Is Technology Good for the Environment?

Casey Roe
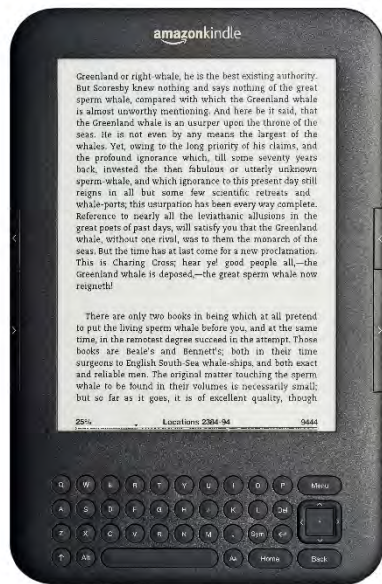**Assistant Director**
Sustainable Duke

What is Sustainability?

"Meeting all the needs of the present without compromising the ability of future generations to meet their own needs"

Technologies in Daily Use
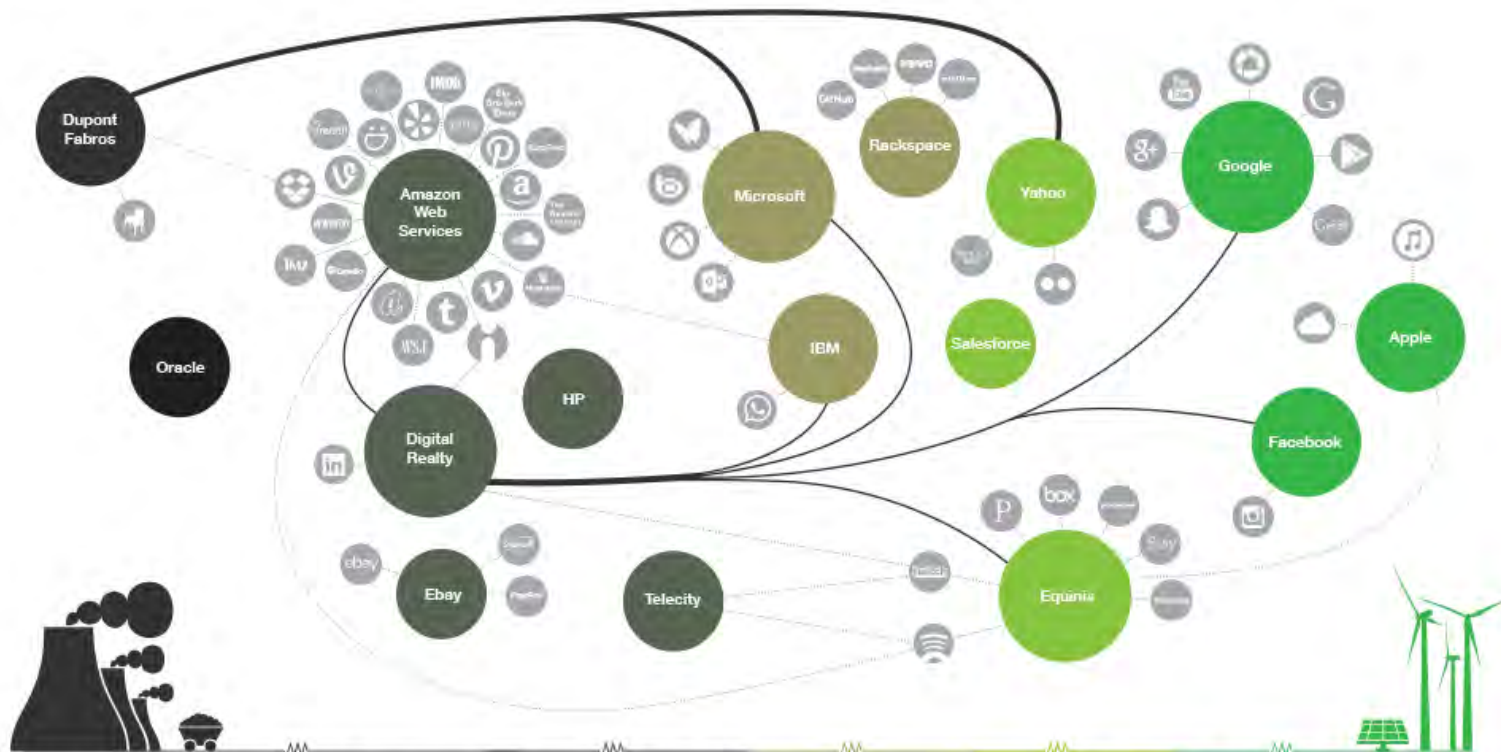
Global Environmental Implications

