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International Energy Agency commentary on Bitcoin energy use

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Of all the potential implications of blockchain for the energy sector, the energy use of cryptocurrencies – and bitcoin in particular – has captured the most interest.

As the price of bitcoin skyrocketed in 2017, attention turned to the cryptocurrency's energy and environmental footprint. High-profile news articles reported that electricity use of the bitcoin network had equalled that of medium-sized countries and was on track to consume as much electricity as the United States in 2019 and all of the world's energy by 2020. A widely reported article in Nature Climate Change warned that Bitcoin emissions alone could push global warming above 2°C.

With bitcoin value tripling in recent months and Facebook announcing its new Libra coin, interest in the energy use of cryptocurrencies is again on the rise.

In this commentary, we explain why and how bitcoin uses energy; dig into published estimates of bitcoin energy use and provide our own analysis; and discuss how these trends might evolve in the coming years.(…)

Around 60% to 70% of bitcoin is currently mined in China(…), where bitcoin mining facilities are concentrated in remote areas of China with rich hydro or wind resources (cheap electricity), with about 80% of Chinese bitcoin mining occurring in hydro-rich Sichuan province. These mining facilities may be absorbing overcapacity in some of these regions, using renewable energy that would otherwise be unused, given difficulties in matching these rich wind and hydro resources with demand centres on the coast.

Electricity generation in other key bitcoin mining centres are also dominated by renewables, including Iceland (100%), Quebec (99.8%), British Columbia (98.4%), Norway (98%), and Georgia (81%). Globally, one analysis estimates that the bitcoin is powered by at least 74% renewable electricity as of June 2019. Another analysis of data from 93 mining facilities (representing 1.7 GW, or about a third of global mining capacity) estimates that 76% of the identified energy mix includes renewables.

Based on these analyses and data from IPO filings of hardware manufacturers and insights on mining facility operations and pool compositions, bitcoin mining is likely responsible for 10-20 Mt CO2 per year, or 0.03-0.06% of global energy-related CO2 emissions.

Apocalyptic headlines that bitcoin would consume all of the world's energy by 2020 echo back to warnings from the late 1990s about the internet and its growing appetite for energy, including one Forbes article in 1999 that predicted that "[…]half of the electric grid will be powering the digital-Internet economy within the next decade".

Since then, researchers have collected real-world data and developed and refined methodologies to establish rigorous estimates of the energy use of data centres and the global ICT sector, including by the IEA. The dire predictions about the energy use of the internet failed to materialise despite exponential growth in internet services, largely because of rapid improvements in the energy efficiency of computing and data transmission networks.(…)

The outlook for bitcoin energy use is highly uncertain, hinging on efficiency improvements in hardware, bitcoin price trends, and regulatory restrictions on bitcoin mining or use in key markets. (…)