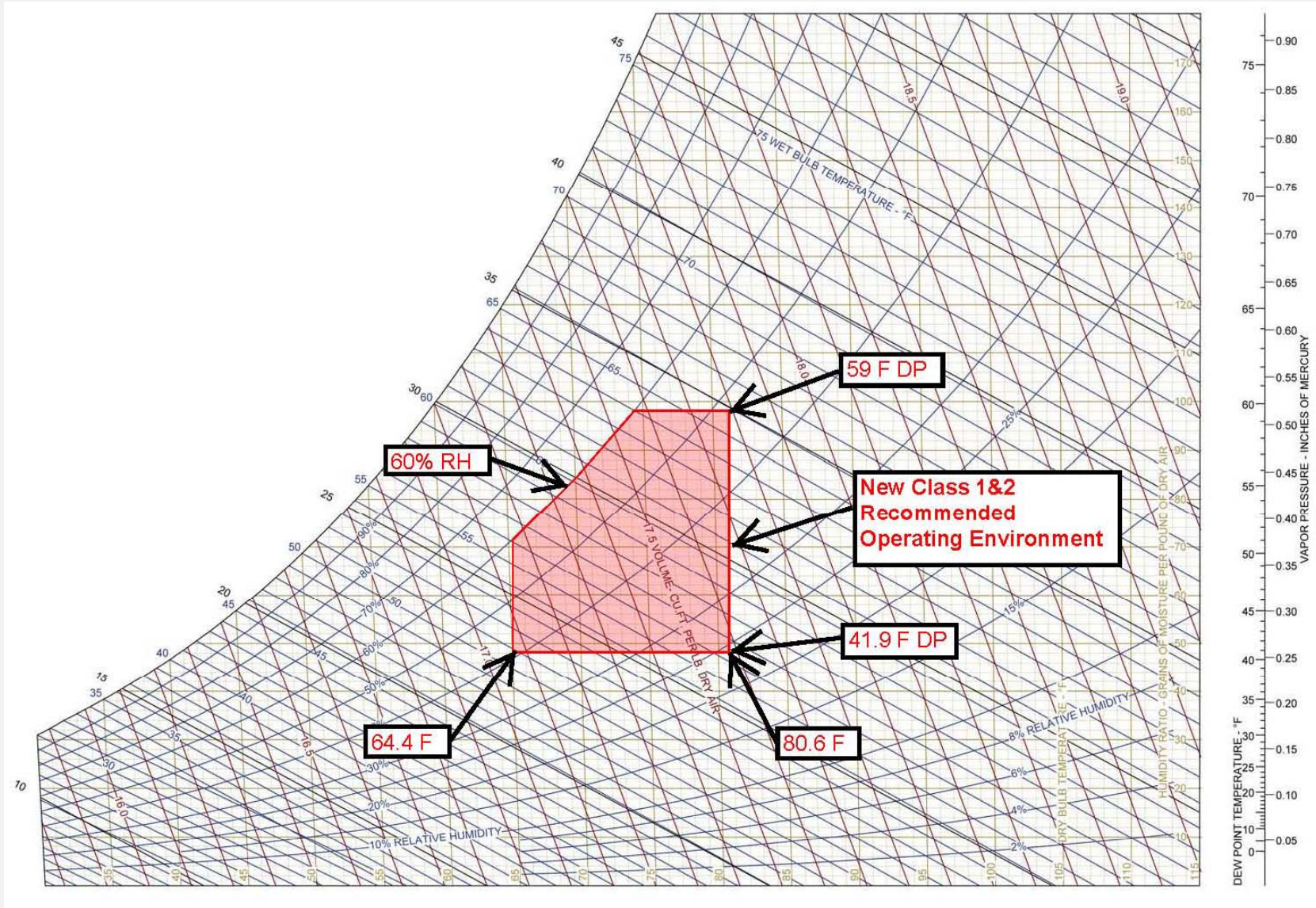
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Wet Bulb Temperatures