Data Centers

- 2% of global greenhouse gas emissions
  - Same as aviation
- Water
  - 3.5 million gallons / MW
  - Data centers range from 5-30 MW
  - 800+ data centers in California
- Tech companies could be drivers for clean technology

2015 REPORT

Stuck in dirty energy past: Efficiency only, using mostly dirty energy, have taken few or no steps to switch to renewables

Middle of the Road: Taking steps toward a greener internet, but not leading the way.

Green Internet Innovators: Committed to 100% renewable energy. Their leadership is helping to make our lives, online and offline, greener.
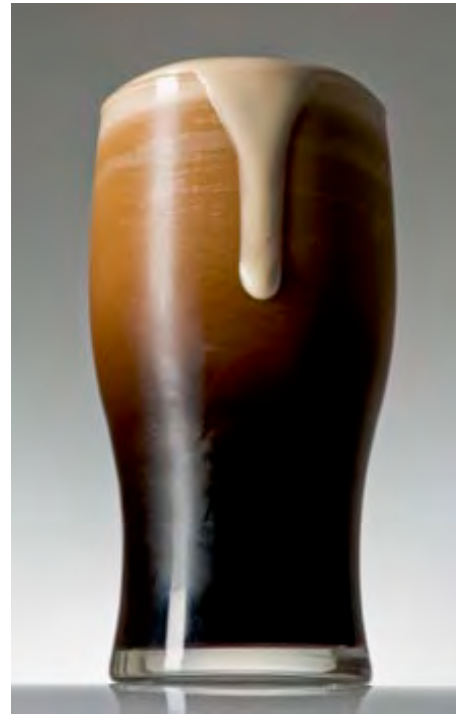
How Much Energy is "A Lot?"

1 Btu

Avg. 170 Btu/hr

700 Btu

114,000 Btu

Aggregate Impacts

- 1 iphone 5
  - About 5 watts per charge
  - $.41 to charge in a year
- Consider:
  - 2016: 1 billion people worldwide have a smart phone

Energy in Production

- Mining accounts for ~10% of global energy use

- Manufacturing uses between 50-80% of an electronic product's total energy requirement

- Energy expended in manufacturing just a handful of microchips can be as much as energy to manufacture a car

Materials

- Resource depletion
- Hazardous chemicals
  – Health impacts in production & disposal
- For example:
  – Smart phone
    - 60+ elements
    - 200 chemical compounds
  – Computer circuitry production
    - 500-1000 chemicals

Computer, Tablet, Wearables

- Copper
- Aluminum
- Gold
- Zinc
- Nickel
- Tin
- Silver

- Iron
- Platinum
- Palladium
- Cobalt
- Tantalum (coltan)
- Silicon
- Antimony

- Arsenic
- Hafnium
- Barium
- Cadmium
- Selenium
- Gallium
- Indium
- Niobium
- Lithium

End of Life

- Global e-waste: 41.8 million tons in 2014
  - Equivalent to 22 million standard sized sedans
- Average American: 65 lbs per year
- 60-90% of e-waste
  - Mountains of rubbish in developing world
  - Traded through criminal e-waste networks
- Worker health & safety
- Toxic chemicals, heavy metals
  - Residents, soil, water

Paper

- Basic recipe: wood, water, energy
- Water
  - 3 gallons water / sheet of paper
- Energy
  - Chop, dry, cook wood; roll and dry pulp
  - Equivalent to 2 gallons of gasoline / ream of paper

What is Duke doing?

