From NegaWatts to Negabytes:

How lessons from energy efficiency can help reduce energy needs for computing.

by: Mark Bernstein

There have been numerous articles recently about the environmental and economic consequences of the electricity we are using today to power our increasing use of computers, phones, gaming platforms etc. More recently people have been writing about how the accelerated use of AI will accelerate the demand for electricity and the associated impact on the environment.[1]

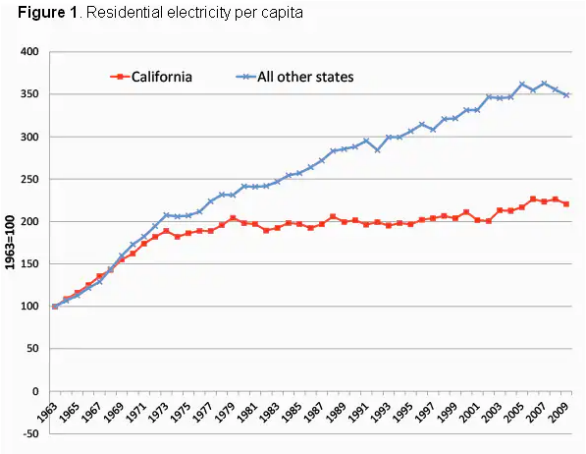
At the same time, some studies claim that there are enough data centers to handle increasing loads, concluding that many data centers are operating at less than 30% capacity (though the data here is sparse). What we do know is that when a data center is operating at a low level the whole building still needs to be cooled and most of the equipment is still running and when we consider just storage - there is little difference in energy use if it is operating at a low level or near capacity.

If we assume there is significant overcapacity, in a world in which almost a billion people don't have access to electricity, and with electricity generation comprising 25% of global greenhouse gas emissions, it is imperative to use more of the existing infrastructure, rather than build new data centers.

Amory Lovins cofounder of RMI first used the term "negawatts" in an article published in 1985, titled "Saving Gigabucks with Negawatts". In the article, Lovins argued that negawatts were a more effective way to meet our energy needs than building new power plants. He also argued that negawatts could create more jobs than power plants and improve the environment. The term "negawatt" is a play on the word "watt", which is a unit of power. A negawatt is a unit of electricity saved. So, when Lovins said that we should "save gigabucks with negawatts", he was saying that we could save billions of dollars by reducing our electricity consumption. At the time there were lots of skeptics (I was not one of them) and he has been proved to be right since.

[1] The International Energy Agency estimates that data centers, cryptocurrency, cloud computing and transmission activity uses up to 3% of global electricity consumption, though there is lots of uncertainty around the actual consumption.

California is an example of success for energy efficiency. CA was the first state to aggressively put into place efficiency measures - from regulations to incentives and funding. These measures proved successful as the per capita electricity consumption plateaued in the early 1970s. The graph below, which has been replicated many times, shows how CA diverged from the rest of the country in the early 2000's and it has remained flat since even though we have added many electricity using devices over the years. Think about the increased use of computers, TVs, gaming devices and more, including air conditioning. It is quite remarkable what efficiency can do.



Showing that Amory Lovins was correct, in 2000, colleagues and I at the RAND Corporation, in a first of its kind report, showed that the economy of California was likely 3% greater with energy efficiency than it would have been without it. We concluded that efficiency added about $1300 per capita to the States' economy at a cost of less than $200 per person, a huge return on the investment. Clearly reducing demand made more economic sense than building new power plants and it was better for the environment too. Negawatts paid off.

Investing in Negabytes:

The growth in demand for computing - from data storage to machine learning - continues to accelerate and looks quite like electricity use per capita did in the 1960's and early 1970's. To meet this demand, companies are attempting to build new data center capacity at a rapid pace which will continue to drive up energy use. Much like electric utility grids in the past where planning was driven by expectations of future growth and excess capacity, indications are that data centers are being used inefficiently today. Therefore, there is an opportunity to invest in 'NegaBytes' instead. NegaBytes are technologies and practices that reduce the demand for new capacity and make the existing utilization more efficient.

Much like Amory Lovins promoted almost 40 years ago - the future should not be about adding new bytes to the system until we use the current capacity more efficiently. Distributed computing, more efficient storage, and more efficient tools for machine leaming will change the future of the digital economy.

To raise the visibility of these issues, the Digital Sustainability Alliance has been launched. The Alliance will work towards increased transparency, providing better information and bringing

together like-minded companies and other stakeholders to address the future impact of computing, in particular as AI accelerates.

We need to invest in Negabytes today to reduce costs and the impact computing has on our planet.