



SDG BLOCKCHAIN ACCELERATOR

Prototype (PoC) Report – KarbonLedger

1. Project Information

- **Project Name:** Streamline — Powered by KarbonLedger
- **Challenge & UNDP Office:** CETP Compliance & Climate Credits — UNDP India
- **Document Version:** v1.0

2. Project Overview

This prototype implements a **real-time compliance and climate accounting system** for Common Effluent Treatment Plants (CETPs).

- CETP sensor data is ingested, validated with AI and hashed on the **Cardano blockchain**.
- **Aiken smart contracts** manage the lifecycle of **Carbon Emission Tokens (CETs)** and **Carbon Offset Tokens (COTs)**.
- The **Streamline dashboard** provides operators and regulators a trusted interface for compliance reporting, with SDG-aligned metadata.

3. Repository Structure

```
/prototype
/contracts  → Aiken smart contracts (minting, validation, marketplace,
crowdfunding)
/tests      → Unit tests in Aiken + integration via Blockfrost webhooks
/scripts    → Deployment scripts (CLI tx build, mint, burn)
/docs       → README.md, workflow.md, schema.md, architecture diagrams
/app        → Next.js frontend (dashboards, registry, validator voting)
/db         → Supabase schema (projects, votes, carbon_offset_tokens,
actions)
```

4. Build Instructions

```
# Compile Aiken contracts
aiken build

# Format & check
aiken fmt
aiken check -D
```

- **Dependencies:** Aiken v1.1.17+, Node.js 20+, Supabase CLI, Blockfrost API key.

- **Env Vars:** `BLOCKFROST_PROJECT_ID`, `BLOCKFROST_WEBHOOK_SECRET`, Supabase service role key.

5. Test Instructions

```
# Run Aiken unit tests
aiken test

# Emulator / integration tests
aiken emu

# Webhook tests (simulate tx event)
curl -X POST http://localhost:3000/api/cot-actions \
  -H "blockfrost-signature: <sig>" \
  -d @sample_tx.json
```

- **Expected outputs:** Mint events insert into `carbon_offset_tokens`; burn events marked `retired`; invalid redeemer rejected.
- **Edge cases tested:**
 - Missing signature header → 400 error
 - Token quantity mismatch → 400 error
 - Self-return outputs handled correctly

6. Deployment Instructions

```
# Build transaction
cardano-cli transaction build \
  --testnet-magic 2 \
  --tx-in <UTXO> \
  --tx-out <ADDRESS>+1000000 \
  --change-address <CHANGE_ADDR> \
  --out-file tx.raw

# Sign
cardano-cli transaction sign \
  --tx-body-file tx.raw \
  --signing-key-file payment.skey \
  --testnet-magic 2 \
```

```
--out-file tx.signed

# Submit
cardano-cli transaction submit \
  --testnet-magic 2 \
  --tx-file tx.signed
```

- **Prerequisites:** Testnet ADA, running cardano-node, Blockfrost API key.
- **Multiple validators:** Deploy `cet_minter`, `project_validation`, `marketplace` contracts sequentially, with corresponding policy IDs.

7. Testnet Results

Assets:

<https://preview.cexplorer.io/policy/68d6e7d81446bb1b72ef42759185bba6e686fc3111eeb9e9af6bafbe>

Owners:

<https://preview.cexplorer.io/policy/68d6e7d81446bb1b72ef42759185bba6e686fc3111eeb9e9af6bafbe?tab=owners>

Mint:

<https://preview.cexplorer.io/policy/68d6e7d81446bb1b72ef42759185bba6e686fc3111eeb9e9af6bafbe?tab=mint>

Transactions:

<https://preview.cexplorer.io/policy/68d6e7d81446bb1b72ef42759185bba6e686fc3111eeb9e9af6bafbe?tab=tx&page=1>

SDG Metadata:

<https://preview.cexplorer.io/tx/ba00af4ba57d0cddcac13386494edaff23d44f4f549195975ad7a066b9e735d4?tab=metadata>

8. Dependencies & Environment

- **Aiken CLI:** v1.1.17
- **Cardano-node:** v8.9.0
- **Network:** Cardano Preview Testnet
- **Blockfrost SDK:** `@blockfrost/blockfrost-js`
- **Supabase:** Postgres + RLS
- **Frontend:** Next.js, Tailwind, ShadCN

9. Demo / Walkthrough

KarbonLedger Demo:

https://drive.google.com/file/d/140LYjt7JG91XyGWJnSDxcM8fsqj0rMvI/view?usp=drive_link

Registry Demo:

https://drive.google.com/file/d/1yBEs8xL5QNvTamqx73RFUQ_nK8RkoxnL/view?usp=drive_link

UNDP Instance:

<https://karbonledgerundpinstance.vercel.app/>

10. Remaining Issues / Next Steps

- Optimize Aiken contracts to reduce execution units further.
- Expand validator tests for crowdfunding & marketplace flows.
- Deploy from Preview to Preprod testnet for larger-scale stress testing.
- Add DAO governance module for SPCB/community oversight