



Data Center Metrics Track Results

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Track Abstract

- There are many metric proposals for the datacenter
 - > PUE, DCiE, SWaP, SPECpower, COP, CLF, DCP, DCeP, CE, PLF, EEP, EPR, CUPS, CADE, SIT, and EPA Energy Star to name a few. The latest proposal out for review is The Green Grid's 8 proxy proposals for measurements of useful work.
- This track is responsible for two things
 - > Provide an official DCP respond to the TGG proposal
 - > Filter through the myriad of metrics, what DCP members are using today, and to make a recommendation for the DCP membership to standardize upon.

Audience

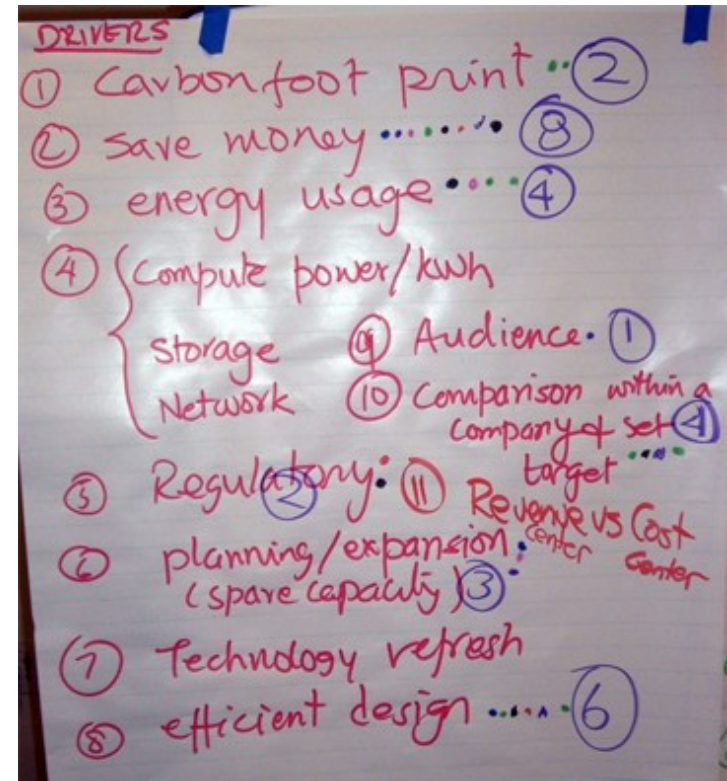
- Workgroup and intended audience is data center operators, both Facilities and IT
- Team from 2 types of organizations
 - > “Data center is a cost center” - 40% of team
 - > “Data center is a revenue center” – 60% of team
- Some metrics work for both groups, some are different
- “IT people” vs. “Facilities people”
 - > Team: 40% IT vs 60% Facilities

Agenda Breakdown

- General Metrics Discussion
 - > Drivers
 - > Criteria
- Feedback on The Green Grid Productivity Proxy Proposals

Drivers for Metrics

- Key to understanding metrics needs is related to Drivers and Criteria
- Key Drivers
 - > Save Money
 - > Efficient Design
 - > Energy Usage
 - > Compare within company
 - > Planning Expansion
 - > Carbon footprint,
 - > Regulatory
 - > Audience (internal or external)



