COALITION FOR INNOVATION

CleanTech Blueprint for the Future

Coalition for Innovation, supported by LG NOVA

Jami Diaz, Director Ecosystem Community & Startup Experience
William Barkis, Head of Grand Challenges & Ecosystem Development
Sokwoo Rhee, Ph.D., Executive Vice President, LG Electronics, Head, LG NOVA

Blueprint Chairs

Alex Fang, CleanTech Chair
Sarah Ennis, AI Chair
Alfred Poor, HealthTech Chair

Authors

Sayeed Ahmed, John Barton, Irene Chen, Darlene Damm, Alex Fang, Aman Johar, Ram Krishnan, Tin Hang Liu, Winston Morton, Jiri Skopek, Julia Yan

The views and opinions expressed in the chapters and case studies that follow are those of the authors and do not necessarily reflect the views or positions of any entities they represent.

Senior Editor, Alfred Poor

October 2025

Preamble

The Coalition for Innovation is an initiative hosted by LG NOVA that creates the opportunity for innovators, entrepreneurs, and business leaders across sectors to come together to collaborate on important topics in technology to drive impact. The end goal: together we can leverage our collective knowledge to advance important work that drives positive impact in our communities and the world. The simple vision is that we can be stronger together and increase our individual and collective impact on the world through collaboration.

This "Blueprint for the Future" document (henceforth: "Blueprint") defines a vision for the future through which technology innovation can improve the lives of people, their communities, and the planet. The goal is to lay out a vision and potentially provide the framework to start taking action in the areas of interest for the members of the Coalition. The chapters in this Blueprint are intended to be a "Big Tent" in which many diverse perspectives and interests and different approaches to impact can come together. Hence, the structure of the Blueprint is intended to be as inclusive as possible in which different chapters of the Blueprint focus on different topic areas, written by different authors with individual perspectives that may be less widely supported by the group.

Participation in the Coalition at large and authorship of the overall Blueprint document does not imply endorsement of the ideas of any specific chapter but rather acknowledges a contribution to the discussion and general engagement in the Coalition process that led to the publication of this Blueprint.

All contributors will be listed as "Authors" of the Blueprint in alphabetical order. The Co-Chairs for each Coalition will be listed as "Editors" also in alphabetical order. Authorship will include each individual author's name along with optional title and optional organization at the author's discretion.

Each chapter will list only the subset of participants that meaningfully contributed to that chapter. Authorship for chapters will be in rank order based on contribution: the first author(s) will have contributed the most, second author(s) second most, and so on. Equal contributions at each level will be listed as "Co-Authors"; if two or more authors contributed the most and contributed equally, they will be noted with an asterisk as "Co-First Authors". If two authors contributed second-most and equally, they will be listed as "Co-Second Authors" and so on.

The Blueprint document itself, as the work of the group, is licensed under the Creative Commons Attribution 4.0 (aka "BY") International License: https://creativecommons.org/licenses/by/4.0/. Because of our commitment to openness, you are free to share and adapt the Blueprint with attribution (as more fully described in the CC BY 4.0 license).

The Coalition is intended to be a community-driven activity and where possible governance will be by majority vote of each domain group. Specifically, each Coalition will decide which topics are included as chapters by majority vote of the group. The approach is intended to be inclusive so we will ask that topics be included unless they are considered by the majority to be significantly out of scope.

We intend for the document to reach a broad, international audience, including:

- People involved in the three technology domains: CleanTech, AI, and HealthTech
- Researchers from academic and private institutions
- Investors
- Students
- Policy creators at the corporate level and all levels of government

Chapter 8: Case Study: Carbon Offset Trading Markets: Technology Tools and Opportunities

Author: Sayeed Ahmed, Aman Johar

Overview

Carbon offset markets are growing fast. Really fast. We're looking at a market that could hit $50 billion by 2030, up from just $2 billion in 2022. Why? Because every major corporation is scrambling to meet net-zero targets, and they need carbon credits to offset emissions that they can't eliminate yet.

