

## Why Bitcoin transactions are more expensive than you think

Bitcoins are sometimes marketed as a low-cost alternative to traditional payments but they're not as cheap as you'd think. What's going on?



### Confronting the Mad Max Problem

A core element of cryptocurrency is the lack of a central authority. Nodes on the network verify transactions which are rewarded with transaction fees and in the case of bitcoins, newly minted bitcoins go with each verified block of transaction. From the verifying nodes' perspective, these new bitcoins are mined. Hence they are referred to as "miners".

As explained in our [report](#), one of the central issues of cryptocurrencies is trust. How can the rest of the cryptocurrency network trust the verification work done by miners? I'd like to call this the [Mad Max problem](#). In a Mad Max world, with no law enforcement, your base assumption has to be that nobody can be trusted. How do transactions take place in such a world without anyone getting robbed?

### Replacing trust with raw computing power

For example, malevolent miners could verify blocks of fraudulent transactions in which bitcoin is

taken from victims and sent to their own wallets, or where the same bitcoin is spent several times. How do network nodes know that the blocks presented by miners are truly valid?

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*Bitcoin is a Mad Max world, with no law enforcement, where nobody can be trusted*

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The innovative concept applied by bitcoin is [proof-of-work](#) (POW) system. By making sure that verifying transactions is a costly business, the integrity of the network can be preserved as long as benevolent nodes control a majority of computing power. Together, they will dominate the verification (mining) process. Read Satoshi Nakamoto's original white paper for a more detailed explanation [here](#).

To make the verification (mining) costly, the verification algorithm requires a lot of processing power and thus electricity. In fact, the website Digiconomist has constructed a [Bitcoin Energy Consumption Index](#), estimating bitcoin energy consumption. And the results are sobering. At the time of writing, verifying one transaction on the bitcoin blockchain consumes about 200kWh.

[Current Bitcoin Energy Consumption Index](#)

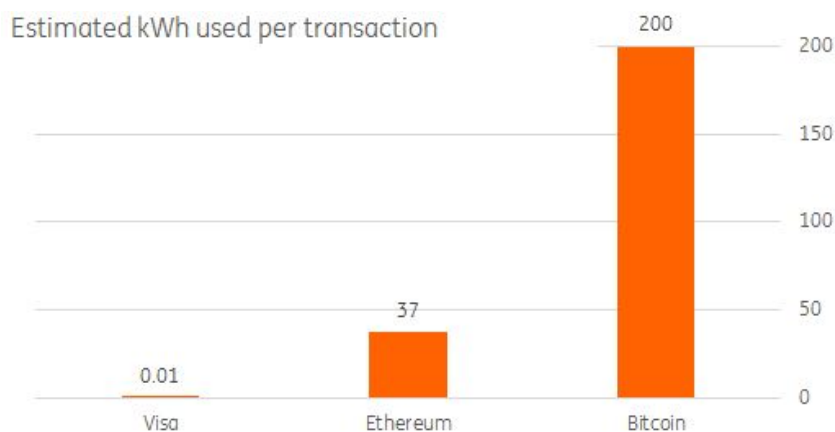
**200kWh** Estimated electricity cost per bitcoin transaction

## Privatising gains, socialising losses?

This number needs some context. 200kWh is enough to run over 200 washing cycles. In fact, it's enough to run my entire home over four weeks, which consumes about 45 kWh per week costing €39 of electricity (at current Dutch consumer prices).

Let's put this another way. To process your bitcoin transaction, which might not cost you anything, 200kWh of electricity is used. Powering the entire Bitcoin blockchain currently, costs over 2200MW which is more than what the biggest Dutch energy plant, the [Eemshavencentrale](#) requires.

This might make you wonder why you're not charged €39 for the electricity used? The answer is simply the block reward. The miner whose block is selected to be added to the chain [currently receives BTC12](#). At current BTC prices, the block reward clearly and vastly outweighs electricity costs. Mining is a no-brainer for individual miners, but the benefit to society at large is much less obvious.



Source: Digiconomist, ING

## Looking for more sustainable alternatives

Bitcoin's energy costs stand in stark contrast to payment systems that have the luxury of working with trusted counterparties. E.g. Visa takes about 0.01kWh (10Wh) per transaction which is 20000 times less energy.

But blockchain technology could be used in a setting with trusted nodes as well, for example between banks. And this would abolish the need for expensive proof of work.

But operating in a setting without trusted authorities was one of the core goals of the original bitcoin project. At the same time, the cryptocurrency community is aware of the sheer energy consumption [issue](#). Therefore, it is looking for alternative solutions to the Mad Max problem.