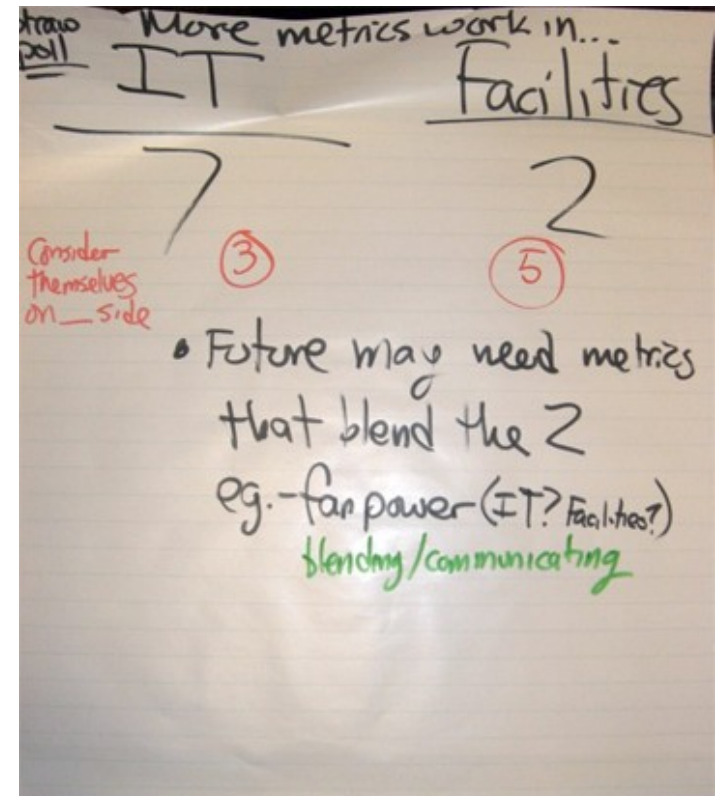
Criteria for metrics

- Low cost to implement
- Ease of use
- Apply across many d.c. types
 - > internal/outsourced, tier levels/redundancy
- Simple, business oriented
- Non-invasive, accurate, use existing monitoring capabilities
- Transparency + 4 others



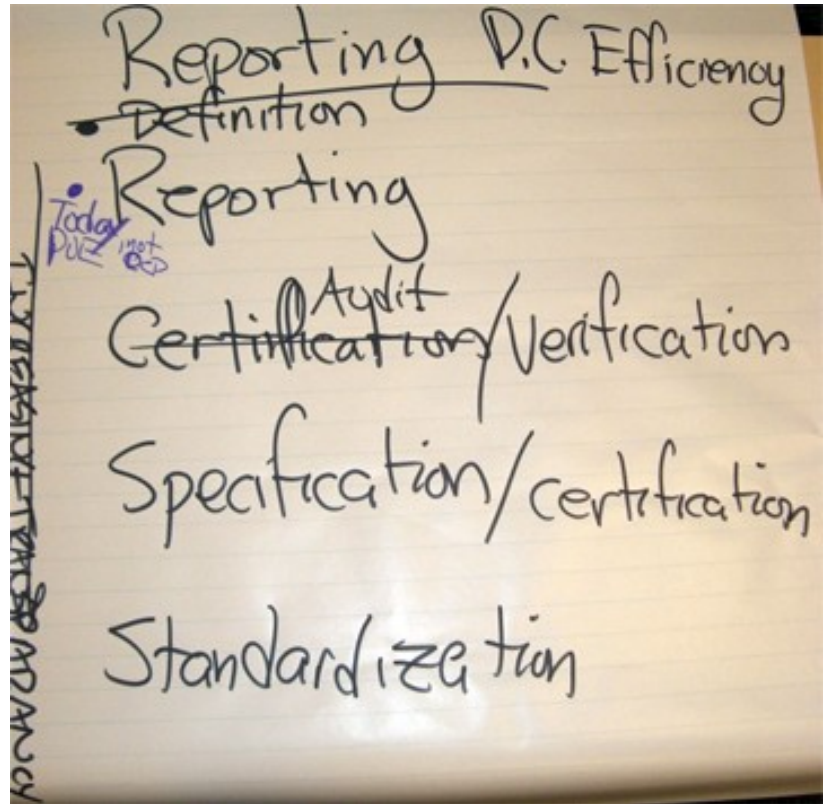
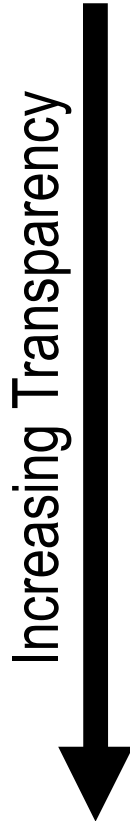
Where is more work needed?

