NREL
NATIONAL RENEWABLE ENERGY LABORATORY

ENERGY SYSTEMS INTEGRATION

ESI optimizes the design and performance of electrical, thermal, fuel, and water pathways at all scales.

PARTNERSHIPS

NREL + ASETEK

To measure the energy savings, performance, and reliability of a warm-water direct-to-chip liquid-cooling retrofit solution for data centers, an Asetek RackCDU liquid-cooling system was installed as a retrofit to an existing air-cooled system in the ESIF high performance computing (HPC) data center. Liquid-cooling technology takes advantage of the fact that liquid has approximately 1,000 times the cooling capacity of air, and that pumps circulating liquid cooling are much more efficient than fans circulating air. The all-liquid path captures heat from the data center's servers to be reused to heat the facility in the winter.

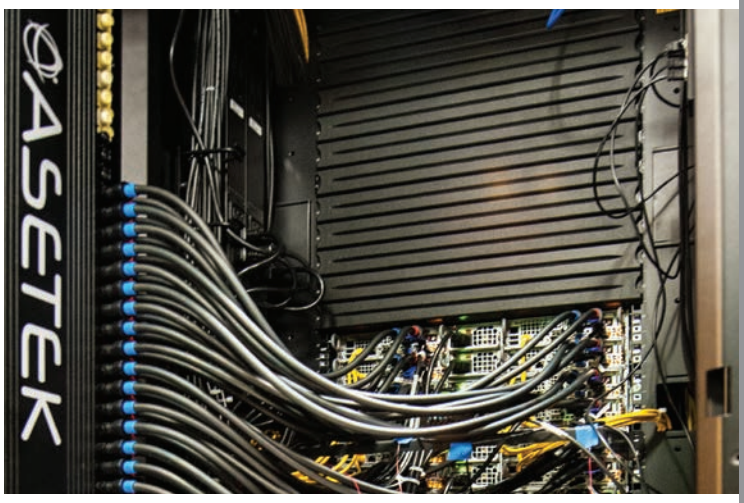
R&D STRATEGY

The ESIF's state-of-the-art HPC data center is designed to be the most energy-efficient data center in the world, achieving an ultra-efficient annualized average power usage effectiveness (PUE) rating of 1.06 or better—making it the perfect place to demonstrate Asetek's energy-saving liquid-cooling technology. Asetek retrofitted an existing air-cooled HPC cluster with Asetek's direct-to-chip "hot water" liquid-cooling system. The higher liquid temperatures used by Asetek's RackCDU (105°F) should improve waste-heat recovery and reduce water consumption for the data center. RackCDU is a hot water, direct-to-chip, data center liquid-cooling system that enables cooling energy savings of up to 80% and density increases of 2.5× when compared to modern air-cooled data centers. RackCDU removes heat from CPUs, GPUs, memory modules, and other hot spots within servers and takes it out of the data center using liquid where it can be cooled for free using outside air, or recycled to generate building heat and hot water.

IMPACT

The goal of this Asetek cooling approach is to reduce the total energy costs in data centers by improving the efficiency of its computer racks—and on a larger scale, this project will benefit taxpayers by proving the performance and reliability of this new technology so that it can be more readily deployed at a broad range of federal data centers.

For more information, download the report *Energy Performance Testing of Asetek's RackCDU System at NREL's High Performance Computing Data Center*, available at: ***www.nrel.gov/docs/fy15osti/62905.pdf***.



NREL is quantifying energy savings from the Asetek rack under a real workload by comparing total power input to the system with total heat removed by liquid and air. *Photo from Asetek*

Partner with the ESIF

User facility access to the ESIF is awarded through the review and approval of user proposals, depending on the scientific merit, suitability of the user facilities, and the appropriateness of the work to DOE objectives, and includes a signed user agreement for the facility.

For more information, please visit:
www.nrel.gov/esi/working_with.html
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The Energy Systems Integration Facility (ESIF) at the National Renewable Energy Laboratory (NREL) provides the R&D capabilities needed for private industry, academia, government, and public entities to collaborate on utility-scale solutions for integrating renewable energy and other efficiency technologies into our energy systems.

To learn more about the ESIF, visit: ***www.nrel.gov/esif***.

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