One alternative may be [Proof of Stake](#). Miners are not asked to show they put in work (computing power) in validating but to commit valuable resources beforehand, indicating they have a stake in the proper outcome. For example, miners may have to put an amount of cryptocurrency in escrow which is only released if no fraud is detected, otherwise forfeited.

That sounds like a smart idea. However, it implies that only those wealthy enough to be able to put resources in escrow can join the mining process. This creates a plutocracy, which sits uncomfortably with cryptocurrency's anarchistic and libertarian roots.

My conclusion is that finding a sustainable and fair solution to the Mad Max Problem is one of the biggest challenges for the cryptocurrency community today.

### Author

**Alissa Lefebvre**

Economist

[alissa.lefebvre@ing.com](mailto:alissa.lefebvre@ing.com)

**Deepali Bhargava**

Regional Head of Research, Asia-Pacific

[Deepali.Bhargava@ing.com](mailto:Deepali.Bhargava@ing.com)

**Ruben Dewitte**

Economist

+32495364780

[ruben.dewitte@ing.com](mailto:ruben.dewitte@ing.com)

**Kinga Havasi**

Economic research trainee

[kinga.havasi@ing.com](mailto:kinga.havasi@ing.com)

**Marten van Garderen**

Consumer Economist, Netherlands

[marten.van.garderen@ing.com](mailto:marten.van.garderen@ing.com)

**David Havrlant**

Chief Economist, Czech Republic

420 770 321 486

[david.havrlant@ing.com](mailto:david.havrlant@ing.com)

**Sander Burgers**

Senior Economist, Dutch Housing

[sander.burgers@ing.com](mailto:sander.burgers@ing.com)

**Lynn Song**

Chief Economist, Greater China

[lynn.song@asia.ing.com](mailto:lynn.song@asia.ing.com)

**Michiel Tukker**

Senior European Rates Strategist

[michiel.tukker@ing.com](mailto:michiel.tukker@ing.com)

**Michal Rubaszek**

Senior Economist, Poland

[michal.rubaszek@ing.pl](mailto:michal.rubaszek@ing.pl)

**This is a test author**

**Stefan Posea**

Economist, Romania

[tiberiu-stefan.posea@ing.com](mailto:tiberiu-stefan.posea@ing.com)

**Marine Leleux**

Sector Strategist, Financials

[marine.leleux2@ing.com](mailto:marine.leleux2@ing.com)

**Jesse Norcross**

Senior Sector Strategist, Real Estate

[jesse.norcross@ing.com](mailto:jesse.norcross@ing.com)

**Teise Stellema**

Research Assistant, Energy Transition

[teise.stellema@ing.com](mailto:teise.stellema@ing.com)

**Diederik Stadig**

Sector Economist, TMT & Healthcare

[diederik.stadig@ing.com](mailto:diederik.stadig@ing.com)

**Diogo Gouveia**

Sector Economist

[diogo.duarte.vieira.de.gouveia@ing.com](mailto:diogo.duarte.vieira.de.gouveia@ing.com)

**Marine Leleux**

Sector Strategist, Financials

[marine.leleux2@ing.com](mailto:marine.leleux2@ing.com)

**Ewa Manthey**

Commodities Strategist

[ewa.manthey@ing.com](mailto:ewa.manthey@ing.com)

**ING Analysts**

**James Wilson**

EM Sovereign Strategist

[James.wilson@ing.com](mailto:James.wilson@ing.com)

**Sophie Smith**

Digital Editor

[sophie.smith@ing.com](mailto:sophie.smith@ing.com)

**Frantisek Taborsky**

EMEA FX & FI Strategist

[frantisek.taborsky@ing.com](mailto:frantisek.taborsky@ing.com)

**Adam Antoniak**

Senior Economist, Poland

[adam.antoniak@ing.pl](mailto:adam.antoniak@ing.pl)

**Min Joo Kang**

Senior Economist, South Korea and Japan

[min.joo.kang@asia.ing.com](mailto:min.joo.kang@asia.ing.com)

**Coco Zhang**

ESG Research  
[coco.zhang@ing.com](mailto:coco.zhang@ing.com)

**Jan Frederik Slijkerman**  
Senior Sector Strategist, TMT  
[jan.frederik.slijkerman@ing.com](mailto:jan.frederik.slijkerman@ing.com)

**Katinka Jongkind**  
Senior Economist, Services and Leisure  
[Katinka.Jongkind@ing.com](mailto:Katinka.Jongkind@ing.com)

