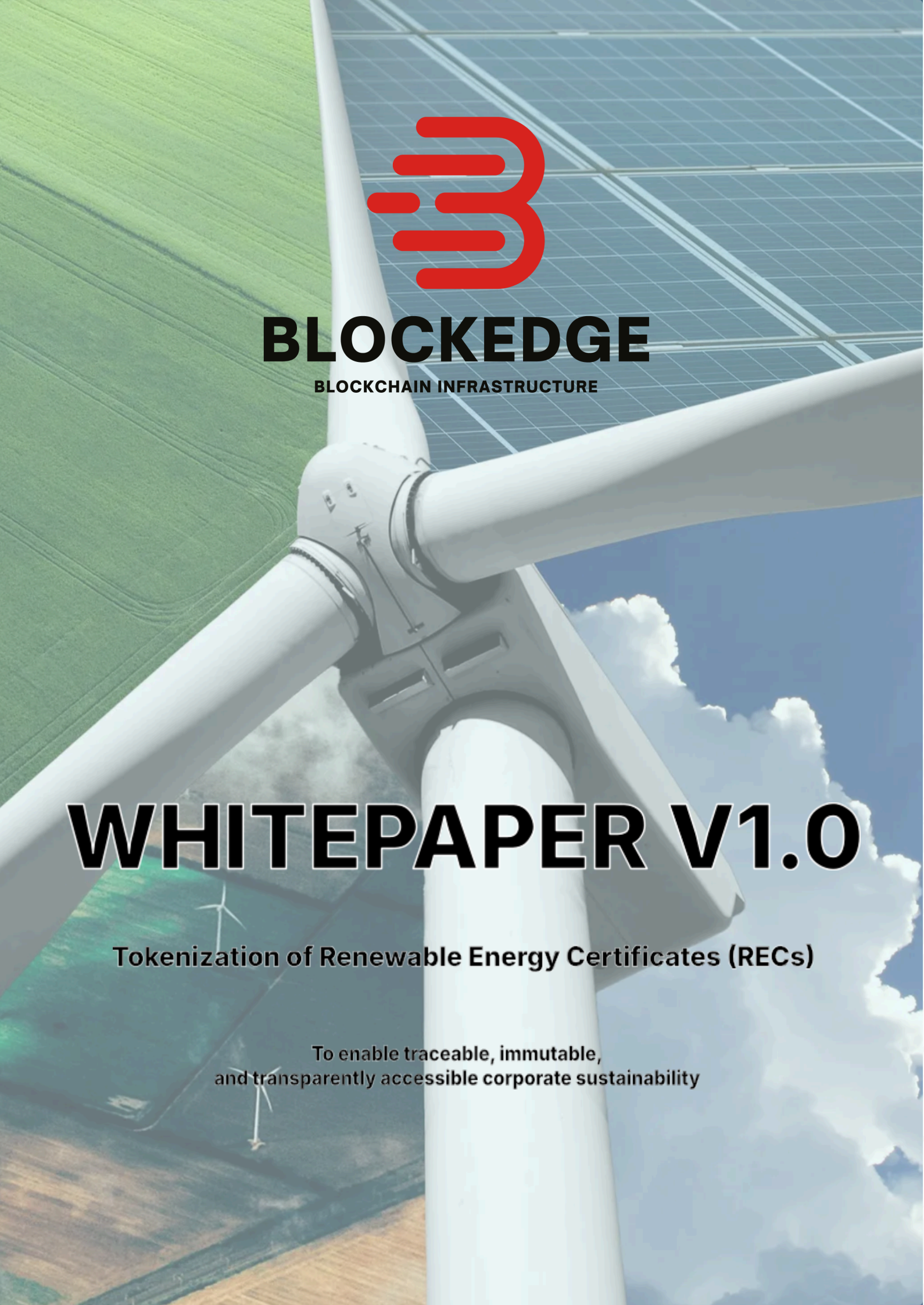

BLOCKEDGE

BLOCKCHAIN INFRASTRUCTURE

WHITEPAPER V1.0

Tokenization of Renewable Energy Certificates (RECs)

To enable traceable, immutable,
and transparently accessible corporate sustainability

Issuer: Blockedge Co., Ltd.

Underlying Asset: Verified Renewable Energy Certificates (RECs)
(1 Token = 1 MWh)

Certification Standard: International REC Standard (I-REC)

Purpose of Tokenization

The tokenization initiative by Blockedge Co., Ltd. aims to enhance the management of Renewable Energy Certificates (RECs) by transforming them into a more efficient, transparent, and accessible digital form.

By converting RECs into blockchain-based tokens, certificate data becomes traceable, verifiable, and tamper-resistant (immutable) throughout the entire lifecycle of the asset.

This structure enables users to conveniently access, manage, and utilize Renewable Energy Certificates in a transparent manner, while supporting their use for renewable energy claims and environmental reporting in a reliable and efficient way.

Certified Custodian: REDEX (via ReHash Platform)
Official Registry: Evident
Smart Contract Auditor: Valix Consulting Co., Ltd.

Risk Warning for Token Purchasers: The purchase of digital tokens involves risks. Purchasers may lose all funds used for the purchase. Prior to making any decision, purchasers should carefully review the information contained in this document and assess the associated risks appropriately. REC Tokens are digital utility tokens designed for the management and verification of Renewable Energy Certificates. They are not financial instruments and are not intended for speculative purposes. These tokens do not provide any guarantee of dividends, returns, or profits of any kind. Purchasers should be aware of the limitations and conditions related to the transfer and use of digital tokens as specified. The publication of this document does not constitute any guarantee of price, returns, or project success.

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Definitions and Glossary

Category: Core Entities & Infrastructure

Blockedge / Issuer

Blockedge Co., Ltd., the technology provider and official issuer of REC Tokens, responsible for platform operations, process governance, and coordination with relevant stakeholders.

REDEX (Custodian)

A certified custodian responsible for holding and safeguarding I-REC certificates on behalf of the system via the ReHash platform, with a clear functional separation from the token issuer.

ReHash Platform

A platform operated by REDEX for the locking, tracking, and management of I-REC certificates to support tokenization and prevent double usage.

