

Bitcoin Emissions Calculator

The Environmental Costs of Cryptocurrencies

Motivation

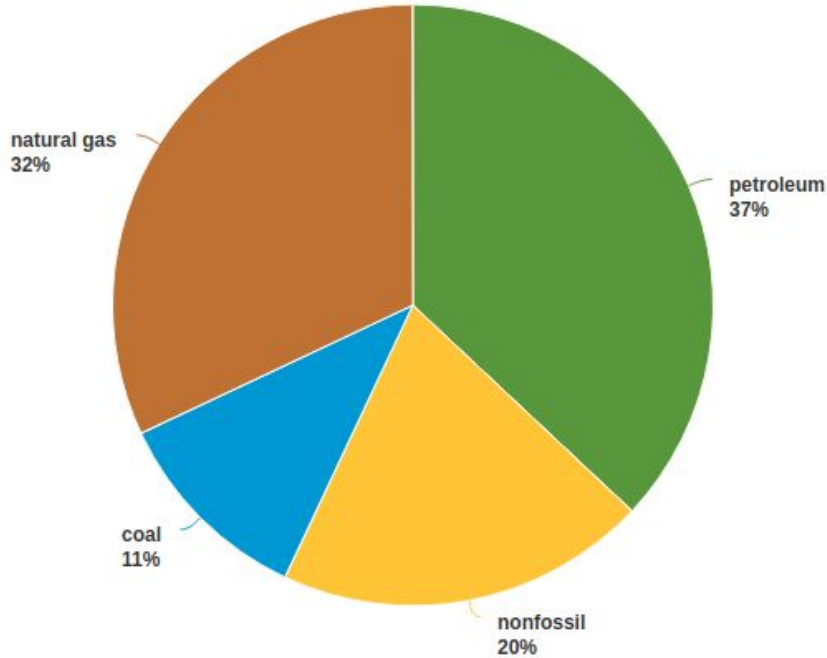
We know that Bitcoins are energy intensive, from mining to verifying transactions. We wanted to allow people to see visually just how much, with their own projections instead of what the experts say.



