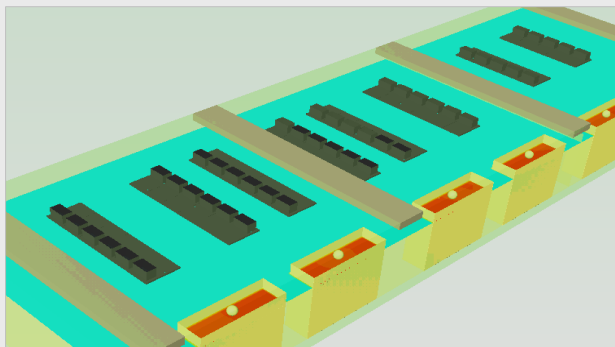


Case Study - Husky Energy *Green* High-Density Computing

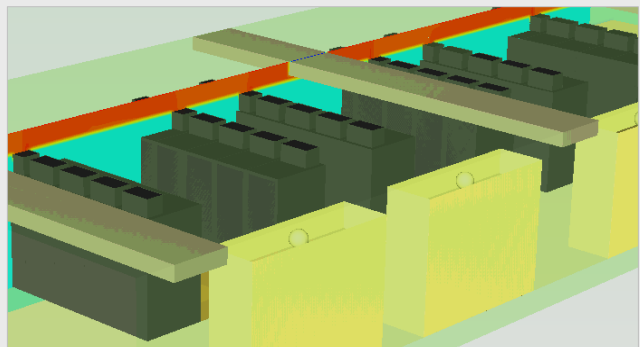
A 40-Billion Dollar Energy Provider Knows How To Keep Pace In A Rapidly Changing IT World

CASE STUDY | EC8001A
Published August 2010

Thermal Model Illustrates the Containment Cooling® Stability Achieved in the Husky Computing Facility



Efficient – Stable IT environment and high heat return to cooling units



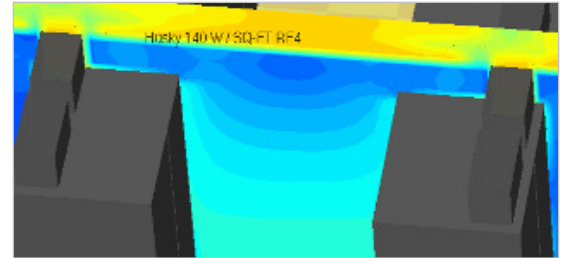
Perfect separation of cool and hot air possible with managed containment

Husky Green Data Center Initiative

The automated high-density cooling distribution system deployed by Husky Energy is actively managed and provides over 320 days of free cooling per year by using the Opengate Containment Cooling® System, raising the supply air temperature, and using a free economizer glycol loop to outdoor dry coolers. Husky's green computing facility provides flexible IT deployment, such as the ability to deploy high-density blade and server racks anywhere while maximizing free cooling hours.

Husky Green High-Density Computing Initiative

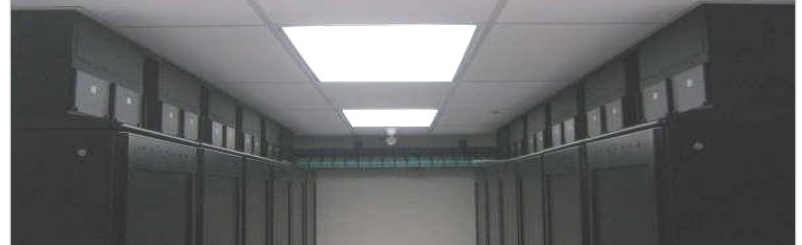
At the heart of Husky's green high-density computing initiative is Opengate's innovative cooling distribution system that **contains the heat, dynamically scales to the IT load in real-time, and reports cooling load data and alarms**. Installation and set-up for the Containment Cooling system was quick and easily adapted to Husky's choice of IT equipment racks, precision cooling, and IT management software.



*"We can maintain the same intake air temperature to every location in the room and automatically scale to the IT load, so every piece of IT equipment is working as efficiently and reliably as possible—no hot spots and no pressure buildup in the rack," said **Dave Oliver**.*

"With Containment Cooling, we have the ability to average 8 kW-per-rack and take any racks we choose to 30 kW, even in the 11-foot slab-to-slab urban setting."

