OFFICIAL WHITEPAPER — English Version

Executive Summary

The Global HashCost Index (GHI) is an open standard estimating the real cost of producing Bitcoin across major mining regions and at the global level. It relies on independent data, a transparent methodology, and an auditable Python engine. It provides, for each day, a floor price (min), a median price (avg), and a ceiling price (max) of the cost to produce one bitcoin.

GHI addresses a growing institutional need: measuring risks, informing public policy, harmonizing datasets, and establishing an objective and reproducible comparison framework.

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1. Context & Challenges

Economies are increasingly interested in Bitcoin's systemic role. Yet no unified indicator measures its production cost accurately.

Three issues dominate:

1. Incomplete and often opaque data.
2. Non-reproducible methodologies (implicit assumptions, hidden parameters).
3. Simplistic aggregation ignoring regional differences (energy mix, climate, hardware, efficiency).

Without a reliable metric, public decisions rely on imprecise estimates, leading to potential errors in analysing economic, energy, and environmental impacts.

GHI establishes a globally auditable framework, enabling a coherent and neutral understanding of the sector.

2. Philosophy & Principles

The model is built on five foundational principles:

1. **Methodological neutrality**: no political, energy-related, or financial bias.
2. **Open-source**: public, verifiable Python engine.
3. **Independence of data**: multiple sources unrelated to mining operators.
4. **Hashrate-weighted aggregation**: each region's weight depends on its computing power.
5. **Full transparency**: documented assumptions, sources, limitations, and versions.

3. Model Methodology

The GHI model calculates the cost of production using three values: min, avg, max. The logic is based on three layers.

3.1. Fundamental Variables

• Electricity price (€/kWh)

• ASIC efficiency (W/TH)

• Average regional temperature (cooling impact)

• Cooling type (air, immersion, hybrid)

• Hardware depreciation

• Energy mix

3.2. Regional Cost Calculation

For each region:

Cost = (Electricity price × Energy consumption × Cooling factor) + Hardware amortization

3.3. Global Aggregation

Each region is weighted according to its estimated hashrate (pool share + geographic distribution + official adjustments).

3.4. Min–Avg–Max Scale

• **Min**: optimal scenario (cheapest mix, most efficient ASICs)

• **Avg**: weighted average conditions

• **Max**: most expensive region/hardware

3.5. Handling Uncertainty

The model integrates:

• confidence intervals,

• weather variability,

• hardware market ranges,

• dispersion across mining farms.

4. Data Sources

The model uses public, commercial, and statistical datasets:

• regional electricity prices,

• ASIC efficiency (manufacturer data),

• NOAA/Copernicus temperature data,

• regional hashrate estimates via pools + institutional confirmations,

• BTC price via aggregated indices (Kaiko, CoinMetrics).

All sources are versioned and published.

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5. API Architecture & Snapshots

The FastAPI-based API exposes:

• **/v1/ghi/snapshot**: daily global state

• **/v1/ghi/regions/{id}**: regional details

• **/v1/ghi/history**: full historical data

• **/v1/ghi/stats**: advanced statistics

Daily refresh; strict versioning; CSV/JSON compatibility.

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6. Governance

Four bodies:

1. **Scientific Committee**: technical oversight
2. **Methodology Committee**: update validation
3. **Institutional Committee**: liaison with regulators
4. **Technical Maintainer**: engine, API, Git repository

Every methodological change is versioned and documented.

7. Institutional Use Cases

• Central banks: macroeconomic risk analysis

• Regulators: neutral basis for ESG/energy reports

• Funds: cost as a fundamental support indicator

• Mining companies: stress-tests, regional competitiveness

• Governments: guidance for digital energy policies

8. Comparison: GHI vs Cambridge CBNSI

Cambridge provides a global energy indicator.

GHI provides a regionalized economic cost indicator, with:

• regional granularity and energy-mix breakdown,

• hashrate-based weighting,

• full formula transparency,

• open API,

• a unique min–avg–max logic.

For institutional use, GHI enriches and complements Cambridge.

9. Long-Term Vision

GHI aims to become a global standard through:

• integration into macroeconomic models,

• adoption by international institutions,

• quarterly public publications,

• progressive compatibility with IFRS/IAS norms.