UN-GGIM
UNITED NATIONS
COMMITTEE OF EXPERTS ON
GLOBAL GEOSPATIAL
INFORMATION MANAGEMENT

International Seminar on UN-GGIM:
Singapore. 16 – 20 May 2022

DataLayer Secured by Chia's Public Blockchain:
Decentralized, Secure Effective Land Administration

Climate Warehouse

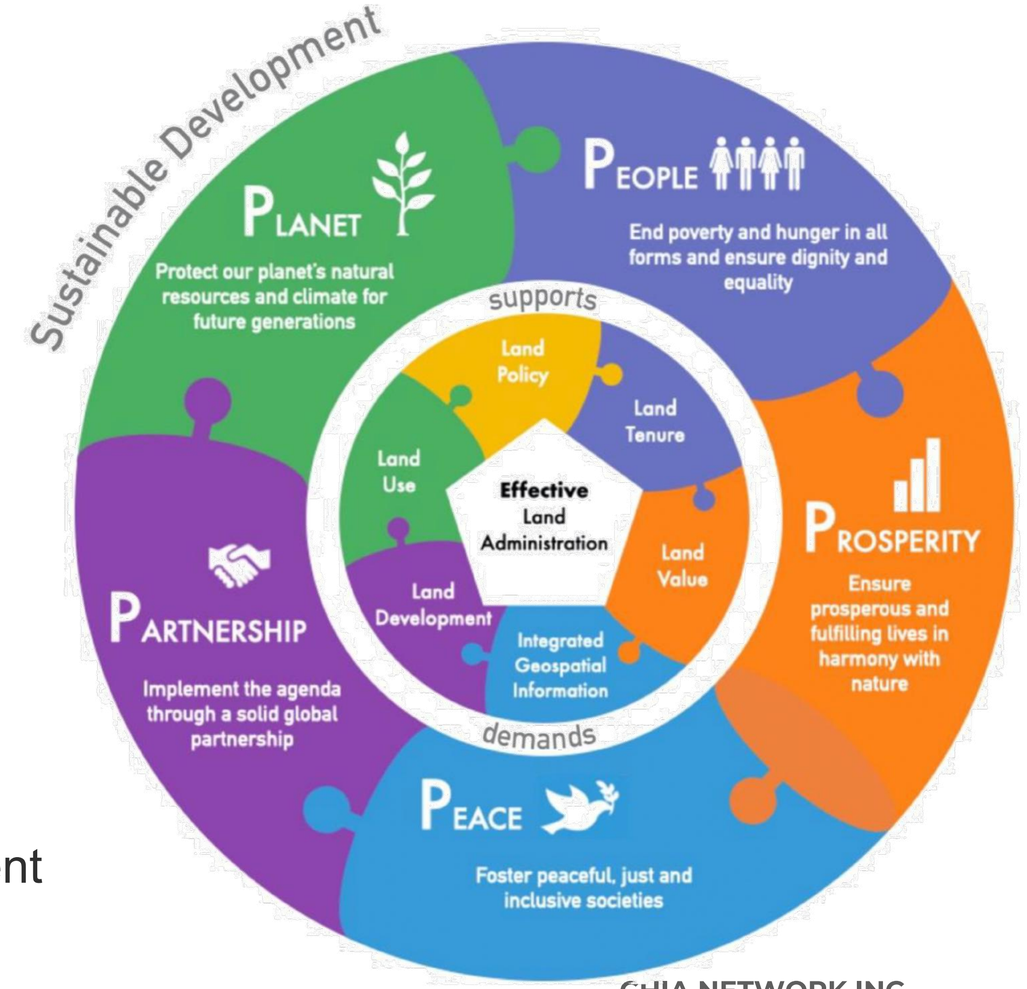
chia

Presented by Neil Cohn, Chia Network Inc. - May 19th 2022

Chia DataLayer also For Land Administration: Inclusive Prosperity Starts with Authenticated Data

Equitable land access may be the only issue associated with ALL 17 Sustainable Development Goals

- **Human Challenge:** The vast majority of humanity lacks secure land rights, to create sustainable and inclusive societies
- **Land Administration:** We must document, record, recognize and monitor people-to-land relationships in all forms
- **Innovative Technology:** Public blockchain can build trust in data to advance effective land administration
- **Opportunity:** Chia's blockchain was designed to authenticate and secure massive amounts of data. DataLayer was developed in partnership with the World Bank and Singapore to deliver the foundational architecture for carbon trading under the Paris Agreement



Trusted by Multilaterals and Governments

Chia has Partnered with the World Bank and Costa Rica

ADVANCED FUNCTIONS, SECURITY, LOW-COST, SIMPLICITY, INCLUSIVITY, AND UNMATCHED SUSTAINABILITY

Climate Warehouse

Singapore

Singapore is the anchor and will host The Climate Warehouse built on Chia's blockchain. The Climate Warehouse uses Chia's DataLayer as the core technology to enable trust and transparency for international carbon markets. Chia's DataLayer is robust, secure technology, capable of safeguarding the traceability, authenticity and authority of land data

WORLD BANK GROUP

World Bank Group: After an extensive vetting process, the World Bank selected Chia to build the Climate Warehouse as the foundational architecture and "Meta DataLayer" of the global carbon markets to assure security and accelerate climate change activities

Costa Rica

Government of Costa Rica: Partnered with Chia to deliver an universal open-source national climate system that includes inventory functions and a registry that syncs with the World Bank's Climate Warehouse. This software will be provided for free to all 196 countries that are participating in the United Nations Paris Agreement

chia

Chia Blockchain is Secure, Sustainable and Legal

Designed with intent and leveraging last mover advantage

The Same Security and Value storage as Bitcoin

More auditable, verifiable programmability than Ethereum

Inclusive, low-cost with low hardware requirements

Sustainable

Environment: Conservation of global resources and healing the planet

- Low Energy and reduces e-waste by leveraging the 2nd use of hard drives to keeps IT equipment out of landfills

Social: Inclusive Prosperity

- Largest global network of validators with over 250,000 nodes earning rewards and keeping the network secure

Governance: Regulatory Compliant Blockchain

- No Initial Coin Offering (ICO) and no coins given to employees or shareholders to avoid any doubt of legal status

Chia DataLayer: Multilateral Functionality

Designed to Secure Trust, Immutability and Transparency in Decentralized Data Sources

- **Authenticated Data:** Data source is immutably tracked to assure the veracity of data and ensure “trustless trust”
- **Transparency:** The data is protected by the public blockchain - all observers can monitor for changes in the data
- **Sovereignty:** Each member country maintains control over its data. While all parties can see that data has been authenticated – the actual ability to read or write data is controlled by the owner of each data store.
- **Dynamic & Relational Data:** Unlike other blockchains, Chia’s DataLayer enables data to be used dynamically on-chain
- **Inclusivity:** The Chia blockchain is open source and public. No permissions are required to observe and monitor the blockchain, the hardware requirements are very low and transaction fees are minimal
- **Sustainability:** Chia is extremely energy efficient, and even with 4 times the validators of any other blockchain in the world, Chia uses less than 1/600th footprint than other secure blockchains
- **Auditability:** All data can be independently verified. All changes are clearly recorded by date, time, and the cryptographic key of the entity making the change. All prior versions of the data remain accessible.
- **Security:** Data Authenticated and stored on the Chia blockchain is secured by over 200,000 validators worldwide.

