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BRICS INDUSTRIAL INNOVATION CONTEST 2026

Eco-Cipher: The Privacy-First Industrial Symbiosis Grid

Speaker: Winsont Desvio Wu

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Basic Project Information

1.1

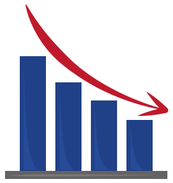
Problem & Solution

01 The Threat to BRICS Exports **(The Problem)**

The Carbon Tariff (CBAM 2026 Full Enforcement)

In 2026, the EU's Carbon Border Adjustment Mechanism (CBAM) transitions to full enforcement. This directly targets **high-emission BRICS exports** (Steel, Aluminum, Cement, Fertilizers).

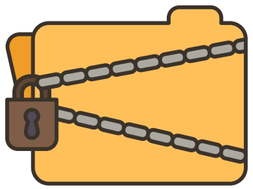
The Impact:
Up to **20% drop** in export volume & billions in tax penalties.



The Sovereignty & Privacy Ultimatum

To avoid these financial penalties, BRICS exporters must prove their green compliance and carbon intensity to Western regulators.

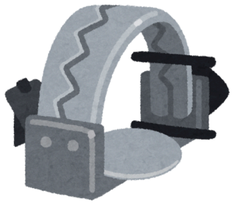
The Crisis:
Forcing the exposure of highly sensitive supplier networks and sovereign trade secrets.



The Internal Deadlock (The Missing Link)

To survive the tariff, factories must lower their carbon footprint internally through Industrial Symbiosis (exchanging waste and energy with neighboring factories).

The Trap:
Trapped between Western regulators and exposing production capacity to local competitors.



Source: ADB.ORG

01 The Flaw in Current Auditing **(The Problem)**

Vulnerability by Association

Supply chains are currently audited as a single block. If a single Tier-3 supplier fails environmental standards, the **entire multi-million-dollar export shipment is penalized**. Exporters lack the granular visibility needed to isolate the risk.

The Oracle Problem

Standard tracking databases and basic Blockchains only secure the data after it is entered. They **cannot verify** if the human typing "zero emissions" is telling the truth, leaving the system highly **vulnerable to data manipulation and "phantom credit" fraud.**

02

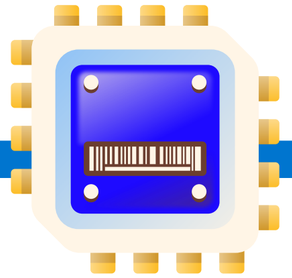
Our Solution: **Cipher-Grid Architecture**

See Our Prototype : https://eco-cipher-edge-dashboard.vercel.app/?view=overview

Phase 1: Hybrid AI Matchmaker

We bypass manual bias through a tiered system.

- **Tiered Ingestion**: Uses ERP tabular data (Tier-1) or Edge-IoT sensors (Tier-2).
- **Dual-AI Engine:** Automatically matches waste-to-resource.
- **The Goal:** Balances carbon quotas between neighboring factories.



Phase 2: zk-STARK Cryptography

Engine encrypts the AI's matching results.

- **Absolute Privacy:** Encrypts the AI's matching results.
- **Match Hash:** Cryptographically secures the waste exchange agreement.
- **IP Protection:** Never exposes production capacity to local competitors.

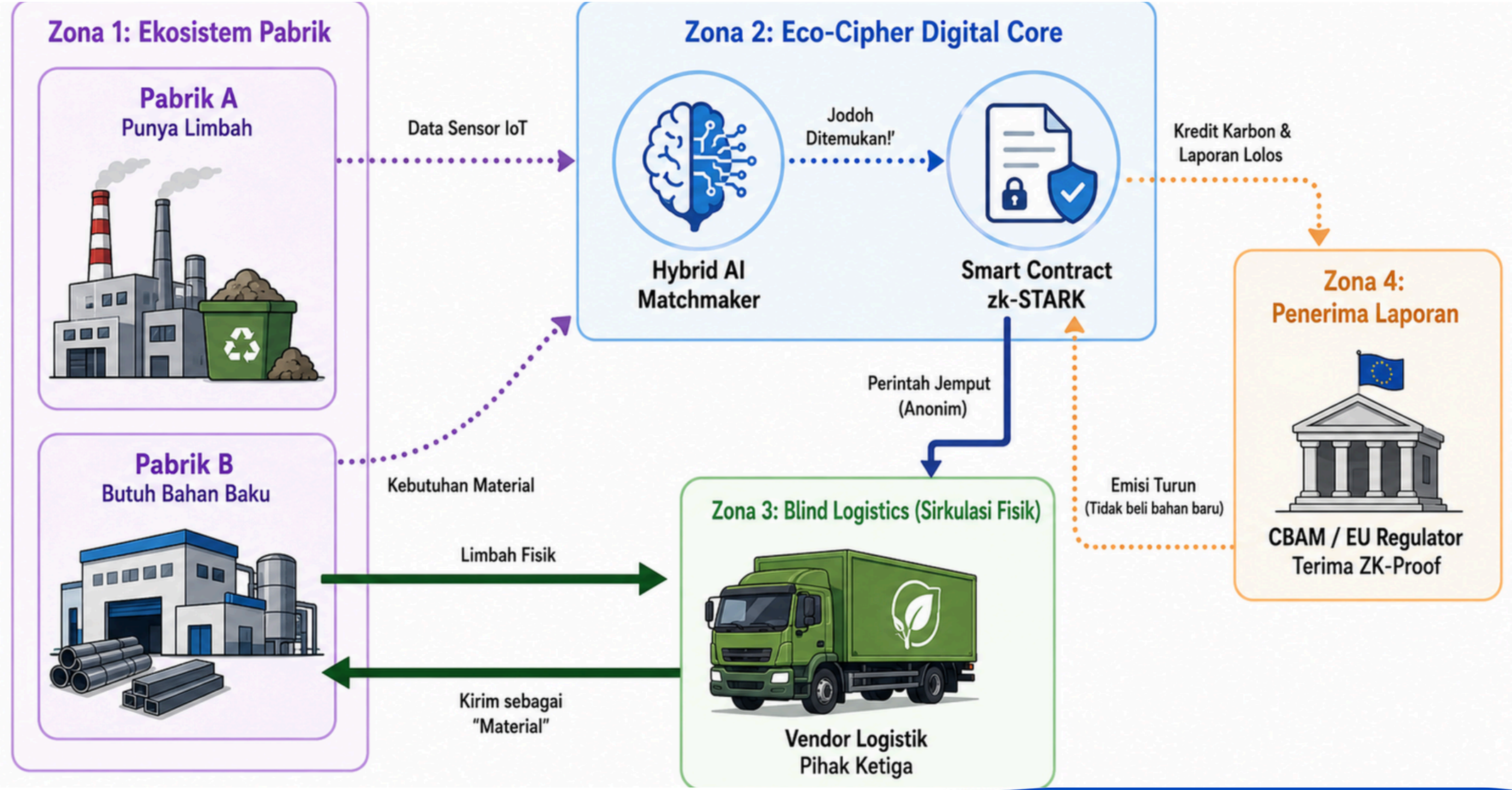
Phase 3: Selective Disclosure

Compliance without accessing corporate IP.

