



**Conference on Enterprise
Servers and Data Centers:
Opportunities for Energy Savings**

IMPACTS AND IMPORTANCE OF ENERGY EFFICIENCY: INDUSTRY VIEWPOINT

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Macro Scale: Energy Increasingly Important Economically

- Server unit volume growing faster than revenue
 - > Implies decrease in server capital costs
- Processor and system energy consumption growing per rack unit
 - > Seen in terms of kwatt/full rack growth (not necessarily seen as watt/ft² because of depopulation)
- Energy consumption increasingly significant in TCO
 - > \$6k server @ 3 yrs is \$2k/yr depreciation
- 1 kwatt (500w PS + HVAC) is \$1k/yr at 12¢/kWh

Metrics: The Key Connection Point

- Engineers love to optimize metrics
 - > A “constructive art” of optimization within constraints
 - > So far, just performance and density, not power
- Getting the RIGHT metric is key

Miles Per Gallon



Most Favorable

Least Favorable

Passenger Miles Per Gallon



Least Favorable

Most Favorable

Utilized Passenger Miles Per Gallon



More Favorable

Less Favorable

More Favorable

Some Complexities

- Could select SPECint/SPECfp and optimize power “in class”
- Better is SPECint/SPECfp rates
- But DRAM is >50% of 2008 server power (and climbing)
- And \approx 50% of datacenter power consumed in HVAC

We Must Consider

- Computing performance
- Memory capacity
- Network connectivity
- HVAC load

Single Metric?

Or

Model Coefficients?

Based on standard U.S. Government tests

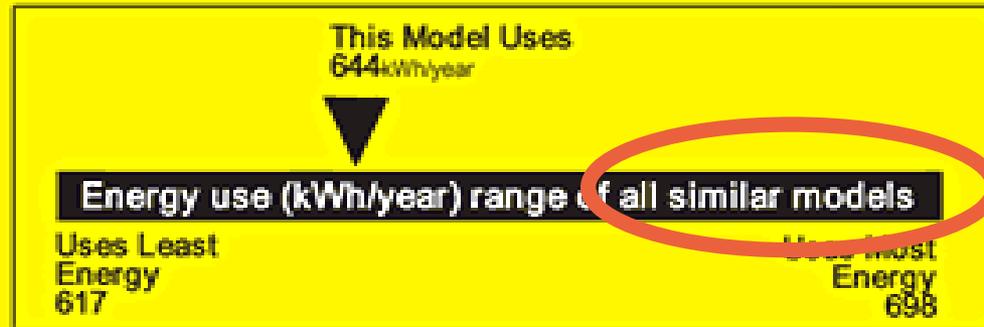
ENERGYGUIDE

Refrigerator-Freezer
 With Automatic Defrost
 With Side-Mounted Freezer
 With Through-the-Door-Ice Service



XYZ Corporation
 Model ABC-W
 Capacity: 23 Cubic Feet

Compare the Energy Use of this Refrigerator
 with Others Before You Buy.



kWh/year (kilowatt-hours per year) is a measure of energy (electricity) use. Your utility company uses it to compute your bill. Only models with 22.5 and 24.4 cubic feet and the above features are used in this scale.

Refrigerators using more energy cost more to operate.
 This model's estimated yearly operating cost is:

\$53

Based on a 2001 U.S. Government national average cost of 8.294 per kWh for electricity. Your actual operating cost will vary depending on your local utility rates and your use of the product.

Important: Removal of this label before consumer purchase violates the Federal Trade Commission's Appliance Labeling Rule (16 C.F.R. Part 205).

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