Voluntary Ecological Markets Overview

Interwork Alliance – Sustainability Business Working Group

To establish the standards for tokenization, contractual extensions, workflows, and analytics for creating a standards-based ecological market.

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Overview

The goal of the Voluntary Ecological Markets Taskforce (VEM) is to establish the standards for tokenization, contractual extensions, workflows, and analytics for creating a standards-based ecological market. These standards, based on the IWA's Token Taxonomy Framework (for token standards) and InterWork Framework (for smart contract standards), will serve as foundations for using distributed ledger techniques (DLT) to create an auditable ecosystem. The taskforce chose to use a broad definition of ecology rather than just carbon, as the same techniques and instruments defined for carbon can be repurposed for other ecological benefit types like water. However, the voluntary carbon market is the most advanced, relatively speaking, so it will be used as the canonical example in the VEM.

Essential to any market are buyers and sellers as well as a method of finding or matching them together, negotiating exchange, and ultimately the exchanging of value between them. In the "carbon" markets, there are, in general, two major types of markets: voluntary and regulated. The voluntary markets are not under any agency of regulatory control or sanction, which means participants are active based on natural market forces or social responsibility to be consumers in the market. For example, environmental, social and governance (ESG) criteria, defined by socially conscious investors, is used to screen potential investments based on company operations. Regulated markets, on the other hand, require a governmental agency, either a nation state or treaty (like the Kyoto or Paris accords), which require industry compliance from participants.

A carbon credit is a permit that allows the company which holds it to emit a certain amount of carbon dioxide or other greenhouse gas (GHG). Carbon credits represent the right to emit that carbon. In short, carbon credits, the "currency" of carbon markets, provide a key driver and incentive for any organization committing to a sustainability plan. Meanwhile, carbon offsets represent the production of a certain amount of sustainable energy, a reduction in emissions, or actual sequestration of GHG to counterbalance the use of fossil fuels. Carbon offsets result in the generation of carbon credits.

Carbon offsets provide a company the means to cost-effectively offset its own carbon dioxide emissions while giving the company the time needed to prioritize and allocate resources and capital into longer-term direct emissions reductions achieved by cleaner technologies, fuels, and supply chains. Purchasing carbon credits allows companies to invest in climate action, claim the achievement of near-term goals, and to sell any surplus credits they do not consume to organizations that do not have enough credits to cover their own emissions.

There are generally two types of carbon credits: emission allowances and carbon offsets. Emission allowances are creatures of government regulation, which issue permits to emit one ton of carbon-equivalent greenhouse gases (identified as CO_{2e}).

A carbon offset is an intangible asset that is created by owners of carbon emissions reduction or removal projects, or programs, which must be verified or validated by a third party. An offset credit is minted when it becomes issued in an environmental registry, something that happens upon verification that one ton of CO_{2e} greenhouse gases have either been avoided (e.g., clean electricity), reduced (e.g., sustainable fuels), or sequestered[1] (e.g., avoided deforestation, sustainable farming) by an approved project or activity. That offset represents the original owner's property right claims to those carbon-related benefits. The owners can then sell their credits directly to buyers or

[1] Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide.

at wholesale. The ultimate end-user has the right to claim the benefits and an ability to retire the credit permanently – usually as part of netting the claimed CO_2e benefits against that end-user's other GHG emissions.

In the VEM, we will be collecting the requirements from the subject matter experts from emissions, credit offsets and market infrastructure based on historical experiences and the new possibilities made available when applying multi-party techniques and technology like distributed ledgers.

The VEM defines the voluntary ecological market in phases:

1. Creating Verified Supply
2. Establishing Voluntary Demand
3. Buying and Trading
4. Offsetting

Each of these phases are connected to model out the lifecycle of an ecological market with standardized roles as well as token, contract, and analytical draft specifications within each phase. The VEM documents these phases in separate sections, where roles can play a part in each phase.

Market Roles

Because roles in a voluntary market participate across phases of the life cycle, we document and define them outside of the phases and reference them within each phase's documentation. Roles in the VEM define an individual or organization that performs specific VEM actions in the lifecycle of the marketplace. The roles defined here can be combined or performed by the same actor or individual.

Supplier

A supplier performs the actions, in either an Ecological Project or Program (EP) , for creating the asset value (i.e. carbon offsets) for use in the voluntary market and becomes the initial owner of the ecological benefit value generated. There can be multiple parties that are a part of the supplier role:

- Owner: the organization or individual that owns the assets used in the activity that is the source of the benefit claims. For an Ecological Project, this might be a farmer.
- Sponsor: the organization or individual that finances the activities generating the benefit claims. I.e., a bank or investment fund.
- Developer: the organization or individual that constructs or develops techniques or technologies used in the activities that generate the benefit claims, like a direct air capture device manufacturer.

Each of these categories in the supplier role can contain multiple different participants (i.e., there can be multiple sponsors or developers). The identity of all participants is recorded in the EP.

Standard Registry

A standard registry is an organization that establishes science-based standards for measuring, reporting, and verifying (MRV) ecological benefit claims and issues value in the form of credit for claims that meet the standard set. A standard registry also authorizes validation and verification bodies (VVBs) to collect and process claims based on the established standard. The creation of scientific-based standards for MRV is a rigorous discipline that requires independence from commercial influence in the pursuit of accurate accounting of benefit or emissions claims.

A standard registry organization can also maintain a central registry of credits they have issued that can be sold directly via the registry itself, or established as reference value on networks, exchanges, or marketplaces.

Validation and Verification Body (VVB)

A VVB is an organization that is authorized by a Standard Registry to validate and verify MRV claims issued by an EP. The VVB may provide technical infrastructure to suppliers for submitting claims for verification and other services to assist and speed up the time to market for verified credits as supply.

Buyer

An individual or organization that purchases verified credits issued by a Standard Registry. In the voluntary market these are usually corporate buyers using credits as offsets for unavoidable emissions to meet their stated ESG goals, but could evolve into speculative or institutional buyers.

Exchange or Marketplace

An organization that provides trading infrastructure to match buyers and sellers together and include services like settlement, clearing, and risk management. Suppliers can list their credits on the exchange and buyers can trade directly or via a broker on the exchange.

Financial Intermediary

An organization, commercial corporate banks, that provides services for suppliers/sellers and buyers like financing, portfolio management, custody, reporting, etc.

Verified Supply – Credits

The VEM has created standard representations of value for either an ecological product or the source of these products by:

- Establishing a standard token or digital asset representation for GHG/Carbon Credits, linked to the removal project (or EP) and verifying organization.
- Collaborating with other initiatives like the TSVCM to align terminology and recommendations with token and contract definitions produced using the IWA tools and frameworks.
- Providing specifications that represent the shared set of data required by market participants allowing for credit comparison and rapid quality determination to increase confidence in the market.

- Recording and linking removal projects and tokens to the removal technique and accounting methodology to enable quality grading of offsets based on aspects like geography, sequestration type, scientific measurement, etc.
- Preventing the double crediting or spending of credits by removal projects or emissions reporters.

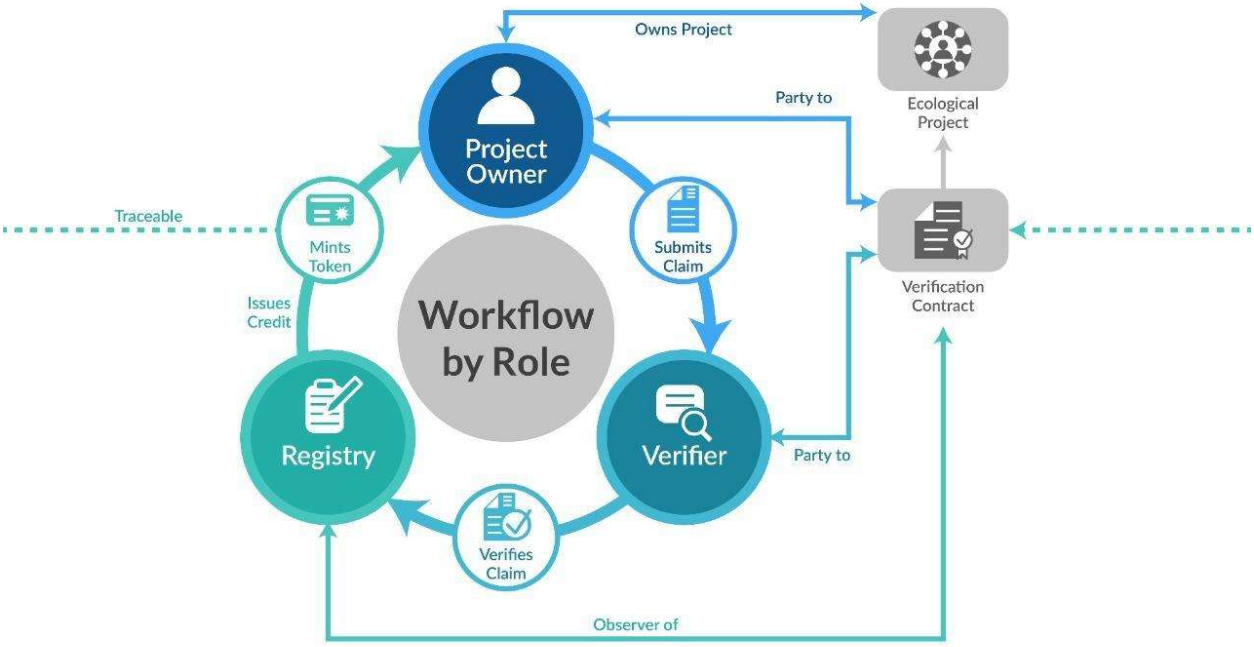
Lifecycle - Supply of Verified Ecological Credits

The creation of carbon credits, a type of ecological benefit token, is the process of creating verified supply. The verification process should result in the creation of a high-quality digital asset, a credit token, whose value can easily be determined and quickly be compared with other tokens of the same type. However, all the data needed to verify the integrity and value of the token should not all reside within the token itself but be available in other data constructs involved in the verification process.

