Climate Action Data Trust

Data Model Version 2.0 Connectivity Guide

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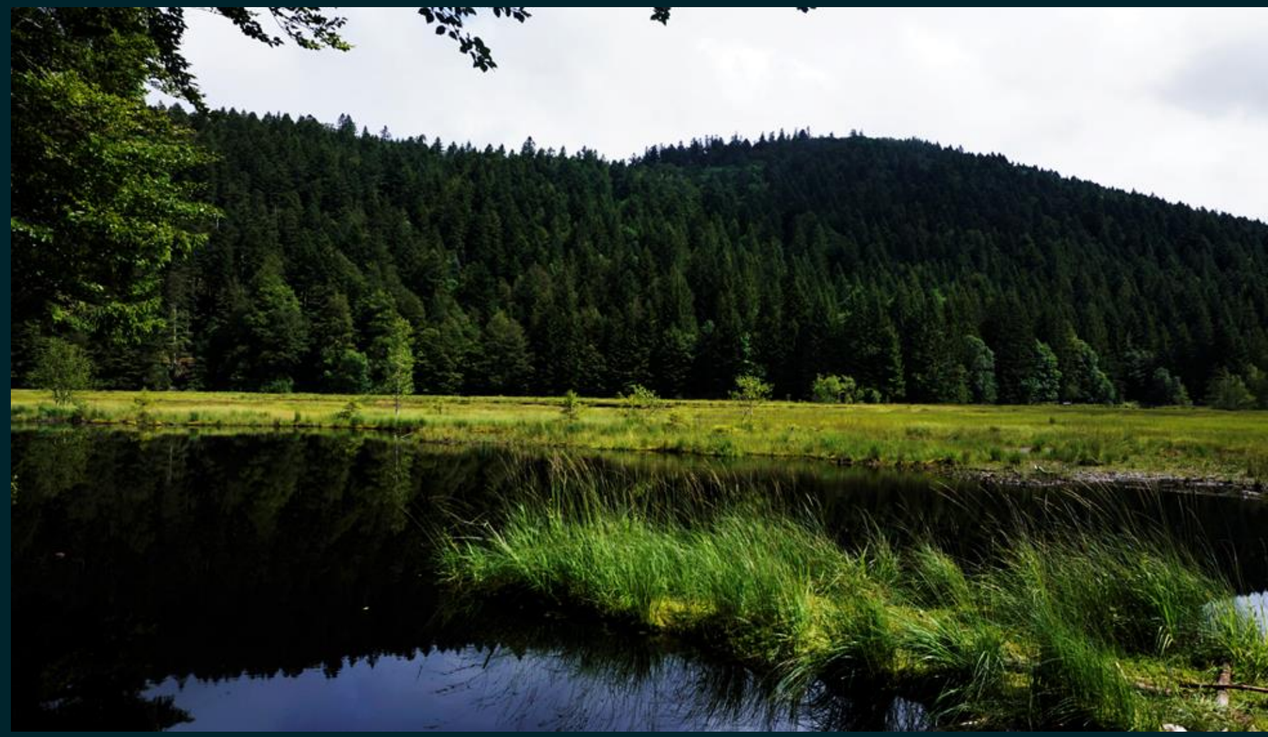
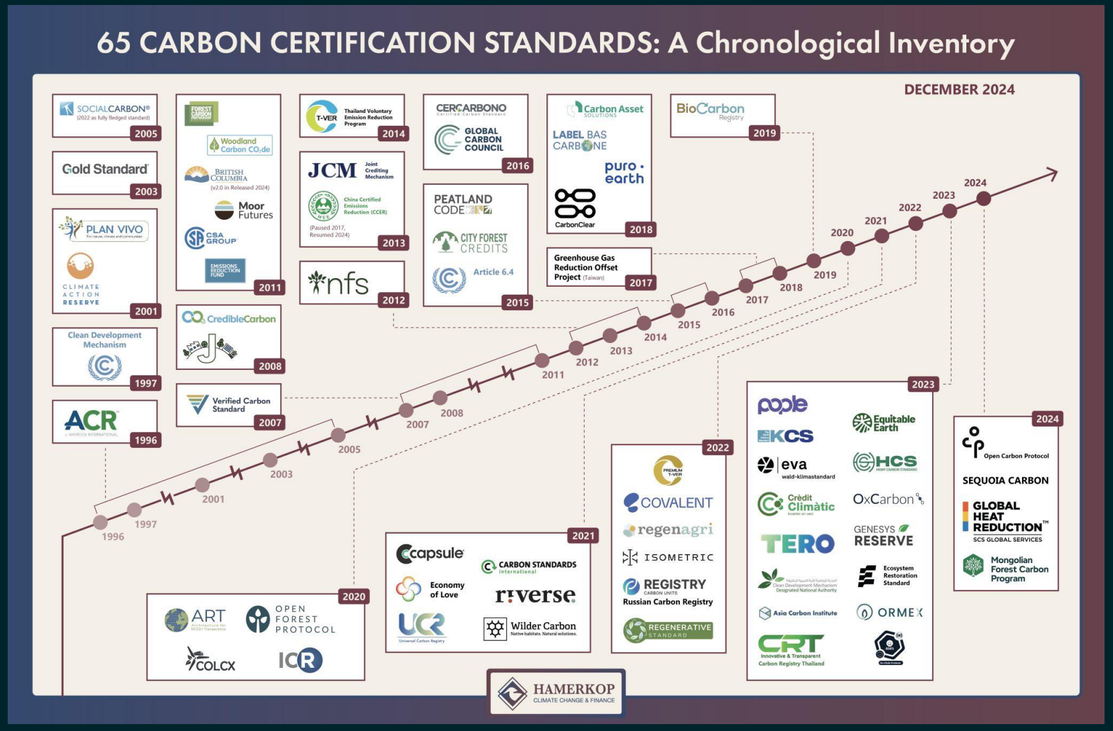
Who we are