Evident

An internationally recognized registry and platform for the issuance, management, and tracking of I-REC certificates.

NetZero Carbon

A strategic partner and asset aggregator responsible for sourcing, selecting, and conducting quality assurance of renewable energy projects prior to tokenization.

CO2e Chain

A Layer 3 blockchain network utilizing Optimistic Rollup technology, designed for recording REC Token transactions.

Central Pool

A liquidity mechanism that aggregates I-REC certificates from multiple projects and jurisdictions into a unified pool, enabling fungibility and system-wide liquidity without binding tokens to specific underlying projects.

Category: Asset & ESG Concepts

Renewable Energy Certificate (REC)

A certificate representing the environmental attributes of renewable energy, where one unit corresponds to the generation of one megawatt-hour (1 MWh) of renewable electricity.

International Renewable Energy Certificate (I-REC)

A globally recognized renewable energy certificate standard used to verify renewable electricity generation and support Scope 2 reporting under the GHG Protocol.

Energy Attribute Certificate (EAC)

A category of instruments representing the environmental attributes of electricity generation, which includes I-RECs.

Scope 2 Emissions

Indirect greenhouse gas emissions resulting from the consumption of purchased electricity, steam, heating, or cooling by an organization.

Market-based Method (GHG Protocol)

An accounting approach under Scope 2 that allows organizations to use Energy Attribute Certificates (such as I-RECs) to reflect renewable electricity consumption.

Vintage

The year in which the renewable electricity associated with an I-REC was generated, used for allocation prioritization and as an indicator of asset quality.

Impact Certificate

A document issued following the retirement of an I-REC, serving as proof for ESG reporting and environmental claims.

Category: Token Mechanics

REC Token

A digital utility token representing rights to renewable energy certificates, backed 1:1 by verified I-RECs.

Tokenization

The process of converting I-REC certificates into digital tokens, requiring that the underlying assets are locked in the ReHash platform and verified by REDEX prior to issuance.

Mint-on-Lock

A mechanism whereby tokens are minted only after verification that the corresponding I-RECs have been securely locked in the system, ensuring a strict 1:1 backing.

Redemption

The process by which token holders return tokens to the system in exchange for underlying I-RECs or to initiate certificate retirement, depending on the selected option.

Retirement (of I-REC)

The process of permanently cancelling an I-REC within the registry system to enable official environmental claims.

Token Burn (Burn)

The irreversible destruction of digital tokens, executed in conjunction with the exercise of rights over the underlying asset.

FIFO by Vintage Year Allocation (Oldest Vintage First)

An allocation method where I-RECs are assigned based on chronological order, prioritizing older vintages first.

Irreversibility

A property of token burning and certificate retirement processes that cannot be reversed, modified, or undone once executed.

Category: Governance, Security & Verification

Smart Contract

A program deployed on the CO2e Chain that defines the rules for minting, transferring, and burning REC Tokens. Execution is initiated and authorized by designated operators and secured through a Multi-Signature (Multi-sig) mechanism. All transactions are transparently recorded on the blockchain and are auditable.

Multi-Signature (Multi-sig)

A transaction authorization mechanism requiring cryptographic approval from multiple designated parties before execution, preventing unilateral control.

01 Executive Summary

1.1 General Information of the Digital Token

RECTOKEN

Item	Details
Token Name (English)	REC Token
Token Name (Thai)	โทเคนดิจิทัลเพื่อพลังงานหมุนเวียน (REC)
Token Type	Utility Token (Ready-to-Use)
Issuer	Blockedge Co., Ltd.
Certification Standard	I-REC certified under I-TRACK standard
Underlying Asset	1 Token represents 1 MWh of renewable electricity
Blockchain Network	CO2e Chain (EVM-compatible Layer 3 Optimistic Rollup)
Smart Contract Address (CO2e Chain)	0xE930e25f64b93f9d696F2Fe67E9D6223a7B50174
Smart Contract Address (Optimism Chain)	0xF4fEfEe4730Cf174608766877911F8D33735f9D7
Smart Contract Address (KUB Chain)	0x777777Be0A429aEF3D2eC27d452FA3591b8bE2Fa
Certified Custodian	REDEX (via ReHash Platform)
Registry Platform	Evident
Legal Advisor	Baker & McKenzie Ltd.
Smart Contract Auditor	Valix Consulting Co., Ltd.

1.2 Nature and Structure of the Offering

Global demand for carbon credits and renewable energy continues to grow, driven by regulators, investors, and consumers seeking tangible climate action. However, traditional carbon and energy markets face several key limitations, including:

- Limited traceability, creating risks of double counting
- Complex and inefficient operational processes, particularly in traditional procurement
- Credibility risks, including concerns related to greenwashing

The REC Token is designed to address these challenges by functioning as a blockchain-based digital twin of verified I-RECs. The system operates under a multi-party framework consisting of:

- **NetZero Carbon** (asset aggregator)
- **REDEX** (custodian)
- **Blockedge** (tokenization operator and issuer)

This structure ensures that environmental claims are transparent, verifiable, and tamper-resistant. Upon redemption, tokens are permanently removed from circulation, ensuring the integrity of the underlying environmental benefit.

1.3 Summary of Operational Workflow

1.3.1 Verification and Issuance

Renewable energy projects (e.g., hydropower) submit project and generation data to Evident, which verifies compliance with the I-REC standard and issues I-REC certificates.

1.3.2 Aggregation and Custody

NetZero Carbon sources and selects I-REC certificates from verified projects. These certificates are transferred to REDEX, which acts as the custodian and securely locks them within the ReHash platform.

1.3.3 Tokenization (Two-Tier Structure)

Once I-RECs are verified and locked, Blockedge tokenizes the assets by issuing project-specific I-REC tokens at a 1:1 ratio. These represent the first-tier tokens.

1.3.4 Central Pool and Trading

Holders of project-specific tokens may transfer them into the Central Pool, where they are converted into pooled tokens (second-tier tokens).

These pooled tokens serve as the primary tradable instruments on digital asset exchanges, enabling standardized market liquidity.

