Green IT at UW

Toward sustainable technology solutions for students, faculty and staff

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Agenda

- Green IT Problem 1: Resource use and disposal
- Green IT Problem 2: Energy consumption
- UW's Climate Action Plan
- Current UW-IT Plans for Sustainable Computing

Green IT – Sustainable Computing

Why sustainability matters:

- Energy costs
- Cooling and energy availability (blocking growth)
- Concerns for the environment
- Threats to public health

If we want to be part of the solution, we have to change the way we use power to reduce our impact on the environment

Green IT Problem 1: eWaste

E-disposal – a shame!

Disposed annually in U.S.

- 40 million desktops and laptops
- 32 million monitors
- 140 million cell phones
- 27 million televisions

2007: Over 3 million tons of E-waste disposal in US

2011: Expected to quadruple

Sustainable IT also reduces consumable and manufacturing waste

Source: EPA. Date from 2007

eWaste Hazards

Think about it:

For every pound a computer weighs, there are more than 2.5 times as much weight in waste, and almost a pound-for-pound equivalent of toxic waste.

Serious health risks:

- Arsenic
- Beryllium
- Cadmium
- Lead
- Mercury

Source: ***Campus Technology, "Green" New Year's Resolution for IT Staff, 12/17/2003***

eWaste Solutions

- Buying less or less often; sharing more
- Using fewer materials in product
- Responsible disposal
- Recycling / re-use

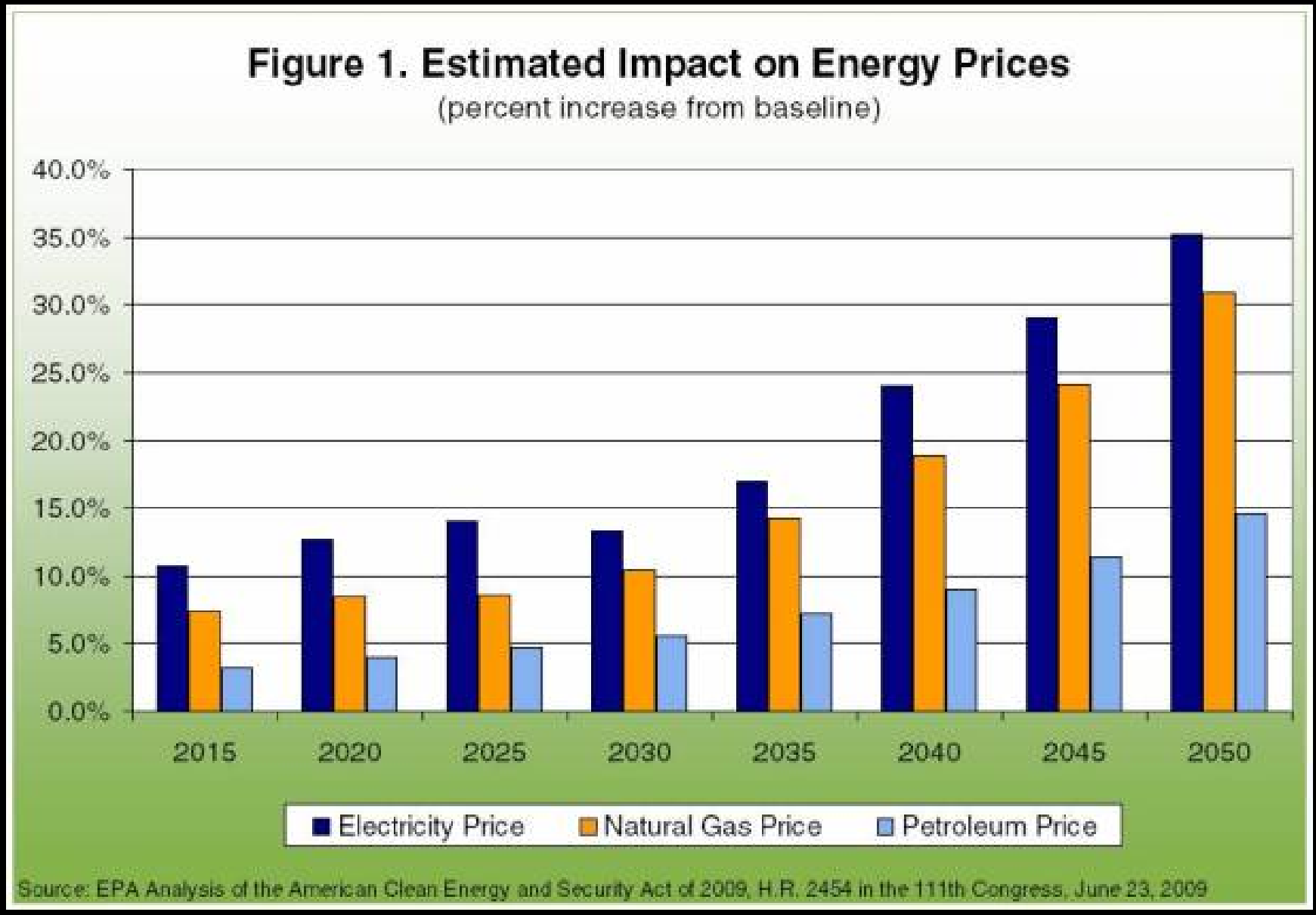
Note: upgrading less often conflicts with goal of replacing older energy-inefficient equipment.

