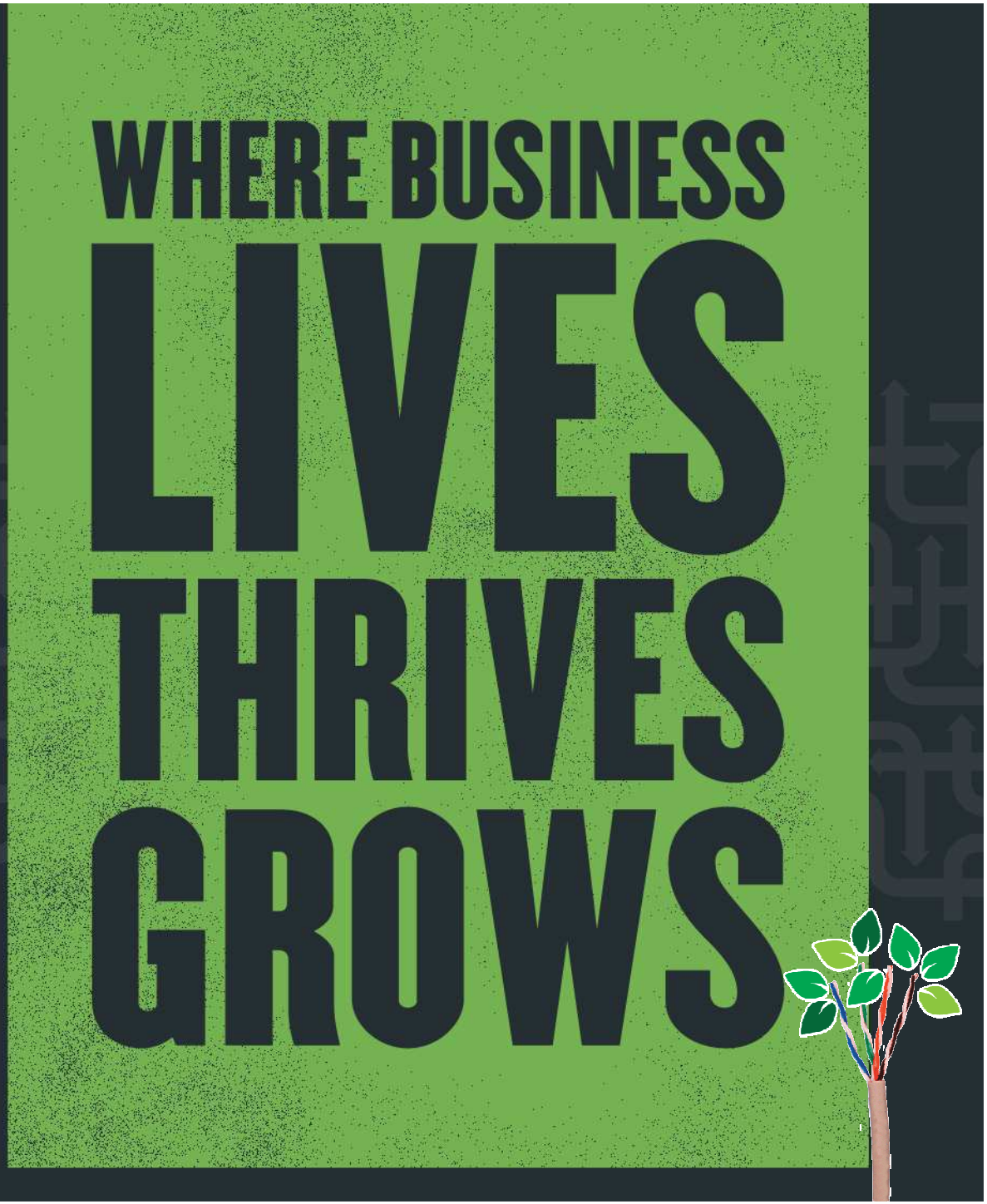
easy·street

Data Center Design and Energy Management

Steve Knipple
CTO / VP Engineering & Operations

August 1, 2013



Agenda

- Introduction to EasyStreet
- Speaker Bio
- EasyStreet Sustainability
- Data Center 1 (Retrofit completed May 2010)
- Data Center 2 (Opened January 2011)

Who is EasyStreet?

- Oregon-based colocation and cloud services provider
  - 3 Independent Data Centers: 2 in Beaverton, 1 in downtown Portland
  - Disaster Recovery Data Center in Phoenix, AZ
  - 24 x 7 x 365 on site Enterprise Operations Center (EOC)
  - Large (and growing) catalog of cloud service offerings
  - In business since 1995
- Sustainability is part of our culture and a focus from the start
  - Carbon neutral, we offset all resources consumed in our Beaverton facilities:
    - 100% electricity offset by PGE Clean Wind
    - 100% city water offset by Water Restoration Certificates
    - 100% natural gas offset by NW Natural Smart Energy
  - Latest energy efficient technology in our Data Centers
  - Highly utilized computing hardware through virtualization
  - E-Recycling of old computer equipment

Speaker Bio

Steve Knipple – VP Engineering and Operations

- Joined EasyStreet in May 2010
- Wisconsin native, traveled a lot, settled in Oregon
- Education: Mechanical Engineer and Information Management
- 15 years of experience working in nationally and internationally in Information Technology and Engineering.
  - Passionate about using real-time and historical automated data collection to drive improvements

