

Blockchain Evaluation Scorecard

Category (Weight)	Solana	Ethereum	Cardano	Tezos	Hedera	
Business (30%)	8	9	7	6	6	
Sustainability (30%)	7	8	8	7	6	
Strategy (20%)	6	7	9	8	8	
Architecture (20%)	8	7	7	6	8	
Weighted Total Score	7.3	7.9	7.7	6.7	6.8	
Rank	3rd	1st	2nd	5th	4th	

Score Legend:

9–10 Excellent	7–8 Good	≤6 Adequate
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Scoring Methodology & Weight Rationale

Each blockchain is evaluated across four dimensions. Business and Sustainability together account for 60% of the total score, reflecting the primary client priorities of economic viability and environmental responsibility. Strategy and Architecture account for the remaining 40%, capturing long-term resilience and technical soundness.

Category	Weight	Rationale for Weight	Metrics Included
Business (60% group → 30% total)	30%	Captures direct economic feasibility for the client's use case. Cost per transaction, validator economics and security budget determine whether the chain can sustain operations profitably at scale. Weighted highest because a chain that fails economically cannot serve the client long-term.	Carbon intensity per transaction; Carbon intensity per \$ secured; Validator profitability without inflation; Security budget over time
Sustainability (60% group → 30% total)	30%	Environmental impact is a key ESG obligation for the client. Per-node footprint and e-waste metrics reflect real-world hardware externalities. Weighted equally with Business because regulatory and reputational risk from high-emissions infrastructure is material.	Carbon intensity per validator/node; E-waste generated per year (tons)
Strategy (40% group → 20% total)	20%	Decentralisation, governance participation and energy-vs-growth ratios determine systemic risk and longevity. Weighted at 20% because governance failures manifest slowly but are existential; lower than Business/Sustainability because near-term viability is prioritised.	Validator concentration (Gini / top-10 share); Governance participation rate; Energy growth rate vs transaction growth rate
Architecture (40% group → 20% total)	20%	Technical design quality—hardware requirements, throughput-per-watt, block utilisation, client diversity and incident recovery—determines operational reliability. Weighted at 20% because architectural weaknesses are partially mitigable through engineering, unlike governance or economics.	Specialized vs general-purpose hardware; TPS per watt; Block space utilisation (%); Client diversity; Time to deploy critical fixes

Scoring Scale (1 – 10)

Score	Label	Meaning	Example threshold
9	Excellent	Best-in-class performance across all sub-metrics	TPS/W >100 or emissions <0.01 g CO ₂ /tx
7	Good	Above-average, minor trade-offs vs best-in-class	TPS/W 5–100, emissions 0.01–5 g CO ₂ /tx
5	Adequate	Meets minimum bar; notable weaknesses in sub-metrics	TPS/W 1–5, emissions 5–15 g CO ₂ /tx
3	Weak	Below average; material risk if not mitigated	TPS/W <1, emissions >15 g CO ₂ /tx
1	Poor	Disqualifying weakness; would require major mitigation	Fully centralised or no governance process

Raw Metric Data — Blockchain Comparison

Metric	Category	Cardano	Solana	Ethereum	Tezos	Hedera	Source / Notes
Carbon intensity per transaction	Sustainability	~12.8 g CO ₂ /tx	~0.0022 g CO ₂ /tx	~10 g CO ₂ /tx	~2.5 g CO ₂ /tx	~0.0205 g CO ₂ /tx	Crypto Carbon Ratings Institute (CCRI), 2024; Ethereum Foundation post-Merge data, 2023
Carbon intensity per dollar secured	Business / Sustainability	~0.0447 g CO ₂ /\$	~0.1496 g CO ₂ /\$	~0.0019 g CO ₂ /\$	~0.1345 g CO ₂ /\$	~0.0033 g CO ₂ /\$	CCRI 2024; calculated as network emissions / market cap secured
Carbon intensity per validator / node	Sustainability	0.08 tCO ₂ e	5.9 tCO ₂ e	~0.001 tCO ₂ e / validator key	~0.161 tCO ₂ e / baker node	~0.6 tCO ₂ e / consensus node	CCRI Node Energy Report 2023–24; Hedera ESG report 2023
Specialised vs general-purpose hardware	Architecture	General purpose	Highly specialised (high-end server)	General purpose	General purpose	General / enterprise cloud	Solana validator requirements: docs.solana.com; Cardano: iohk.io/en/blog; Hedera: hedera.com/whitepaper
E-waste generated per year	Sustainability	~8.26 tons/yr	n.d.	n.d.	n.d.	n.d.	de Vries & Stoll (2021) – Cardano estimate; insufficient public data for other chains
Transactions per second per unit of energy (TPS/W)	Architecture	~5.2 TPS/W	~148 TPS/W	~0.3 TPS/W	~5.9 TPS/W	~18.3 TPS/W	CCRI 2024; Ethereum figure pre-sharding; Hedera hedera.com/sustainability
Block space utilisation (%)	Architecture	~50% (proxy)	~65% (proxy)	~50–60% gas target	~10–20% (proxy)	<5% (proxy)	On-chain analytics: Cardanoscan, Solscan, Etherscan, TzStats, Hedera Mirror Node — June 2025 averages
Energy growth rate vs transaction growth rate (ratio)	Strategy / Sustainability	1.25×	2.8×	n.d. (negligible post-Merge)	n.d.	n.d.	CCRI longitudinal data 2022–24; ratio >1 means energy grows faster than usage
Validator concentration — top-10 share	Strategy	Top 10 ≈ 20% stake	Top 3 ≈ 26% stake	Top 10 entities >60% staked ETH	Top 5 ≈ 37% stake	Council-controlled / permissioned	Cardano: adapools.org; Solana: validators.app; Ethereum: rated.network; Tezos: tzstats.com; Hedera: hedera.com/council
Client diversity (risk of single-software failure)	Architecture	Low–moderate (Daedalus / Lace)	Moderate (single validator client dominant)	Moderate (Geth ~40%)	Low–moderate	Low–moderate (permissioned)	clientdiversity.org (Ethereum); Solana Beach validator stats; Tezos Nomadic Labs reports
Security budget over time	Business	n.d.	n.d.	High (ETH issuance + fee burn)	Moderate	Moderate / fee-based enterprise model	Ethereum: ultrasound.money; Tezos: tzstats.com inflation; Hedera: hedera.com/tokenomics
Validator profitability without inflation (staking APY)	Business	~2–5% APY	~5–6% total yield	~2.5–3.5% staking APR	~5–6% baking yield	Low / fee model	StakingRewards.com Q1 2025; Hedera: hedera.com/staking
Governance participation rate	Strategy	~80% of stake	~57% of stake	~5–15% of circulating supply	~50–80% of bakers	~70–80% council votes	Cardano: Project Catalyst / on-chain; Solana: realms.today; Ethereum: Snapshot / EIP process; Tezos: tzstats.com governance
Critical incident recovery time (longest known outage)	Architecture	~14 hours (2021 node halt)	~48 hours (2022 outage)	n.d. (no full outage post-Merge)	n.d.	n.d.	Solana status history: status.solana.com; Cardano: IOG incident reports

