

# Telos Energy Consumption & Competitor Comparison – June 30<sup>th</sup> 2021

## Overview/Introduction

This document was created to support early energy consumption claims surrounding the Telos ecosystem and how much energy the Telos network consumes, in comparison to other blockchains. It's more important than ever that people are educated on exactly how energy is being consumed by any initiative and what impact that has on our world's natural resources. This is particularly important in the blockchain sector, where inefficient networks consume massive amounts of energy with every transaction.

Telos is one of, if not the greenest blockchain out there. The power of DPoS, allows it to remain both efficient and geographically decentralized. With the recent announcement of Telos' [ESG initiative](#), these numbers become even more important for evaluating the importance that the Telos ecosystem will play in society.

An audit was recently conducted by the Telos Core Devs & Telos Foundation that looked at 12 of the networks top 42 block producers around the world. With about 25% of the network reporting on energy consumption and more to come, this is far more granular a report than most decentralized blockchains can achieve.

The results found that on average a Telos Block Producer consumes 25.044 kWh/day. Further calculations determined that the entire network only consumes 1,052 kWh/day and 0.0004 TWh/year. When you consider that Telos is one of the fastest blockchains in the industry with a proven metric of 10,000 transactions/second (TPS), it can be calculated that the Telos network could use as little as 0.0000012174166667 kWh/transaction.

Similar calculations were run on competitors based off sources which are cited in this document. Additional iterations of this report will be released in the future, as further data is gathered. This information will be utilized to support a future opportunities for the Telos network to become carbon neutral by working alongside regenerative projects which are part of the Telos ecosystem.

## Telos vs Competitors Energy Consumption

	Bitcoin (BTC)	Ethereum (ETH)	Ethereum 2.0 (ETH)	Ripple (XRP)	Cardano (ADA)	Polygon (MATIC)	VISA	Telos (TLOS)
TWh/Year	126	49	0.02	0.4	0.006	0.0008	0.2	0.0004
kWh/Day	4,234,777,133	135,280,911	67,640	1,023,840	16,428	2,159	562,795	1,052
kWh/Transaction	1,547	104	0.04	0.008	0.0007	0.000003	0.001	0.000001

# Telos vs Competitors Calculations

## Telos Energy Breakdown

### Per Day Math

- 42 BPs
- Each BP uses an average of 25.044 kWh/day
- $25.044 \times 42 \text{ BPs} = 1051.848$
- **1051.848 kWh/day**

### Per Year Math

- $1051.848 \text{ kWh/day} \times 365.24 \text{ days} = 384176.96352 \text{ kWh/year}$
- 1 Terawatt Hours = 1,000,000,000 kWh
- To convert to TWh multiply by 0.000 000 001
- $384176.96352 \text{ kWh/year} \times 0.000 \text{ 000 001} = 0.00038417696352$
- **0.00038417696352 TWh/year**

### Per Transaction Math

- To get per minimum energy per transaction, divide the energy used per second (86400 seconds in a day) by the maximum number of transactions/second (10,000 TPS).
- $1051.848 \text{ kWh/day} \div 86400 \text{ seconds} \div 10,000 \text{ transactions} = 0.0000012174166667$
- $0.021000000000017 \div 10,000 \text{ Transactions} = 0.0000021 \text{ kWh/Transaction}$
- **As little as 0.0000012174166667 kWh/Transaction**

**Sources:** See energy audit, provided by Telos network BPs at the end of this document.

## Bitcoin Energy Notes

- **1546.71 kWh/Transaction**
- **126.09 TWh/Year**
- **Source:** <https://digiconomist.net/bitcoin-energy-consumption/>

### Per Day Math

- $1546.71 \times 1,000,000,000 = 1,546,710,000,000 \text{ kWh/year}$

- $1,546,710,000,000 \div 365.24 \text{ days} = 4234777132.8441572664549337 \text{ kWh/day}$
- **4234777132.8441572664549337 kWh/day**

### XRP Notes

- **0.0079 kWh/tx**
- **Source:** <https://xrpl.org/assets/pdf/xrpl-sustainability-methodology-2020.pdf>

### Per Day Math

- 1500 tps (<https://xrpl.org/overview.html>)
- $1500 \text{ tps} \times 0.0079 \text{ kWh/tx} = 11.85 \text{ kWh/second}$
- 86400 seconds/day
- $11.85 \text{ kWh} \times 86400 = 1023840$
- **1023840 kWh/day**