The Climate Warehouse

Climate Warehouse

A global public meta data layer for the carbon markets

Simulation III, Phase II, May 2022

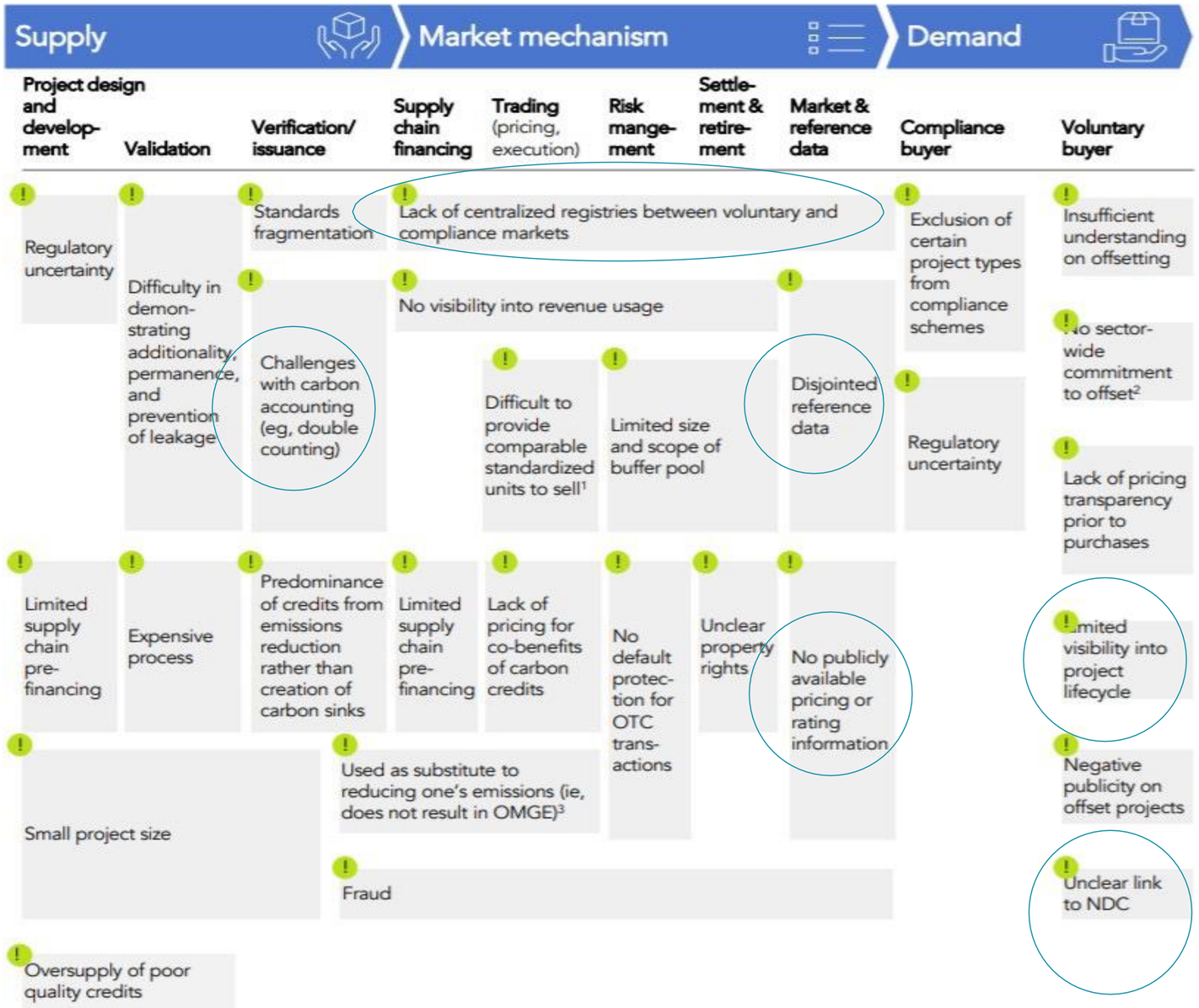
WORLD BANK GROUP chia

The World Bank's collaborative partnership with Chia is non-exclusive. It is for open-sourced public good, bears no costs or intellectual property rights from the World Bank and promotes interoperability.

Context-setting

- **Individual commitments through nationally determined contributions (NDCs).** The Paris Agreement introduced a bottom-up approach for addressing climate change.
- **Decentralized cooperative approaches to achieve their NDCs.** This is expected to lead to heterogeneous climate markets, which may have differences in governance rules and operate under different technological systems.
- **Climate Warehouse: a decentralized information technology approach to connect climate markets systems.** Consistent with the World Bank's role in testing development solutions and the bottom-up ethos of the Paris Agreement.

Report by Taskforce on Scaling Voluntary Carbon Markets (TSVCM)



What is the value proposition?
A decentralized IT approach to connect climate markets

Climate Warehouse

A shared open metadata repository

1. **Facilitating a peer-to-peer connection and communication** among decentralized registries in order to track mitigation outcomes