EasyStreet Green Recognition

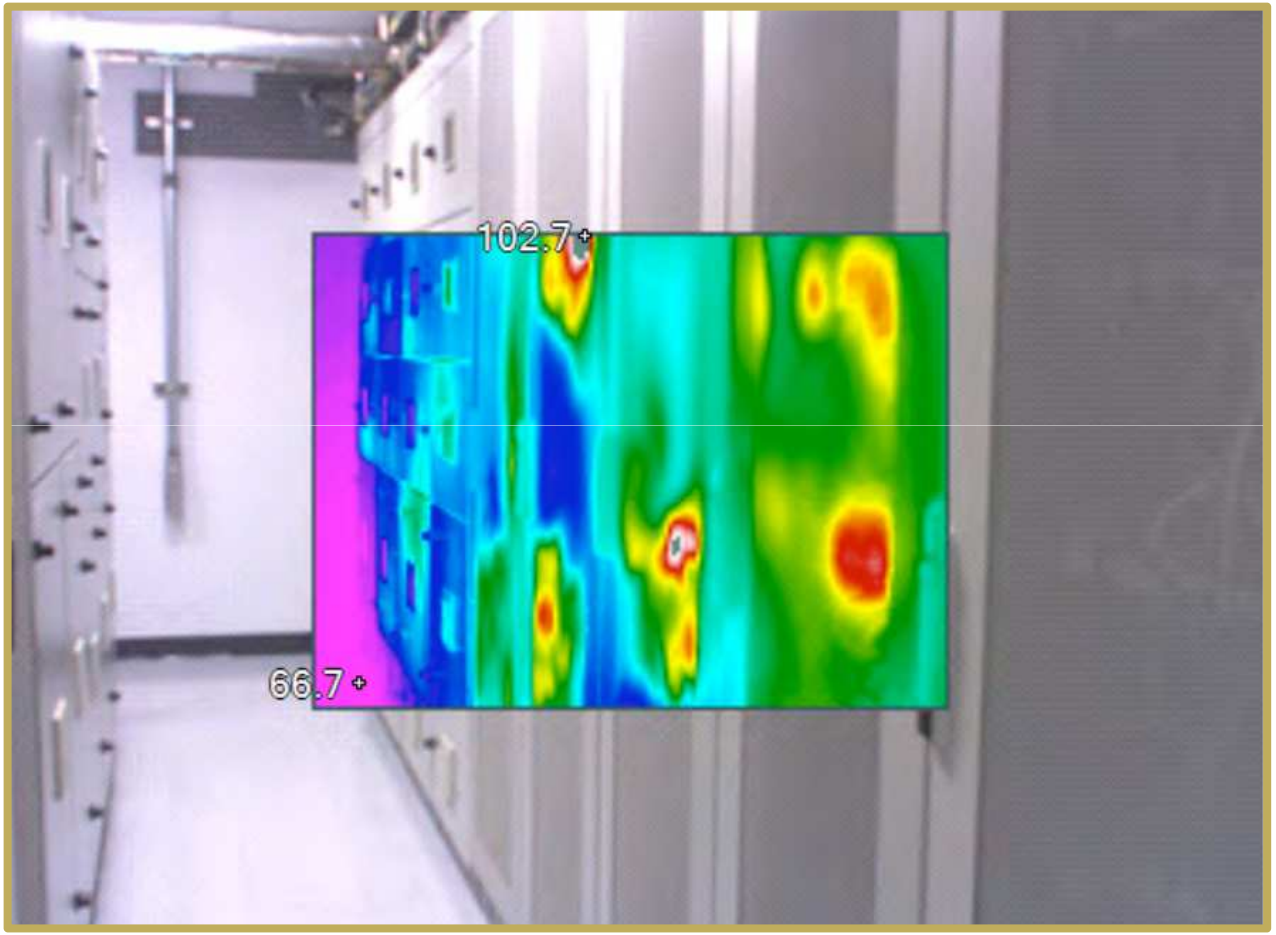
- 2012 Oregon Governor's Sustainability Award (Technology)
- Portland Office of Sustainable Development BEST Award Winner, 2011 and 2012
- Ranked in *Oregon Business Magazine's* 2009 – 2011 "100 Best Green Companies to Work for in Oregon"
- Named PGE's 2008 "Green Power Leader"
- An EPA "Leadership Club" Green Power Partner since 2009
- Earned a Bronze (2009) and Silver (2010 – 2012) awards from the League of American Bicyclists
- Recognized by Bicycle Transportation Alliance as the first "official" Bike-Friendly Business in Beaverton

Data Center 1 Retrofit

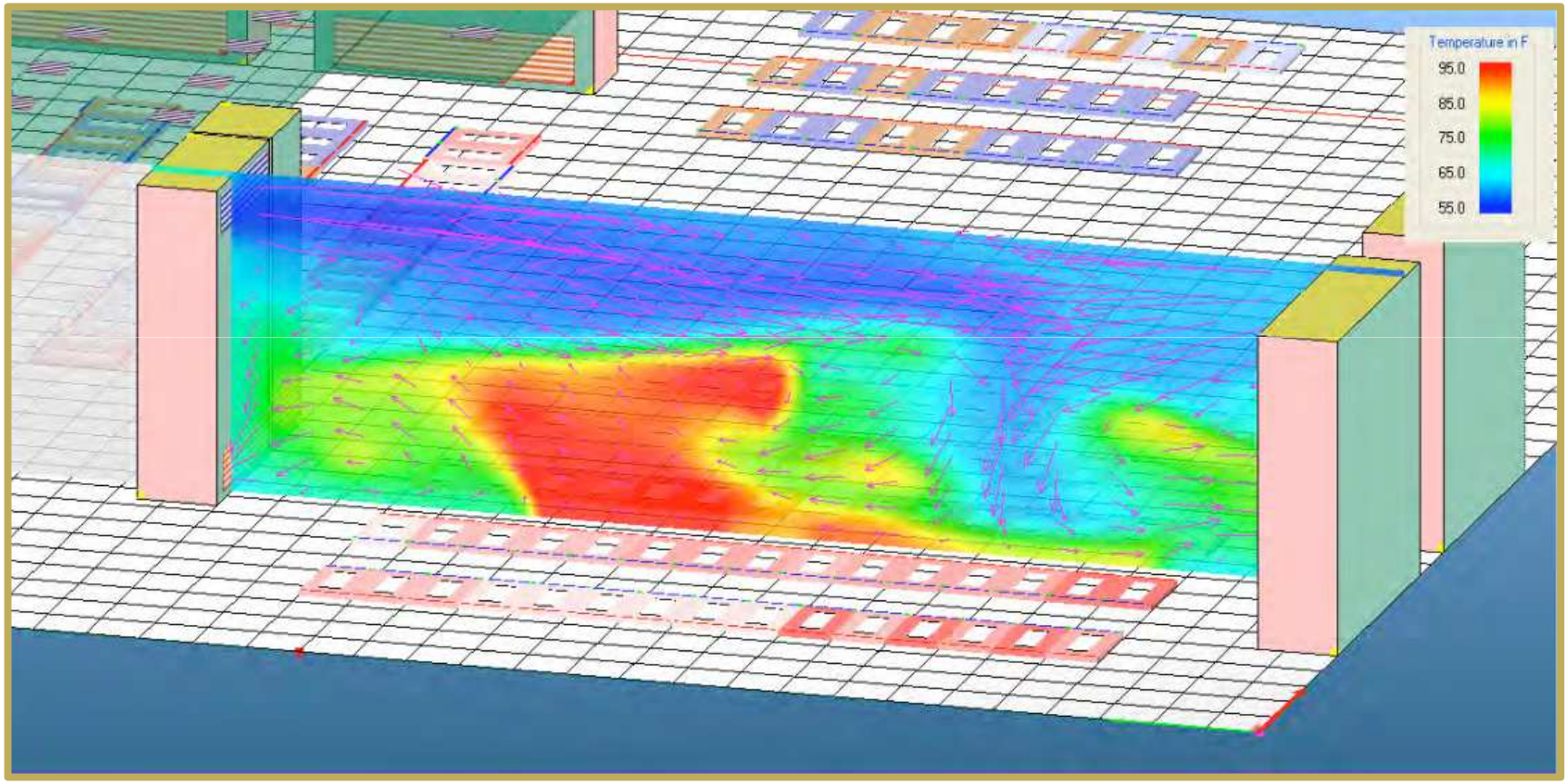
- Hot aisle containment project
  - Allowed two CRAC units to be turned off
  - Reduced AC maintenance costs by up to $10,000/year
  - Will save 524,000 kWh/year with a payback in 18 months
  - Improves customer equipment reliability with a more uniform supply of cold air
  - Sensors provide ongoing monitoring for fine-tuning

