The R-REC Standard

R·EEE

Version 2.0

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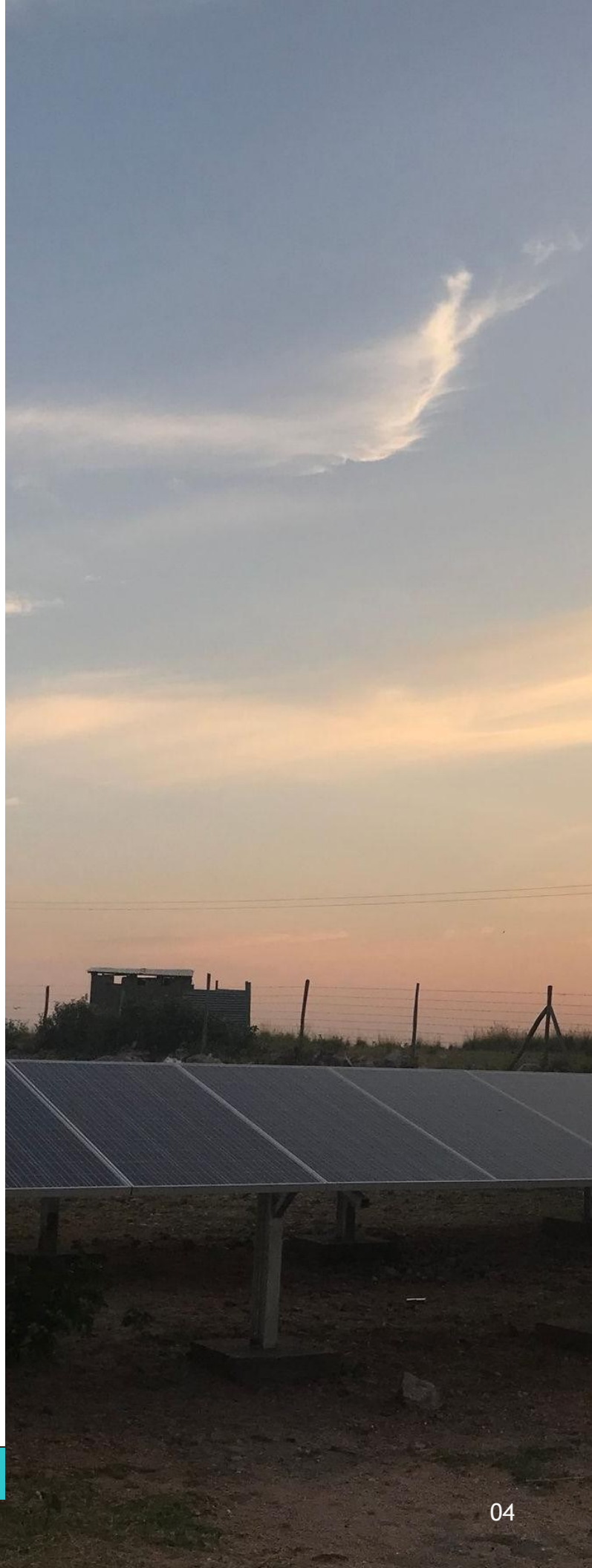
Overview

The rise of decentralized renewable energy generation, particularly through mini-grid systems, is a significant global trend. However, current renewable energy certificate (REC) and carbon credit solutions in the voluntary carbon markets lack transparency and fair compensation for energy producers.

At the core of the R-REC standard lies a data-driven approach that anchors every asset in verified renewable energy generation. By meticulously aligning with globally accepted standards for carbon asset minting, the Renewvia Environmental Equity Exchange (REEE) ensures that subjectivity is removed from the verification process. This objectivity is key to providing a reliable and transparent market structure, where the credits represent real, measurable environmental benefits. Through the use of advanced monitoring and blockchain validation, the REEE deliver a robust, traceable record of clean energy production, enabling producers and buyers alike to trust in the integrity and environmental value of each credit issued. The result is a market that operates with scientific precision, ensuring that every REC and carbon credit reflects a tangible contribution to our planet's sustainability.



Principles

The guiding principles of the REEE aligns with the goals of promoting renewable energy, empowering sustainability projects, and ensuring transparency and fairness in carbon markets.

Accessibility and Inclusivity

R-RECs are deliberately structured to facilitate broad participation across diverse stakeholder groups, including energy producers, consumers, investors, governments, individual investors, and communities. The standard's inclusive design embraces large- and small-scale renewable energy projects, democratizing access to the carbon market and ensuring that all have the opportunity to engage in sustainable practices.

Environmental Integrity

A core tenet of the REEE is the commitment to environmental integrity. Rigorous criteria are established to validate the renewable attributes of energy generation, guaranteeing that each R-REC represents the production of one megawatt-hour of renewable electricity.

Transparency

The REEE harnesses the power of blockchain technology to create a transparent and auditable record of transactions. This decentralized ledger enhances trust, immutability, and traceability, thereby ensuring the integrity and transparency of the carbon asset market.

Fair and Efficient Market Mechanisms

The R-REC Standard introduces fair and efficient market mechanisms that facilitate the trading of carbon assets. The marketplace fosters equal opportunities for all participants, promoting price discovery, liquidity, and competitiveness. Smart contract functionality automates transactions for maximum efficiency.

Stakeholder Empowerment

R-RECs empower renewable energy producers by allowing them to take full control of and benefit from their carbon assets. This direct engagement between energy producers and buyers eliminates intermediaries and reduces transaction costs, incentivizing further investment in sustainable practices.

Collaboration and Openness

Principles of collaboration, knowledge-sharing, and community engagement drive the development and implementation of R-RECs. The Standard adheres to open-source principles, allowing for continuous improvement, peer review, and the involvement of diverse stakeholders, promoting innovation, standardization, and evolution in line with industry best practices.

