

Power

Voltage

Current

Temperature

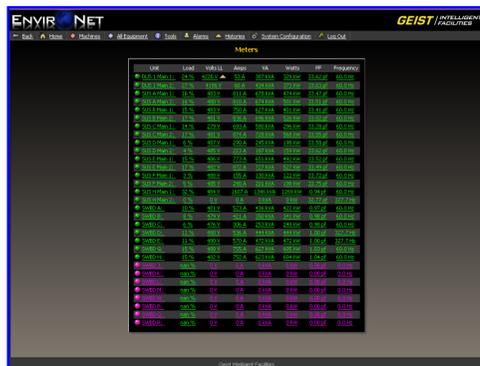
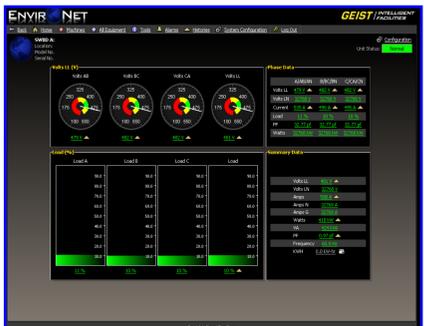
Air Flow

PUE

DCiE

Live Equipment Monitoring

Power metering sensors were installed on substations, distribution switchboards, and rotary uninterruptible power supplies (RUPS) that give line to line and line to neutral voltage, current, percent load, power factor, and power on each phase of the data center's three phase system. The metering devices were installed to access daily reports on total facility power usage, IT power consumption and total mechanical power consumption. Data will be used to increase efficiencies and design strategy for major electrical/mechanical upgrades needed for future generation computing. Recording this information will be an important building block towards a more energy efficient data center.

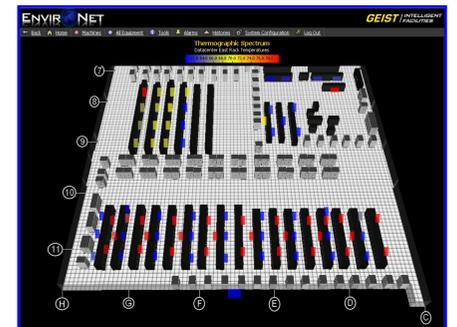
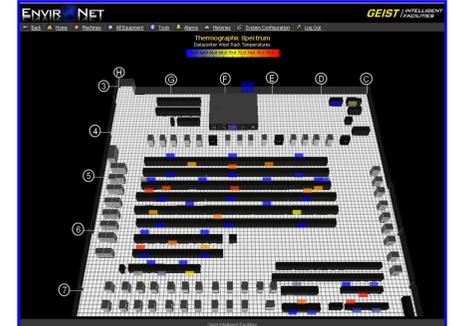
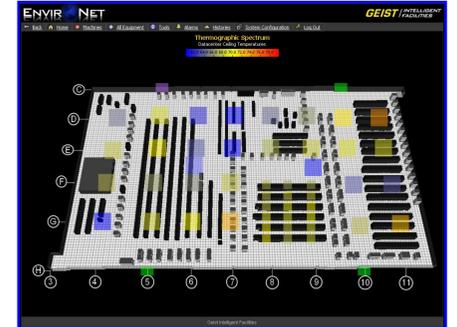


Live Computer Floor Temperature Monitoring

- 172 Wireless Temperature Sensors
- 6 Wireless Temperature/Humidity Sensors
- 4 Pressure Sensors
- 2 Return Air Sensors

A total of 184 sensors were placed in and around the computer floor that communicate with LANL's yellow network to send live temperature, humidity, and air flow readings to the Environet Software that can be accessed from any computer on the network. This allows for real time data, history, and alarm trending that is valuable for data center operations.

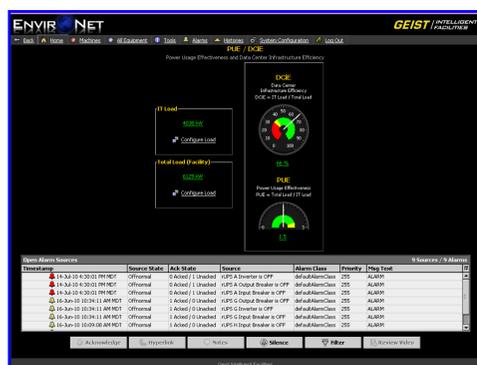
The new supercomputer Cielo is scheduled to be installed at the end of the fiscal year, and is expected to emit 120 degree exhaust from the top of the rack while running at 54 kW per rack.



Power Usage Effectiveness(PUE) & Data Center Infrastructure Efficiency

A metric for characterizing and reporting overall data center infrastructure efficiency.

$$PUE = \frac{\text{TOTAL FACILITY POWER}}{\text{IT MACHINE POWER}}$$



The Future of Supercomputers

The High Performance Computing Division is planning on expanding the capabilities of the Nicholas C. Metropolis Center for Modeling and Simulation (SCC) by adding an additional 45MW of power from the utility company which will prepare the data center for the next generation of high-density exascale computing. This environmental monitoring system will serve as a summation of the current state the SCC is in before major infrastructure upgrades take place.

Data & History Trending

The Environet Software that the metering project is supported by has the ability to generate and export history reports in the form of data lists and various graphs that can be emailed, printed, or saved accordingly.

Alarm & Notification

Along with constant meter readings, the system has adjustable thresholds that go into alarm if the values go outside the set range. Appropriate personnel are instantly notified via automated page or phone call informing them of the justification for alarm.

Benefits

- Future planning for high-density exascale computing.
- Validation of Computational Fluid Dynamic (CFD) modeling software.
- History trending and reporting that can be exported into other programs.
- Site preparation, planning, and maintenance.
- Real time machine monitoring.
- Alarm notification to prevent equipment failure and/or damage.
- Easily accessible and user friendly.
- Helping to reduce energy consumption and loss.
- Valuable data for reference points.