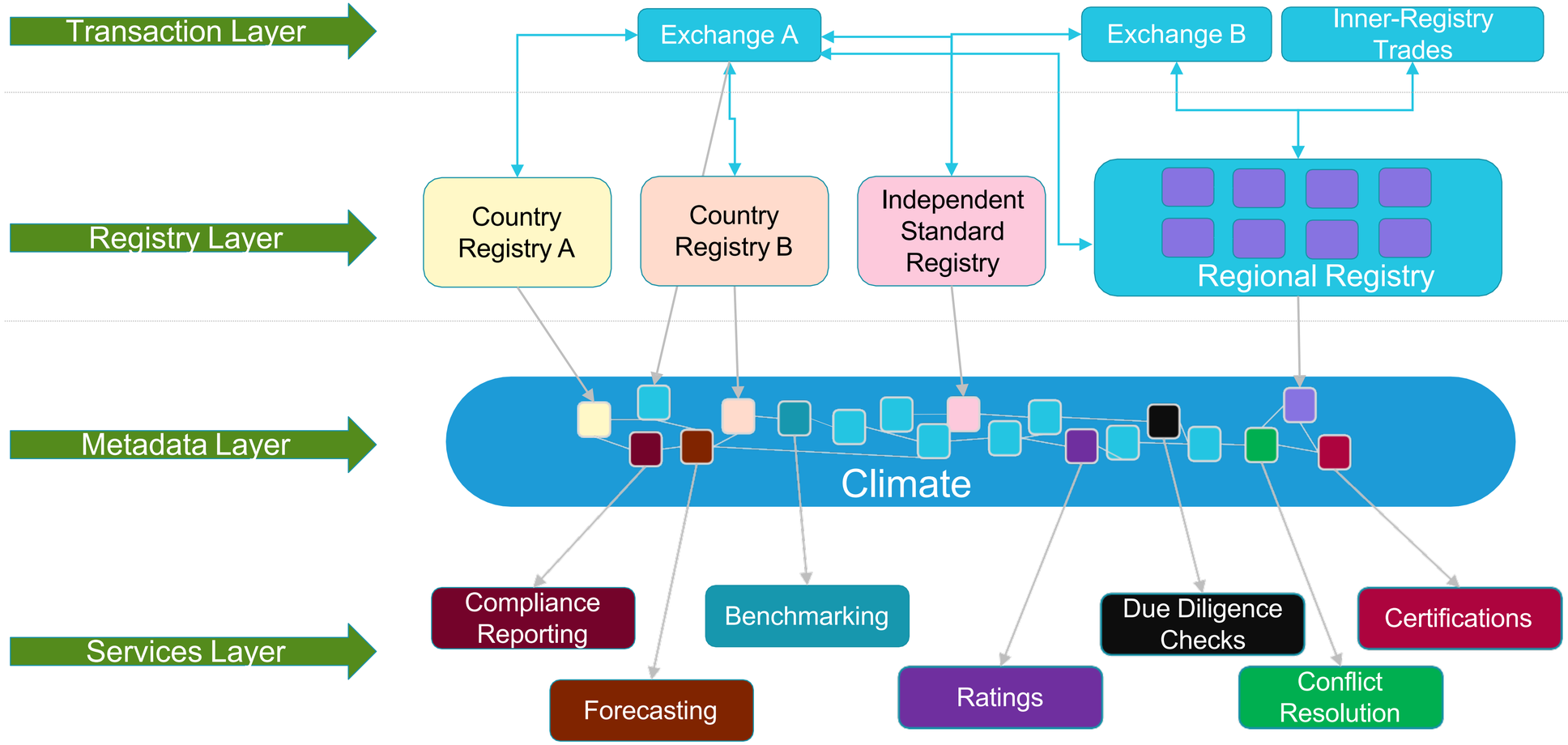
2. **Provide visibility into corresponding adjustment procedures and the lifecycle of carbon offsets** from issuances to retirement, which will safeguard against double counting and ease reporting requirements.

3. **Surface publicly-available information on MOs (carbon offset credits call "Mitigation Outcomes")** and record status changes to provide information on how MOs are used.

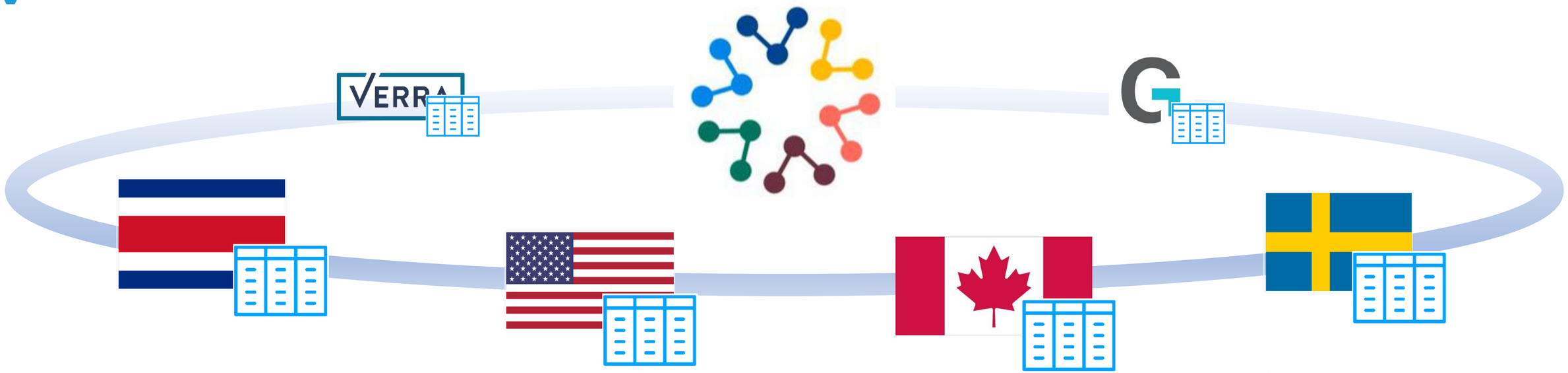
4. **Enhance transparency and trust among market participants and enable tracking of MOs and reduce double counting risk**. The Climate Warehouse would not hold assets or directly facilitate.

The Climate Warehouse: Building a public good data layer

- Designed as an open shared infrastructure layer
- Common taxonomy of data facilitates communication between entities
- Registry service providers and countries share data to the Warehouse
- Public and private sector market players can host a node and build out the service layer



Climate Warehouse on Chia's Public Blockchain Data Layer



Interconnected Autonomy

Each member government or standards registry owns their node and their data. There is no central server, no proprietary software or environments required, and no dependencies on foreign or private entities. All code is free and open source.

Easy to Use

It is easy to run a node on low-cost hardware, with limited Internet connection.

There are multiple ways to upload or sync data from a registry into the Climate Warehouse.

Intuitive interface for basic data access and update

Enables and Activates Service Layer

The data is stored with the blockchain and is accessible through an API. Any data analytics tool can be used to aggregate, report and visualize the data.

Secure

The data is protected by the global 250,000 node Chia public blockchain.

Each table of data has separate security settings for read and write so that only permissioned users can add or update the data in that table.

Why Chia's Public Blockchain was Selected:

Open Source, Low Cost and Inclusive

- Open source and provided as public good
- Low hardware and low bandwidth requirements
- No commercial software licenses required
- Local installation with cloud deployment option

Secure Public Blockchain:

- New Nakamoto consensus: Proof of Space & Time
- Sustainable: Very low energy use & very low e-waste
- Cost-effective: No / low transaction fees
- Compliant: Not a security and complies with US Law

Data Capable, Integrated, Connected and Accessible

- Chia's DataLayer stores data calculable "on chain"
- Available user interface for direct access
- Fully localizable user interface
- Native integration with open-source National registry system being developed by Chia and Costa Rica

Sovereign Participants, Public Observers

- Permissionless publicly viewable / auditable data
- Permissioned write functionality to protect tables
- Permissioned Versatile data entry, export & reporting
- Data model built to be easily upgraded or revised
- Capable of Permissioned viewing functionality when beneficial for security sensitive data

Appendix: Not Presented Additional Information About Chia and it’s DataLayer

Chia was Designed to be Great, Not Less Bad

Chia is Secure, Functional and Sustainable Blockchain

Leverages Excess Storage and Used Drives

Proof of Space and Time leverages underutilized storage to secure the network energy efficiently

Decentralized and Inclusive

Low barrier to entry for farming has made Chia the most decentralized blockchain in the world with over 200,000 public nodes

Circular Drive Initiative

Incentivizes circular economy

Chia farming is optimized for used storage and will drive circular business models for storage devices, and reduce e-waste