### Per Year Math

- $1023840 \text{ kWh/day} \times 365.24 \text{ days/year} = 373947321.6 \text{ kWh/Year}$
- $373947321.6 \times 0.000\,000\,001 = 0.3739473216 \text{ TWh/Year}$
- **0.3739473216 TWh/Year**

### Ethereum Notes

- **49.41 TWh/Year**
- **104.41 kWh/Transaction**
- <https://digiconomist.net/ethereum-energy-consumption/>

### Per Day Math

- $49.41 \times 1,000,000,000 = 49,410,000,000 \text{ kWh/year}$
- $49,410,000,000 \div 365.24 \text{ days} = 135280911.181688752601029 \text{ kWh/day}$
- **135280911.181688752601029 kWh/day**

### Ethereum 2.0

- 35Wh/transaction
- **0.035 kWh/transaction**
- <https://blog.ethereum.org/2021/05/18/country-power-no-more/>

### Per Year Math

- 99.95% less energy on Ethereum 2.0 then Ethereum (according to the source above)
- $49.41 \text{ TWh/Year} * 0.0005 = 0.024705 \text{ TWh/year}$
- **0.024705 TWh/year**

#### Per Day Math

- $0.024705 \text{ TWh/year} * 1,000,000,000 = 24705000 \text{ kWh/Year}$
- $24705000 \div 365.24 \text{ Days/year} = 67640.455590844376301$
- **67640.455590844376301 kWh/Day**

#### Polygon Energy Consumption

- 788,400 kWh/year
- **788,400 x 0.000 000 001 = 0.0007884 TWh/year**
- <https://blog.polygon.technology/polygon-the-eco-friendly-blockchain-scaling-ethereum-bbdd52201ad>

#### Per Day Math

- $788400 \text{ kWh} \div 365.24 \text{ days} = 2158.580659292519987 \text{ kwh day}$
- **2158.580659292519987 kWh day**

#### Per Transaction Math

- 7200 TPS (<https://blog.matic.network/7200-tps-achieved-on-matic-networks-counter-stake-testnet/>)
- $2158.580659292519987 \text{ kWh/day} \div 86400 \text{ seconds/day} = 0.024983572445515 \text{ kWh a second}$
- $0.024983572445515 \div 7200$
- **0.000003469940617 kWh/Transaction**

#### Cardano Notes

- 6GWh/Yeah (<https://www.forbes.com/sites/jonathanponciano/2021/05/13/cardano-surges-during-300-billion-crypto-crash-as-musk-eyes-sustainable-bitcoin-alternatives/?sh=707cfd1e259e>)
- 257 Transactions/second (<https://coinmarketcap.com/alexandria/article/a-deep-dive-into-cardano#toc-what-is-cardano-s-transaction-speed-tps->)

#### Per Year Math

- $6 \times 0.001 = 0.006$  TWh/year
- **0.006 TWh/year**

#### Per Day Math

- $0.006 \times 1000000000 = 6000000$  kWh/year
- $6000000 \div 365.24 = 16427.554484722374329$  kWh/Day
- **16427.554484722374329 kWh/Day**

#### Per Transaction Math

- $16427.554484722374329 \div 86400$  seconds/day = 0.190133732462065 kWh/second
- $0.190133732462065 \div 257$  Transactions/second = 0.00073981997067 kWh/Transaction
- **0.00073981997067 kWh/Transaction**

#### Visa Energy Notes

- 148.63 kWh every 100,000 transactions (<https://www.statista.com/statistics/881541/bitcoin-energy-consumption-transaction-comparison-visa/>)
- 138.3 billion total transactions processed in 2019 (<https://usa.visa.com/dam/VCOM/download/corporate-responsibility/visa-2019-corporate-responsibility-report.pdf>)

#### Per Transaction Math

- $148.63 \div 100,000$  transactions = 0.0014863 kWh a transaction
- **0.0014863 kWh a transaction**

#### Per Year Math

- $0.0014863$  kWh/transaction  $\times$  138,300,000,000 transactions/year = 205555290 kWh/year
- $205555290 \times 0.000000001 = 0.20555529$  TWh/Year
- **0.20555529 TWh/Year**

#### Per Day Math

- $205555290$  kWh/year  $\div$  365.24 days/year = 562795.121016318037455
- **562795.121016318037455 kWh/Day**

**Telus Blockchain Network Energy and Carbon Usage**

The purpose of this document is to track energy used to operate and support the Telus Blockchain Network and the CO2 created from that energy consumption. Support companies include block explorers, wallets, service providers- anyone running nodes to add extra services to Telus outside of standard BP functions. Companies that are BPs, but also provide other services (eg. Hyperion, a block explorer, or drain) should separate BP functions from auxiliary functions.