Duke University's GHG Emissions
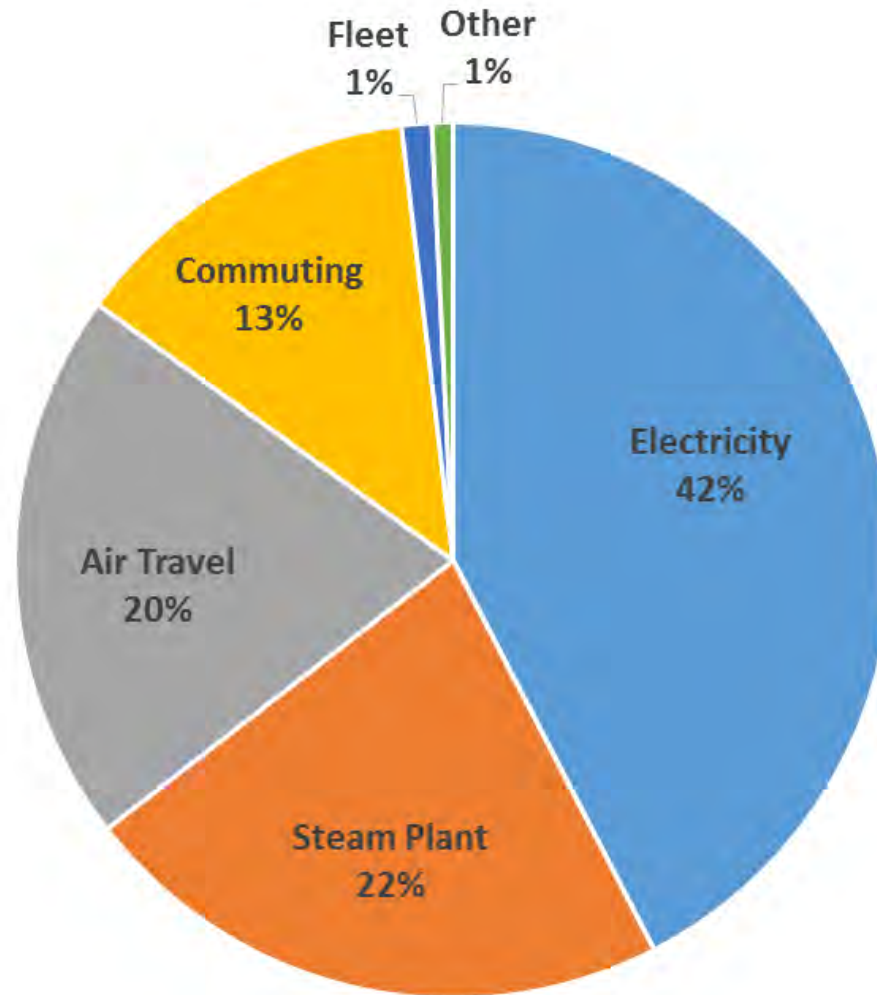
University Greenhouse