

## Quick Facts

NREL has teamed with Hewlett-Packard (HP) and Intel to develop the innovative warm-water, liquid-cooled Peregrine supercomputer, which not only operates efficiently but also provides hot water to the Energy Systems Integration Facility (ESIF), serving as the primary source of building heat for the ESIF's offices and laboratories.

Peregrine is the first installation of the new HP Apollo Liquid-Cooled Supercomputing Platform, and it can perform more than a quadrillion calculations per second as part of the world's most energy-efficient HPC data center.

Peregrine's warm-water cooling system eliminates the need for expensive data center chillers and heats the water to 95°F–110°F, allowing it to help meet building heating loads.

At least 90% of the computer's waste heat is captured and reused as the primary heat source for the ESIF offices and laboratory space. Any waste heat not used is dissipated efficiently via evaporative cooling towers.

The ESIF is designed to address the key challenge of delivering distributed energy to the grid while maintaining reliability. This is a complex problem involving systems within systems and leveraging "big data"—and Peregrine serves as a powerful new tool in NREL's ongoing work to find a solution.

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**NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.**

NREL/ FS-6A42-62864 • September 2014

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## NREL's Building-Integrated Supercomputer Provides Heating and Efficient Computing

The Energy Systems Integration Facility (ESIF) at the National Renewable Energy Laboratory (NREL) is meant to investigate new ways to integrate energy sources so they work together efficiently, and one of the key tools to that investigation, a new supercomputer, is itself a prime example of energy systems integration. NREL teamed with Hewlett-Packard (HP) and Intel to develop the innovative warm-water, liquid-cooled Peregrine supercomputer, which not only operates efficiently but also serves as the primary source of building heat for ESIF offices and laboratories.

Peregrine is the first installation of the new HP Apollo Liquid-Cooled Supercomputing Platform, and it provides the foundation for numerical models and simulations that are enabling NREL scientists to gain insights into a wide range of energy systems integration issues. This innovative high-performance computer (HPC) can perform more than a quadrillion calculations per second as part of the world's most energy-efficient HPC data center.

As HPC systems are scaling up by orders of magnitude, energy consumption and heat dissipation issues are starting to stress the supporting systems and the facilities in which they are housed. But unlike most other computers that are air-cooled, Peregrine is cooled directly with warm water, allowing much greater performance density, cutting energy consumption in half, and creating efficiencies with other building energy systems.

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Not surprisingly, the capabilities of the ultra-efficient HPC data center are placing NREL in the spotlight. It earned a 2014 R&D 100 Award and helped the ESIF earn R&D Magazine's 2014 Laboratory of the Year award and the Energy Department's 2013 Sustainability Award.



The innovative Peregrine supercomputer is the centerpiece of the world's most efficient data center for high-performance computing.

*Photo from Nic Dube, Hewlett-Packard.*

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