Source: IDC Market Perspective
"Chia Cryptocurrency Farming Is Real"

Chia DataLayer: Breakthrough Data Solution

Affordable stored data that is calculable in smart contracts

AUTHENTICALLY ADVANCED TECHNOLOGY BENEFITS THE ENVIRONMENT AND GLOBAL SOCIETY

Secure Data Storage

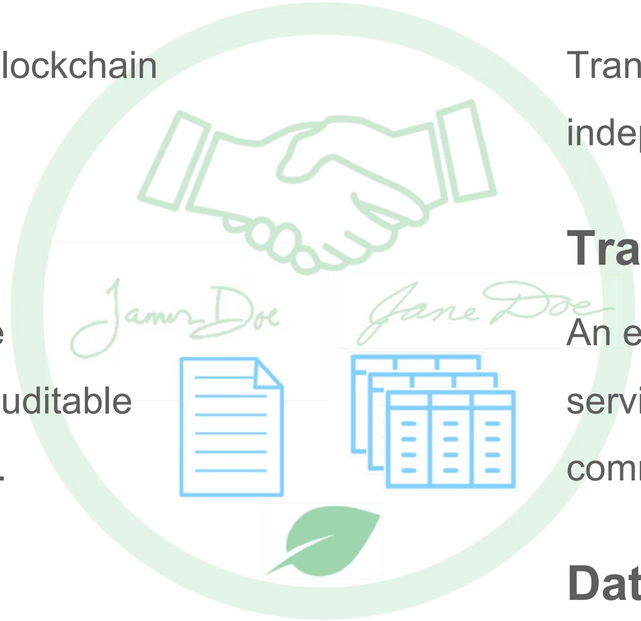
The Chia blockchain can secure data using a public blockchain without incurring high fees or network congestion.

Data Audit-ability

Any update to data stored with Chia is signed with the committer of the change. All changes over time are auditable and the prior states of the data are always accessible.

Relational Data

Data stored on the blockchain is calculable on-chain and can have arbitrarily complex foreign key relationships.



Multiparty Signatures

Transactions on Chia can require signatures from multiple independent parties for a transaction to complete.

Transaction Documentation

An entire document can be included with a transaction serving as a contract describing any off-chain commitments made as part of the transaction

Data Predicates

Transactions on Chia can depend on certain data in the data store. If that data is not present as required by the transaction, the transaction does not get completed.

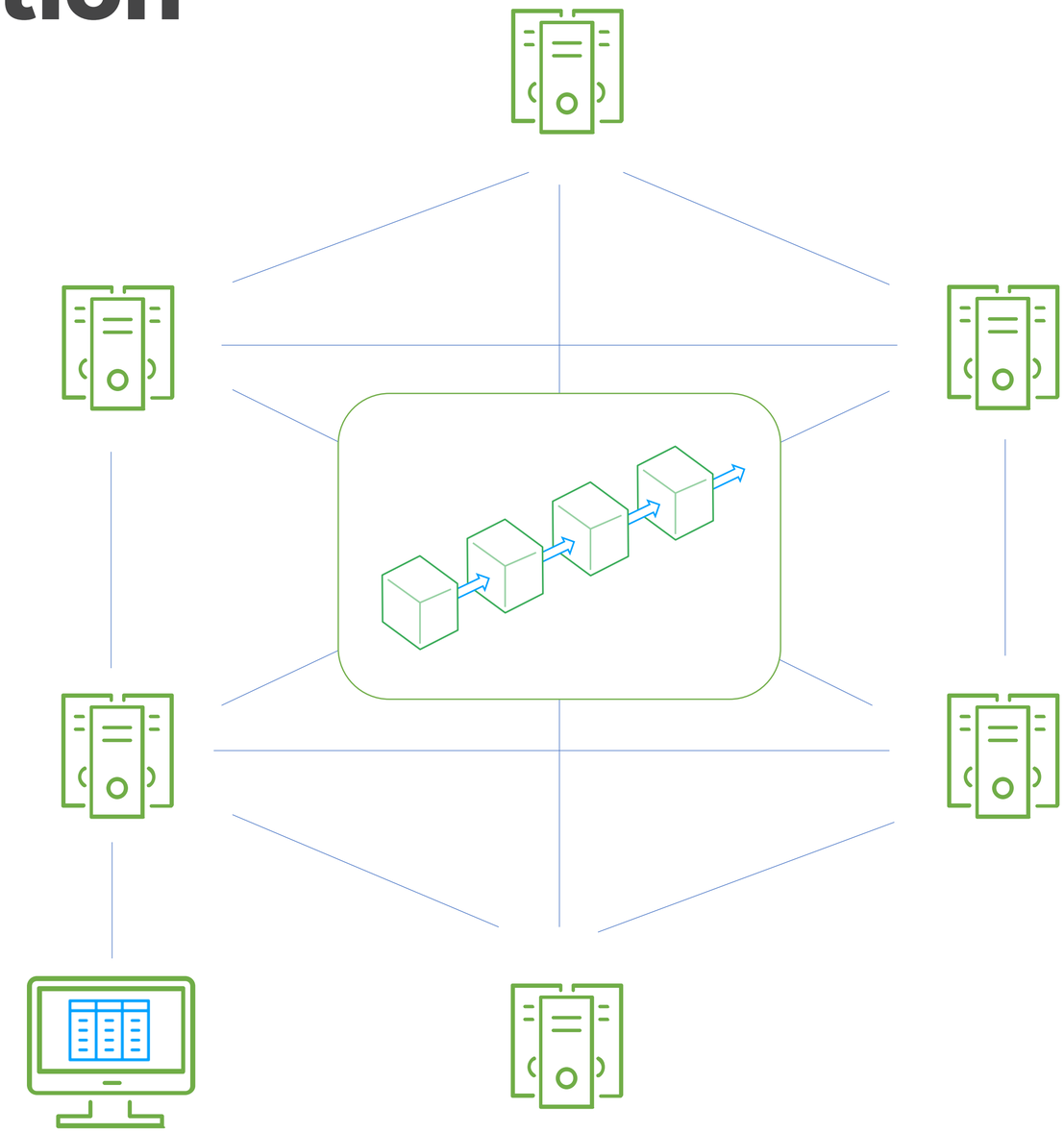
DataLayer Decentralization

Designed to enable security

Decentralized: There is no single data store controlled by a single party.

