

# LIQUID COOLED SERVER RACKS EXECUTIVE SUMMARY

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Data Center with Blade or Rack Servers



Edge Rack



High-Performance 5G Node



Zero-Carbon Rack



Outdoor Edge Rack



Modular Data Center



Harsh / Industrial Computers



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## 1.0 EXECUTIVE SUMMARY

Most information technology (IT) equipment installed in data centers, telecom locations and other applications that require centralized computing utilize air cooled servers. These servers generate heat that is removed from the surface of the processors by blowing air across them. This air is then generally cooled by Computer Room Air Conditioning (CRAC) units or perhaps Computer Room Air Handlers (CRAH) that receive chilled water from a central chiller plant. Beyond removing heat, CRAC and CRAHs also condition the air to remove impurities and control humidity in a range in which the air-cooled devices can reliably operate.

Liquid cooled server racks are a type of immersion cooling, a method of cooling IT equipment by submerging electronics in a dielectric fluid that conducts heat but not electricity. The product used in this project was LiquidCool Solutions' (LCS) liquid cooled server rack technology, which utilizes a method of removing heat from electronics with a dielectric fluid that eliminates the need for all HVAC systems and their energy consumption, including noise. The LCS test server rack uses single phase, directed and forced flow technology which does not rely upon changes in fluid density or phase (boiling) to move fluid in its systems. As a result, the technology enables designers to control precisely how device components are cooled. For instance, within the device, cooling can be directed towards the hottest components, either first or last, and in series or in parallel paths, all depending upon the customer's desired system performance. The rejected heat (up to 60°C) can then be removed by passing the hot fluid through a heat exchanger. In the simplest case the heat is rejected directly to the atmosphere, via a dry air cooler; however, the technology may also be used as a heat source to use the captured heat elsewhere. This technology uses less energy to remove heat while also allowing for an increase in the computing density of traditional data center or telecom spaces.

The following sections describe the work that was performed as part of this study. Overall, the study found that there is potential for significant energy savings with the use of liquid cooled server racks. A summary of the energy savings can be seen below in Table 1.

**Table 1. Energy Savings Summary**

Baseline Description	Baseline PUE	LCS Real PUE	Unit Savings Per kW of IT (kW)	Percent Savings
High End Data Center (Test Facility)	1.30	1.18	.120	40.0%
Edge Computing	1.70	1.18	.520	74.3%

PUE (Power Usage Effectiveness) is a ratio that describes how efficiently a computer data center uses energy; specifically, how much energy is used by the computing equipment (in contrast to cooling and other overhead that supports the equipment).  $PUE = \text{Total Facility Energy} / \text{IT Equipment Energy}$ .