**Marina Le Blanc**  
Sector Strategist, Financials  
[Marina.Le.Blanc@ing.com](mailto:Marina.Le.Blanc@ing.com)

**Samuel Abettan**  
Junior Economist  
[samuel.abettan@ing.com](mailto:samuel.abettan@ing.com)

**Franziska Biehl**  
Economist, Germany  
[Franziska.Marie.Biehl@ing.de](mailto:Franziska.Marie.Biehl@ing.de)

**Rebecca Byrne**  
Senior Editor and Supervisory Analyst  
[rebecca.byrne@ing.com](mailto:rebecca.byrne@ing.com)

**Mirjam Bani**  
Sector Economist, Commercial Real Estate & Public Sector (Netherlands)  
[mirjam.bani@ing.com](mailto:mirjam.bani@ing.com)

**Timothy Rahill**  
Credit Strategist  
[timothy.rahill@ing.com](mailto:timothy.rahill@ing.com)

**Leszek Kasek**  
Senior Economist, Poland  
[leszek.kasek@ing.pl](mailto:leszek.kasek@ing.pl)

**Oleksiy Soroka, CFA**  
Senior High Yield Credit Strategist  
[oleksiy.soroka@ing.com](mailto:oleksiy.soroka@ing.com)

**Antoine Bouvet**  
Head of European Rates Strategy  
[antoine.bouvet@ing.com](mailto:antoine.bouvet@ing.com)

**Jeroen van den Broek**

Global Head of Sector Research  
[jeroen.van.den.broek@ing.com](mailto:jeroen.van.den.broek@ing.com)

**Edse Dantuma**  
Senior Sector Economist, Industry and Healthcare  
[edse.dantuma@ing.com](mailto:edse.dantuma@ing.com)

**Francesco Pesole**  
FX Strategist  
[francesco.pesole@ing.com](mailto:francesco.pesole@ing.com)

**Rico Luman**  
Senior Sector Economist, Transport and Logistics  
[Rico.Luman@ing.com](mailto:Rico.Luman@ing.com)

**Jurjen Witteveen**  
Sector Economist  
[jurjen.witteveen@ing.com](mailto:jurjen.witteveen@ing.com)

**Dmitry Dolgin**  
Chief Economist, CIS  
[dmitry.dolgin@ing.de](mailto:dmitry.dolgin@ing.de)

**Nicholas Mapa**  
Senior Economist, Philippines  
[nicholas.antonio.mapa@asia.ing.com](mailto:nicholas.antonio.mapa@asia.ing.com)

**Egor Fedorov**  
Senior Credit Analyst  
[egor.fedorov@ing.com](mailto:egor.fedorov@ing.com)

**Sebastian Franke**  
Consumer Economist  
[sebastian.franke@ing.de](mailto:sebastian.franke@ing.de)

**Gerben Hieminga**  
Senior Sector Economist, Energy  
[gerben.hieminga@ing.com](mailto:gerben.hieminga@ing.com)

**Nadège Tillier**  
Head of Corporates Sector Strategy  
[nadege.tillier@ing.com](mailto:nadege.tillier@ing.com)

**Charlotte de Montpellier**  
Senior Economist, France and Switzerland  
[charlotte.de.montpellier@ing.com](mailto:charlotte.de.montpellier@ing.com)

**Laura Straeter**

Behavioural Scientist  
+31(0)611172684  
[laura.Straeter@ing.com](mailto:laura.Straeter@ing.com)

**Valentin Tataru**  
Chief Economist, Romania  
[valentin.tataru@ing.com](mailto:valentin.tataru@ing.com)

**James Smith**  
Developed Markets Economist, UK  
[james.smith@ing.com](mailto:james.smith@ing.com)

**Suvi Platerink Kosonen**  
Senior Sector Strategist, Financials  
[suvi.platerink-kosonen@ing.com](mailto:suvi.platerink-kosonen@ing.com)

**Thijs Geijer**  
Senior Sector Economist, Food & Agri  
[thijs.geijer@ing.com](mailto:thijs.geijer@ing.com)

**Maurice van Sante**  
Senior Economist Construction & Team Lead Sectors  
[maurice.van.sante@ing.com](mailto:maurice.van.sante@ing.com)