- **STARK Proofs:** Generated upon successful symbiosis execution.
- **Public Verifier:** Yields a definitive "Pass/Fail" green compliance grade.
- **Zero Exposure:** CBAM regulators audit without accessing corporate data.

Existing solutions (Watershed, Persefoni, South Pole) report carbon data. They do not protect it. Eco-Cipher is the first platform that treats privacy as a technical guarantee, not a policy promise.

Our Solution: **Cipher-Grid Architecture**



Existing solutions (Watershed, Persefoni, South Pole) report carbon data. They do not protect it. Eco-Cipher is the first platform that treats privacy as a technical guarantee, not a policy promise.

1.2 Technical Details

03 Technical Foundation **(The AI Matchmaker Engine)**

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Core Concept & Flow

Eco-Cipher transforms industrial compliance into a profitable, privacy-first circular economy. Our engine replaces manual waste audits with a multi-variable reasoning algorithm, enabling secure Industrial Symbiosis without exposing raw production data.

The Workflow

Ingest

Secure extraction of tabular data from factory ERPs/Manifests.

Process

AI multi-variable matching (Waste -> Resource, Energy -> Carbon Offset).

Handoff

Generating a cryptographic "Match Hash" for ZK-Smart Contract execution.

The Dual-Optimization Engine

Material Symbiosis:
Matches Factory A's chemical/waste output with Factory B's raw material needs, calculating the lowest-carbon logistics route.

Predictive Carbon Balancing :
Forecasts monthly emission anomalies and automatically pairs over-limit factories with under-limit neighbors for carbon credit offsetting.

Tech Stack

Reasoning & Orchestration

Deployed on **Qwen** (Alibaba's advanced LLM ecosystem) for complex tabular data extraction, reasoning-based assessment, and decision logic.

Tabular Engine

Utilizing XGBoost & TabNet for high-speed, accurate classification of chemical compositions and hazard levels.

Forecasting

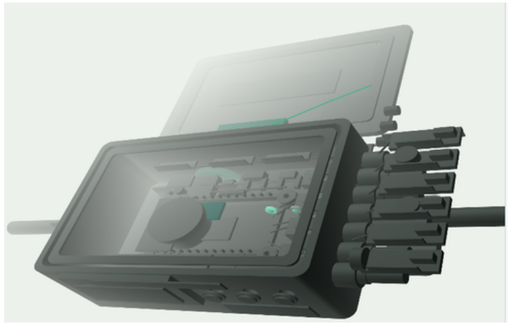
LSTM (Long Short-Term Memory) models for time-series energy consumption prediction.

Data Strategy

Current
Pre-trained on Synthetic Datasets derived from global environmental registries (e.g., E-PRTR).

Future Deployment
Utilizing Federated Learning, allowing the AI to train locally on factory servers. Only model weights are shared, guaranteeing zero raw data leakage

04 Technical Foundation **(The Trust Layer (IoT & ZK))**



details in appendix

Tier-2 Edge-IoT Hardware

- Custom-built microcontroller modules (e.g., ESP32/Raspberry Pi) integrated with localized sensors (gas flow, energy meters).
- **Edge Processing:** Data is processed locally. Instead of sending raw continuous data, the device only computes the aggregated carbon intensity.

Zero-Knowledge Cryptography (zk-STARK)

- **The Shield**: Implements **zk-STARK** protocols to generate cryptographic proofs of emission compliance.
- **Zero-Data Leakage**: Outputs a "True/False" hash. Regulators verify green status with 100% certainty **without exposing proprietary production volumes.**

The Blockchain Ledger

- **Immutable Record**: The ZK proofs and AI Match Hashes are logged onto a secure Layer-2 Blockchain (e.g., Polygon).
- **Smart Contracts**: Automates carbon credit transfers and waste-exchange payments upon verification, eliminating human delays.

1.3

Bussines And Finance

05

Application Prospects & Target Market

Targeting Integrated Ecosystems for Rapid Adoption & Maximum Impact.

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The Pilot Market (Indonesia's Mega-Estates)

- **The Beachhead**: Indonesia's Mega-Estates (e.g., KIIC, Jababeka). Jababeka alone **houses 2,000+** multinational tenants, offering instant massive scale.
- **The Rationale**: Closed ecosystems within a **5-10 km radius**. The perfect sandbox for a circular economy.

The BRICS Expansion (Scalability)

- **The Global Prospect**: Designed to be cloned across **Special Economic Zones (SEZs)** in India, China, and Brazil to combat global CBAM threats.
- **Market Size**: Positioned at the intersection of a **$1.2 Trillion** waste market and an $**800 Billion** carbon compliance market.

The Operational Advantage (Why it Works Here)

- **Micro-Logistics**: Ultra-short distances make waste transport highly profitable with **near-zero carbon emissions.**
- **Centralized Acquisition**: We partner directly with Estate Management. **1 contract = hundreds of factories onboarded**, bypassing traditional B2B friction.

Karawang International Industry City (source: kicc.co.id)

Kawasan Industri Kendal
(source: jabadeka.com)

Sources: PT Jababeka Tbk Corporate Profile; BlomberNEF; Grand View Research Estimates.

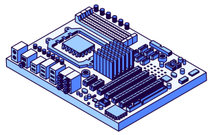
06 Financial Status & Business Model

Current Financial Status

- **Bootstrapped & R&D Phase**: Currently operating on initial grant/competition funding.
- **Objective**: Seeking strategic partnerships and Seed funding to finalize the MVP and deploy the first Tier-1 software pilot in a target Mega-Estate by late 2026.

Tier-1 SaaS (Software Revenue)

B2B Subscription: Charging a fixed monthly licensing fee to Industrial Estate Managements. This grants their tenants access to the AI matchmaking dashboard and basic ESG reporting tools.



Tier-2 HaaS (Hardware Revenue)

Hardware-as-a-Service: For factories requiring high-grade verification (Zero-Knowledge proofing), we lease the Edge-IoT sensors on a monthly contract, creating a recurring and sticky revenue stream.a

The Core Engine (Success Fee)

2-5% Transaction Fee: Taking a small cut from the value of every successful carbon credit traded or waste exchanged. Because we turn their waste into profit, this fee is highly acceptable to factories, driving massive revenue scalability.

1.4

Team Strength and Roles

07 Team Strength & Roles

Winsont Desvio Wu | AI & System Architect

Focus: Deep Learning (ConvNeXt/ViT) architecture and executing the "Dual-Matchmaker" algorithm for waste-to-carbon offsetting.

Gregorius WIllson | IoT & Edge Engineer

Focus: Hardware telemetry, NDIR sensor integration, and ensuring tamper-proof physical data ingestion at the factory edge.

Nicholas Kenny Hendrawan | UI/UX & Platform Designer

Focus: Translating complex Zero-Knowledge cryptographic outputs into an intuitive, seamless Web2 compliance dashboard for regulators.

Greshen Chin | Business & Supply Chain Strategist

Focus: Structuring CBAM monetization, carbon tokenomics, and securing 3rd-party logistics (escrow) partnerships within industrial estates.

Darris Felicio Hartanto | Project Manager & Tech Lead

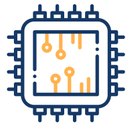
Focus: Overseeing rapid MVP deployment, cybersecurity integration, and ensuring B2B operational compliance across physical and digital workflows.

