

Revolutionizing Data Center Efficiency (Update)

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**Our Mission Is to Continuously Increase
Uptime and Global IT Productivity
Through
Benchmarking and Collaborative Learning**

McKinsey Report: Revolutionizing Data Center Efficiency

- Double data center efficiency by 2012 as measured by CADE (Corporate Average Datacenter Efficiency)

Four Year Financial Outcome Current Trends vs. CADE/Energy Czar

	2008 - 2012	
	No Chg	Czar
IT server CapEx expenditures	\$31	\$20
Site asset CapEx expenditures	112	0
4 Year IT + Site OpEx expenses	<u>54</u>	<u>33</u>
Total CapEx + OpEx	\$197	\$53
Four Year Savings		\$144

All numbers in millions of dollars

CADE/Energy Czar IT Initiatives

- Kill comatose servers
 - **100% kill of accumulated comatose servers**
 - **Implement formal de-commissioning program using ITIL to document, bill back, and audit**
- Virtualize
 - **40% of applications**
 - **5 to 1 collapse**
- Buy 20% more energy efficient hardware
 - **More efficient power supplies and better fans**
 - **Rightsize memory**

CADE/Energy Czar Facilities Initiatives

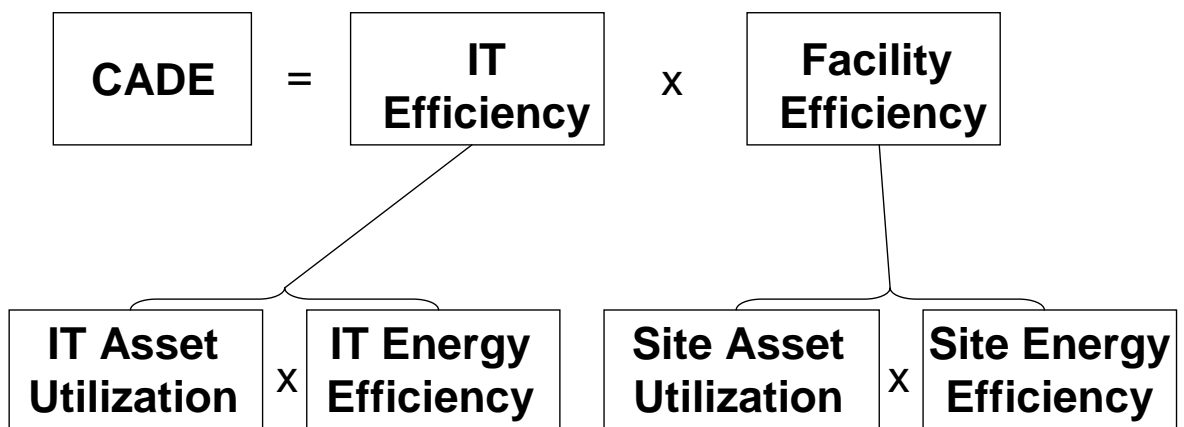
- **12% improvement in site energy efficiency**
 - **Measure site infrastructure energy overhead (Green Grid 1/DCiE or PUE if all forms of energy are included over a 12 month period) and correct any surprises**
 - **Correctly set cooling unit setpoints**
 - **Truly implement hot/cold aisle concepts**
 - **Eliminate humidification/de-humidification**
 - **Turn off unneeded cooling units**
 - **If available, increase waterside free-cooling**

Apps, Servers, IT and Utility kW, & CO₂ Baseline and Fourth Year

	Baseline Year	2012	
		No Chg	Czar
One App/One Server	6,200	10,900	6,500
Virtualized Apps	0	0	4,400
Active Applications	6,200	10,900	10,900
Comatose Servers	1,100	3,000	0
IT Plug Load – kW	2,200	6,000	3,100
Utility Load – kW	4,800	11,800	5,300
4 Year CO₂ emissions		242*	130*

* Cumulative over 4 years in thousands of tons

Corporate Average Datacenter Efficiency (CADE)



Current Trends vs. CADE/Energy Czar Baseline and Fourth Year

	Baseline Year	2012	
		No Chg	Czar
IT asset utilization	9%	8%	15%
IT energy efficiency	5%	5%	76%
Site asset utilization	55%	75%	77%
Site energy efficiency	46%	51%	58%
CADE	11	15	500

Processing increase	-	75%*	75%*
Utility load (megawatts)	4.8	11.8	5.3

* Not including Moore's Law increase from buying new equipment

CADE ver 1.0 – Servers Only Baseline Year Calculations

- IT Efficiency
 - IT asset utilization* (10% on active apps, 8.5% overall due to comatose servers)
 - IT energy efficiency (assume 5% for base year)
- Facility Efficiency
 - Site asset utilization* (55%)
 - Site energy efficiency** (46%) (use a 12 month moving average)
- $CADE = 8.5\% \times 5\% \times 55\% \times 46\% \times 100 = 11$
 - * Asset utilization = IT Plug load/site asset capacity
 - ** Same as The Green Grid's DCiE if all forms of energy in a running average over 12 months are included

CADE ver 2.0

- Include all product classes: servers, mainframes, midrange, storage, tape, network
- IT energy efficiency factor will be further elaborated
 - EPA EnergyStar products
 - Include saving from implementing power saver option

Site Costs per \$2,500 Server (assumes low cost location and Institute best practices)

Site Costs (USA)	Site Concurrent Maint./Fault Tolerance					
	Tier II		Tier III		Tier IV	
CapEx per Server*	\$8,300	%	\$14,000	%	\$15,400	%
Annual Expense						
Site Depr'n	550	42	950	50	1,000	44
Electricity	420	32	420	23	470	33
Site Operations	350	26	500	27	550	23
Total per Server	\$1,320	100	\$1,870	100	\$2,020	100
CO₂ per server	4 tons		4 tons		4 tons	

* 55% site asset utilization

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Additional Information

- McKinsey: Revolutionizing Data Center Efficiency
- Uptime: Revolutionizing Data Center Efficiency - Updated
- Symposium 09

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