Here's the problem; the carbon offset markets are a mess. Different registries don't talk to each other. Verifying credits takes months and costs a fortune. Nobody really knows if that forest protection project in Brazil is actually saving trees or just pushing deforestation next door. And small companies? They're basically locked out because the whole system is too complex and expensive. (*See "Summary Table of Sources 1" below.)*

But here's where it gets interesting. We're seeing a convergence of technologies that could fix these problems. Artificial Intelligence (AI) can automate the tedious verification work. Blockchain can create transparent, tamper-proof records. IoT sensors can monitor projects in real-time. Together, they're turning a broken market into something that actually works.

List of Stakeholders

Who needs to pay attention to this? Pretty much everyone in the climate space:

- **Corporate Sustainability Teams**: You're trying to hit net-zero targets without breaking the bank.
- **Tech Leaders**: You're evaluating which solutions actually work versus which are just hype.
- **Project Developers**: You want to generate credits faster and cheaper.
- **Banks and Investors**: You see carbon as the next big asset class.
- **Regulators**: You need to ensure market integrity without stifling innovation.
- **VCs and Private Equity**: You're hunting for the next climate unicorn.
- **Environmental Groups**: You want to make sure this actually helps the planet.

Challenges / Gaps

Let's be honest about what's broken:

The Data Problem

Right now, verifying carbon credits is like doing taxes with a calculator and paper receipts. It takes forever, costs too much, and mistakes happen constantly. Most projects rely on annual site visits and manual calculations. By the time credits are verified, the data is already months old. And don't get me started on trying to track the same credit across different registries.

Market Fragmentation

Imagine if every stock exchange used different currencies and couldn't trade with each other. That's the carbon markets today. Verra has its system. Gold Standard has another. The compliance markets in Europe don't connect with voluntary markets in Asia. This fragmentation kills liquidity and makes price discovery nearly impossible.

The Trust Gap

Here's an uncomfortable truth; many buyers don't really trust carbon credits. They worry about additionality (would this project happen anyway?), permanence (will that forest still be there in 10 years?), and double counting (is someone else claiming my credit?). This trust gap keeps prices low, and participation limited.

Access Barriers

Small and medium businesses are effectively locked out. Getting credits verified can cost $50,000 to $100,000 upfront. Understanding the rules requires expensive consultants. Trading requires relationships with brokers who take hefty commissions. It's a rich company's game.

Artificial Intelligence (AI)

Artificial Intelligence is revolutionizing how we measure, verify, and trade carbon. Here's what's working:

Automated Carbon Accounting

AI agents are replacing armies of consultants. These systems pull data from everywhere — ERP systems, utility bills, supply chain databases, IoT sensors — and automatically calculate emissions across all three scopes (detailed below). What used to take months can now happen in real-time.

Machine learning algorithms continuously improve accuracy by learning organizational patterns, identifying anomalies, and suggesting reduction strategies. Advanced platforms demonstrate the potential for significant cost reductions while providing exponentially more granular data than traditional methods.

What Are the "Three Scopes"?

The phrase **“three scopes”** refers to the categories defined by the **Greenhouse Gas (GHG) Protocol**, which is the most globally adopted framework for measuring and managing greenhouse gas emissions:

Scope 1: Direct GHG emissions from sources owned or controlled by an organization (e.g., on-site fuel combustion, company vehicles, fugitive emissions). (sustainability.yale.edu+2National Grid+2Reuters+15Wikipedia+15Wikipedia+15)

Scope 2: Indirect emissions from the generation of purchased electricity, steam, heat, or cooling used by the organization. Although these emissions occur off-site (e.g., at a power plant), they are accounted for because the energy is consumed within the organization’s operations. (Persefoni+5US EPA+5Plan A+5)

Scope 3: All other indirect emissions that occur in an organization's value chain—including both upstream (e.g., purchased goods, supplier activities, business travel) and downstream (e.g., product use, disposal) emissions. These are typically the most challenging to measure and often constitute the largest portion of a company's total emissions. (Deloitte Insights+15Wikipedia+15Carbon Trust+15)

Why It Matters

- **Standardization**: The three scopes create a structured way to categorize emissions, ensuring consistency and transparency across organizations and sectors. (National Grid+1)
- **Strategic Insight**: Scope 3 emissions, in particular, shed light on the broader climate impact embedded in a company’s entire value chain—which is crucial for identifying decarbonization opportunities. (Wikipedia+15sustainability.yale.edu+15Plan A+15)

Summary Table

Scope	Definition
Scope 1	Direct emissions from owned or controlled sources
Scope 2	Indirect emissions from consumed energy (electricity, heat, etc.)
Scope 3	All other indirect emissions related to value chain (upstream & downstream)

Satellite Monitoring and Verification

Manual on-the-ground forest inspections can be time-consuming, labor-intensive, and expensive especially for large areas, while satellite-based monitoring offers a cost-effective solution by eliminating the need for extensive manual efforts.