02

Project Implementation Plan

08 Timeline & Main Activities

Aggressive 6-Month MVP Deployment & Scaling Phase



Prototype & Single-Factory Pilot

Q3 2026

Deploy IoT verification nodes and Edge-AI at one initial pilot factory in KIIC to ensure agile deployment and rapid data validation.

Target Output:

Automate initial data ingestion and successfully train the baseline AI model with real-world waste metrics.

KPI — AI model accuracy ≥ 85% on waste classification within 60 days.

ZK-Ledger & Matchmaker Integration

Q4 2026

Launch the Zero-Knowledge smart contracts and activate the "Dual-Matchmaker" algorithm securely.

Target Output:

Execute the **first successful, anonymous "waste-to-resource"** simulated barter between two factory profiles.

KPI — First anonymous barter transaction executed with proof generation under 30 seconds.

UI Launch & Estate Expansion

Q1 2027

Release the Web2 Regulatory Dashboard and expand IoT nodes to 3 additional factories in the estate.

Target Output:

Deliver a **fully functional ecosystem** where estate managers can **audit anonymous CBAM compliance via ZK-Proofs.**

KPI — 3 factories audited via ZK-proof dashboard with zero manual intervention.

BRICS Cross-Border Preparation

Q2+ 2027 (Scaling)

Adapt the proven MVP architecture to support international carbon data standards.

Target Output:

Position Eco-Cipher for pilot deployments in allied BRICS manufacturing hubs.

KPI — Proof-of-concept data exchange completed with 1 allied BRICS manufacturing hub.

09

Risk Management & System Resilience

Anticipating Bottlenecks in Industrial & B2B Adoption

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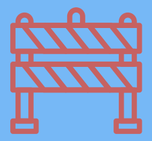
Risk Factor	Mitigation Strategy
 **Corporate Resistance to Data Sharing** Competing factories refuse to share waste and energy data, fearing it will expose proprietary production capacities to rivals.	 **RISC Zero zkVM Integration** Executes "Blind Matchmaking" and verifies CBAM compliance using STARK-based proofs. Guarantees mathematical privacy without ever exposing raw data. (Open-source, production-ready. Used by Starknet and StarkEx in live financial markets.)
 **IoT Failure & Data Manipulation** Physical edge-sensors in harsh factory environments go offline, are damaged, or face tampering, disrupting the data pipeline.	 **Hybrid Fallback System** Auto-switches to software-only ERP APIs if sensors fail. Utilizes satellite data (e.g., ESA Sentinel) to cross-verify physical activity and prevent manipulation. (ESA Sentinel-2 satellite API is publicly available and free-tier accessible for pilot deployment.)
 **The Physical Logistics Gap** Digital anonymity breaks down when physical trucks must transport hazardous waste (B3) directly from Factory A to Factory B.	 **Blind Logistics Escrow** Smart contracts assign encrypted transport mandates to certified 3rd-party vendors. They act as "neutral middlemen," executing physical delivery while preserving total anonymity.

09

Risk Management & System Resilience

Risk Management: Adoption & Compliance

Risk Factor	Mitigation Strategy
Regulatory Legitimacy Gap Current international auditing frameworks (ISO 14064, GHG Protocol) mandate human-readable audit trails. Relying solely on cryptographic ZK-proofs risks immediate rejection by EU CBAM customs or BRICS regulators at border crossings.	**Dual-Output Compliance Engine** Our Selective Disclosure API simultaneously generates two outputs: a secure ZK-STARK proof for on-chain verification, and a human-readable, ISO 14064-formatted PDF for traditional regulators. We ensure Day-1 operational legality under current frameworks while future-proofing the system.
SME Digital Infrastructure Gap A significant portion of factories in Indonesian estates (especially SMEs) lack formal ERP systems. Relying solely on API integrations creates a hard adoption ceiling, breaking the data pipeline before the AI Matchmaker can function.	**Zero-Barrier 3-Tiered Onboarding** We deploy a progressive adoption ladder to guarantee 100% network density from launch: • Tier 0: Standardized CSV manifest upload (requires no API or tech team). • Tier 1: Real-time ERP integration via API. • Tier 2: Full IoT hardware deployment for tamper-proof verification.

03

Patents, Awards, and Media Coverage

10 Track Record & Execution Capability

Blockchain & Smart Contract Architecture

Developer of anti-fraud Ticketing platform using blockchain (**Top 10 Finalist Project at Infinity Hackathon (OJK/Ekraf)**)

AI & Satellite Data Integration

Developer of App for tracking forest fire using Satellite Data and Green Project Rewarding App **(Bussises Plan 2nd Runner Up)**

Financial Regulatory & B2B Execution

Developers of stockpro, an AI platform to analyze and predict stock price; and **winner Elevate Hackathon and Finalist Indonesia Accounting Fair**

Relevance to Eco-Cipher:

- Proven capability in architecting secure smart contracts.
- Deployed decentralized ledgers for B2B industrial transactions.
- Ensures a seamless, risk-free transition to building Eco-Cipher's ZK-Ledger.

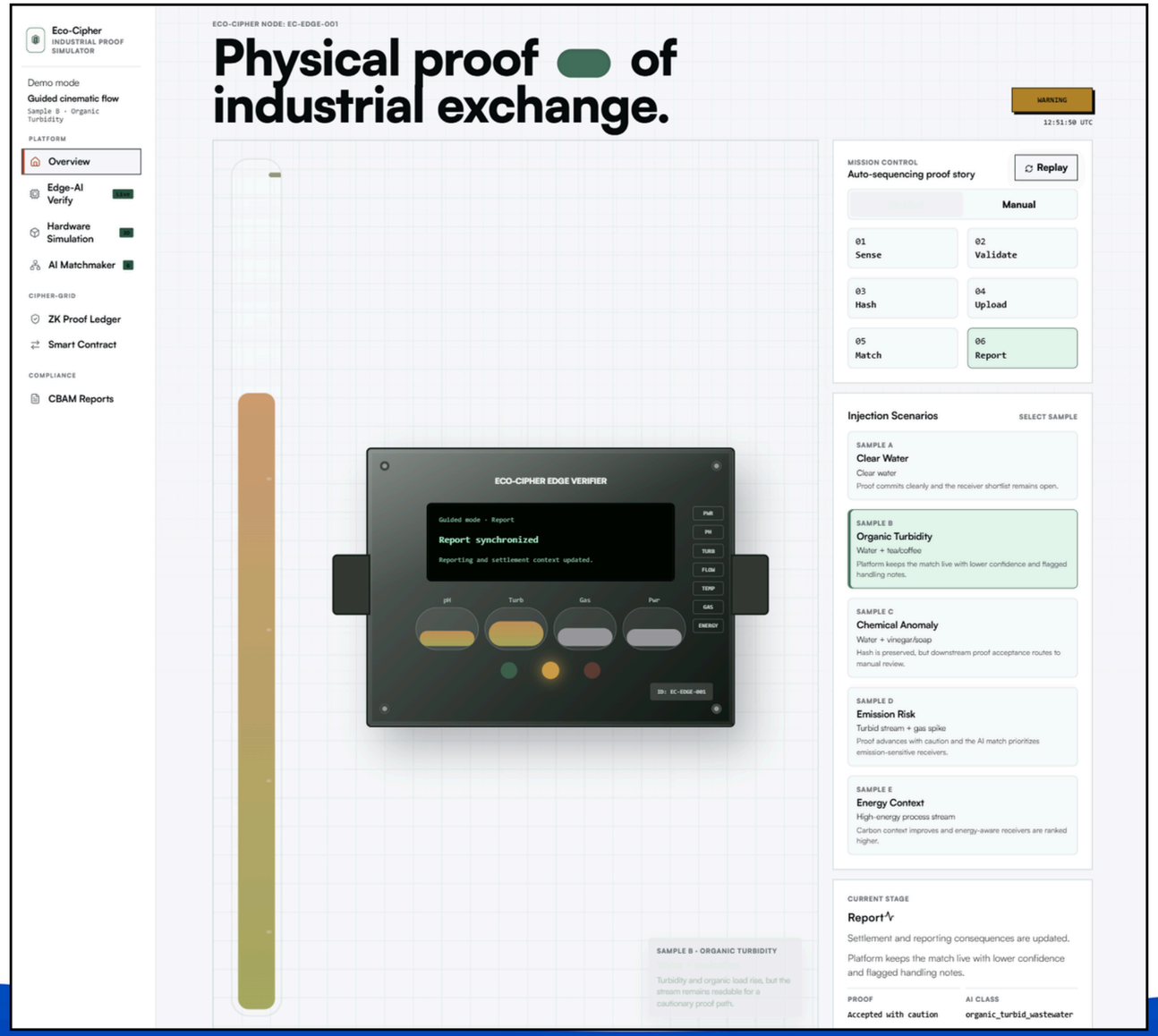
- Processed complex environmental data pipelines.
- Integrated open-source satellite APIs for cross-verification.
- Provides the exact software-fallback protocol required for Eco-Cipher's IoT network.

