Data Center Design and Energy Management

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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
- 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…
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)
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
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Branch Circuit Power Consumption (7/26/2013 - 8/1/2013)
Facility: DC1  Rack: L8-1  Customer: 15657  Volts: 120

- Circuit A (481) Amps Used
- Circuit B (682) Amps Used
- Total Amps Used
- Max Amps
- Low Amps

- Total Min: 19.24
- Total Max: 20.50
- Total Avg: 19.46
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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