Gas Emissions
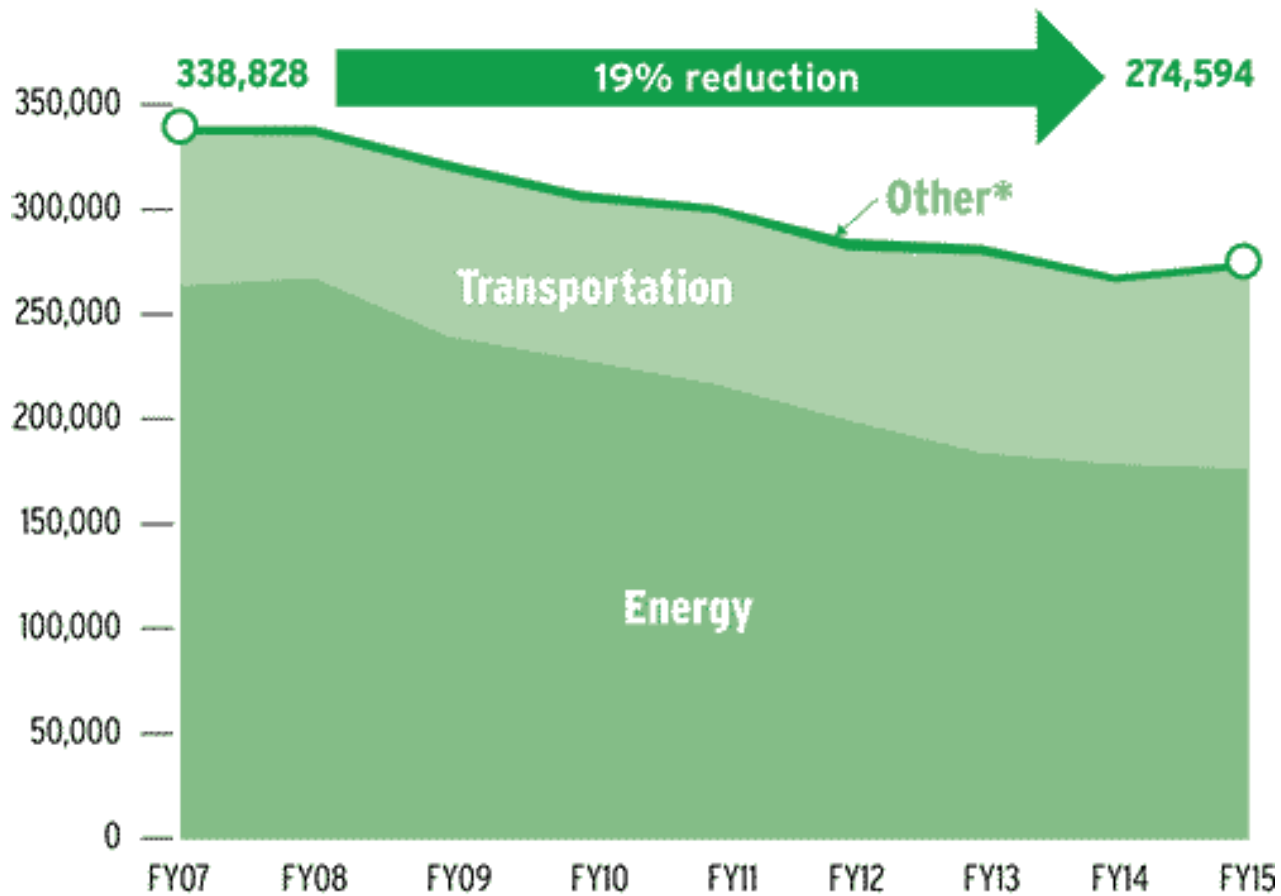
What does this reduction mean?