- Deep expertise in macroeconomic policies and compliance.
- Proven cross-functional B2B tech project management.
- Ensures rapid alignment with CBAM and BRICS financial standards within the 6-month MVP.

04

Appendix or Supporting Material

11.1 UI/UX Platform Mockup

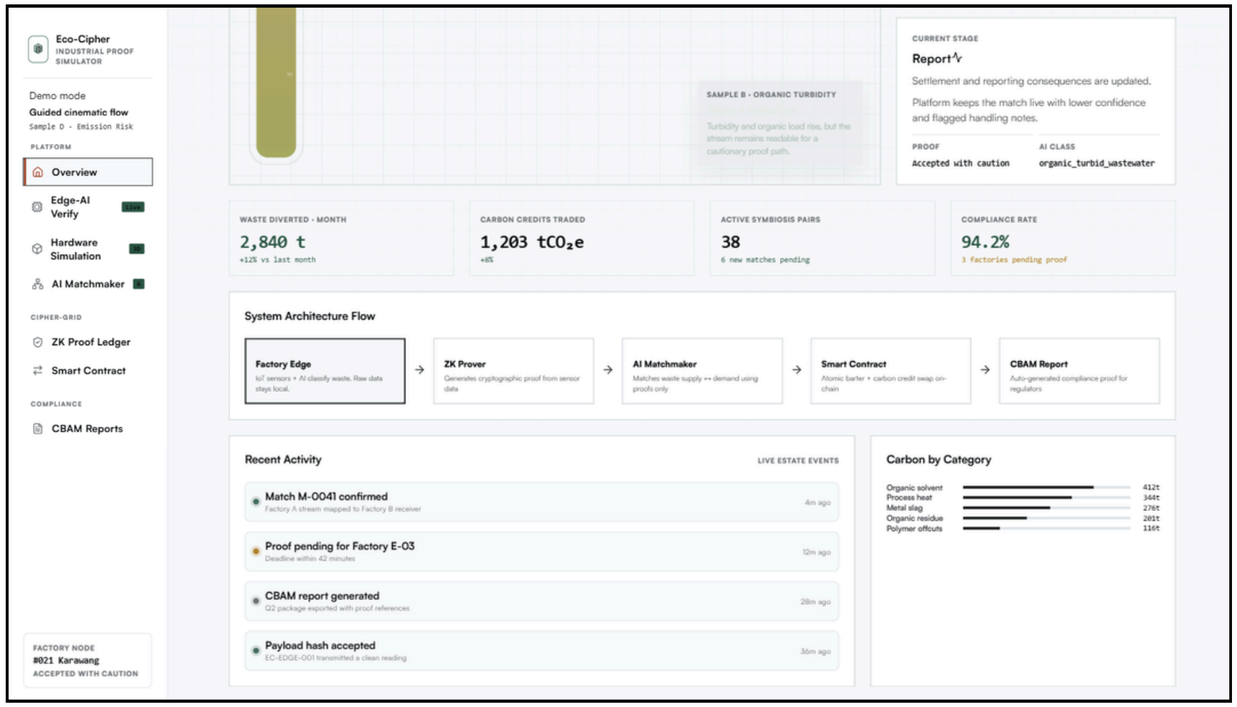


Dashboard Overview Page

This acts as the mission control center for the industrial estate, tracking the system's "waste-to-resource" simulated barter.

It visualizes the high-level impact of our Dual-Optimization Engine, displaying **real-time metrics on waste diversion, active symbiosis pairs, and carbon credit circulation**. It provides estate managers with a **secure, macro-level view of ecosystem health and compliance rates** without exposing individual factory data.

