



• August 15-18, 2010 • Dallas, Texas •  
• Dallas Convention Center •



# Data Center Sustainability

# DATA CENTER SUSTAINABILITY?

## WHO HAS THAT JOB?

Jake Wooley  
Program Manager, IT Sustainability  
Energy IT Services  
Office of Chief Information Officer  
U.S. Department of Energy



# Data Center Sprawl

Why?

- Not my problem
- Not a corporate priority
- Fear

# Why Change Now?

- Federal IT Strategy?
- OMB Federal Data Center Consolidation Initiative?
- EO 13514 – Strategic Sustainability Performance Plan (SSPP)?

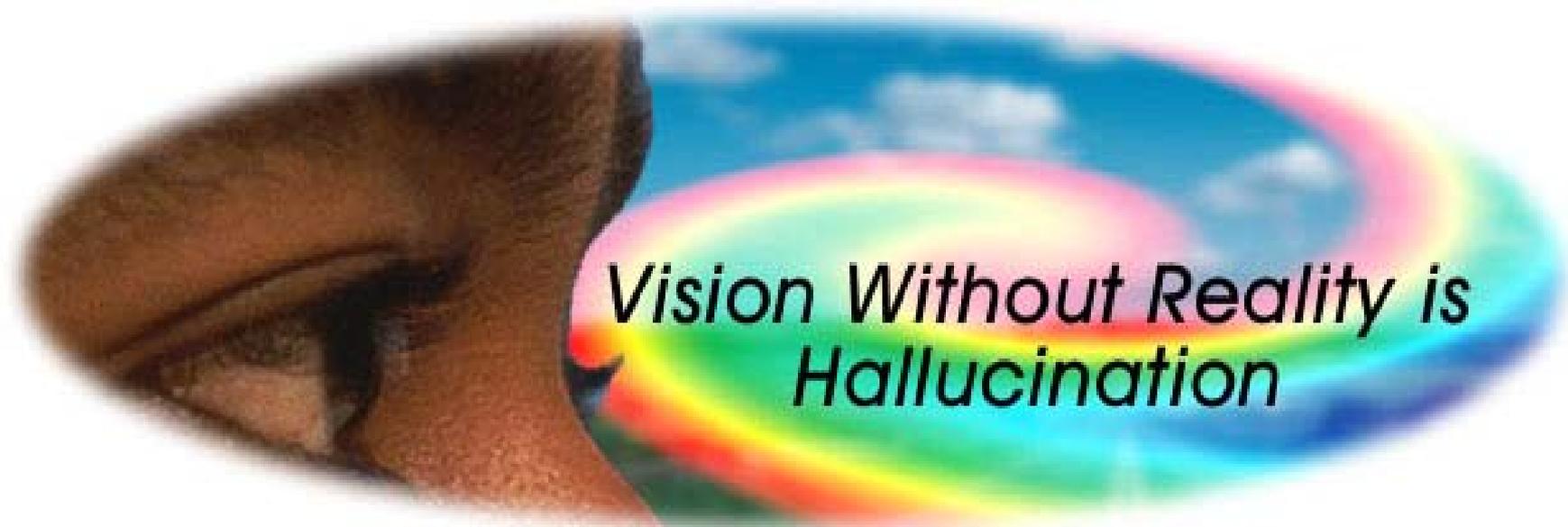
## • Where is the **authority**?

- Is there a clear objective?
  - Fewer data centers?
  - Consolidation of IT Services?
  - Federal IT Cloud?
  - Reduction of GHG Emissions?
  - All of the above?

