Vertiv

CASE STUDY • DRIVING PLANET-SAVING INNOVATION

DIGITAL REALTY

Vertiv and Digital Realty worked together to explore energy savings and operational performance.

Knowing that Digital Realty is both cost conscious and a willing innovator, Vertiv, formerly Emerson Network Power, and one of the world's leading providers of critical infrastructure that enables vital applications for data centers, communication networks, and commercial and industrial facilities, proposed moving from a water-cooled thermal management system to one that uses pumped refrigerant—an alternative technology that promised both capex and opex savings as well as operational improvements.

California's economization requirements

California's Energy Commission (CEC) leads the nation in environmental energy standards governing public buildings, with special attention to those like data centers, where it requires that computer rooms use economization in their heat rejection processes when outside air temperatures fall to certain levels.

VERTIV™

Data centers are constantly growing and changing, and operators are working to control their costs, reduce risk and simplify the management of their data center thermal environments. The new line of Vertiv cooling products has the potential to help operators achieve those objectives, particularly as these products are designed to deliver high efficiency and design flexibility while minimizing the total cost of ownership."

– Rob Brothers, Vice President of datacenter trends and strategies at IDC

Economization is a set of technologies that reduce power consumption by using different cooling mediums, such as air, water or refrigerant, to reject heat to the outside air without the use of motor-driven air conditioner compressors. Shutting down the cooling machinery at lower temperatures and moving to passive heat rejection for "free cooling" significantly reduces the power a data center consumes.

In 2012, when Vertiv first proposed the Liebert® DSE™ system, their pumped refrigerant economization solution, to Digital Realty, only air and water coolants were approved for data center economization in California. CEC Title 24 required that air-side-economized systems be capable of carrying 100% of the IT heat load when the outside air temperature is 55°F or lower. Water-side economization systems were required to carry 100% of the IT heat load at temperatures of 40°F or lower.

Partnering to prove the worth of pumped refrigerants

Vertiv developed their Liebert DSE system for data centers where chilled water thermal management was either too expensive or simply too big for the space available. Digital Realty was open to exploring a new cooling solution. For nine months, Vertiv and Digital Realty worked together to explore the energy savings and operational performance benefits of a pumped refrigerant system and compared it to that of a chilled water system. The companies shared their results with the CEC and apply for a formal exception to the air- and water- only rule in order to bring a promising new cooling solution to market.

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Digital Realty has saved more than 1 billion gallons of water since 2013, by using Liebert DSE pumped refrigerant systems in its data centers, compared to using chilled water systems.

	MWh	%MWh	TDV kBtuh/ft²	%TDV	Water Reduction
Climate Zone	Reduction				(1000gal/year)
Climate Zone 1- Arcata	-686.8	30%	-803.8	28.1	3,875
Climate Zone 2- Santa Rosa	-338.1	14.8%	-285.9	9.9	4,260
Climate Zone 3- Oakland	-364.5	16.3%	-388.1	13.9	4,063
Climate Zone 4- Sunnyvale	-336.5	14.4%	-294.0	10.1	4,378
Climate Zone 5- Santa Maria	-426.1	18.4%	-457.0	15.9	4,003
Climate Zone 6- Los Angeles	-236.9	10.3%	-234.0	8.3	4,258
Climate Zone 7- San Diego	-225.1	9.8%	-235.0	8.1	4,280
Climate Zone 8- El Toro	-239.1	10.3%	-198.3	6.9	4,312
Climate Zone 9- Pasadena	-217.2	9.4%	-186.7	6.5	4,414
Climate Zone 10- Riverside	-101.9	4.5%	1.8	-0.1	3,664
Climate Zone 11- Red Bluff	-396.4	15.6%	-259.3	8.1	4,755
Climate Zone 12- Sacramento	-296.3	12.7%	-219.2	7.3	4,541
Climate Zone 13- Fresno	-190.9	8.1%	-60.4	2.0	4,822
Climate Zone 14- China Lake	-204.4	8.4%	-37.6	1.2	5,061
Climate Zone 15- El Centro	94.0	-4.0%	291.9	-9.9	5,551
Climate Zone 16- Mount Shasta	-632.1	25.9%	-610.1	19.8	4,154
Average	-299.9	12.8%	-248.5	8.5	4,399
Industry Weighted Average (per 1.2MW)	-293.0	12.1%	-278.0	10.2	4,274