11.1 UI/UX Platform Mockup

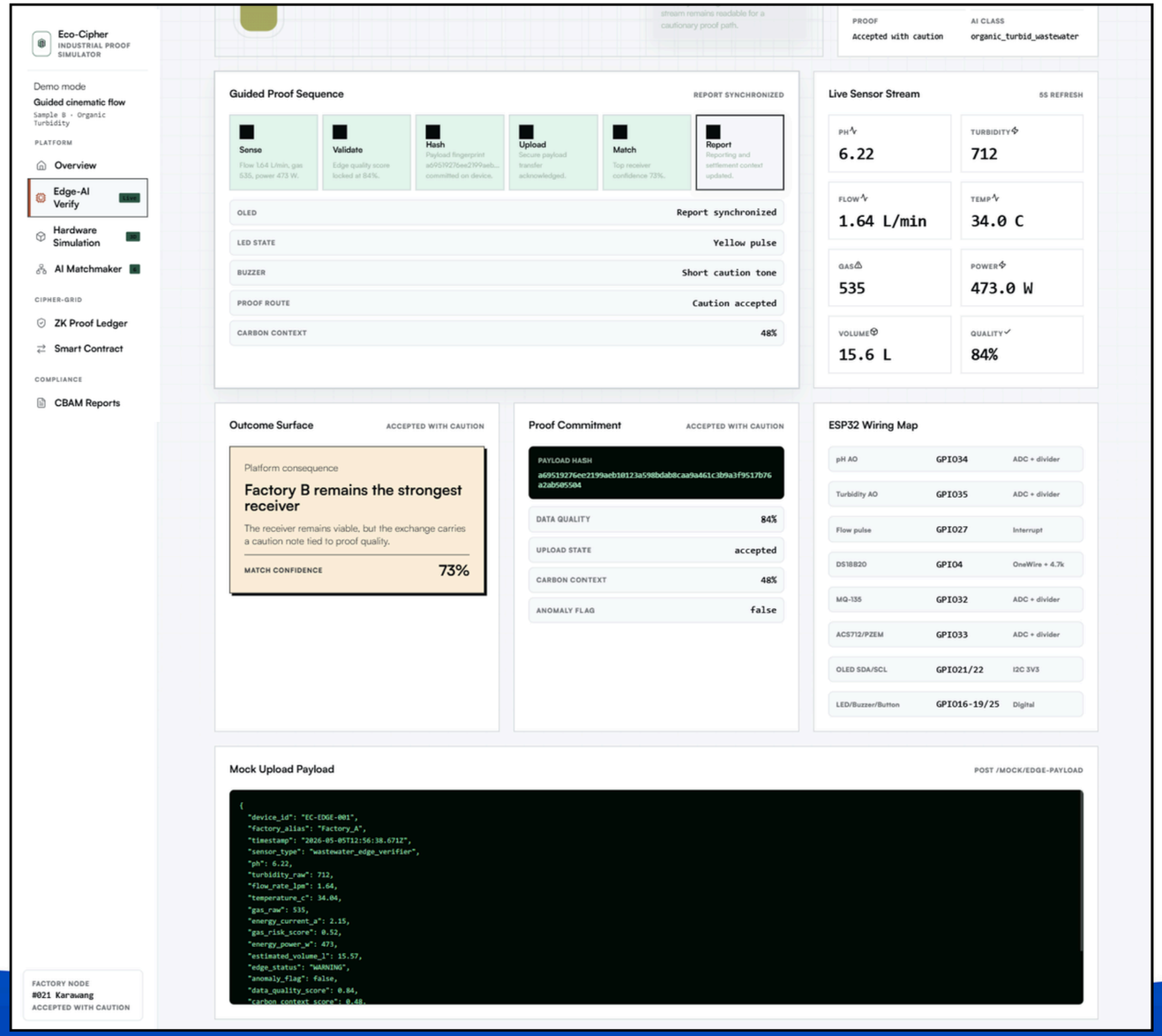


Dashboard Overview Page

Dashboard Overview Page Components:

- **KPI Metrics**: Display four distinct aggregated data points. These function as high-level indicators for:
  - **Waste Diverted**: Total tonnage of industrial waste successfully repurposed.
  - **Carbon Credits**: Total value of digital credits circulating within the network.
  - **Active Symbiosis**: The number of ongoing "waste-to-resource" factory pairings.
  - **Compliance Rate**: The percentage of factories meeting environmental standards.
- **System Architecture Flow**: A visual diagram that describes the data's journey from a physical sensor to a final CBAM report.
- **Carbon by Category**: Horizontal bar charts that categorize waste types, such as Organic Solvents or Metal Slag, showing which materials are most prevalent in the current cycle.

11.2 UI/UX Platform Mockup

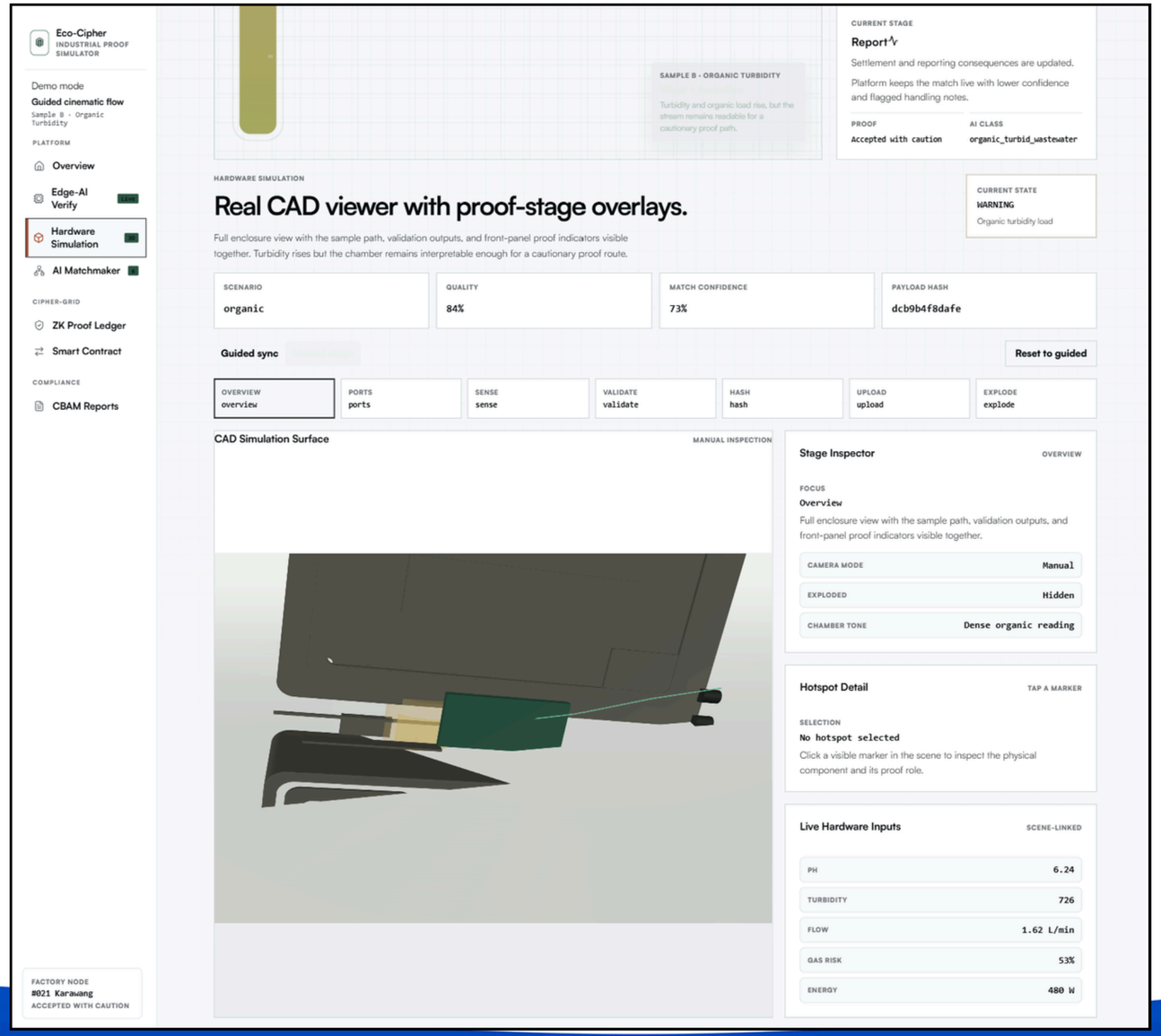


Edge-AI Verify Page

This menu demonstrates how AI technology is deployed locally at the factory site to prevent data tampering.
The Main Components:

- **Guided Proof Sequence**: Visualizes the payload journey; it automatically halts and quarantines evidence if the system detects an anomaly.
- **Live Sensor Stream**: Displays real-time telemetry (pH, flow, gas, power) used by the Qwen LLM and TabNet engine for material reasoning.
- **Outcome & Commitment**: Reports the immediate platform consequence, such as halting receiver rankings, while displaying the unique Payload Hash for the session.
- **Hardware Transparency**: Provides an ESP32 Wiring Map and Mock Upload Payload to offer technical auditors full visibility into sensor-to-code transitions.