# Obstacles or Challenges

- Workforce resistance to change 90 %
- Agencies' desire to remain autonomous 86 %
- Problems experienced in moving localized devices away from current customer base 48 %
- Backlash when consolidation didn't meet specific business needs 21 %
- Higher than anticipated costs 17 %
- Seeking exemptions from federal regulatory requirements 17 %
- Failure to identify and adhere to service levels 4 %





*Vision Without Reality is  
Hallucination*

# FDCCI Implementation Methodology



## ACTIVITIES

- |  |   |  |  |  |   |
|--|---|--|--|--|---|
| <ul style="list-style-type: none"><li>• Create an inventory of HW/SW assets by data center</li><li>• Capture Baseline Metrics for utilization &amp; energy for each data center</li><li>• Quick Wins</li></ul> | <ul style="list-style-type: none"><li>• Map Applications:<ul style="list-style-type: none"><li>✓ To Server/Mainframe</li><li>✓ To Database/Platform</li></ul></li><li>✓ App Dependencies</li><li>✓ App Security</li><li>✓ App Usage &amp; SLAs</li><li>✓ Segment Architecture</li></ul> | <ul style="list-style-type: none"><li>• Perform energy and cost evaluation of different approaches</li><li>• Identify the risks, alternatives, cost assumptions and business benefits</li><li>• Make strategic technology &amp; consolidation investment decisions</li></ul> | <ul style="list-style-type: none"><li>• Design &amp; test consolidation alternatives</li><li>• Develop transition plan for energy use optimization &amp; data center consolidation</li><li>• Create project plan and WBS for the transition plan</li></ul> | <ul style="list-style-type: none"><li>• Execute virtualization, consolidation and migration plans</li><li>• Execute energy use optimization plans</li><li>• Measure and report on Utilization and Cost Savings Metrics</li></ul> | <ul style="list-style-type: none"><li>• Continue energy use optimization, virtualization and consolidation</li><li>• Continue on-going monitoring and reporting of Utilization and Cost Savings Metrics</li></ul> |
|--|---|--|--|--|---|

## DELIVERABLES

- |   |  |   |   |   |  |
|---|--|---|---|---|--|
| <b>1</b><br><i>IT Asset Inventory Baseline &amp; Quick Wins</i> | <b>2</b><br><i>Application Mapping</i> | <b>3</b><br><i>Consolidation Analysis &amp; Strategic Investment Decisions on Standard Platforms and Services</i> | <b>4</b><br><i>Consolidation Design &amp; Transition Plan</i> | <b>5</b><br><i>Consolidation Execution &amp; Progress Reports</i> | <b>6</b><br><i>Semi-annual Metrics Reports</i> |
|---|--|---|---|---|--|

# FDCCI Implementation Methodology



## ACTIVITIES

- Create an inventory of HW/data
  - Map Applications:
  - Perform energy and
  - Design & test
  - Execute
  - Continue energy optimization, transition and
- IT Centric
- Segment Architecture technology & consolidation and WBS for the transition plan Cost Savings Metrics Savings Metrics
- Quick Wins