Savings in 14 of 16 climate zones on 3 of 3 metrics

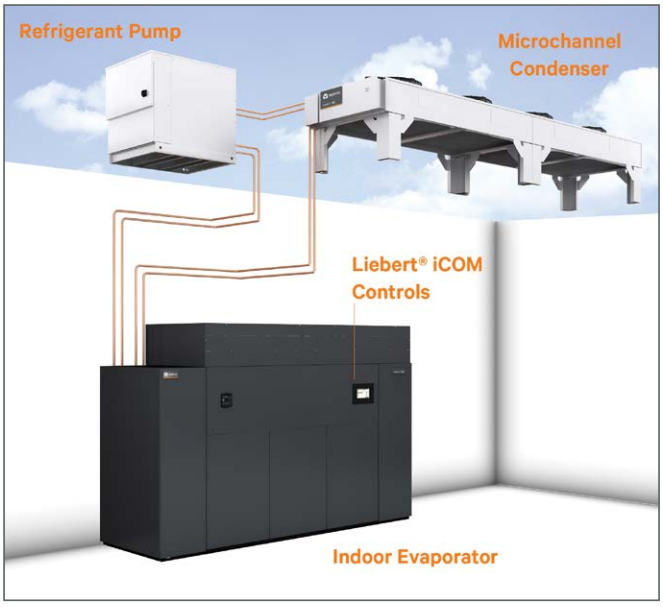
The results, as presented in the document Vertiv presented to the CEC as part of their application for Compliance Exception, were more than promising—they were persuasive. The chart above, which is part of that application, catalogs real numbers and percentages savings achieved in each of California's 16 climate zones. The chart reports savings by megawatts, by Time Dependent Valuation, and by the reduction of water use, per zone[1].