- Power monitoring
- Additional “green” upgrades include flywheel UPSs
  - No battery storage
- Tested new technologies and methodologies to improve design and reduce risk in the new facility

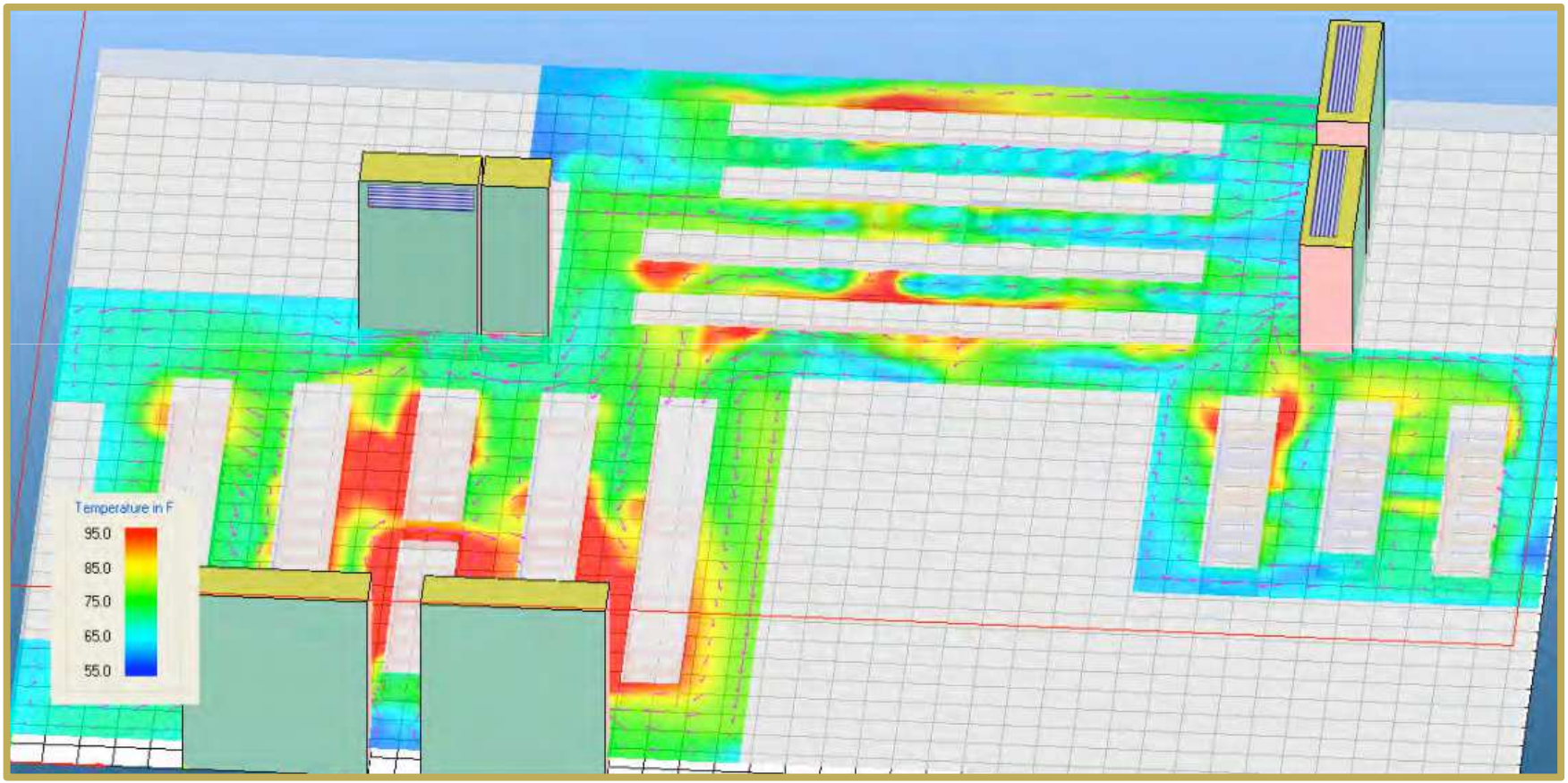
Thermal Imaging



Thermal Modeling (by Row)