Regulatory Compliance and Credibility

The REEE aligns with relevant regulatory frameworks and best practices to ensure credibility and market acceptance. The standard complements existing renewable energy policies and initiatives while accommodating future regulatory developments, enhancing its credibility in global markets.

Disclosure of Verification and Certification Processes

Users have the right to a clear understanding of how verification and certification processes are conducted for R-RECs, including the criteria used to determine the eligibility and authenticity of renewable energy generation. This disclosure builds trust in the integrity of the carbon asset market.

Traceability and Auditability

REEE users should be able to trace and verify the origin of their certificates, including the specific renewable energy projects from which they were generated. Blockchain technology facilitates this by providing a transparent and auditable record of transactions and renewable energy generation, thereby enhancing accountability.

Immutable and Tamper-Resistant

Blockchain technology ensures an immutable and tamper-resistant ledger where R-REC transactions and associated data are recorded decentralized. Once a transaction is added to the blockchain, it becomes virtually impervious to alteration or manipulation, thus enhancing the security of R-RECs and guarding against unauthorized modifications and fraudulent activities.

Resilience to Attacks

The REEE benefits from the inherent resilience of blockchain networks, making it resistant to Distributed Denial of Service (DDoS) attacks due to their distributed nature. Blockchain's decentralized structure presents a challenging target for malicious actors, further fortifying the security of the R-REC Standard against attacks.

Alignment with ICVCM CCPs through Established Methodologies

To ensure our practices are in harmony with the highest standards for environmental integrity, the REEE commits to aligning with the Integrity Council for the Voluntary Carbon Market (ICVCM) Core Carbon Principles (CCPs): additionality, mitigation activity information, no double counting, permanence, programme governance, registry, robust independent third-party validation and verification, robust quantification of emission reductions and removals, sustainable development impacts and safeguards, and transition towards net-zero emissions. In this Standard, “third party” refers to an entity that is independent of both the buyer and seller of R-RECs. The REEE will ensure alignment with the CCPs by employing quantification methodologies that are already established and recognized for their adherence to these principles. This approach avoids the need to develop our own algorithms, instead relying on proven, robust methodologies that align with standards.

By adhering to these guiding principles, the REEE forges a robust and sustainable framework for carbon assets. This framework empowers renewable energy systems around the world, facilitates the transition to a greener and more equitable energy future, and exemplifies the potential of blockchain technology to transform environmental solutions.

Renewable Energy Producer Verification

Application Submission

Producers submit New Renewable Energy Producer Registration Form to verification authority.

Documentation Review

Authority assesses project documents for eligibility, compliance with standards and regulations.

Site Inspection

Accreditation may include site visits to verify power generation equipment presence and functionality.

Data Collection & Logging

During verification, Authority collects data from power generation equipment and power plant system logs.

Data Analysis & Validation

Authority analyzes data to confirm accuracy of renewable energy generation and consistency with R-REC standards.

Independent Auditing

Independent auditors may assess equipment functionality, data logs, calibration, and system components to verify data accuracy.

Accreditation Decision

Authority decides on accreditation based on review and verification results. If criteria are met, accreditation is granted, with communicated conditions and obligations to the producer.

Accredited renewable energy producers must undergo regular compliance monitoring to verify that they continue to meet the standards for renewable energy production.

Ongoing Compliance & Monitoring

Token Classification and Types

The R-REC Standard recognizes the importance of categorizing and classifying carbon assets (RECs) to meet the diverse needs and regulatory requirements of buyers and stakeholders. This section outlines the token classification and types within the REEE ecosystem, enabling buyers to align their nonrenewable energy consumption with the corresponding renewable energy generation in specific US states and African countries. Importantly, for buyers, the decision to utilize geography-specific R-RECs is optional, allowing access to the entire marketplace if there is no requirement for location-specific offsets. Additionally, the platform supports carbon credits, including Mini-Grid Carbon Credits (MCCs), which are not geography-specific and are detailed in the "Exchange of R-RECs for Carbon Credits" chapter of the Standard, offering a versatile approach to carbon offsetting.

US State-Specific Tokens

R-RECs are broken down into different tokens for each US state, labeled as "RREC-XX," where "XX" represents the two-letter abbreviation of the respective state. These state-specific tokens allow buyers to accurately offset their nonrenewable energy consumption within a particular US state by purchasing R-RECs generated within the same state.

African Country-Specific Tokens

To address the unique renewable energy landscape in Africa, R-RECs are classified into country-specific tokens labeled as "RREC-AKE" (for example), where "A" signifies "Africa" and "KE" serves as a stand-in for the top-level domain of the African country from which the R-REC originated. These tokens represent renewable energy generation from projects located within specific African countries, enabling buyers to support and offset their nonrenewable energy consumption in alignment with renewable energy projects across the continent.

Mini-Grid Carbon Credits

Mini-Grid Carbon Credits (MCCs) are a class of carbon assets within the REEE ecosystem, designed to represent the carbon reduction achieved through decentralized renewable energy systems. Unbound by geographic constraints, each MCC is denoted simply as "MCC" without regional distinction. MCCs represent the amalgamation of verified carbon reductions from renewable mini-grids, transcending borders to support a collective approach to carbon offsetting and providing buyers with the flexibility to support global sustainability efforts.

AVERT-US Carbon Credits

AVERT-US Carbon Credits (AVERT-USCC), a distinct category within our carbon credit framework, are converted from US R-RECs using the Environmental Protection Agency's Avoided Emissions and Generation Tool (AVERT). AVERT-USCCs shed their geographical ties, allowing them to be denoted uniformly as "AVERT-USCC." This non-location-specific designation enables buyers to contribute to carbon reduction efforts across the United States, supporting a collective impact on the nation’s carbon footprint.