1.3.5 Redemption and Retirement

Token holders may initiate redemption (minimum of 100 tokens). Pooled tokens are burned and converted back into project-specific allocations based on a First-In, First-Out by Vintage Year (FIFO by Vintage Year) methodology, determined by vintage year (older vintages are allocated first).

The underlying I-RECs are then either:

- Transferred to the user's REDEX account, or
- Retired on behalf of the user

This process ensures the full and verifiable realization of environmental claims.

02 Issuer, Management, and Ecosystem Partners

2.1 Digital Asset Issuer (Token Issuer): Blockedge Co., Ltd.

Blockedge Co., Ltd. is a limited company incorporated under the laws of Thailand. The company acts as the Whitelist Authority and serves as the technical developer and issuer of REC Tokens.

Blockedge is responsible for the design, development, deployment, and maintenance of smart contracts related to REC Tokens on the CO2e Layer 3 network. The company also oversees governance processes to ensure that operations comply with defined rules and standards.

Management Team

Mr. Dom Charoenyos (Founder & Chief Executive Officer)

An expert in information technology and digital transformation, responsible for strategic direction and aligning platform development with market demand.

Ms. Getsara Tienchai (General Manager)

Responsible for day-to-day operations, regulatory compliance, and coordination with ecosystem partners.

2.2 Strategic Partner: NetZero Carbon Co., Ltd. (Asset Aggregator)

NetZero Carbon Co., Ltd. is responsible for identifying, selecting, and sourcing renewable energy projects to ensure that only high-quality assets enter the system.

All projects must meet the following selection criteria:

2.2.1 Geographic Scope

Projects must be located within Southeast Asia (SEA).

2.2.2 Asset Type Restriction (Hydropower Only)

Assets must be certified under the I-REC standard and originate exclusively from hydropower projects. Other energy sources, including solar, wind, and biomass, are not included.

2.2.3 Certificate Age Requirement

I-REC certificates must not exceed 24 months from the official issuance date under the I-REC standard.

2.2.4 Due Diligence

Preliminary verification of generation data and supporting documentation is conducted to ensure strict compliance with the defined selection criteria prior to sourcing.

2.2.5 Procurement and Transfer

All I-RECs are acquired through legally compliant processes, and their transfer into the REDEX custody system is fully executed and verified.

2.3 Custody Framework: REDEX and ReHash Platform

To ensure the highest level of asset security, the REC Token ecosystem adopts a legally structured custody framework that strictly separates the token issuer from the holder of the underlying assets.

2.3.1 Custodian

All digital I-REC certificates are securely held by REDEX, an internationally certified REC custodian and an official operator recognized by I-TRACK.

2.3.2 Custody Structure

Certificates are securely locked within the ReHash platform, which is owned and operated by REDEX.

2.3.3 Immutability and Issuance Control

Blockedge cannot mint REC Tokens without formal confirmation that the corresponding I-RECs have been securely locked by REDEX.

Such confirmation requires:

- Official communication via authorized email, and
- Independent verification through the official ReHash platform

This strict verification framework is designed to prevent double spending, ensuring that I-RECs cannot be simultaneously traded in traditional OTC markets while corresponding REC Tokens remain in circulation on the blockchain.

03 Business Plan, Market Overview, and Pricing Mechanism

3.1 Concept of International Renewable Energy Certificates (I-REC) and Scope 2 Emissions

3.1.1 What is I-REC

An International Renewable Energy Certificate (I-REC) is a globally recognized Energy Attribute Certificate (EAC).

When a renewable energy power plant (e.g., hydropower) generates 1 megawatt-hour (MWh) of electricity and injects it into the grid, it is issued 1 I-REC.

This certificate serves as verified proof that:

- 1 MWh of renewable electricity has been generated, and
- the environmental attributes of that electricity are assigned to the certificate holder

3.1.2 Difference Between I-REC and Carbon Credits

I-RECs and carbon credits are often confused but serve fundamentally different purposes:

Carbon Credits represent the reduction or removal of 1 metric ton of CO_2 equivalent (tCO_2e), typically from projects such as reforestation or carbon capture. These are generally used for Scope 1 and Scope 3 emissions.

I-RECs represent renewable electricity generation and are recognized under the GHG Protocol as a valid instrument for managing Scope 2 emissions, which are indirect emissions from purchased electricity.

The retirement of an I-REC enables organizations to credibly and transparently claim that a portion or all of their electricity consumption is sourced from renewable energy, supporting ESG and sustainability objectives.

3.2 Market Trends and Increasing Corporate Demand

Although voluntary in nature, demand for I-RECs—particularly in Southeast Asia—has been growing significantly.

What was once considered a CSR activity has evolved into a business-critical requirement, driven by:

- global supply chain expectations
- increasing demand for verifiable ESG disclosures

3.2.1 RE100 Initiative

RE100 is a global corporate initiative committed to 100% renewable electricity.

Large multinational corporations participating in RE100 often require their suppliers—especially in Southeast Asia—to adopt renewable energy, significantly increasing regional demand for I-RECs.

However, REC Tokens are not limited to RE100 participants. Any organization may use them to support renewable energy claims and ESG goals.

3.2.2 Science Based Targets initiative (SBTi)

Many organizations adopt emissions reduction targets aligned with scientific pathways (SBTi). Within this framework, EACs such as I-RECs are a primary mechanism for managing Scope 2 emissions under the market-based method.

3.2.3 Market Growth Trends

Data from Evident Global Registry and the I-REC Standard Foundation indicates continuous growth in both issuance and retirement of I-RECs globally, particularly in Asia.

This growth is further supported by international climate policies, such as the Carbon Border Adjustment Mechanism (CBAM).

These structural changes are expected to drive sustained long-term demand for verifiable renewable energy certificates such as I-RECs.

3.3 I-REC Standard, Jurisdictional Validity, and Cross-Border Usage

3.3.1 I-REC Standard

The I-REC Standard is an international framework for issuing Energy Attribute Certificates (EACs) that verify renewable electricity generation.

Under:

- the GHG Protocol, and
- SBTi guidelines,

I-RECs are recognized as a valid mechanism for Scope 2 reporting under the market-based method, enabling structured and auditable renewable energy claims.