Instructions: list the number of each type of node and energy usage per each in appropriate cells, list misc. equipment such as routers under Support Infra. Note the source of your energy. You may have 1

Standard Physical Server (P) usage (watts) 200 P = Physical Server  
 Standard Virtual Server (V) usage (watts) 100 V = Virtual Server

S = service is being performed by another physical or virtual server calculated under that server's energy usage.  
 "Energy Use" is recorded per server, not totaled

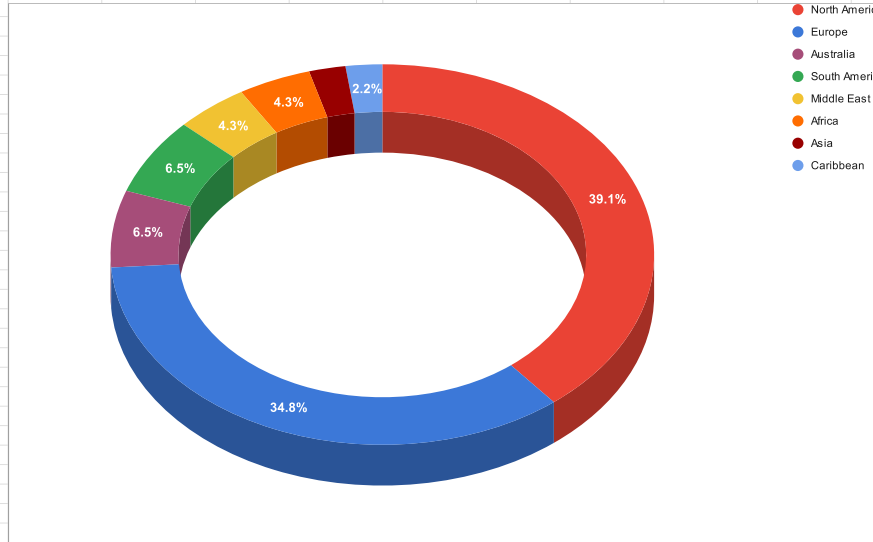
**Block Producers**

Company	BP Node Name	Permitted to Publish name and state	Mainnet BP Node Number	Mainnet BP P2P/Seed Energy Use	Mainnet BP P2P/Seed Nodes #	Mainnet API Node Energy Use	Mainnet API Node Energy Use	Mainnet History Node Energy Use	Mainnet History Node Energy Use	Testnet BP Node Energy Use	Testnet BP P2P/Seed Nodes #	Testnet API Node Energy Use	Testnet API Node Energy Use	Testnet History Node Energy Use	Testnet History Node Energy Use	Oracle Node Energy Use	Oracle Node Energy Use	Misc Node Energy Use	Misc Node Energy Use	Support Infra Energy Use	Mainnet Energy Use	Testnet Energy Use	Misc Energy Use	Total Energy Use (KWH/day)	Energy Source 1 Percentage	Energy Source 1 CO2/KWH	Energy Source 2 Percentage	Energy Source 2 CO2/KWH	Energy Source 3 Percentage	Energy Source 3 CO2/KWH	Energy Source 3 CO2/day	1,000 KG (Metric ton) CO2/year																															
																																	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	Energy Use	
Goodblock	goodblockids	Yes	1	P	4.8	2	V	2.4	1	V	2.4	0	0	1	V	2.4	1	0	0	0	5.76	12	2.4	5.76	20.1%	USA, WA State	100%	0.0241				0.43	0.18																														
CatID5	catid5blocks	Yes	1	P	4.8	1	P	4.8	1	S	4.8	1	S	4.8	1	S	4.8	0	0	0	2.4	14.4	0	2.4	16.8%	San Jose, CA, USA					0.00	0.00																															
The Telescope	thetelescope	Yes	2	P	3.6	1	S	3.6	1	P	3.6	0	1	P	2.4	1	S	0	0	0	3.6	10.8	4.8	3.6	19.2%	Asturias, Spain					0.00	0.00																															
EDSignet	esignetnode	Yes	1	P	3.6	1	V	2.4	1	V	2.4	2	V	2.4	1	V	2.4	0	1	P	2.88	1	2.88	5.76	13.2%	24.2%	Australia, NSW gov	100%	0.0820			1.99	0.73																														
Telus Ltd/mbtd	teluslimtd	Yes	1	P	4.8	1	P	3.12	1	P	6.4	2	P	2.88	1	P	8.4	0	0	0	1	P	2.88	1	2.88	5.76	22.08%	8.4	8.64	39.12%	Calgary, Canada			0.00	0.00																												
Telus Arabia	telusarabia1	Yes	2	P	3.6	1	V	2.4	1	V	2.4	0	2	P	2.4	1	V	2.4	1	V	2.4	1	2.4	2.4	9.6	2.88	24.48					0.00	0.00																														