City	Colorado Springs	Phoenix	Austin	Nashville	Denver
Design Wet bulb	63.3	76.1	79.1	78.2	64.9
Extreme Max Wet Bulb	71.1	81.9	84.9	83.7	69.3

ASHRAE TC 9.9



Mechanical Systems Studied

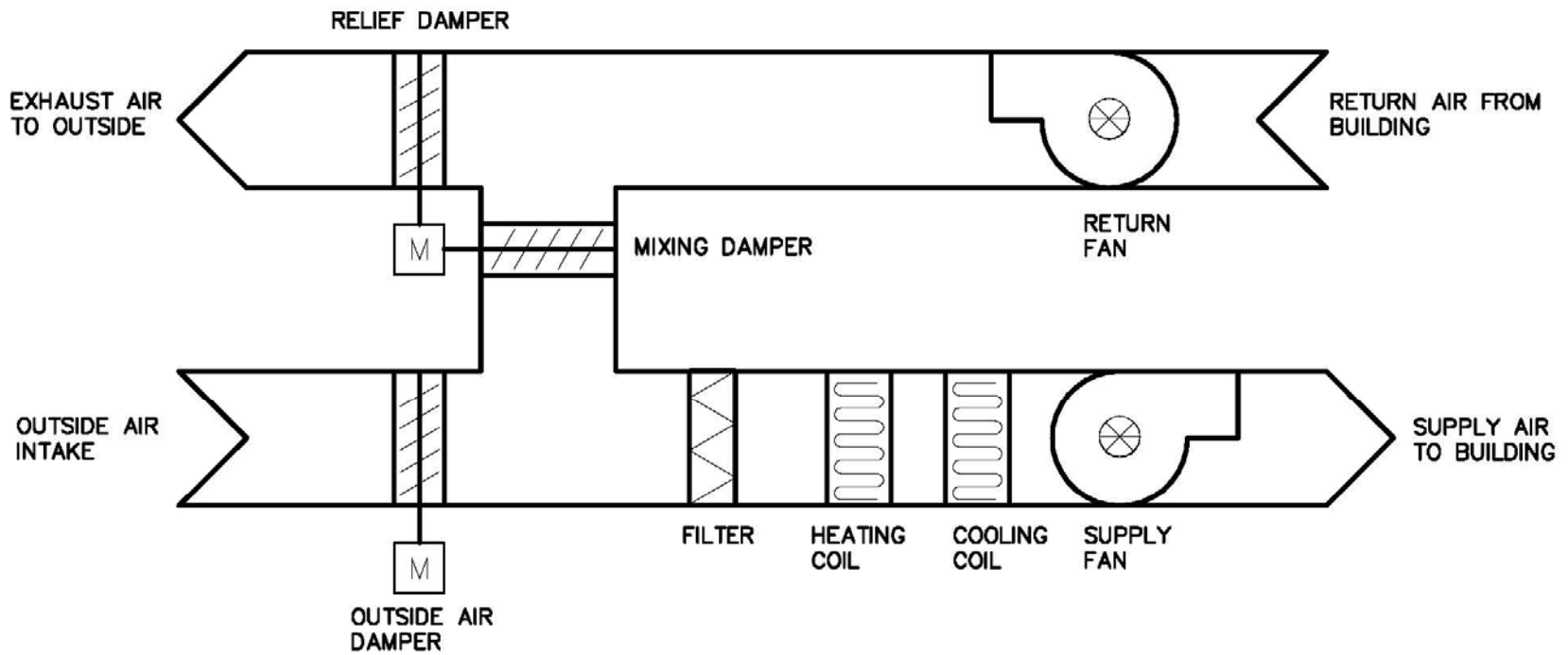
- Mechanical equipment optimized for local temperature, altitude, and humidity conditions.
- Chilled water plant with water side economizer.
- Plate and frame heat exchanger in series with the cooling towers and chillers.
- Chilled water air handling units with underfloor air distribution.