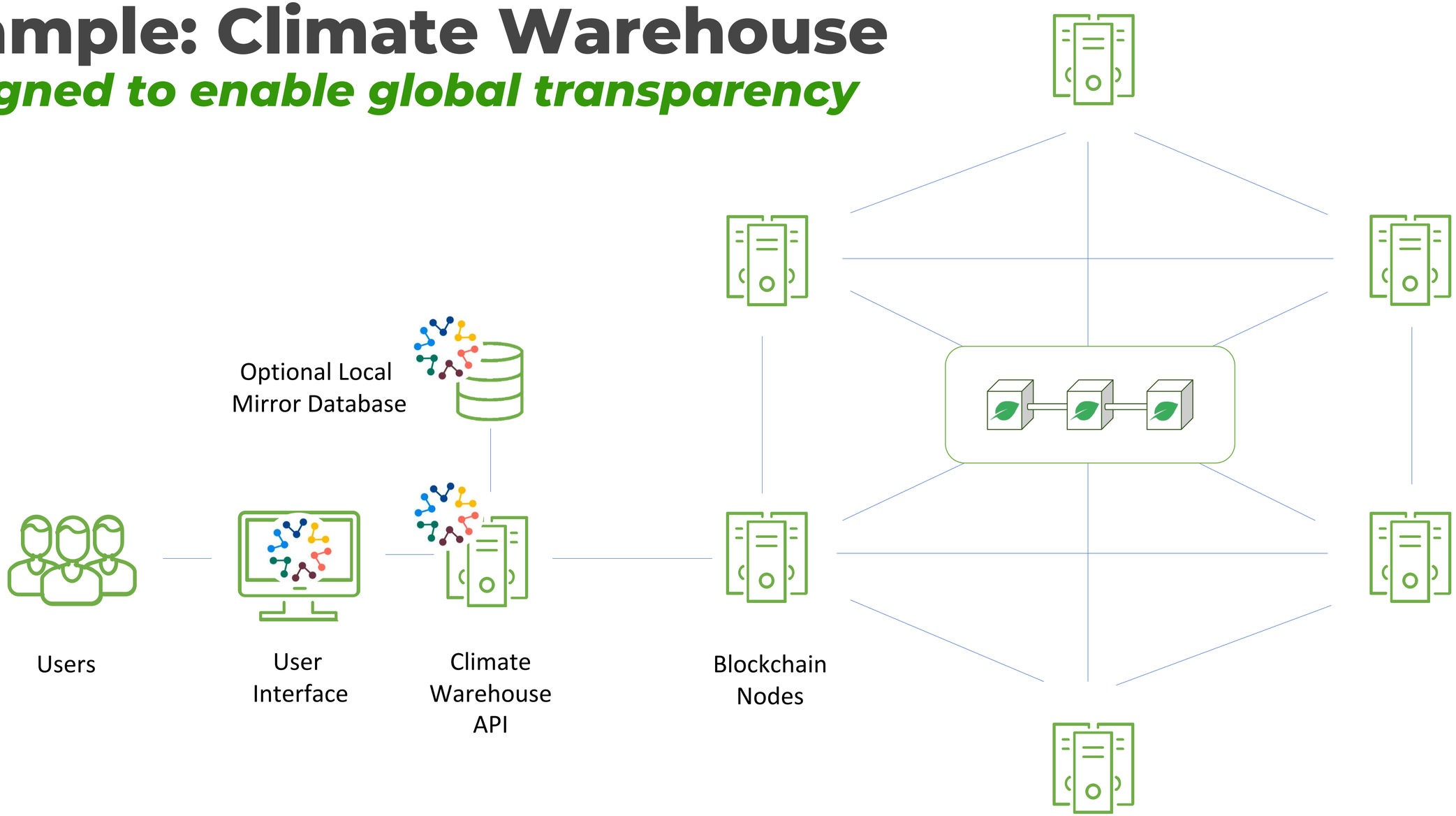
Accessible: All blockchain participants can choose to subscribe to data, but data publishers may choose to limit subscribers.

Low Impact: The blockchain stores only small proofs of the data called “hashes” on each one of the nodes run by blockchain validators worldwide. While all validators secure every decentralized data store, participants may elect to subscribe to a particular store of data and can validate it using the proofs.