Satellite technology combined with AI is revolutionizing how we track and verify carbon projects around the world. Instead of sending teams to visit forests and other carbon sites on the ground, which is expensive and time-consuming, we can now use satellites to monitor these areas from space. The cost savings are significant - traditional tree surveys cost about 15 euros per tree and take 15 minutes each, while satellite analysis drops this to just 5 euros per tree and 3 minutes of processing time. Modern AI systems can detect individual trees across thousands of hectares and track changes in forest health, biomass, and carbon storage in real-time. These satellites can spot illegal logging within days, measure how much carbon trees are storing, and even predict which areas might be at risk of damage. This technology makes it much harder for false claims to go undetected, as every project can be continuously monitored rather than checked just once or twice a year. The combination of satellite data and AI gives us a powerful, affordable way to ensure carbon projects are really delivering the environmental benefits they promise.

Traditional tree surveys cost approximately 15 EUR per tree and take 15 minutes of field time each, while satellite analysis reduces this to 5 EUR per tree and 3 minutes of processing time (Using Artificial Intelligence to Map the Earth's Forests - Meta Sustainability).

Meta's global canopy height dataset at 1-meter resolution allows the detection of single trees at a global scale, with AI models achieving a mean absolute error of 2.8m for canopy height prediction (7 Benefits to forest satellite monitoring).

For each 1/20 of an acre (0.02 hectare), AI systems can build lists of individual trees including species and diameter measurements (Remote sensing inventory for precision forestry | AFRY).

Drone + AI based Data Collection

These autonomous aerial systems fill a critical gap in ground truth data collection, especially for remote, large-scale, or hazardous environments.

Predictive Analytics for Carbon Reduction

Here's where AI gets really interesting. By analyzing massive datasets, AI can identify carbon reduction opportunities humans might never spot.

Machine learning algorithms continuously improve accuracy by learning organizational patterns, identifying anomalies, and suggesting reduction strategies. Advanced platforms demonstrate the potential for significant cost reductions while providing exponentially more granular data than traditional methods.

These systems also model financial impacts.

An Omdena case study documented a 10% reduction in carbon emissions and $5M in annual savings through AI-powered supply chain optimization (AI-Driven Emissions Tracking for Enhanced Sustainability and Environmental Impact).

Natural Language Processing for Compliance

Nobody likes writing sustainability reports. AI agents now generate them automatically, pulling data from across the organization and formatting it for different standards: TCFD, CDP, GRI, or whatever you need. They even adapt the language and focus based on the audience.

Web3

Blockchain and tokenization are fixing the trust and liquidity problems that plague carbon markets.

Tokenized Carbon Credits

Think of this as turning carbon credits into cryptocurrency. Each credit becomes a digital token on a blockchain: traceable, divisible, and instantly tradeable. No more waiting weeks for brokers to settle trades. No more minimum purchase requirements. A small business in Kenya can buy $50 worth of credits as easily as Walmart buys $50 million worth.

The smart platforms are creating different token types for different credit categories. High-quality direct air capture credits trade at premium prices. Nature-based credits with co-benefits (such as biodiversity) attract impact investors. The market is finally getting the nuance it needs.

Smart Contract Automation

This is where Web3 shines. Smart contracts eliminate middlemen and automate complex processes. When a sensor network confirms a solar farm generated 1,000 MWh of clean energy, smart contracts can automatically mint the corresponding credits, list them for sale, and distribute revenues to stakeholders. No paperwork. No delays. No disputes.

