

Summary

- The energy grid is facing significant challenges related to grid instability, energy transfer and storage, as well as harmful byproducts.
- Bitcoin mines have a unique mix of flexibility, consistency, and transparency that can help with some of these challenges.
- There are projects focused on using new tech to mitigate challenges; these miners should be viewed as partners in the energy transition.

What challenges is the grid facing today?

As the world faces an energy transition, investments in energy infrastructure are critical. However, there are several challenges that stand in the way:

Grid Instability: Renewable resources like wind and solar have a variable supply. That is, there are “intermittency” issues that result from the fact that these resources are sensitive to factors like time of day and weather.

Energy Transfer and Storage: There is a geographic mismatch between renewable energy resources and energy demand. Power generation often takes place in remote areas because they are optimal in terms of space and resource. However, energy is difficult to transfer to the end consumer.

Harmful Byproducts: Byproducts of energy production, such as gas flaring have significant negative environmental impacts. However, this has been a persistent challenge given that oil production frequently takes place in remote and inaccessible locations.

Mismatches in supply and demand result in curtailment, which is costly & results in wasted energy. New projects are stalled or withdrawn due to interconnection challenges - and [over 90% of US requests](#) are for renewable energy sources.

Energy producers are being forced to sell at low or negative costs. Unmitigated gas flaring emits more than [400 million tons of CO2 equivalent emissions](#) annually.

T&D electricity in the USA



206 TWh

Could power the entire Bitcoin network

1.6 times

Global gas flaring recovery potential



688 TWh

Could power the entire Bitcoin network

5.3 times

Renewables curtailment in China



105 TWh

Could power the entire Bitcoin network

0.8 times

How can Bitcoin help?

The need for action on the energy transition is urgent - and Bitcoin mining can be an important bridge to much-needed investments and market support. These mining operations, which are - in essence simply data centers that power the Bitcoin network - are uniquely suited to address some of these challenges due to their unique combination of flexibility, consistency, and transparency.

Specifically:

(1) Flexibility: Numerous studies found that a flexible load on renewable-powered grids can be a key solution minimizing the mismatch of supply and demand. Bitcoin mining operations are flexible on two critical axes: (1) location and (2) demand. This means that they can access stranded sources of energy and power up and down, depending on grid conditions.

(2) Consistency: Similarly, sustained demand at-scale is important. Typical demand for energy varies based on several factors such as time of day, population, etc. Consequently, markets for renewable energy sources can face periods of low demand, which affects their market prices and business models. Mining can serve as a consistent source of demand, reducing the need for costly curtailment.

Understanding Bitcoin's Role in the Energy Transition

Transparency: Bitcoin provides a new model for engagement with energy more broadly. The transparency of the industry means that data that can be used to inform decision-making - and, it can provide a model for greater accountability.

Sites powered by renewables

There are 20 sites approaching sustainable operations in various ways, including:

Utilizing flared gas as a power source to mitigate the effects of methane emissions - which has over 80x the warming power of CO2 over 30 years (GWP30).

Experimenting with new technology for cooling, which makes up an estimated 40 percent of energy consumed by data centers

Balancing grid instability by powering data centers up or down within a 5-15 second timeframe.

Building brand-new, renewable energy infrastructure, representing over 3 GW of added renewable energy to the grid in the long-run.

The companies [in this report](#) have made hundreds of millions of dollars of investments in sustainable infrastructure supported by local communities, adding hundreds of jobs. Throughout these examples, one thing is clear, such business models are powered by the unique properties of these operations. While others may follow, these can be the starting point to make the economics work for investing in similar renewable energy sources.

What is Proof of Work & why does it matter?

Through economic incentives, consensus mechanisms simultaneously dis-incentivize malicious behavior by making "cheating" expensive and incentivize honest behavior, by providing rewards to honest network operators.

The best known example is [Proof-of-Work \(PoW\)](#). Under PoW, nodes "work" to add new records to the ledger by conducting mathematical computations.

The quickest receives compensation called a block reward, which includes two parts - a block subsidy of newly-minted coins and transaction fees. PoW is currently used by the Bitcoin network, the largest crypto by market cap.

This enables: (1) Openness: Allowing anyone to join as the network to validate transactions and (2) Integrity: Providing on-chain rewards to incentivize miners to behave in line with the shared interests of the network and disincentivize fraud.

Academic research showed that actions taken by China to ban data centers [worsened its environmental impact](#) - increasing its carbon intensity by 17%. This is unfortunate, given that data centers' flexibility allowed them to [consume excess hydroelectricity](#) during Sichuan's rainy season.

Moreover, these efforts were not effective in curbing this activity. New data from the Cambridge Centre for Alternative Finance showed that [the quelling effects of the ban were temporary](#), with mining activity re-surfing following a short gap.

What can be done?

We underscore that the industry is not asking for special treatment. Rather, many want to work collectively with the broader ecosystem to understand the holistic impact of mining operations. Miners are willing and able to serve as partners, and leaders, in advancing new economic and environmental models.

This requires taking a detailed and nuanced view of the ecosystem. Getting to an accurate understanding of Bitcoin's impact requires going beyond simplified measures of energy use and accounting for the [energy mix used](#), how it may [support the market for renewables](#), and how the underlying technology may be used to [aid climate efforts](#). The industry is interested in being a part of the solution and has already invested significant resourcing into research and innovation on this front.

Download CCI's full report: Proof of Work & Enabling the Energy Transition