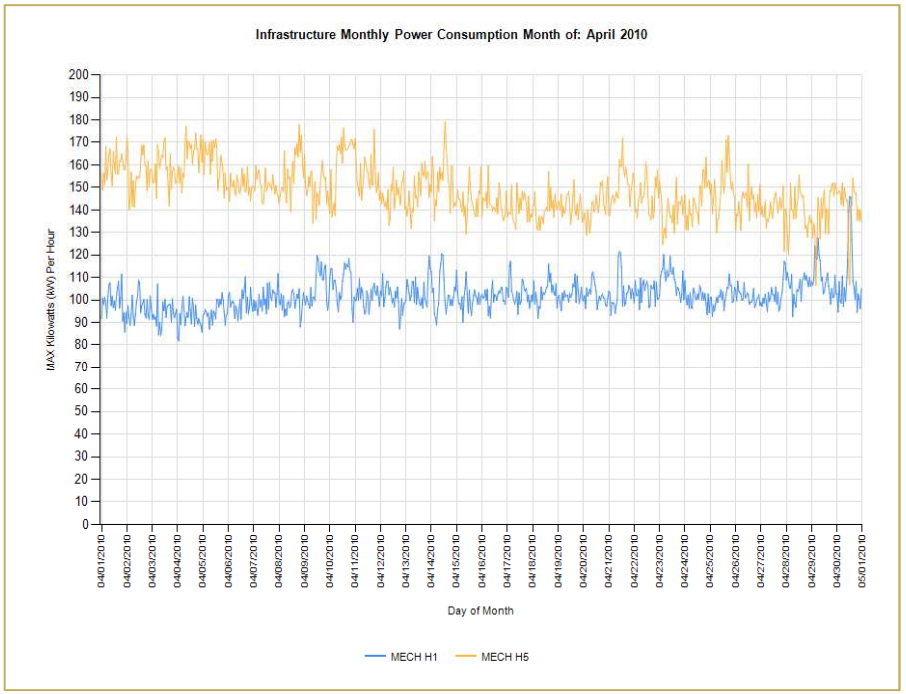


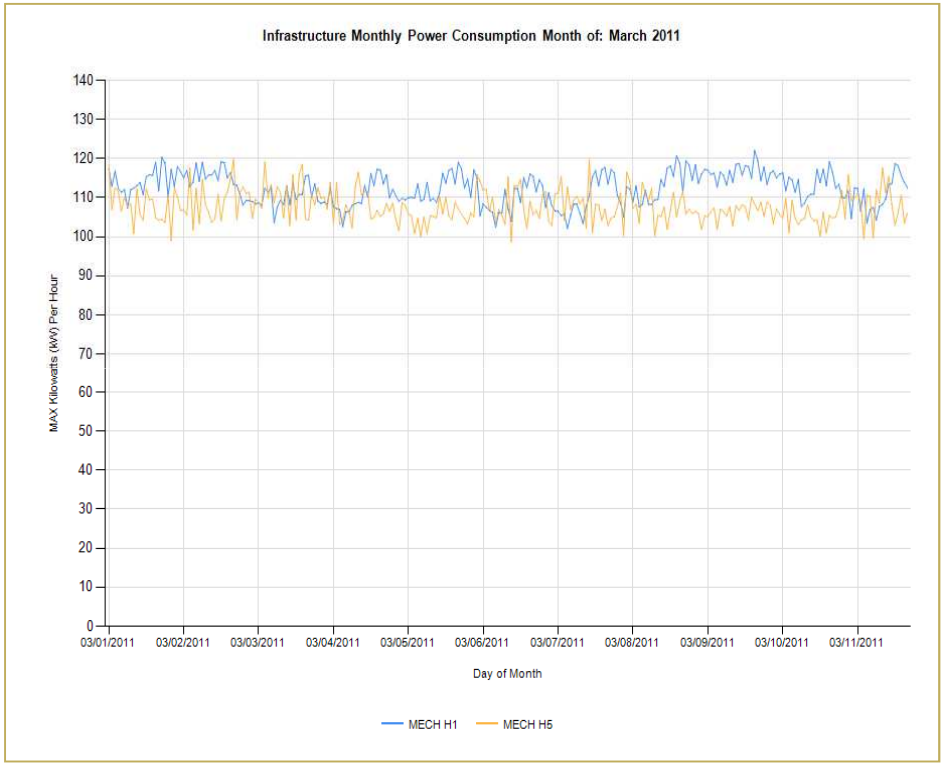
Thermal Imaging (Entire Data Center)



Ongoing Tuning and Monitoring

- One example: Tuning CRAC units to stabilize operation





- We try to monitor EVERYTHING: Inside/outside temps, humidity, CRAC utilization, power usage etc. Always looking for new ways to optimize.

Green IT Press Event, July 2010

- Received $65,000 from ETO for hot/cold aisle containment project
- Recognized for new data center expansion
- Shared information and resources with like-minded attendees

- Rich Bader, EasyStreet
- Oliver Kesting, Energy Trust of Oregon
- Jon Haas, Intel
- Denny Doyle, Mayor of Beaverton

What Else did We Learn in the Retrofit?

- It's difficult to retrofit old data centers
  - Often designed without energy management in mind
  - Fundamental design can limit cost effective changes
  - The best solution is not always obvious
- Little things can make a big difference
  - Inventory equipment and shut off everything that is not being used
  - Raise the temperature… a DC is not a refrigerator
  - Shut off lights
  - Rack computer equipment cleanly to allow for proper airflow
  - Consolidate load in less physical space
- At some point you need to start from scratch…

Designing a Green Data Center

- An unprecedented group design effort with shared goals:
  - Maximize energy efficiency to reduce energy consumption and costs
  - Accommodate growth and energy efficiency improvements over time
  - Help customers improve the power efficiency of their IT equipment
  - Reduce overall carbon footprint
  - Improve Power Usage Effectiveness (PUE)