## DELIV



IT Asset Inventory Baseline & Quick Wins

Application Mapping

Decisions on Standard Platforms and Services

Transition Plan

Progress Reports

Annual Savings Reports

Does not take holistic approach

# Data centers are 2 lines-of-business

## IT Infrastructure

IT systems performance & availability

Operational control of floorspace

Energy efficiency **not** an incentive

## Facilities Infrastructure

Utility (power & cooling) service provider – only

No operational control

Pay the electric bill

We must create a  
**collaborative environment**

We must take an  
**integrated approach**

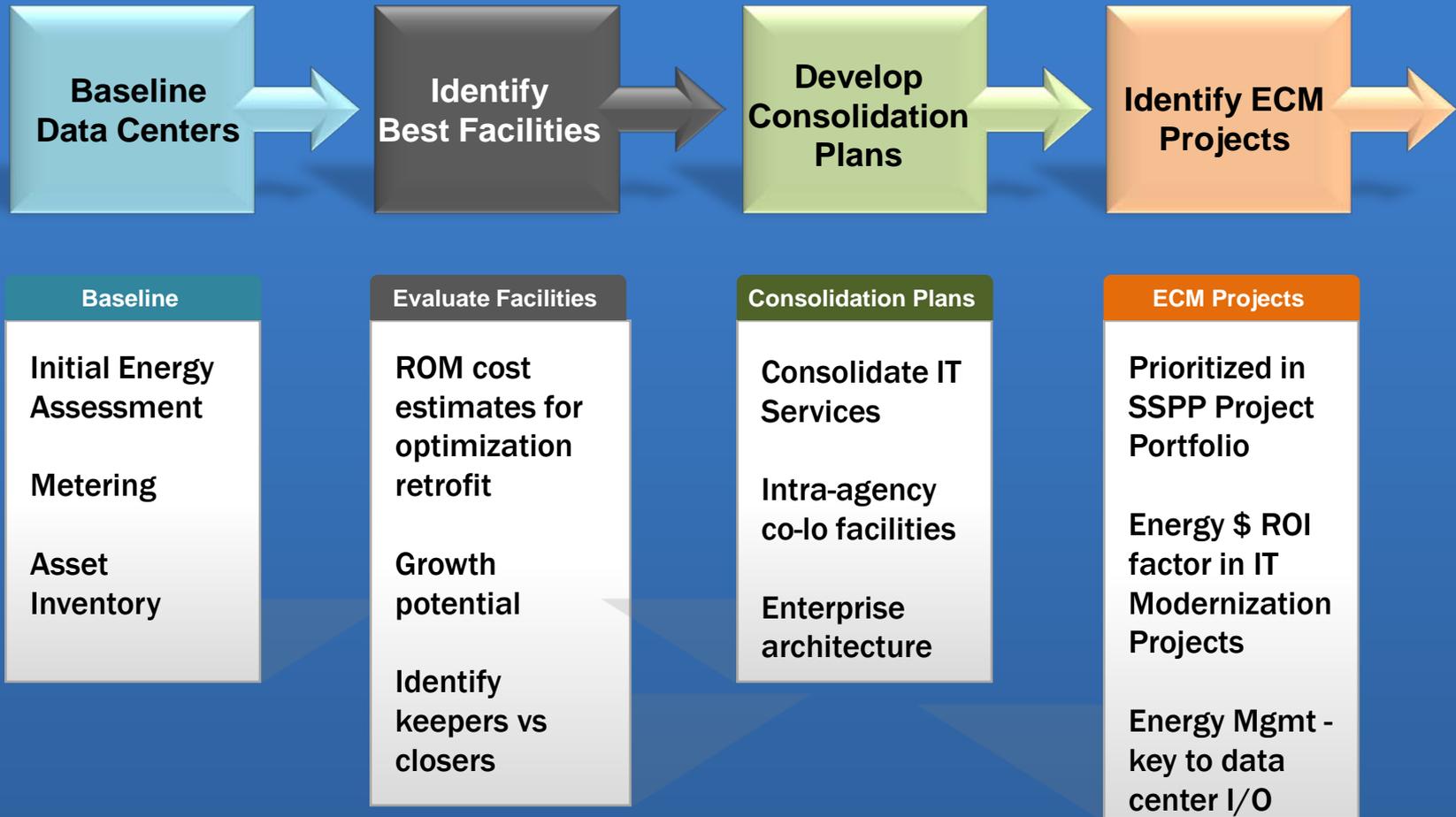
# Target Performance Measures

Utilization Metrics	Typical Results	Target Results
Average Virtualization (%)	0 - 10%	30 - 40%
Ave Virtual OS per Host (#)	5 - 10	15 - 20
Ave Svr Virtualization (%)	7 - 15%	60 - 70%
Ave Rack Space Utilization (%)	50 - 60%	80 - 90%
Ave Power Density (W/SF)	50 - 100 w/sf	150 - 250 w/sf
Power Usage Efficiency (PUE)	3 - 2	< 1.6
% of data centers w/ advanced metering		100 %
Reduction in # of agency data centers		40 %
% of cloud activity hosted in data center		60 %
% of data centers > 70% CPU utilization		75 %