Roles

The process or workflow for creating verified supply involves 3 roles:

- Project owner or developer - this is the entity (person or company) that owns the project whose activities will be the source of benefit claims in a process generically called measurement or monitoring, reporting and verification (MRV) to create a credit.
- VVB - the entity who performs the actions needed to verify the benefit claims issued by a project. Claims and verification should be based on a scientific standard for measuring the results of the activity being conducted by the project.
- Standard registry - the entity that establishes the scientific standard that the claims are based on and the rules for verifying them. A VVB is certified to verify claims against the established standard and once verified, the standard registry creates the verified carbon credit that represents the actual intangible value that becomes the property of the project owner that created the claim.

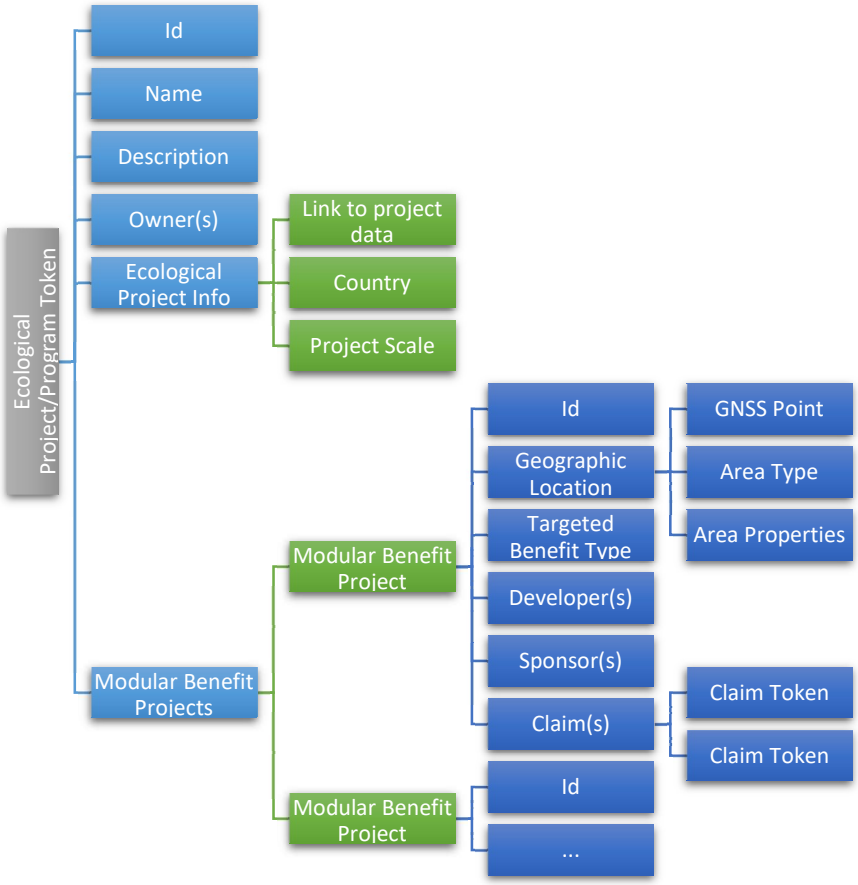


Ecological Project or Program (EP)

Ecological Projects or Programs provide a single source of truth to all participants regarding the identity of a project or program and its ecological benefit claims. It is important to have this source of truth for all participants to be able to trace the ecological benefit token back to its project. Key details that are important for the supplier, validation and verification body ("VVB"), standard registry, and buyer in the market are recorded in the Ecological Project or Program object. The token specification for an EP using the Token Taxonomy Framework (TTF) is given in the figure on page 9.

What is the difference between a Project and a Program?

- A Project is typically used to describe nature-based projects like agricultural (farms) or forestry.
- A Program is typically used to describe a technology-based solution like direct air capture or carbon capture during natural gas extraction or processing.



Every Ecological Project or Program will have the following:

- Unique identifier ("Id"): An identifier that is issued and independent of the "name" of the project. The Id is used to reference the project and link it to its claims, verification, and credits issued to it.
- Name: A name is recommended, but not required, to be unique.
- Description: A brief description of the project.
- Owner(s): One or more references to the Id(s) of the project or program owner(s).

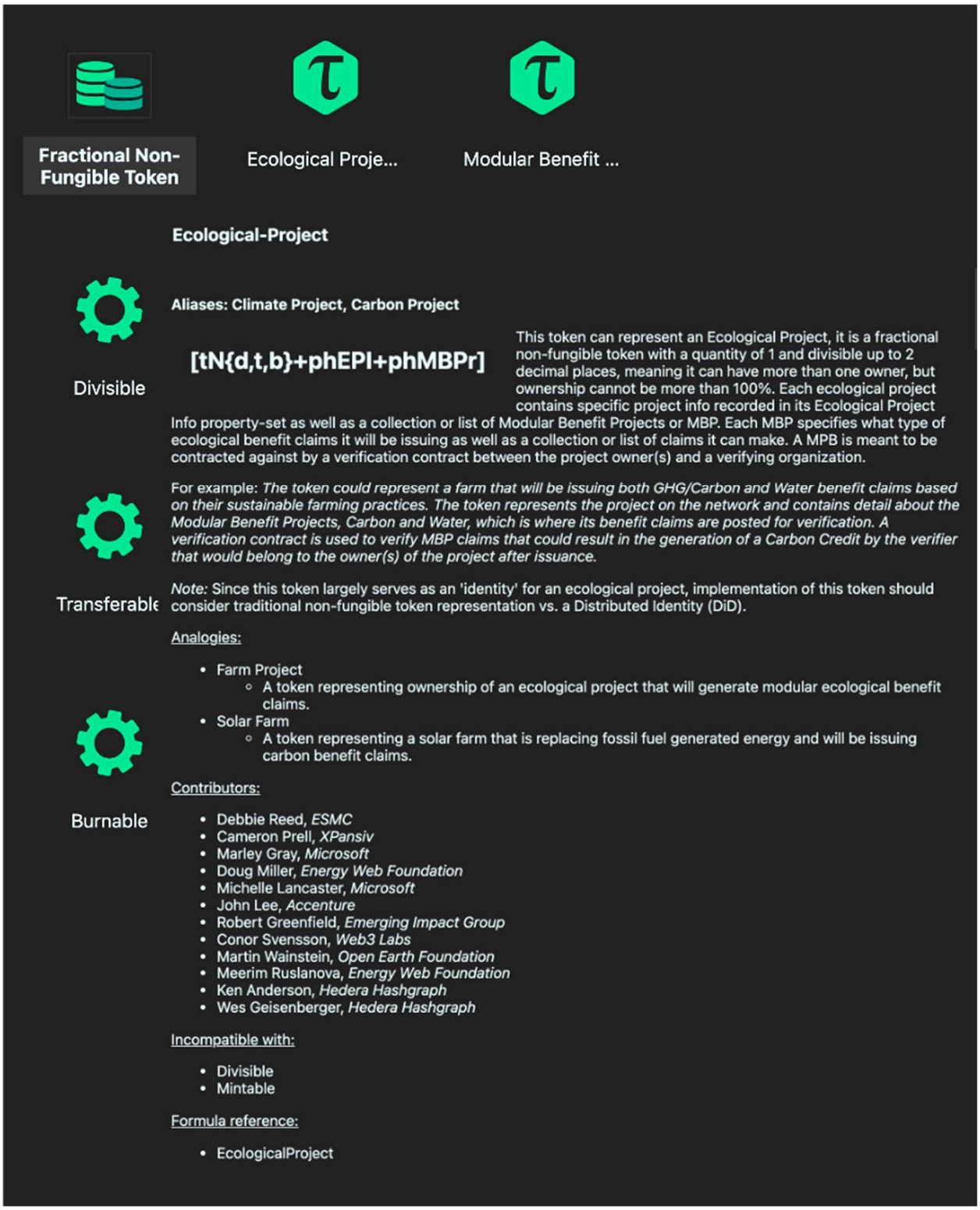
- Ecological Project Info: Metadata, defined below, about the project.
- Modular Benefit Projects ("MBP"): A project has one or more MBPs based on the type of claim that the project will be making. For example, a project can make both carbon reduction and carbon removal claims and would need a MBP for each type of claim it will make.
- Ecological Project Info contains:
    - Link to Project Data: A verified link to more project data like marketing materials or a website.
    - Country: The host country for the project.
    - Project Scale: One from the list of - Micro, Small, Medium, or Large

A Modular Benefit Project contains:

- Unique identifier ("Id"): An identifier that is issued and is independent of the project. The Id is used to establish a compound identifier linking the MBP with its host EP.
- Geographic Location:
    - Basic GNS/GPS for Programs
    - GeoJSON for Projects
- Targeted Benefit Type
- Carbon: Reduction/Removal + Natural/Technology
- Water
- Nitrogen
- Phosphorus
- Sediment
- Developer(s)
- Sponsor(s)
- Claim Tokens

A Claim Token contains:

- Unique identifier (Id): An identifier that is issued and independent of the MBP. The Id is used to establish a compound identifier linking the claim with its MBP and EP.
- Co-benefits: One or more options from a list of the added benefits we get above and beyond the direct benefits of a more stable climate.
- A collection of Claim Checkpoints, where each checkpoint represents a portion of the claim as it builds over time. A checkpoint includes:
    - Verified Link: Is a reference to the source data the claim is based on. This contains a URI pointing to the data file which can be verified. The data file should be accompanied by either a signature or a hash so that the integrity can be verified. For example, this can be accomplished using the W3C DID specification.
    - Date Range: The date span for which the claim is being made.
    - Environmental Effects Before: A measure of the claim before project activities.
- Environmental Effects After: A measure of the claim after project activities.