3.3.2 Jurisdictional Validity

I-RECs are internationally recognized and designed for markets where national renewable tracking systems may not yet exist.

In Southeast Asia, countries such as:

- Thailand
- Vietnam
- Malaysia
- Indonesia

play a significant role as issuers.

All I-RECs used within the REC Token system are:

- officially registered
- verifiable
- aligned with applicable regulatory and voluntary environmental frameworks

3.3.3 Cross-Border Usage and Claims

Under the GHG Protocol Scope 2 guidance, organizations may use EACs sourced from other countries, provided that:

- market boundary conditions are satisfied, and
- source disclosure is transparent

In Southeast Asia, regional initiatives such as the ASEAN Power Grid (APG) support increasing energy market integration, making cross-border I-REC usage widely accepted in practice.

Additionally:

- RE100
- SBTi

allow the use of international RECs when domestic supply is limited, subject to transparent disclosure.

Accordingly, users may retire I-RECs originating from Southeast Asia through the REC Token system to support Scope 2 environmental claims in alignment with global ESG standards.

3.4 Pricing Mechanism

REC Tokens are utility tokens whose value is derived from the actual cost of sourcing, verification, custody, and tokenization of I-RECs within a verifiable framework.

The primary market price reflects these cost components and is not fixed, but calculated as:

REC Token Price = Underlying Asset Value (OTC) + Platform Fee

3.4.1 Underlying Asset Value (OTC)

Based on the over-the-counter (OTC) market price of I-RECs per 1 MWh.

Prices may vary depending on:

- supply and demand
- geographic origin
- certificate vintage

Although the Central Pool is limited to hydropower, pricing reflects broader regional market conditions.

3.4.2 Platform Fee

Covers operational and infrastructure costs, including:

- Blockedge technology costs
  - smart contract development and deployment
  - token issuance on CO2e Layer 3
  - blockchain transaction fees
- Custody costs by REDEX
- secure storage
- lifecycle management within ReHash

REC Token Pricing Structure

COST COMPONENT	DESCRIPTION	ESTIMATED RATIO / VALUE	PRICE IMPACT
Base Asset Value (OTC)	The real-world cost to procure 1 MWh of certified renewable energy (I-REC). Fluctuates based on project type (Solar, Wind, Hydro), geographic location, and Vintage Year.	Variable (Market Driven)	Base Price
REDEX Custody Fee	Costs associated with securing and locking the physical I-REC certificates within the ReHash accredited custodian platform.	Included in Platform Fee	+ 0.00 THB (Bundled)
Tokenization Platform Fee	Blockedge's fee for smart contract deployment, token minting, infrastructure maintenance, and platform operations.	**Fixed Operational Fee**	+ Platform Fee
Network Gas Fees (L3)	Blockchain transaction fees required for minting, transferring, or burning the tokens on the CO2e Layer 3 network.	~ 0.01 - 0.05 THB / Tx	Negligible

ISSUANCE PRICING FORMULA

Asset **1 MWh I-REC (OTC)** + Platform **Standardized Platform Fees** = Final Price **1 REC Token**

3.4.3 Rationale for the Initial Offering Price

The Company sets the initial offering price of the REC Token at **40 THB per token**, based on the cost structure of the underlying asset and the overall cost of operating the tokenization system. Each REC Token represents the right to 1 MWh of renewable electricity under the I-REC standard, with the underlying certificate locked and maintained through a verifiable custody and tracking system.

The initial price is determined by two key components:

3.4.3.1 Underlying I-REC Asset Value

The Company uses market data for I-REC in Thailand as a reference, particularly for hydropower, which is the primary asset type included in the Central Pool during the initial phase. The market price data published by the Energy Regulatory Commission of Thailand for 2025 indicates that the price of hydropower I-REC ranges approximately from THB 12.7 to THB 44.5 per MWh, with an average of approximately THB 28.6 per MWh. In addition, the public consultation document on Utility Green Tariff type 1, or UGT1, for 2026 proposes an overall premium of approximately THB 37.5 per MWh, consisting of the I-REC cost and related charges.

3.4.3.2 Platform Fee and Exchange-Ready Premium

In addition to the cost of the I-REC itself, tokenizing renewable energy certificates involves operational costs, verification costs, custody arrangements, integration with the custodian, token issuance and management on blockchain, traceability infrastructure, as well as costs related to liquidity support and secondary market risk management. These include, for example, market maker inventory costs, order-book obligations, transaction monitoring, abnormal trading surveillance, and periodic audit cadence.

Accordingly, the initial price of **40 THB per token** reflects both the value of the underlying I-REC and the additional costs required to provide the infrastructure for holding, transferring, trading, redeeming, and retiring certificates in a transparent, verifiable, and ready-to-use tokenized format.

The initial price is not intended to guarantee any future value or return to token holders. It serves as the initial offering price for the primary market. The trading price in the secondary market may fluctuate depending on supply and demand, liquidity, the quality of the underlying assets, certificate vintage, and other relevant market factors.

For the avoidance of doubt, the **40% portion of REC Tokens allocated for direct user allocation** may be sold back to the Asset Aggregator or repurchased by the Asset Aggregator only at a price not lower than **THB 40 per token**, being the initial offering price. This arrangement does not constitute a guarantee of secondary market price, investment return, or liquidity for token holders, but serves as a pricing floor for transactions between the relevant allocation pool and the Asset Aggregator under the project's commercial arrangement.

3.5 Legal Rationale for Cross-Border I-REC Usage (Thailand)

A key regulatory consideration is whether Thai entities can use I-RECs sourced from other Southeast Asian countries.

Under the GHG Protocol Scope 2 (market-based method):

- organizations may use EACs such as I-RECs
- provided that market boundary conditions are met
- and source disclosure is transparent

Regional energy integration through initiatives such as the ASEAN Power Grid (APG) supports cross-border I-REC usage as an accepted practice.

Additionally:

- SBTi
- RE100

permit international REC usage where domestic supply is insufficient or structurally constrained.