Example: Climate Warehouse

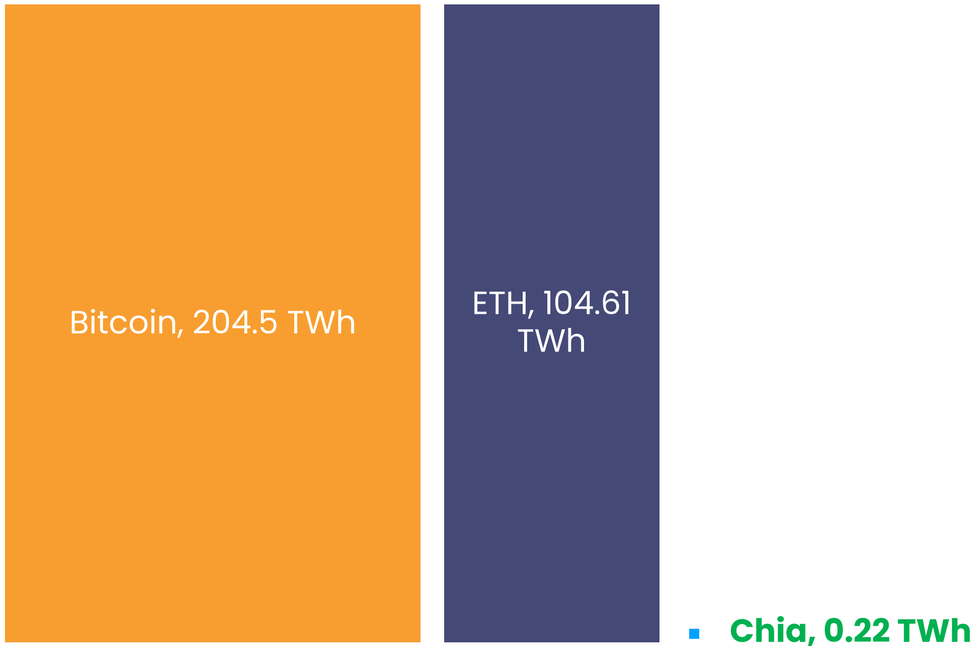
Designed to enable global transparency



Intrinsically Green

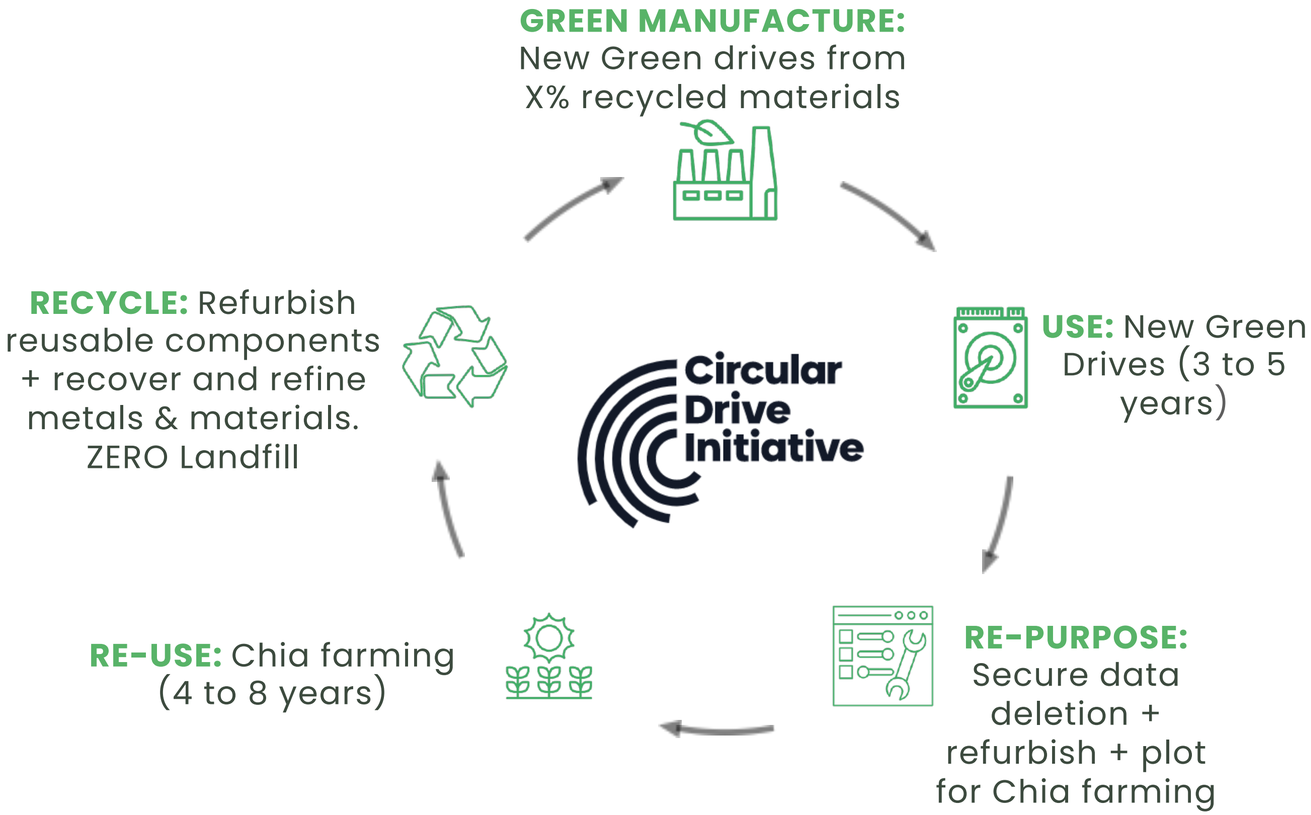
Chia is a force for carbon reduction and e-waste mitigation

Chia Relative Energy Use:



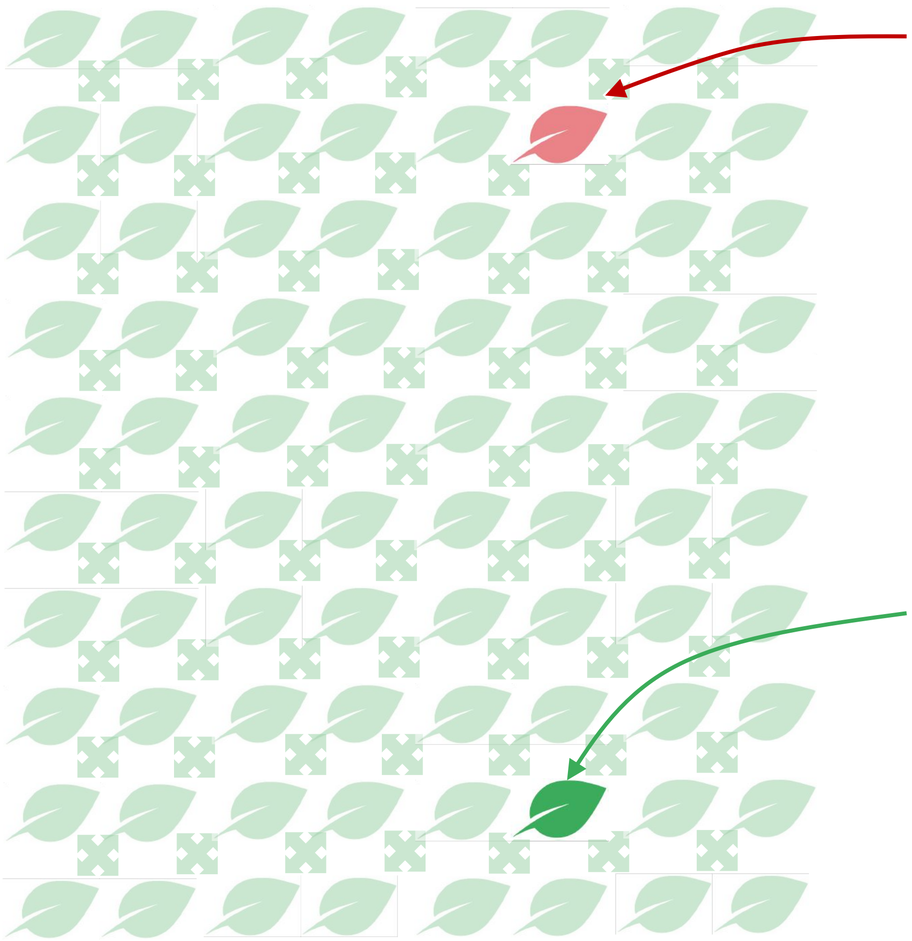
https://digiconomist.net/bitcoin-energy-consumption/
https://digiconomist.net/ethereum-energy-consumption
https://Chiapower.org (5/16/22)

Addressing E-Waste and Creating a Circular Economy for Hard Drive Reuse and Recycling:



Secure and Inclusive

The Most Secure Blockchain in History



Most Decentralized

Each validator node independently validates each transaction in a Nakamoto blockchain. In a robust **public blockchain** like Chia, it takes corrupting 51% of the validator nodes to corrupt the data. The Chia network includes **over 250,000 nodes** today. It would be nearly impossible to corrupt over 125,000 validator nodes.

Simultaneous Execution

Ethereum nodes notoriously front-run transactions to their own personal benefit. This is almost impossible in Chia.

For Comparison...