- 19% reduction from 2007 baseline
- 64,000 metric tons of carbon reduced
- Equivalent to annual emissions from:
  - 13,500 passenger vehicles
  - 68 million pounds of coal burned
  - 5,800 homes' energy use
- Emissions are up from last year
  - Transportation
- Carbon offsets reach neutrality

How Much Energy & Water Does Duke Demand?

System	Projected Usage, FY16	Common Energy/Water Units	Peak Demand
Steam	1,187,994,036 lbs	1,238,594 MMBtu	350,000 lbs/hr
Chilled Water	130,642,200 ton-hrs	1,567,706 MMBtu	37,000 tons
Electricity	468,987,331 kW-h	1,600,185 MMBtu	78 MW
Water	59,233,796 CF	442,993,994 Gal	2 MGD

4,406,485 Million Btu of Energy

442,993,994 Gallons of Water

How Do Buildings Use Energy?

MODELED END-USE ENERGY CONSUMPTION - STUDENT HEALTH & WELLNESS CENTER
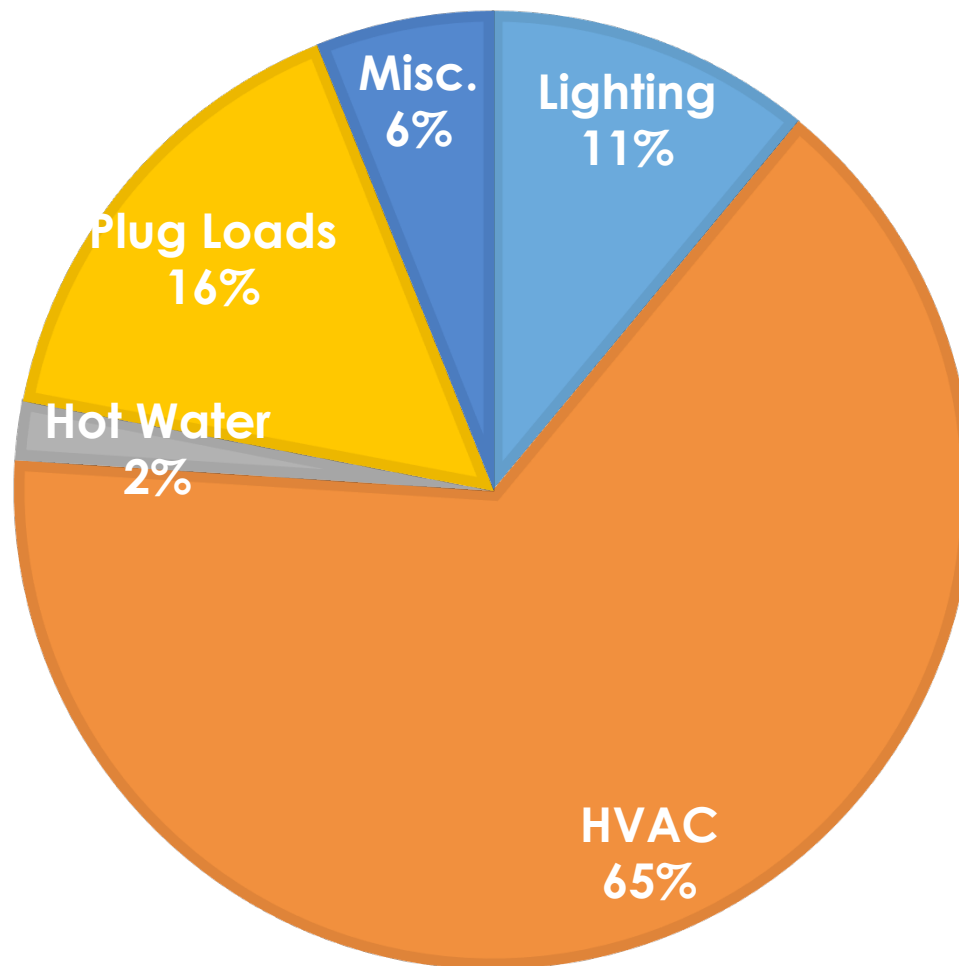
Greening IT at Duke

- Energy Star policy
- Consolidating servers into efficient data centers
- Educating staff
  - Power management
- Donating used computers
- E-waste recycling
- Telecommuting
- Phone & video conferencing

E-waste Recycling

- Refurbished when possible for local schools & non-profits
- Electronics recycler