eToro

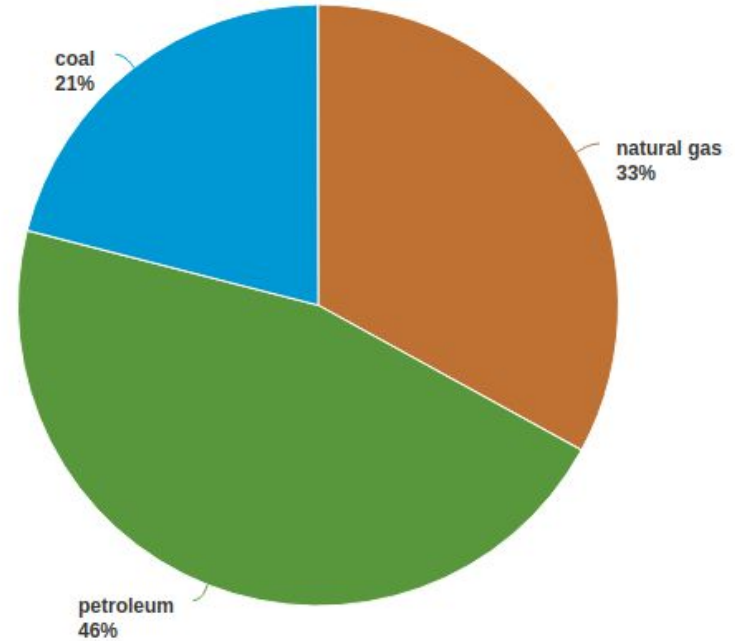
U.S. energy consumption by source, 2019

total = 100.2 quadrillion British thermal units



U.S. energy-related carbon dioxide emissions by source, 2019

total = 5,130 million metric tons



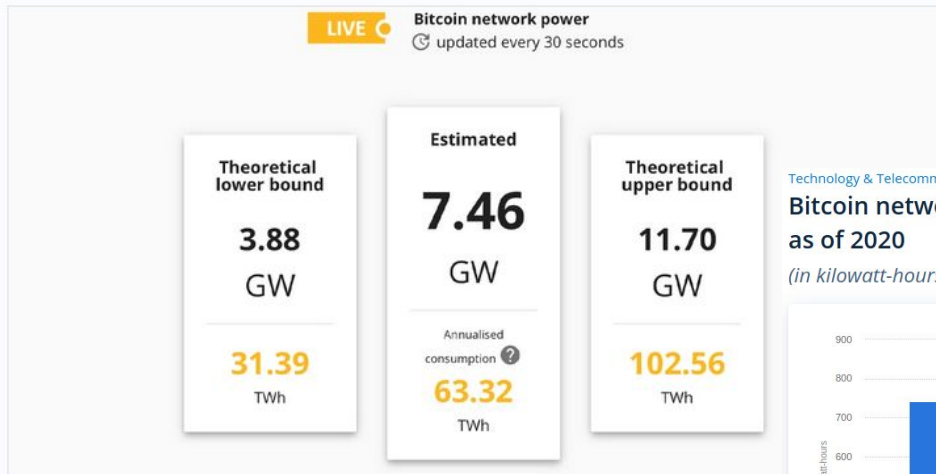
This allowed us to calculate CO₂ emission per unit of energy produced, by source

Electricity Generation (TWh)		Growth Rate (%)	Shares (%)	
	2018	2017-2018	2000	2018
Total Generation	26 672	4.0%	100%	100%
Coal	10 116	2.6%	39%	38%
Oil	903	-3.9%	8%	3%
Gas	6 091	4.0%	18%	23%
Nuclear	2 724	3.3%	17%	10%
Hydro	4 239	3.1%	17%	16%
Biomass and waste	669	7.4%	1%	3%
Wind	1 217	12.2%	0%	5%
Solar photovoltaics	570	31.2%	0%	2%
Other renewables	144	4.2%	0%	1%

Convert Terawatt Hours to Quads

[Kyle's Converter](#) > [Energy, Work, And Heat](#) > [Terawatt Hours](#) > [Terawatt Hours to Quads](#)

These two told us how much energy comes from each source, worldwide. We can now calculate emissions per unit of energy used.

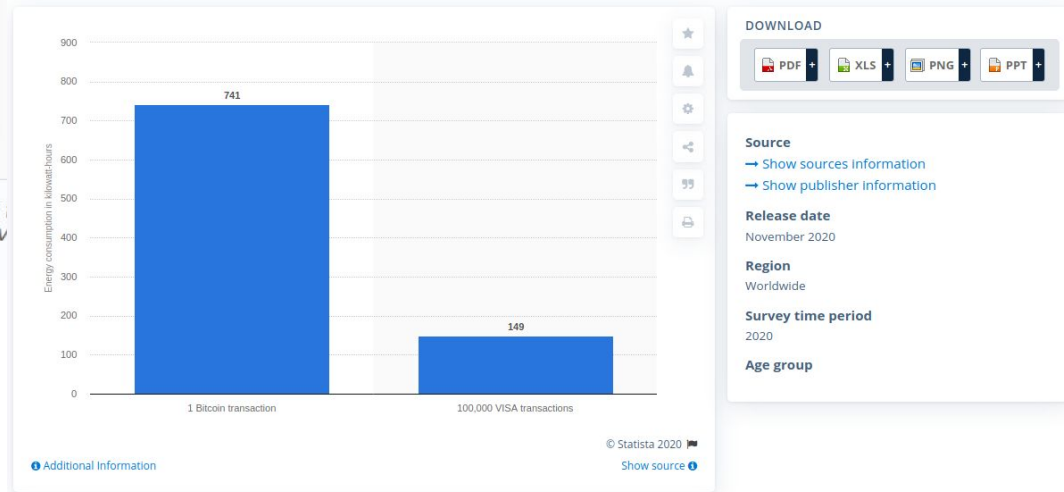


The Cambridge Bitcoin Electricity Consumption Index (CBECI) shows power to run the Bitcoin (BTC) network is 7.46 gigawatts (GW). An average nuclear plant in 2020 produces 1GW of electrical power.

