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Coinmotion Oy

ENVIRONMENTAL IMPACT DISCLOSURE OF CONSENSUS MECHANISMS

INTRODUCTION

This document provides information about the (adverse) environmental impacts of consensus mechanisms used by crypto-assets available through Coinmotion's services, as required by Article 66(5) of the Markets in Crypto-assets Regulation (MiCA).

BACKGROUND NOTE

While MiCA requires crypto-asset issuers to provide detailed environmental impact information in their white papers, many existing crypto-assets do not yet have MiCA-compliant white papers with such information. This document provides general information about the environmental impacts of different consensus mechanisms based on publicly available sources.

MAIN CONSENSUS MECHANISMS AND THEIR ENVIRONMENTAL IMPACTS

1. **Proof of Stake (PoS) and its variants (including Delegated PoS, Nominated PoS, Pure PoS, Ouroboros)**
    - Energy Consumption: Generally low energy consumption compared to Proof of Work; the Proof-of-Stake validator nodes usually have high data storage, high network bandwidth and low network latency requirements, but low energy consumption requirements.
    - Estimated annual energy consumption: Varies significantly by network size but typically ranges from 0.001% to 1% of comparable PoW networks
    - Primary environmental impacts:
        - Minimal hardware requirements
        - Generally low carbon footprint due to relatively low energy consumption
        - Limited electronic waste generation

    Source: Ethereum Foundation, 2023 (Post-merge environmental impact data)

2. **Proof of Work (PoW)**

    - Energy Consumption: Significant energy usage depending on the network total hash rate; however, the energy usage is highly variable on demand and can be used to balance electricity grids and bootstrap isolated renewable energy sources.
    - Environmental impacts:
        - High electricity consumption
        - Substantial carbon footprint depending on energy sources used for PoW mining operations; for example it is estimated that less than half of Bitcoin mining is done with fossil energy sources
        - Electronic waste from mining equipment

    Sources: Cambridge Bitcoin Electricity Consumption Index

3. **Proof of Authority (PoA)**
    - Energy Consumption: Significantly lower than PoW systems due to limited validator set
    - Energy Source Mix: Determined by validator locations
    - Energy Intensity: Not publicly quantified, but inherently lower than PoW due to architectural differences

4. **Byzantine Fault Tolerance (BFT) based mechanisms**
    - Energy Consumption: Generally comparable to PoS systems
    - Energy Source Mix: Varies by implementation and validator distribution
    - Energy Intensity: Not publicly quantified

5. **Hybrid Mechanisms (e.g., Proof of History + PoS, Tree-Graph)**
    - Energy Consumption: Varies significantly by implementation
    - Energy Source Mix: Dependent on specific implementation and validator distribution
    - Energy Intensity: Varies by implementation

METHODOLOGY AND DATA LIMITATIONS

This information is based on publicly available sources and research. Specific consumption data for individual crypto-assets may vary significantly e.g. based on:

- Network size and activity
- Implementation details
- Geographic distribution of validators

- Energy sources used

IMPORTANT NOTES

1. **Data Availability:** Detailed environmental impact data (such as specific metrics for water consumption, waste generation, etc.) is not consistently available across all consensus mechanisms or crypto-assets.
2. **Variability:** Environmental impacts can vary significantly even within the same consensus mechanism type based on implementation and scale.
3. **Evolution:** Consensus mechanisms and their environmental impacts are continuously evolving as technology improves.