- Interaction and communications between IT and Facilities will be important in the future
- IT folks felt more work needed in facilities, Facilities folks felt more work needed in IT



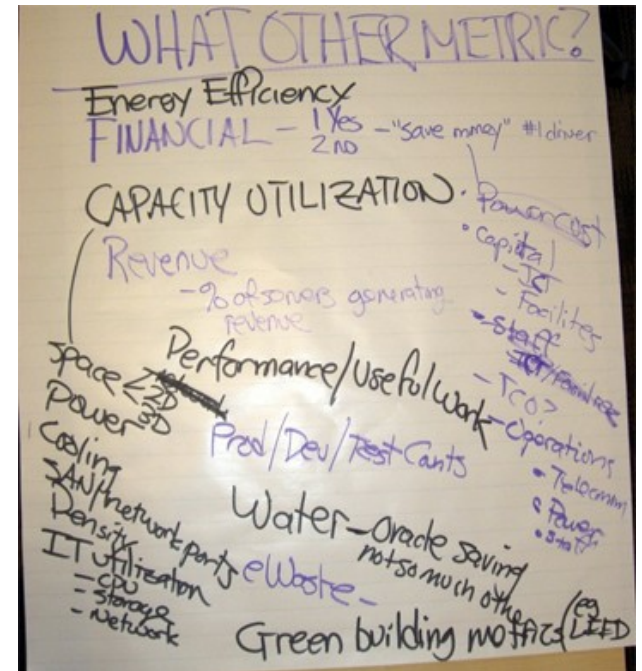
Reporting Hierarchy

- Definition
- Reporting
- Audit/Verification
- Specification/
Certification
- Standards
Acceptance



Other Metrics Discussions

- Financial (“Save money” #1 driver)
 - > Capital, Operations
 - > IT, Facilities, Telco, power, staff
- Capacity Utilization
 - > Space, power, cooling, density
 - > SAN/Network & IT Utilization
- Other
 - > Performance/Useful Work
 - > Production/Dev/Test/DR
 - > Water – missed opportunity? eWaste
 - > Green Buildings Metrics (e.g. LEED, BREEAM)



The Green Grid Productivity Proxies

- The Green Grid (TGG) trying to ignite the discussion around “useful work” in the data center
- True productivity measure requires useful work in order to define efficiency
- A productivity proxy is closely correlated to real work
- TGG proposed 8 proxies, seeking feedback

Proxy Proposals

Proxy Name	Description
Useful Work Self-Assessment and Reporting	All applications self-report, utility function is uniform and equal to one; user must decide how to normalize each task
DCeP Subset by Productivity Link	A subset of all applications self-report using Productivity Link, a freely available Software Development Kit (SDK); scale results to represent whole data center
DCeP Subset by Sample Workload	An instrumented subset of servers is measured running as sample workload; scale results to represent whole data center
Bits per Kilowatt-hour	Sum all outbound bitstreams from data center, divide by energy used by data center
Weighted CPU Utilization – SPECint_rate	Use CPU clock speed, SPECint_rate benchmarks, and CPU utilization to determine amount of work being done.
Weighted CPU Utilization – SPECpower	Use CPU clock speed, SPECpower benchmarks, and CPU utilization to determine amount of work being done.
Compute Units Per Second (CUPS)	Uses trend curve based on Moore's law, age of server, and CPU utilization to determine work done.
Operating System Workload Efficiency	Estimate efficiency by calculating the number of operating system instances per watt

