

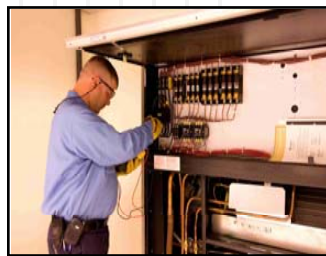
# **Lean & Green: Guide to a More Cost-Effective, Energy-Efficient Datacenter**

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Engineering, Digital Realty Trust**

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# About Digital Realty Trust: NYSE (DLR)

- Exclusive focus on technology-related real estate assets
  - Assets that are critical to the operations of our tenants
  - Diversified across various users of technology real estate
- Over 70 properties comprising 12 million net rentable square feet
  - Strategically located in 26 key markets in the North America and Europe
- Our products include:
  - Turn-Key Datacenters™, Build-To-Suit Datacenters, Datacenter Acquisitions and Financing, Critical Facilities Management™



**We know datacenters: flexible, reliable, cost-effective solutions**

# “Green” Defined

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- Green = Efficient
  - Efficient operations minimize input costs
    - Electricity, water, capital
    - Efficient operations as a design element
  - Efficient builds minimize capital costs and materials
    - Re-use of existing structures
    - Reduce consumption of materials
- Green should be good for business
  - Reduced operational costs impact the bottom line
  - Efficient capital deployment is a competitive advantage
- Green *should not*.
  - Impact reliability and availability
  - Cost more than it saves

**Goal:** Maximize the amount of KW of IT Load for every KW of Utility Power

# Implementation of Green Strategies

- Optimal operations efficiency is the end goal
  - Build an engaging process with cross functional participation
  - Operations teams are critical
- Upfront design and operations planning is key
- Implement “real” solutions modeled on real conditions
  - Challenge all your exiting assumptions
  - Make decisions based on operational data
  - Simulate/model and test vs. actual results
- This is a new, long-term process for our industry



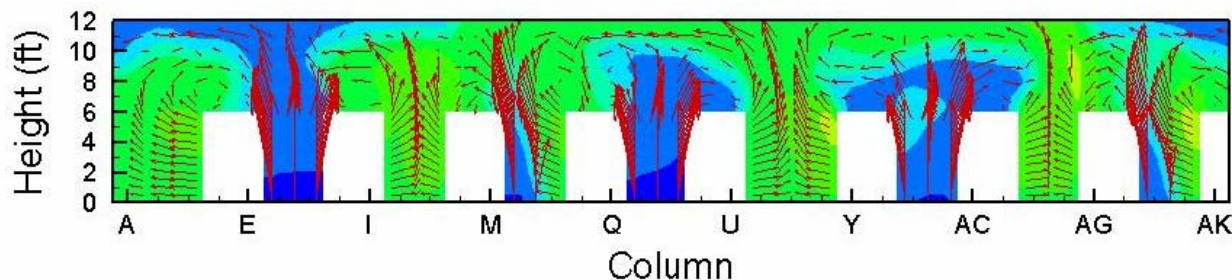
# Design for Efficiency

- Efficient design eliminates waste
  - Optimize the load package
- Common mistake
  - Design for worst case scenario
  - Results in “over-engineered” solution
  - Components over powered, underutilized
- Example:
  - “Cascading over-engineering”
  - 90% margin across five layers of infrastructure
    - $90\% \times 90\% \times 90\% \times 90\% \times 90\% = 60\%$
  - Is there hidden kW in your datacenter?



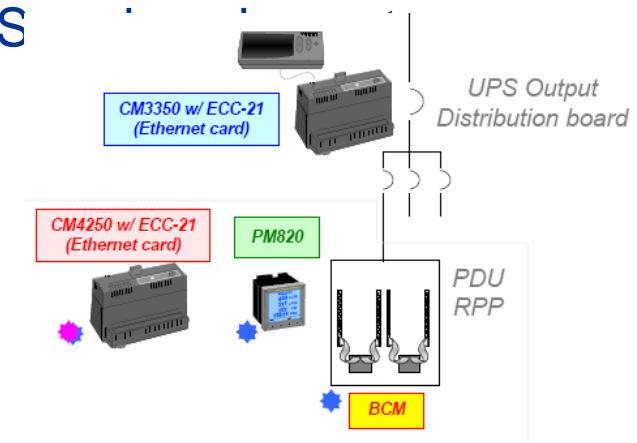
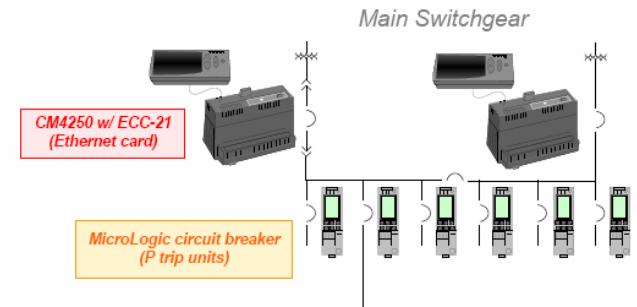
# Design for Efficiency

- Modularize your builds around the deployed footprint
  - POD Architecture
  - Force a planning process into procurement and technology
  - A small and optimized POD is more efficient
- Model the space with CFD tools during schematic design
  - Not every rack is a blade deployment!
  - Identify opportunities to tune the space with construction elements, pipe placements, site constraints, etc.