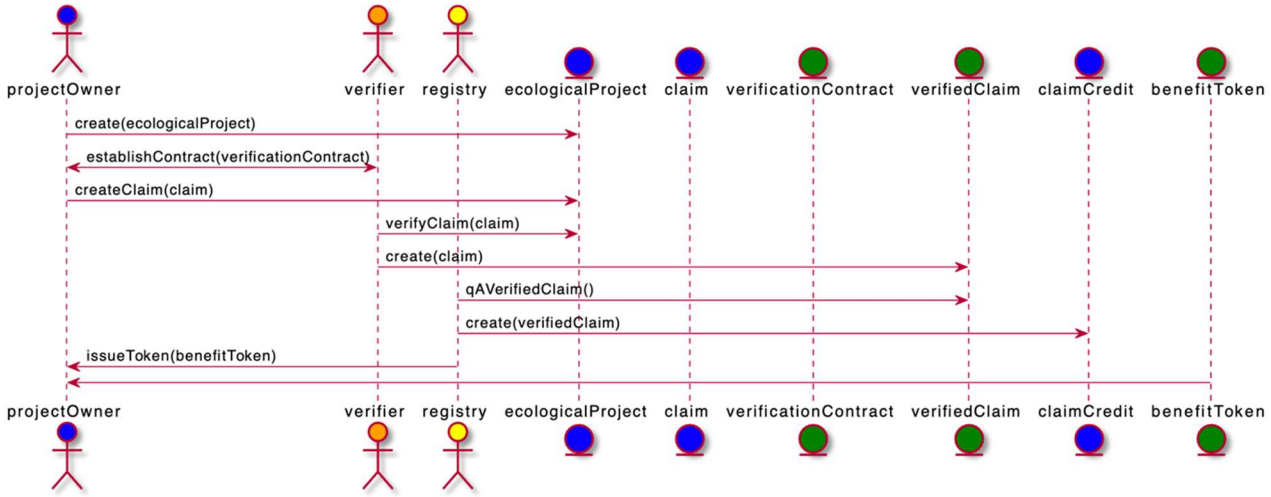


Token Specification for an Ecological Project Using the Token Taxonomy Framework (TTF)

Basic flow for establishing a project and issuing offsets

Here are the high-level, "greenfield", steps for establishing an ecological project and having Core Carbon Principles tokens (CCPs) issued for it:

1. An ecological project owner defines their project and determines the type of benefit claims that it will be making. Claims should be based on a scientific standard established by a standard registry that matches the activity the project will be conducting.
2. The project owner will need to contract with a certified VVB of the standard for which they are submitting claims, or an Ecological Claim token. Once contracted, the project owner can submit the claim token, which consists of the data required by the standard for the period of the claim. The claim token will be linked to the submitted Modular Benefit Project and have references to its raw data and any reference claim data.
3. The contracted VVB validates and verifies the claim, by encumbering the claim token then processing it against the associated registry standard. Once completed, a Processed Claim token is created and the claim that was verified is marked as processed/retired with the link to the Processed Claim token. The processed claim contains the amount of the claim, a carbon reduction or removal, which consists of the marked-up claim data and verification report.
4. A processed, verified claim is then picked up by the registry of the standard that is a party to the verification contract. After a quality check, the registry creates a credit in the amount verified by the processed claim. This becomes the carbon credit. Once the credit is established in the registry, the credit is "tokenized" in an intangible reference token. This is generically referred to as an Ecological Benefit Token, but is tokenized as a specific type, like a Core Carbon Principles token. On the registry and ledger where the token is implemented, the owner of the credit is the ecological project owner. The Processed Claim token is then credited/retired along with the Id for the credit issued against the claim, preventing the processed claim from being credited more than once.



Core Carbon Principles (CCP) Token

A Core Carbon Principles ("CCP") token represents a specified volume of metric tons of greenhouse gas ("GHG") emissions reduced or removed by a project. The technique for reduction or removal of GHGs in a project, its measurement, and verification methodology are found in the Verification Contract and the issuing standard registry. The CCP is a tradeable digital asset whose price is determined by the market using the associated information found in the related entities.

The CCP has standard data elements that represent the shared view required by the parties in the carbon market from suppliers, buyers, validation and verification bodies ("VVB"), registries, and exchanges. These standard data elements are based on the recommendations from the TSVCM. The token specification for a CCP Token using the TTF is given in the figure on page 13.

Every CCP will have the following behaviors and properties:

- Is a fungible token that represents one metric ton of CO_2 ($mtCO_2$) or 1 $mtCO_2e$ that is either a reduction, avoidance, or removal. See classification in Core Carbon Attributes.
- Is divisible, transferable, encumberable, revokable, delegable, offsetable and mintable with role support.
- Unique identifier (Id): An identifier that is assigned when issued.
- Owner: The Id of the account that is the owner of the token.
- Issuer: The Id for the issuing standard registry.
- Core Carbon Principles (CCP): A set of properties that every CCP will have.
- Core Carbon Attributes (CCA): A set of properties where the values can differ significantly between CCPs and allows comparisons and grouping of like CCPs together.

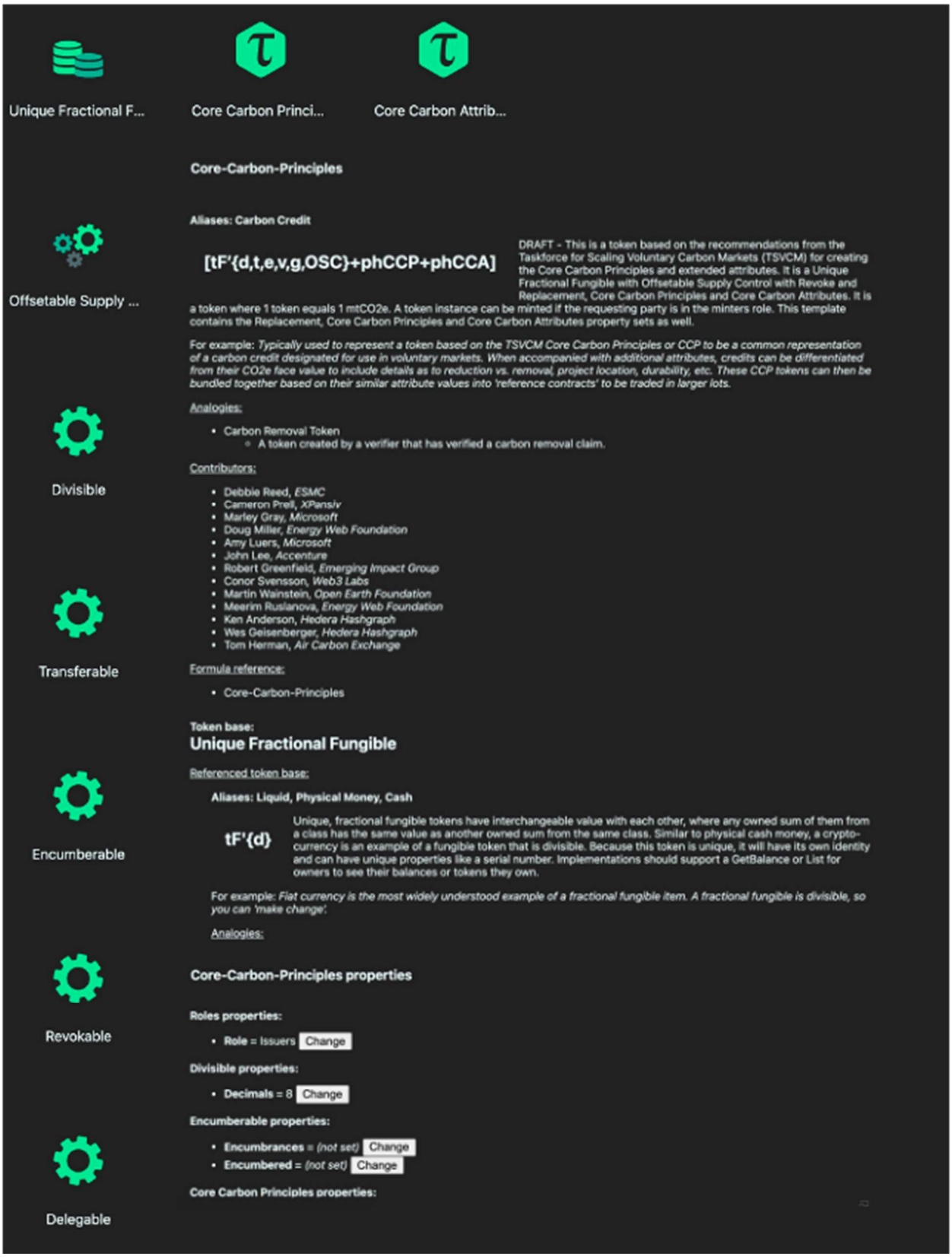
Core Carbon Principles contain:

- AssetId: The serial number or unique identifier of the referenced credit on the standard registry that the token represents.
- Issuance Date: The date of creation.
- Determined Value: Ex-ante, Ex-post
- Verification Standard: VCS, GS, etc.
- Additionality:
    - Some Value – see additionality
- Leakage:
    - Some Value – see leakage
- Reference to Project/MBP/Claim
- Reference to Contract/VerifiedClaims/Claim
- Date Range: The verified period of the benefit claim.