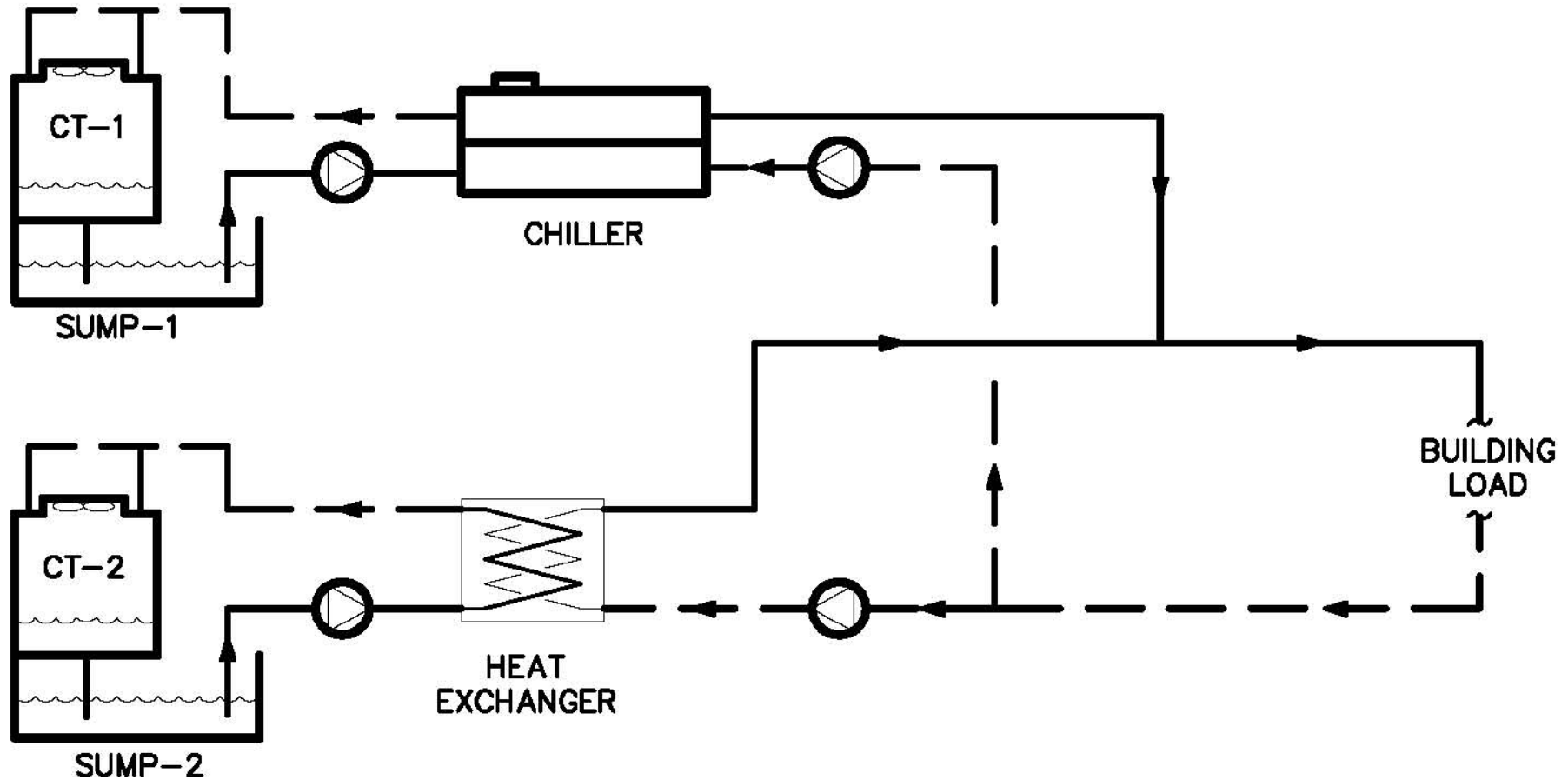
Mechanical Systems Studied

- Makeup air units and exhaust fans to meet code requirements of outside air and exhaust.
- Heating water boiler plant.
- Air handling units serving terminal air units in office area.
- Chilled water CRAC units and fan coils serving ancillary spaces.