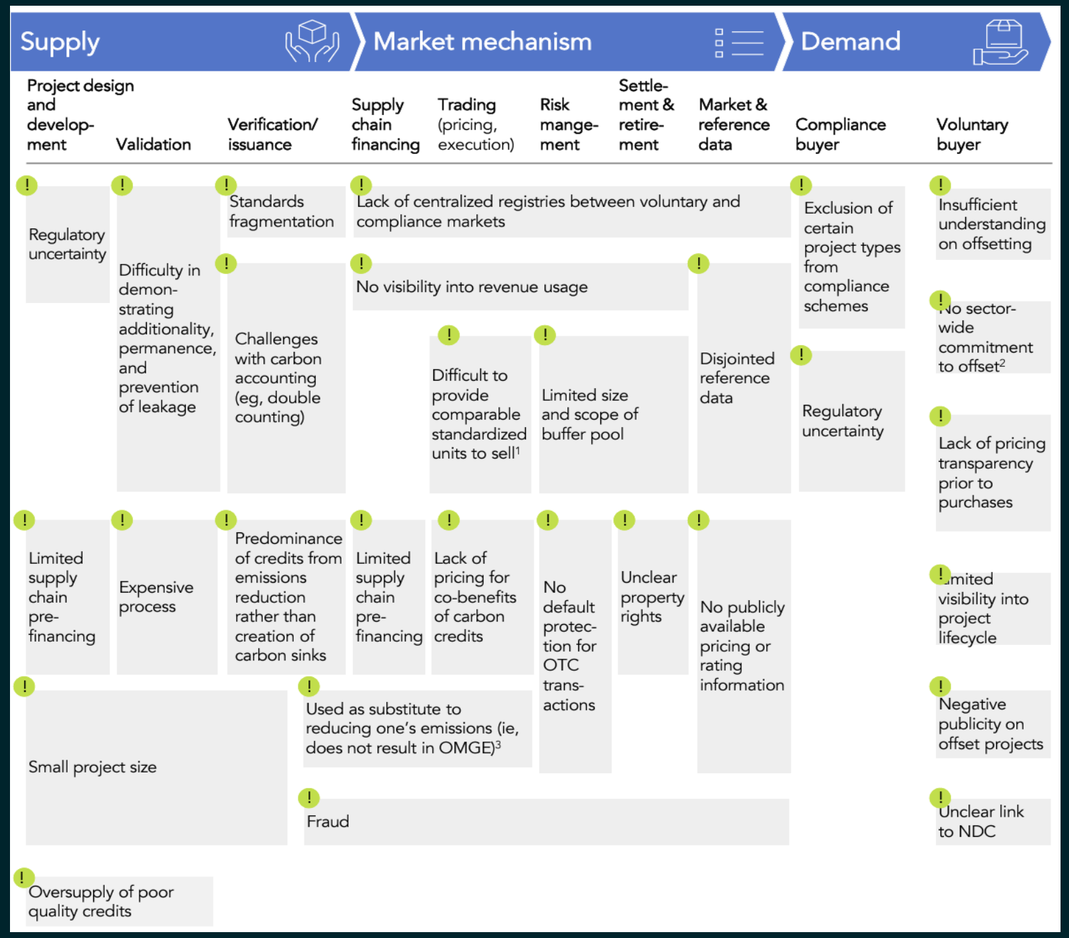
Market fragmentation creates risks…

- Carbon credits are intangible: issuance is backed by assumptions and measurement
- No central authority governs all crediting and market activity: 60+ crediting standards, 200+ methodologies
- Credits interact with domestic policy frameworks and international cooperation through Article 6 and CORSIA
- General lack of transparency and accessibility hinders participation and effective accounting



…contributing to trust gaps for buyers and regulators

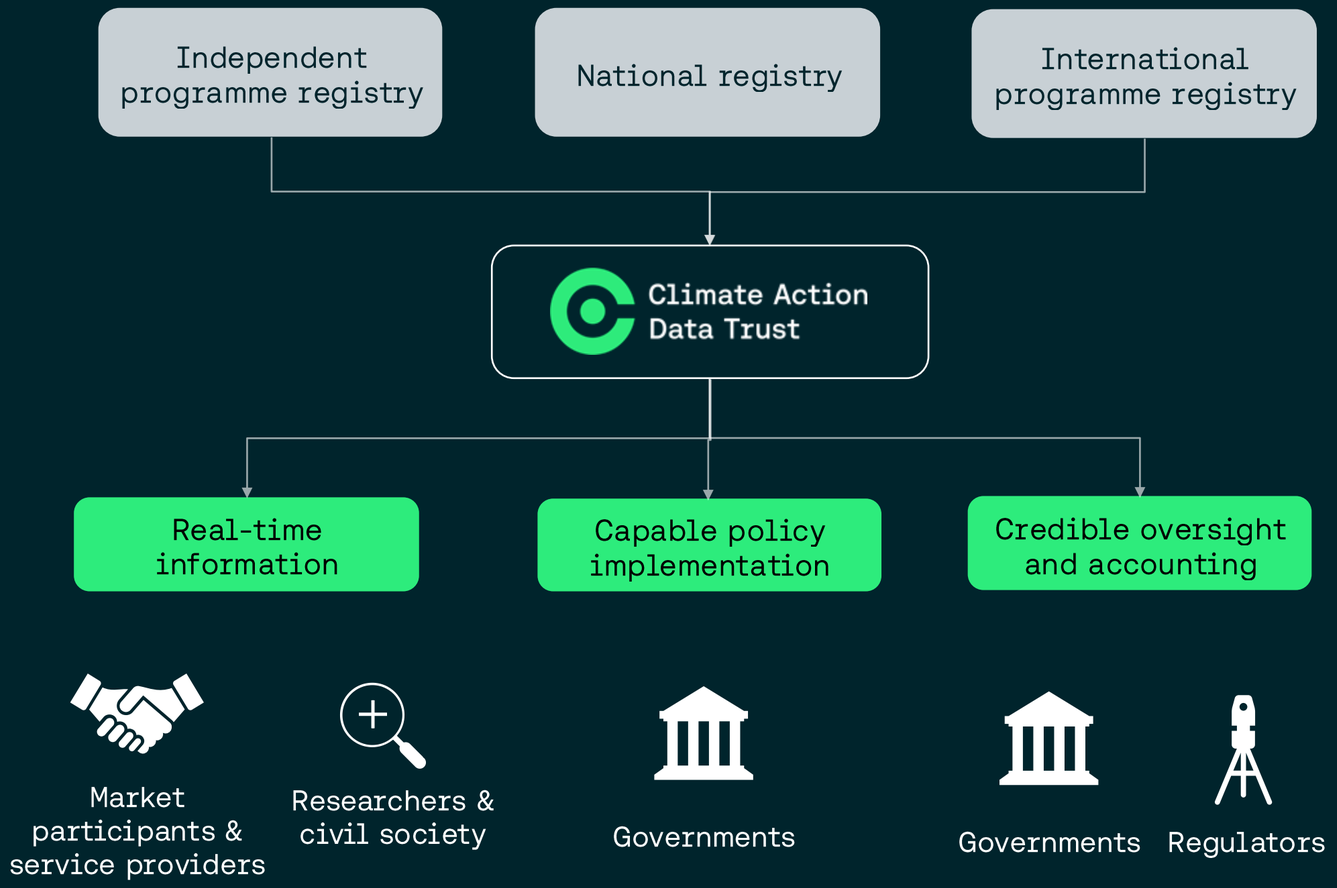
- Lack of harmonised frameworks and difficulties in data access makes cross-system checks difficult
- Lack of systematic assurance increases counterparty risk and contributes to reputational concerns around credit quality and use
- Double counting concerns arise – not due to negligence or wrongdoing, but as a result of a fragmented system
- Harmonised data foundations are needed to support market oversight and scaling with integrity



Based on TSVCM (2021)

CAD Trust connects carbon market data systems

- Public data infrastructure connecting registries
- Data standards and interoperability protocols
- Nonprofit, collaborative governance



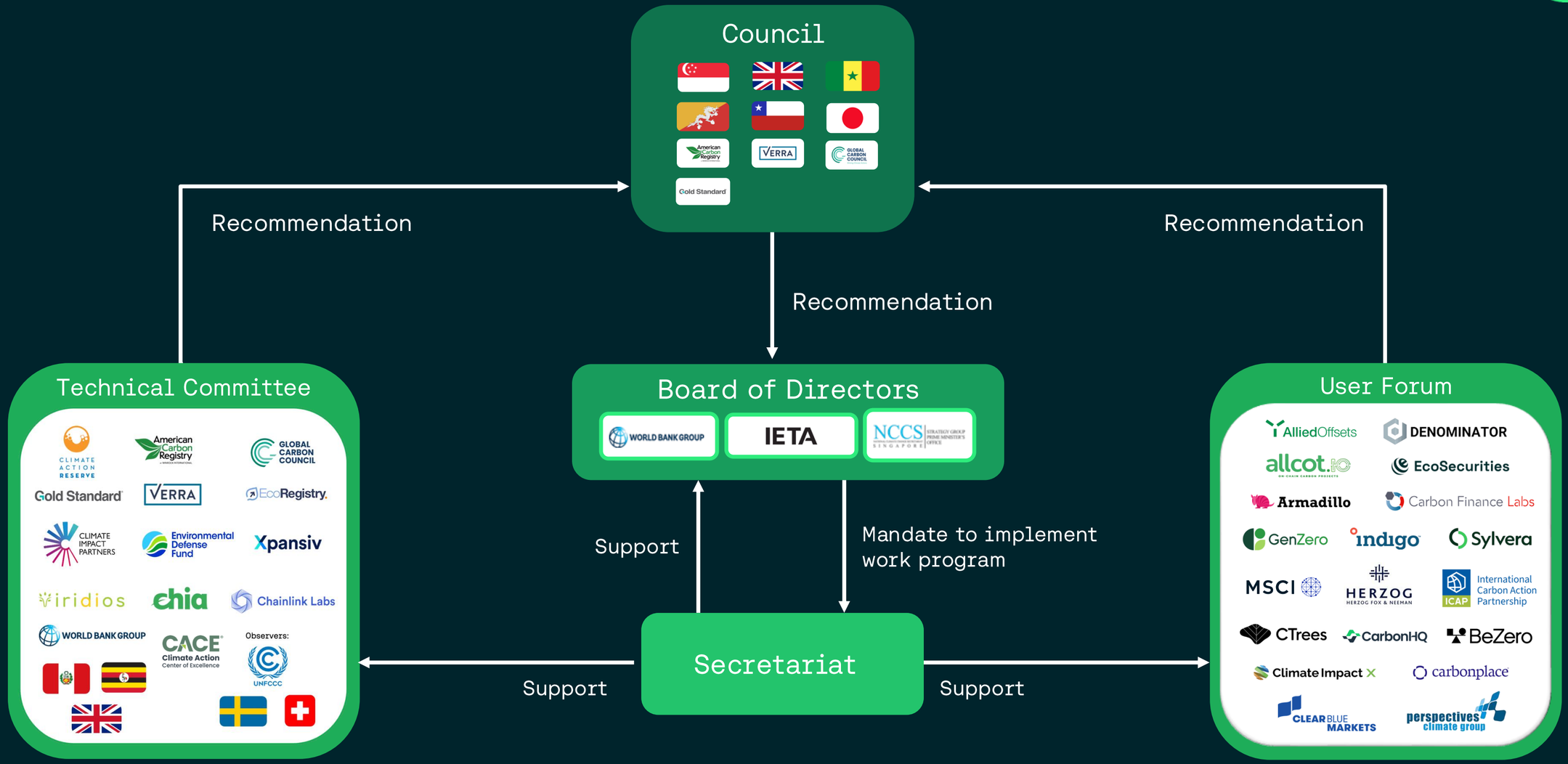
Co-founded by:

WORLD BANK GROUP

NCCS NATIONAL CLIMATE CHANGE SECRETARIAT SINGAPORE | STRATEGY GROUP PRIME MINISTER'S OFFICE

IETA

Collaborative global governance



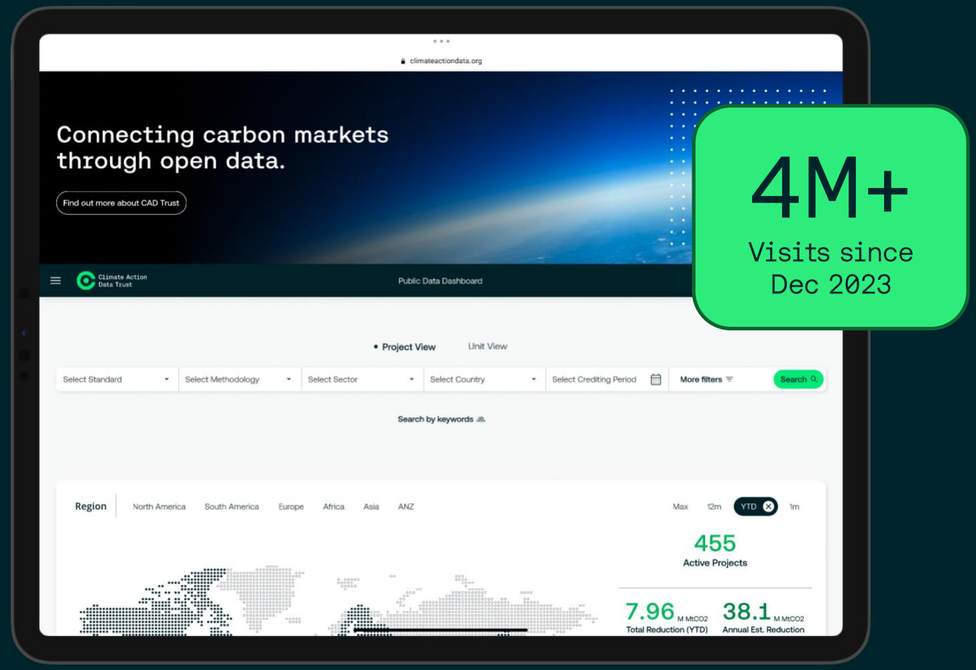
https://climateactiondata.org/about/

Harmonized data on over 90% of credits ever issued

Data Dashboard | API access

16K+
Projects

3B+
Issued units



4M+
Visits since Dec 2023

Top countries by visits

- USA 23%
- UK 13%
- Singapore 10%
- Spain 7%
- Brazil 6%
- Rest of World 41%

VERRA · Gold Standard · Global Carbon Council · CERCARBONO Certified Carbon Standard · BioCarbon Standard · TERO CARBON · Asia Carbon Institute · Rainbow · UNFCCC CDM · The World Bank IBRD • IDA Carbon Assets Tracking System (CATS)

Strengthening the market integrity infrastructure

Governments & regulators

Crediting programs

Buyers & others

Strengthening oversight and accounting capacity

Supporting authorization & UN reporting obligations

Enabling identification of double counting risks

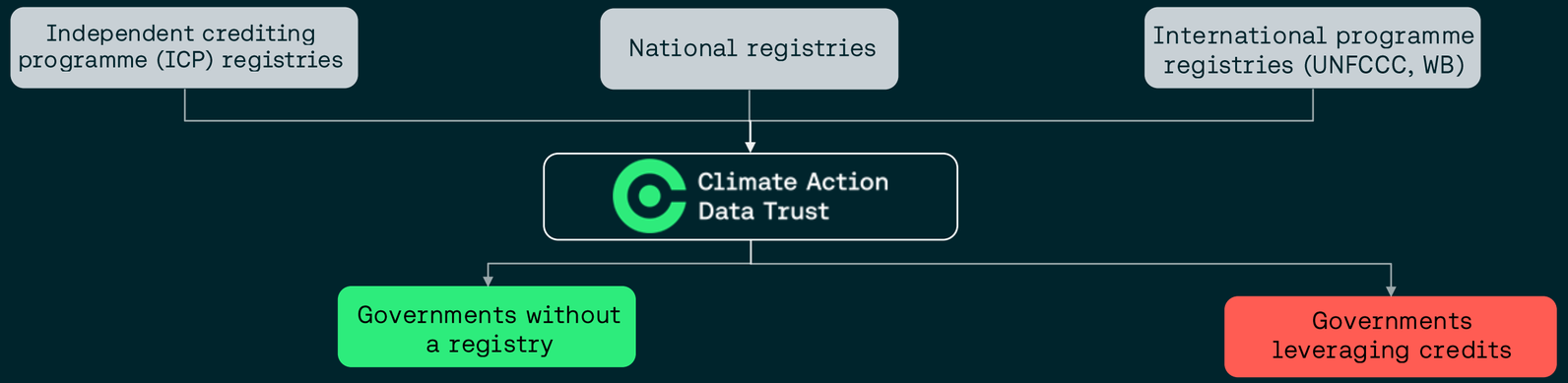
Interoperability and regulatory compliance

Neutral public source of information

Greater trust and demand through transparency and risk reduction

Helping governments use carbon credits toward policy goals

CAD Trust's digital public infrastructure helps governments access, use and verify credit information from different systems, reducing costs and increasing global connectivity



Jurisdictional oversight	Article 6.2 reporting	National-crediting programme registry data reconciliation
Tracking projects in a specific jurisdiction (national, subnational, regional) Example: a government using the CAD Trust Data Dashboard to get an overview of project activity from different programs active within their country	Enabling countries to prepare AEF or BTR reports on ICP projects authorised for Article 6.2 ITMO trades Example: exporting information on authorised credits from multiple crediting programme registries connected to CAD Trust in the AEF format for annual reports	Check and reconcile records of the same project in crediting program and national registries Example: ICP & national registries connected to CAD Trust can cross-reference and exchange data regarding credit status, policy eligibility, or retirement information, cutting down need for manual exchanges or data formatting

Building toward global identification of double counting risks

Anticipated use cases:

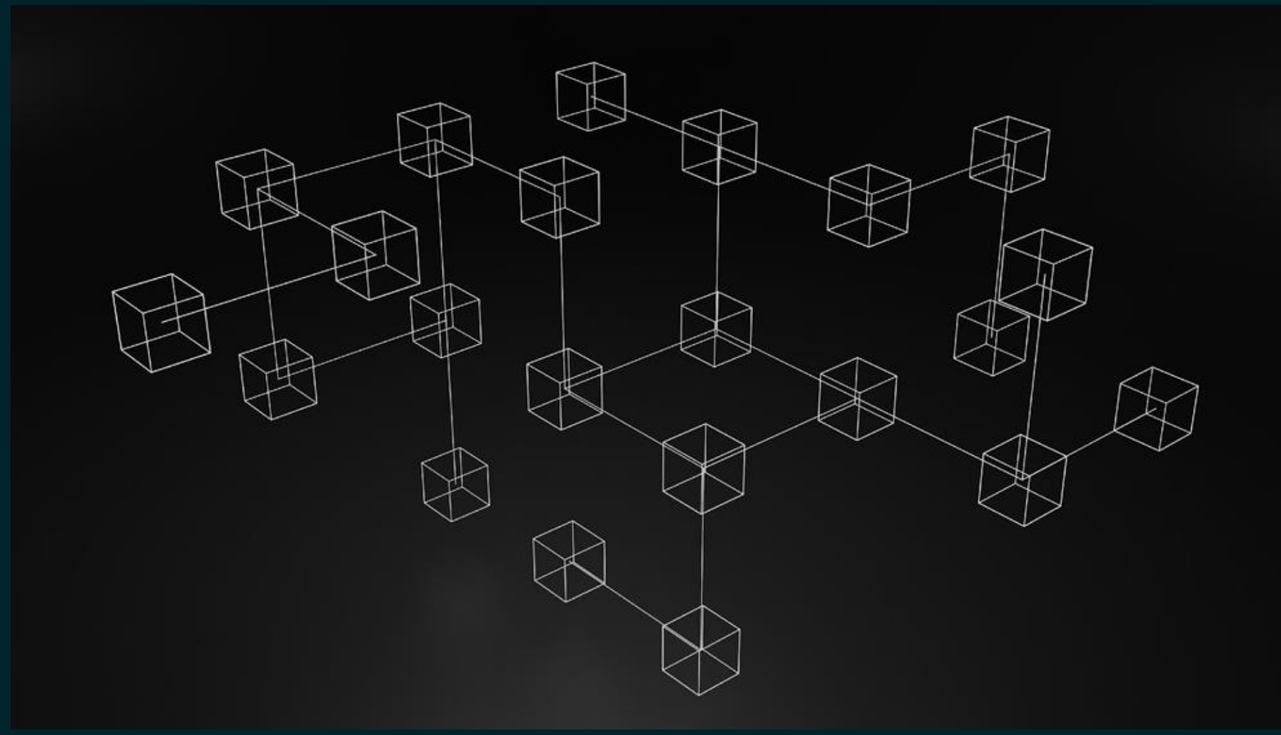
- Area and methodology overlap analysis
- Double claiming risks between voluntary or Article 6 credit uses, corresponding adjustment applications
- Connections to other compliance frameworks or policy mechanisms

- Ratings agency
- Corporate buyer
- Government buyer (Art6.2)
- Intermediary

- Project developer
- VVBs

- Government official
- International regulator (ICAO/ICVCM)
- Crediting programme

Technology

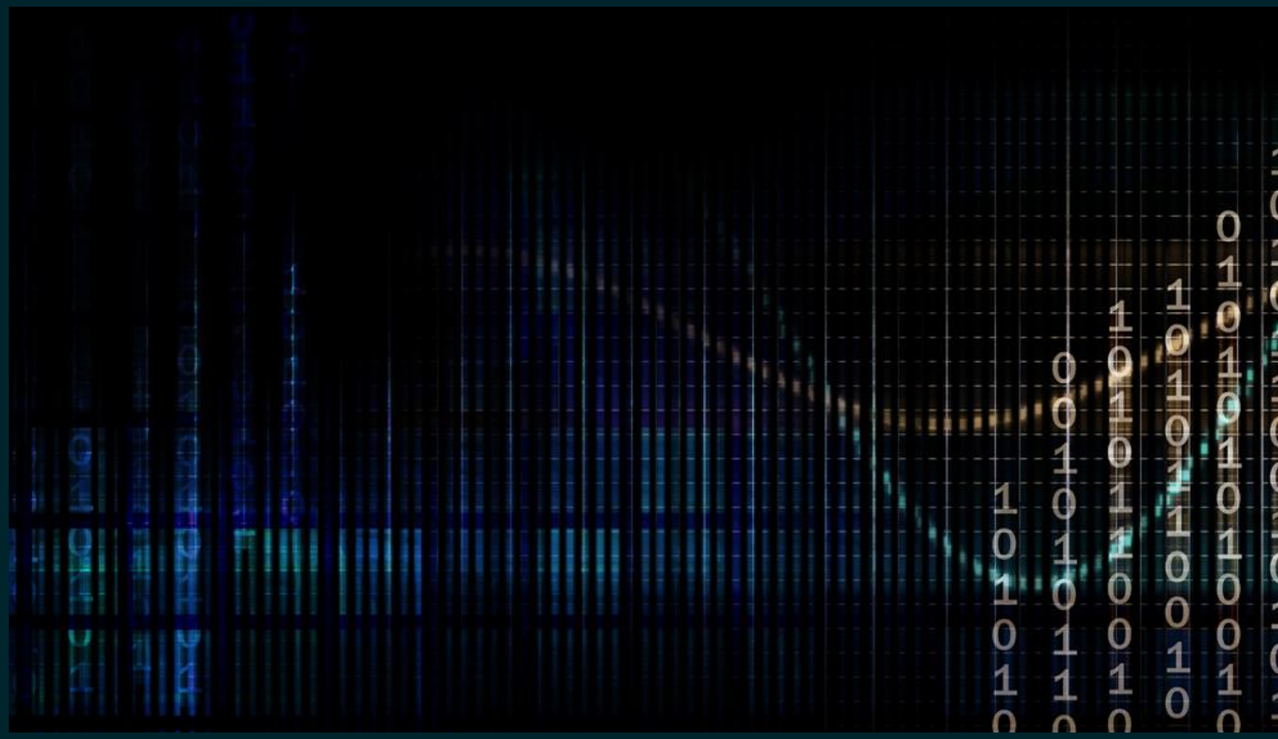


Chia Blockchain

Sustainable blockchain technology

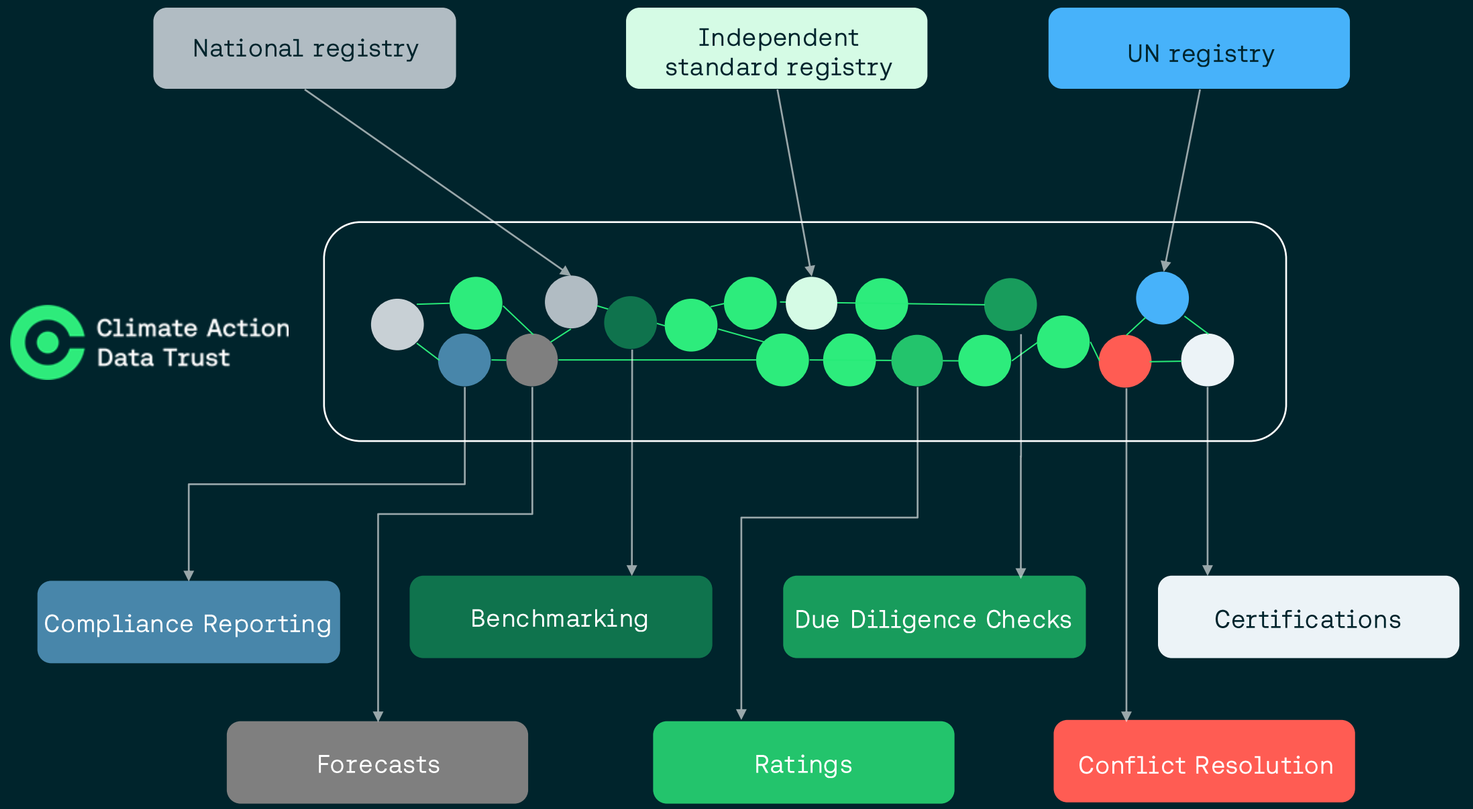
Chia designed a more sustainable blockchain, which consume lesser energy needs compared to other industry protocol. Chia also provides and supports a decentralised data layer which is key for CAD Trust operations.

