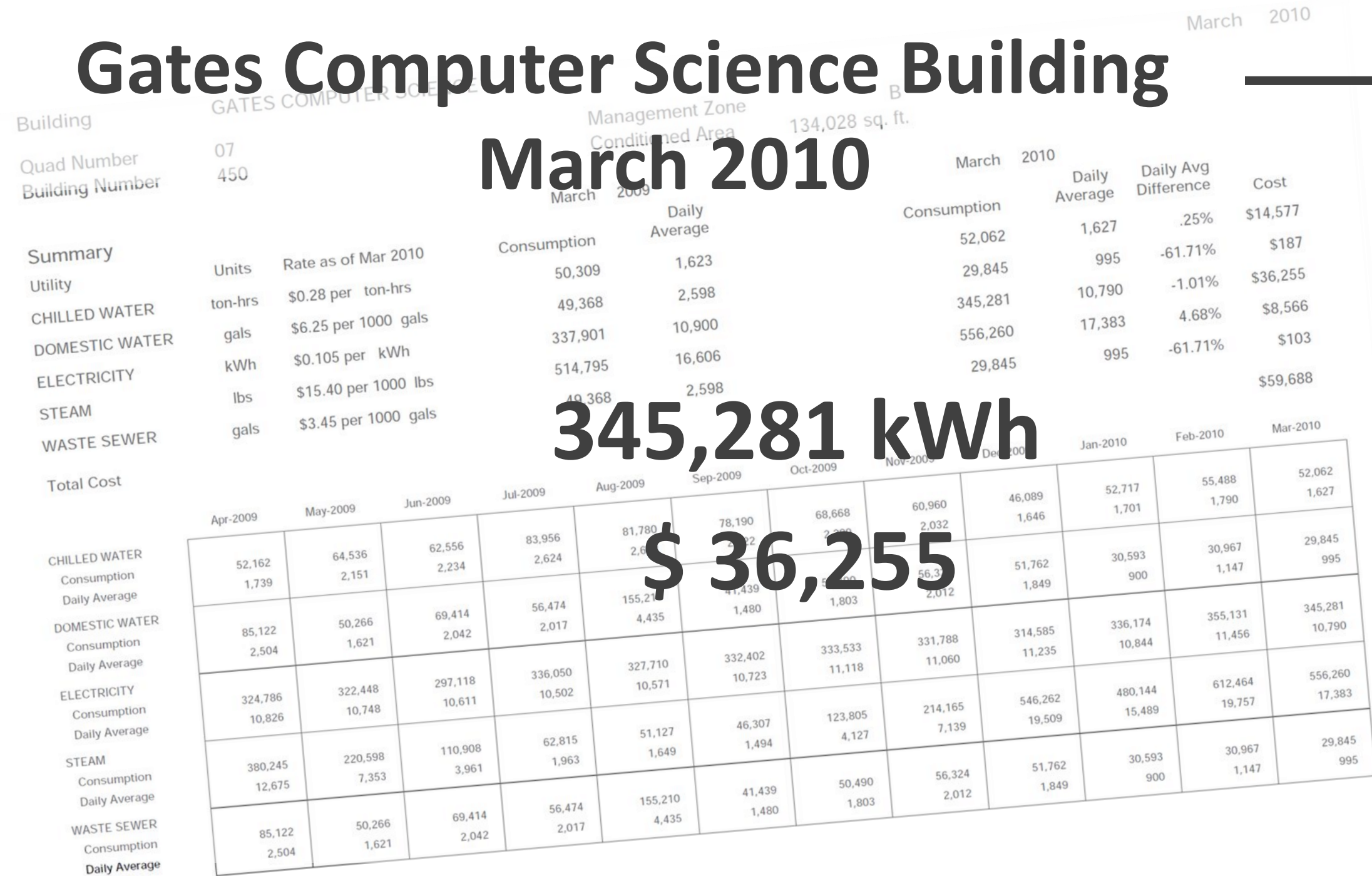


PowerNet: Energy Use & Energy Waste

powernet.stanford.edu

Maria Kazandjieva, Brandon Heller, Philip Levis, Christos Kozyrakis

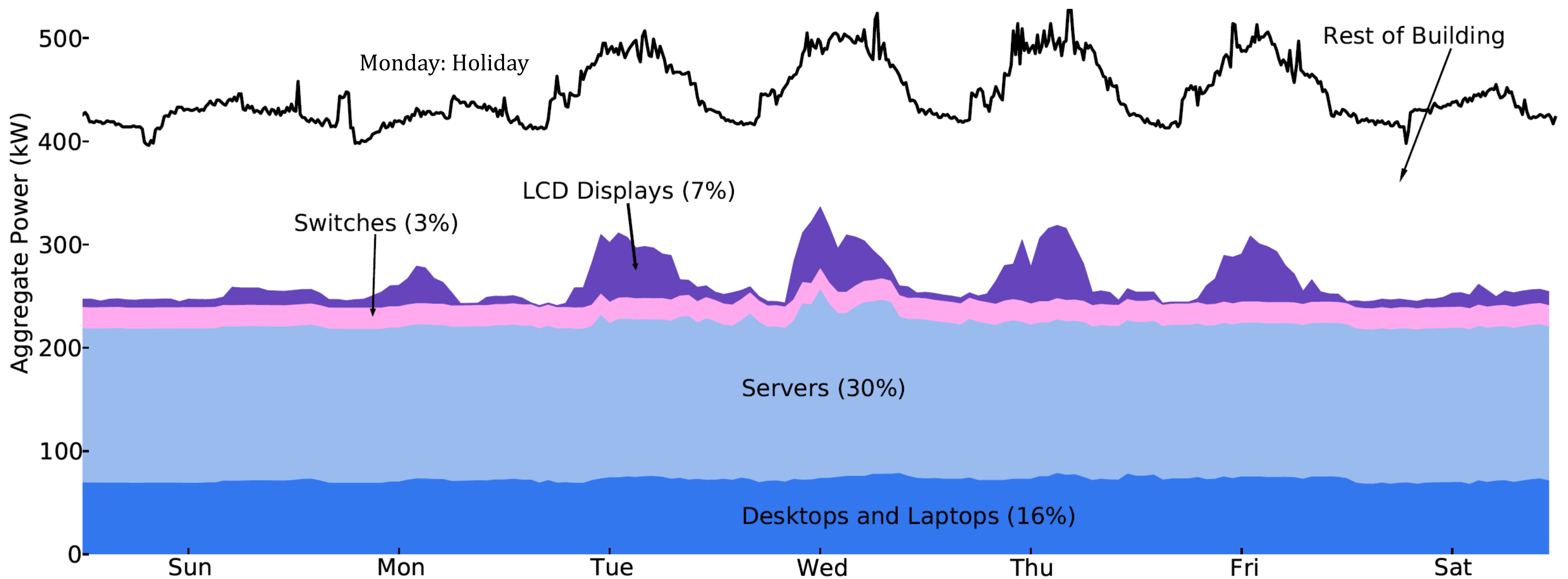


742 desktops
 500 servers
 750 screens
 62+ switches
 lights, etc.



Device Type	Measured	Utilization
Desktop	44	CPU (15)
LCD Screen	40	
Laptop	16	CPU (1)
Network Switch	11	Traffic (7)
Printer	10	
Server	9	
AP	2	
External Hard-drive	1	
Fax Machine	1	

Current Energy Use of Computing Systems



What About Waste?