**Marcel Klok**  
Senior Economist, Netherlands  
[marcel.klok@ing.com](mailto:marcel.klok@ing.com)

**Piotr Poplawski**  
Senior Economist, Poland  
[piotr.poplawski@ing.pl](mailto:piotr.poplawski@ing.pl)

**Paolo Pizzoli**  
Senior Economist, Italy, Greece  
[paolo.pizzoli@ing.com](mailto:paolo.pizzoli@ing.com)

**Marieke Blom**  
Chief Economist and Global Head of Research  
[marieke.blom@ing.com](mailto:marieke.blom@ing.com)

**Raoul Leering**  
Senior Macro Economist  
[raoul.leering@ing.com](mailto:raoul.leering@ing.com)

**Maarten Leen**  
Head of Global IFRS9 ME Scenarios  
[maarten.leen@ing.com](mailto:maarten.leen@ing.com)



**Maureen Schuller**

Head of Financials Sector Strategy

[Maureen.Schuller@ing.com](mailto:Maureen.Schuller@ing.com)

**Warren Patterson**

Head of Commodities Strategy

[Warren.Patterson@asia.ing.com](mailto:Warren.Patterson@asia.ing.com)

**Rafal Benecki**

Chief Economist, Poland

[rafal.benecki@ing.pl](mailto:rafal.benecki@ing.pl)

**Philippe Ledent**

Senior Economist, Belgium, Luxembourg

[philippe.ledent@ing.com](mailto:philippe.ledent@ing.com)

**Peter Virovacz**

Senior Economist, Hungary

[peter.virovacz@ing.com](mailto:peter.virovacz@ing.com)

**Inga Fechner**

Senior Economist, Germany, Global Trade

[inga.fechner@ing.de](mailto:inga.fechner@ing.de)

**Dimitry Fleming**

Senior Data Analyst, Netherlands

[Dimitry.Fleming@ing.com](mailto:Dimitry.Fleming@ing.com)

**Ciprian Dascalu**

Chief Economist, Romania

+40 31 406 8990

[ciprian.dascalu@ing.com](mailto:ciprian.dascalu@ing.com)

**Muhammet Mercan**

Chief Economist, Turkey

[muhammet.mercan@ingbank.com.tr](mailto:muhammet.mercan@ingbank.com.tr)

**Iris Pang**

Chief Economist, Greater China

[iris.pang@asia.ing.com](mailto:iris.pang@asia.ing.com)

**Sophie Freeman**

Writer, Group Research

+44 20 7767 6209

[Sophie.Freeman@uk.ing.com](mailto:Sophie.Freeman@uk.ing.com)

**Padhraic Garvey, CFA**

Regional Head of Research, Americas

[padhraic.garvey@ing.com](mailto:padhraic.garvey@ing.com)

**James Knightley**

Chief International Economist, US

[james.knightley@ing.com](mailto:james.knightley@ing.com)

**Tim Condon**

Asia Chief Economist

+65 6232-6020

**Martin van Vliet**

Senior Interest Rate Strategist

+31 20 563 8801

[martin.van.vliet@ing.com](mailto:martin.van.vliet@ing.com)

**Robert Carnell**

Regional Head of Research, Asia-Pacific

[robert.carnell@asia.ing.com](mailto:robert.carnell@asia.ing.com)

**Karol Pogorzelski**

Senior Economist, Poland

[Karol.Pogorzelski@ing.pl](mailto:Karol.Pogorzelski@ing.pl)

**Carsten Brzeski**

Global Head of Macro

[carsten.brzeski@ing.de](mailto:carsten.brzeski@ing.de)

**Viraj Patel**

Foreign Exchange Strategist

+44 20 7767 6405

[viraj.patel@ing.com](mailto:viraj.patel@ing.com)

**Owen Thomas**

Global Head of Editorial Content

+44 (0) 207 767 5331

[owen.thomas@ing.com](mailto:owen.thomas@ing.com)

**Bert Colijn**

Chief Economist, Netherlands

[bert.colijn@ing.com](mailto:bert.colijn@ing.com)

**Peter Vanden Houte**

Chief Economist, Belgium, Luxembourg, Eurozone

[peter.vandenhoute@ing.com](mailto:peter.vandenhoute@ing.com)

**Benjamin Schroeder**

Senior Rates Strategist

[benjamin.schroeder@ing.com](mailto:benjamin.schroeder@ing.com)

**Chris Turner**

Global Head of Markets and Regional Head of Research for UK & CEE

[chris.turner@ing.com](mailto:chris.turner@ing.com)

**Gustavo Rangel**

Chief Economist, LATAM

+1 646 424 6464

[gustavo.rangel@ing.com](mailto:gustavo.rangel@ing.com)

**Carlo Cocuzzo**

Economist, Digital Finance

+44 20 7767 5306

[carlo.cocuzzo@ing.com](mailto:carlo.cocuzzo@ing.com)