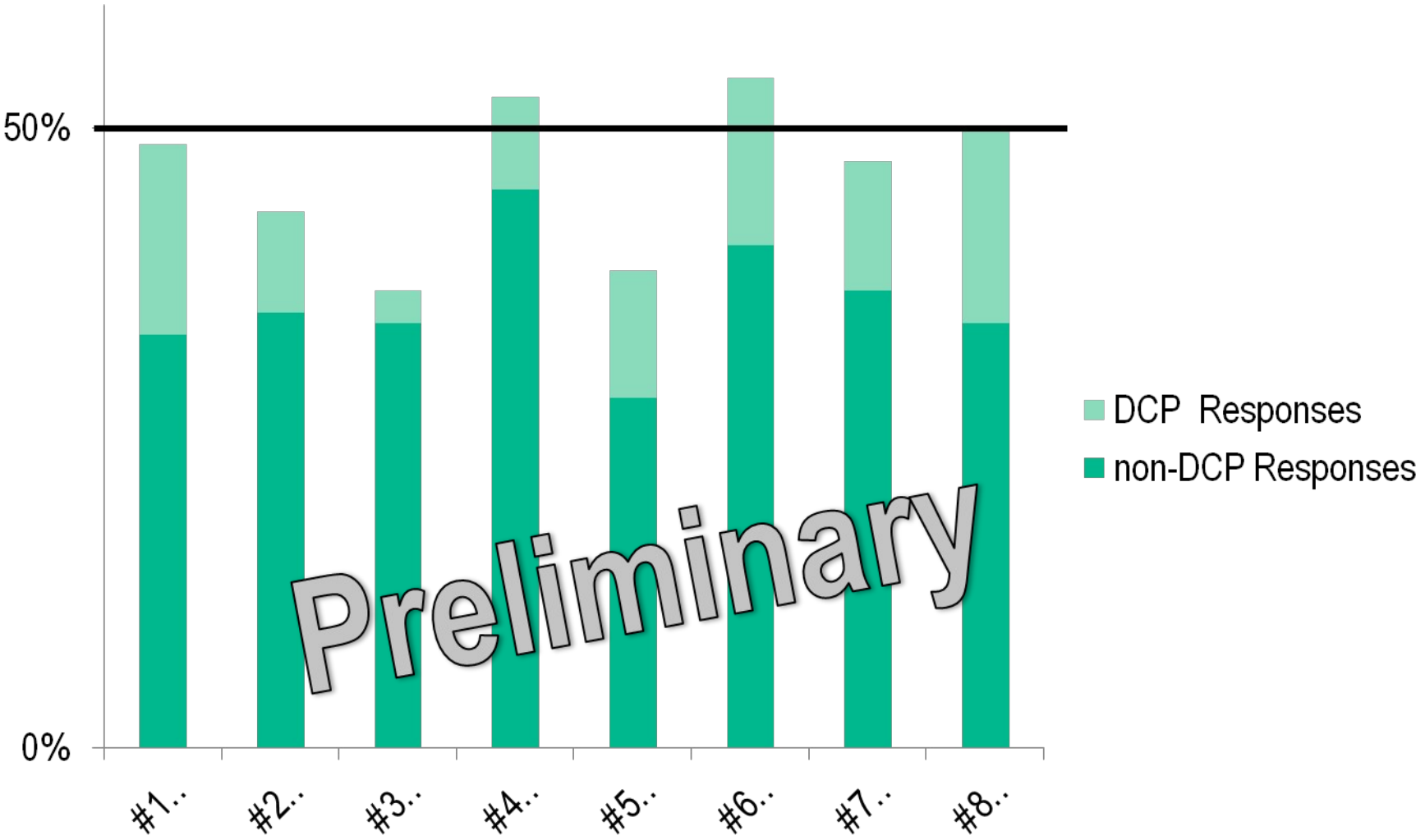
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DCeP-based
Proxies