Ember Grid Reduction Carbon Credits

Ember Grid Reduction Carbon Credits (EGRCCs), a class of carbon credits in our framework, are derived from R-RECs associated with grid-tied renewable energy projects across various African countries. Utilizing Ember's "Yearly Electricity Data" dataset for accurate CO2 intensity calculations, EGRCCs are distinctly labeled as "EGRCC" without regional distinctions within Africa. This uniform naming convention underscores the pan-African impact of these credits, facilitating buyers in contributing to continent-wide carbon reduction efforts.

Technical Implementation

R-RECs are implemented as tokens on the Polygon Mainnet using a Solidity contract. The The contract leverages OpenZeppelin upgradeable contract libraries, including ERC20Upgradeable, ERC20PausableUpgradeable, ERC20PermitUpgradeable, OwnableUpgradeable, and UUPSUpgradeable. The implementation is open-source on GitHub and operates under the GPLv3 license and is designed with security, flexibility, and transparency at its core.

The R-REC token implements the ERC20 standard with additional security and management features. It uses ERC20Upgradeable to provide the core token functionality such as transfers, balances, and approvals. The implementation includes ERC20PausableUpgradeable which allows pausing token transfers during emergencies. ERC20PermitUpgradeable enables gasless approvals through signatures following the EIP-2612 standard. The contract incorporates OwnableUpgradeable to implement contract ownership controls and UUPSUpgradeable to allow contract upgradeability while preserving token state. A custom BlacklistableUpgradeable implementation provides address blacklisting capabilities for enhanced security.

The R-REC Standard implements a transparent minting mechanism with built-in verification. Minting is restricted to the contract owner through the onlyOwner modifier. The mint function includes overflow protection and decimal conversion. Each mint operation emits a MintWithInfo event capturing the recipient address, token amount (without decimals), and URL containing verification information for the underlying renewable energy generation. This approach ensures complete transparency by making all verification data publicly accessible on the blockchain, enabling independent verification of each token's authenticity by any interested party.

The R-REC Standard incorporates multiple security mechanisms. The contract owner can pause all token transfers in case of emergencies through the pause and unpause functions. When paused, no token transfers can occur until the contract is unpaused by the owner.

The R-REC Standard implements a comprehensive blacklisting system through the BlacklistableUpgradeable contract. Addresses can be blacklisted by the contract owner, and the isBlacklisted function allows public checking of blacklist status. The contract provides functions to add addresses to the blacklist and remove them if necessary. Blacklist status is enforced on transfers through the _checkBlacklist function, and minting to blacklisted addresses is prevented via the notBlacklisted modifier.

All token transfers are validated through the overridden _update function, which checks blacklist status for both sender and recipient addresses, enforces pause status, and ensures transfers comply with token economics and security rules.

Renewable energy producers and other stakeholders can interact with R-RECs through compatible wallets supporting Polygon Mainnet, decentralized applications on the Polygon Mainnet, and smart contract integrations supporting ERC20 tokens. The standard ERC20 interface ensures compatibility with existing blockchain infrastructure, including exchanges, wallets, and DeFi protocols.

The technical implementation of R-RECs on the Polygon Mainnet provides a robust and secure framework for managing and transferring these carbon assets. The use of upgradeable contracts, established libraries, and industry-standard practices enhances interoperability while ensuring the system can evolve to meet future needs.

Lifecycle of an R-REC

Minting

R-RECs are minted when a verified renewable energy producer generates one megawatt-hour (MWh) of renewable electricity from their solar installation. The producer's charge controllers and PV inverters track and log the energy generation data, which is reported to the verification authority. Upon verification of the renewable energy production, the authority mints the corresponding number of R-RECs and assigns them to the producer's digital wallet address.

Transferring and Selling

R-RECs can be transferred between digital wallets, similar to any other cryptocurrency. Owners of R-RECs can initiate transfers by specifying the recipient's wallet address and the desired amount of R-RECs to be transferred. The transfer transaction is broadcast to the Binance BNB smart chain network, and once confirmed, the R-RECs are deducted from the sender's wallet and credited to the recipient's wallet. This transferability allows R-RECs to be traded, sold, or utilized by various stakeholders within the renewable energy ecosystem.

Retirement

To retire an R-REC, the owner initiates a transfer from their digital wallet to a special "retirement" wallet designated for this purpose. The retirement wallet is designed to only receive R-RECs and does not send any tokens. When an R-REC is transferred to the retirement wallet, it signifies that the carbon asset has been retired and can no longer be traded or utilized for claiming carbon offsets or other purposes. This retirement mechanism provides a transparent and auditable process for ensuring the permanent retirement of R-RECs, reinforcing their environmental impact and credibility.

Return

In certain cases, a renewable energy producer may wish to return their R-RECs to the system without claiming any benefit or credit associated with them. This allows producers to transition to a different kind of carbon asset within the REEE ecosystem or from a different company or for other specific purposes. The return process involves transferring the R-RECs to a dedicated "return" wallet, effectively removing them from circulation within the REEE system.

Throughout the lifecycle of an R-REC, the blockchain ensures the integrity and transparency of transactions. The verification authority plays a vital role in verifying the renewable energy production and minting the corresponding R-RECs. Stakeholders, such as renewable energy producers, investors, and carbon offset buyers, can participate in the REEE marketplace, leveraging the transferability and retirement mechanisms to support renewable energy adoption, track carbon emissions reductions, and contribute to sustainable development.

Exchanging RECs for Carbon Credits

Introduction

This section outlines the process for exchanging Renewable Energy Certificates (RECs) in the REEE ecosystem for Mini-Grid Carbon Credits (MCCs), AVERT-US Carbon Credits (AVERT-USCCs), and Ember Grid Reduction Credits (EGRCCs) in accordance with globally verified and accepted methodologies. R-RECs generated from mini-grid projects can be converted into MCCs using an exchange rate determined by the United Nations Framework Convention on Climate Change (UNFCCC) Clean Development Mechanism (CDM) AMS-III.BB. R-RECs generated from US commercial or utility solar projects can be converted to AVERT-USCCs using the Environmental Protection Agency's (EPA) Avoided Emissions and Generation Tool (AVERT). R-RECs generated from commercial or utility solar projects from countries outside the US can be converted to Ember Grid Reduction Carbon Credits (EGRCCs) using Ember's "Yearly Electricity Data" dataset.