Should manufacturers be responsible for final disposition of products?

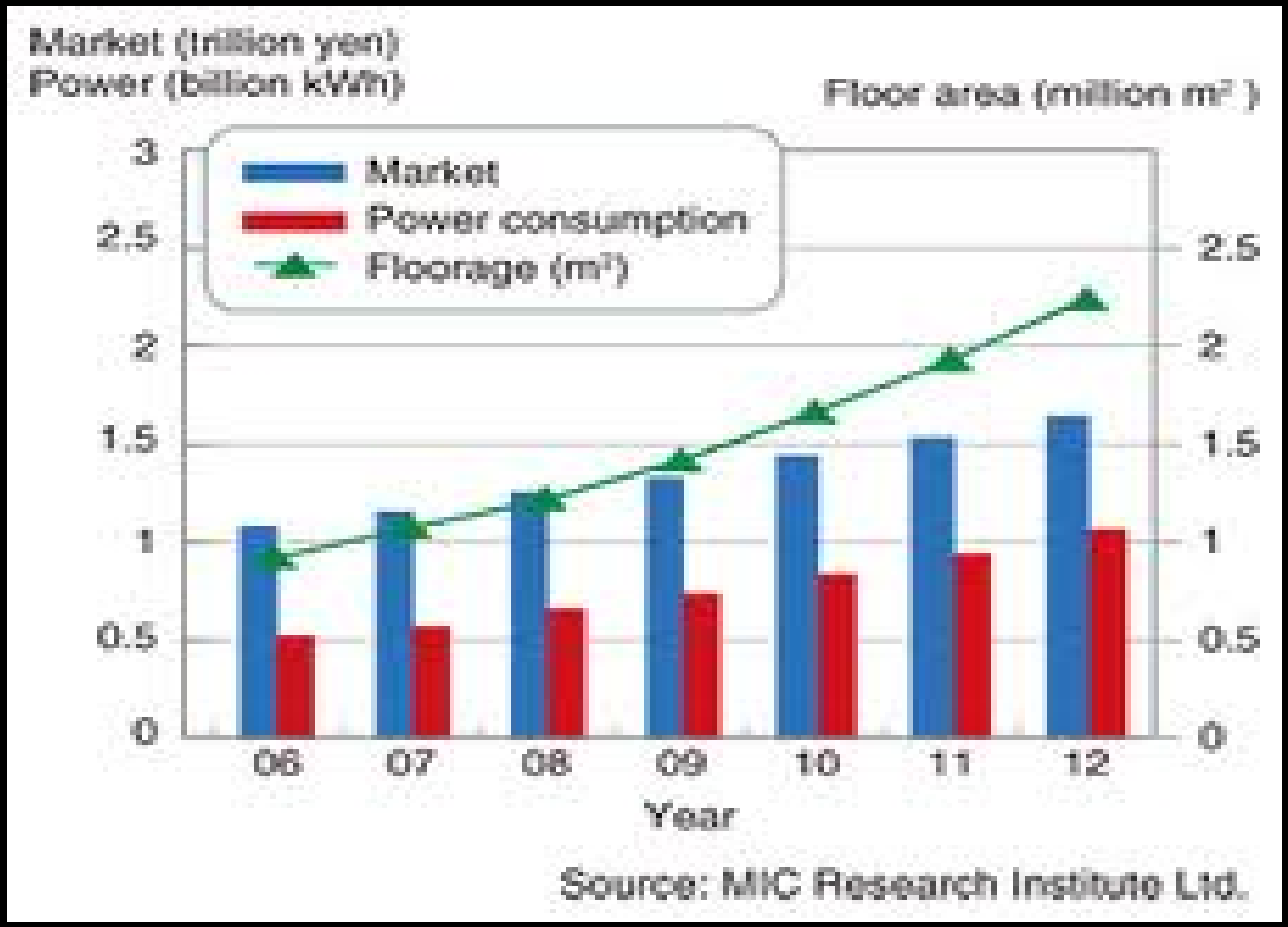
Green IT Problem 2: Energy

Data center energy consumption accelerating

Enlightened Self-interest: Saving $$



Usage Trends



https://www.ntt-review.jp/archive_html/200910/images/sf2_fig01.gif

Rules for Energy Reduction

1. “Do more with less”