Chia Network has over
250,000 nodes

Bitcoin has around
65,000 nodes

Ethereum has less than
5,500 nodes

Not "Proof of Stake"

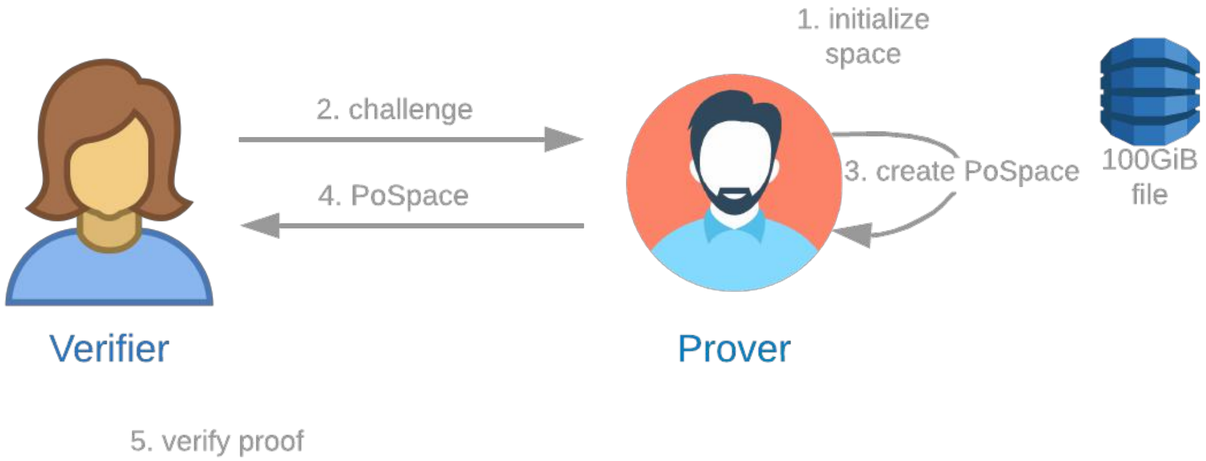
Proof of Stake (PoS) is literally "rich get richer" as nodes must stake a significant amount of money to have the opportunity to earn the rewards of helping to operate the blockchain.

PoS is also far less secure as it encourages centralization of nodes and cannot overcome certain types of attacks.

Consensus Mechanism: Proof of Space & Time

Efficient One-time Hash Processing, Stored on Hard Drives for Re-use

FIRST NEW NAKAMOTO CONSENSUS SINCE BITCOIN



Proofs of Space

- Farmers store hash “plots” on excess drive space
- Must prove to the network they are storing the plots with hash puzzles
- Needs to be easily and quickly verifiable
- Must be resistant to attacks

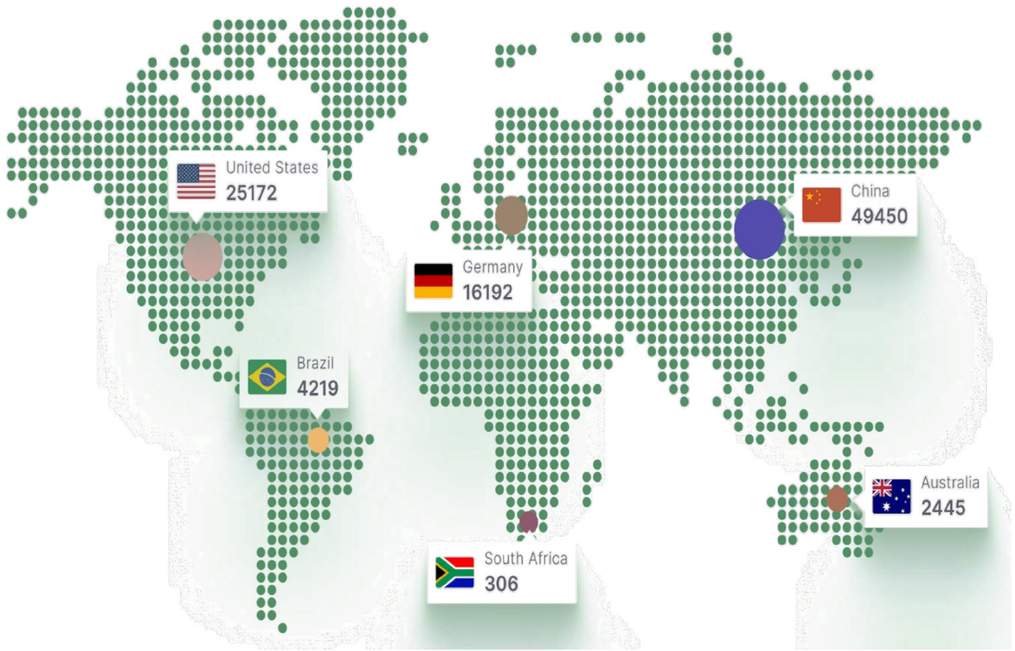
Proofs of Time

- Verifiable Delay Function (VDF) cannot be parallelized
- Easily verifiable that a real amount of time was spent with deterministic output
- Performs squaring computations within class groups of binary quadratic forms

Proof of Space & Time is Green and Inclusive

Proof-of-Stake is an Oligarchy for the Incumbent Stakeholders

STORAGE IS THE SOLUTION TO THE PROOF-OF-WORK ENERGY CRISIS. NO TRADEOFFS FOR LOWER ENERGY USE



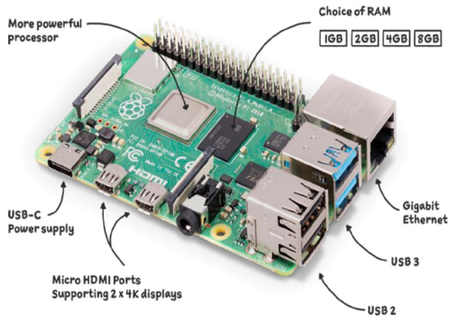
Over 200,000 Nodes Globally

Chia is Farmed in over **160** Countries

Fair, Inclusive, and Energy Efficient

Unlike Proof-of-Stake, Chia achieves energy efficiency without sacrificing fairness and inclusivity

USB SSD



Arm / Pi4

Validation Full nodes are Incentivized
Chia farming is Inclusive. The minimum requirement is sub $100 Raspberry Pi or a 15-year-old laptop / PC

Better Smart Contracts

Security of Bitcoin's UTXO model & Programmability of Ethereum

CHIALISP PROGRAMMING LANGUAGE: SECURE, STREAMLINED, COMPLIANT AND AUDITABLE

Sophisticated Custody and Controls

CATs Tokens & NFTs: Issue Currencies & Assets

Identify verification and management

Native Distributed Exchange Functionality

Storage is Energy Efficient

Better Today

MINING
Antminer S19 Pro
3,259 Watts

Need access to cheap electricity

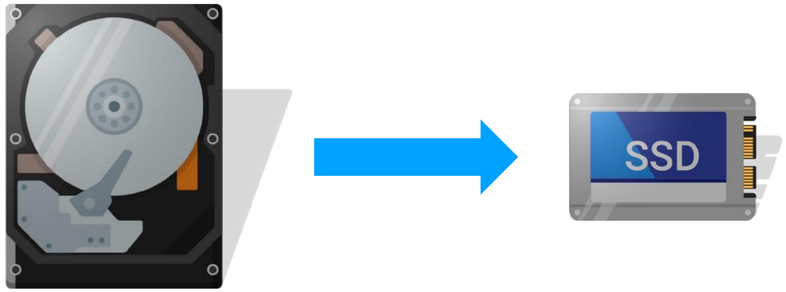
New Single-use ASICs quickly become e-waste