Conversion from R-RECs to MCCs

R-RECs minted from mini-grid projects are eligible for exchange for MCCs. These R-RECs can be returned to a designated, receive-only return wallet for conversion into MCCs.

Under the UNFCCC CDM AMS-III.BB, the conversion process involves categorizing mini-grid customers into two distinct types and applying corresponding emission factors to calculate carbon emission reductions.

Type I-M (Metered Household Consumers): For each Type I-M customer, their annual energy consumption is divided into two portions for the purpose of applying different emission factors:

1. For the initial 0.055 MWh of their annual energy consumption, an emission factor of 2.72 tCO2e/MWh is applied.
2. For any consumption beyond the initial 0.055 MWh, the emission factor is 0.8 tCO2e/MWh.

Type II (Metered Non-Household Consumers): For Type II customers, a uniform emission factor of 0.8 tCO2e/MWh is applied to their entire annual energy consumption.

Total baseline emission reduction is calculated annually using the above structure. This total is then adjusted by subtracting 0.0036 tCO2e for each kilogram of diesel burned by the mini-grid's backup generator during the year. Alternatively, the total can be adjusted by subtracting 0.0031 tCO2e for each liter of diesel burned by the mini-grid's backup generator during the year. The emission factor of 0.0036 tCO2e per kg of diesel is derived using Tool 33's value of 3.2 kg CO2 per kg of diesel, which is then divided by 0.9 as per Equation 13 of AMS-III.BB, to accurately compute the project emissions for the mini-grid. The alternative, volumetric emission factor of 0.0031 tCO2e per liter of diesel is derived by multiplying the mass-based emission factor by 0.845 kg/L, the upper limit for diesel density at 15°C as defined in the EN 590.

The adjusted total baseline emission reduction determines the number of MCCs that can be exchanged for the returned R-RECs. R-RECs must be exchanged in quantities corresponding to individual projects over individual years. Partial exchanges within a single project year are not permitted.

Example 1: Calculating MCCs for a Mini-Grid Over One Year

Consider a mini-grid project serving a rural community with a mix of household and non-household consumers. For simplicity, let's assume the project has 40 Type I-M (Metered Household) consumers and 10 Type II (Metered Non-Household) consumers. The total energy consumption and diesel generator usage for one year are recorded:

- **Type I-M Consumers (40 households):** Each consumes 0.1 MWh during the year.
- **Type II Consumers (10 businesses):** Each consumes 0.5 MWh during the year.
- **Diesel generator usage for backup:** 500 kg for the year.

The total MCC calculation is as follows:

1. Type I-M Consumers First Portion Emission Reduction:

   40 households x 0.055 MWh x 2.72 tCO_2e/MWh = 5.968 tCO_2e
2. Type I-M Consumers Second Portion Emission Reduction:

   40 households x (0.1 - 0.055) MWh x 0.8 tCO_2e/MWh = 1.44 tCO_2e
3. Total Emission Reduction for Type I-M:

   5.968 tCO_2e + 1.44 tCO_2e = 7.408 tCO_2e
4. Type II Consumers Emission Reduction:

   10 businesses x 0.5 MWh x 0.8 tCO_2e/MWh = 4 tCO_2e
5. Total Baseline Emissions Reduction:

   7.408 tCO_2e + 4 tCO_2e = 11.408 tCO_2e
6. Adjustment for Diesel Generator:

   500 kg x 0.0036 tCO_2e/kg = 1.8 tCO_2e
7. Adjusted Total Emission Reduction:

   11.408 tCO_2e - 1.8 tCO_2e = 9.608 tCO_2e

Therefore, the example mini-grid project can claim 9.608 MCCs for that year.

Example 2: Allowed and Prohibited MCC Exchanges

Consider a renewable energy company operating three mini-grid projects, A, B, and C. Over a three-year period, their R-REC generation is as follows:

	Year 1	Year 2	Year 3
Project A	80 R-RECs	120 R-RECs	90 R-RECs
Project B	60 R-RECs	50 R-RECs	70 R-RECs
Project C	100 R-RECs	150 R-RECs	110 R-RECs

Allowed Exchanges:

- The company can choose to exchange all R-RECs from a single project for a single year, such as all 80 R-RECs from Project A in Year 1.
- They can also opt to exchange R-RECs for all years of a single project, like all R-RECs from Project B across the three years (60 + 50 + 70 = 180 R-RECs).
- Another option is to exchange R-RECs for all projects in a single year, for example, all R-RECs from Year 3 across Projects A, B, and C (90 + 70 + 110 = 270 R-RECs).

Prohibited Exchanges:

- The company cannot exchange a portion of R-RECs from a single project in a single year, like only 40 R-RECs out of 80 from Project A in Year 1.
- The company cannot exchange a cumulative total that combines partial amounts from different years or projects, such as 100 R-RECs combining 40 from Project A in Year 1, 30 from Project B in Year 2, and 30 from Project C in Year 3.

Conversion from R-RECs to AVERT-USCCs

R-RECs minted from US utility-scale or distributed solar projects, such as rooftop solar installations, are uniquely positioned for conversion into AVERT-USCCs. This transformation leverages the Environmental Protection Agency's (EPA) Avoided Emissions and Generation Tool (AVERT), which assigns specific emission rates to renewable energy projects based on their geographic location and the year of energy generation. This process enables the quantification of the environmental impact of renewable energy in terms of avoided carbon emissions, translating R-RECs into AVERT-US Carbon Credits (AVERT-USCCs).

