

Environmental Impact of Search and the Internet

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The internet has become such an integral part of our daily lives that in many ways we hardly notice it any more. In the early days, there was much talk about the 'paperless' society and how the internet would have a beneficial impact on the environment. But recently, that view has been called into question. So what are the various claims about the environmental impact of the internet and what are the facts and figures underlying these claims?

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Alex Wissner-Gross (2009)

In 2009, Harvard physicist Alex Wissner-Gross published a paper on the environmental impact of the internet. An article in The Times newspaper singled out this statistic from the report: each Google search has a carbon footprint of 7g of CO₂, enough to boil half a cup of water. The article also quoted statistics relating to other Google services. For example, it claimed that watching a YouTube video produced 1g of CO₂ for every ten minutes watched and a typical Gmail user would produce 1.2kg annually. The use of these statistics sparked an intense debate that has continued ever since.

Google's Response

Google disagreed with this assertion and produced evidence in a number of areas to back up their view.

Energy Required for each Search

ON its official blog, Google challenging the context of the statistics. The blog post claimed that even taking into account pre-search tasks such as building the search index, each search used 0.0003kWh (1kj) of energy, stating: 'For comparison, the average adult needs about 8000 kJ a day of energy from food, so a Google search uses just about the same amount of energy that your body burns in ten seconds.'

Comparison with Tailpipe Emissions

Google also stated that each search only produces 0.2g of CO₂, adding for comparison that this was significantly below the EU regulations regarding tailpipe emissions, and that 'the average car driven for one kilometre (0.6 miles for those in the U.S.) produces as many

greenhouse gases as a thousand Google searches.'

Further Comparisons

In order to add extra food for thought, Google went on to give several other interesting statistics for comparison:

- CO2 emissions of an average daily newspaper (PDF) (100% recycled paper) = 85 searches
- A glass of orange juice = 1050 searches
- One load of dishes in an EnergyStar dishwasher (PDF) = 5100 searches
- A five mile trip in the average U.S. automobile = 10 000 searches
- A cheeseburger = 15 000 searches
- Electricity consumed by the average U.S. household in one month = 3,100,000 searches

The Scale of Google's Operations

Google also felt that it was important to understand the scale of its operations when discussing the impact on the environment. Google conceded that their searches produced CO2 equivalent to running a domestic freezer for 5400 years and consumed enough energy to process 5.57 million loads of laundry (3,900,000 kWh). But the company argued that this should be viewed in context: their search engines processed 100 billion queries monthly (500 million times a day), and published results within microseconds.

Google's Green Credentials

However Google was also at pains to point out that it was not complacent about these figures and was taking a number of steps to reduce its carbon footprint and develop its green credentials.

Data centres are an essential element of the internet, and in particular to cloud storage solutions.

What is a Data Centre?

A data centre is 'a large group of networked computer servers typically used by organizations for the remote storage, processing, or distribution of large amounts of data.' Stanford professor Jonathan Koomey has been studying the environmental impact of the internet since 2000, and

has found that data centres account for between 1.1% and 1.5% of global electricity use.

Why are Data Centres Better than Local Solutions?

Nowadays, more and more customers are turning to cloud storage to keep their data in a secure and central location. This has several benefits. It frees them from the necessity of running their own storage servers which are often old and inefficient. Central storage also makes data easily accessible from almost anywhere, allowing remote working for employees, and also ensuring data protection and security arrangements comply with regulations.

Google's Data Centres

How Much Energy do Google's Data Centres Use?

Google has gone to considerable lengths in an effort to make its data centres more environmentally friendly, resulting in data centres which are 50% more efficient than most others. Independent studies have verified that Google data centres only use around 0.01% of the world's electricity, equivalent to only 1% of Koomey's estimated figures. Considering that Google processes over 70% of all searches, this is proportionally very small.

What has Google Done to Make its Data Centres More Efficient?

Google has taken several actions to improve the efficiency of its data centres.

Streamlining the Search Process

Google has an entire department devoted to finding ever more efficient ways to conduct internet searches, which has been a critical factor in reducing its energy consumption. It believes that in the time it takes to complete a search, the user's home computer will use more energy than Google takes to process it.

Efficient Design

The use of green building technologies, including smart temperature controls, using natural cooling solutions such as outside air and recycled water, and smart architectural design, have all contributed to making data centre buildings extremely efficient.

External Verification

Google is the first large internet company to gain external accreditation for its commitment to

providing safe workplaces, energy-efficient buildings and high environmental quality standards.

Google's Other Energy Saving Initiatives

Google calculates that providing all its services to an average user for one year requires the energy equivalent to driving a car one mile. When its carbon-offsetting programme is taken into account, this results in a carbon neutral situation.