Core Carbon Attributes contain:

- Classification:
    - Category: Reduction, Avoidance or Removal
    - Method: Nature or Technology
- Vintage

- Storage
    - Biosphere
    - Geosphere
- Durability: permanence risk, near term (up to 20 years), short term (20-50 years), medium term (50-80 years), long term (80-100 years), and very long term (100-1000 years)
- Clear Removals:
    - N_2O: ≤ 0
    - CH_4: ≤ 0
- Co-benefits: One or more options from a list of the added benefits we get above and beyond the direct benefits of a more stable climate.
- PA-Compliance:
    - Corresponding Adjustment



Token Specification for a CCP Token Using the TTF

Using CCP

CCPs can be held for their value or spent to offset reported emissions in either a voluntary or a regulated market. When an owner offsets a CCP, it is applied towards an ESG Goal or another target and is retired or burned and cannot be offset again. See ESG Scorecard.

Issues with CCP

Narrowing the list of attributes to cover most demand signals may cause limitations when it comes to value variables including:

- Year scale for Global Warming Potential (GWP) for calculating GHG CO_2e:
    - 100yr GWP vs. 20yr GWP for methane (CH_4) that has greater warming potential in the 20yr vs. 100yr GWP.

Additionality

Additionality, for carbon removal, is whether it would have happened without the existence of the project. This is a complicated and controversial topic—relying on logic that can be difficult to prove in either direction.

- There is not a single, clear market agreement for how to calculate the baseline against which a project's impact gets measured. Project developers can misuse baselines, resulting in inflated credit values. Baselines against which removals are estimated must be set conservatively to minimize risk of over-crediting.
- No best practice, or common authoritative standards body guiding best practices, exists to guide decisions on how carbon finance and corporate procurement of credits contribute to additionality. Some projects have received criticism because payments for carbon credits are only a percentage of the entire project funding stack or because landowners don't know that the project is generating carbon credits.

Baseline

Establishing an accurate and fair baseline to measure progress, like reductions measurement requires a baseline level to be established. Historically, establishing a baseline has been troublesome for validation of claims.

Leakage

Some projects inadvertently shift emissions from one geographic area to another area that is not counted in the project claim. Activity leakage occurs when an activity is displaced from one geographic area to another. Market leakage occurs when a project reduces supply of a specific product, but market demand encourages others to provide that product instead. For example, carbon removal might be achieved in one area by letting trees grow longer but may indirectly result in trees being cut elsewhere to satisfy timber market demands. To improve leakage determinations, registries should develop stronger science-based benchmarks for leakage that are informed by research.

Carbon Removal Unit (CRU) Token

A Carbon Removal Unit is very similar to the Core Carbon Principles (CCP) token regarding properties but differs in that it is a non-fungible token (NFT), meaning a CRU token is not interchangeable with other tokens of the same type. It represents 1 metric tons of GHG emissions removed by a project or program. The technique for removal, its measurement and verification methodology shall be found in the Verification Contract and the issuing standard

registry. The CRU is a tradeable digital asset which the market determines price using the associated information found in the related entities on the network. The specification for a CRU Token is shown in the figure on page 16.

The CRU has standard data elements which represent the shared view required by the parties in the carbon market from suppliers, buyers, VVBs, registries, and exchanges, and are based off the recommendations from the TSVCM.

CRUs have the following behaviors and properties:

- A non-fungible token (NFT) that represents 1 Carbon Removal Unit or CRU, a unit representing one metric ton of CO_2 ($mtCO_2$) removed
- Is divisible, transferable, encumberable, revokable, delegable, offsetable and mintable with role support.
- Unique identifier (Id): that is assigned when issued.
- Owner: has Id of the account that is the owner of the token.
- Issuer: the Id for the issuing standard registry.
- Core Carbon Principles (CCP): a set of properties that every CRU will have.
- Core Carbon Attributes (CCA): a set of properties where the values can differ significantly between CRUs and allows comparisons and grouping like CRUs together.

Core Carbon Principles contain:

- AssetId: the serial number or unique identifier of the referenced credit on the standard registry that the token represents.
- Issuance Date: the date of creation.
- Determined Value: Generated, Ex-ante, Ex-post
- Verification Standard: VCS, GS, etc.
- Additionality:
    - Some Value – see additionality
- Leakage:
    - Some Value – see leakage
- Reference to Project/MBP/Claim.
- Reference to Contract/VerifiedClaims/Claim.
- Date Range: the verified period of the benefit claim.

Core Carbon Attributes contain:

- Classification Category: Removal
    - Method: Nature or Technology
- Vintage
- Storage: Biosphere or Geosphere
- Durability: permanence risk, short term (up to 100 years), medium term (100 to 1,000 years), and long term (more than 1,000 years)
- Clear Removals:
    - N_2O: ≤ 0
    - CH_4: ≤ 0
- Co-benefits: one or more from a list
- PA-Compliance:
    - Corresponding Adjustment

CARBON-REMOVAL-UNIT

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Tom Herman	AirCarbon Pte Ltd
Tom Baumann	Climate Check

Taxonomy Formula: [tN{d,t,e,v,g,OSC}+phCCP+phCCA]

Token Specification Summary

Token Classification

Template Type:	**SingleToken**	**This token has no sub or child tokens.**
Token Type:	NonFungible	This token is not interchangeable with other tokens of the same type

Example of a CRU Token Formula Using the TTF's Taxonomy

Using CRU

CRUs can be held for their value or spent to offset reported emissions in either a voluntary or regulated environment. When an owner offsets a CRU, it is applied towards an ESG Goal or another target and is retired or burned and cannot be offset again. See ESG Scorecard.

Issues with CRU

Narrowing down the list of attributes to cover the majority of demand signals may run into limits when it comes to value variables like:

- Year scale for Global Warming Potential (GWP) for calculating GHG CO_2e:
    - 100yr GWP vs. 20yr GWP for methane (CH_4) that has greater warming potential in the 20yr vs. 100yr GWP.

Additionality

Additionality, for carbon removal, is whether it would have happened without the existence of the project. This is a complicated and controversial topic—relying on logic that can be difficult to prove in either direction.

- There is not a single, clear market agreement for how to calculate the baseline against which a project's impact gets measured. Project developers can misuse baselines, resulting in inflated credit values. Baselines against which removals are estimated must be set conservatively to minimize risk of over-crediting.
- No common authoritative standard exists on how carbon finance and corporate procurement of credits contribute to additionality. Some projects have received criticism because payments for carbon credits are only a percentage of the entire project funding stack or because landowners don't know that the project is generating carbon credits.

Baseline

Establishing an accurate and fair baseline to measure progress, like reductions measurement, requires a baseline level to be established. Historically, establishing a baseline has been troublesome for validation of claims.

Leakage

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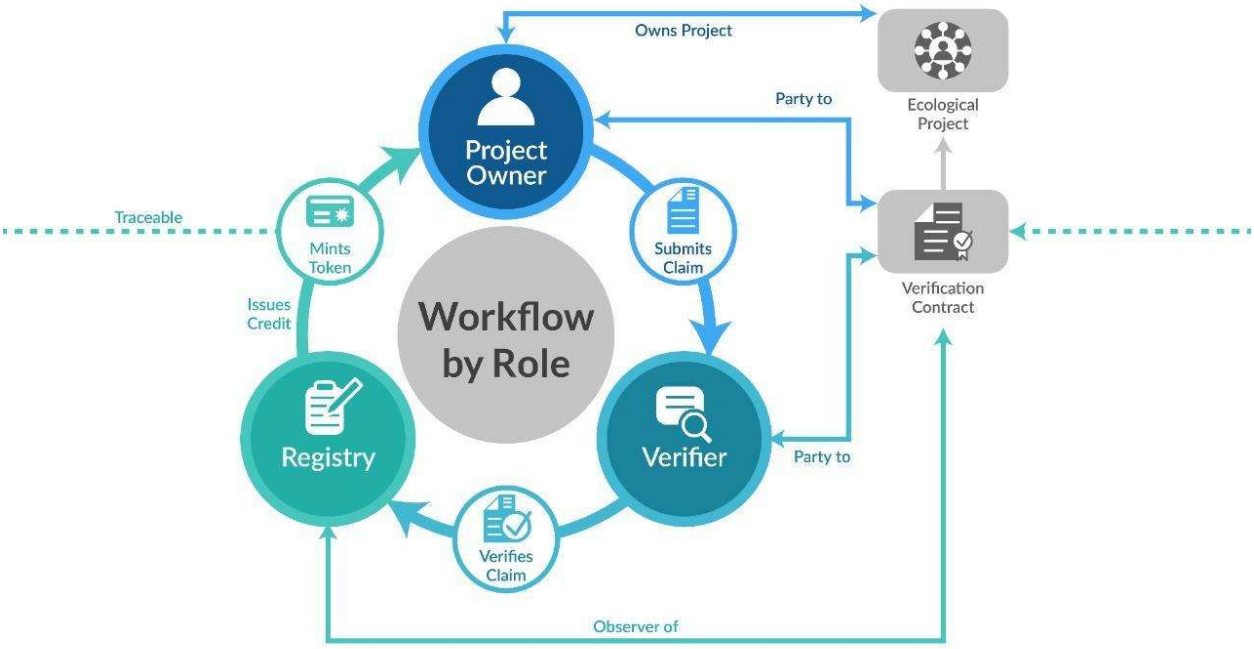
Validation and Verification Contract

A Validation and Verification Contract is a multiparty contract between an Ecological Project owner and a VVB of the type of benefit claims that the project will be creating. Because benefit claims should map to a scientific standard developed by a registry, the VVB must be authorized to perform the verification by the registry.