To initiate conversion, holders of eligible R-RECs must first return them to a specified, receive-only return wallet. Once returned, the R-RECs are evaluated using AVERT's region-specific emission rates for the relevant year, project class, and region given a conversion rate of 2205 pounds per ton. Upon successful calculation, the equivalent number of AVERT-USCCs is issued to the project. These credits are now available for use in carbon offsetting or trading within the broader carbon market.

For example, consider a distributed solar project in South Carolina that generated 134.914 MWh in 2022. AVERT assigns an avoided CO2 rate of 0.6435 tCO2e/MWh for such a project. The conversion to AVERT-USCCs is then calculated as follows:

134.914 MWh x 0.6435 tCO2e/MWh = 86.81 tCO2e

Therefore, the example project could exchange 134.914 R-RECs for 86.81 AVERT-USCCs.

Conversion from R-RECs to Ember Grid Reduction Carbon Credits (EGRCCs)

R-RECs generated from grid-tied renewable energy projects in various African countries are eligible for conversion into Ember Grid Reduction Carbon Credits (EGRCCs). This conversion process utilizes Ember's "Yearly Electricity Data" dataset, which provides detailed "CO2 Intensities" or emissions factors for each country's electrical grid. This methodology allows for a precise calculation of the carbon reduction impact of renewable energy projects based on their specific country location and the year of energy generation. By doing so, it translates R-RECs into EGRCCs, a measure of the tangible environmental benefit achieved through these projects.

To begin the conversion process, holders of eligible R-RECs must first transfer them to a designated, receive-only return wallet. Once the R-RECs are returned, they are evaluated using the Ember dataset's country-specific emission rates for the corresponding year. The conversion is calculated by applying these rates to the total energy generated by the project.

Upon successful calculation, the corresponding number of EGRCCs is credited to the project. These credits are then available for carbon offsetting purposes or for trading on the broader carbon credit market.

For instance, consider a solar energy project in Kenya that generated 200 MWh in 2022. Based on Ember's dataset, the avoided CO2 rate for Kenya's grid in 2022 is 0.10113 tCO2e/MWh. The conversion to EGRCCs would be calculated as follows:

200 MWh x 0.10113 tCO2e/MWh = 20 tCO2e

Therefore, the project could exchange 200 R-RECs for 20 Ember Grid Reduction Carbon Credits.

RE100 Compliance

While the RE100 initiative does not officially certify any standards as compliant with their criteria, the R-REC Standard has been independently certified by Deloitte as meeting all RE100 technical criteria. This chapter details how R-RECs fulfill these requirements.

1. Credible Generation Data

1.1. Verification of Static Data

All renewable energy generation projects must undergo third-party verification of their static data. The primary verification method is to be a REEE staff or contracted verification agent to conduct on-site inspections using the Site Verification Report detailed in Appendix A. This approach provides the most thorough and reliable verification of project characteristics.

The REEE recognizes that physical site visits may not always be feasible, particularly for remote areas or conflict zones. When a physical site visit is not convenient, project verification can be accomplished through a combination of official documentation that collectively verifies the project's essential characteristics, including generation capacity, fuel type, location, and date of first operation:

- Project commissioning report approved by the local government
- Countersigned off-taker agreement
- Land lease agreements
- Official license to operate
- Equipment purchase and installation contracts
- Grid connection agreements
- Insurance documentation
- Environmental impact assessments
- Technical inspection certificates from certified, third-party bodies

Regardless of the verification method, all projects must provide clear photographs of the installed generation and metering equipment. These photographs serve as confirmation of the project's implementation.

1.2. Verification of Dynamic Data

Generation data must be recorded through established metering systems, including dedicated meters like SparkMeter and SteamaCo, integrated inverter monitoring systems from major manufacturers, or comparable energy tracking solutions. These industry-standard systems provide reliable measurement and logging of electrical output, ensuring the accuracy of generation data used for R-REC issuance.

The REEE accepts metering systems from established manufacturers that have demonstrated reliable performance in the renewable energy sector. Only facilities with both verified static data and approved metering solutions qualify for participation on the REEE platform, maintaining the integrity of all generation data.

2. Attribute Aggregation

2.1. Ownership and Integrity of All Attributes

R-RECs ensure that buyers obtain ownership of all environmental and social attributes associated with the generation of renewable energy. This includes, but is not limited to, greenhouse gas (GHG) emission reductions and renewable energy generation.

To uphold the integrity of RE claims, the REEE will not sell off, transfer, or claim the environmental or social attributes of the power generation. Additionally, the REEE requires all our generators, the sellers on the platform, to enter into a contractual agreement, representing and warranting that they will also neither sell, transfer, nor independently claim any of the attributes associated with the power they generate. This dual commitment reinforces the authenticity and

reliability of the RE claims across our entire operation.

2.2. Adherence to Local and International Frameworks

The conditions for attribute aggregation vary by country due to different legal and regulatory frameworks governing the electricity sector. R-RECs are issued in compliance with local laws and policies, ensuring that they are valid under the specific conditions of each market.

3. Exclusive Ownership

3.1. Property Rights

R-RECs are supported by legally enforceable contracts that clearly define the property rights to environmental attributes. These contracts specify the terms of exchange, ensuring that all transactions are backed by a solid legal framework, which is enforceable irrespective of governmental recognition of the market. Each transaction on the REEE is documented with precise terms that clearly articulate the transfer and ownership of attributes, ensuring that these rights are exclusively held and legally protected.

3.2. Tracking

R-RECs utilize an advanced electronic tracking system where each megawatt-hour of energy generation is issued and tracked electronically. This system is designed to prevent the double counting of attributes by ensuring certificates are traded within a secure and closed system.

Each R-REC contains the standardized static verification data detailed in Section 1.1. This tracking clearly defines its geographical boundaries to prevent double registration and issuance, with mechanisms in place to ensure that a generator is registered in only one system at a time. These mechanisms are detailed in Appendix B: Standard Operating Procedure to Prevent Double-Counting.

The R-REC tracking system operates under transparent and non-discriminatory issuance criteria. Its operation rules are publicly accessible, ensuring fair access and treatment for all participants.