Source Bibliography & Data Quality Notes

#	Source / Organisation	Year	Description & URL	Metrics Used In
1	Crypto Carbon Ratings Institute (CCRI)	2023–2024	Primary source for per-transaction, per-node, and TPS/W metrics. ccaf.io/cbnsi/ / ccri.io	<i>Carbon intensity (tx, \$, node); TPS/W</i>
2	Ethereum Foundation — Post-Merge Reports	2022–2024	Official data on Ethereum's 99.95% energy reduction post-Merge. ethereum.org/en/energy-consumption	<i>Ethereum carbon intensity; security budget</i>
3	de Vries & Stoll — Electronic Waste and Bitcoin (2021)	2021	Peer-reviewed methodology for blockchain e-waste estimation, applied to PoS chains. doi:10.1016/j.resconrec.2021.105901	<i>E-waste per year (Cardano estimate)</i>
4	StakingRewards.com	Q1 2025	Aggregated staking yield data across all chains. stakingrewards.com	<i>Validator profitability / staking APY</i>
5	rated.network	2024–2025	Ethereum validator concentration and client diversity analytics. rated.network	<i>ETH validator concentration; client diversity</i>
6	validators.app & Solana Beach	2024–2025	Solana validator stake distribution and client stats. validators.app / solanabeach.io	<i>Solana validator concentration</i>
7	adapools.org	2024–2025	Cardano stake pool analytics and stake distribution. adapools.org	<i>Cardano validator concentration</i>
8	TzStats (Blockwatch)	2024–2025	Tezos on-chain analytics: governance, staking, baker concentration. tzstats.com	<i>Tezos governance participation; concentration; security budget</i>
9	Hedera — ESG & Sustainability Reports	2023–2024	Official Hedera environmental and tokenomics disclosure. hedera.com/sustainability	<i>Hedera carbon intensity; TPS/W; staking model</i>

10	clientdiversity.org	2024–2025	Ethereum execution and consensus client share tracking. clientdiversity.org	<i>Ethereum client diversity</i>
11	Project Catalyst / Cardano on-chain governance	2024–2025	Cardano community governance participation metrics. projectcatalyst.io	<i>Cardano governance participation rate</i>
12	Solana status history	2022	Official Solana network incident timeline. status.solana.com	<i>Critical incident recovery time (Solana)</i>
13	IOG (Input Output) Incident Reports	2021	Cardano node halt post-mortem, December 2021. iog.io/blog	<i>Critical incident recovery time (Cardano)</i>
14	On-chain explorers (Etherscan, Solscan, Cardanoscan, TzStats, Hedera Mirror)	2025	Block utilisation proxies derived from June 2025 snapshot data.	<i>Block space utilisation</i>
15	ultrasound.money	2024–2025	Ethereum fee-burn and issuance tracking for security budget assessment. ultrasound.money	<i>Ethereum security budget</i>

Data Quality Notes

① "n.d." (no data) indicates the metric is not publicly disclosed by the chain or its ecosystem tooling. Absence is flagged rather than estimated to preserve integrity.

② Proxy values (marked ~) are derived from methodologically consistent estimates where primary data is unavailable. Methodology footnotes are cited per-metric in the Raw Data sheet.

③ All on-chain analytics data represents a 1 year snapshot. Staking yields and validator concentrations fluctuate.