2. “Do less with less”
3. “Nothing Gets Better Without Feedback”

“Do more with less”

- Improve system efficiency
- Improve cooling efficiency
- Reduce overhead (software and people)
- Share resources – and overhead
  e.g. virtualization

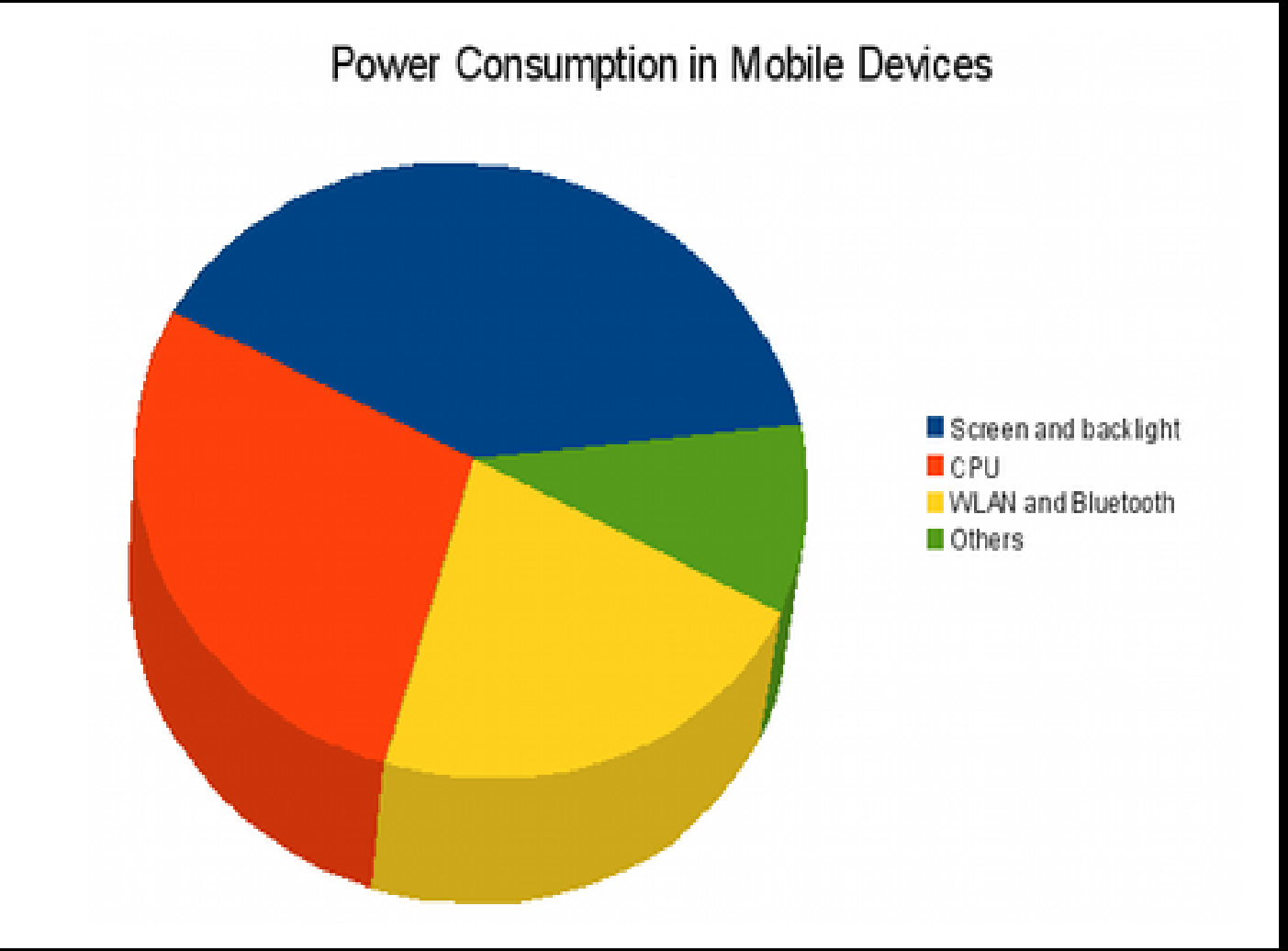
This theme applies to more than just energy reduction, e.g. paper use

