

# Recommendations for HPC Energy Management Dashboard Displays



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# Agenda

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Energy Efficient HPC Working Group  
Using Dashboards for Energy Efficiency  
Current Ideas and Recommendations

## OBJECTIVES:

- Summarize the paper

- Encourage on-going dialogue and action

# EE HPC WG:

## Purpose, Goals and Contact

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**Purpose:** Driving energy conservation measures and energy efficient design in HPC

**Goals:** Forum for sharing of information (peer-to-peer exchange, best practices), and taking collective action (guidelines, recommendations)

EE HPC WG Website:

<http://eehpcwg.lbl.gov>

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# EE HPC WG:

## Membership

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350+ members and growing

Approximately 50% government labs, 30% vendors and 20% academe

International- members from ~20 countries

Only membership criteria is 'interest' in driving more energy efficient HPC

Caveat, not a vehicle to promote products

Bi-monthly general membership meeting

Monthly webinars

# Neighborly Competition: Every Trip is a Race for Fuel Efficiency

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**The Washington Post**

**For Hybrid Drivers, Every Trip Is a Race for Fuel Efficiency**

By Michael S. Rosenwald, May 26, 2008

**Katie: 41 MPG**

His mileage is better because his commute is on flat land while mine is hilly.

Plus, they take long trips on week-ends.

**Evan: 43 MPG**

We haven't been out of town in a while.

Besides, it is well known that Katie is a lead-footer.

# Dashboard Introduction

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Philosophy: provide quick access to actionable visual data

Characteristics:

- Most important performance measures

- Tailored to different users

- Fits on single screen

- Automatic updates

- Supports interactivity and report generation

# HPC Center Dashboard Status

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Most HPC centers are just starting to gather and use dashboards for energy management

Survey conducted by the EE HPC WG of the major DOE National Laboratory HPC centers (early 2012)

Overwhelming positive response that the EE HPC WG should develop and document best practices relative to energy performance dashboards

Only a few DOE labs reported having energy performance dashboards (LBNL, LLNL and NREL) and those were described as partial, piecemeal and under construction



# Objectives:

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Identify and prioritize HPC center energy parameters for dashboards

Identify potential stakeholder(s) for each of the energy parameters

Document recommendations to assist the HPC community to choose the parameters they want to monitor and manage

# Stakeholders:

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Director – Responsible for the overall center's activity

Facility Manager – Primarily responsible for the physical infrastructure

Information Technology Manager – Primarily responsible for the information technologies (hardware & software) in the data center

# Director's High Level Items

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<b>Item</b>	<b>Primary Information</b>	<b>Unit</b>	<b>Priority</b>
1	Total power & energy	kW & kWh	High
2	Energy cost	\$	High
3	Average IT utilization- Compute System	Percent	High
4	Power Usage Effectiveness –Power	Index	High
5	Power Usage Effectiveness- Energy	Index	High
6	IT efficiency <sup>a</sup>	Work output/ Watt	High

<sup>a</sup> Depends on how each HPC center defines its work output

# Facility Manager's High Level Items

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<b>Item</b>	<b>Primary Information</b>	<b>Unit</b>	<b>Priority</b>
1	Total power/energy	kW & kWh	High
2	IT Power /energy	kW & kWh	High
3	Power Usage Effectiveness -Power	Index	High
4	Power Usage Effectiveness- Energy	Index	High
5	Cooling Efficiency	kW/ton	High
6	Cooling Energy Use	kWh	High
7	Data center IT equipment cooling diagram	degF/C	High
8	Temperature (map)	degF/C	High
9	UPS input / output power /Energy	kW & kWh	High
10	Data center electrical distribution diagram		High
11	CRAC/CRAH/AHU RAT (avg, min, max)	degF/C	High
12	CRAC/CRAH/AHU SAT (avg, min, max)	degF/C	High

# Information Technology Manager's High Level Items

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<b>Item</b>	<b>Primary Information</b>	<b>Unit</b>	<b>Priority</b>
1	Energy Cost per data processing unit	\$/unit	High
2	Total power/energy	kW & kWh	High
3	IT Power /energy	kW & kWh	High
4	Average IT utilization- Compute System	Percent	High
5	Power Usage Effectiveness –Power	Index	High
6	Power Usage Effectiveness- Energy	Index	High
7	IT efficiency <sup>a</sup>	Work output/ W*	High
8	Data center IT equipment cooling diagram	degF/C	High

Next update:  
36 seconds



Power Usage  
Effectiveness  
(PUE)

**1.08**

Water Usage  
Effectiveness  
(WUE)

**0.06**

Humidity  
(Outdoors)

**49%**

Temperature  
(Outdoors)

**57°**

Annualized Numbers — The chart above shows real-time PUE, WUE, temperature and humidity for Facebook’s Prineville data center. The numbers to the right are the Prineville data center trailing 12-month PUE and WUE as of the end of March 2013.

PUE  
**1.09**  
TTM

WUE  
**0.52**  
L/kWh

# Summary and Next Steps

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Document recommendations to assist the HPC community to choose the parameters they want to monitor and manage

Can we create a “Prius effect” environment with HPC energy efficiency dashboards?

# Questions and Thank you!

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