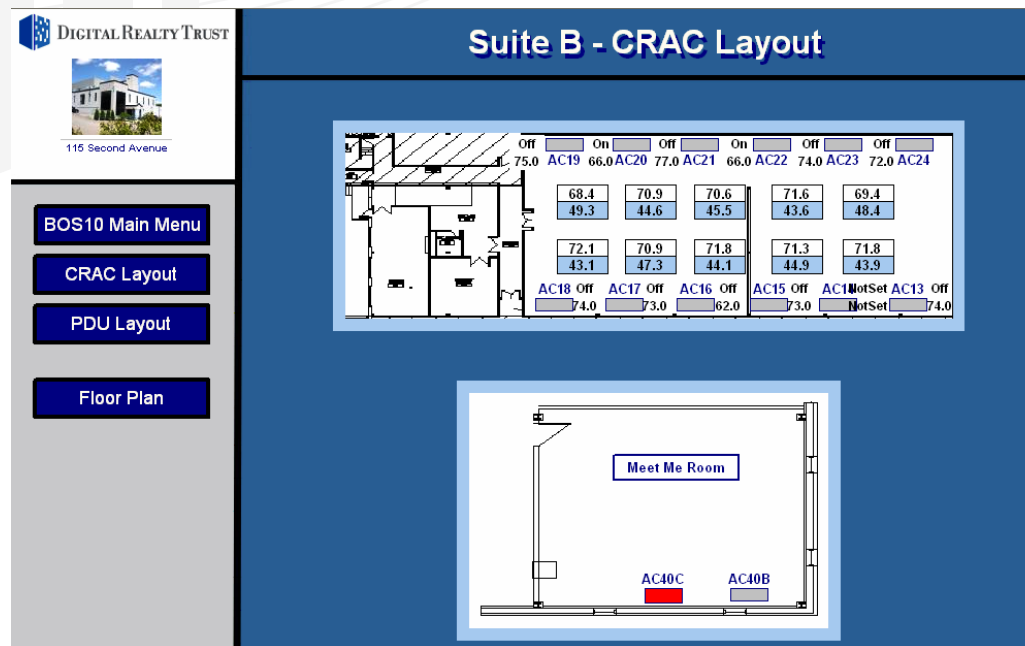
# Common Sense Green Strategies - Measurement

- Use Power Quality Monitoring as your foundation for performance measurement
  - Green Grid Metrics as your benchmark
    - DCE – Data Center Efficiency
    - PUE – Power Usage Effectiveness
  - Continuous and discrete measurement
  - Manual polling is OK
- PQM is an important adjunct to your BMS callouts and alarming
  - Example of Green Strategy improving performance
  - Branch circuit monitoring helps IT teams understand the impact of their hardware choices



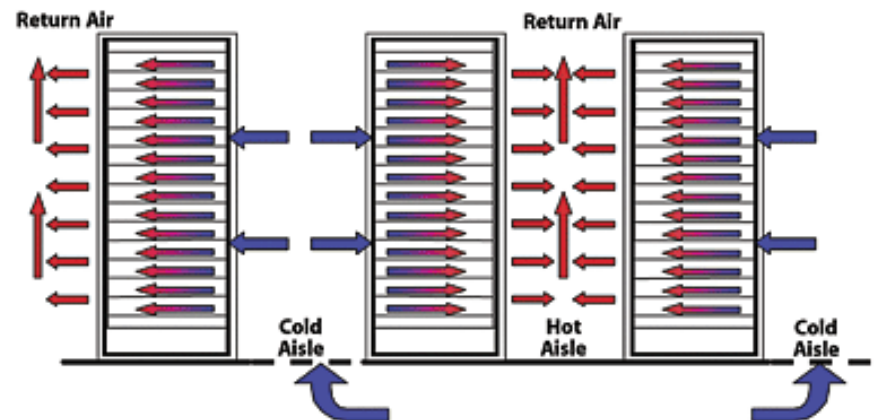
# Common Sense Green Strategies - Measurement

- Use a Building Management System (BMS)
  - Monitor and manage important infrastructure systems
  - Capture and trend data to identify variances in usage levels
  - Allows for systems to be turned off when not in use
    - Power used only when necessary



# Common Sense Green Strategies – Airflow

- Hot Aisle/Cold Aisle
  - Equipment racks placed in alternating hot/cold aisles
- Hot aisles act as heat exhausts
  - Goal is to isolate and extract heat before it mixes with cold air
- Cooling system able to supply cool air only to cool aisles
- Don't overlook the “little” things
  - Sealed floor/bypass air
  - Blanking panels
  - End-aisle curtains
  - Perf placements are DYNAMIC!!!
  - CFD tools are worth their cost



# Common Sense Green Strategies – Heat Rejection

- Match cooling methodology to AC tonnage
  - 50-200 tons (DX)
  - 200-1000 tons (air-cooled CHW)
  - 1000+ tons (water-cooled CHW)
- Non-Condensing Chilled Water Temperature
  - Operate up to 55°
  - Reduces temperature difference between chilled and condenser water loops
    - “Lift”- Lower is better
    - Increases efficiency and reduces power requirement
- Free Cooling via Waterside Economizer



# LEED Certification

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- LEED Certification is an interesting topic
  - Certification does not explicitly address efficiency issues
  - Provides a good framework for the total picture
  - Good first start for builders, especially with new structures
- DLR has achieved industry's first GOLD certification
- All new DLR projects will seek LEED certification
- Our experience so far is a 2-5% cost increase on projects
  - Half fees and half materials/requirements
- Manageable impact on constructability, schedule, etc.
- LEED Process delivers tight focus for delivery teams

# Let Common Sense Be Your Guide

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- Designing and building a “Green” datacenter requires planning
  - On-going operations must be factored in
- Component efficiency equals power efficiency
  - “Right-size” your deployments
- BMS systems provide monitoring and management of critical components
  - Increase efficiency by managing systems based on empirical information
- Introduce financial discipline
- The by-product of a “Green” datacenter
  - Cost efficiency
  - Capital efficiency

# DIGITAL REALTY TRUST



We  
Know  
Datacenters