

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?

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

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](#)

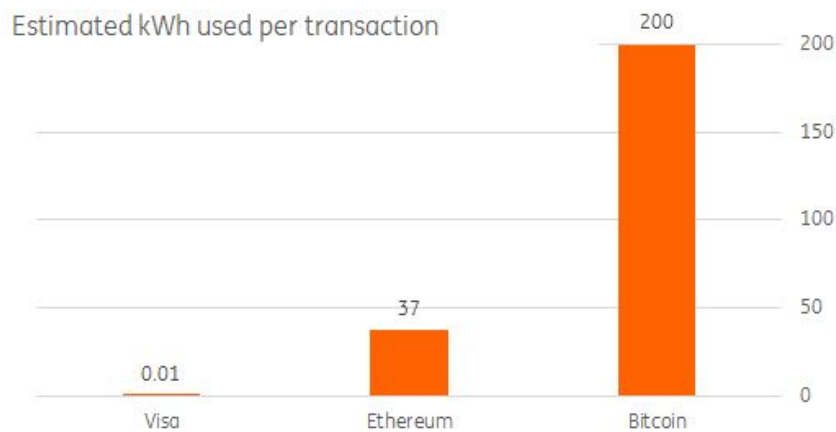
200kWh Estimated electricity cost per bitcoin transaction

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

Deepali Bhargava

Regional Head of Research, Asia-Pacific

Deepali.Bhargava@ing.com

Ruben Dewitte

Economist

+32495364780

ruben.dewitte@ing.com

Kinga Havasi

Economic research trainee

kinga.havasi@ing.com

Marten van Garderen

Consumer Economist, Netherlands

marten.van.garderen@ing.com

David Havrlant

Chief Economist, Czech Republic

420 770 321 486

david.havrlant@ing.com

Sander Burgers

Senior Economist, Dutch Housing

sander.burgers@ing.com

Lynn Song

Chief Economist, Greater China

lynn.song@asia.ing.com

Michiel Tukker

Senior European Rates Strategist

michiel.tukker@ing.com

Michal Rubaszek

Senior Economist, Poland

michal.rubaszek@ing.pl

This is a test author

Stefan Posea

Economist, Romania

tiberiu-stefan.posea@ing.com

Marine Leleux

Sector Strategist, Financials

marine.leleux2@ing.com

Jesse Norcross

Senior Sector Strategist, Real Estate

jesse.norcross@ing.com

Teise Stellema

Research Assistant, Energy Transition

teise.stellema@ing.com

Diederik Stadig

Sector Economist, TMT & Healthcare

diederik.stadig@ing.com

Diogo Gouveia

Sector Economist

diogo.duarte.vieira.de.gouveia@ing.com

Marine Leleux

Sector Strategist, Financials

marine.leleux2@ing.com

Ewa Manthey

Commodities Strategist

ewa.manthey@ing.com

ING Analysts

James Wilson

EM Sovereign Strategist

James.wilson@ing.com

Sophie Smith

Digital Editor

sophie.smith@ing.com

Frantisek Taborsky

EMEA FX & FI Strategist

frantisek.taborsky@ing.com

Adam Antoniak

Senior Economist, Poland

adam.antoniak@ing.pl

Min Joo Kang

Senior Economist, South Korea and Japan

min.joo.kang@asia.ing.com

Coco Zhang

ESG Research
coco.zhang@ing.com

Jan Frederik Slijkerman
Senior Sector Strategist, TMT
jan.frederik.slijkerman@ing.com

Katinka Jongkind
Senior Economist, Services and Leisure
Katinka.Jongkind@ing.com

Marina Le Blanc
Sector Strategist, Financials
Marina.Le.Blanc@ing.com

Samuel Abettan
Junior Economist
samuel.abettan@ing.com

Franziska Biehl
Senior Economist, Germany
Franziska.Marie.Biehl@ing.de

Rebecca Byrne
Senior Editor and Supervisory Analyst
rebecca.byrne@ing.com

Mirjam Bani
Sector Economist, Commercial Real Estate & Public Sector (Netherlands)
mirjam.bani@ing.com

Timothy Rahill
Credit Strategist
timothy.rahill@ing.com

Leszek Kasek
Senior Economist, Poland
leszek.kasek@ing.pl

Oleksiy Soroka, CFA
Senior High Yield Credit Strategist
oleksiy.soroka@ing.com

Antoine Bouvet
Head of European Rates Strategy
antoine.bouvet@ing.com

Jeroen van den Broek

Global Head of Sector Research
jeroen.van.den.broek@ing.com

Edse Dantuma
Senior Sector Economist, Industry and Healthcare
edse.dantuma@ing.com