“Do Less With Less”

- Or “Do nothing well” – David Culler, UC Berkeley

  → Minimize power used when ”idle”
- Requires:
  - Better CPU and support chip designs
  - Better wireless protocols
  - Better operating systems
  - More efficient monitors and power converters
  - Optimal configurations (auto sleep)
- Idle vs. Sleep vs. Hibernate
  - System must be ready when you are

No Single Culprit



http://maemo.org/maemo_release_documentation/maemo4.1.x/power-consumption-piechart.png

“Nothing Gets Better Without Feedback”

Preferably in Real-Time!

“If you can't measure it,
you can't improve it”

– Lord Kelvin

Green IT – Practical Solutions

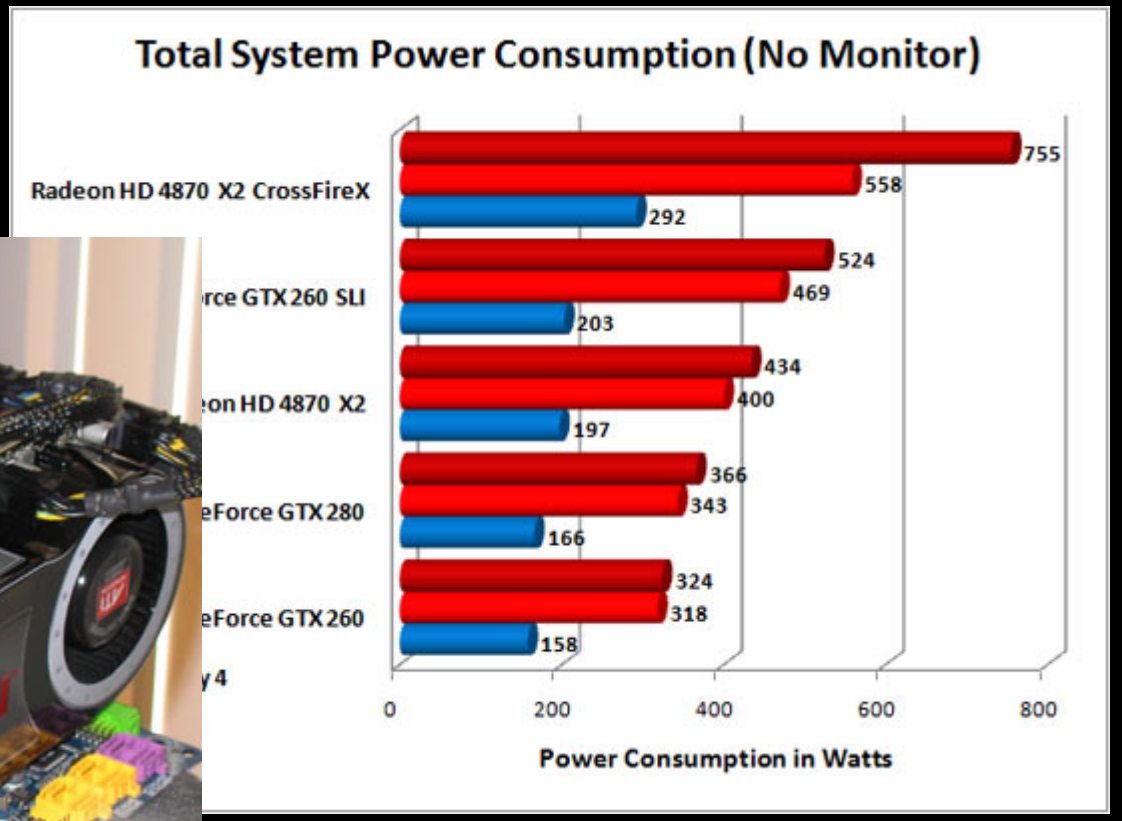
- Right-size servers and desktop systems
- Improve data center efficiency
- Replace old hardware
- Leverage mobile device trends
- Leverage high-scale cloud providers
- Share more! (Virtualize)
- Get enough sleep! (desktop and server config)
- Encourage telecommuting and telepresence