Data Layer



Public metadata infrastructure for carbon markets

- Link, aggregate and harmonize carbon registry data using a common data model and decentralized infrastructure
- Provide an auditable public record of carbon market activity
- Empower carbon market use cases



VERRA Gold Standard GLOBAL CARBON COUNCIL CERCARBONO Certified Carbon Standard BioCarbon Standard TERO CARBON Asia Carbon Institute Rainbow UNFCCC CDM THE WORLD BANK IBRD • IDA Carbon Assets Tracking System (CATS)

Data Flow

Registry's Existing Database

(Independent standards, sovereign registries, UNFCCC registries)

CAD Trust API *Server*

Chia Node Wallet and data layer

Chia Blockchain Network

Climate Warehouse
End-to-End Digital Ecosystem for Carbon Markets

Data Dashboard

CAD Trust API *Server*

- Compliance reporting
- Forecasting
- Benchmarking
- Ratings
- DD Checks
- Conflict Resolution
- Certifications

Registry Layer

Node as a Service (Managed by Chia)

Metadata Layer

Data End Users

Key application features

Secure, decentralised data storage application for carbon credit registries worldwide

Open-Source

The Climate Action Data Trust application is delivered as open-source software. This means there are no fees incurred to obtain the CAD Trust application.

Fully Managed

Chia hosts and maintains each registry's CAD Trust node as a managed service. Registries connect without standing up or operating any infrastructure, and without changes to their existing registry systems.

Decentralised

Public blockchain technology allows each registry to keep full sovereignty of their data while sharing it to the CAD Trust for global transparency goals. Users can access a read-only version of the harmonised dataset.

How it works

Chia Data Layer is a shared data network with no central authority. Data is stored locally by a member (in this case: crediting programs and governments), while proofs of the data are stored on the blockchain with URLs that can be used to fetch the stored data. Members in this network can subscribe to data from other nodes and receive updates whenever the data changes and can compare the received data to the proof on the blockchain and confirm that the data is correct.

In use, each participant in the CAD Trust publishes data in their Data Layer tables through a dedicated CAD Trust node that Chia provisions and operates on the participant's behalf. The "governance" node publishes another Data Layer table with the list of Data Layer tables published by each of the recognised participants. Each participant and observer only needs to know the Data Layer table ID for the governance node to locate all of the other participants' data.

Because this is done on the public blockchain, anyone can subscribe to the data and audits log – ensuring transparency and auditability.

Connectivity

Participants / Publishers:

- Each registry publishes data through its managed CAD Trust node, provisioned and operated by Chia
- The data must conform to the data model established for the CAD Trust

User Type:

Registry Layer

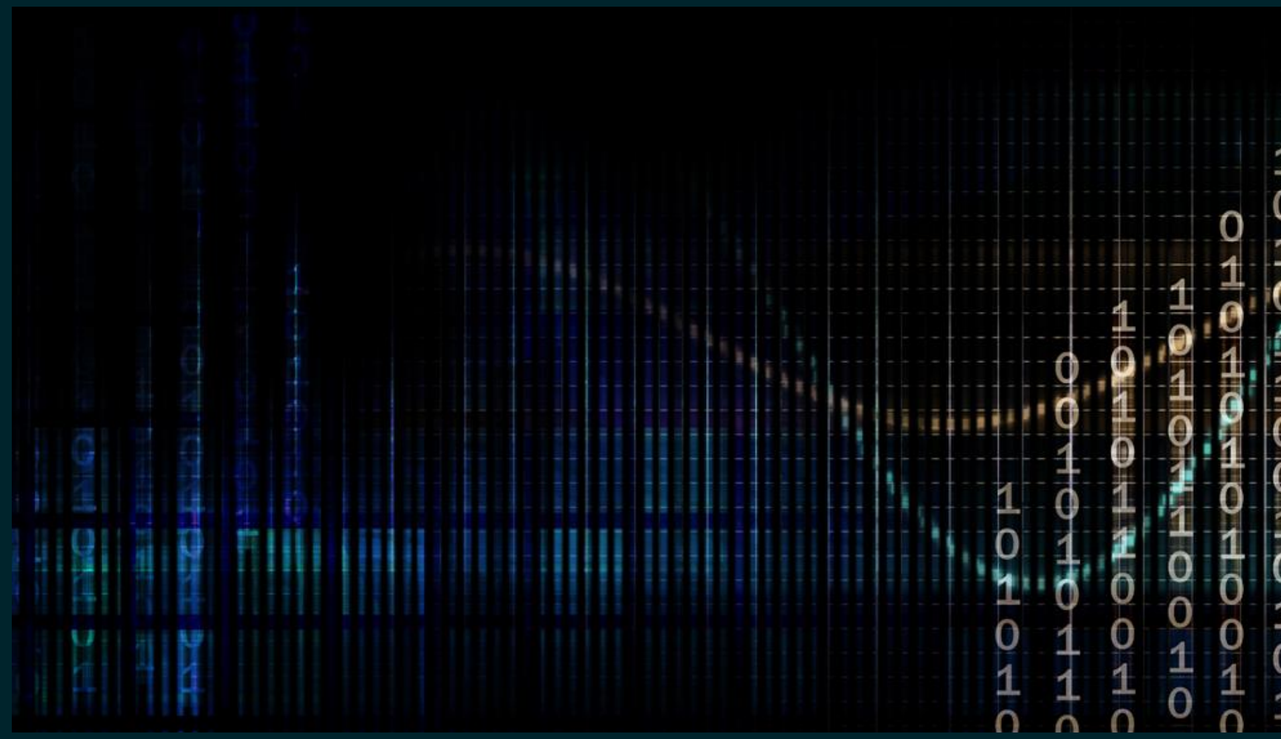
Observers / Subscribers:

- Read access is provided via the Data Dashboard and CAD Trust API server

User Types:

Registry Layer + Service Layer + Public

Data Model



CAD Trust Data Model Version 2.0

Version 2.0 is our enhanced baseline for harmonising carbon registry data. It supports greater registry interoperability and public good use cases while improving infrastructure performance and actively shaping emerging data standards for carbon markets.