The Water Win

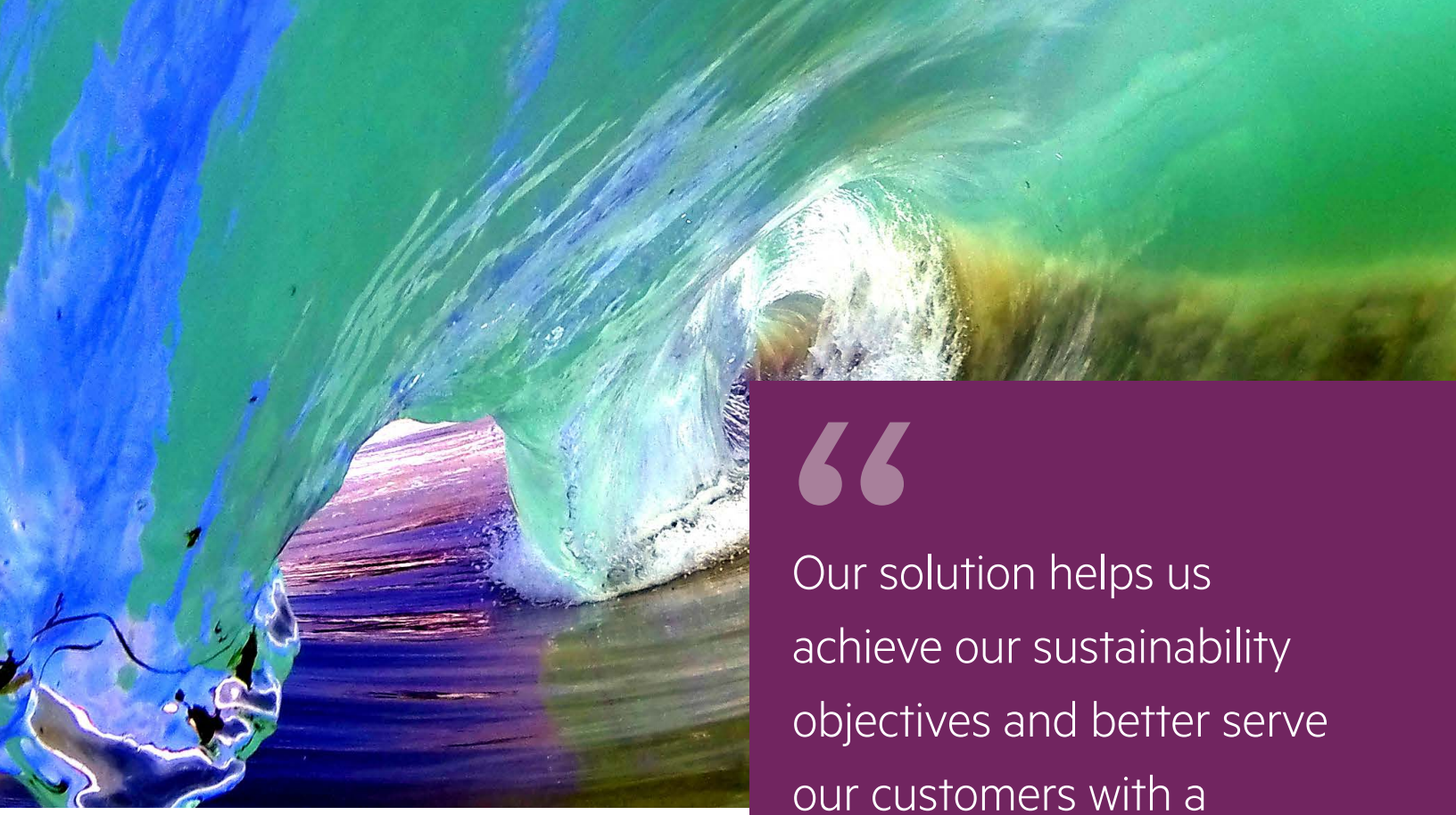
While the review by the CEC initially focused on ensuring adequate energy performance for this system, the analysis clearly indicated that there was another compelling value for this system – significant water use reductions. A cooling system with a water economizer uses an average of 4.3 million gallons of water per year for a data center with an IT load of 1.2 MW. If that same data center were to employ air-side economization, the water spend would still be 2.7 million gallons (with no lower dew point control) or 3.2 million gallons (with lower dew point control) of water per year during the chiller operation. The Liebert® DSE™ system eliminates water usage for cooling altogether.

Making Installation Easy

The Liebert DSE consists of several components— CRAC unit with compressors, a pumped refrigerant economizer, a high-efficiency condenser and intelligent thermal controls. It is available in different sizes and configurations for deployment indoors or outdoors.



[1]STAFF PAPER: Pumped Refrigerant Economizers for Use in Computer Rooms, California Energy Commission, August 2015