We're seeing creative applications too. "Streaming" contracts that retire credits automatically as companies emit. "Basket" tokens that bundle credits from multiple projects to reduce risk. "Future" contracts that let projects sell credits before they're generated, solving the financing problem.

Decentralized Registries

The holy grail is connecting all registries into one interoperable system. Several protocols are building this using blockchain. Credits maintain their original certification but can trade across platforms. It's like how you can send email between Gmail and Outlook: different systems but one common protocol.

This interoperability unlocks massive liquidity. Suddenly, a buyer in Singapore can purchase credits from a project in Ghana without worrying about registry compatibility. Price discovery improves. Transaction costs plummet. The market starts acting like an actual market.

Zero-Knowledge Proofs for Privacy

Here's an elegant solution to a tricky problem; companies want to prove they're carbon neutral without revealing competitive information. Zero-knowledge proofs let them demonstrate compliance mathematically without showing the underlying data. Your competitors can't see your supply chain emissions, but auditors can verify your claims.

Examples

Let me share what's actually working in the real world:

Drones + AI: The New CleanTech Frontier

One of the most exciting developments in CleanTech is the rise of drone-based AI systems. These autonomous aerial systems fill a critical gap in ground truth data collection, especially for remote, large-scale, or hazardous environments.

Use Cases Across the Carbon Value Chain

APPLICATION AREA	DRONE-BASED AI USE	IMPACT
FORESTRY & NATURE-BASED PROJECTS	Lidar and multispectral drones map biomass, tree height, and canopy cover with centimeter-level accuracy.	Enables fast, automated verification of reforestation and avoided deforestation
METHANE & GHG LEAK DETECTION	Drones equipped with infrared and hyperspectral sensors identify methane plumes or CO2 leaks.	Critical for verifying emission reductions in oil & gas, agriculture, and landfills
PRECISION AGRICULTURE	Drones monitor soil health, crop stress, water usage, and fertilizer application in real time.	Supports carbon credit projects from regenerative farming by providing verifiable data
INFRASTRUCTURE & RENEWABLES	Drones inspect solar farms, wind turbines, and power lines for efficiency loss or degradation.	Improves energy asset performance and carbon credit validity
DISASTER MONITORING & RISK MODELING	AI-driven aerial imaging enables post-fire and flood assessments.	Ensures permanence of carbon sinks and informs reinsurance models

Why This Matters for Carbon Markets

- **Faster Verification:** Replaces costly ground audits with real-time aerial data
- **Greater Accuracy:** AI classifies land use, biomass, and emissions with high fidelity
- **Lower Costs:** Reduces verification time and expense by 70–90%
- **Credibility Boost:** Independent, high-frequency validation builds buyer confidence

Microsoft's AI-Powered Carbon Negative Journey

Microsoft built an internal carbon fee system powered by AI that charges business units for their emissions. The AI tracks everything from data center energy use to employee commuting. It then automatically invests the fees in carbon removal projects. Result? They're on track to be carbon negative by 2030 and remove all historical emissions by 2050.

KlimaDAO's Tokenized Carbon Treasury

This Web3 project absorbed 17 million tons of carbon credits onto the blockchain in its first year: more than most countries' annual emissions. By creating a liquid market for tokenized credits, they've driven prices up 10x for some credit types, incentivizing more carbon removal projects.

Pachama's Forest Monitoring Platform

Using AI and satellite data, Pachama can verify forest carbon projects for one-tenth the traditional cost. They've monitored over 50 million hectares and helped projects raise $100M+ in funding. Their API lets anyone integrate verified forest data into their applications.

Toucan Protocol's Cross-Chain Carbon Bridge

Toucan built infrastructure that lets carbon credits move between different blockchains. Over 25 million credits have been bridged, creating a liquid market worth $2 billion. They've proven that Web3 can handle real-world assets at scale.

Potential Risks & Mitigations

Let's not sugarcoat it; there are real risks:

Technology Risks

AI Hallucinations: AI might overestimate carbon reductions or miss important factors.

Mitigation: Always use human oversight for material decisions. Build in conservative assumptions. Implement regular model audits.

Blockchain Energy Use: Proof-of-work blockchains use massive energy.

Mitigation: Use proof-of-stake chains only. Ethereum's switch cut energy use by 99.95%.