Access all information:

- Press release
- Technical Report
- Data Dictionary
- Entity Relationship Diagram

Transition timeline

A systems-wide upgrade underway in 2026

- Q2 2025: Data model developed with participation of connected registries and wider stakeholders
- Q3 2025: Alignment with G20 SFWG-initiated CCCDM and other initiatives
- Q4 2025: Data model released, infrastructure and API upgrades completed and tested internally
- Q1 2026: Connected registries test new data upload pathway and start migration; data user testing sessions

- Q2 2026+: Start migration of connected (12) and onboarding of interested (10+) registries
  - Transitional period planned through mid-2026, maintaining both models until critical mass migrates
  - Release of upgraded Data Dashboard with main registry data and label filters hinges on major registry progress; currently planned for late Q3 or Q4

Data Model Version 2.0

Baseline Tables

STAKEHOLDERS

- CAD Trust Project ID* (FK)
- CAD Trust Stakeholder ID* (PK)
- Stakeholder Name*
- Stakeholder Type*
- Stakeholder Link
- Created At*
- Updated At*

ESTIMATIONS

- CAD Trust Project ID* (FK)
- CAD Trust Estimations ID* (PK)
- Estimation Start Date*
- Estimation End Date*
- Unit Count*
- Estimation Reference Number
- Created At*
- Updated At*

RATINGS

- CAD Trust Project ID* (FK)
- CAD Trust Rating ID* (PK)
- Rating Name*
- Rating Type*
- Rating Value*
- Rating Link
- Created At*
- Updated At*

CO-BENEFITS

- CAD Trust Project ID* (FK)
- CAD Trust Co-Benefit ID* (PK)
- Co-Benefit ID*
- Created At*
- Updated At*

PROGRAMS

- CAD Trust Project ID* (FK)
- CAD Trust Trust Program ID* (PK)
- Program Name*
- Program Registry*
- Program Registry ID*
- Program Description
- Created At*
- Updated At*

PROJECTS

- CAD Trust Project ID* (PK)
- CAD Trust Program ID (FK)
- CAD Trust Reference Project ID
- Project ID*
- Organization ID
- Project Registry Name*
- Project Crediting Program
- Project Name*
- Project Description
- Project Link*
- Project Sector*
- Project Type*
- Project Subtype
- Project Status*
- Project Status Date*
- Unit Metric*
- Created At*
- Updated At*

Each ID is global unique, meaning no organisations will generate the same ID for any table.

LOCATIONS

- CAD Trust Project ID* (FK)
- CAD Trust Location ID* (PK)
- Country*
- In Country Region
- Geographic Identifier
- Map Type
- Map File Link
- Created At*
- Updated At*

VALIDATIONS

- CAD Trust Project ID* (FK)
- CAD Trust Validation ID* (PK)
- Validation ID*
- Validation Type*
- Validation Body*
- Validation Date
- Crediting Period Start Date
- Crediting Period End Date
- Created At*
- Updated At*

METHODOLOGIES

- CAD Trust Methodology ID* (PK)
- Methodology Code*
- Methodology Name*
- Methodology Version
- Methodology Date
- Methodology Link
- Created At*
- Updated At*

PROJECT METHODOLOGIES

- CAD Trust Project Methodology ID*(PK)
- CAD Trust Project ID* (FK)
- CAD Trust Methodology ID* (FK)
- Project Methodology Date
- Project Methodology Description
- Created At*
- Updated At*

LABELS

- CAD Trust Label ID* (PK)
- Label Name*
- Label Type*
- Label Link
- Label Date
- Created At*
- Updated At*

UNIT LABELS

- CAD Trust Unit Label ID*(PK)
- CAD Trust Label ID* (Composite PK, FK)
- CAD Trust Unit ID* (Composite PK, FK)
- Label Unit Date* (PK)
- Label Unit Description

VERIFICATIONS

- CAD Trust Project ID* (FK)
- CAD Trust Verification ID* (PK)
- CAD Trust Validation ID (FK)
- Verification Start Date
- Verification End Date
- Verification Body*
- Created At*
- Updated At*

ISSUANCES

- CAD Trust Verification ID* (FK)
- CAD Trust Project Methodology ID* (FK)
- CAD Trust Location ID* (FK)
- CAD Trust Issuance ID* (PK)
- Issuance ID*
- Issuance Date
- Created At*
- Updated At*

UNITS

- CAD Trust Issuance ID* (FK)
- CAD Trust Unit ID* (PK)
- Organization ID
- Unit Serial ID*
- Unit Start Block*
- Unit End Block*
- Unit Count*
- Unit Type*
- Vintage Year*
- Unit Status*
- Unit Status Reason*
- Unit Status Date*
- Unit Retirement Detail
- Unit Retirement Beneficiary
- Unit Link
- Unit Metric*
- Unit Current Owner
- Unit ITMO Reference ID
- Created At*
- Updated At*

Fields with an * are required form fields

PK denotes primary key for a specific table

FK denotes foreign key which links tables together

Data Model Version 2.0

Article 6 AEF Tables

AEF T1 SUBMISSIONS

- CAD Trust AEF T1 Submission ID* (PK)
- AEF T1 Submission Party
- AEF T1 Submission Version
- AEF T1 Submission Report Year
- AEF T1 Submission Submission Date
- AEF T1 Submission Review Status
- AEF T1 Submission Result Check
- AEF T1 Submission NDC First Year
- AEF T1 Submission NDC Last Year
- AEF T1 Submission Reference Review Report
- Created At*
- Updated At*

PROJECTS

ISSUANCES

UNITS

AEF Tables are connected to the Baseline Tables through Unit table

Each ID is globally unique. No organisations will generate the same ID for any table.

AEF T2 AUTHORIZATIONS

- CAD Trust AEF T2 Authorizations ID* (PK)
- CAD Trust AEF T1 Submission ID* (FK)
- CAD Trust Unit ID* (FK)
- CAD Trust Project ID* (FK)
- CAD Trust AEF T5 Authorized Entities ID* (FK)
- AEF T2 Authorizations ID
- AEF T2 Authorizations Date
- AEF T2 Authorizations Cooperative Approach ID
- AEF T2 Authorizations Version
- AEF T2 Authorizations Quantity
- AEF T2 Authorizations Metric
- AEF T2 Authorizations GWP Value
- AEF T2 Authorizations Applicable Non GHG Metric
- AEF T2 Authorizations Sector
- AEF T2 Authorizations Activity Type
- AEF T2 Authorizations Purposes For Authorization
- AEF T2 Authorizations Authorized Party ID
- AEF T2 Authorizations Authorized Entity ID
- AEF T2 Authorizations OIMP Authorized Party
- AEF T2 Authorizations Authorized Timeframe
- AEF T2 Authorizations Authorization Terms
- AEF T2 Authorizations Authorization Documentation
- AEF T2 Authorizations First Transfer Definition OIMP
- AEF T2 Authorizations Additional Information
- Created At*
- Updated At*

AEF T3 ACTIONS

- CAD Trust AEF T3 Actions ID* (PK)
- CAD Trust AEF T1 Submission ID* (FK)
- CAD Trust Unit ID* (FK)
- CAD Trust Project ID* (FK)
- CAD Trust AEF T2 Authorizations ID* (FK)
- AEF T3 Actions Date
- AEF T3 Actions Type
- AEF T3 Actions Subtype
- AEF T3 Actions Cooperative Approach ID
- AEF T3 Actions Authorization ID
- AEF T3 Actions First Transferring Party ID
- AEF T3 Actions Party ITMO Registry ID
- AEF T3 Actions ITMO First ID
- AEF T3 Actions ITMO Last ID
- AEF T3 Actions Unit Registry ID
- AEF T3 Actions Unit First ID
- AEF T3 Actions Unit Last ID
- AEF T3 Actions Metric
- AEF T3 Actions GWP Value
- AEF T3 Actions Applicable Non GHG Metric
- AEF T3 Actions Quantity T CO2
- AEF T3 Actions Quantity Non GHG
- AEF T3 Actions Mitigation Type
- AEF T3 Actions Vintage Year
- AEF T3 Actions Transferring Party ID
- AEF T3 Actions Acquiring Party ID
- AEF T3 Actions Purpose Of Use OIMP
- AEF T3 Actions Using Participating Party ID
- AEF T3 Actions Using Authorized Entity ID
- AEF T3 Actions ITMO Used Year
- AEF T3 Actions Consistency Check Result
- AEF T3 Actions Additional Information
- Created At*
- Updated At*