Right-sizing the system

7 Watts!

http://www.linuxfordevices.com/c/a/News/Toradex-Xiilun-PC-and-Topaz-SBC/

Right-sizing ?

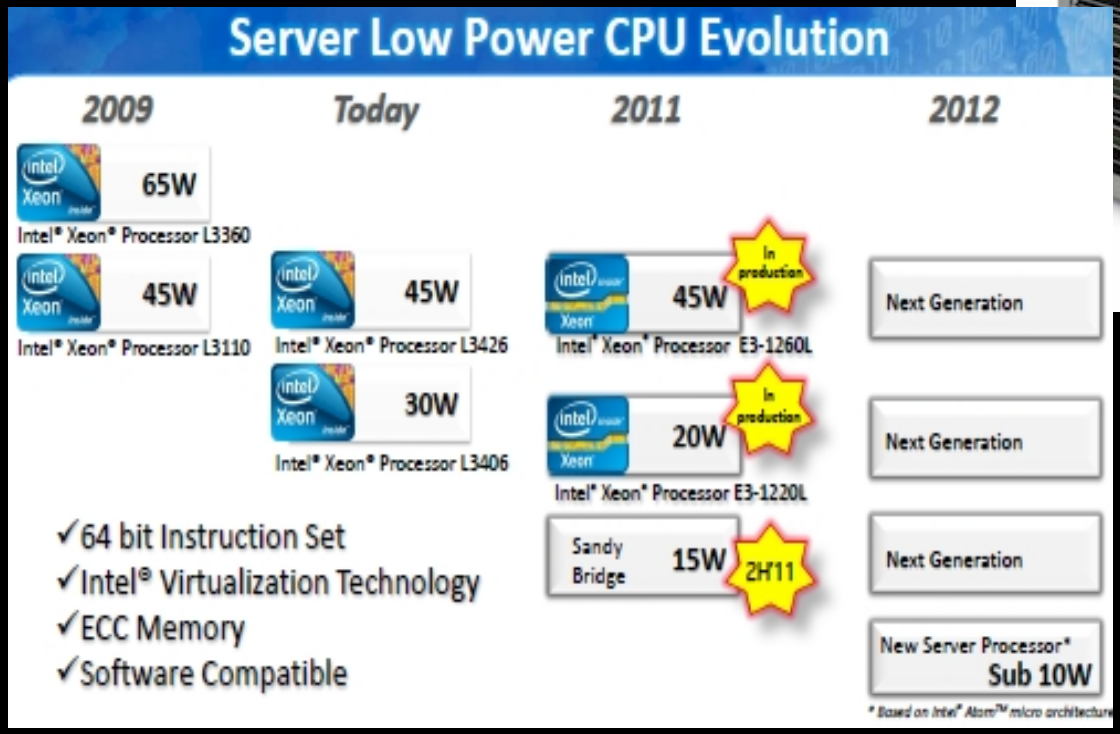


700 watts!