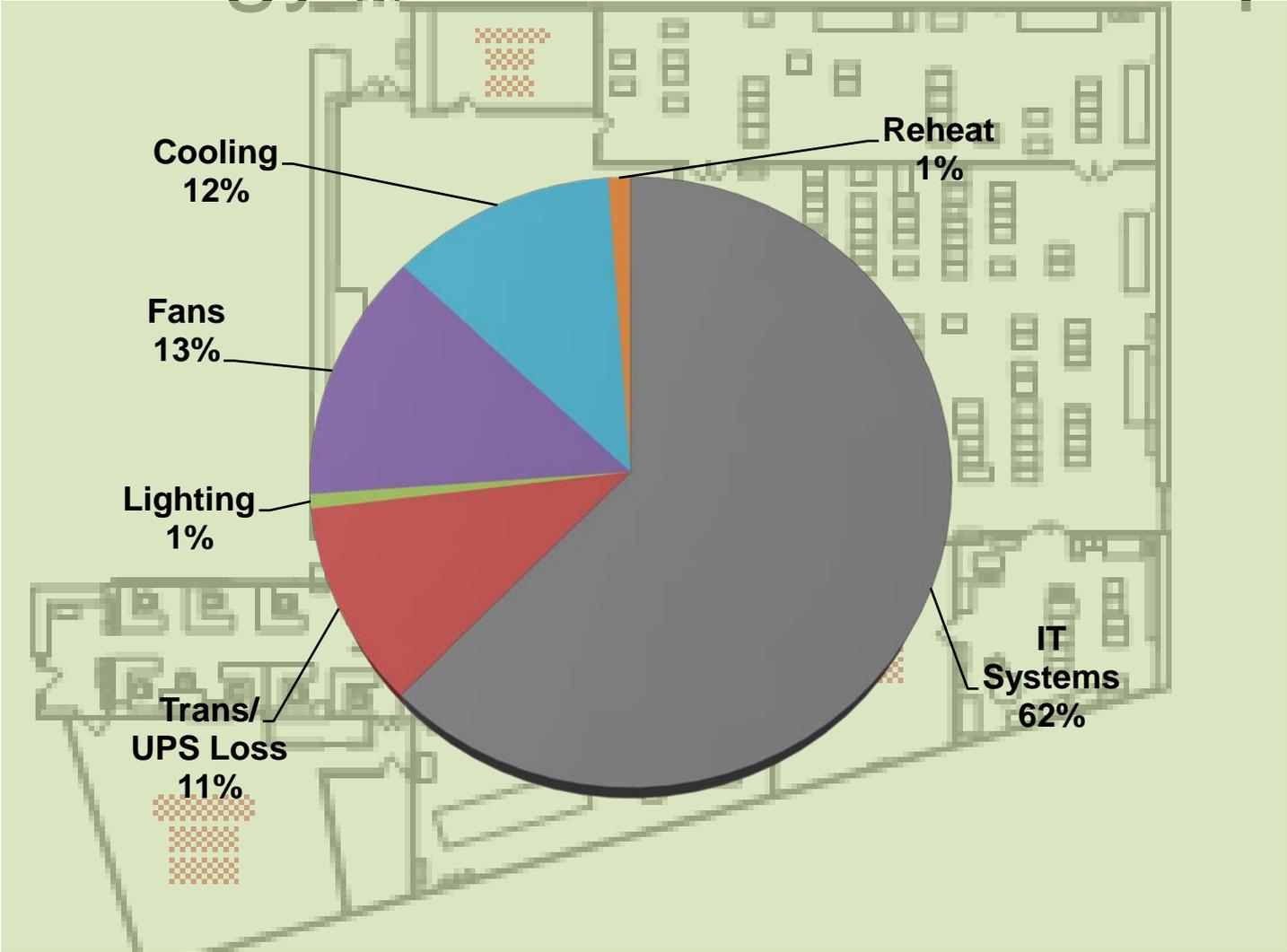
# Data Center Sustainability Assessment

- Data Center Demographic Data
- Energy Management
- IT Systems (Life-Cycle)
- IT Systems (Functional Areas)
- Environmental Conditions
- Air /Cooling Management
- IT Equipment Power Chain
- Lighting Systems