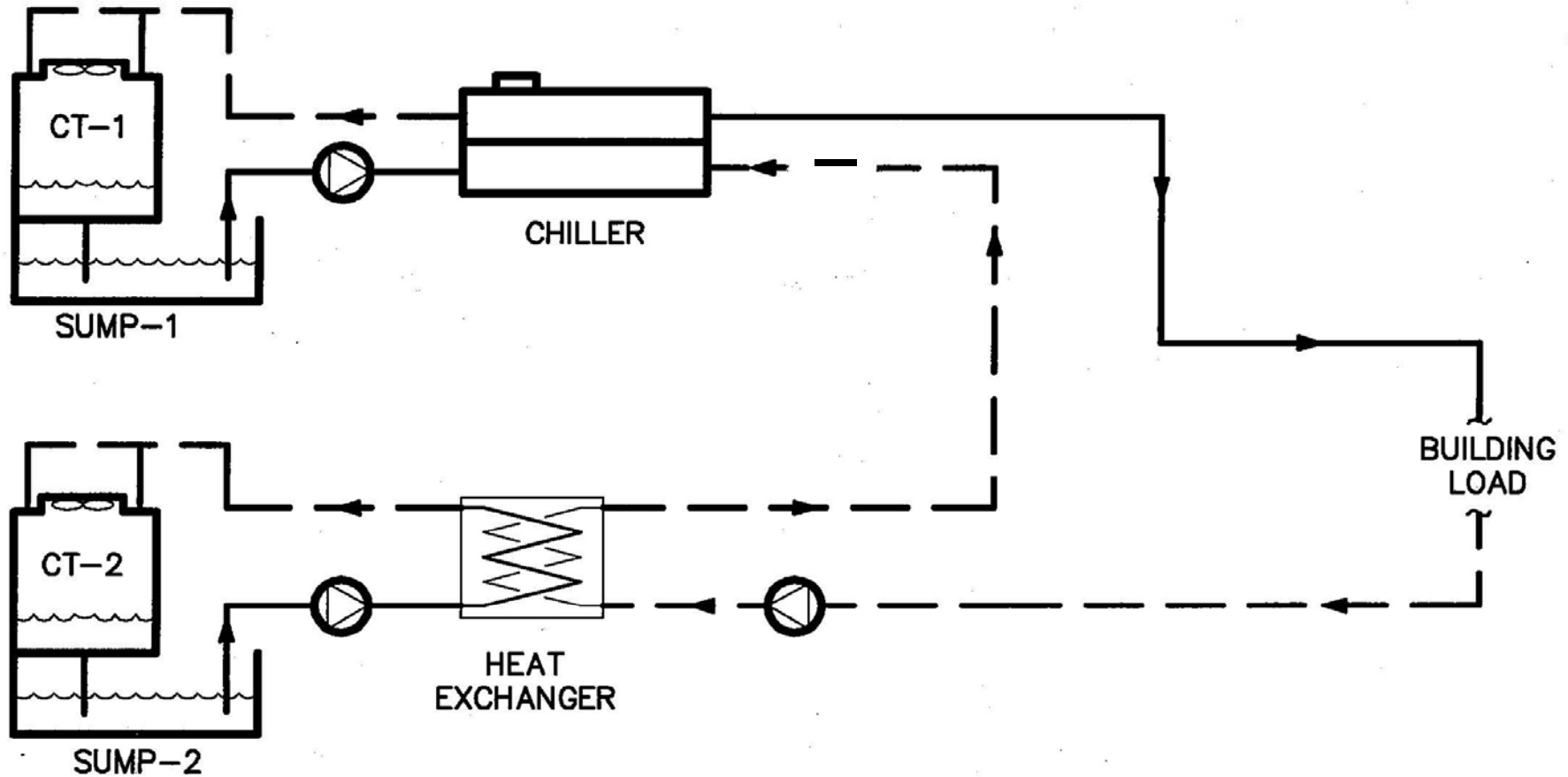
Air Economizer



Variable Primary System w/Parallel Heat Exchanger and Separate Sump



Variable Primary System w/ Series Heat Exchanger and Separate Sump

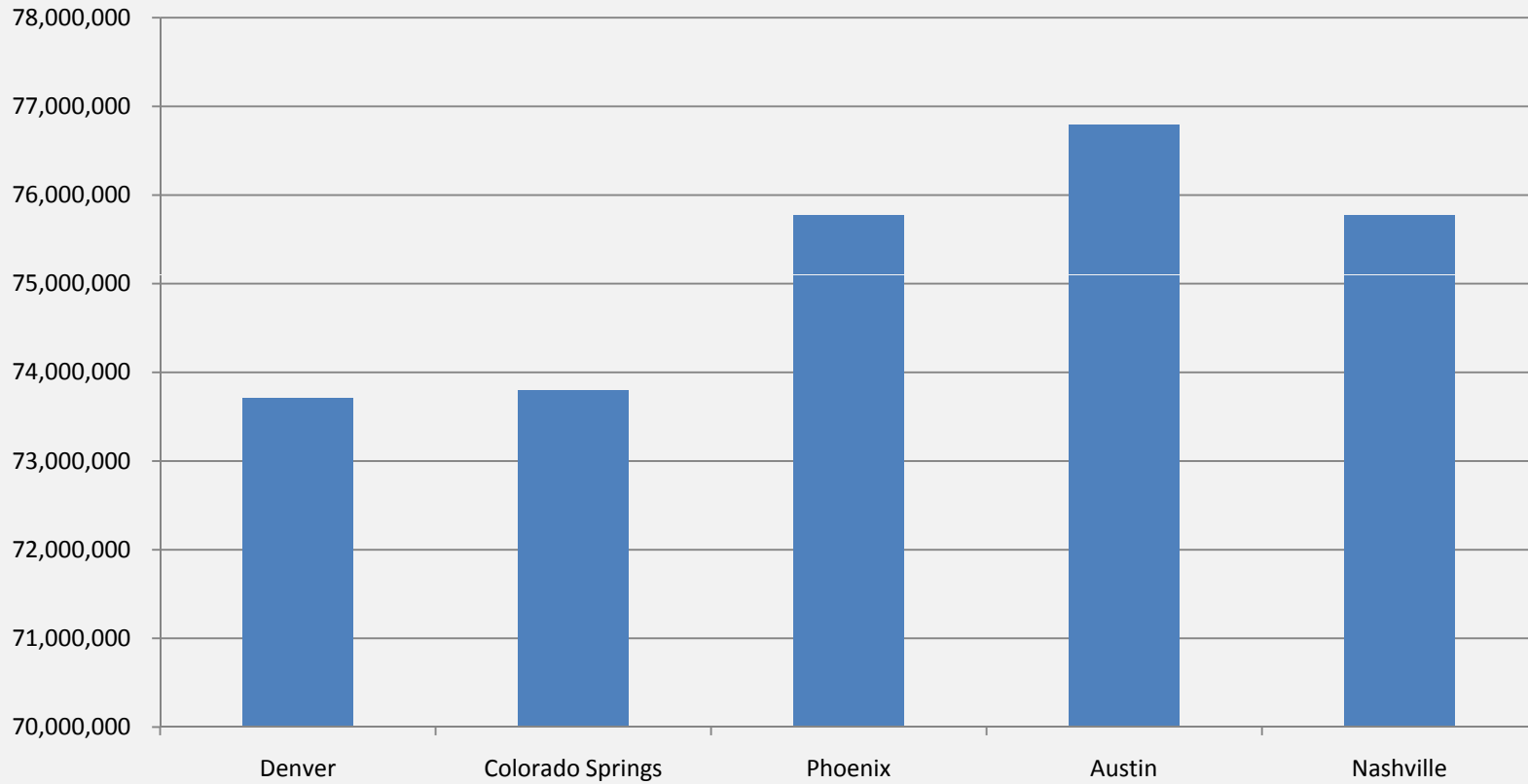


Pre cooling/ Free cooling hours