Both the static and dynamic verification data undergo frequent audits. Results are made publicly available to uphold the integrity and transparency of the market. Furthermore, the system is designed to provide full access to regulators and system auditors, allowing for independent verifications of consumer claims and ensuring compliance with best practices.

4. Exclusive Claims

4.1. Blockchain as a Foundation for Exclusive Claims

The blockchain serves as an immutable ledger where all transactions related to R-RECs are recorded. Once a transaction is entered, it cannot be altered or deleted, ensuring that each REC's history is permanently and transparently documented.

The decentralized nature of blockchain technology significantly enhances the security and reliability of the tracking system. It prevents unauthorized changes and ensures that all certificate data, including ownership and transaction history, is secure against tampering.

Each R-REC verification is uniquely serialized upon issuance. This serialization facilitates precise tracking from generation to final consumption or retirement, ensuring that each certificate can be individually accounted for throughout its lifecycle.

4.2. Mechanism for Retirement of R-RECs

To establish an exclusive claim, the owner must retire the R-RECs. Retirement is a critical process where the REC is permanently removed from circulation in the market, thereby concluding its lifecycle. This act ensures that the environmental attributes represented by the R-REC cannot be claimed or used by another party. The retirement process is governed by clear legal protocols within the tracking system, ensuring that once a R-REC is retired, it is publicly recorded and recognized as used by the entity that retires it.

All R-REC transactions, including retirements, are transparently documented and

accessible for audit. This transparency ensures that all market participants can verify the legitimacy of claims and that the RECs are used in accordance with contractual agreements and regulatory standards.

5. Geographic Market Boundaries

Each R-REC is issued based on the specific country/region where the renewable energy is generated. This specificity ensures that all certificates are sourced and utilized within the same regulatory environment, maintaining consistency and compliance with local energy policies and regulations.

The generation and consumption of R-RECs within the same country ensure that both align with national laws and regulatory frameworks that are sufficiently consistent throughout the territory. This alignment supports the legal enforceability and credibility of renewable energy claims made within these boundaries. Furthermore, by focusing on country-specific R-RECs, Renewvia contributes to the development of local energy markets. This approach supports domestic renewable energy projects, enhancing local job creation and economic growth within the renewable sector of each country.

6. Vintage Limitations

When making a renewable energy claim, the vintage of the attributes or certificates—referring to the specific year or period in which the energy was generated—plays a crucial role in ensuring the credibility of the claim. The concept of "reasonable" proximity between the generation and the reporting year varies across different markets and lacks a universally fixed definition. This flexibility allows for adjustments based on the availability and practicalities of renewable energy sourcing within specific geographies.

6.1. Adapting to Market Conditions

Companies should align with local or regional certification standards and claim verification programs that provide guidance on acceptable vintage. These standards are often tailored to reflect the renewable energy availability and market maturity in specific regions, ensuring that the vintage requirements are both practical and enforceable.

Additionally, reference to greenhouse gas (GHG) inventory reporting systems can help define a reasonable timeframe for vintage. These systems often have established protocols that can serve as a benchmark for determining the temporal proximity between generation and consumption.

6.2. Flexibility Based on Technical and Market Requirements

The capabilities and limitations of the tracking systems used for issuing and managing RECs might influence what is considered a reasonable vintage. Systems that allow for real-time or near-real-time tracking may support a narrower vintage window.

The specific market in which the consumer is active can also dictate the flexibility of vintage limitations. In markets where renewable energy is less developed or sporadic, a more flexible approach to vintage may be necessary to accommodate the sporadic availability of renewable generation.

6.3. Following Established Certification Criteria

Where applicable, adhering to criteria set by established certification programs like Green-e, which specifies a 21-month vintage eligibility window, provides a clear, justifiable guideline. These programs have conducted extensive market analyses to define their criteria, ensuring that they are both reasonable and supportive of market growth.

6.4. Documentation and Transparency

The REEE maintains thorough documentation of all energy attribute generation and their corresponding vintages. This transparency will support the credibility of RE claims, especially during audits or reviews by external parties. The REEE will clearly communicate the rationale behind the chosen vintage limitations to stakeholders, including investors, customers, and regulatory bodies. This ensures that all parties understand and agree on the flexibility and criteria applied in each specific case.

Amendments to the Standard

When the R-REC standard undergoes changes that may impact the compliance of accredited renewable energy producers, the following approach is taken:

1. Communication and Notification

The verification authority responsible for overseeing the R-REC Standard will promptly communicate any proposed changes or updates to all accredited renewable energy producers. This ensures that producers are aware of the potential impact on their compliance status and provides them with an opportunity to prepare for the changes.

2. Transition Period

The length of the transition period for accredited renewable energy producers during the implementation of changes to the R-REC Standard can vary depending on the nature and complexity of the updates. Factors that will be considered include the complexity of the changes, impact on renewable energy producers, consultation with stakeholders, industry best practices, and the possibility of adding flexibility via a phased approach.

3. Compliance Assessment

Following the transition period, the verification authority will conduct a compliance assessment for the accredited renewable energy producers to determine their adherence to the updated standard. This assessment may involve site visits, document review, data analysis, and other evaluation methods to verify compliance with the revised requirements.

4. Support and Guidance

During the compliance assessment process, the verification authority will provide guidance and support to renewable energy producers to help them understand and meet the updated standard requirements. This may include clarifications, training, and resources to assist producers in implementing the necessary changes to achieve compliance.

5. Conditional Accreditation

In cases where accredited renewable energy producers are unable to meet the revised standard requirements within the transition period, the verification authority may consider offering conditional accreditation. This conditional status allows producers to continue operating while working towards achieving full compliance within a defined timeframe. During this period, producers would be required to demonstrate progress and submit regular reports on their compliance efforts.