Technology & Telecommunications > Software

Bitcoin network average energy consumption per transaction compared to VISA network as of 2020

(in kilowatt-hours)



Constantly updated data provides up-to-date estimates

Caveat: This data is for the U.S. We're extrapolating to global because I can't find comparable data for worldwide production of energy. Source: <https://www.eia.gov/energy>

A	B	C	D	E	F	G	H	I
Caveat: This data is for the U.S. We're extrapolating to global because I can't find comparable data for worldwide production of energy. Source: https://www.eia.gov/en								
Energy Consumption	%	QBTUs	Emissions %	MTons	Ratio	Rounded		
Source								
Petroleum	37	37.074	46	2359.8	63.65107623	63.65		multiply bitcoin en
Natural Gas	32	32.064	33	1692.9	52.79752994	52.8		
Coal	11	11.022	21	1077.3	97.74088187	97.74		
Non-fossil*	20	20.04	0	0	0	0		
* nuclear or renewable								
Absolute amounts								
Consumption (QBTUs)	Emissions (M metric tons)							
100.2	5130							
Worldwide production & emissions (Source: https://www.eenews.net/assets/2019/03/26/document_cw_01.pdf)								
Energy Consumption	%	Generation (TWh)	QBTUs	Million Metric To	Rounded	Acres of US For	# of Homes' Yearly Energy Use	
Source								
Petroleum	3	903	3.07923	195.9929895	195.99	254532467.5	22605536.33	
Natural Gas	23	6091	20.77031	1096.672368	1096.67	1424246753	126490196.1	
Coal	38	10116	34.49556	3371.596034	3371.6	4378701299	388881199.5	
Non-fossil*	36	9563	32.60983	0	0	0	0	
* nuclear or renewable								

We put it all together in a spreadsheet to figure out how to calculate & check results

Files

main.py

bitcoin.csv
equivalencies.csv
power.csv

Packager files

poetry.lock
pyproject.toml

main.py

```
1 # Bitcoin Emissions Calculator
2 # Huan Wang & Tsee Lee, 2020
3 import pandas as pd
4 import datetime
5 import locale
6 locale.setlocale(locale.LC_ALL, '') # Use '' for auto, or force e.g. to
   'en_US.UTF-8'
7
8 #CSV inputs that can be updated as new data arises (eventually can be automated)
9
10 #The power data was extrapolated from two sources:
   https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gas
   es-come-from.php and https://www.eenews.net/assets/2019/03/26/document_cw_01.pdf)
11 power = pd.read_csv("power.csv")
12 power.set_index("Energy Source", inplace=True)
13
```

Approximately 112,285,856 transactions were done globally on Bitcoin from Jan 01, 2020 to Dec 31, 2020

That's the carbon equivalent of 397,971 passenger vehicles being driven for a year.
That's the carbon equivalent of 4,572,221,385 miles driven by the average passenger vehicle.
That's the carbon equivalent of 212,527 US homes' annual energy use.
That's the carbon equivalent of 2,392,994 acres of US Forest annually.
That's the carbon equivalent of 238,026,171,697 smartphones being charged.
That's the carbon equivalent of 398 wind turbines running for a year.
That's also equivalent to the carbon emissions generated from 7,083,805,680,537 credit card transactions, a 63887 times difference.

Approximately 368,920,000,000 transactions were processed by credit cards globally in 2018.

What percentage of those transactions do you think could be replaced by Bitcoin transactions in the future ?

Then we coded