	Denver	Colorado Springs	Phoenix	Austin	Nashville
Free Cooling Hours	5509	5935	2305	1394	3370
Pre Cooling Hours	2770	2579	3304	1845	1573
Total	8279	8514	5609	3239	4943

Energy Usage Per Year

Utility Energy Usage Per Year (kWh)



Utility Data Rates Based On

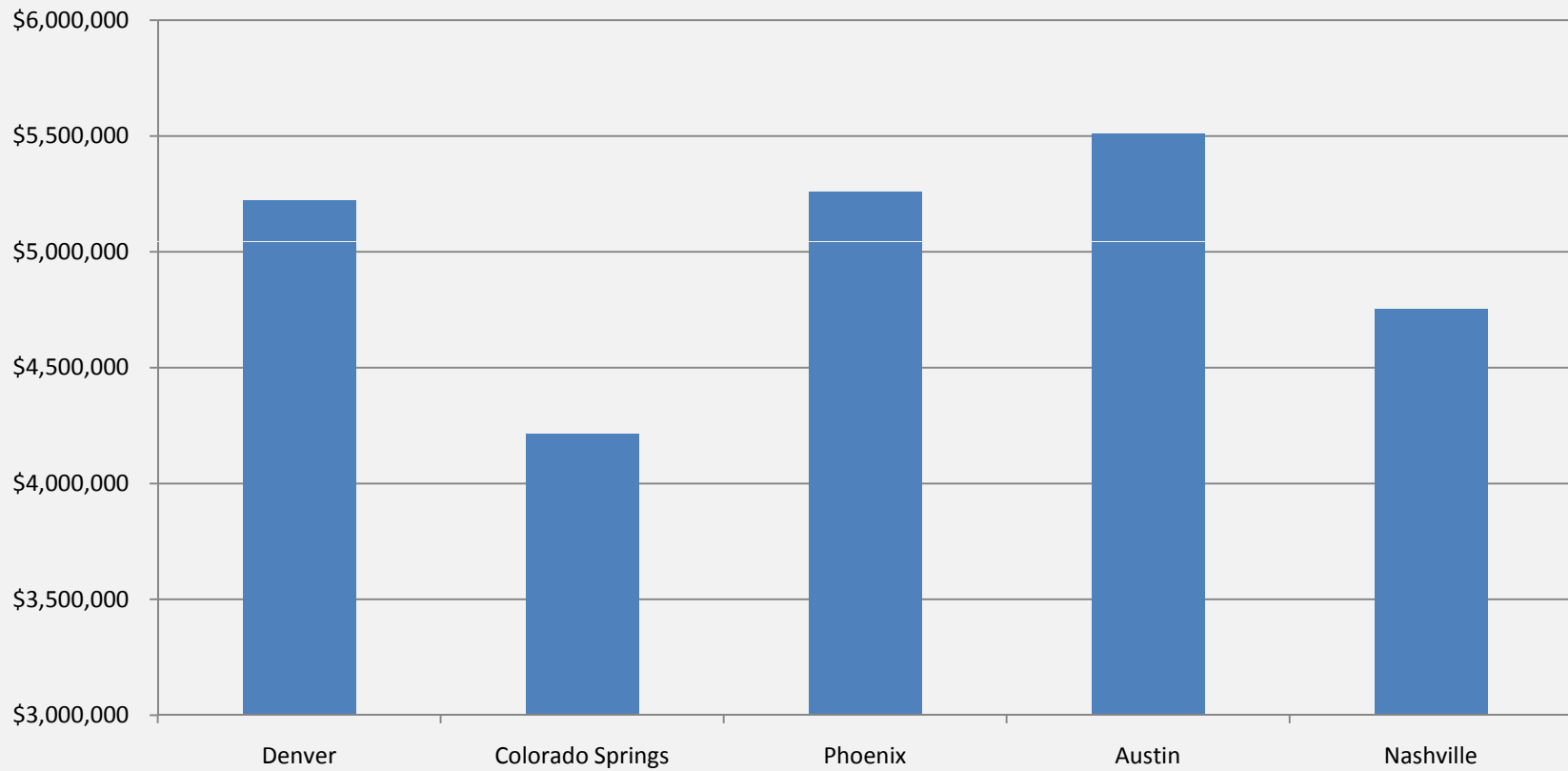
- Colorado Springs – Colorado Springs Utilities
- Denver – Xcel Energy; Public Service Company of Colorado
- Austin – Austin Energy
- Nashville – Nashville Electric Service & Tennessee Valley Authority
- Phoenix – Arizona Public Service Company