Maximized IT flexibility and data center efficiency – Highly available high-density computing in a low slab-to-slab facility



Maximized energy savings while maintaining a stable computing environment in this tight urban setting



Goals for Husky Energy's Green Computing Facility

- ✓ Maintain a stable environment within a low slab-to-slab high-rise building
- ✓ High-density computing that maximizes IT and real estate resources
- ✓ Conform to the *green energy* mandate with a PUE of 1.4 or less
- ✓ Full IT flexibility with the ability to locate high-density racks anywhere
- ✓ Utilize familiar and time-tested, Glycol-cooled DX CRAC units at the floor's perimeter
- ✓ Utilize outdoor dry coolers to achieve over 320 days of free cooling per year
- ✓ Containment and continuous cooling distribution during a utility failure



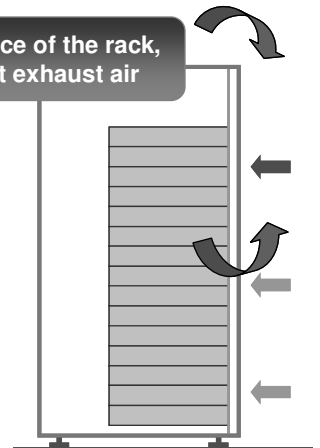
Opengate

Before the Automated Containment Cooling System...

Region in front of the IT rack

With inadequate supply air volume in front of the rack, high-density equipment was pulling in hot exhaust air. When deploying higher-density equipment, **the volume of air pulled through the IT equipment rack exceeded the volume of cool air distributed at the face of the rack**, resulting in hot air recirculation to the equipment intakes.

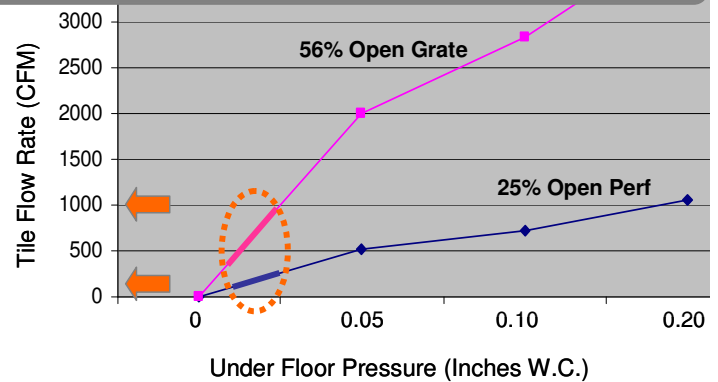
With inadequate supply air volume at the face of the rack, high-density equipment was pulling in hot exhaust air



Floor Tile Gymnastics

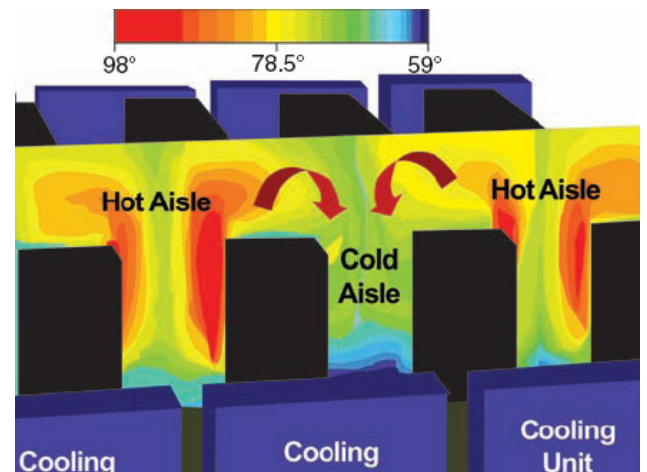
Actual tile flow rates varied significantly and, on average, were lower than expected. **Achieving desired flow rates from floor tiles**, or other cool-air delivery methods, in front of every IT rack on the floor **is complex and highly dynamic**. Affecting under-floor pressure, and the resulting tile flow rates, are: Size, Floor aspect ratio and height, Tile positions and types, Presence of floor leakage paths, Size and orientation of CRAC/H (Computer Room Air Conditioner/Handler) units, Under-floor obstructions, CRAC/H maintenance, and Under-floor work.

Actual tile flow rates vary significantly and are, on average, lower than expected due to many *difficult to control* variables



Cooling Over-Provisioning Approach

Husky's previous data center had an over-provisioning of the cooling volume and a reduced air temperature, which was below the recommended ASHRAE lower limit in an attempt to reduce hot spots at the top of the equipment racks. Due to the unpredictable mixing of cool air with hot IT equipment exhaust air, **a significant portion of cooling was never utilized and hours of free cooling were lost**.