Market Manipulation

Wash Trading: Bad actors could artificially inflate credit prices.

Mitigation: On-chain analytics can detect suspicious patterns. Regulatory frameworks are emerging.

Quality Dilution: Tokenization could flood markets with low-quality credits.

Mitigation: Maintain strict standards for tokenization. Create quality-based pricing tiers.

Systemic Risks

Over-Automation: Removing all humans could miss critical context.

Mitigation: Keep humans in the loop for project design and major decisions.

Regulatory Backlash: Governments might ban or heavily restrict crypto-based carbon markets.

Mitigation: Be proactive about engagement with regulators. Build compliant-by-design systems.

Next Steps for Companies Seeking Carbon Offsets

Here's your roadmap:

1. **Run a Pilot** (Months 1-3): Pick one business unit. Deploy AI carbon accounting. Measure the impact.
2. **Explore Tokenization** (Months 3-6): Buy some tokenized credits. Test the user experience. Understand the economics.
3. **Build Partnerships** (Ongoing): You can't do this alone. Partner with tech providers, project developers, and other buyers.
4. **Invest in Capabilities** (Months 6-12): Train your team. Hire Web3 natives. Build or buy the tech stack you need.
5. **Scale What Works** (Year 2+): Take successful pilots company-wide. Share learnings with your industry.

Case Study: DATACURVE's AI-Powered Carbon Intelligence Platform

Now let me show you what this looks like when it all comes together. DATACURVE built something that actually works - and the numbers prove it.

The Problem That They Solved

DATACURVE's clients were drowning in carbon data. One Fortune 500 company was spending $2M annually on consultants just to calculate their footprint. Another had 50 people manually collecting utility bills. A third couldn't figure out how to monetize their reduction efforts. These were classic carbon accounting nightmares.

Their Solution

DATACURVE built Logicware; think of it as an AI brain for carbon management. Here's what makes it different:

It's Truly Autonomous: This isn't just a system of automated spreadsheets. Logicware uses AI agents that actively hunt for data across your entire organization. They pull from SAP, read utility bills with OCR, parse supplier reports, and even analyze satellite imagery of your facilities. One client went from 3-month reporting cycles to real-time dashboards overnight.

It Thinks Like a Trader: The platform doesn't just track carbon; it finds ways to make money from it. The AI identifies which reduction projects qualify for credits, handles the registration paperwork, and even times the market for optimal selling. It turns sustainability from a cost center into a profit center.

It Speaks Every Standard: SBTi, GHG Protocol, TCFD, CDP: Logicware generates reports for all of them automatically. But here's the clever part; it learns from feedback. When auditors request clarifications, the AI remembers and improves future reports.

The Tech Stack

DATACURVE made some smart architectural choices:

- **Multi-Agent Architecture**: Specialized AI agents for different tasks: one for data collection, another for analysis, another for trading
- **Privacy-First Design**: Their AURA framework lets companies share carbon data without exposing competitive information.
- **Time-Series Database**: Every piece of carbon data is timestamped and immutable which is critical for audit trails.
- **API-Everything**: The system connects to 200+ data sources out of the box.

CarbonCX: The Registry Revolution

DATACURVE's CarbonCX registry is where things get really interesting. Instead of another walled garden, they built a bridge. CarbonCX can ingest credits from Verra, Gold Standard, and other major registries, standardize them, and make them tradeable on one platform. It's like a universal adapter for carbon credits.

The platform handles the entire lifecycle:

- Credit creation with built-in verification
- Fractional ownership for small buyers
- Automated retirement and certificate generation
- Real-time price feeds from global markets

The Results

DataCurve customers reported the following results post deployments:

Dramatic Cost Reduction: Carbon accounting costs dropped 75-90%. One client saved $1.5M in the first year just on consultant fees.

Revenue Generation: This is the headline number: $3.3M in new revenue from carbon credit sales in

nine months. Credits that were sitting unused became liquid assets.

Speed: Credit registration went from 6 months to 3 weeks. Trading settlement from T+30 to instant.

Scale: One deployment is tracking 50M tons of CO2 across 2,000 facilities in 40 countries. Try doing that with spreadsheets.

