excerpts from

The Surprisingly Large Energy Footprint of the Digital Economy

Time Magazine Aug. 14, 2013

Our computers and smartphones might seem clean, but the digital economy uses a tenth of the world's electricity — and that share will only increase, with serious consequences for the economy and the environment

Which uses more electricity: the iPhone in your pocket, or the refrigerator humming in your kitchen? Hard as it might be to believe, the answer is probably the iPhone. As you can read in a post on a new report by Mark Mills — the CEO of the Digital Power Group, a tech- and investment-advisory firm — a medium-size refrigerator that qualifies for the Environmental Protection Agency's Energy Star rating will use about 322 kW-h a year. The average iPhone, according to Mills' calculations, uses about 361 kW-h a year once the wireless connections, data usage and battery charging are tallied up. That accounts for the high-end estimate of the total power the phone would be consuming over the course of a year. NPD Connected Intelligence, by contrast, estimates that the average smartphone is using about 1 GB of cellular data a month, and in the same survey that reported high data use from Verizon iPhone users, T-Mobile iPhone users reported just 0.19 GB of data use a month—though that's much lower than any other service. Beyond the amount of wireless data being streamed, total energy consumption also depends on estimates of how much energy is consumed per GB of data. The top example assumes that every GB burns through 19 kW of electricity. That would be close to a worst-case model. The Centre for Energy-Efficient Communications (CEET) in Melbourne assumes a much lower estimate of 2 kWh per GB of wireless data, which would lead to a much lower electricity consumption estimate as well—as little as 4.6 kWh a year with the low T-Mobile data use.

The iPhone is just one reason why the information-communications-technologies (ICT) ecosystem, otherwise known as the digital economy, demands such a large and growing amount of energy. The global ICT system includes everything from smartphones to laptops to digital TVs to — especially — the vast and electron-thirsty computer-server farms that make up the backbone of what we call "the cloud." In his report, Mills estimates that the ICT system now uses 1,500 terawatt-hours of power per year. That's about 10% of the world's total electricity generation or roughly the combined power production of Germany and Japan. It's the same amount of electricity that was used to light the entire planet in 1985. We already use 50% more energy to move bytes than we do to move planes in global aviation. No wonder your smartphone's battery juice constantly seems on the verge of running out.

As our lives migrate to the digital cloud — and as more and more wireless devices of all sorts become part of our lives — the electrons will follow. And that shift underscores how challenging it will be to reduce electricity use and carbon emissions even as we become more efficient. That's because the cloud uses energy differently than other sectors of the economy. Lighting, heating, cooling, transportation — these are all power uses that have rough limits. As your air conditioner or lightbulb becomes more efficient, you might decide to then use them more often — in energy efficiency, that is what's known as the rebound effect. But you can only heat your home so much, or drive so far before you reach a period of clearly diminishing returns. Just because my Chevy Volt can get 100 miles per gallon doesn't mean I'm going to drive back and forth to Washington each day. So it stands to reason that as these appliances become more efficient, we can potentially limit and even reduce energy consumption without losing value — which is indeed what's happened in recent years in the U.S. and other developed nations.

None of this is to argue that energy efficiency isn't important in the ICT sector. Just as the Bank of America Tower's green features keep its gigantic electricity demand from ballooning even more, efficient smartphones and laptops can slow the growth of the cloud's carbon footprint. But grow it will. Energy efficiency has never been a big part of the sales strategy for digital devices, probably because electricity is still cheap in the U.S. and it's something we pay for in bulk at the end of the month. Compare the feeling of paying your utility bill to the irritation of forking out $3.50 a gallon to fill up your car. The costs of electricity are hidden in our society.

That includes the environmental costs. The full title of Mills' report is The Cloud Begins with Coal: Big Data, Big Networks, Big Infrastructure and Big Power, and it's sponsored by the National Mining Association and the American Coalition for Clean Coal Electricity. Unsurprisingly, the report argues that coal — still the single biggest source of electricity in the U.S. — essentially powers our wonderful cloud. (And it is wonderful! The cloud generates a lot of value for all the electricity it uses.) Coal is hardly the only source of electricity that can keep the ICT system going — cleaner natural gas is already gaining, nuclear provides carbon-free base-load power, and renewables are growing fast. Certain aspects of the ICT system will also help reduce energy use, as smart grids and smart meters promote conservation. But users of the wireless cloud are likely to grow from 42.8 million people in 2008 to nearly 1 billion in 2014 — and that's just the beginning, as smartphones spread from the developed to the developing world. We already have a gigantic digital cloud, and it's only going to get bigger. What we need is a cleaner one.

As I write above, the nature of a smartphone or a tablet makes it hard to realize how much energy it may be using—especially given the fact that the electricity is often produced at plants far away from our outlets. At a gas station, for instance, the immediate cost and the smell of petrol is a potent reminder that we're consuming energy. The digital economy is built on the sensation of seamlessness—but it still comes with a utility bill.

Article Questions

1. How much of the world's electricity is used by the digital economy?
2. Compare the energy usage of a refrigerator to that of an iphone.
3. What factors influence the energy usage of a smartphone?
4. Describe the "rebound effect".
5. What does it mean that "the costs of electricity are hidden in our society"?
6. What is the major source of electricity in the U.S.?