http://www.legitreviews.com/images/reviews/766/ati_test_system.jpg

Server Power Trends

Intel Roadmap



SeaMicro 256-node
Atom-based server

Limits of Scale

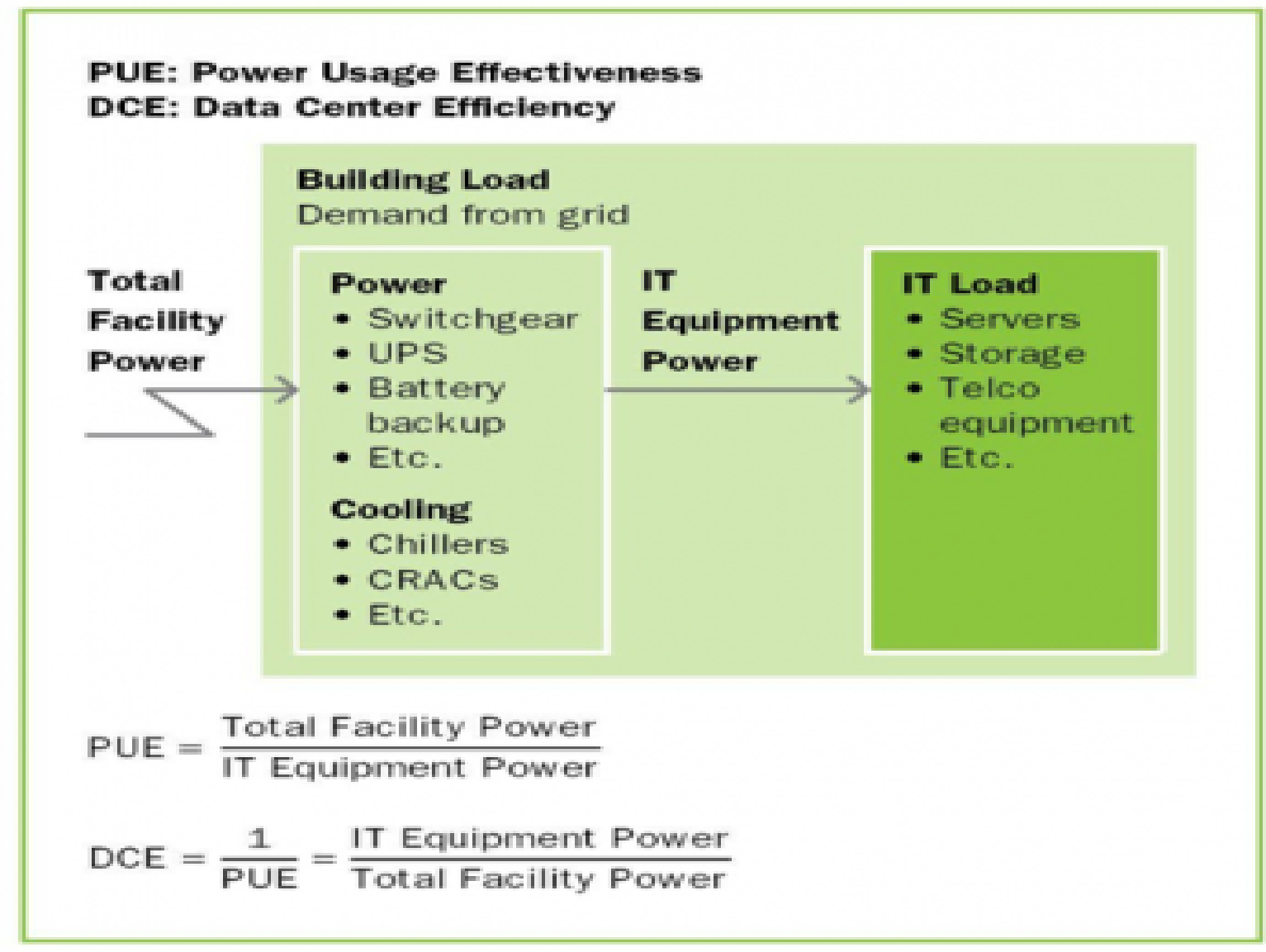
- Bigger is better...
  - High scale spreads fixed costs efficiently
  - High volume benefits from manufacturing learning curves
- Except when it isn't
  - UPS scale vs. cost: whole datacenter ↔ per server
  - Data center size: step function on switch gear costs
  - Nuclear reactors: traditional ↔ small, modular
  - Entities too big or important to fail (banks, single sources)