Electric Utility Rates

Electric Utility Rate	CO Springs	Phoenix	Austin	Nashville	Denver
Monthly Charge	\$ 760.417	\$504.147	NA	\$2,000.00	\$309.42
Sum. Demand \$/kW	NA	NA	NA	NA	\$14.6236
Win. Demand \$/kW	NA	NA	NA	NA	\$11.57
All Season Demand \$/kW	NA	NA	NA	\$15.5700	\$4.0400
All Season \$/kW	NA	NA	NA	NA	NA
All Season \$/kWh up to 620 hrs	NA	NA	NA	\$0.0421	NA
All Season \$ kWh above 620 hrs	NA	NA	NA	\$0.03	NA
Sum. Peak \$/kWh	\$0.05410	\$0.04295	\$0.06344	NA	\$0.05220
Sum. Non Peak \$/kWh	\$0.024	\$0.031	\$0.045	NA	\$0.04
Win. Peak \$/kWh	\$0.05410	\$0.04295	\$0.05644	NA	\$0.05220
Win. Non Peak \$/kWh	\$0.024	\$0.031	\$0.036	NA	\$0.04
Sum. Non Peak \$/kW	\$10.91350	\$15.28808	\$12.60000	NA	NA
Win. Peak \$/kW	\$6.089	\$3.604	\$0.000	NA	NA
Win. Non Peak \$/kW	\$10.91350	\$15.28808	\$11.81000	NA	NA