Case Study: ePrint

ePrint Paper Savings

2 million sheets = 240 Trees

228,000 Gallons of Water

Annual energy of 4 homes
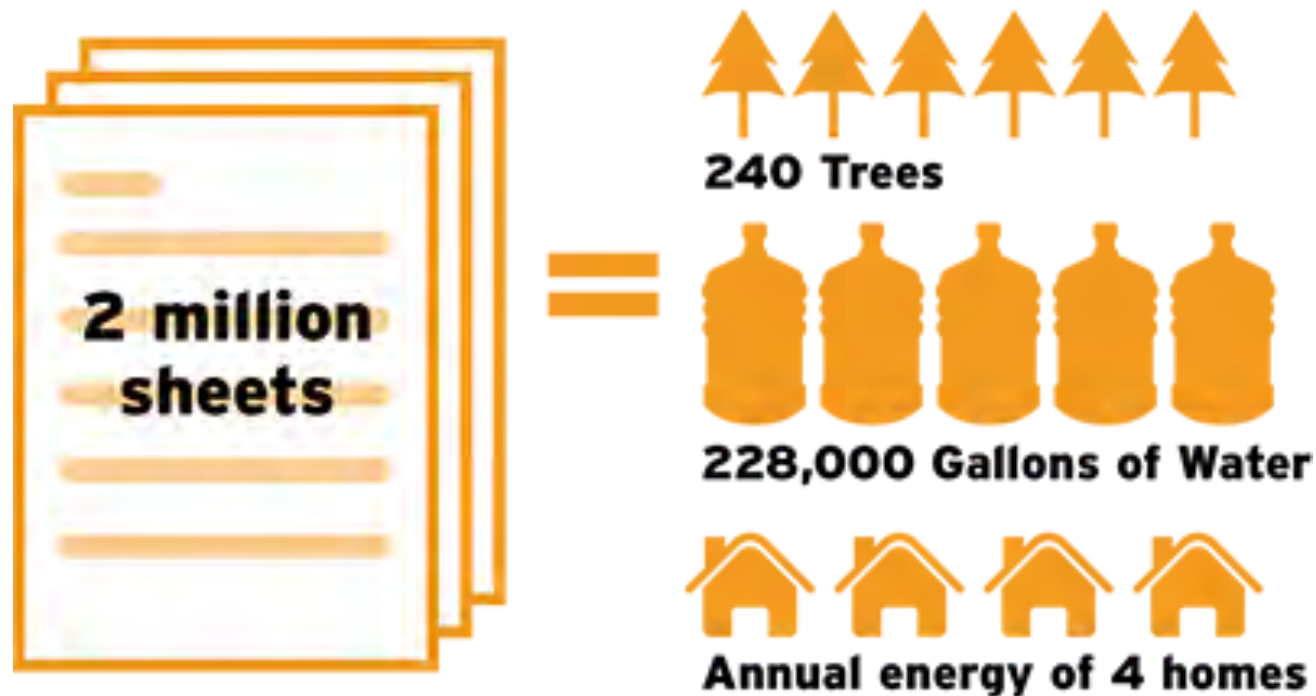
24% reduction in undergraduate printing in fall 2014

What can you do?

Complex Choices: Book vs. eReader?

- Manufacturing
  - Book
    - 2/3 lb of materials
    - 2 gallons water
    - 2kw hours
  - eReader
    - 33 lb of materials
    - 79 gallons of water
    - 100kw hours

Complex Choices: Book vs. eReader?

- Over lifetime
  - eReader's lifetime ~ 2 years
  - Biological and ecological toxins are estimated to be 70 times greater
  - Environmental impact of one eReader is equivalent to 100 print books
- Will you read 50 books per year?

What actions can you take?

- Use electronics longer
- Purchasing electronics
  - EPA Energy Star
    - 15-25% more efficient
  - Recycled content
  - LED lighting
  - Printers and copiers
    - Duplex capable
    - Automatic stand by features

What actions can you take?

What actions can you take?

- Energy Conservation
  - Turn off equipment and lights
    - Computer, monitor, printer, speakers, etc
    - Check with IT
  - Phantom power
  - Powerstrip
  - Energy saving modes
    - Sleep, hibernate
    - No screen savers
  - Eliminate unnecessary equipment

Power Management

- Strict energy management can reduce overall energy use of a typical workstation by up to 88%

- Sleep and hibernate modes can reduce energy consumption up to 60%

What actions can you take?

- Purchasing paper
  - High post-consumer recycled content
    - Staples offers comparable pricing
  - Forest Stewardship Council Certified
  - Chlorine free
  - Unbleached

What actions can you take?

- Printing
  - Default double-sided
  - "One-side-used" bin
  - Grayscale
  - Narrow margins

What actions can you take?

- Reuse, then Recycle
  - Recycling bins
  - Recycle toner cartridges
  - Recycle all e-waste
    - At Duke
    - Durham, Wake, Orange counties

What actions can you take?

What actions can you take?

- Travel
  - Telecommuting
  - Phone & video conferencing

Duke Green Workplace Certification

Learn More

- Leading for Environmental Sustainability workshop
    - June 2, 8:30-11:30am

Questions?

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