11.3 UI/UX Platform Mockup

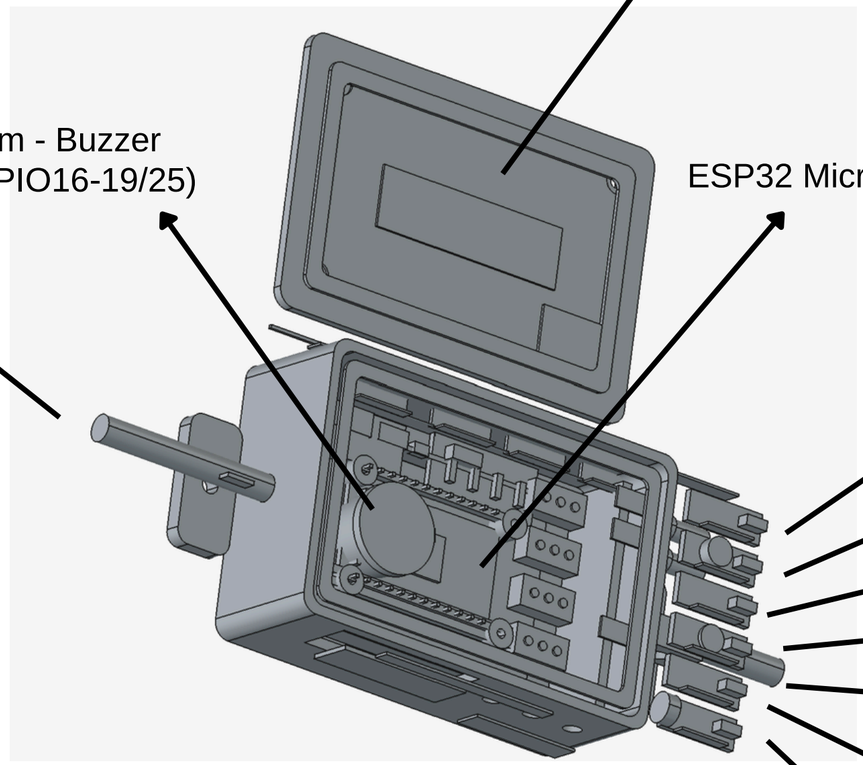


Hardware Simulation Page

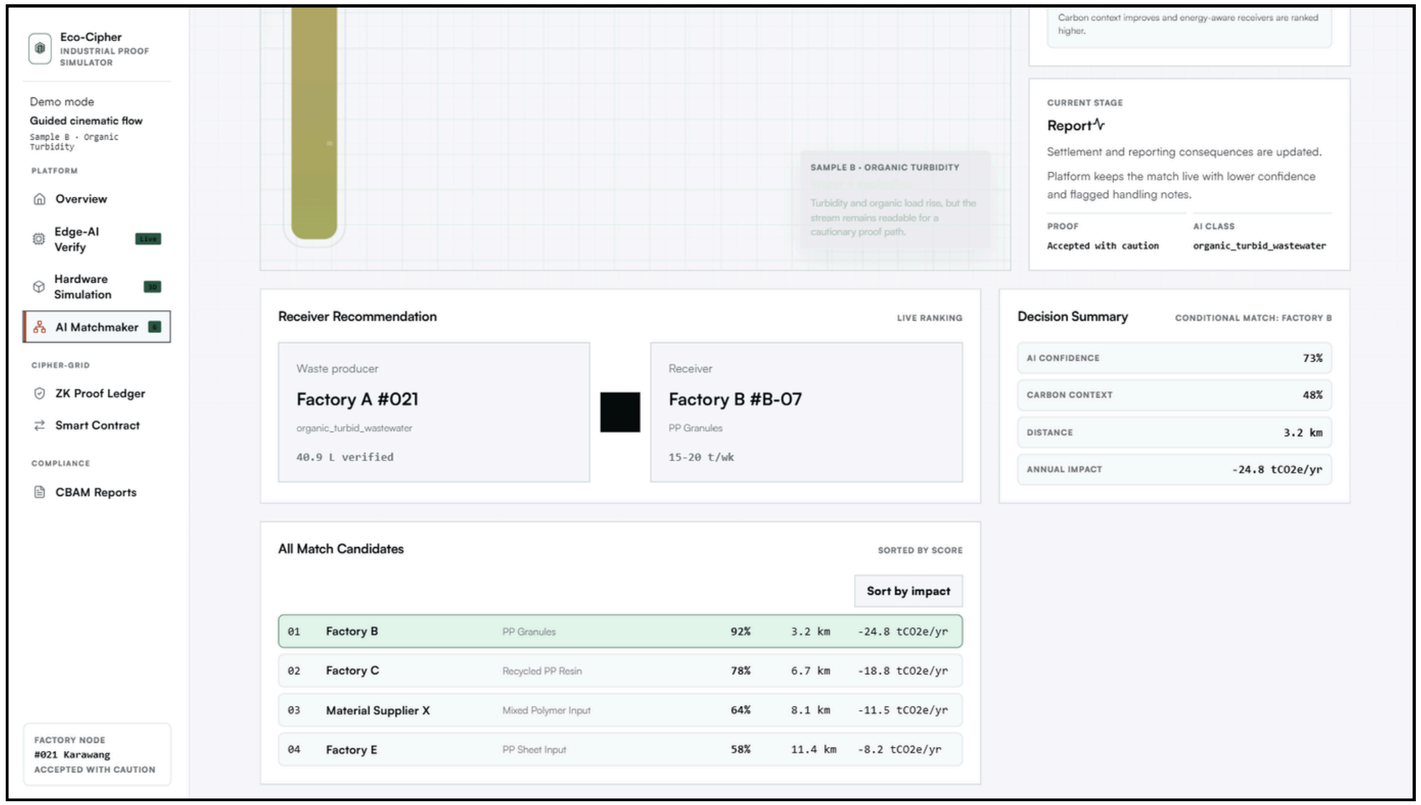
The Stage Inspector provides an interactive 3D hardware simulation that acts as a digital twin for our physical edge nodes, ensuring total transparency of the data ingestion process. It visualizes the **end-to-end journey of waste metrics, from raw electrical signal sensing and local classification to the generation of tamper-evident cryptographic hashes**. By utilizing 'exploded' views to inspect internal sample paths and controller zones, it offers physical proof of data integrity before any evidence enters the Cipher-Grid. This simulation is critical for regulatory auditing, as it demonstrates exactly how raw sensor states are converted into secure, structured payloads.

