

AoW #16

1. Mark your confusion.
2. Show evidence of a close reading on the page.
3. Write a one-page reflection in your WN

The Energy of an Internet Search

Source: Alexandra Ossola 12/15/10

<http://sciencenewsforkids.org/>

Vocabulary Preview:

Servers: both the hardware (physical machine) that contains data about a website and the software (computer program) that allows users (other computers) to access those machines. Every website uses a server to process the information and requests that comes into it.

Relevance: how much one thing has to do with another. Internet search results are called highly relevant when they are extremely close to what was actually being sought.

Data centers: buildings where many servers (physical machines) are housed.

kWh: a common unit of energy measurement that is 1,000 watts used over the period of one hour.

Sustainable: something that can be continued for a long period of time. In environmental terms, something is sustainable if it has a relatively small impact on the environment. For example, it does not use many resources or does not produce too much waste product.

Typing the word “pizza” into your favorite search engine may seem harmless enough. But you may not know that, with this simple act, you’re sending information to possibly hundreds of machines located possibly thousands of miles from where you sit. Each machine that search encounters on its journey uses energy. Because so many people are always searching at the same time all over the world, that energy can really add up.

Few people have a day without computers. From more traditional desktops and laptops to the latest smart phone, most of the computers people use every day are connected to the Internet. And it’s easy to type, click and search to get answers to even the silliest question. We enjoy this luxury so much that we can forget that each search does in fact use energy. And making that energy emits the greenhouse gas carbon dioxide.

“Every time you type something into Google, it uses several machines to find those answers for you and display the stuff on your page. All of that requires power,” says Sudhanva Gurumurthi, a computer science professor at the University of Virginia in Charlottesville. Go back to that search for “pizza,” Gurumurthi explains. You might get hits, or suggested websites, for restaurants, Google maps showing local pizza places, restaurant reviews, even recipes. Every search requires lots of other machines to process a lot of information — and to process it in a fraction of a second.

Your search for “pizza” is only one; there are easily thousands of other people searching at the same moment. In December of 2009, Web users around the world conducted an estimated 131 billion searches, according to marketing research firm comScore Inc.

“Because you need answers so fast and of such high quality [or relevance], the amount of data is huge. And since many people are using the system at the same time, you end up needing a large number of servers to run it,” says Gurumurthi. A server is a computer dedicated to storing data — specifically, the information that makes up a particular website — and making that data available to other computers that request it.

Computers and electronics account for about 9 percent of home electricity use, which is a lot less than what the big users, especially heat and air conditioning, take up. But using your computer to search the Web has effects that reach much farther than your own home.

Web sites such as Google, Yahoo and Bing are called search engines, programs that crawl all over the Internet to find results when you type in some terms and press “search.” But when you use a search engine, not only does your computer use energy, but the site uses thousands of connections to other websites and their servers to come up with all the results you see. This means that emissions of greenhouse gases that result from energy use are connected with several different places at once for just one search.

Most technologies for providing electricity — such as the burning of coal, oil or natural gas — release carbon dioxide into the atmosphere. These so-called greenhouse gases can be harmful when too much is released. These gases are largely credited for fueling a global warming. So, even if it may not seem that way, energy use has a big effect on the environment. In fact, a recent report from an organization in London called the Climate Group estimates that the production and use of computers, printers, mobile phones and other devices emitted as much carbon dioxide in 2007 as the aviation industry did. (Generating electricity from the sun, wind or water can create “cleaner” energy — that is, energy that releases fewer

greenhouse gases and other air pollutants. But these sources are relatively expensive and none is totally clean. Even their use will have environmental impacts.)

Studies from the Environmental Protection Agency have shown that, in the United States, the amount of power used by data centers, places where servers are housed, has gone up over the past five years because Internet use is more and more common, and increasingly necessary. The EPA estimates that, by 2011, data centers will use 107 billion kilowatt-hours per year (a kilowatt-hour is a way to measure energy use; it corresponds to 1,000 watts used over the period of one hour).

That 107 billion kilowatt-hours is almost double what the data centers used in 2006, and is 2.5 percent of the total electricity used in the United States. The amount of power the data centers used in 2006 was the same amount, the EPA reports, used by 5.8 million households that year (that's a million more than the number of households in the state of Pennsylvania). The power runs the servers, supports backup power generators and maintains a cool environment for the machines.

As energy use continues to increase, so will the corresponding emissions of pollutants. Corporations that run these data centers are working on doing something about it. "Researchers all over the world are actively exploring ways to make data centers more energy efficient," Gurumurthi says.

But even now, the Internet often uses less energy than other methods. "What [computer] technology allows you to do, you couldn't do otherwise," says Jonathan Koomey, a project scientist at Lawrence Berkeley National Laboratory in Berkeley, Calif. "You're moving electrons instead of moving atoms [physically]. Downloading music still creates 40 to 80 percent fewer emissions than buying music on CD." Because the convenience of the Internet makes it easier to use fewer resources, Koomey suggests that, in the end, computers and the Internet probably cause less environmental damage than would occur without them.

So, if you were working on a school project and needed to do research, what would be greener: searching the Web or hitting the library? There are a lot of factors involved, including how you get to the library (whether in a car or on your bike), how long it takes to find the books, and how many searches you would need if you relied on the Internet. Maybe a librarian could help you find the right information better than could multiple online searches that return millions of results.

One person can't stop data centers from sucking energy, but each one of us can take small steps to conserve energy by watching our own computer habits.

"Desktop computers use three to five times more energy than do laptops," says Koomey. Because laptops use batteries and are not always plugged into the wall, they need to be more energy efficient than desktop computers. Many people believe that putting a computer in "sleep" mode uses more power than shutting it down completely, but the difference in power use is small. Koomey suggests, "Turn your computer off at night and on the weekends. When you're not using it during the day, put it to sleep. You can also easily turn off the monitor on a desktop computer, which is a big part of computer power use."

Some computers and other electronics also use power even when they're not turned on. A phenomenon called vampire power causes devices like TVs or microwaves to keep sucking energy, even if the power button is off. Simply unplug your computer (or any other appliance) when you're not using it.

As more people use computers more often for work and pleasure, both companies and individuals need to understand how much energy they're really using. "Computers are everywhere and are easy to take for granted without thinking about the consequences. Things have to be done to make this sustainable," says Gurumurthi.

But, Koomey says, whether or not energy use goes down significantly depends on Internet companies making their equipment more sustainable. These companies could, for example, choose to use servers that are physically smaller, so that more can fit into a smaller space. This change could decrease the amount of energy needed to heat and cool the data center. "Users can have a big impact by smartly managing their own energy use," says Koomey, "but I wouldn't worry too much about using the Internet."

Possible WN topic:

What steps can you take to conserve energy?