Data Center Efficiency

$$PUE = \frac{\text{Total Facility Power}}{\text{IT Equipment Power}}$$

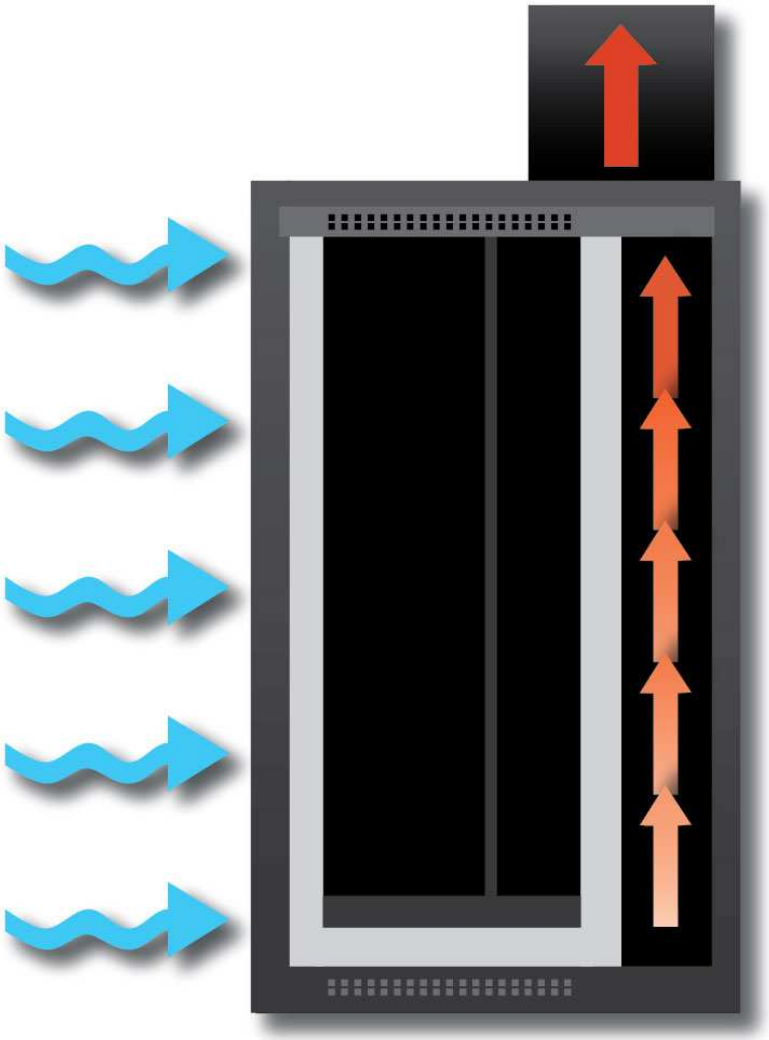
- Expressed as Power Usage Effectiveness (PUE) by The Green Grid
  - Perfect PUE = 1.0
- Typical data center today = 2.0

Our “Showcase” New Data Center

- Highly sustainable design and operation
  - Lessons learned from existing DC efficiency projects
  - First data center project to qualify for ODOE Small Scale Energy Loan Program
- Highly efficient and sustainable energy usage
  - Power Usage Effectiveness (PUE) estimated at <1.3
  - 100% PGE Clean Wind
  - High power density of 5kW/cabinet average
  - Efficient power use buffers future energy cost increases
- Indirect Evaporative Cooling with hot air containment
  - Supplemental AC typically needed ~15 days/year
  - Rainwater capture system

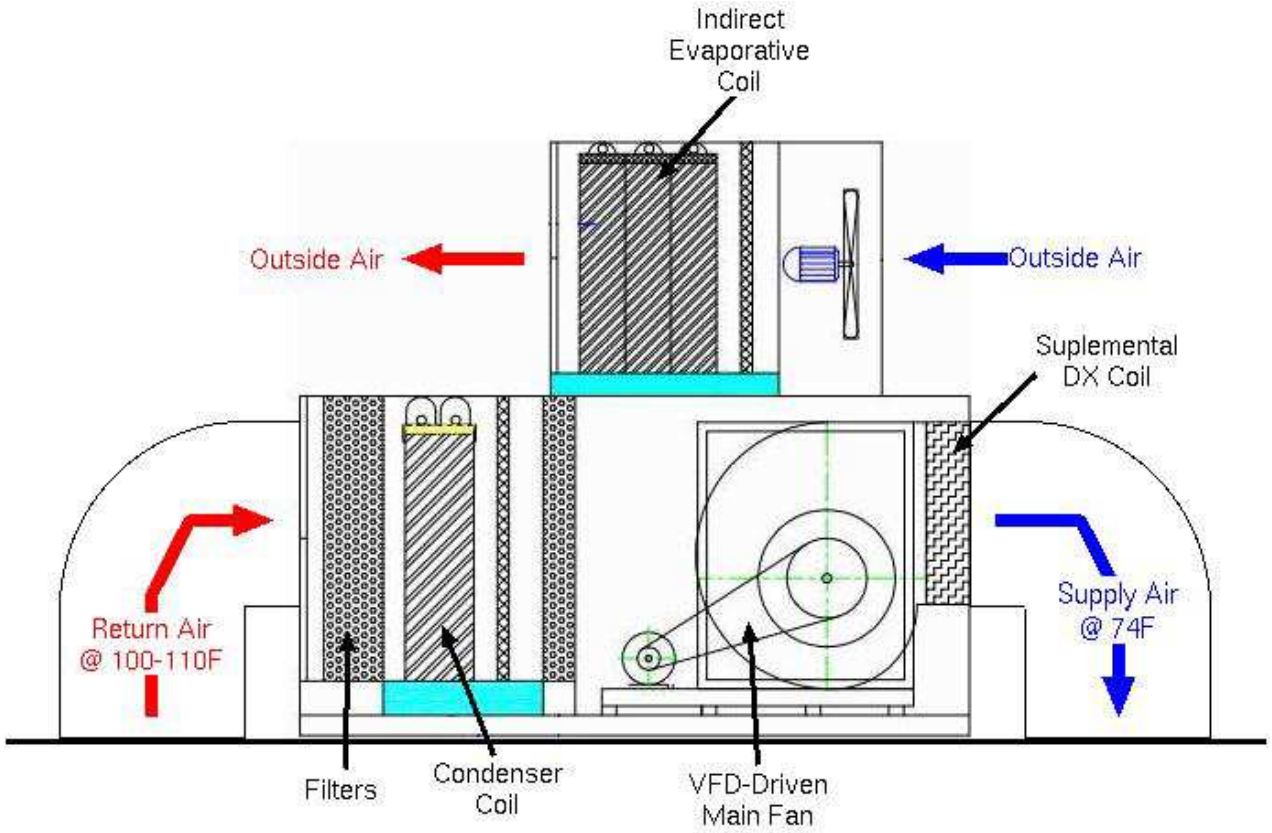
Highly Efficient Cooling System

- Indirect Evaporative Cooling (IEC) units in an N+2 configuration
  - Any spare unit can replace any failed unit for seamless restore
- Passive chimney cabinets gather hot exhaust air and route it to the roof units for processing
  - Highly efficient for reduced energy consumption and cost savings
  - Supplemental DX system needed only 180 hours/year
  - More power available for IT equipment
  - Underground storage tank holds 24-hours of harvested rainwater (with city water backup)