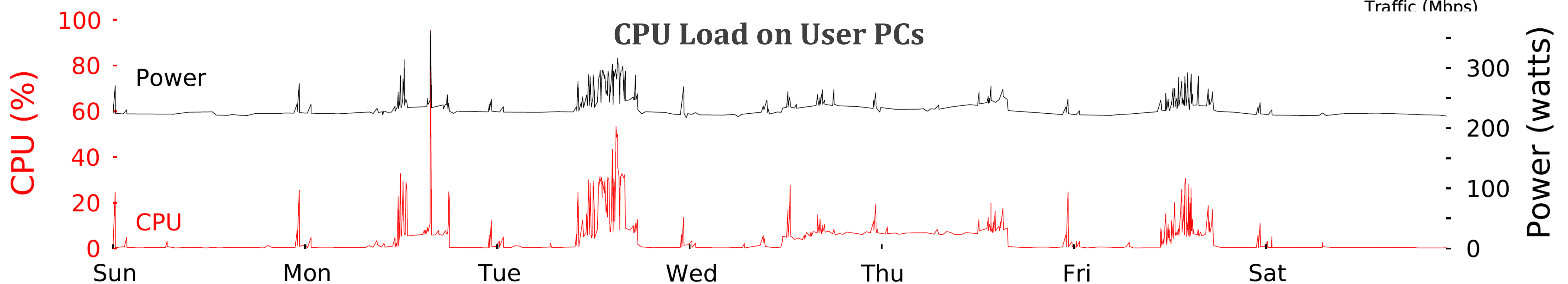
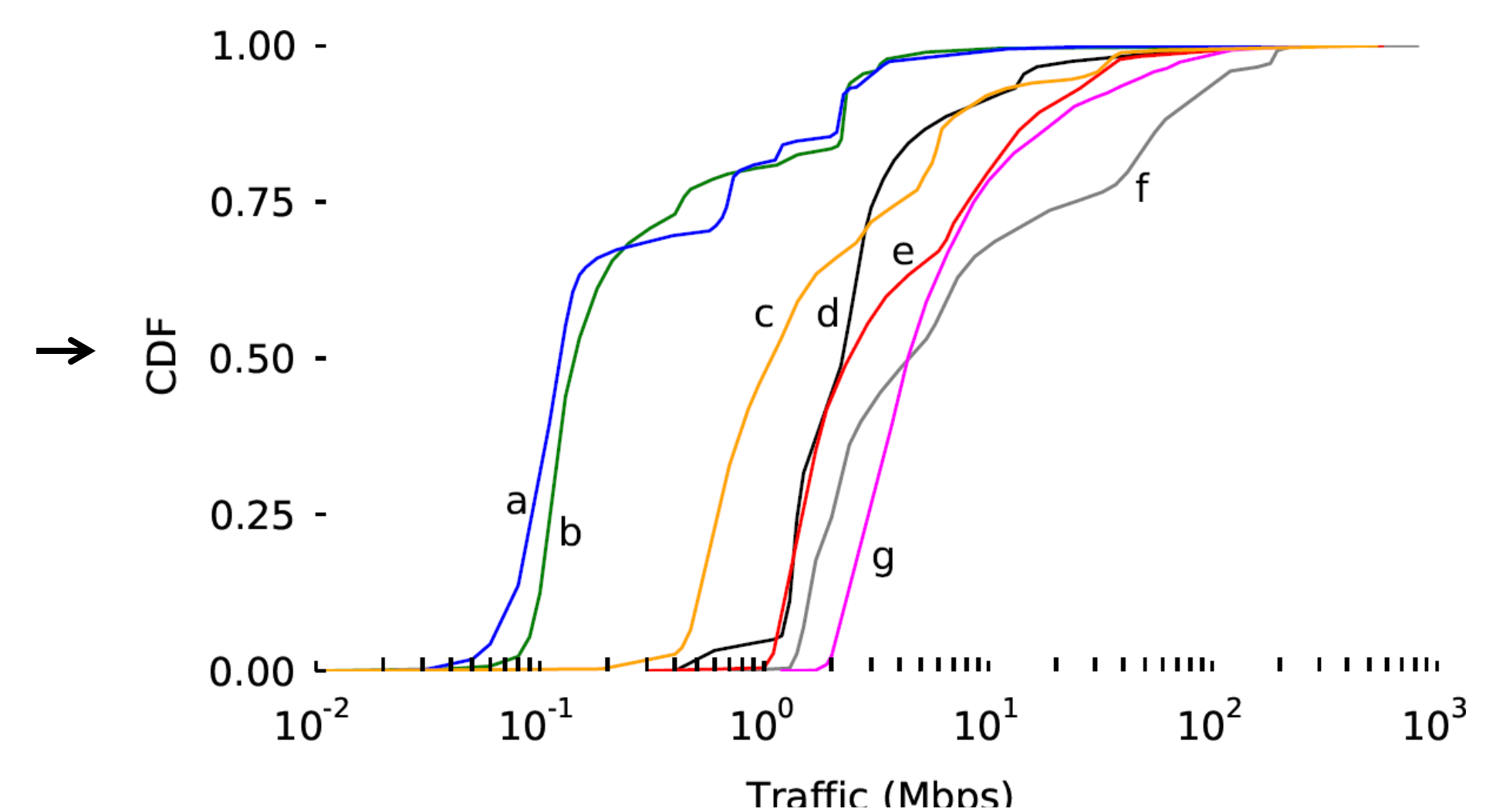
Switch power consumption **does not vary** with traffic demands.

28 core and edge switches in the Gates building consume 250 to 500 watts each.

But do we need all of them?

Label	Switch Type	Active Ports (gigabit each)	Data trace (# days)
a	HP 5412zl	120	150
b	HP 5406zl	96	40
c	HP 5412zl	120	40
d	HP 5406zl	72	150
e	NEC IP8800	24	420
f	HP 5412zl	24	420
g	NEC IP8800	48	420

Network Traffic on Core Switches



Machine Type	Percentile CPU		
	5 th	50 th	95 th
High-end Custom-built	0%	1%	57%
Dell Optiplex 745	1%	9%	58%
Dell Precision T3400	0%	4%	29%
Dell Precision T3400	0%	1%	13%
Dell Inspiron 530	1%	1%	8%
HP Pavilion m9250r	0%	0%	25%
Dell Precision T3400	0%	1%	7%

Smart schemes for putting desktops in sleep mode can reduce energy consumption of the Gates building by approximately 10%.

'Dumb terminal'-style computing can reduce consumption further by aggregating workloads on server machines.