Key Points



There are a few key details regarding the parties involved in the verification process:

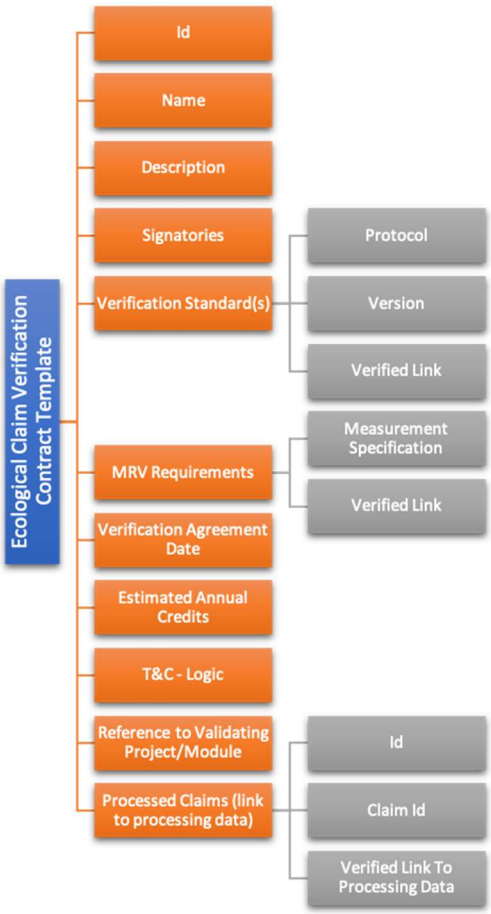
- Each Ecological Project (EP) can have multiple Modular Benefit Projects (MBP), where each MBP creates claims based on a selected standard. Only one MBP can create claims of a specific type per EP. For example: an Ecological Project can have a MBP for Carbon Reductions and another for Carbon Removals.
- The Verification Contract is established at the MBP level as it is the source of claims to be verified.
- There can be different VVBs for different MBPs in each EP.
- EPs can switch VVBs between claims from its MBP.
- MBP Claims are based on the selected standard from a registry, thus the registry is an observer in the verification process. There are standards where the verification and registry roles can be handled by the same entity, but, in this case, through independent departments within the organization.

Properties

Each Verification Contract contains the following:

- Unique identifier (Id): that is issued and is independent of the "name" of the contract. The Id is used to reference the contract and link it to its verified claims and credits issued from it.
- Name: A name, recommended, but not required, to be unique.
- Description: a brief description of the contract.
- Signatories: have Id(s) of the EP owner, VVB and Standard Registry.
- Verification Standard:
    - Protocol
    - Version

- Verified Link: link to the published standard.
- MRV Requirements (Measurement, Reporting and Verification)
    - Measurement Specification
    - Verified Link: link to the detailed measurement spec.
- Agreement Date
- Estimated Annual Credits
- T&C - Logic
- Reference to Ecological Project/MBP
- Processed Claims:
    - Verified Claim
        - Id: unique, independent Id for the verified claim.
        - Claim Id: reference to the source claim.
        - Verified Link: link to the verification data.



Measurement or Monitoring, Reporting and Verification (MRV)

Under the Kyoto Protocol, an Emissions Trading System (ETS), requires emission measurement, estimation of the impact of climate actions, reporting the results of activities, and verification of the data to make sure they are correct and complete. This process is known as Measurement, Reporting, and Verification.

Measurement means scaling of emissions, reductions, or other results and estimating based on measure-related data. Reporting indicates the recording and submission of data and detailed analysis. Verification refers to the assessment of the emissions, reductions, and other data that is measured and reported. MRV requires the following six characteristics: transparency, comparability, reliability, usefulness, timeliness, and completeness.

Data acquisition, handling, processing, and storage across various phases of the MRV process should enable a greater degree of standardization, digitization, and automation.

Principles

The application of the following guiding principles helps build the confidence and trust in the MRV system. The guiding principles that underpin the Digitalized MRV System are the same as those that have been cited in the international standards: ISO-14064, IPCC Guidelines, CDM Project Standard, The Gold Standard and Verra: Verified Carbon Standard (VCS), and could be summarized as per the following characteristics:

- Relevance: to select the greenhouse gas (GHG) sources, GHG sinks, GHG reservoirs, data, methodologies, and all other information that is appropriate to the needs of the intended user.
- Completeness: to include all relevant GHG sources and sinks, and information to support compliance with all requirements.
- Consistency: to enable meaningful comparisons in project activity-related information.
- Accuracy and Conservativeness: to reduce bias and uncertainties as far as it is practical/cost-effective, or otherwise use conservative assumptions, values, and procedures to ensure that GHG emission reductions or net anthropogenic GHG removals are not overestimated.
- Transparency: Disclose sufficient and appropriate project activity-related information in a truthful manner to allow intended users to make decisions with reasonable confidence. However, proprietary, or confidential, information should not be disclosed without the written consent of the provider of the information, except as required by national law.

Standards

A clear understanding of the key data that is required to be measured and monitored, the standard, and the associated methodology for calculating the environmental impact to be adopted, are essential to perform consistent and accurate reporting that could be compared and transparently verified.

- Standard: represents the key data required to be measured, monitored, and reported which is the basis for submitting a claim based on the data.
- Methodology or Protocol: represents the technique or method used to collect, validate, and verify the data the standard requires to submit a claim and have a claim verified.

In compliance markets, the annual procedure for MRV, together with all the associated processes, is known as the ETS compliance cycle. In voluntary markets, standards can be adapted to more accurate and timely data collection to increase the frequency of the MRV process.

MRV Framework

An MRV process is used in both the determination of emissions as well as reductions and removals, which lends itself toward reuse. A generic, modular IWA MRV framework that can be used to describe the MRV process with interchangeable parts (Type Standards, Methodology, Participants in Roles, etc.) consists of the following entities, roles, and steps:

- Entities:
  - Verification Standard - has a protocol or methodology version for the scope and type of benefit or disclosure being made, i.e., Forestry & Land Use, Afforestation/Reforestation OR Agriculture, Manure Methane Digester. This standard describes the MRV technical specifications as to what data is required and when.
  - An Ecological Claim Token - is a tokenized ecological claim, comprised of a collection of claim checkpoints as it is built over time and is issued by a MBP.
  - Verification Contract - the MRV agreement between an EP, VVB, and a Standard Registry for the EP to submit benefit claims, the VVB to validate and verify the claims, and the Standard Registry to issue credits and/or tokens based on the results.
  - A Processed Claim Token - is the tokenized processed, or verified, claim that is created by the VVB after processing the benefit claim. The Processed Claim token sets the benefit claim as processed, which retires it, and provides its Id to link the two artifacts together.
- Roles:
  - Ecological Project or Program Owner
  - Modular Benefit Project Developer
  - Modular Benefit Project Sponsor
  - Validation and Verification Body (VVB)
  - Standard Registry
- Steps:
  1. MBP Developer determines the appropriate standard for the type of activity it will be conducting to be able to issue benefit claims for. The standard will prescribe a methodology or protocol that the MBP Developer will need to follow in order to collect the data required for validation and verification in its submitted benefit claim.
  2. A contractual agreement between the MBP Developer, VVB, and Standard Registry to conduct the MRV process that should result in the creation of tokenized value representing the verified benefit derived from the MBP.
  3. The MBP follows the methodology or protocol required to collect the claim data for the type of claim it will be submitting. This claim is for a period of time, which can be 6 months or a year. The methodology/protocol may require that the benefit claim be built over time so that project/program progress can be tracked, and a solid evidence chain of work can be established. An MRV solution should digitize and automate as much of the process as possible and regularly submit updates or checkpoints over time to build its claim. An Ecological Claim token is a summary claim that includes the claim checkpoints which have links to the raw and reference claim data prescribed by the methodology/protocol.
  4. Once an Ecological Claim is submitted according to the Verification Contract, the VVB will encumber the claim so that no other VVB can verify the same claim and begin the validation and verification process.

5. A Processed Claim token is created by the VVB when validation and verification is complete. This token includes the verified properties of the initial claim and links to the validation and verification report which is used by the Standard Registry to issue a credit. The Ecological Claim that was verified is marked as Processed, or retired, recording the Processed Claim token id linking the two artifacts together.
6. A Processed Claim token is then evaluated by the Standard Registry according to the Verification Contract. Once the Processed Claim is determined to be valid, the Standard Registry then issues an Ecological Benefit Token, i.e., CCP or CRU, in the amount of the Processed Claim along with the attributes that were also verified. The Processed Claim token is then set to Credited, or retired, recording the id of the benefit token issued, linking the two artifacts together and preventing a Processed Claim from being credited more than once.

Establishing Voluntary Demand – Emissions and Reporting

Most organizations participating in the voluntary market are setting goals and reporting their carbon emissions.

The VEM will not attempt to define a level of detailed carbon accounting, but rather follow developing standards like the Greenhouse Gas Protocol and simply record a summary of Scope 1, 2 and 3 emission goals, forecasts, and reporting. Netting of owned credits to offset reported emissions will result in effective emissions to track progress for participants in the voluntary market. See the figure on page 23 for a breakdown of emissions scoping.

Lifecycle - Establishing Voluntary Demand

The Sustainability Working Group initially focused on organizational voluntary emissions goals, reporting, and applying offsets to match effective emissions with targeted goals. Calculating emissions follows the Greenhouse Gas Protocol and records emissions quantity, scope, and category for the reporting organization. In order to send a demand signal, an organization's sustainability goals, forecasting, buyer preferences, and reporting should be established for tracking their progress as well as providing valuable guidance to suppliers.