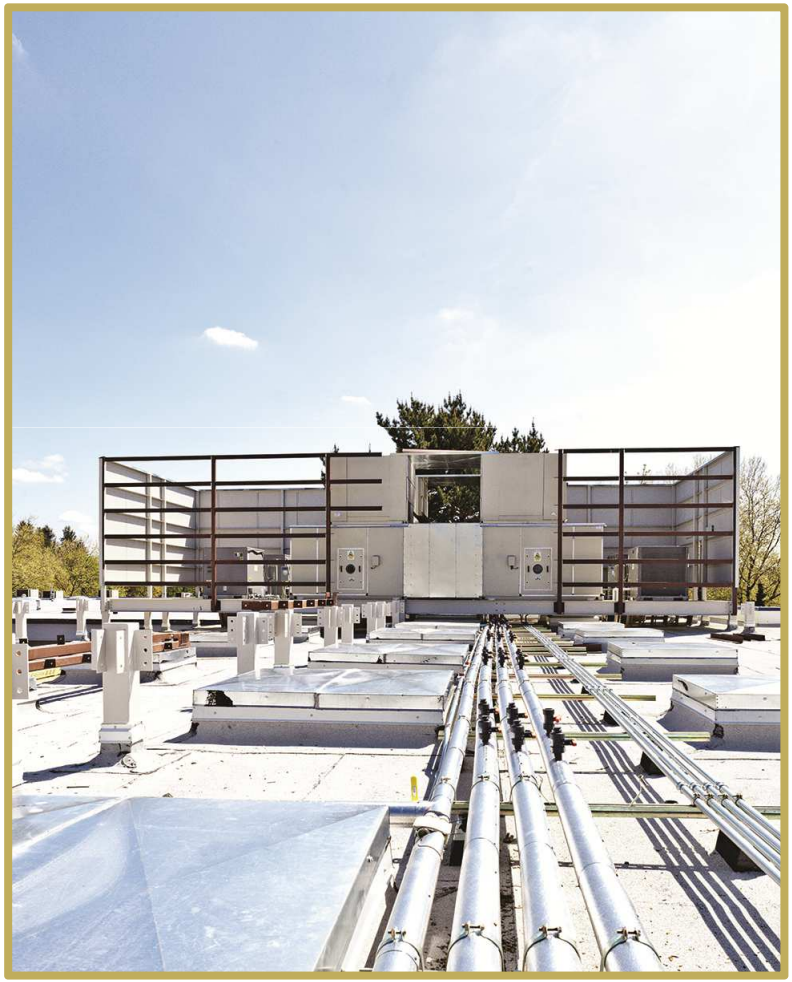


Roof-Top Mounted IEC Units

The Speakman indirect evaporative coolers (IEC) are roof-top mounted high efficiency units which use outside air to cool water which is then used to cool the data center exhaust air stream. Each unit contains a small cooling tower, a scavenger fan blowing outside air over the “hot side” of the IEC coils, and VFD-controlled main fan moving the data center air stream over the “cold side” of the IEC coils.