11.3 UI/UX Platform Mockup

Hardware Simulation Page



11.3 UI/UX Platform Mockup



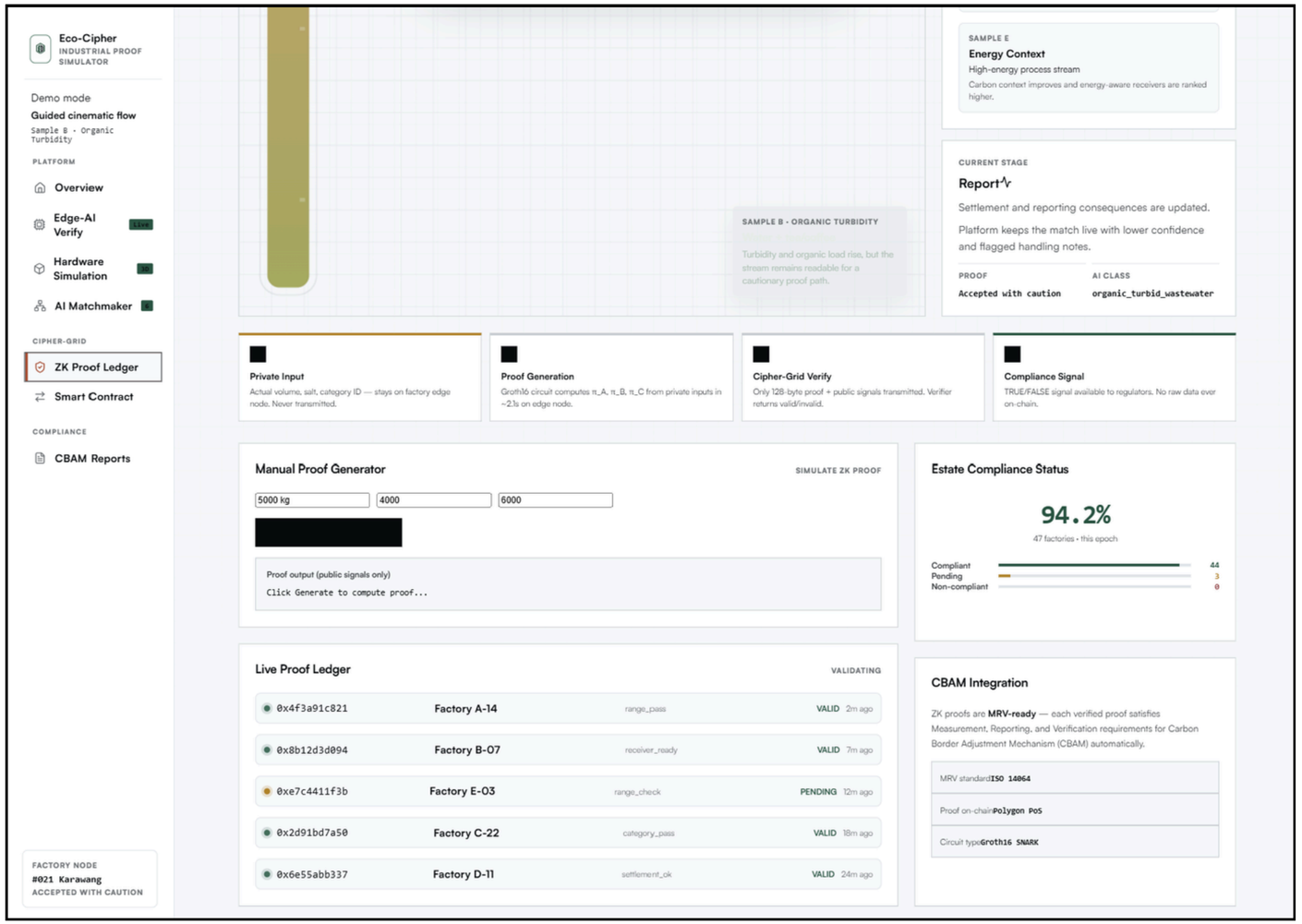
AI Matchmaker Page

The AI Matchmaker acts as the **system's autonomous core**, replacing manual waste audits with a multi-variable reasoning algorithm to identify industrial symbiosis opportunities. It executes "Material Symbiosis" by **pairing anonymous waste producers with compatible material receivers**.

The Main Components:

- **Receiver Recommendation**: Pairs factories for "waste-to-resource" barters while maintaining anonymity until both parties confirm the match.
- **Decision Summary**: Displays critical KPIs including AI Confidence, Carbon Context, Logistical Distance, and Annual Impact (e.g., -24.8 tCO2e/yr).
- **Match Candidates Table**: Ranks all potential symbiosis pairings using Predictive Carbon Balancing to prioritize the lowest-carbon logistics routes.
- **Reasoning & Orchestration**: Utilizes a Tabular Engine (XGBoost/TabNet) to classify chemical compositions and hazard levels securely.

11.4 UI/UX Platform Mockup



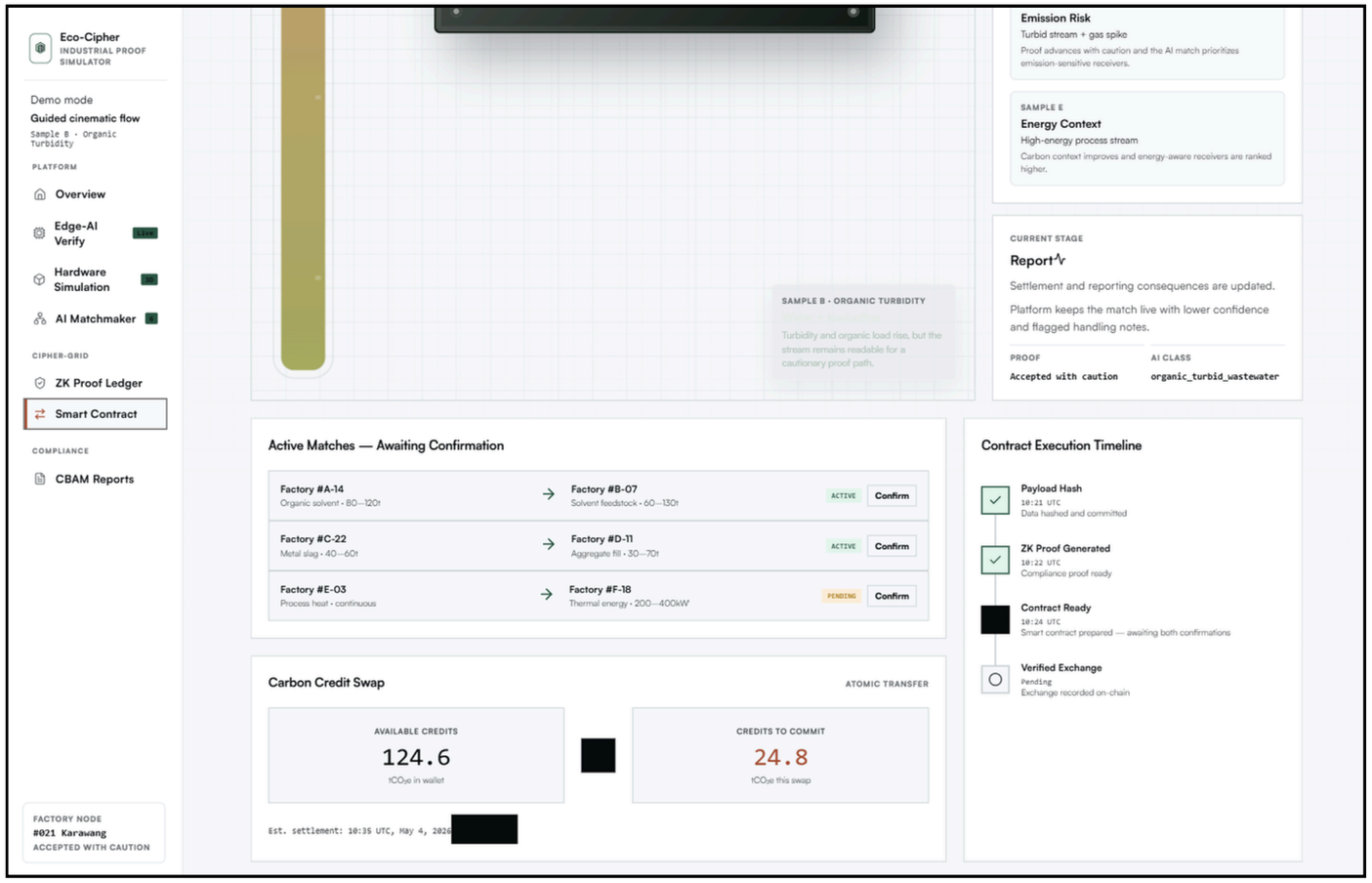
Cipher-Grid (ZK Proof Ledger) Page

The Cipher-Grid serves as the **system's primary defense against corporate resistance to data sharing,** allowing factories to prove compliance without exposing proprietary production secrets. It utilizes zero-knowledge cryptography to ensure that only mathematical "proofs" of truth are transmitted to the network.