Therefore, Thai entities may utilize I-RECs sourced from Southeast Asia through the REC Token Central Pool to support Scope 2 reporting in alignment with global ESG frameworks.

Domestic Policy Considerations

While cross-border I-REC usage aligns with international voluntary standards, certain domestic policies may impose limitations.

In Thailand, specific programs (e.g.):

- green electricity tariffs (UGT)
- tax incentives

may require domestically sourced RECs.

Users should verify eligibility criteria prior to redemption.

Since the Central Pool aggregates I-RECs from multiple Southeast Asian countries, users should ensure that the certificate origin aligns with their intended use case.

04 Token Details, Functional Design, and Anti-Double Counting Mechanisms

4.1 Tokenomics, Total Supply, and Allocation

4.1.1 Token Characteristics and Technology Architecture

REC Token is a utility token compliant with the ERC-20 standard, deployed on the CO2e Chain, an EVM-compatible Layer 3 blockchain utilizing Optimistic Rollup technology.

The network is specifically designed for environmental asset management, providing:

- security inherited from Ethereum, and
- enhanced transaction speed and cost efficiency suitable for enterprise use

4.1.2 Supply Mechanism

The REC Token has a maximum supply cap of 100,000,000 tokens, with no pre-minting.

The circulating supply is dynamic and strictly tied to the underlying assets:

- Tokens are minted only when verified I-REC certificates are deposited and locked within the REDEX ReHash platform
- Tokens are burned upon retirement of the underlying I-REC certificates

This mechanism ensures continuous 1:1 backing integrity:

1 REC Token = 1 MWh of verified renewable energy, represented by a locked I-REC

4.1.3 Token Issuance and Allocation Mechanism

The system operates under an on-demand minting model, ensuring that no tokens are created without corresponding underlying assets.

Token allocation is structured into two main categories:

- 40% – Direct User Allocation
  Tokens in this category are minted and allocated to organizations or users who supply the underlying I-REC assets.
  These tokens may be used for renewable energy claims, trading, or digital asset storage.
- 60% – System Liquidity Reserve
  This portion is reserved to support system liquidity and market accessibility. These tokens may be introduced into the Central Pool and digital asset exchanges to facilitate continuous market participation.
  This reserve is strictly intended for operational purposes and does not constitute any profit-generating or yield mechanism.

4.1.4 Traceability and Immutability

Regardless of whether tokens are held in private wallets or within the Central Pool, full traceability of the underlying assets is preserved.

Each token is associated with immutable metadata, ensuring that origin and attributes can be verified at all times.

Key metadata includes:

I-REC certificate ID	generation technology and capacity
certification standard (I-REC)	generation period and issuance date
issuing body	energy vintage year (subject to ≤24-month policy)
project developer	verification status
project location (country/region)	registry verification link
project type (e.g., hydropower)	usage status (active / retired)

4.2 Anti-Double Counting Mechanisms

Double counting—where a single environmental attribute is claimed more than once—is a critical risk in renewable energy and carbon markets.

Blockedge implements a multi-party control framework to mitigate this risk through the following mechanisms:

4.2.1 One-Way Binding Mechanism

Once an I-REC is transferred into the REDEX system, and tokenized into REC Tokens, the underlying asset is locked within the system and cannot be traded externally.

Release of the asset is only possible if the corresponding REC Tokens are first burned. This ensures that environmental claims cannot be duplicated or reused across markets

4.2.2 Periodic Reconciliation

To ensure transparency, accuracy, and system integrity, the company conducts regular reconciliation between:

- total REC Tokens in circulation on the blockchain, and
- total I-REC certificates held in custody

Reconciliation is conducted quarterly by the company, based on clearly defined methodologies and scope.

This process ensures that all circulating REC Tokens remain fully backed at a 1:1 ratio by underlying I-RECs.

Summary reports and relevant disclosures will be publicly released within 7 business days after the end of each reporting period.

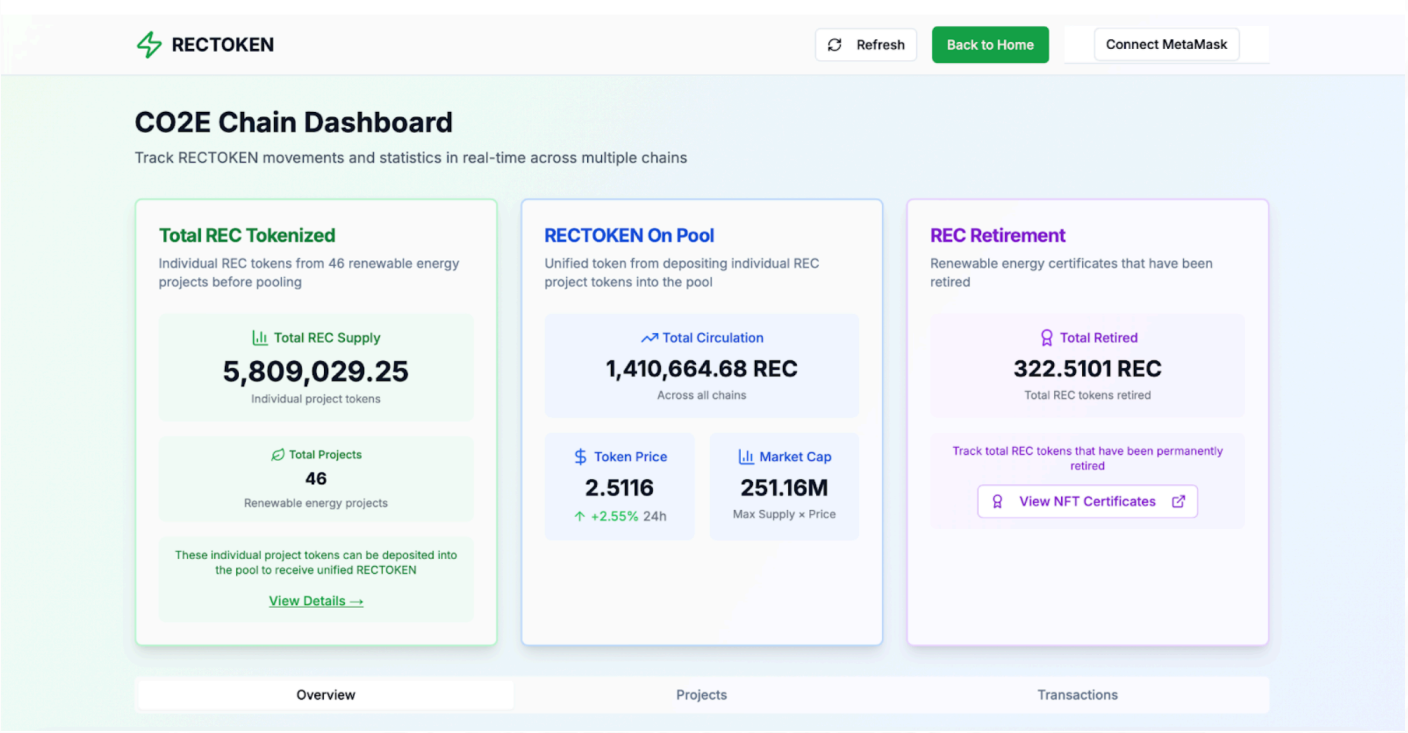
The company may additionally appoint independent auditors or assurance providers to enhance credibility and provide external validation where appropriate.