# Tailor Approach to SSPP Requirement



# Energy Assessment Example



**Baseline  
PUE - 1.60**

# Solution Sensor Types

Temperature

Humidity

Pressure

Leak Detection

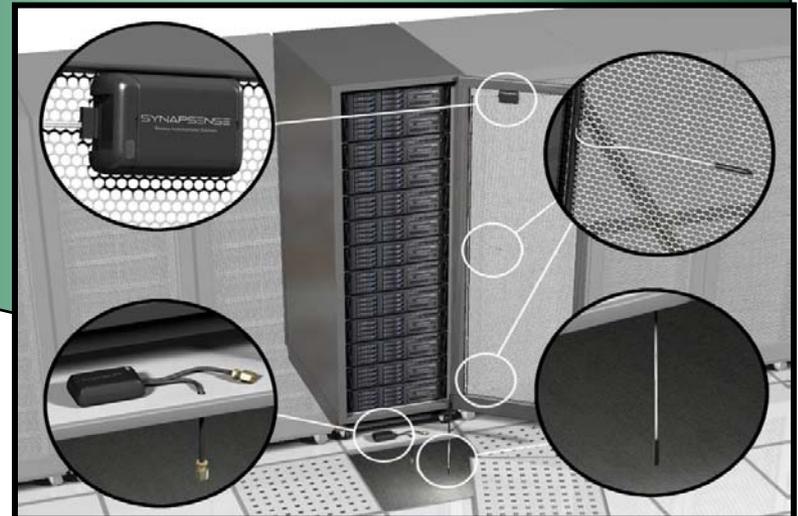
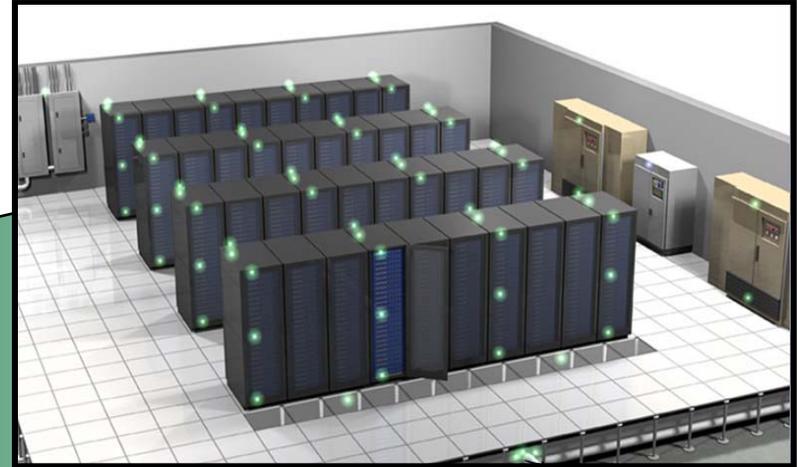
Dry Contact