The company has taken a positive approach to tackling environmental issues across its whole field of operations, including involving employees in suggesting and implementing green strategies and initiatives.

Renewable Energy and Carbon Off Setting

Google has actively collaborated with its energy suppliers to make the company's energy use as green as possible. 35% of Google's energy now comes from renewable sources, including deals with local wind farms and installation of 1.9 MW of solar panels producing 3 million kWh of energy annually. It also actively invests in renewable energy projects around the world to encourage greater use of clean energy. Google practises carbon-offsetting for the remaining 65%, making its overall operations carbon neutral.

Energy Efficient Buildings

Google works with architects to design its buildings with green and sustainable features, such as maximising natural light, installing efficient energy systems and eliminating dangerous materials. Over 4 million square feet of its buildings have been granted LEED Green Certification status.

Green Transport Solutions

Google provides a bio-fuelled shuttle service, electric car charging points, and a car-sharing scheme for its employees, resulting in a reduction of private vehicle use to the tune of 5,700 vehicles and saving 87 million vehicle miles each year. Co-workers who cycle or walk to work can designate a charity to receive company donations.

Google's Wider Initiatives

Google is also committed to working with partners to reduce carbon emissions on a wider scale. For example, it co-founded the Climate Savers Computing Initiative (2007), focused on reducing global computer CO2 emissions.

The environmental impact of the internet as a whole

However, Google is just one cog, albeit a large one, in the internet machine as a whole. What is the environmental impact of the internet overall?

The Internet in Daily Life

The modern public demands to be connected to the internet seamlessly for almost every aspect of their everyday lives. It is inconceivable that today's businesses and individual users would not be able to access the internet quickly and efficiently via a host of different gateways, including mobile devices. Many government services, such as applying for tax credits or payment of Child Benefit, can only be done online. Almost every other area of daily life, including diverse tasks such as banking, reading, shopping, and making travel arrangements, are increasingly taking place online.

How Much has the Internet Expanded?

The internet has expanded at an astounding rate to meet this ever-growing demand. For example, internet usage has increased dramatically:

December 1995 – the internet had 16 million users (0.4% of global population)

March 2014 – the internet had an estimated 2,937 million users (40.9% of global population)

In theory, if growth continued at that rate, the whole world could be online by 2017.

In what Ways is the Internet Used?

Who is Using the Internet?

Internet usage can be broken down into the following age bands:

Usage of all adults by percentage in 2009:

- Age 16-24 – 15%
- Age 25-34 – 18%

- Age 35-44 – 20%
- Age 45-54 – 15%
- Age 55-64 – 15%
- Age 65+ - 18%

The age profile of those using the internet the most is between 25 and 44 years.

How Much Time is Being Spent on the Internet Each Week?

In May 2010 the UK Adult's Media Literacy Report showed that the average amount of time spent by individuals on the internet each week has been rising steadily for personal use.

- 2005: 6.6 hpw
- 2007: 8.2 hpw
- 2009: 8.4 hpw

However, work-related or academic use rose slightly by 2007 but had fallen by 2009:

- 2005: 3 hpw
- 2007: 3.3 hpw
- 2009: 3.1 hpw

The report also found that men spent an average of 4.5 hours longer than women on the internet, with men more likely to access it at work whilst the women accessed it mainly at home.

What are the Reasons for People Using the Internet?

People use the internet for a wide variety of reasons, including for fun or relaxation, but the most popular reasons were for 'finding out and learning things' (76% of all adults), and maintaining contact with people (60%). Men were more likely than women to use the internet to stay informed about news (47% compared with 32%), and sports (36% compared with 9%), but in other activities, results were broadly similar.

Which Activities Were Carried out at Least Once a Week?

The study also compared the activities carried out on the internet in 2007 and 2009. The main activities carried out at least weekly were:

- Communication
- Transactions
- Work / study information
- Social networking
- Entertainment
- News
- Leisure information
- Public / civic

Activities such as communication, leisure information, communication and news remained broadly the same. There was a significant rise in the use of social networking (19% - 35%), and in accessing the internet for entertainment (19% - 35%). Work-related or academic activities fell slightly from 40% to 36%. Online transactions also fell (41% - 37%), but the study concluded this could be due to the effects of the recession.

How Does all this Internet Activity Impact the Environment?

Mobile devices such as smart phones and tablets now give users almost limitless internet access, and people in many developing countries are also getting online. Use of the internet is increasing significantly and looks likely to continue for the foreseeable future. But what is the impact of all this connectivity on the environment? This topic is the subject of much debate and there are several aspects that need to be considered.

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