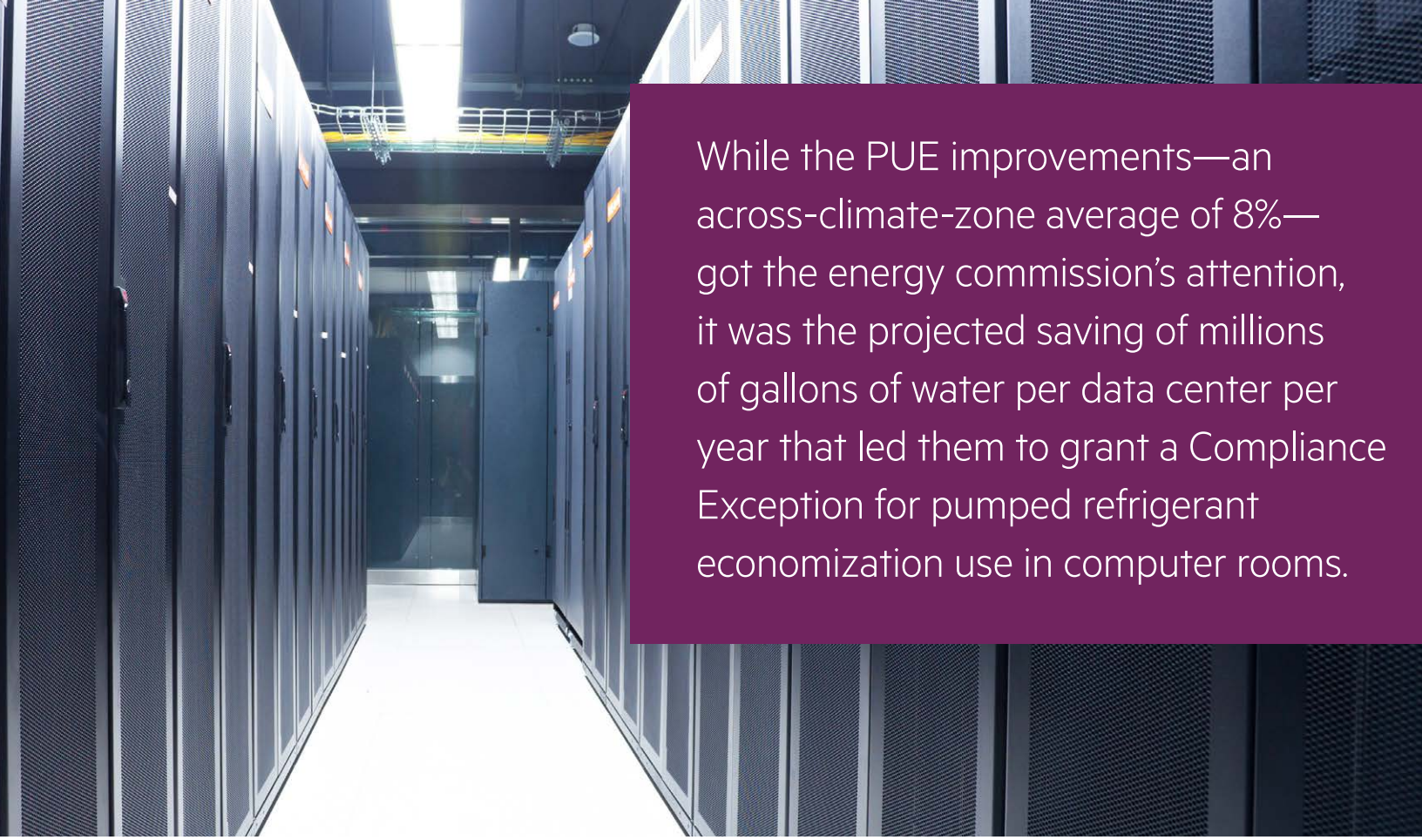


> Our solution helps us achieve our sustainability objectives and better serve our customers with a cooling technology that reduces energy consumption, eliminates water usage for cooling and stabilizes the data center thermal environment.
>
> Kevin Dalton, Vice President of design, global design at Digital Realty.

The system operates for most of the year in economization mode, with the compressors partly or fully turned off and the refrigerant pump turned on to move the refrigerant through the system to reject the heat of the data center, using only a fraction of the power of a compressor.

The Vertiv-Digital Realty partnership also had to find a simple and cost effective to way to site and install the necessary equipment. Vertiv adapted a solution they had developed for electrical products, factory-mounting the system components on skids, so only the skids themselves required installation on the data center roof, thus satisfying Digital Realty's strong preference for minimal on-site construction.

Since the California project, Vertiv and Digital Realty have collaborated on the development of new configurations of the Liebert® DSE™, including a 250kW capacity system that can be used in perimeter, gallery and side-by-side (fan array) configurations, providing the highest flexibility among large data center cooling systems. The solution has now been deployed at Digital Realty data centers in California, Virginia, Texas, and Australia.



While the PUE improvements—an across-climate-zone average of 8%—got the energy commission's attention, it was the projected saving of millions of gallons of water per data center per year that led them to grant a Compliance Exception for pumped refrigerant economization use in computer rooms.

About Digital Realty

Digital Realty Trust, Inc. supports the data center and colocation strategies of more than 2,300 firms across its secure, network-rich portfolio of data centers located throughout North America, Europe, Asia and Australia. Digital Realty's clients include domestic and international companies of all sizes, ranging from financial services, cloud and information technology services, to manufacturing, energy, gaming, life sciences and consumer products.

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