Equip Status

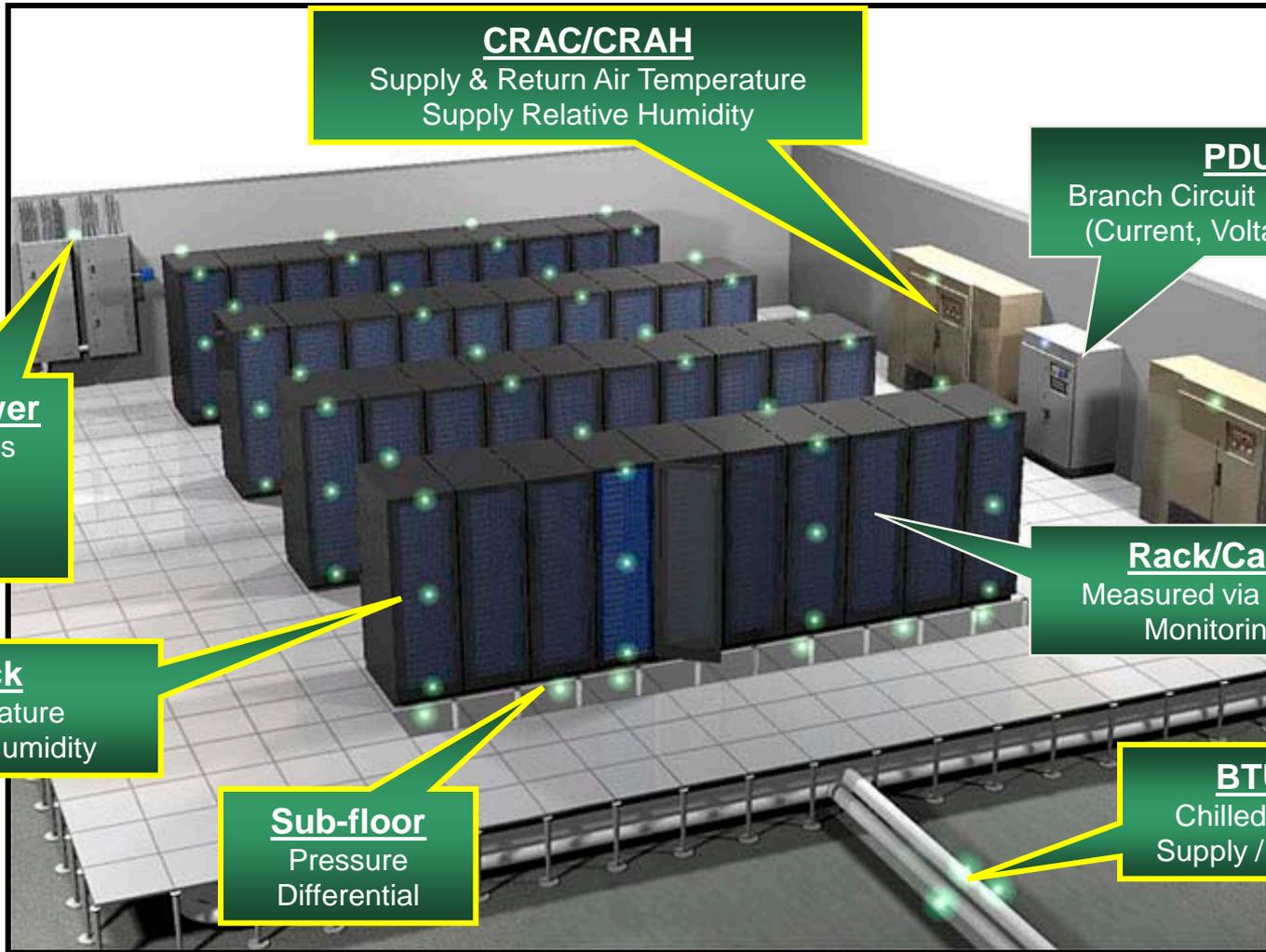
CW BTU

Power

Particle Count



# SynapSense Visualization Points



**CRAC/CRAH**  
Supply & Return Air Temperature  
Supply Relative Humidity

**PDU**  
Branch Circuit Monitoring  
(Current, Voltage & PF)

**Panel Power**  
CRAH Fans  
Lighting  
Pumps

**Rack/Cabinet kW**  
Measured via Branch Circuit  
Monitoring @ PDU

**Rack**  
Temperature  