Francesco Pesole
FX Strategist
francesco.pesole@ing.com

Rico Luman
Senior Sector Economist, Transport and Logistics
Rico.Luman@ing.com

Jurjen Witteveen
Sector Economist
jurjen.witteveen@ing.com

Dmitry Dolgin
Chief Economist, CIS
dmitry.dolgin@ing.de

Nicholas Mapa
Senior Economist, Philippines
nicholas.antonio.mapa@asia.ing.com

Egor Fedorov
Senior Credit Analyst
egor.fedorov@ing.com

Sebastian Franke
Consumer Economist
sebastian.franke@ing.de

Gerben Hieminga
Senior Sector Economist, Energy
gerben.hieminga@ing.com

Nadège Tillier
Head of Corporates Sector Strategy
nadege.tillier@ing.com

Charlotte de Montpellier
Senior Economist, France and Switzerland
charlotte.de.montpellier@ing.com

Laura Straeter

Behavioural Scientist
+31(0)611172684
laura.Straeter@ing.com

Valentin Tataru
Chief Economist, Romania
valentin.tataru@ing.com

James Smith
Developed Markets Economist, UK
james.smith@ing.com

Suvi Platerink Kosonen
Senior Sector Strategist, Financials
suvi.platerink-kosonen@ing.com

Thijs Geijer
Senior Sector Economist, Food & Agri
thijs.geijer@ing.com

Maurice van Sante
Senior Economist Construction & Team Lead Sectors
maurice.van.sante@ing.com

Marcel Klok
Senior Economist, Netherlands
marcel.klok@ing.com

Piotr Poplawski
Senior Economist, Poland
piotr.poplawski@ing.pl

Paolo Pizzoli
Senior Economist, Italy, Greece
paolo.pizzoli@ing.com

Marieke Blom
Chief Economist and Global Head of Research
marieke.blom@ing.com

Raoul Leering
Senior Macro Economist
raoul.leering@ing.com

Maarten Leen
Head of Global IFRS9 ME Scenarios
maarten.leen@ing.com

Maureen Schuller

Head of Financials Sector Strategy

Maureen.Schuller@ing.com

Warren Patterson

Head of Commodities Strategy

Warren.Patterson@asia.ing.com

Rafal Benecki

Chief Economist, Poland

rafal.benecki@ing.pl

Philippe Ledent

Senior Economist, Belgium, Luxembourg

philippe.ledent@ing.com

Peter Virovacz

Senior Economist, Hungary

peter.virovacz@ing.com

Inga Fechner

Senior Economist, Germany, Global Trade

inga.fechner@ing.de

Dimitry Fleming

Senior Data Analyst, Netherlands

Dimitry.Fleming@ing.com

Ciprian Dascalu

Chief Economist, Romania

+40 31 406 8990

ciprian.dascalu@ing.com

Muhammet Mercan

Chief Economist, Turkey

muhammet.mercan@ingbank.com.tr

Iris Pang

Chief Economist, Greater China

iris.pang@asia.ing.com

Sophie Freeman

Writer, Group Research

+44 20 7767 6209

Sophie.Freeman@uk.ing.com

Padhraic Garvey, CFA

Regional Head of Research, Americas

padhraic.garvey@ing.com

James Knightley

Chief International Economist, US

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

Karol Pogorzelski

Senior Economist, Poland

Karol.Pogorzelski@ing.pl

Carsten Brzeski

Global Head of Macro

carsten.brzeski@ing.de

Viraj Patel

Foreign Exchange Strategist

+44 20 7767 6405

viraj.patel@ing.com

Owen Thomas

Global Head of Editorial Content

+44 (0) 207 767 5331

owen.thomas@ing.com

Bert Colijn

Chief Economist, Netherlands

bert.colijn@ing.com

Peter Vanden Houte

Chief Economist, Belgium, Luxembourg, Eurozone

peter.vandenhoute@ing.com

Benjamin Schroeder

Senior Rates Strategist

benjamin.schroeder@ing.com

Chris Turner

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

chris.turner@ing.com

Gustavo Rangel

Chief Economist, LATAM

+1 646 424 6464

gustavo.rangel@ing.com

Carlo Cocuzzo

Economist, Digital Finance

+44 20 7767 5306

carlo.cocuzzo@ing.com