The Main Components:

- **Manual Proof Generator**: An interactive tool that simulates the generation of ZK-proofs, transforming private factory inputs into public cryptographic signals.
- **Estate Compliance Status**: A macro-level gauge displaying the total compliance rate across the industrial zone, proving the system can be audited without data leakage.
- **Live Proof Ledger**: A real-time feed of cryptographic receipts and hashes, providing a transparent, immutable record of all verified factory declarations.
- **CBAM Integration**: Outlines technical standards, including ISO 14064 compliance and Polygon PoS on-chain verification, ensuring the estate is ready for international carbon border adjustments.

11.5 UI/UX Platform Mockup



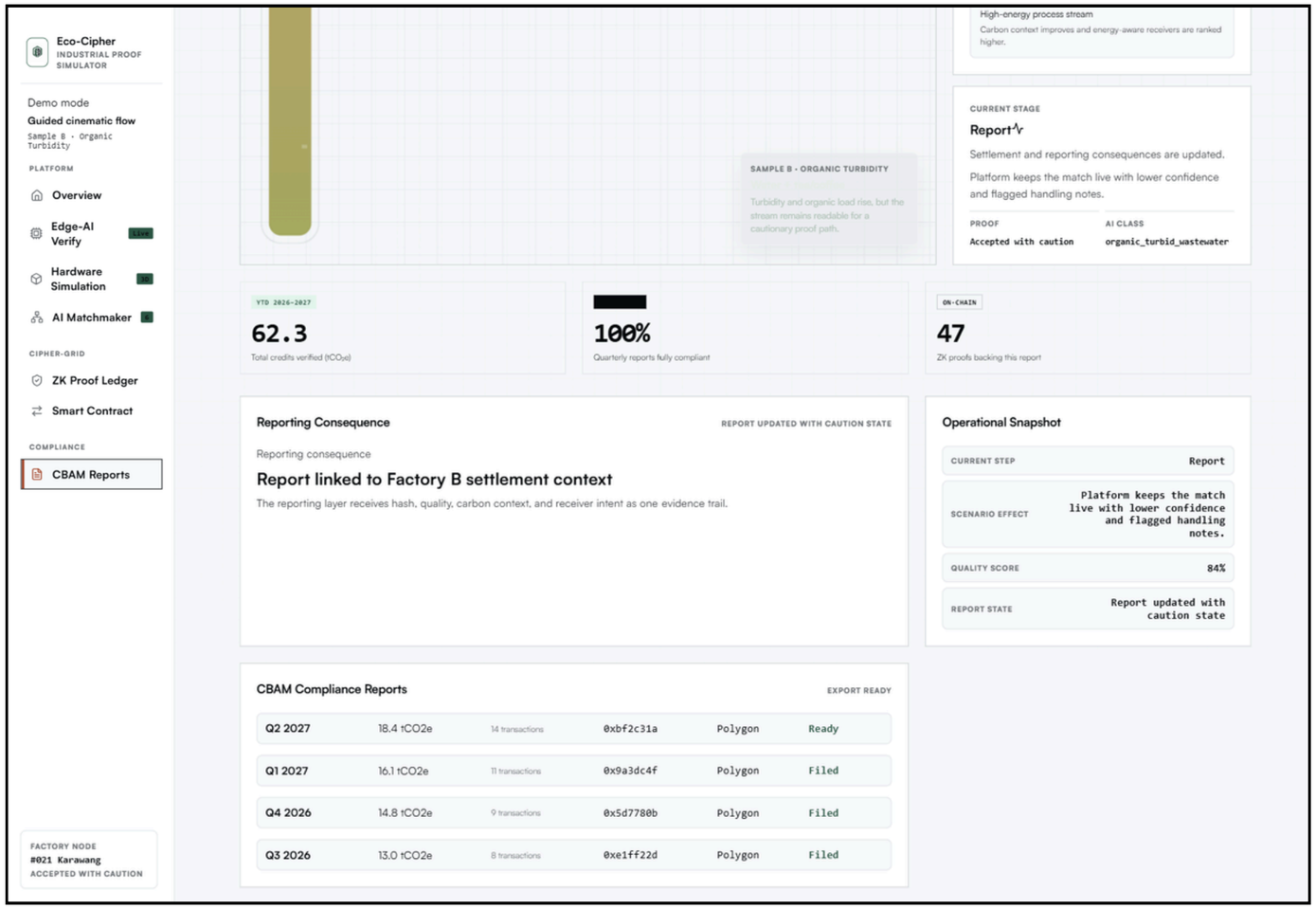
Smart Contract Exchange Page

The Smart Contract Exchange page **manages the secure, trustless execution of industrial barters** using digital escrow and atomic swap mechanisms. It bridges the gap between digital matching and physical resource transfer.

The Main Components:

- **Active Matches**: Displays anonymous "waste-to-resource" pairings awaiting final confirmation from both parties to trigger the Blind Logistics Escrow.
- **Atomic Carbon Credit Swap**: Visualizes the secure transfer of carbon offsets from the factory wallet, ensuring that material delivery and credit allocation happen simultaneously.
- **Contract Execution Timeline**: Provides an immutable audit trail of the transaction status, from initial Payload Hashing to final Verified Exchange recorded on-chain.
- **Blind Logistics Escrow**: Enforces physical anonymity by assigning encrypted transport mandates to certified third-party vendors who verify delivery without exposing factory identities.

11.6 UI/UX Platform Mockup



CBAM Reports Page

The CBAM Reports page **bridges local industrial operations with international regulatory frameworks**, specifically the EU Carbon Border Adjustment Mechanism. It utilizes a Selective Disclosure API to generate human-readable, ISO 14064-compliant documentation alongside on-chain verification.

The Main Components:

- **Report Summary Cards**: Display high-level aggregates, including total verified credits and the specific number of ZK-STARK proofs backing the report's legitimacy.
- **Reporting Consequence & Snapshot**: Provides an automated audit trail for anomalous data, such as routing suspicious evidence to exception reporting to maintain data pipeline integrity.
- **Compliance Reports Table**: Lists quarterly manifests with their corresponding tonnages, transaction counts, and immutable Polygon blockchain hashes.
- **Scenario Effect Reasoning**: Describes how the AI matchmaker prioritizes emission-sensitive receivers based on the report's Quality Score.

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THANK YOU