Relative Humidity

**Sub-floor**  
Pressure  
Differential

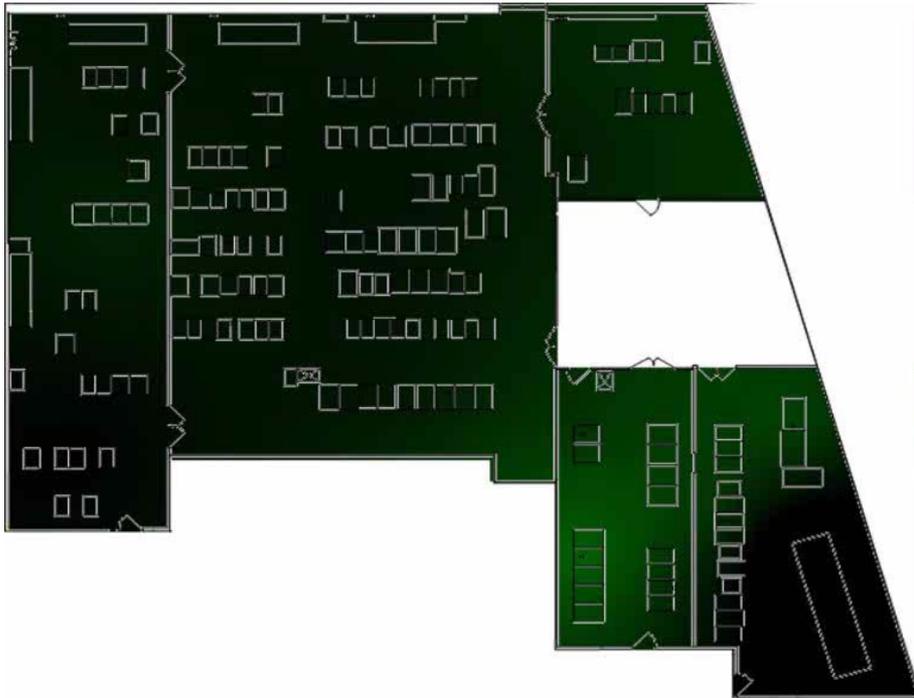
**BTU Node**  
Chilled Water Flow  
Supply / Return Temp

# Energy Assessment Example

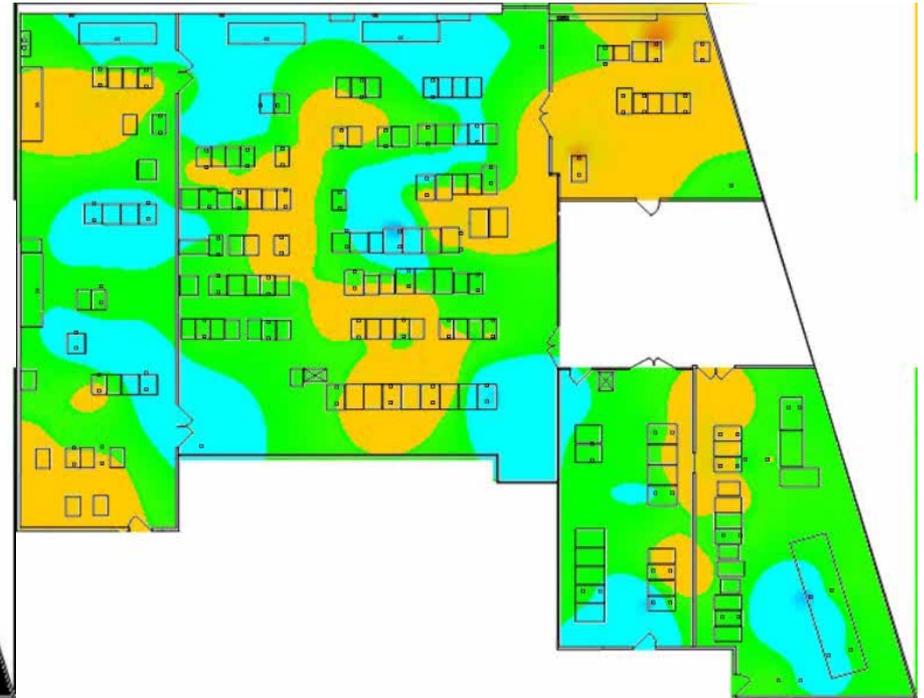
## Meter – Measure - Manage

- The SynapSense environmental sensors allow us to see results of improvements and respond to changes in the Data Center IT demands.