FARMING
Hard drive
3 to 5 Watts

Can farm at home with residential electricity

Used and Recycled Drives can farm Chia

And Tomorrow

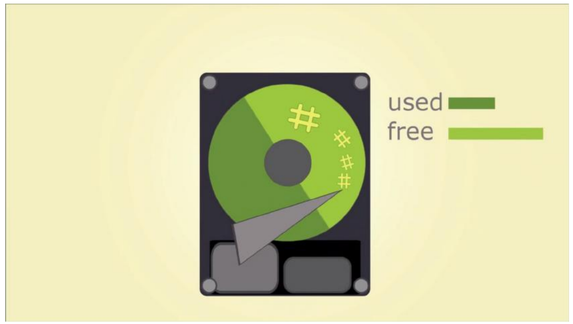


- SSD is already dominant technology in consumer laptops (90%)
- Enables near zero power farming
- SSDs 27%* of global storage byte TAM in 2025, already larger revenue

Source: Gartner, Wells Fargo Securities

Chia “Farming” is Inclusive and Sustainable

Versus Crypto “Mining” That Cuases Resource Depletion



Chia farmers store cryptographic hashes in plot files on hard drive

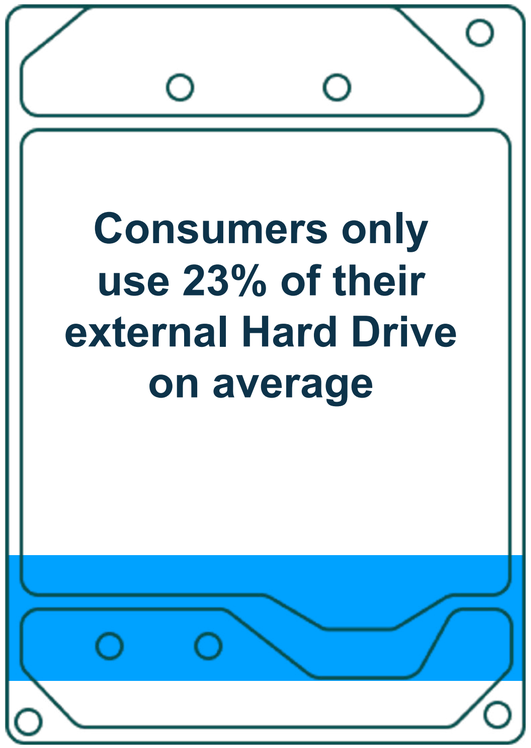
Challenges come in from the network and a farmer checks plots for winning hash proofs

If farmer finds a winning hash proof, they broadcast that to the network to form the next “block” on the blockchain to upload data / transactions

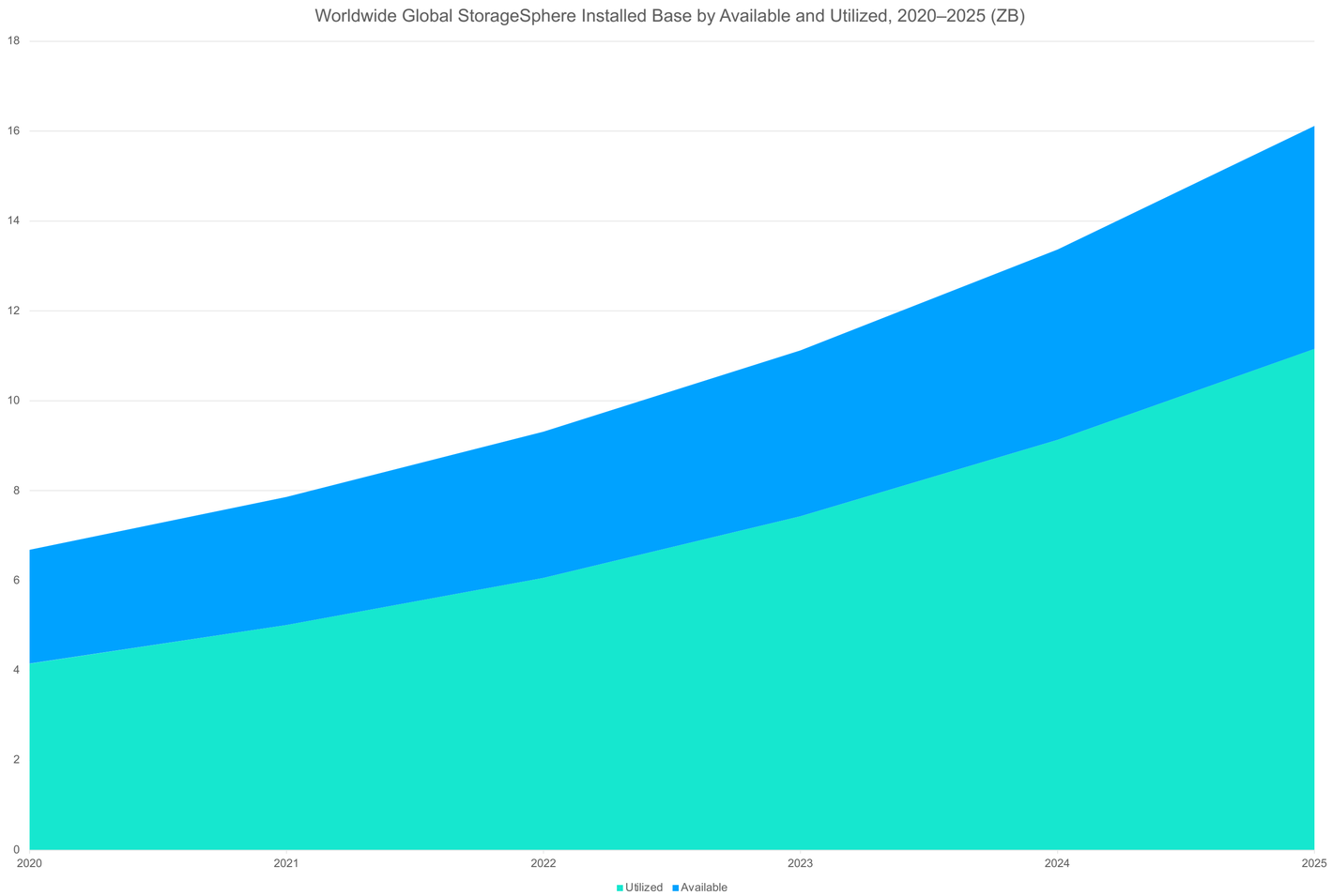
Farmer is rewarded in Chia (XCH)

Currently 2 XCH per block

Chia Can Leverage the Large Amount of Global Underutilized Storage to Secure the Blockchain



Source: IDC Market Perspective “Chia Cryptocurrency Farming Is Real and Uses Lots of Storage”



IDC Worldwide Global StorageSphere Forecast, 2021–2025 To Save or Not to Save Data, That Is the Question - 2021 Mar

Accelerating Circular Economy Reuse of Storage

Chia Farming Ideal 2nd use for previously shredded data-center drives

Circular Drive Initiative

Western Digital.

SEAGATE

chia

& GROWING

chia

"Much of the e-waste we see from hard drives today is driven by perceived risk and insufficient secondary markets for this technology, I am thrilled to welcome these founding members on board the initiative as we create a compelling global Circular Economy business case."

William McDonough

Chief Executive, McDonough Innovation