Emissions

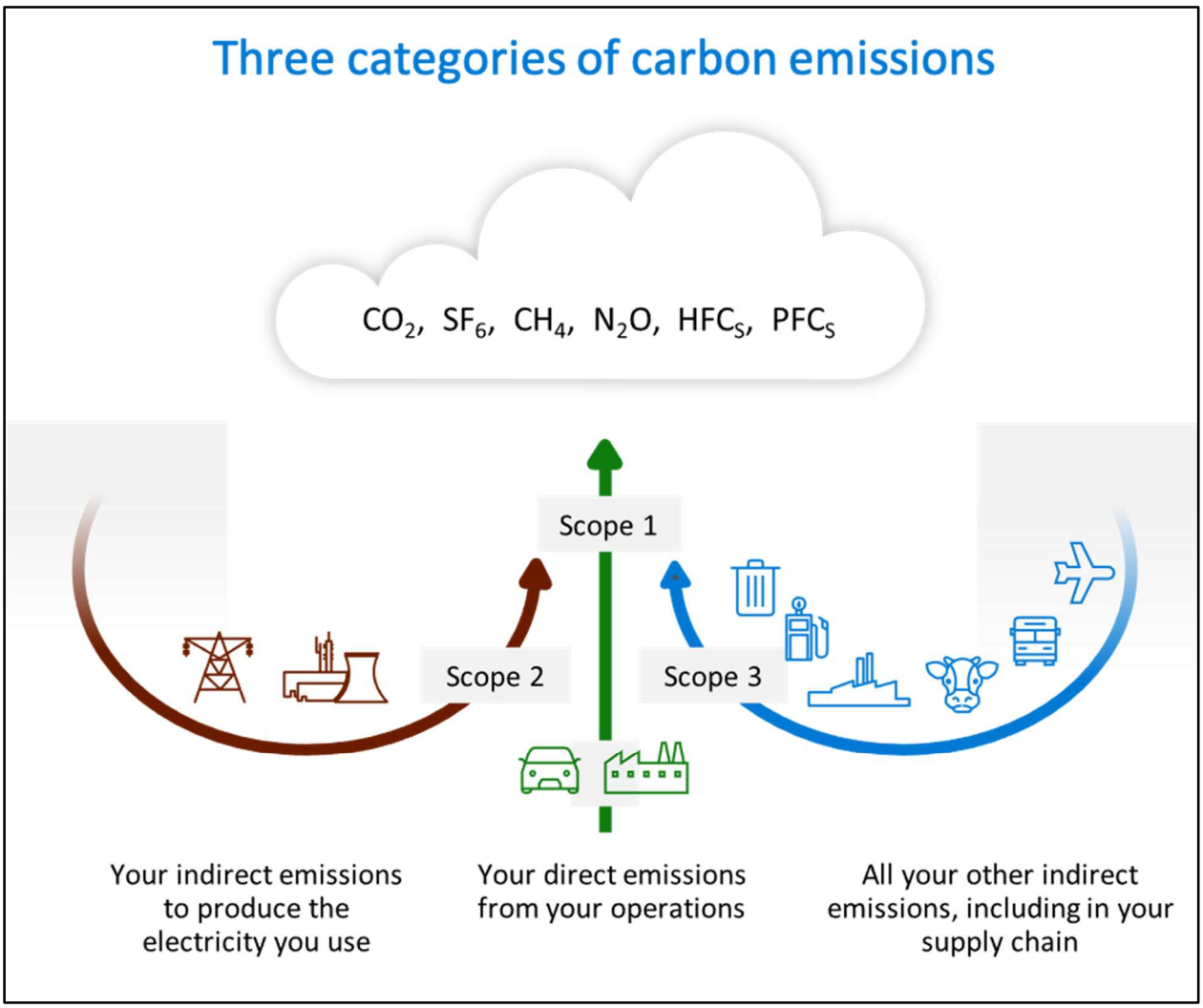
It is possible to tokenize emissions for reporting, however, the taskforce has not delved into this topic deeply to date and has a working draft that is a starting point.

Carbon Emissions Token (CET)

Reporting GHG/Carbon emissions following the GHG Protocol follows a standardized accounting methodology for calculating the actual emissions an organization directly and indirectly emits.

The CET represents a specified volume of metric tons of greenhouse gas (GHG) emissions and should be able to distinguish GHG Protocol (GGP) Scope and Category of the emissions reported.

To understand how carbon is spread across a supply chain and to effectively begin targeting reductions where they are the largest, it is important to be able track and trace the emissions across the entire supply chain. The GGP does this by scoping and categorizing emissions.



At a high level, one participant's scope 1 emissions become other participants scope 2 for direct energy consumption. Scope 3 emissions flow upstream and need to be calculated, which is a complex process that involves estimations at best with a bit of guesswork thrown in. If full track-and-trace for scope 1 & 2 emissions can be captured by enough participants in a supply chain, it should be able to be overloaded with trade flows between the supply chain to produce a more straightforward and accurate calculation.

One additional aspect for CETs is their offsetting with CCPs and allowing that offset to cascade through the emissions reporting within a supply chain. Any implementation of offsets should ensure that an offset cannot be spent or applied twice for scope 1 emissions, it DOES want to ensure that any offset that decreases a downstream participant's emissions also decreases proportionately for the upstream consumers calculating their scope 3 emissions.

Using both a CET to account for emissions and CCPs or CRUs to account for an offset/reduction allows for this behavior in any implementation.

Voluntary Reporting, Progress Tracking, and Demand Signals

Environmental, Social, and Governance (ESG) Contract

Participating organizations in the voluntary market should record their emissions goals and report their audited results alongside to get an accurate gauge of demand for offsets. Currently, the pledge an organization makes in most jurisdictions are largely marketing exercises in the spirit of Environmental, Social, and Governance (ESG) criteria for socially conscious investors.

An organization can record its ESG pledge, using a regular reporting cadence, for achieving a targeted ESG goal of carbon neutrality or negativity and then report their actual emissions in the same location. This would provide a baseline for needed supply of offsets to achieve this ESG goal.

Further, if this organization were to purchase offsets from the marketplace and apply/spend/consume them to lower their reported emissions to an effective rate that met their cadence goal, this would remove the applied offsets from the supply and complete the lifecycle of the offset.

An organization that participates in the voluntary market establishes a contract between itself and an auditing participant for each reporting cycle (cadence). The figure on page 26 presents an example of what an ESG scorecard might look like in practice.

ESG Scorecard

- Establishment of a voluntary reporting network where participants can register their ESG goals, report their actual emissions, as well as apply offsets to achieve an effective emissions report demonstrating progress towards their goals.
- Enable track-and-trace for GGP Scope 1 & 2 emissions used in the calculation of Scope 3 emissions.
- Standardize on a token or digital asset representation for emissions.

The ESG Scorecard is for:

- Buyers looking to offset, which they do so for various reasons: brand protection, valuation/stock price, and compliance are a few.
- Establishing emissions goals and reporting progress.
- Sending demand signals about product preferences.
- Having a verified record of goals, emissions and offsetting activity for investors concerned about ESG (Environmental, Social & Governance) criteria.
- Providing accurate and trusted (governance) data to firms evaluating corporate progress and actions.
- Having a standard voluntary progress tracker to state goals, record actual emissions, and offset against.
    - Emissions reporting – recommendation to start with coarse goals and actual emissions. Structure to allow for more granular reporting to follow as the process matures.
    - Offsetting details should come from transactions and provide the granular detail available from standards in supply creation.

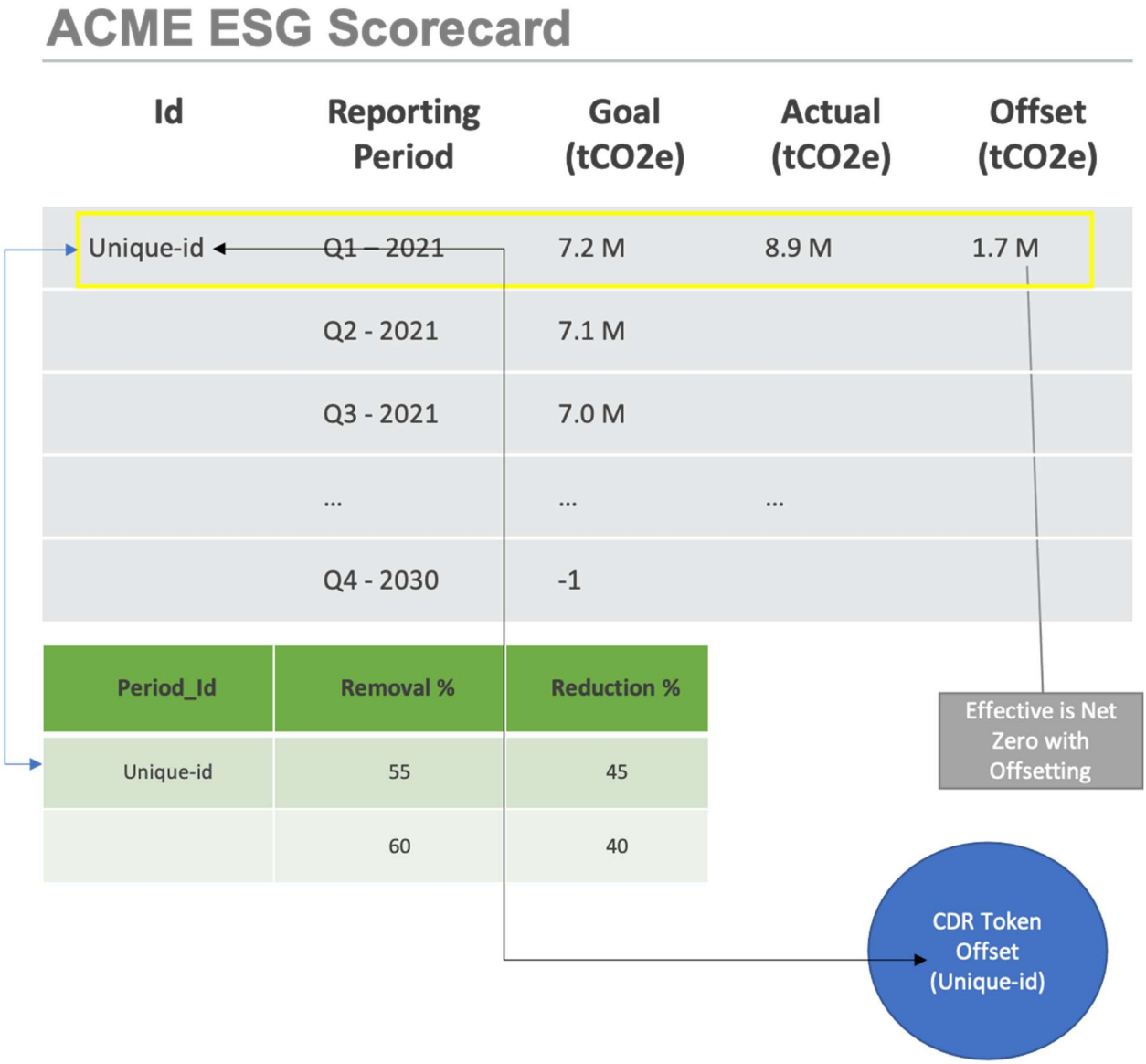
The contract is a simple ESG scorecard for a participant to record their established pledge (net zero, net negative, etc.) and track progress (goals, forecast, actual, effective). The contract can also include an auditor or registry for different reporting periods. The contract provides the following key capabilities:

