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IS BITCOIN MINING AN ECOLOGICAL DISASTER?

A REPORT COMMISSIONED BY BITQYCK, INC
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1 THE ALLEGATIONS

VICE'S MOTHERBOARD ALLEGES THAT BITCOIN IS KILLING THE PLANET

There's a post that was put out by Vice's online technology publication Motherboard this week that's making the rounds alleging that, amongst other things, each Bitcoin transaction carries the same ecological carbon footprint as powering an average American house for a month.

They use many numbers and vaguely sourced factoids to support this, so it hits all the cursory examination highpoints to *look* legitimate at a glance, but is it?

The short answer is no. But first, let's examine exactly what Vice alleges.

The money quotes are around the middle of the post:

> Bitcoin's incredible price run to break over $7,000 this year has sent its overall electricity consumption soaring, as people worldwide bring more energy-hungry computers online to mine the digital currency.
>
> An index from cryptocurrency analyst Alex de Vries, aka Digiconomist, estimates that with prices the way they are now, it would be profitable for Bitcoin miners to burn through over 24 terawatt-hours of electricity annually as they compete to solve increasingly difficult cryptographic puzzles to "mine" more Bitcoins. That's about as much as Nigeria, a country of 186 million people, uses in a year.
>
> This averages out to a shocking 215 kilowatt-hours (KWh) of juice used by miners for each Bitcoin transaction (there are currently about 300,000 transactions per day). Since the average American household consumes 901 KWh per month, each Bitcoin transfer represents enough energy to run a comfortable house, and everything in it, for nearly a week. On a larger scale, De Vries' index shows that bitcoin miners worldwide could be using enough electricity to at any given time to power about 2.26 million American homes.
>
> Expressing Bitcoin's energy use on a per-transaction basis is a useful abstraction. Bitcoin uses x energy in total, and this energy verifies/secures roughly 300k transactions per day. So this measure shows the value we get for all that electricity, since the verified transaction (and our confidence in it) is ultimately the end product.

The crux of the data comes from a thinly sourced table published by Digiconimist. If you look at their estimate of how much power it takes to run the world's mining equipment, there's an asterisk leading to a paragraph that says the following: "Even though the total network hashrate can easily be calculated, it is impossible to tell what this means in terms of energy consumption as there is no central register with all active machines (and their exact power consumption). "

Meaning they're basing their entire estimate entirely on conjecture that they later explain they wildly inflate for, essentially, unknowable reasons.

> "A detailed examination of a real-world Bitcoin mine has taught us that such an approach will certainly lead to underestimating the network's energy consumption, [so] the index is built on the premise that miner income and costs are related. Since electricity costs are a major component of the ongoing costs, it follows that the total electricity consumption of the Bitcoin network must be related to miner income as well."

Essentially, what they're saying, is that since we can't estimate what actual energy usage is, we'll guess that they're using the maximum amount of energy that's economically feasible.

2 PAST CALCULATIONS

THIS TOPIC REARS ITS HEAD EVERY COUPLE YEARS

This allegation has reached the stage of meme, one that pops up every two years like clockwork, it seems. It's generally a reaction to a run up in price. When Bitcoin prices are in a bear market, those that are antagonistic to cryptocurrency don't have to reach far for ways to bash it. When it's on a bull run, the arguments to try to convince individuals not to buy in on the concept of blockchain have to be more creative.

The last refuge always seems to be a cry to consider the ecological implications. In November 2013, the University of Nicosia announced that it would be accepting bitcoin as payment for tuition fees, with the university's chief financial officer calling it the "gold of tomorrow." During November 2013, the China-based bitcoin exchange BTC China overtook the Japan-based Mt. Gox and the Europe-based Bitstamp to become the largest bitcoin trading exchange by trade volume. In December 2013, Overstock.com announced plans to accept bitcoin in the second half of 2014.

At the start of that bull run, Ars Technica released a post entitled "Is mining Bitcoin an ecological disaster?" That post was passed around so much that when I was Editor-in-Chief at SiliconANGLE, I commissioned some research that Kyt Dotson and I published under where we compared the energy usage of Bitcoin to other payment transaction systems of the day.

At the time, the transaction volume of the Bitcoin blockchain had just surpassed the transaction volume of PayPal. We used the Ars Technica estimates on the energy usage of the Bitcoin blockchain at that time and compared it to eBay's stated energy usage. In 2010, eBay published in a green report that they used 500,000 megawatt hours that year (which seems a bit low) in the operations of their facilities (presumably including but not limited to datacenters and office space). At the time, they had around 30,000 employees, and an unknowable amount of vendors, all of which had to commute, use general planetary resources, print documents, and other energy using activities that wouldn't necessarily show up on an electric bill.

Using the Ars Technica numbers of the day, for roughly the same amount of transaction volume, the Bitcoin blockchain consumed around 360,000 megawatt hours that year in electricity to machines and cooling. There is no other carbon footprint to the Bitcoin blockchain than these two things.

Similarly, Bitcoin was under increased scrutiny in 2015 for a variety of reasons, this topic came up for renewed discussion. This time, the definitive rebuttal report was published by Kernel Mag, which was later covered by my publication at the time.