4.2.3 Public Transparency Dashboard

The system provides a public-facing dashboard that displays key information in near real-time, including:

- total token supply
- circulating supply
- number of tokens retired (burned)
- underlying asset data at the project level

Users can access this information through the Blockedge platform to continuously monitor and verify the status of the system.



4.3 Asset Quality Review

To maintain the quality of underlying assets and market confidence, Blockedge conducts an annual review of I-REC assets within the Central Pool.

The review considers key factors, including:

- certificate vintage (issuance year)
- project origin
- market acceptance
- alignment with international standards (e.g., GHG Protocol, SBTi)

In cases where certain assets are identified as:

- having vintage considered too old for market acceptance.
  For example, where such certificates can no longer be utilized for regulatory or compliance purposes
- presenting ESG or compliance-related risks
- no longer aligned with corporate demand.
  For example, where certificates from specific countries are no longer accepted within the corporate market

Blockedge reserves the right to remove such assets from the Central Pool and reallocate them for alternative use cases within the company (e.g., carbon offset stamp programs such as https://co2.help).

Such actions:

- do not affect the overall 1:1 backing principle of REC Tokens, and
- will be disclosed via the public dashboard for transparency

4.4 Holder Rights, Transfers, and Retirement Policy

4.4.1 Token Transfer

REC Tokens may be transferred peer-to-peer between standard digital wallets and traded on legally authorized digital asset exchanges.

4.4.2 Utility Rights

Token holders have the right to use REC Tokens for retirement, enabling verified claims of renewable energy usage for Scope 2 emissions reporting.

Upon retirement, users will receive a digital proof of retirement.

(Refer to Section 5.1 for detailed conditions and limitations.)

4.4.3 Pre-Confirmation Transaction Policy

If a transfer or trade transaction has not yet been confirmed on the blockchain, or is canceled prior to confirmation, the asset remains under the user's ownership.

4.4.4 Irreversibility of Retirement

Once REC Tokens are retired, the tokens are permanently burned, and the corresponding I-RECs are permanently retired in the registry.

This process is final and irreversible, and cannot be undone under any circumstances.

4.4.5 Project Termination or Certificate Revocation

If an underlying I-REC is revoked by the relevant authority, Blockedge reserves the right to burn the affected tokens, and implement remediation measures in accordance with the terms defined in the user agreement.

4.5 Project Scope, Central Pool Operation, and Document Updates

4.5.1 Dual-Token Structure

The system operates under a dual-token structure:

- Project-specific tokens
- Pool tokens (Central Pool tokens)

Users may:

- deposit project-specific tokens into the Central Pool to receive pool tokens, and
- convert pool tokens back into project-specific tokens

Allocation follows a FIFO by Vintage Year mechanism based on vintage year (oldest first).

4.5.2 Pooling Mechanism

When project-specific tokens are deposited into the Central Pool, users receive pool tokens automatically on a 1:1 basis:

1 Pool Token = 1 Project Token = 1 I-REC = 1 MWh

Pool tokens:

- are fungible utility tokens
- represent a basket of qualified I-REC assets
- preserve holder rights to underlying environmental attributes

4.5.3 Disclosure and Document Updates

As the composition of the Central Pool changes dynamically, asset composition and token supply are disclosed via the public dashboard in real time. The whitepaper will be updated only in material cases, including:

- changes in system architecture, smart contracts, or legal structure
- inclusion of new renewable energy asset classes
- changes in asset aggregators

Routine operational changes (e.g., asset inflow/outflow within the pool) do not require immediate document updates, provided they remain within defined parameters.

4.6 Underlying Asset Vintage Management Policy

Under the I-REC standard and REDEX framework, I-REC certificates do not expire in terms of usability, as they can be retired regardless of age.

However, market acceptance and ESG relevance may vary depending on the certificate vintage.

To maintain asset quality aligned with market expectations, Blockedge adopts the following policies:

4.6.1 Inclusion Policy

Blockedge does not tokenize I-REC certificates that are older than 24 months from issuance, ensuring that all assets within the system meet ESG usability expectations.

4.6.2 Continuous Monitoring

Blockedge continuously monitors the vintage of I-RECs held within the system, particularly those supporting liquidity, to assess market relevance and usability.

4.6.3 Aging Asset Management

If underlying assets become less suitable for market use due to age, Blockedge may:

- remove them from the Central Pool, or
- reallocate them for internal use cases

Such actions do not affect the overall 1:1 backing integrity of REC Tokens.

4.6.4 Quality Maintenance

To maintain system integrity, Blockedge replenishes liquidity using tokens backed by I-RECs within acceptable vintage ranges.

This ensures that:

- asset quality remains high
- market expectations are met
- ESG usability is preserved

05 Burn, Redemption, and Retirement Mechanism

The retirement process represents the final stage of the REC Token lifecycle, converting digital tokens into verifiable environmental (ESG) claims.

