

DR15.20: Characterizing the Transient and Aggregate Response of Dispatchable Condenser Air Pre - Coolers

OPPORTUNITY

What have previous studies demonstrated about the potential for dispatchable condenser air pre-coolers?

While significant work has been done to demonstrate pre-coolers as an energy efficiency measure, this project studied the technology as a dispatchable demand response resource, controlled by the utility for grid management purposes.

TECHNOLOGY

How do evaporative condenser air pre-coolers work?

The technology uses evaporative cooling methods to pre-cool the inlet air to the condenser of an AC system. This results in a lower temperature for air conditioner heat rejection, reducing power demand and increasing air conditioning process efficiency.

M&V

Where did Measurement and Verification (M&V) occur?

For laboratory testing, the combined pre-cooler retrofit package was installed on a four-ton commercial York RTU. The transient response was evaluated along with the load reduction that occurred when the pre-cooler was turned on and off during three different California outdoor air climate conditions.

For field testing, the condenser air pre-cooler package was installed on 11 RTUs that served a big box retail store in Corona, CA. The data collection period ran from July 1, 2017 through October 31, 2017, and consisted of 26 remotely-triggered demand response events when the outside air temperature was above 95°F.

RESULTS

How did pre-cooler retrofits perform in M&V?

UP TO 75% kW REDUCTION	10-89% DISPATCH	FIELD TESTING
Laboratory test results show most evaporative pre-cooler power reduction benefits are achieved quickly, within less than two minutes of turning on the pre-cooler.	For field testing, across the 10 analyzed events the number of RTUs that dispatched varied from 10% to 89%, and the aggregate power reduction was between 0.07kW and 17.56 kW.	When more than 70% of the available RTUs successfully dispatched, the aggregate power draw was reduced by up to 17.05 kW.

CONCLUSION

What does M&V recommend as next steps regarding condenser air pre-coolers?

Additional Field Testing of Control Changes

The laboratory results illustrate that at steady-state operation, the technology can reduce demand quickly, and by up to 25%. This trend was not as clear in field testing, because the RTUs could change cooling modes during events, potentially delaying cooling until shortly after event start. The field results did not demonstrate the full potential of dispatchable evaporative pre-cooling, because the controls did not reliably dispatch the pre-coolers for every available RTU. Based on these results, it is recommended the technology be considered for further study to identify the control changes that would be required to ensure all available units successfully dispatch.