Utility Cost Per Year

Utility Cost Per Year

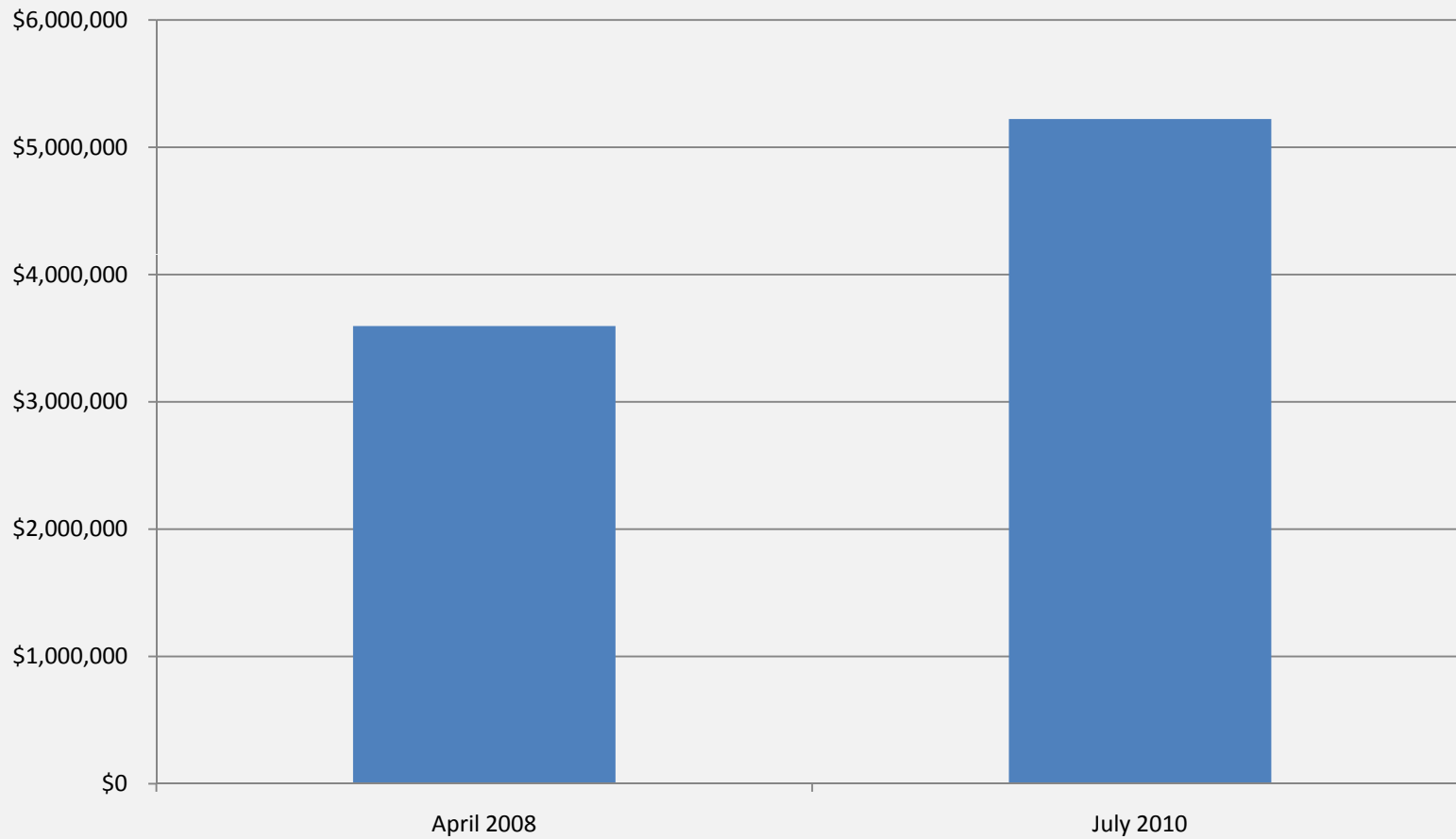


Denver Comparison

Utility Rate	April 2008	June 2010
Monthly Charge per Month	\$130.000	\$309.42
Sum. Demand \$/kW	\$14.3300	\$14.6236
Win. Demand \$/kW	\$13.1300	\$11.5696
All Season Demand \$/kW	NA	\$4.0400
All Season \$/kW	\$0.02522	NA
All Season \$/kWh up to 620 hrs.	NA	NA
All Season \$ KWh above 620 hrs.	NA	NA
Sum. Peak \$/kWh	NA	\$0.05220
Sum. Non Peak \$/kWh	NA	\$0.03534
Win. Peak \$/kWh	NA	\$0.05220
Win. Non Peak \$/kWh	NA	\$0.03534
Sum. Peak \$/kWh	NA	NA
Sum. Non Peak \$/kW	NA	NA
Win. Peak \$/kW	NA	NA
Win. Non Peak \$/kW	NA	NA

Denver Utility Costs

Denver Utility Costs



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