


Polygon

ERC-21

NFTs

ERC-20 = fungible Carbon Credit

Identification and Verifier Status → Wallet address

Goal: An NGO ("GreenFuture") wants to issue 10,000 Carbon Credits (VCUs) from a mangrove reforestation project, which are then bought by a company ("CleanAir Corp") to offset their emissions.

Block 1

- **Action:** GreenFuture (NGO) registers their project.
- **Transactions in this Block:**
 1. **NGO Registers:** GreenFuture interacts with the `UserRegistry` smart contract to register their public wallet address as an "NGO." This creates a record on-chain, potentially minting a unique "NGO Identity NFT" to their wallet.
 2. **Project Creation Transaction:** GreenFuture then interacts with the `ProjectRegistry` smart contract, providing initial details about their mangrove project (e.g., "Sunderbans Mangrove Project," location coordinates, estimated CO2 capture: 10,000 tonnes).
 3. **NFT Minting:** The `ProjectRegistry` smart contract mints a unique **ERC-721 "Project NFT"** for "Sunderbans Mangrove Project" and assigns it to GreenFuture's wallet.
 - **Project NFT Metadata:** This NFT stores vital metadata like: `Project_ID: #001`, `Name: Sunderbans Mangrove Project`, `Location: [Lat, Long]`, `Est_CO2_Capture: 10,000 tonnes`, `Status: Pending Verification`. It also stores an IPFS hash pointing to the full Project Design Document (PDD) and monitoring plan off-chain.
- **Outcome:** The blockchain now immutably records the existence of "Sunderbans Mangrove Project" and its initial details, represented by a unique Project NFT owned by GreenFuture.

Block 2 =

Block 2: Verification & Carbon Credit Issuance Approval

- **Action:** A qualified Third-Party Verifier ("EcoCert") reviews the project and approves it.
- **Transactions in this Block:**
 1. **Verifier Registration (if not already done):** EcoCert (the verifier) registers their public wallet address as a "Verifier" in the `UserRegistry` (similar to NGO registration).
 2. **Verification Initiation/Report Hash:** EcoCert reviews GreenFuture's detailed PDD and conducts site visits (off-chain). Once satisfied, they generate a comprehensive Verification Report. They then submit a transaction to the `ProjectRegistry` or a `VerificationContract`, attaching:
 - `Project_ID: #001`
 - `Verification_Outcome: Approved`
 - `Approved_VCUs: 10,000`
 - `Verification_Report_Hash: [IPFS hash of EcoCert's detailed report]`
 3. **NFT Minting (Verification Report):** A unique **"Verification Report NFT" (ERC-721)** is minted, linked to `Project_ID: #001`. This NFT acts as the official, signed proof of verification. Its metadata includes the verifier's ID, the outcome, and the approved VCU quantity.
 4. **Project NFT Update:** The `ProjectRegistry` smart contract updates the state of `Project_ID: #001` (the Project NFT's metadata) to `Status: Verified` and records the `Approved_VCUs: 10,000`.
- **Outcome:** The project is officially verified on-chain, and the number of carbon credits it can issue is confirmed. The Verification Report NFT provides irrefutable proof.

Block 3: Carbon Credit Minting & Initial Transfer

- **Action:** The approved carbon credits (VCUs) are minted as ERC-20 tokens and transferred to GreenFuture.
- **Transactions in this Block:**
 1. **Minting Transaction:** GreenFuture, having their Project NFT and the associated Verified status, calls the `CarbonCreditToken` smart contract (our ERC-20 contract for VCUs).
 2. The `CarbonCreditToken` contract checks if `Project_ID: #001` is verified and has 10,000 Approved VCUs.
 3. **Token Creation:** The `CarbonCreditToken` smart contract mints 10,000 ERC-20 tokens (each representing 1 VCU) and transfers them directly to GreenFuture's blockchain wallet address.
 - **Token Metadata (for the ERC-20 type):** These tokens might have metadata like `Token_Symbol: VCU`, `Project_ID: #001`, `Vintage_Year: 2023`.
- **Outcome:** GreenFuture now holds 10,000 tradeable Carbon Credit (VCU) ERC-20 tokens in their blockchain wallet, ready to be sold on a marketplace.

Block 4: Marketplace Sale & Transfer to Buyer

- **Action:** CleanAir Corp buys 10,000 VCUs from GreenFuture on a decentralized marketplace.
- **Transactions in this Block:**
 1. **Listing (Optional, could be separate):** GreenFuture lists their 10,000 VCUs on a decentralized exchange (DEX) or a dedicated carbon credit marketplace smart contract, setting a price.
 2. **Purchase Transaction:** CleanAir Corp, needing to offset emissions, initiates a purchase order on the marketplace.
 3. **Token Transfer:** A smart contract orchestrates the exchange:
 - CleanAir Corp's payment (e.g., stablecoins) is transferred to GreenFuture.
 - 10,000 VCU ERC-20 tokens are transferred from GreenFuture's wallet to CleanAir Corp's wallet.
- **Outcome:** CleanAir Corp now owns 10,000 Carbon Credits (VCU) tokens, which are recorded as being in their wallet on the blockchain. The ownership transfer is transparent and immutable.