6. Revocation of Accreditation

If accredited renewable energy producers consistently fail to meet the updated standard requirements and do not show sufficient progress within the conditional accreditation period, the verification authority may revoke their accreditation. Revocation should be considered as a last resort when all reasonable efforts to achieve compliance have been exhausted. Revocation will not affect R-RECs that have already been minted.

7. Recertification

Once renewable energy producers have successfully adjusted their operations and comply with the updated standard, the verification authority can recertify them as compliant entities under the revised requirements. This recertification validates their renewed compliance and allows them to continue generating and selling R-RECs.

By following this process, the R-REC Standard can ensure a smooth transition for accredited renewable energy producers when changes are implemented.

Fee Structure

The verification authority established under the R-REC Standard plays a crucial role in ensuring the integrity, transparency, and effectiveness of the accreditation process for renewable energy producers. To sustain its operations and provide ongoing services, the verification authority adopts a revenue model that includes annual fees from accredited renewable energy producers and optional consultancy or advisory services. These revenue sources are designed to support the authority's administrative expenses, compliance monitoring, and provision of valuable guidance and expertise to the renewable energy industry.

Percent-Based Transaction Fee on R-REC Sales

Participants in the REEE are subject to a percent-based transaction fee. This fee is applicable only when the verification authority facilitates the sale of assets. The transaction fee is calculated as a percentage of the total sale value of the R-RECs.

This fee structure is designed to align the interests of the renewable energy producers with those of the verification authority, ensuring that both parties benefit proportionally from successful transactions. The verification authority ensures fairness by setting the fee structure in a manner that reflects the services provided and promotes the broad participation of renewable energy producers.

Optional Consultancy Services and R-REC Sales Facilitation

In addition to the core functions of the verification authority, the consultancy services provided also encompass certain optional services that support renewable energy producers in the sale of their R-RECs. These services include connecting producers with potential R-REC buyers, facilitating the aggregation of R-RECs across multiple producers for sale, and assisting in the overall sales process. It is important to note that the utilization of these services is entirely optional and not mandatory for renewable energy producers participating in the R-REC program.

As part of the consultancy services, the verification

authority can assist renewable energy producers in connecting with potential R-REC buyers. By leveraging its network, market expertise, and industry connections, the authority can help facilitate meaningful connections between producers and interested buyers. This service aims to streamline the process of R-REC sales, enabling producers to explore potential market opportunities and expand their reach.

The verification authority can provide assistance in aggregating R-RECs across multiple renewable energy producers for sale. This service allows for the consolidation of R-RECs from various projects, enhancing market liquidity and creating larger volumes of carbon assets for potential buyers.

The verification authority may also assist renewable energy producers in the facilitation of R-REC sales. This can involve providing guidance on sales strategies, market trends, and pricing considerations. By leveraging its expertise in carbon asset markets, the authority can support producers in navigating the sales process, facilitating negotiations, and ensuring compliance with relevant regulations and reporting requirements.

It is important to emphasize that the utilization of these additional services is entirely at the discretion of REEE participants. Neither producers nor buyers are obligated to engage the consultancy services of the verification authority for R-REC sales, and they retain the freedom to independently sell their R-RECs to any buyer, at any time, and for any negotiated price.

This optional nature of the consultancy services ensures that renewable energy producers have the flexibility to explore various sales channels, engage in direct negotiations, or utilize other intermediaries if they choose to do so. The verification authority's role is to provide assistance, expertise, and facilitation, should producers opt to avail themselves of these additional services.

By offering these optional consultancy services, the verification authority aims to enhance market access, provide valuable guidance, and create opportunities for renewable energy producers to maximize the value of their R-RECs. It further reinforces the authority's commitment to supporting the growth and success of the renewable energy sector, while allowing producers the autonomy to navigate the carbon asset market according to their individual preferences and strategies.

Complaint Management Policy

Introduction

This policy outlines the guidelines and procedures for managing complaints within the R-REC Standard. The verification authority is committed to ensuring a fair and transparent process for addressing complaints raised by stakeholders, including renewable energy producers, buyers, and other relevant parties. The policy aims to promote efficient resolution, maintain trust, and continuously improve the standard and its implementation.

Scope

This policy applies to all complaints related to the R-REC Standard and its accreditation process. Complaints may include, but are not limited to, issues related to accreditation decisions, compliance assessments, consultancy services, fee structures, communication, or any other aspect associated with the authority's operations.

Complaint Submission

Complainants are encouraged to submit their complaints in writing to the verification authority. Complaints should include clear and specific details about the nature of the issue, relevant supporting documents or evidence, and contact information of the complainant. Complaints can be submitted via email to the verification authority.

Complaint Handling Process

1. **Receipt and Acknowledgment.** Upon receiving a complaint, the verification authority will promptly acknowledge receipt of the complaint to the complainant. This acknowledgment will include an assigned reference number for future correspondence and tracking purposes.
2. **Investigation and Evaluation.** The authority will conduct a thorough and impartial investigation into the complaint, gathering relevant information, reviewing documentation, and seeking input from relevant parties, if necessary. The investigation process will be conducted by qualified personnel who are independent of the subject matter of the complaint.
3. **Resolution and Communication.** Once the investigation is complete, the authority will provide a written response to the complainant, outlining the findings, conclusions, and any actions taken or recommendations proposed to address the complaint. The response will be clear, concise, and transparent, addressing the concerns raised by the complainant.

Timelines

The authority will strive to resolve complaints in a timely manner. While the specific timeline for resolution may vary depending on the complexity of the complaint, every effort will be made to provide a response within a reasonable timeframe. The complainant will be kept informed of the progress and any anticipated delays during the resolution process.

Confidentiality and Privacy

The verification authority recognizes the importance of maintaining the confidentiality and privacy of complainants and any sensitive information disclosed during the complaint handling process. All complaints and related information will be handled in accordance with applicable privacy laws and regulations.