CFD provides a visual of hot air recirculation to the face of the IT equipment rack due to cool air supply instability

Husky Energy – New Data Center Case Study

Husky Energy High-Density Rack Deployment

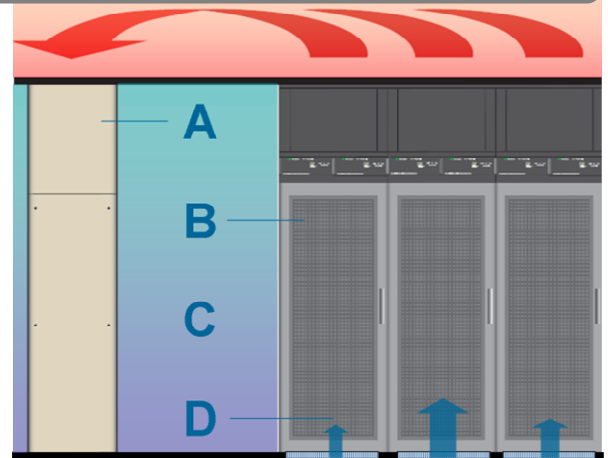
Husky Energy now knows how to manage IT exhaust heat, raise supply air temperature within the ASHRAE range, eliminate waste, and gain flexibility to locate high-density IT racks anywhere on the floor.

Husky easily deployed high-density racks in quantity, *anywhere* on the data center floor. Placing high-density racks anywhere was not only possible, but Opengate's cooling distribution system also allowed full utilization of cooling resources.

Managed Cooling-Distribution Points

- A. All IT exhaust heat has a direct return path to perimeter cooling units
- B. IT equipment takes cooling from the room, regardless of cooling supply methods
- C. Supply air temperature has been raised to 21 °C (70 °F) with no hot air recirculation
- D. Non-uniform air delivery has no effect on room ambient or rack intake temperatures

Intake air temperature stabilized to within a few degrees of supply air temperature at all points in the data center

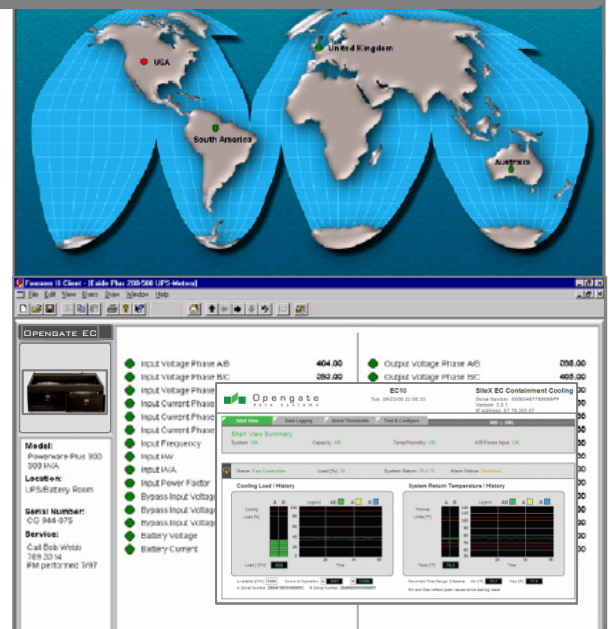


Opengate Integration with Husky's Choice of IT/Building Management Software

Opengate software is providing real-time cooling load and environment monitoring as well as critical alarms at the management console level. IT or building management software integration was a breeze. Opengate SiteX View software has easy-to-use MIB and XML data and the software suite is included, integrated within each system microprocessor.

Opengate systems are independent of precision cooling vendor, rack vendor, or management software platform, giving Husky the flexibility to adapt to any future need.

Fully integrated with Husky's choice of data center management software, Eaton Foreseer

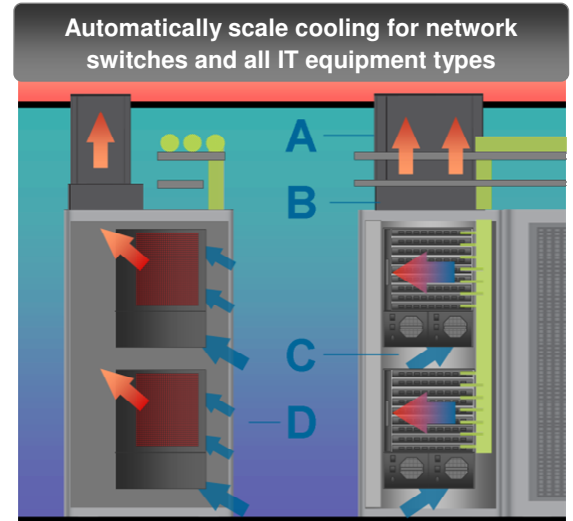


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Managed Rack Cooling for Multiple Core Switches

The Containment Cooling system is configured to draw cool air in along the side of network switches. In the Husky configuration, two large Cisco 6509 switches are placed in 30-inch wide racks.