The money quote from their report was:

> How much electricity does it actually take to generate one gigahash? There is no good answer to this question. You can mine Bitcoin with a cell phone, with your laptop, with a graphics card GPU, or you can mine with specifically designed ASIC chips installed into rack servers. Depending on the hardware you use, mining widely differs in its efficiency. This site estimates anything from 18,750 watts for a Raspberry Pi, to 0.001 watts per Gh/s for an ASIC. This site uses a average rate of 10 watts per Gh/s. The comments on this article cite anecdotal evidence of between 10 and 0.5 watts per Gh/s.
>
> If we take 10 watts per Gh/s, and multiply that by the global hashrate (as of the afternoon of Dec. 20, 2013) of 8,353,557 Gh/s, that's 83.54 megawatts. So it would use just over 2 gigawatt-hours per day, or 731.8 gigawatt-hours per year. This is just over the capacity of the Loon Lake hydroelectric plant, near Sacramento, Calif.
>
> What about a rate of 1 watt per Gh/s, which the above sources seemed to think was fairly plausible in the near-term? That gives us 8.35 megawatts, given the current global hashrate. This is about the power output of two GE E60C locomotives, which pull Amtrak trains. Is this more accurate a figure, because it seems more reasonable? Who knows. Calculations of scale are difficult to judge, which is why we're in stuck with this myth to begin with.

Essentially, this report describes a decreasing amount of energy being used due to advances in technology from 2013 to 2015, even as the price ascended.

This brings us to the present.

3 THE CURRENT REALITY

THERE BE MATH DRAGONS HERE

That Vice post everyone is sharing currently about the carbon footprint of the Bitcoin blockchain can be completely debunked using the same methodology that was used in the previous two reports and by simply attacking the underlying premise.

It's very difficult to find the true cost of a gigahash of compute power, but the whole paradigm is built to encourage efficiency - that's why ASICs are used instead of CPUs or GPUs. Yes, if you use the most inefficient means of mining, you'll be burning up scads of energy, but you also won't be achieving ROI.

The best place to start to understand the power requirements for Bitcoin mining is to look at the state of the art ASICs (that is, application specific integrated circuits) for mining. They've gotten, quite literally, exponentially more energy efficient each generation. The Bitcoin Wiki currently lists the AntMiner S9 as the fastest and most efficient Bitcoin specific miner on the market.

It currently takes 1,375 Watts to power an Antminer S9, and the advertised Megahashes per Joule are over 10,000, more than twice the efficiency of the previous generation, the S7.

As of the time of this report, the latest reported hash-rate was 7.8 Million Th/s per Second.

The AntMiner S9 operates at roughly 14 Million Mh/s.

Assuming the majority of the network is riding on modern hardware (which it is ultimately incentivized to do), and each AntMiner S9 uses 1,375 Watts (which it does) you can easily calculate the computational electricity cost of the network using the following formula.

One can find the kWh rating from the Watt rating of a device using the following forumla:

kWh = W × hr / 1000

So, running a single S9 for a month would use around 1003 kWh.

If you take the global hash rate, and divide it by the hash-rate of an S9, you come up with 557,142, which is roughly the number of AntMiner S9's it would take to run the global Bitcoin blockchain.

That means, globally and every month, the blockchain network is using around 559 million kWh, or around several orders of magnitude less than the report by Digiconomist and Vice (who, as you may recall, said Bitcoin used around 2 trillion kWh per month).

But what of heating and cooling? In a typical data center, cooling can account for around 30% of the cost of electric, but if we were to even double our estimates around efficiency, we're still several orders of magnitude off in terms of electric costs from the original estimates.

And *none* of this takes into account the preponderance of data centers that take advantage of **free** Chinese renewable power, or the natural cooling effects of having a large cryptocurrency mining operation in the arctic circle. Both of these well known use cases are major driving factors towards raising the competitive barrier of entry to new mining operations, because these are your competition. If your margins (on electric and hardware) don't approach theirs, you'll never be able to scale up at the same rate they're able to scale up, something which incentivizes energy efficiency even more.

I do some amount of consulting on this topic. I generally guide clients away from attempting to build mining farms for Bitcoin for these reasons. If you even have a standard deviation better than average price for energy, you're still not going to be able to compete with the efficiency of these mining operations.

The bottom line is that every incentive in cryptocurrency mining in general and Bitcoin mining in specific pushes miners towards more energy efficiency. Any protestations to the contrary are simply not built on reality.

7 WHO IS ROGER WILCO?

We are a team of highly-skilled, multi-disciplinary professionals, dedicated to giving you the absolute best product and experience for your organization.

75+ COMBINED PERSON-YEARS OF EXPERIENCE IN TECH, NEW MEDIA, TRADITIONAL MEDIA, DESIGN, MARKETING, ENTERPRISE BUSINESS AND NON-PROFITS.

10 YEARS OF EXPERIENCE COVERING LIVE EVENTS

ORGANIZATIONS WE'VE WORKED WITH