- Signal demand and buyer preferences.
- Offsets are applied to the scorecard when retiring the offset.
- Completes the lifecycle of the offset credit.
- Should be able to be private with conditional access.
- In the future it can be used to provide verification for 3rd parties evaluating the participants ESG score and used for more detailed emissions reporting.

Properties

The ESG Scorecard contract contains these initial properties and functions:

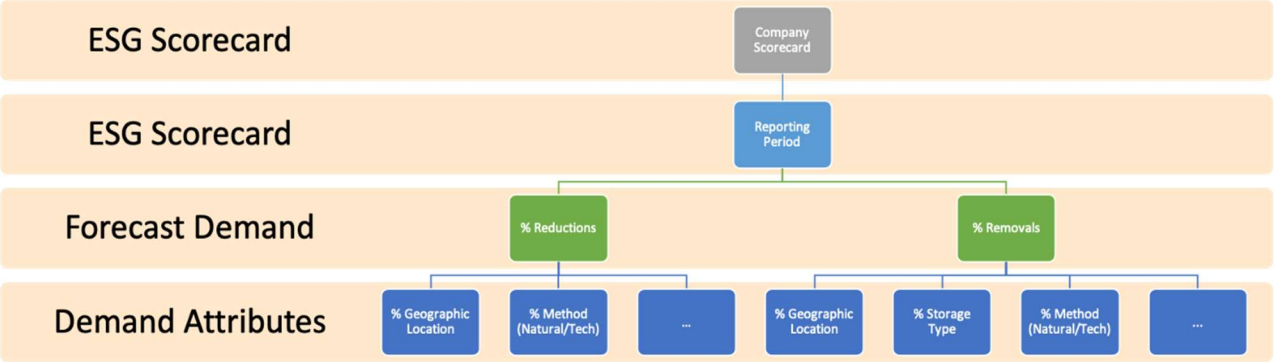
- Company Name:
- Long Term Pledge: Carbon x by Date (where x is neutral, net zero, or negative)
- Forecast for reporting periods up to Date:
    - Quarter, Year = y $mtCO_2e$ emitted
    - Placeholder for Quarter, Year for actual emission entry as demand indicator
    - Offsets are spent and applied towards a reporting period, which can be used to calculate effective emissions.
    - When a token is offset towards an ESG Reporting period, the offset request should pass in the Id of the scorecard entry it offsets.



ESG Scorecard Example

Demand Signals

To establish a clear demand signal to suppliers, a more detailed forecast for the type of offsetting the buyer will engage in can provide details about removals vs. reductions. Then, in each offset preference, the demand signal can be filtered further via technique (nature vs. technical), storage (biosphere vs. geosphere), geography, etc.



Determining the list of attributes to cover most demand signal preferences may run into limits. It is yet to be determined whether variables like GWP would be important for buyers, for example:

- Year scale for Global Warming Potential (GWP) for calculating GHG CO_2e:
    - 100yr GWP vs. 20yr GWP for methane (CH_4) that has greater warming potential in the 20yr vs. 100yr GWP.

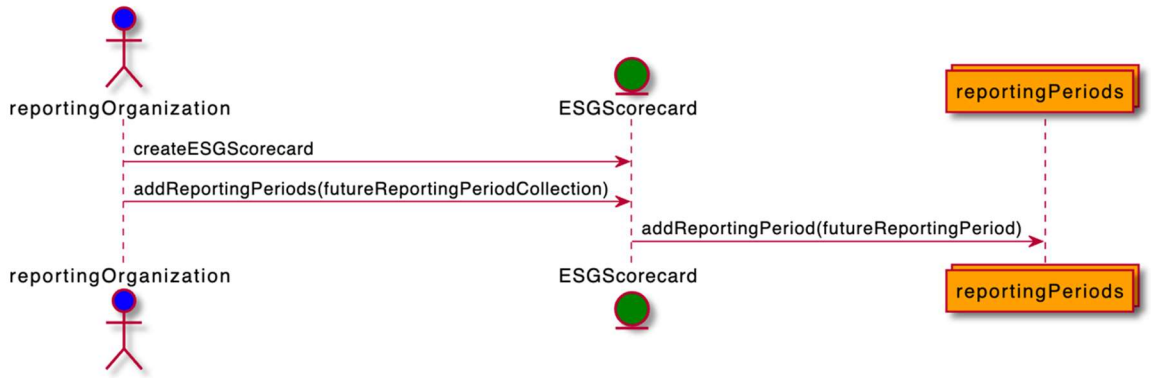
Example ESG Scorecard Contract with Future Emissions Goals

Here an organization (the reportingOrganization in the figures on page 28) creates a new ESG Scorecard Contract, publishing their future GHG Emissions goals by a certain date and adding a reporting entry placeholder for each reporting date up to the future emission goal.

For example, if an organization's goal is to be carbon negative by 2030, they would publish that goal for the final quarter of 2029 having an emissions report of -1. Then they would add an entry for each reporting period (quarterly, bi-annually, or annually), recording their progress toward their goal for that period.

If their current quarterly emissions report is 10,000 and they have 38 reporting periods (quarters) until their goal, they can simply establish their period goal by reducing emissions by 264 for each period to achieve a negative emission goal.

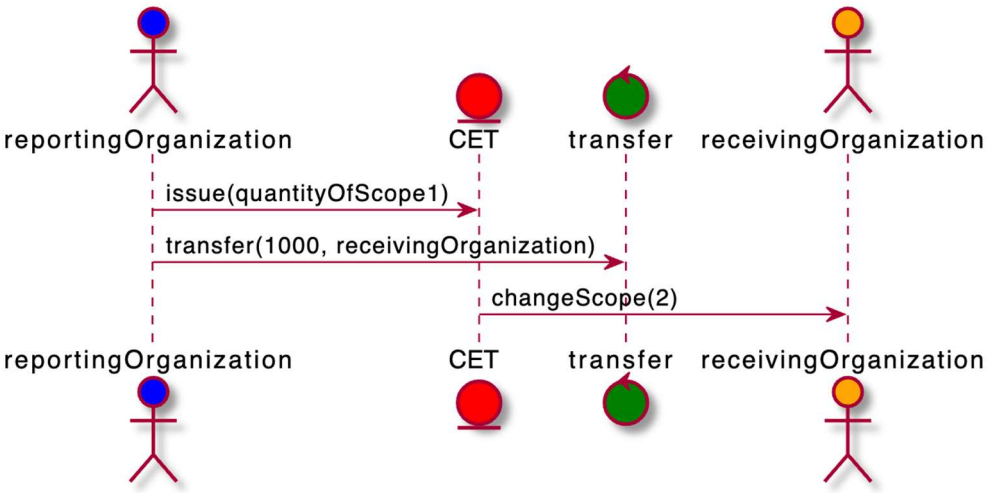
`10,000/38 = ~264` subtract 264 from each period's emission goal.



(FUTURE) Reporting and Allocated Transfer of Emissions

Participants report their emissions using CET (Carbon Emission Tokens) and may transfer ownership of CETs through their supply chain which changes their GGP Scope and Category. CETs are issued by GHG sources like power utilities and organizations that emit GHG through their direct operations; CETs are issued as Scope 1.

When a CET is transferred in the supply chain from Scope 1 (direct generation) to another participant, like a power company's consumer, a quantity of CETs are transferred to the consumer and set to Scope 2. If the participant's power provider does not issue CETs, the participant can issue CETs directly as Scope 2 emissions. Scope 3 emissions are more difficult to calculate until the entire supply chain is reporting their Scope 1 & 2 emissions and correctly performing allocated transfers of CET upstream. To accommodate the accounting and calculation of Scope 3 emissions in the meantime, Scope 3 emissions can be recorded in the period report.