5.1 Redemption and Retirement Process

5.1.1 Eligibility and Requirements

Redemption is available to both legal entities and individuals, subject to a minimum of 100 tokens per request.

Conditions are as follows:

- **Legal Entities**
  Must maintain an active account on the REDEX platform.
- **Individuals**
  Due to registry limitations that prevent direct retirement under an individual's account, Blockedge will perform the retirement on behalf of the individual, with the individual's name (or a user-designated name) recorded in the retirement purpose field.

5.1.2 Process Flow

Step 1: Submission of Request

Token holders submit a request via Blockedge, providing required details such as:

- legal name
- REDEX account details
- token amount
- redemption option

Step 2: Verification

Blockedge verifies the submitted information and confirms eligibility within 3–14 business days.

Step 3: Token Transfer

The user transfers pool tokens to the designated wallet address provided by the company.

Step 4: Redemption Execution (FIFO by Vintage Year)

Upon receipt of tokens:

- tokens are burned, and
- I-RECs are allocated under a FIFO by Vintage Year mechanism based on vintage year (oldest first)

Users may select one of the following options:

- **Option 1: Receive I-REC without retirement (Legal Entities only)**
  I-RECs are transferred to the user's REDEX account.
- **Option 2: Retirement under Legal Entity**
  I-RECs are retired on the REDEX platform, and an official retirement certificate is issued.
- **Option 3: Retirement on behalf of an Individual**
  I-RECs are retired under Blockedge's account, with the individual's name (or designated name) recorded in the retirement details.

Step 5: Confirmation

- **For transfer:**
  Users verify receipt via REDEX and receive supporting documentation
- **For retirement:**
  Users receive an Impact Certificate for ESG reporting purposes

5.2 System Continuity and Verifiable Process

5.2.1 Service Level Agreement (SLA)

Valid redemption requests will be completed within 3–14 business days, without requiring further user action.

5.2.2 Control and Security Mechanisms

All redemption operations are subject to strict controls:

- confirmation of token burn on the blockchain
- mandatory multi-signature (multi-sig) authorization
- retirement executed only by authorized operators via REDEX
- full audit trail recorded for all events
- records subject to periodic review by independent auditors

5.3 Process Integrity Assurance

The issuer confirms that:

- redemption and retirement are performed strictly in accordance with the **intended utility of the token**
- outcomes are deterministic and executed at a **1:1 ratio** relative to burned tokens

The process:

- does not involve randomness
- does not involve chance or speculation
- does not constitute gambling under applicable Thai law

5.4 Fees and Charges

Redemption may involve fees imposed by third parties, including REDEX platform fees and I-REC registry fees. Such fees are borne directly by the token holder and must be settled prior to execution.

Blockedge may update applicable fees from time to time, with notice provided through official communication channels.

5.5 Appeal Mechanism and Dispute Handling

To ensure transparency and align user expectations. Prior to confirming a redemption request, users are provided with advance visibility of the underlying assets to be allocated, including project type, country of origin, energy technology and vintage year.

Submission of a redemption request constitutes full acknowledgment and acceptance of the disclosed asset details.

Post-Redemption Appeal

After confirmation, if a user encounters issues in utilizing the allocated I-REC (e.g.,) ESG eligibility concerns, regulatory limitations, technical issues related to retirement, the user may submit an appeal within 14 days through designated channels.

Appeal Requirements

Appeals must include:

- transaction details
- description of the issue
- supporting documentation (if any)

Evaluation Criteria

Blockedge will evaluate appeals based on:

- pre-disclosed asset information
- FIFO by Vintage Year allocation
- asset status at the time of allocation
- registry rules (Evident / REDEX)
- applicable ESG standards

Scope Limitation

Appeals are considered only for functional usability issues and do not cover personal preferences, subjective dissatisfaction.

Final Decision

Blockedge reserves sole discretion in evaluating appeals, and all decisions shall be final and binding.

06 Technical Infrastructure and Security Framework

6.1 CO2e Chain (Layer 3 Optimistic Rollup)

The REC Token operates on the CO2e Chain, an EVM-compatible Layer 3 blockchain built using Optimistic Rollup technology, specifically designed for environmental asset applications.

6.1.1 Cost Efficiency

Operating on Layer 3 significantly reduces transaction costs compared to Ethereum Layer 1, enabling high transaction throughput, and efficient handling of small-value transactions.

6.1.2 Transaction Performance

Token operations, including minting and transfers, are processed with low latency, with transaction confirmations typically occurring within seconds.

6.1.3 Network Security

Transactions are executed on Layer 3, with state commitments periodically anchored to Ethereum Layer 1. Through the Optimistic Rollup architecture:

- transaction validity is secured via fraud-proof (challenge) mechanisms
- the system inherits the security guarantees of Ethereum at the base layer

6.2 Smart Contract Audit and Security Controls

6.2.1 Smart Contract Audit

All smart contracts related to REC Tokens undergo comprehensive security assessments, including:

- static code analysis
- dynamic testing
- expert review

These audits are conducted by an independent third party: Valix Consulting Co., Ltd.

6.2.2 Access Control and Multi-Signature (Multi-sig)

Critical system functions, including:

- contract state changes
- asset-impacting operations

are governed through multi-signature wallets, requiring approval from multiple authorized parties.

This mechanism:

- reduces the risk of unauthorized access
- enforces multi-party governance

6.2.3 Administrative Recovery Process (Emergency Handling)

In the event that an enterprise user loses access to a wallet, or experiences a verified security incident, an administrative recovery process may be initiated under strict conditions. This process requires multi-signature approval at all times, enabling secure transfer of tokens to a new designated wallet.

Users must provide:

- a formal request
- verifiable proof of ownership

All recovery actions are recorded in the system and subject to audit and verification.

07 Risk Factors

7.1 Regulatory and Compliance Risks

7.1.1 Changes in Digital Asset Regulations

Laws, regulations, or regulatory guidance in Thailand or other jurisdictions may change, which could affect the issuance, trading, transfer, or holding of REC Tokens.