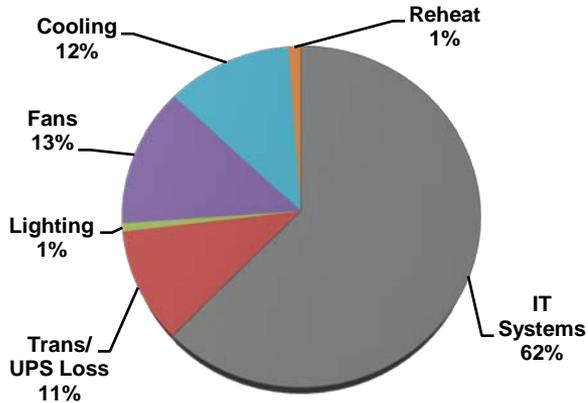
Under Floor Air Pressure



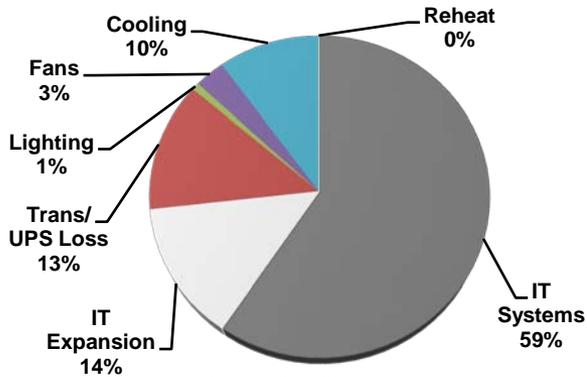
Intake Temperature – Top of Rack



# Energy Assessment Example



**Baseline  
PUE - 1.60**



**Retrofit Option  
PUE - 1.37**

Activity	Description	Cost Estimate
<b>1.0</b>	<b>Energy Management</b>	\$ <b>78,506</b>
	Purchase SynapSense Sensors	\$ 78,506
<b>2.0</b>	<b>IT Systems</b>	\$ <b>257,240</b>
<b>3.0</b>	<b>Environmental Conditions</b>	\$ <b>233,065</b>
<b>4.0</b>	<b>Air Management</b>	\$ <b>666,259</b>
	Construct and seal new zone walls	\$ 210,000
	Install full cold aisle containment including hard doors and ceiling panels	\$ 269,659
	Install missing blanking plates	\$ 18,000
	Seal all legacy cable penetrations with Koldloks	\$ 19,000
	Re-balance the perforated floor tiles using the SynapSense rack inlet air sensors	\$ 4,600
	Configure AC-2 to cool data center space	\$ 145,000
<b>5.0</b>	<b>Cooling Plant</b>	\$ <b>600,000</b>
<b>6.0</b>	<b>IT Equipment Power Chain</b>	\$ <b>626,000</b>
<b>7.0</b>	<b>Lighting</b>	\$ <b>165,000</b>
	Replace / relocate overhead lighting	\$ 165,000
<b>Option 1 Estimates</b>		<b>\$ 2,626,070</b>

## Benefits:

- 16% (653,000 kWh) reduction in energy consumption (annual)\*
- 441 mt reduction in GHG emissions (annual)\*
- \$81,600 reduction in energy bill (annual)\*
- 65 kW - Expansion capacity for additional IT equipment\*\*
- 2,800 SF - Expansion capacity for a total of 281 racks (Currently there are about 150 racks in GTN)
- Supports future infrastructure upgrades and enhancements (i.e. fuel cell / co-gen systems)

\* Based on current IT Load and Energy cost of \$0.125/kWh

# Questions?