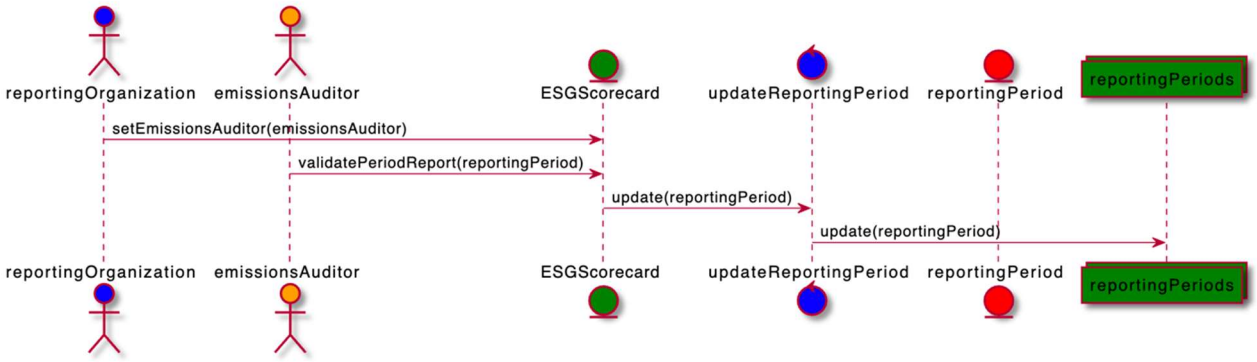
Auditing Emissions

An organization reporting their emissions will select an auditor for their reporting period and record their emissions 'side by side' with their period goal. The period goal is recorded as a number entry, but actual emissions are reported using CET (Carbon Emission Token) sums for the reporting period.

Because CETs have a lifecycle and transfer in a carbon supply chain between GHG sources and consumers, in the future the same CET will transfer between owners until it reaches its destination. For example, a power utility company's Scope 1 emissions become their customer's Scope 2 emissions which can become another organization's Scope 3 emissions in a supply chain. This is covered in more detail in CET.

However, until a critical mass of participants reporting emissions that can be "track-and-traced" through the supply chain is hit, Scope 3 emissions calculations should be reported using one of several methodologies being developed in the market.

The role of the auditor is to ensure that the issued and owned CETs for the reporting organization match their audit results, correct any discrepancies, and then sign off on the period's report.



Lifecycle – Buying and Trading Contracts

Participants in the voluntary market will want to list, trade, offset, etc., these ecological projects and have a common understanding of the rules that the market will set.

- Establish standardized contracts for applying or spending credits by emissions reporters retiring them so they cannot be applied again or resold once consumed.
- Establish standard reference contracts, spot, forward, and futures for either OTC or exchange-based trades.

This section covers contracts that span across emissions and credits, like a Delivery vs. Payment contract for trading offsets for another established value (money). The VEM will align with the recommendations issued by the TSVCM operating committee to shape the drafts for each of the below contract types.

Standard Reference Contracts

Due to the nature of the underlying "commodity/asset," these contracts will have to be cash-settled, as physical delivery is not possible. These contracts can be fungible or non-fungible, but the distinction may impact the legal analysis of whether the contract is a security, commodity, or hybrid.

To-Be-Defined Market Types:

- Spot – typically, spot markets are considered to settle in T+2. However, gas spot markets may have hourly delivery (however, hourly settlement might not be possible).
- Forward – OTC contracts between two parties agreeing on terms of a contract for future delivery or settlement (typically within 24 months).
- Futures – derivative financial instruments that derive their value from the underlying asset. Typically, exchange boilerplate listed contracts can be traded for up to 24 months (most futures exchanges are in North America, UK, Asia)

Buyer Preference for Offsets

Buyers in a voluntary marketplace can send a demand signal through their ESG Scorecard, but will also need to be able to search for, and trade, credits based on their properties. Buyer preference can be based on a classification filter, e.g.:

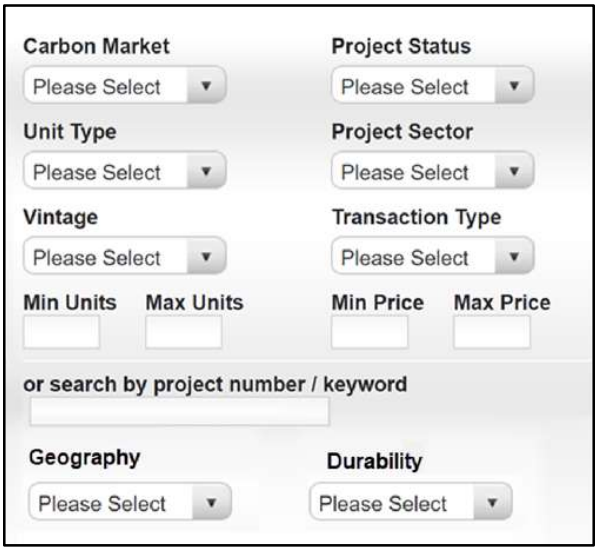
- Reduction vs. Removal
- Natural vs. Technological
- Co-benefit Types
- Source Geography
- Vintage
- Durability
- Methodology
- Etc.

However, through the derivatives instruments (spot/forwards/futures), there would be a readily available market to bring the sellers and buyers of the offers together.

Voluntary Buyer Use Cases

As a voluntary market can offer both standardized carbon credits like a commodity, an implementation should have searchable parameters. For example, a standard reference contract can be fungible with other credits in the same class or can be non-fungible custom contracts that can differ in value and be bundled together based on their Core Carbon Attributes.

Using the specifications for Ecological Projects, Core Carbon Principle Credits and Verification Contracts, buyers should be able to build queries to find products based on their buyer preferences.



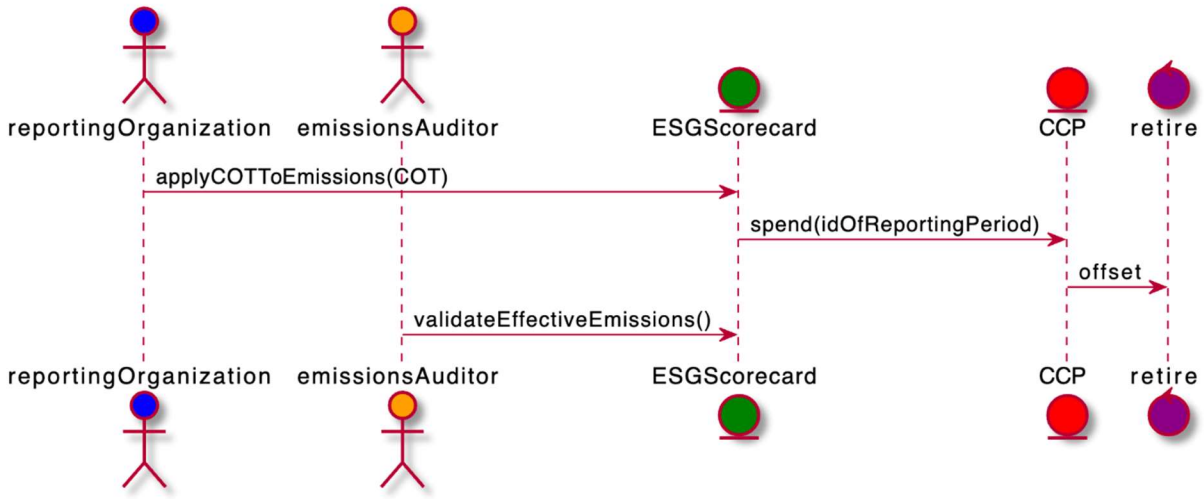
Example Interface for Selecting Buyer Preferences

Lifecycle – Offsetting Emissions to determine effective emissions

Once a participant owns a credit they wish to use as an offset against their emissions, they can spend/retire their credit tokens towards their ESG Goals.

Participants can purchase carbon offsets and apply them against their reported period's actual emissions to achieve their goal for the period. When an offset is applied to reduce actual emissions, the offset is spent and cannot be reused or sold and generates a lower effective emissions balance.

Core Carbon Principle tokens (CCP) represent credits that can be used to offset or decrease (netting) a reporting organization's effective emissions for the reporting period. Effective balances for a period can be calculated from the ledger based on the actual CET transferred or issued in the period for the organization minus the CCPs or CRUs it spends in the period.



Once track-and-trace capabilities are realized, the applied offsets should cascade in the supply chain and be reflected upstream in a reduction of Scope 3 reported emissions.

Summary

This overview of the Voluntary Ecological Markets is just the beginning. The IWA and the Sustainability Working Group continue to revise and refine the specifications outlined in this document. The specifications for the main entities: Ecological Project, Ecological Claim, Core Carbon Principles (CCP) and Carbon Removal Unit (CRU) tokens, and the ESG Scorecard will get more detailed and refined with implementation feedback moving towards released standards that can support implementation certifications.

Future work on a standard, open MRV framework, based on ISO 14064-1:2018, that integrates natively with the specifications identified in this document will help accelerate innovation in the creation of verified supply from diverse ecosystems.

IWA members will also be driving thought leadership across various channels to evangelize and influence using the IWA working group documentation and specifications to connect with organizations that are aligned and driving standardization. To this point, this documentation will be informing and extending into the work of the GSMI. Launched in October 2020, the Global Standards Mapping Initiative (GSMI) is an industry-led effort to map and assess the blockchain and digital asset landscape in three distinct areas:

1. Technical standards
2. Legislation and guidance released by sovereign and international bodies
3. Industry best practices and blockchain consortia

Version 1.0 of the GSMI was spearheaded by the Global Blockchain Business Council (GBBC) and World Economic Forum, with key collaborators, including: Accenture; Digital Currency Initiative, MIT Media Lab; ESG Intelligence; Global Digital Finance (GDF); Hyperledger, The Linux Foundation; ING; the Milken Institute; and SIX Digital Exchange (SDX).

Version 2.0 of the GSMI will include the *Green Economy & Sustainability* section, led by IWA and Digital Asset, to integrate with other key subject matter experts through a working group. The Proposed Main Deliverables are:

1. Establish how the GSMI 2.0 WG will support the efforts of IWA Working Groups
2. Map interested enterprises, governments, entities re: tokenized carbon credit trading
3. Prepare and lead webinar or roundtable to discuss topic for community at large and governments/ regulators (2H21)
4. Deliver the Oct 2021: GSMI 2.0 Report – Green Economy & Sustainability section

For more information on GSMI see GSMI - Global Blockchain Business Council (gbbcouncil.org)

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