Why It Worked

Three factors made DATACURVE successful where others failed:

1. **They Started with the Data Problem**: Instead of building trading features first, they solved data collection and standardization. Everything else became easier.
2. **They Made It Profitable**: By connecting carbon tracking to credit generation and trading, they gave CFOs a reason to care.
3. **They Partnered Smart**: Integration with Google Cloud, IBM, and Databricks gave them enterprise credibility and scalable infrastructure.

Key Takeaways

If you're building in this space, learn from DATACURVE:

- **Automation beats perfection**: Their AI isn't perfect, but it's 100x faster than humans.
- **Integration is everything**; The value comes from connecting previously siloed systems.
- **Follow the money;** Features that generate revenue get adopted; compliance features get delayed.
- **Trust takes time;** Start with pilot clients and build credibility through results.

The successful deployment of these technologies demonstrates the potential for AI, Web3, and automation to improve transparency, efficiency, and scalability in carbon markets. The broader challenge now lies in how the industry can build on these foundations to realize the full potential of the projected $50 billion carbon offset market.

Summary Table of Sources 1

Quoted Data / Claim	Source
Voluntary carbon market ~$2B (2022)	**The Guardian+12Carbon Credits+12Sprih+12**
~$2B (2021) baseline	**Reuters**
Carbon market forecast to >$50B by 2030	**McKinsey & Company Investcorp**
$50B projection by 2030 (IdeaUsher)	**Idea Usher**
Sprih blog: exceeding $50B by 2030	**Sprih**

FT: Carbon market could reach $2T by 2030	**Financial Times**
Pachama involvement (forest monitoring, $100M fund)	**capitalforclimate.com**
KlimaDAO treasury >17M tonnes CO_2	**Chainlink EcosystemToucan ProtocolKlimaDAO**
KlimaDAO token infrastructure (BCT, NCT, retiring credits)	**Carbon CreditsKlimaDAOMediumFrontiers**
Toucan cross-chain carbon bridge & infrastructure	**Toucan Protocol+1PolygonToucan**

Summary Table of Sources 2

Statement	Supporting Source
AI agents replacing consultants; data from ERP, utility bills, supply chain, IoT	CarboLedger on Agentic Carbon Accounting xlnctechnologies.com+8carboledger+8Carbon Accounting Financials+8
Automated data aggregation from IoT/ERP/utility bills	AI carbon tracking platforms xlnctechnologies.comNASSCOM
Emissions across Scope 1, 2, and 3	CarboLedger (Agentic Carbon Accounting) carboledger; Granular carbon accounting literature Wikipedia+10MDPI+10Niskanen Center+10
Real-time vs. months-long processes	World Kinect & Deloitte connectivity case Deloitte Insights
Manufacturing client cost and granularity figures	**No public source found** (possibly proprietary)

Summary Table of Sources 3

Application Area	Source
Forestry & biomass via drone LiDAR (agroforestry)	arXiv
Forestry management (drone LiDAR)	bluefalconaerial.com
Drone methane leak detection (infrared)	Spectroscopy Online
Methane detection in Permian Basin	MRT
Drone methane detection (industrial)	Cat
Precision agriculture (thermal/multispectral)	MDPIfarmonaut.com
Crop stress & yield via drones (CGIAR)	CGIAR
Solar/wind inspection via drones	Viper Drones https://www.applus.com
Utility-scale drone-inspections	raptormaps.com
Rapid disaster mapping (CLARKE)	stories.tamu.edu
NASA AI drone swarms for wildfire	NASA Earth Science and Technology Office
Survey of AI-drone wildfire management	arXivScienceDirect

Author (In order of contribution)

Sayeed Ahmed, Co-Founder, and Chief Biz Officer, DataCurve
Sayeed Ahmed has 20 years' experience in Telco industry. Focused on Agentic AI workflows for Cleantech, Sports & Entertainment.

Aman Johar, Co-Founder and CEO, DataCurve
Aman Johar is CEO of DataCurve and focused on CleanTech plus Sports & Entertainment with AI to Craft New Revenue Streams.

For more information about the Coalition for Innovation,
including how you can get involved, please visit coalitionforinnovation.com.

View the Next Chapter