Roof-Top Mounted IEC Units

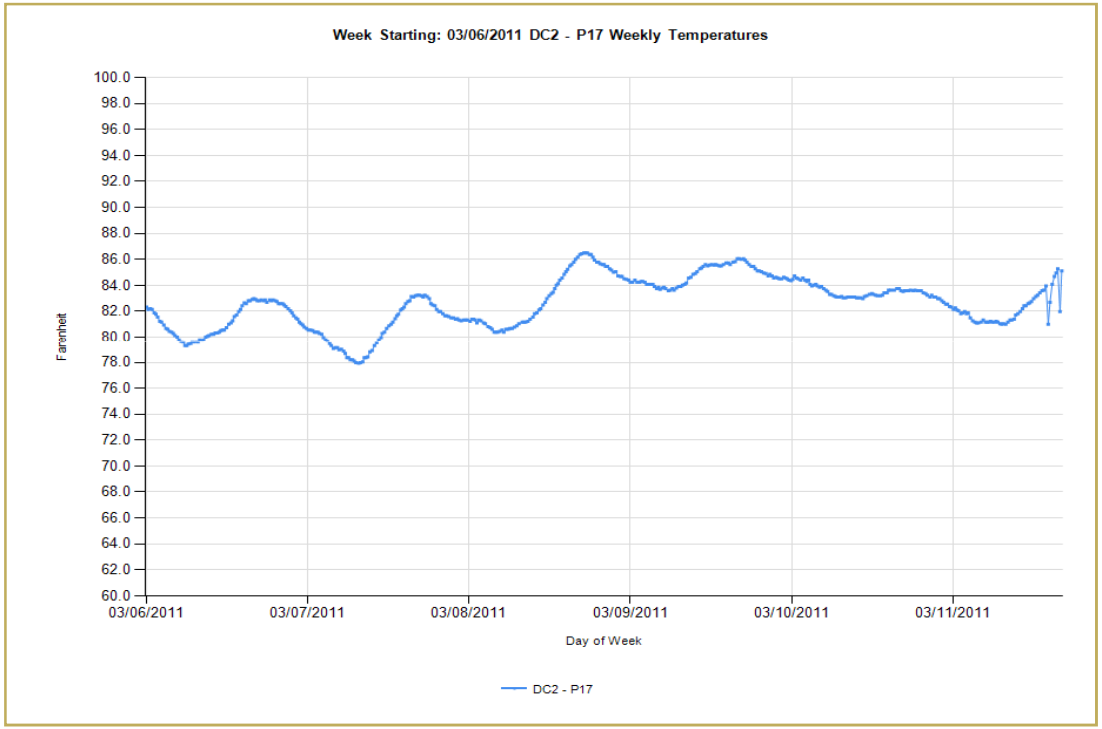


Supply and Return Ductwork

The Finished Data Center

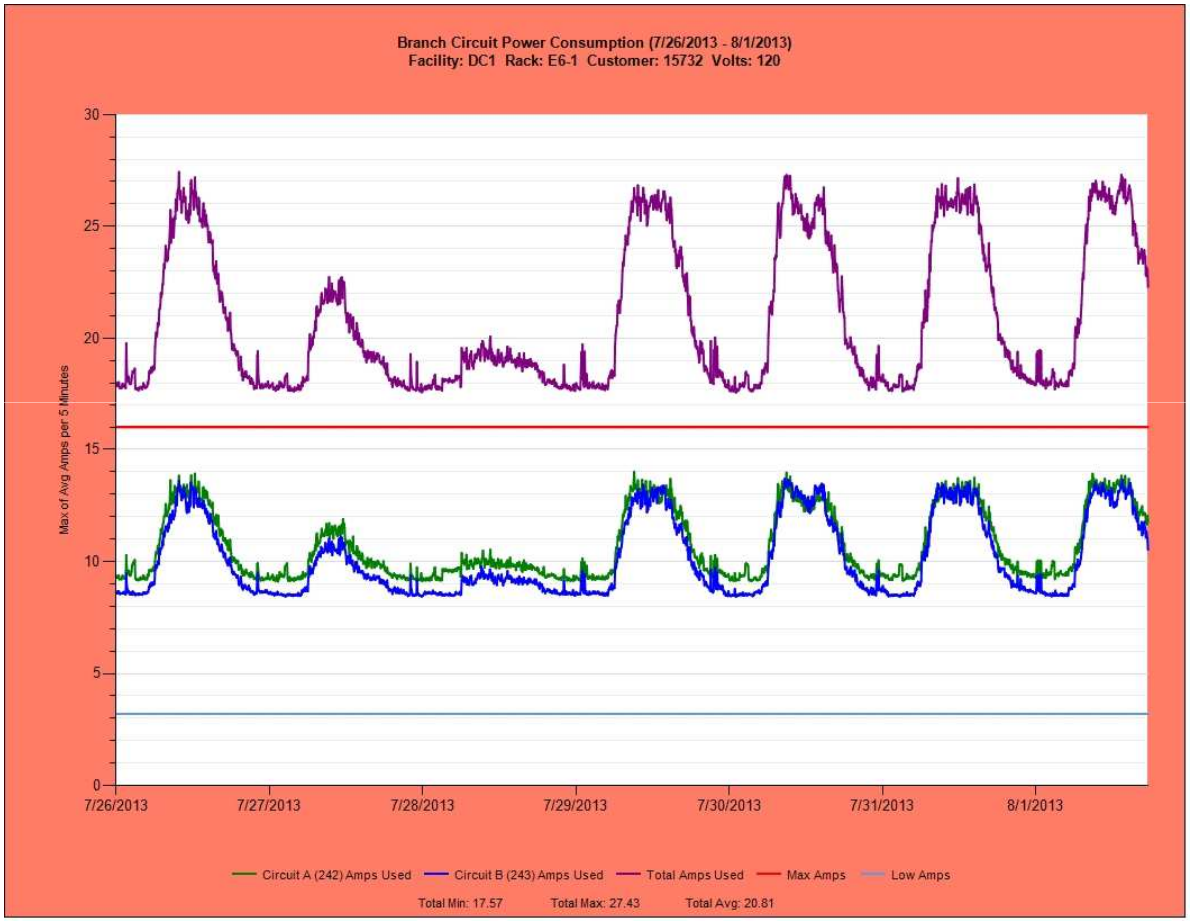
Ongoing Tuning and Monitoring

- One example: Chimney temperature for a 1.8kW load

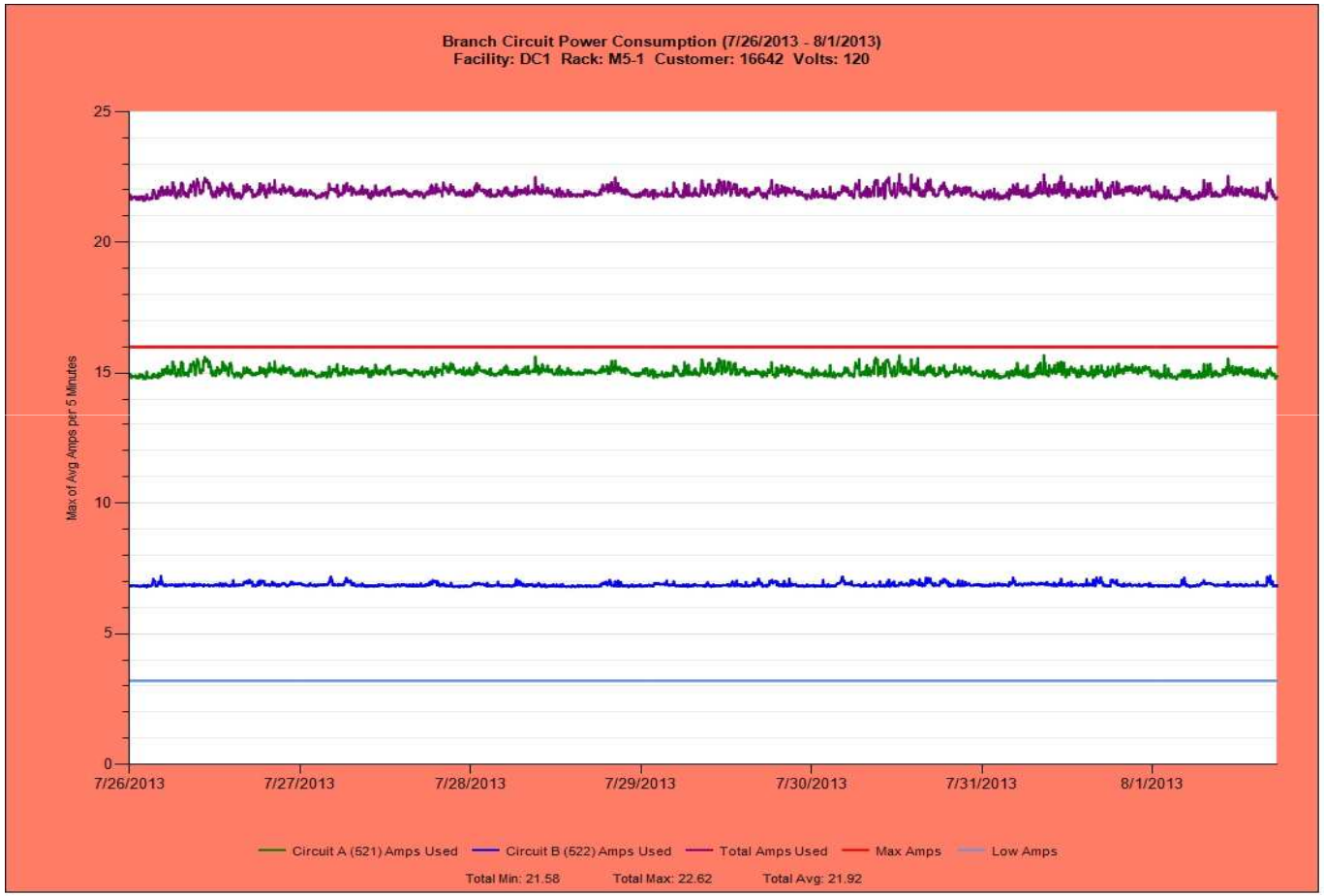


- We expect a temperature change of 25 degrees F for 4kW of IT load…. right on target!

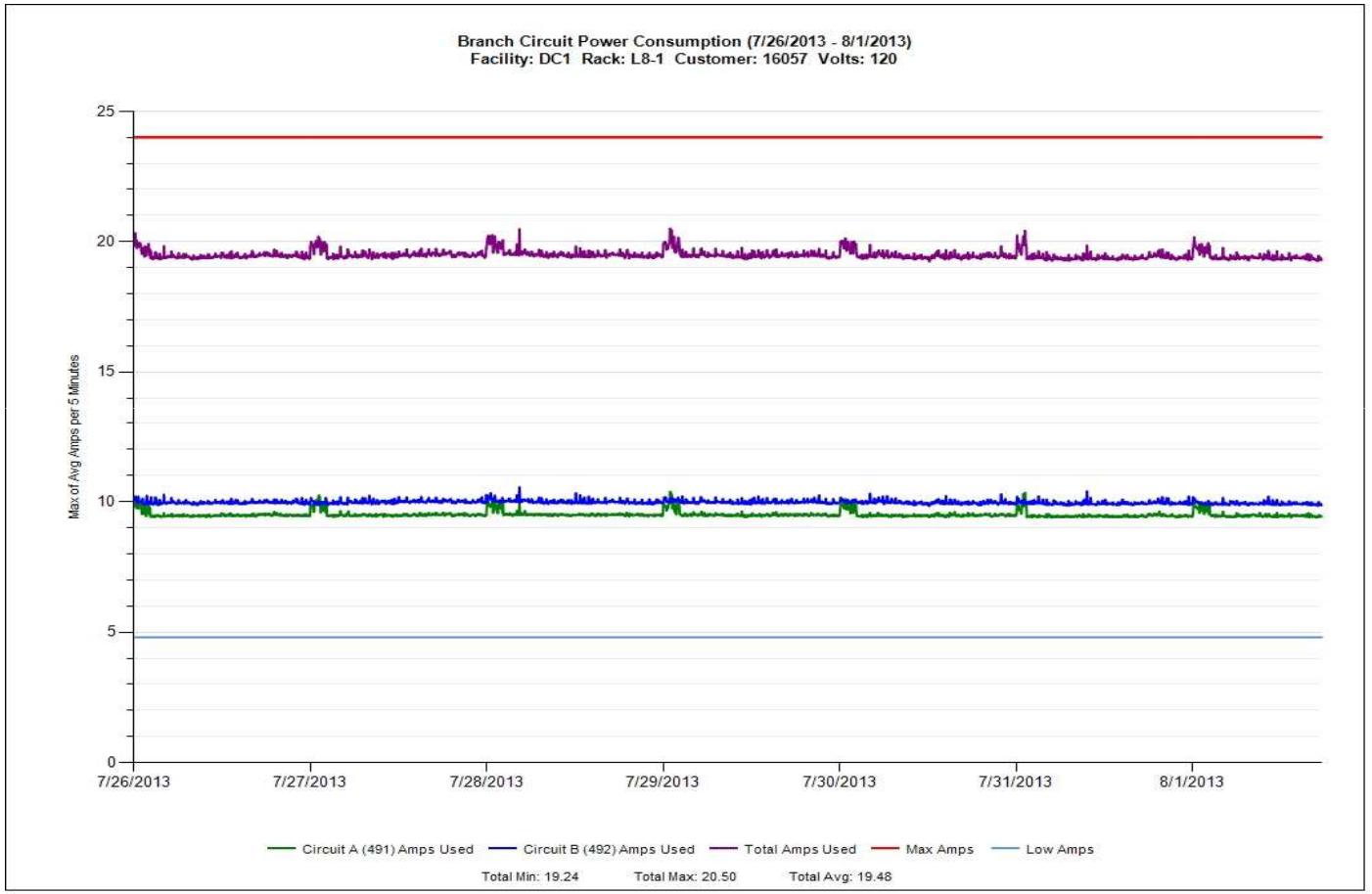
Ongoing Tuning and Monitoring



Ongoing Tuning and Monitoring



Ongoing Tuning and Monitoring



Even better benefits when you control the load

- Cloud computing generates efficiency through consolidation
  - Virtualization
- Managing peak loads and responding to low demand
  - Server at idle used 60% of power
  - Server at 100% uses 90% of power
  - Dynamically and non disruptively moving load to shut down excess capacity is key.

If You Want to Learn More…

You are always welcome to visit!

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