

EVM NFT ENERGY CONSUMPTION AND CARBON EMISSIONS FOR A SINGLE TOKEN

Data below represents the kWh and kgCo2 for deploying a single contract, minting a single token, and uploading/writing 5MB of media assets to storage.

METHODOLOGY

<https://github.com/ManyUses/fungyproof-nrg-matrix>

MARKETPLACE METHOD & STORAGE

	MARKETPLACE	CHAIN	KWH / TOKEN	EVM KGCO2 / TOKEN	STORAGE	KWH / TOKEN	KGCO2 / TOKEN
DEPLOY SINGLE CONTRACT	Rarible 721, deploy	Ethereum	311.03	174.81	P2P (ipfs pinning service)	0.00900	0.00375
	Mintbase 721, deploy	Ethereum	306.57	172.31	P2P (Arweave)	0.22502	0.93833
	Rarible 1155, deploy	Ethereum	261.99	147.25	P2P (ipfs pinning service)	0.00900	0.00375
MINT SINGLE TOKEN	Zora 721, mint	Ethereum	294.85	165.72	P2P (ipfs pinning service)	0.00900	0.00375
	MakersPlace 721, mint	Ethereum	235.82	132.55	P2P (ipfs pinning service)	0.00900	0.00375
	Rarible 721, mint	Ethereum	160.70	90.32	P2P (ipfs pinning service)	0.00900	0.00375
	Foundation 721, mint	Ethereum	145.50	81.78	P2P (ipfs pinning service)	0.00900	0.00375
	SuperRare 721, mint	Ethereum	140.11	78.75	P2P (ipfs pinning service)	0.00900	0.00375
	Rarible 1155, mint	Ethereum	113.70	63.91	P2P (ipfs pinning service)	0.00900	0.00375
	Mintable 721, mint	Ethereum	91.20	51.26	Datacenter (AWS)	0.37950	0.15825
	OpenSea 1155, mint	Ethereum	90.46	50.85	Datacenter (Google)	0.37950	0.15825

MARKETPLACE-AGNOSTIC METHOD + STORAGE

METHOD	IPFS	ARWEAVE	DATACENTER
1155 mint	low	low	medium
721 mint	low	medium	medium
1155 deploy	medium	medium	high
721 deploy	medium	high	high

LEGEND

- low consumption
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- high consumption

CLARIFICATIONS

Does not account for batch minting functions.

Does not account for transfers, auction mechanics, or sales.

Storage assumes one initial upload/transfer and write of average media asset size of 5MB with no ongoing storage or network costs.

Arweave storage makes broad assumptions of file sharding methods.

Data Center figures do not factor in green initiatives of platforms.

EQUATIONS

PLATFORM/CONTRACTS

- $gas\ per\ token = \frac{contract\ deploy\ gas}{total\ minted\ tokens} + mint\ function\ gas$
- $kWh\ per\ token = (\frac{total\ ethereum\ kWh}{total\ ethereum\ gas}) (gas\ per\ token)$
- $kgCO2\ per\ token = (gas\ per\ token) (carbon.fyi\ constant)$

DATA STORAGE

Centralized Cloud:

- $kWh\ per\ Token = (total\ data\ center\ energy + data\ transmission\ energy)(Media\ Size) (\#\ of\ Availability\ Zones)$
- OR
- $kWh\ per\ Token = (2.47kWh + 0.06kWh) (5MB) (3)$

Distributed Cloud (P2P):

- $kWh\ per\ Token = (data\ write\ energy + data\ transmission\ energy)(average\ media\ size) (\#\ of\ nodes)$
- OR
- $kWh\ per\ Token = (0.00000kWh + 0.06kWh) (5MB) (3)$

KgCO₂ Calculations:

- $1\ kWh = 0.417\ kgCO2$
- $KgCO2\ per\ kWh = (kWh\ per\ token) (0.417\ kgCO2)$

MARKETPLACE KGCO2

	MARKETPLACE	KGCO2/TOKEN
DEPLOY SINGLE CONTRACT	Rarible 721, deploy	174.81375
	Mintbase 721, deploy	173.2483
	Rarible 1155, deploy	147.25375
MINT SINGLE TOKEN	Zora 721, mint	165.72375
	MakersPlace 721, mint	132.55375
	Rarible 721, mint	90.35375
	Foundation 721, mint	81.78375
	SuperRare 721, mint	78.75375
	Rarible 1155, mint	63.91375
	Mintable 721, mint	51.41825
	OpenSea 1155, mint	51.00825