Modular Data Centers

Microsoft Chicago facility

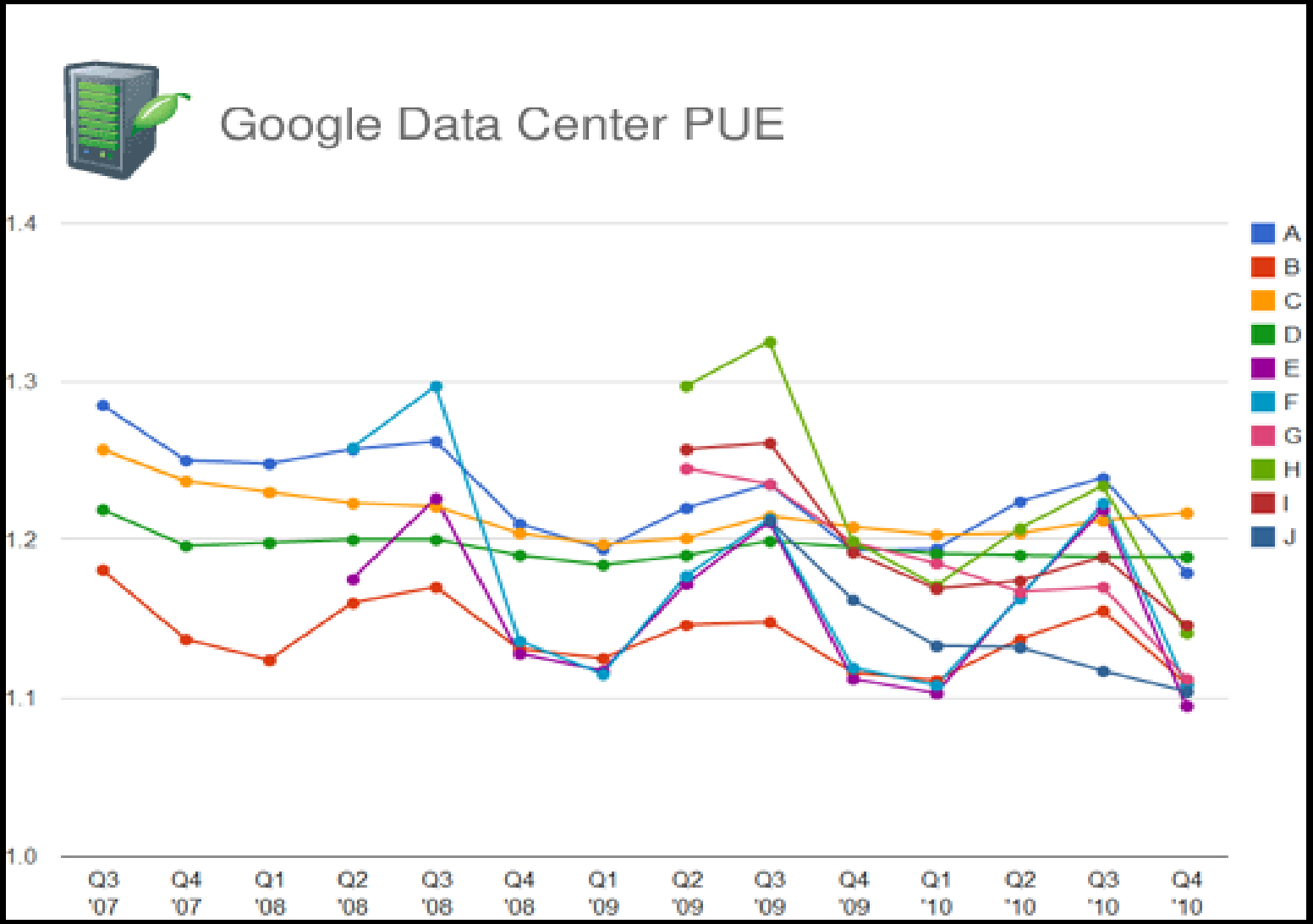
http://i.zdnet.com/blogs/movimiento61.jpg

PUE and DCE



http://tjcanning.files.wordpress.com/2009/07/pue1.png?w=347&h=376

PUE Trends



http://www.google.com/corporate/datacenter/images/datacenterpue.png

Energy reduction: how many devices?