Continuous Improvement

The verification authority is committed to continually improving its operations, including its complaint management process. Feedback received through complaints will be carefully reviewed and analyzed to identify opportunities for enhancement. Lessons learned from the complaint handling process will be used to refine policies, procedures, and practices to prevent similar issues from recurring in the future.

Reporting and Transparency

The authority will maintain records of all complaints received, including details of investigations, resolutions, and any actions taken. Aggregate and anonymized complaint data may be used for reporting purposes to enhance transparency and demonstrate the authority's commitment to effective complaint management.

Review and Appeals

If a complainant is not satisfied with the resolution provided by the verification authority, they may have the right to request a review or appeal.

Compliance

The verification authority is committed to complying with all applicable laws, regulations, and industry standards pertaining to complaint management and resolution.

Changelog

1.1 - 2024-02-11

- Added Ember Grid Reduction Carbon Credits (EGRCCs)
- Added links to referenced material
- Added changelog

2.0 - 2025-03-XX

- The name of the platform is the Renewvia Environmental Equity Exchange (REEE). The name of the products sold through REEE is an R-REC.
- Clearly defined “third party”
- Streamlined Renewable Energy Producer Verification timeline to be in line with the RE100
- Updated Technical Implementation chapter with new features
- Added chapter on RE100 compliance
- Added appendices “A: Site Verification Report” and “B: Standard Operating Procedure to Prevent Double-Counting”

Appendix A:
Site Verification Report

Basic Information

Date of Inspection: _____

Inspector Name: _____

Project Details

Project Name: _____

Owner/Company: _____

Contact Person: _____

Contact Email: _____

Contact Phone: _____

Site Location

Physical Address: _____

GPS Coordinates: Latitude: _____ Longitude: _____

Grid Connection Status: ▫ Grid-Connected ▫ Mini-Grid ▫ Off-Grid

Date of First Operation: _____

Generation Facility Details

Primary Energy Source

Type: _____

Detailed Description: _____

Backup/Secondary Energy Source (if applicable)

Type: _____

Detailed Description: _____

Plant Specifications

Total Installed Capacity (kWp): _____

Make/Model of Main Equipment: _____

Expected Annual Generation (MWh): _____

Metering and Monitoring Systems

Primary Meter

Make: _____

Model: _____

Backup Meter (if applicable)

Make: _____

Model: _____

Data Logging System

Type of System: _____

Data Storage Method: _____

Physical Inspection Checklist

▫ Generation Equipment Verified

▫ Metering Equipment Verified

▫ Data Logging System Verified

▫ Safety Systems Verified

▫ Grid Connection Point Verified (if applicable)

▫ Fuel Storage Facilities Inspected (if applicable)

Documentation Review

▫ Operating License (if applicable)

▫ Environmental Permits (if applicable)

▫ Grid Connection Agreement (if applicable)

▫ Previous Generation Data (if applicable)

Photographs

Equipment Photos Attached: ▫ Yes ▫ No

Meter Photos Attached: ▫ Yes ▫ No

Site Overview Photos Attached: ▫ Yes ▫ No

Consumer Information (for Mini-Grids)

Number of Type I-M (Metered Household) Consumers: _____

Number of Type II (Metered Non-Household) Consumers: _____

Findings and Observations

Compliance Status

- ▫ Fully Compliant
- ▫ Partially Compliant
- ▫ Non-Compliant

Detailed Observations

Non-Compliance Issues (if any)

Recommended Actions

Verification Outcome

- ▫ Approved for R-REC Generation
- ▫ Conditional Approval (see recommendations)
- ▫ Not Approved

Declaration

I hereby declare that the information provided in this report is accurate and complete to the best of my knowledge.

Inspector Signature: _____

Date: _____

Facility Representative Acknowledgment

Name: _____

Position: _____

Signature: _____

Date: _____

For Official Use Only:

Report Received Date: _____

Processed By: _____

Verification Status: _____

Appendix B: Standard Operating Procedure to Prevent Double-Counting

Purpose

This Standard Operating Procedure (SOP) establishes the systematic approach for preventing double-counting of renewable energy generation within the REEE system and across other platforms.

Scope

This procedure applies to all renewable energy projects registered on the REEE platform and covers verification processes for both new project registration and ongoing monitoring.

Procedure

1. New Project Registration Verification

After collecting the complete Site Verification Report as detailed in the chapter on RE100 Compliance, the REEE verification team shall perform the following checks before approving any new project:

1.1. Compare all submitted static project information against existing REEE database entries

1.2. Cross-reference project location, capacity, and commissioning date

1.3. Flag any matches or suspicious similarities for further investigation

2. Generation Data Verification

Renewable energy generation can only be reported from energy meters as detailed in the chapter on RE100 compliance. For all reported renewable energy generation:

2.1. Compare new generation timestamps against existing blockchain records, confirming no temporal overlap with previously recorded generation

2.2. Verify alignment between metering data and timestamp records

2.3. When the new R-RECs are minted to the blockchain, record verified generation data with corresponding timestamps, linking the generation records to specific project identifiers

3. External Platform Verification

3.1. Contractual Requirements

- Ensure all generator contracts include explicit exclusivity clauses
- Obtain written confirmation of exclusive REEE registration from generators

- Maintain current contract documentation for all active projects

3.2. Annual Compliance Review

- Identify and document relevant certification systems in each region of operation
- Cross-reference REEE projects against other tracking systems
- Document the review process and findings
- Issue annual compliance notices to stakeholders

3.3. Ongoing Monitoring

- Maintain regular communication with generators regarding exclusivity requirements
- Update registry of relevant certification systems as market evolves
- Document and investigate any reported irregularities
- Maintain records of all compliance activities

Responsibility

Project Verification Team: New project registration verification

Technical Team: Generation data and blockchain verification

Compliance Team: External platform verification and annual reviews

Management: Review and approval of compliance notices

Review

This SOP shall be reviewed annually and updated as needed to reflect changes in market conditions or regulatory requirements.