AEF T4 HOLDINGS

- CAD Trust AEF T4 Holdings ID* (PK)
- CAD Trust AEF T1 Submission ID* (FK)
- CAD Trust Unit ID* (FK)
- CAD Trust Project ID* (FK)
- CAD Trust AEF T2 Authorizations ID* (FK)
- AEF T4 Holdings Cooperative Approach ID
- AEF T4 Holdings Authorization ID
- AEF T4 Holdings First Transferring Party ID
- AEF T4 Holdings Party ITMO Registry ID
- AEF T4 Holdings ITMO First ID
- AEF T4 Holdings ITMO Last ID
- AEF T4 Holdings Unit Registry ID
- AEF T4 Holdings Unit First ID
- AEF T4 Holdings Unit Last ID
- AEF T4 Holdings Metric
- AEF T4 Holdings GWP Value
- AEF T4 Holdings Applicable Non GHG Metric
- AEF T4 Holdings Quantity T CO2
- AEF T4 Holdings Quantity Non GHG
- AEF T4 Holdings Mitigation Type
- AEF T4 Holdings Vintage Year
- Created At*
- Updated At*

AEF T5 ENTITIES

- CAD Trust AEF T5 Authorized Entities ID* (PK)
- CAD Trust AEF T1 Submission ID* (FK)
- CAD Trust AEF T2 Authorizations ID* (FK)
- AEF T5 Authorized Entities Authorization Date
- AEF T5 Authorized Entities Name
- AEF T5 Authorized Entities Incorporation Country
- AEF T5 Authorized Entities ID
- AEF T5 Authorized Entities Cooperative Approach ID
- AEF T5 Authorized Entities Conditions
- AEF T5 Authorized Entities Change Conditions
- AEF T5 Authorized Entities Additional Information
- CAD Trust Unit ID
- CAD Trust Project ID
- Created At*
- Updated At*

Fields with an * are required form fields

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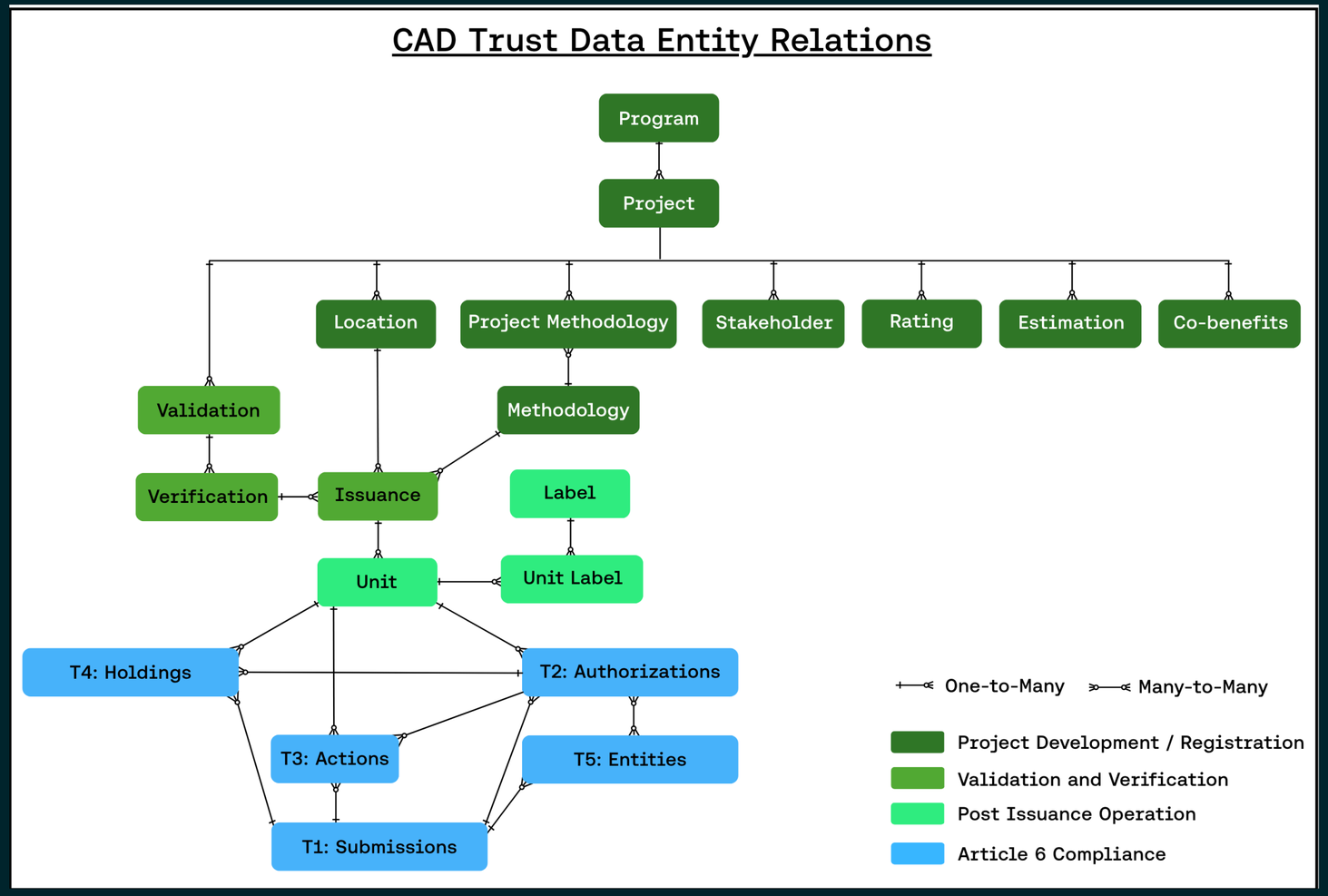
FK denotes foreign key which links tables together

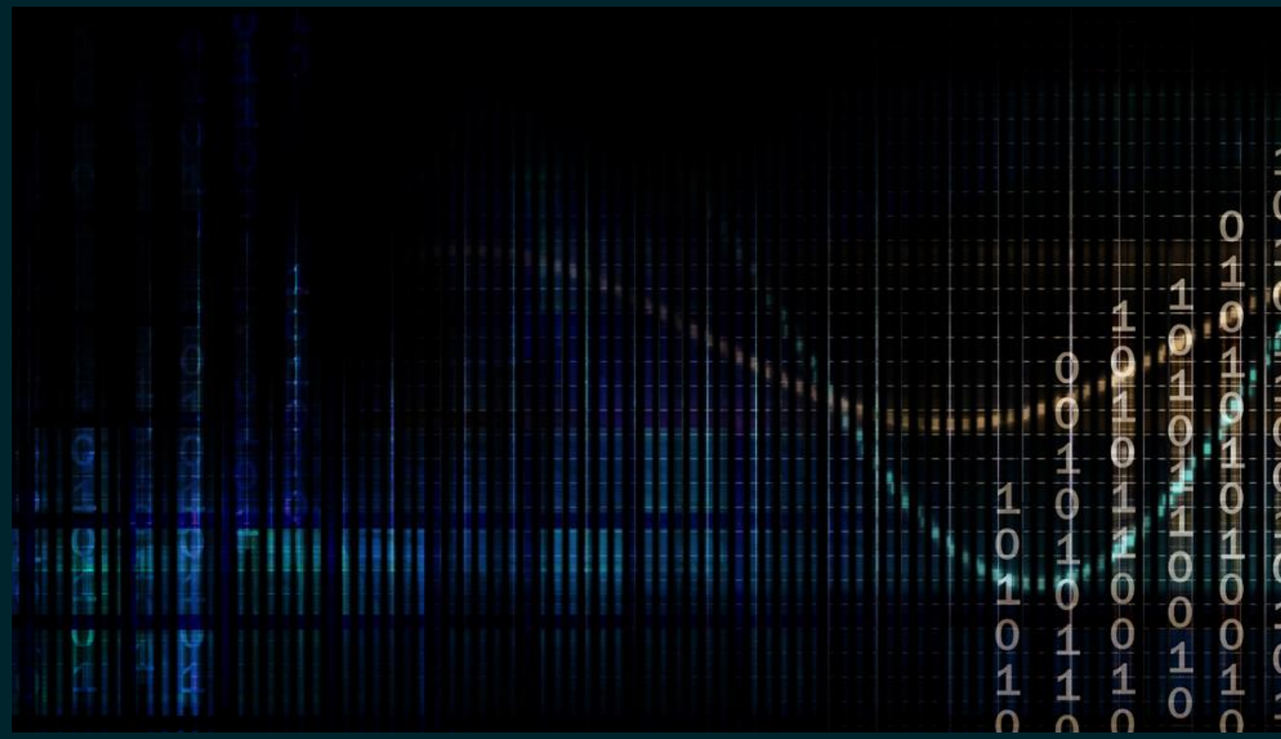
CAD Trust Data Model Version 2.0

Relational Structure



- Project as the main entry of the carbon credit lifecycle.
- Project progresses through Methodology, Validation, followed by Verification before Issuance and Unit.
- Unit as the connector for Labels and Article 6 Authorization, Action, Holding details.
- All five AEF tables can be linked back to the project level.