- Desktop computer?
- Laptop computer?
- Tablet computer?
- Desktop phone?
- Cell phone?

Is the Motorola Atrix the future??

Thin clients??

Telecommuting / Telepresence

http://www.flightglobal.com/blogs/flight-international/747.gif

http://images.tmcnet.com/tmc/misc/article-images/Image/Tandberg%20Telepresence%20T3.png

Cloud Computing Leverage

- Shared resources → more efficiency
- High-scale, low-cost providers
- Advanced applications, rapid evolution
- State-of-the-art data centers and virtualization

UW's Role

Is UW part of the problem or the solution?

- 50,000 students
- 30,000 faculty/staff
- 400,000 managed identities
- 150,000 devices on network
- 30,000 phones
- Thousands of servers

UW is committed to being part of the solution,
alleviating impact on environment through sustainable computing
– maximizing energy efficiency and minimizing waste.

UW Climate Action Plan

- 4.1 Campus Energy Supply
  - 4.1.3 Strategy: Measure and Monitor Building Performance
- 4.3 InformationTechnology
  - 4.3.1 Strategy: Buy Green
  - 4.3.2 Strategy: Exercise Power Management
  - 4.3.3 Strategy: Increase Data Center Efficiency
  - 4.3.4 Strategy: Consolidation and Virtualization
  - 4.3.5 Strategy: Utilize Cloud Computing
- 4.4 Commuting
  - 4.4.6 Strategy: Encourage Telework and Distance Education
- 4.5 Professional Travel
  - 4.5.2 Strategy: Develop Videoconferencing as an Attractive Alternative to Air Travel

Current UW-IT Plans

- Data center efficiency
- Cloud services adoption
- Desktop configuration management
- Improved UCS tools for virtual meetings
- Remote Access to Student Lab Software

Conflicting Goals

- Green goal: power down unused systems
- Research goal: scavenge cycles
- IT management goal: do upgrades at night

But:

- Scavenging desktop cycles is not power-efficient
- Current networks and mgt software can wake up systems

Data Center Initiatives

- Decommission unneeded services
- Replace aging, inefficient servers
- Server virtualization
- Improve cooling systems

Desktop Management Initiative

Deploying IBM's ”Tivoli Endpoint Manager”

- Desktop power and patch management
- Enforces common policies for sleeping
- Provides central reporting for subscribed systems
- Offers real-time estimates of current power usage
- Control can be delegated

Cloud Computing Initiative

UW Strategy

- Dual vendor approach for collaboration platforms
- Many other SAAS apps, e.g. Doodle, Facebook
- Multiple IAAS vendors (AWS, Azure, Rackspace...)
- Stay ahead of campus demand
- Improve compliance risk via partner contracts

Green IT – Solutions

On the Horizon:

- Thin client student computing laboratories
- Student IT strategy
  - Targeting devices that are sustainable
  - Include power management
- More mobile devices with greater functionality, less carbon footprint
- Virtual student desktop in the cloud

Engaging Students

Students can be a catalyst for change:

- They are early adopters of new technologies – Netbooks, Cloud, Facebook, Twitter

Green students should . . .

- Be energy smart
  - Set power option to sleep mode when not active
- Go Energy Star
  - Purchase Energy Star 4 or greater equipment
- Print wisely
  - Print only what you need, apply duplex printing, and use recycled content paper when possible
- Encourage proper recycling

"We do not inherit this land from our ancestors; we borrow it from our children."

Haida Indian saying

Discussion

Thanks to Kelli Trosvig and Brad Greer for major contributions to this presentation.