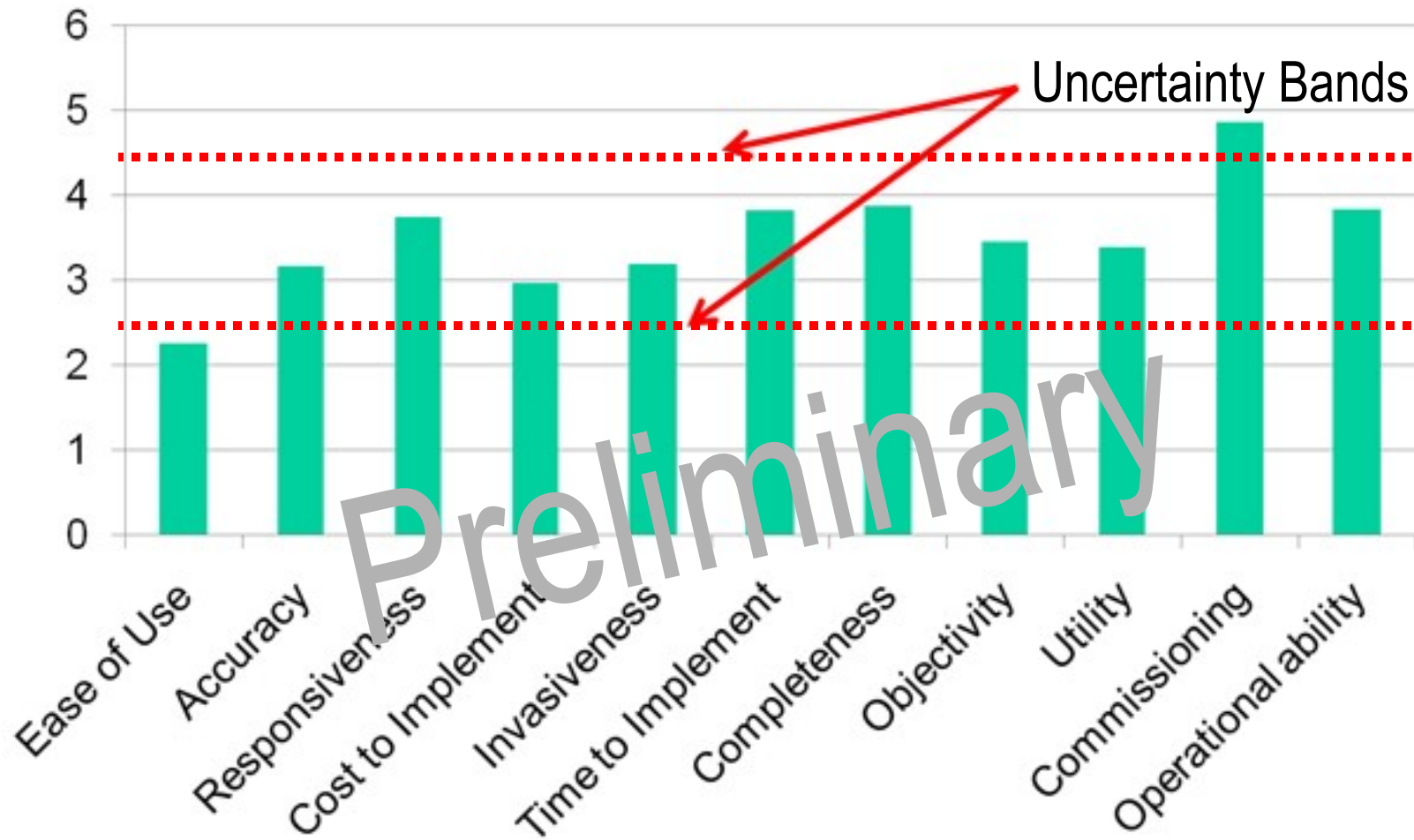
CPU Utilization-based
Proxies

Would you use these proxies?



Evaluation Criteria

Evaluation Criteria - Median Survey Response



Pugh Matrix

	Ease of Use		
	Count of Better	Count of Same	Count of Worse
#1 - Useful Work Self-Assessment and Reporting	14	8	1
#2 - DCeP Subset by Productivity Link	10	5	8
#3 - DCeP Subest by Sample Workload	9	8	6
#4 - Bits per Kilowatt-hour	16	4	3
#5 - Weighted CPU Utilization - SPECint_rate	11	6	7
#6 - Weighted CPU Utilization - SPECpower	10	8	4
#7 - Compute Units Per Second Trend Curve	12	6	6
#8 - Operating System Workload Efficiency	15	6	2

Preliminary