Integration & Setup



Node as a Service

As part of v2.0 implementation, registries no longer install or operate CAD Trust infrastructure.

- CAD Trust data layer vendor, Chia Network, will deploy, manage and maintain a dedicated CAD Trust node for each registry – the Chia full node, wallet, data layer mirroring service, and the CAD Trust API server – in a managed cloud environment.
- Your registry connects to its node and pushes Data Model v2.0 data through the CAD Trust API. Provisioning, hosting, security, backups, monitoring and software upgrades are handled for you.
- CAD Trust manages enrolment and the relationship with each registry. There are no servers for the registry to size, install, secure or maintain.

Offered to registry partners at no charge. Each environment is logically isolated, and registries keep full control of their data.

What’s changing

Previously: self-hosted

Each registry provisioned and ran its own stack — Chia full node, wallet, data layer and mirroring service, and the CAD Trust API server.

Plus the cloud infrastructure, server sizing, key management, security, monitoring and upgrades behind them.

Setup and operations sat with the registry.

Now (v2.0): Node as a Service

CAD Trust data layer vendors, Chia Network runs the same stack on the registry’s behalf in a managed cloud environment.

Registries connect and push data through the CAD Trust API — no servers to size, install, secure or maintain.

Provisioning, hosting and upkeep sit with Chia.

Node as a Service replaces self-hosting as the way registries connect to CAD Trust.

What Node as a Service covers

CAD Trust via Chia runs the full stack

- Chia full node, wallet, data layer mirroring service
- CAD Trust API server environment
- Cloud provisioning and lifecycle management
- Backups, recovery, managed upgrades and maintenance
- Network security, encrypted communications, and performance monitoring

Registries keep control

- API key authentication, with rotation on request
- IP whitelisting and network access controls
- Read/write configuration matched to the registry's CAD Trust role
- Environments logically isolated; data remains the registry's property
- Registry decides what data to publish and when

Not included: MySQL mirror database, analytics / data warehousing, or separate SQL replication of CAD Trust data — provisioned independently if required.

How to get connected

1. **Enrol with CAD Trust**
   CAD Trust confirms eligibility and manages your onboarding into the participant network.
2. **Your node is provisioned for you**
   CAD Trust and Chia set up your dedicated managed node — full node, wallet, data layer and CAD Trust API server.
3. **Receive your credentials**
   You receive your CAD Trust API endpoint and API key, with IP whitelisting and access controls configured to your registry.
4. **Integrate and push your data**
   Connect your registry database and push Data Model v2.0 data to the CAD Trust API (see the ETL guidance that follows).
5. **Validate, then go live**
   Test against the provided test environment, then publish to production on the live network.

Building ETL Architecture

- Goals: Continuous integration – updating the registry's own database and pushing to your managed CAD Trust node via the CAD Trust API and Chia Data Layer
- It is up to Registry to determine the frequency of data loading and extraction
- Ensure that sensitive data is handled securely throughout the ETL process. Implement encryption, access controls, and data masking as needed
- Thoroughly test the ETL pipelines in different scenarios to ensure data accuracy and consistency
- Regularly review and optimise your ETL pipelines for performance, reliability, and maintainability

References & resources

- **CAD Trust API v2.0 documentation** — endpoints your registry uses to push and read data via the managed node
- **Postman API collection** — ready-made requests for testing your integration against the CAD Trust API
- **Data Model v2.0 dictionary & ERD** — field definitions and table relationships your data must conform to
- **CAD Trust public GitHub repository** — open-source CAD Trust application

Onboarding contact — evan@climateactiondata.org or erick@climateactiondata.org to begin Node as a Service enrolment

Appendix

Threat Analysis

The CAD Trust is unique in that it is a fully-decentralized application. There is no central server that can be attacked by a malicious actor to cause system-wide failures. Instead, it is a true peer-to-peer network with each participant's managed node acting as a peer to all of the other participants' nodes.

Identified potential attacks on the CAD Trust fall into a few broad categories:

- Changing data - a threat actor attempts to either change data without permission or causes the data to appear to be changed when other users view it.
- Denial of service - a threat actor attempts to prevent legitimate users from accessing the system.
- Malicious code injection - a threat actor attempts to cause the system to distribute malicious payloads.
- Stealing cryptocurrency - there is a small amount of chia cryptocurrency (XCH) required to publish data using the Chia blockchain that a threat actor could attempt to steal.
- Blockchain attacks - a threat actor attempts to change data previously confirmed on the blockchain or stops the blockchain entirely.

Threat Analysis

Registry nodes are operated by Chia as a managed service in secured cloud infrastructure, rather than self-hosted by registries.

Read-only consumers access published data through the public Data Dashboard and API and cannot change data, so the impact of any compromise on their side is limited to their own view.

The managed environment mitigates most attacks using industry-standard technologies, including:

- Isolated and secured subnet deployment
- Reverse proxy with SSL/TLS
- Web application firewall (WAF)
- Identity and access management system (IAM)
- Local firewall on the application server

Threat Analysis

- Exogenous factors such as compromised client computers or networks, leaked credentials, phishing and zero-day vulnerabilities are outside the scope of the CAD Trust and must be mitigated through good security hygiene practices among users and the managed-service operators.
- Blockchain attack vectors and their mitigating factors are thoroughly described in documentation published by Chia Network, Inc.
- As a truly decentralized system, DDoS attacks would have very limited effectiveness and can only disable access to a single node. Users of all other nodes would be unaffected.
- A number of additional potential attack vectors are considered and mitigations addressed, including malicious source code commits, malicious upstream library releases, poisoned installers and leaked or lost cryptographic keys, among others.
- In summary, the application can be fully secured through the use of correct operation and maintenance of the managed service by Chia, good security practices by users and good source code control and upstream monitoring by code maintainers.

Chia Technical FAQ

Q: Why was it important to use a public blockchain instead of a private blockchain?

A: Public blockchain is within the spirit of the Paris Agreement's decentralized bottom-up approach. It does not rely on the trust of any central authority, including the company managing the chain. It is a truly decentralized tool that democratizes access and cannot be manipulated by any authority or owner.

Q: More validators (nodes) on a blockchain network make it more decentralized and secure. Are there adequate incentives to ensure Chia's 200,000+ validators continue? Have there been any reductions in the hype leading to a decrease in validators?

A: Chia's Proof of Space & Time consensus mechanism rewards the storage ecosystem effectively and incentivizes validators. If validators start to leave the Chia ecosystem, that creates a higher rate of return for new validators allocating storage to Chia and thus incentivizes more validators to add space to the network.

Q: Carbon credit project data is often very high volume. Is this costly? Are all participants expected to store all the data in order to participate with the CAD Trust?

A: Chia's blockchain was designed to be simple, extremely resource-efficient and functional. Chia's unique Data Layer is a decentralized database that is calculable on-chain and secured by Chia's entire network. The CAD Trust Data Model is limited to critical fields to ensure fast and ultra-low-cost datasync on blockchain. Although uniquely "calculable on-chain" the blockchain only stores proofs (hashes) of the transactional data, so each node is not required to store every other node's data, but rather proofs that the other nodes' data are all provable, calculable, and correct.

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