7.1.2 Changes in Environmental Standards

Updates to international frameworks such as GHG Protocol, Science Based Targets initiative (SBTi) or I-REC Standard, may impact the eligibility of I-RECs for Scope 2 claims and could reduce the utility and acceptance of REC Tokens.

7.1.3 Domestic Policy Restrictions

Although cross-border use of I-RECs is generally accepted internationally, domestic regulations or policies (e.g., green electricity tariffs (UGT) or specific incentives) may require locally sourced certificates.

As I-REC allocation within the system follows a FIFO by Vintage Year mechanism, users cannot directly select the country of origin, which may result in allocated certificates not meeting specific domestic requirements.

7.2 Technology and Security Risks

7.2.1 Blockchain Infrastructure Risk

Network congestion, delays, or disruptions on Ethereum or Layer 3 infrastructure may affect transaction processing and system availability.

7.2.2 Smart Contract Risk

Despite security audits, smart contracts may contain undiscovered vulnerabilities, which could be exploited and lead to loss of assets or system malfunction.

7.2.3 Integration Risk

System operations depend on integrations with third-party platforms, including REDEX and Evident.

Service interruptions or failures in these systems may affect redemption and operational continuity.

7.2.4 Transaction Ordering Risk

Although the system applies a logical FIFO by Vintage Year allocation model, actual transaction execution on blockchain networks may be influenced by network fees (gas price).

This may result in transaction ordering outcomes differing from user expectations.

7.3 Market and Liquidity Risks

7.3.1 Underlying Price Volatility

The value of REC Tokens is linked to the market price of I-RECs, which may fluctuate based on supply and demand and market conditions.

7.3.2 Liquidity Risk

Market liquidity may be limited at times, potentially affecting the ability to transfer or trade tokens at desired prices.

7.4 Operational Risks

7.4.1 Dependency on Ecosystem Partners

The system relies on key partners, including NetZero Carbon, REDEX and Evident. Any disruption, operational failure, or change in status of these parties may impact the overall system.

7.4.2 Dependency on External Standards and Registries

Changes to the I-REC Standard or registry operations, including suspension, termination, or rule modifications, may affect the usability and recognition of REC Tokens.

7.5 Business Continuity and Disaster Recovery (BCDR)

To mitigate the above risks, the system implements the following continuity and resilience measures:

7.5.1 Data and Infrastructure Redundancy

Platform data is hosted on high-availability cloud infrastructure, with regular backups and geographically separated storage environments.

7.5.2 Blockchain State Anchoring

Transaction data and system state are anchored to Ethereum Layer 1, enabling verifiability and recovery at the protocol level.

7.5.3 Operational Fallback Procedures

In the event of failure in automated integrations, controlled manual processes may be executed by authorized personnel under defined procedures and verification controls.

7.5.4 Emergency Pause Mechanism

Smart contracts include a pause function, which may be activated under multi-signature authorization to temporarily suspend operations in response to security incidents.

08 Legal Framework, Governance, and Conflict of Interest Management

8.1 Governance, Token Issuance Authority, and Conflict of Interest Mitigation

Blockedge operates in accordance with applicable legal and regulatory frameworks, with a strong emphasis on transparency, auditability, and systemic risk control.

To prevent conflicts of interest and unauthorized token issuance, the following governance principles are enforced:

8.1.1 Mint-on-Lock Mechanism

REC Tokens are minted only upon verifiable confirmation that the corresponding I-REC certificates have been transferred and securely locked under the custody of REDEX.

No pre-minting is permitted under any circumstances.

8.1.2 Multi-Signature Authorization

Token minting requires approval through a multi-signature (multi-sig) mechanism, involving authorized parties from:

- Blockedge (issuer), and
- NetZero Carbon (asset aggregator)

This process is executed only after confirmation of asset lock by REDEX.

8.1.3 Segregation of Duties

Roles within the ecosystem are clearly separated:

- Blockedge – token issuer and technology provider
- NetZero Carbon – asset sourcing and selection
- REDEX – independent asset custodian

Blockedge has no ownership rights or discretionary control over I-REC assets held in custody by REDEX.

8.1.4 System Transparency

Token issuance mechanisms, allocation structures, and operational conditions are:

- predefined
- verifiable
- publicly accessible

Note: These governance measures are designed to ensure transparency and system integrity, and do not constitute any guarantee of economic benefits or outcomes for token holders.

8.2 Custody of Underlying Assets

REC Tokens are issued under a strict 1:1 linkage to I-REC certificates, which are held under the custody of REDEX as an independent third-party custodian.

The system is designed such that:

- no commingling with carbon credits or other asset classes occurs
- no underlying assets other than I-RECs are utilized

In the event of circumstances affecting the issuer, the treatment of underlying assets shall be governed by applicable laws, and the rights of token holders shall be subject to the relevant legal processes.

8.3 Interoperability

REC Tokens are developed under the ERC-20 standard, enabling compatibility with:

blockchain infrastructure

- standard digital wallets
- Smart contracts do not impose transfer restrictions at the protocol level.

However, usage, transfer, or trading of tokens may be subject to:

- regulatory requirements
- policies of platform providers or exchanges

8.4 Governing Law and Dispute Resolution

The use of REC Tokens and all related systems shall be governed by the laws of the Kingdom of Thailand, unless otherwise specified.

Any disputes arising out of or in connection with the system shall be resolved through:

- courts of competent jurisdiction in Thailand, or
- arbitration under Thai law

8.5 Limitation of Liability

REC Tokens are designed solely as a digital mechanism for recording, verifying, and managing renewable energy certificates (I-RECs).

They are not intended for:

- fundraising
- investment
- financial return generation

This document is provided for explanatory purposes only and does not constitute any guarantee of outcomes.

To the extent permitted by law:

- Blockedge shall be liable only for direct damages arising from failure to perform the processes explicitly described
- Blockedge shall not be liable for:
- indirect damages
- consequential losses
- losses arising from external factors

Blockedge reserves the right to pursue legal action against any party causing harm to the system, including cases involving:

- inaccurate underlying asset information
- fraudulent conduct

BLOCKEDGE

BLOCKCHAIN INFRASTRUCTURE

Together, We build a Greener Future