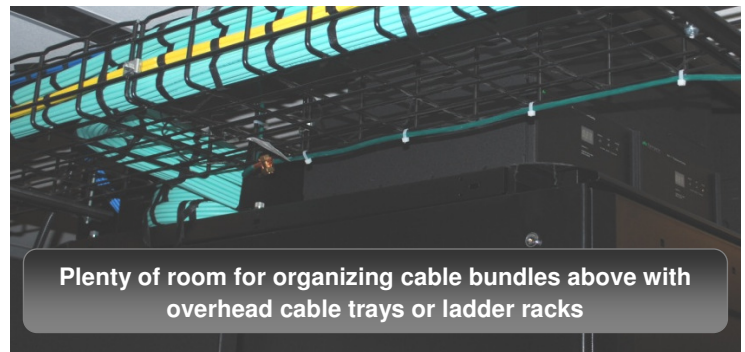
- A. Heated exhaust from network switches is directed out of the rack
- B. Containment Cooling system set to a slightly negative rack pressure
- C. Cool air enters the rack below the network switch chassis
- D. Cool air enters the rack at the switch side intake and ensures proper network switch operation



Husky's Ultra-Efficient Data Center

Opengate Containment Cooling scales to the real-time IT load. **All heat is contained and cooling distribution is managed, allowing maximum cooling efficiency and flexibility for high-density computing.** Husky deploys ultra-efficient servers that are designed closer to their thermal limits while still fully utilizing their cooling infrastructure, and have eliminated the need to add supplemental cooling.

The Husky Energy Data Center Project addressed three areas that impact data center spending: energy consumption, real estate utilization, and operational overhead. Husky achieves 320 minimum days of free cooling while giving Operations the ability to **deploy IT and maintain a safe thermal environment, regardless of rack density or placement and without any manual overhead.**



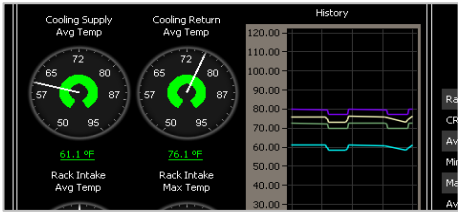
Husky has achieved 100% cooling utilization for zero-waste cooling and the lowest PUE!

Raised supply air temp | Raised supply water temp | Maximized free cooling hours

The entire Husky data center has been normalized to within a few degrees of the supply air temperature. Husky can deploy more IT racks without heat issues and intelligently manage data center growth.

Full data center loading is achieved using Opengate's Containment Cooling system.

Opengate Intelligent Data Center Solutions



Unity Cooling®

Automated Cooling Controls & Management

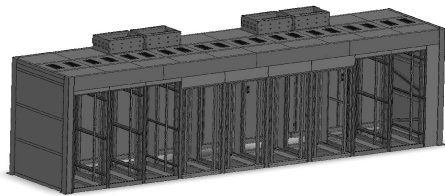
Automate cooling delivery with intelligent aggregation and organization of cooling load and environment data



SiteView™

Data Center Management System

Data Center Management Software with Graphical Interface, Trending, & Alarms



IT-Row™ Cooling

Automated Row-Heat Containment

Quickly and effectively group the IT-Row for ultra-efficient and maximum flexibility of high-density computing



SwitchAir™

Network Switch Cooling

Effective switch cool-air delivery for rear-rack mounted 1U switches



SiteX EP™ Enterprise Rack Power

Intelligent Rack Power Distribution

Effective rack power distribution with true RMS remote metering for up to 34 kW-per-rack power bar



SiteX EM™ Environment Monitoring

Intelligent Environment Monitoring

Effective environment monitoring with visibility to critical temperature, water, smoke, and video information

Customers choose Opengate systems to automate data center cooling and maximize energy efficiency!



Build with Confidence

Why adapt to hot spots when you can normalize your entire data center?

Achieve Unity Cooling® and Maximize Free Cooling:

- Supply air at 76F
- Intake air less than 78F

Maximize Rack and Room Density and Achieve Best-In-Class PUE:

- Zero Cooling Waste
- Zero Heat Issues

Deploy More IT with Confidence

...In Data Centers

...In Racks

...In Small Spaces

Unity Cooling®
Automated Cooling Circuit Control & Management

SiteView™
Data Center Management System

IT-Row™ Cooling
Automated Row Heat Containment

SwitchAir™
Network Switch Cooling

SiteX Rack Power
Intelligent Rack Power Distribution

HUSKY CASE STUDY
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