Telology	telologygts	Yes	1	V	2.4	1	V	2.4	1	V	2.4	1	P	7.728	1	V	2.4	0	0	0	0	2.4	14.028	2.4	2.4	19.728%	Hong Kong, CN					0.00	0.00																														
Kanos BP	kanos&pro	Yes	1	P	4.8	1	V	2.4	1	P	4.8	1	P	4.8	1	V	2.4	1	x	1	V	2.4	1	x	1	V	2.4	1	x	1	V	2.4	2.01	0.73																													
Bold	boldbp	Yes	1	P	4.8	1	V	2.4	1	S	4.8	0	1	V	2.4	1	V	2.4	1	S	0	4	2.4	2.4	7.2	4.8	12	24	undisclosed (use world global average)				0.00	0.00																													
Amsterdam	amsterdam	Yes	1	P	4.8	1	S	4.8	1	P	4.8	0	1	P	4.8	1	S	0	2	3.6	2.4	9.6	9.6	9.6	28.8%	Amsterdam, Netherlands					0.00	0.00																															
The Telus Crew	thetelescope	Yes	1	P	4.8	1	P	4.8	1	S	4.8	1	S	4.8	1	S	4.8	0	0	0	2.4	9.6	0	2.4	12	Frankfurt, German	100%	0.0418				0.50	0.18																														
Cryptolans	cryptolans1	Yes	2	P	3.6	1	P	3.6	1	P	3.6	0	1	P	2.4	1	P	2.4	1	S	0	2	1.2	2.4	14.4	4.8	4.8	24	Germany				0.00	0.00																													
Total Reported																							300.528	KWH/day																																		4.98		1.82			
BP's responding																							12	Average BP		25.044		KWH/day																																52.32		19.11	
Average to G2																							1,051.85	KWH/day																																							
																							KWH/day		TWH/year																																						
																							TX per day	1,982,266	-		1,885.54		txs/KWH																																		
																							Actions per day	8,015,048	-		7,619.97		actions/KWH																																		
																							Max TX per day	864,000,000	-		821,411.46		txs/KWH																																		

Physical Server power consumption (Typical, Full Load Power Intel Xeon E5-2640 v2 20核 2 socket server  
 Source: <http://www.eec.com/~/media/Files/Server/Server-Checklist/2012-03-01-Server-Checklist-8120x-2M.pdf>  
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BY COUNTRY		# of countries:	22
United States	15		
Australia	3		
Canada	3		
Spain	3		
Germany	2		
Italy	2		
Netherlands	2		
Sweden	2		
Argentina	1		
Brazil	1		
Cayman Islands	1		
Croatia	1		
Finland	1		
Hong Kong	1		
Iran	1		
Ireland	1		
South Africa	1		
UAE	1		
Ukraine	1		
United Kingdom	1		
Venezuela	1		
Nigeria	1		
BY CONTINENT			
North America	18		
Europe	16		
Australia	3		
South America	3		
Middle East	2		
Africa	2		
Asia	1		
Caribbean	1		

Telos Validator Geographic Decentralization - by Region



Telos Validator Geographic Decentralization - Country

