Renewables and energy efficiency addressing the rising energy usage of cryptocurrency mining

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SPEAKERS

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Renewables and energy efficiency addressing the rising energy usage of cryptocurrency mining
Power sector transformation propelled by three trends

I. Decentralisation – supply side. Wind and PV is largely centralised today but distributed generation - notably rooftop PV, ~ 1% of all electricity generation today – is growing, bringing new flexibility opportunities at demand side

II. Electrification – demand side. It plays in two ways, may decarbonise end-use sectors through renewable electricity and, if done in a smart way, become a flexibility source to integrate more renewables in power systems

III. Digitalisation – system integration. Covert data into value by optimising complex systems with more actors involved, many small generation units and new type of loads

Source: IRENA (2019), Innovation landscape for a renewable-powered future: Solutions to integrate variable renewables
Blockchain (DLT) – Decentralised RE with smart contracts at the core

- **Transactions**

- **Peer to peer power trade**: 36%
- **Electric mobility**: 11%
- **Management of renewable energy certificates**: 11%
- **Financing renewable energy development**: 12%
- **Others**: 6%

**Note**: Data as of July 2018.

Based on: Livingston et al. (2018), Applying Blockchain Technology to Electric Power Systems.

Source: IRENA (2019), Innovation landscape brief: Blockchain
Global power supply projections in a 1.5C scenario

Electrification of end use sectors

In 2018
- Global electricity demand: 22k TWh
- Electricity consumed in the transport sector: 390 TWh (1.8% of total)
- Data centres demand: 200 TWh (1% of total)

In 2030
- Global electricity demand: 36k TWh
- Transport sector: 3k TWh (8.3%)
- Data centres: 1k to 4k TWh (2.7% to 11%)
Innovation unlocks flexibility across the power system

**Flexibility sources:**
- Flexible generation
- Regional interconnections and markets
- Demand response
- Storage
- Power to X

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**Issues**

1. **Annual Energy demand:** must come from renewables
2. **Load profile:** peak demand

**Smart vs dumb electrification**

IRENA (2019). Innovation landscape for a renewable-powered future: Solutions to integrate variable renewables

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In Coinbase’s Rise, a Reminder: Cryptocurrencies Use Lots of Energy

The company’s stock market arrival establishes Bitcoin and other digital currencies in the traditional financial landscape. It also elevates a technology with astonishing environmental costs.

Electricity needed to mine bitcoin is more than used by ‘entire countries’

Bitcoin mining – the process in which a bitcoin is awarded to a computer that solves a complex series of algorithms – is a deeply energy-intensive process.

The debate about cryptocurrency and energy consumption

Cathie Wood’s ARK Says Bitcoin Mining Is Good for the Planet

Bloomberg

Why does Bitcoin need more energy than whole countries?

Running the cryptocurrency Bitcoin requires more energy than New Zealand and Belgium put together. How can something virtual be so power-hungry around the world? DW’s Timothy Béring looks into the numbers.
Why is energy required for blockchains
Reaching consensus, securing the network

**Proof of work**
- **Bitcoin**
- **Ethereum**
- **Others**

Many miners  
Decentralised, energy-intensive, difficult to scale

**Proof of stake**
- **Ethereum 2.0**
- **Others**

Many validators  
Decentralised, energy-efficient, easier to scale

**Proof of authority**
- **Hashgraph**
- **Energy Web**
- **Others**

Few validators  
Centralised, energy-efficient, easiest to scale
Proof of work mining

Miners use specialised mining equipment to solve complex mathematical problems in order to receive rewards (Bitcoin, ETH, others).
Estimated Bitcoin network electricity consumption (2015-2021)
TWh (annualised)

Data source: Cambridge Centre for Alternative Finance
Bitcoin price

BTC price (USD)

Data source: coinbase
Estimated Ethereum network electricity consumption (2017-2021) TWh (annualised)

Data source: Digiconomist
Renewables make economic sense for mining

Renewable energy costs declined rapidly over the last 10 years (2010-2019)

82% 47% 39% 29%

Solar Photovoltaics (PV)  Concentrating Solar Power (CSP)  Onshore Wind  Offshore Wind
Opportunities for grid flexibility

Matching peak load with peak renewables supply
• Changing the profile of consumption of miners through price signals

Battery storage
• Integrating battery storage into mining operations to store renewable electricity during periods of peak supply
• Consume or sell power back to grids when renewables production falls

District heating
• Use waste heat from mining rigs to produce hot water local minimalities

We explore these options and more in IRENA’s Innovation Landscape report

Learning from related sectors: Strategies to integrate higher shares of renewables and increase efficiencies

A few key strategies employed by data centres which may prove useful for PoW mining include, among others:

- Locating data centres in locations with abundant and cheap renewable electricity
- Enabling data centres to provide services in power flexibility markets
- Leveraging sector coupling
- Integrating battery storage
- Using machine learning to optimise operations and increase energy efficiency

Example: Intelligent load shifting

Conventional compute load

Execution of compute tasks throughout the day, regardless of carbon impact
Example: District heating via waste heat

Odense Data Center: Heat Recovery Process

Wind turbines add renewable energy to the electric grid that supplies our data center and powers our servers.

Hot air from the servers is directed over water coils to heat water.

The warm water from the data center coupled with additional renewable energy is used in a heat pump facility to create hot water for the district heating network.

The hot water delivers the heat to the community via the district heating network.

Source: Facebook
Increasing energy efficiency via new consensus mechanisms

• Ethereum’s imminent shift from PoW to PoS is set to reduce the network’s energy demand by around 99%.

• Layer 2 innovations reducing energy needs
  • ETH L2
  • BTC Lightning Network

Source: Blockgeeks
Way forward

Many uncertainties remain, threats and opportunities

Switch to energy-efficient means of consensus wherever possible, decarbonise PoW where needed

Adopt strategies from similar, power-hungry, sectors to manage energy consumption more effectively

Climate targets are not doomed but that depends on how we move forward
If you have thoughts on this topic please reach out to

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Q & A
10 min
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