

Impacts and Challenges of Digitalising Measurement, Reporting and Verification (MRV) in the Carbon Credit Market

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Hong Kong Productivity Council
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Asia Carbon Institute

Founded in Asia in 2022, **Asia Carbon Institute (ACI)** is a non-profit organisation that aspires to become a leading standards organisation for the voluntary carbon market, focusing on technology-based and urban solutions in Asia.





Asia Carbon Institute

MISSION

To accelerate the transition towards a climate neutral economy by creating a creditable, transparent and financially inclusive carbon credit certification standard for Asia

VALUES

- Scientific Basis, Independence, and Transparency
- Inclusivity and Collaboration with International Specialists and Peer Organisations
- Technology Leverage for Improved Efficiency in the Verification Process
- Protection Against Corruption and Greenwashing

Our Work



1

Issue Carbon Credits

We set standards, certify and issue Carbon Credits with high quality and integrity.

2

Offer a Trustworthy Platform for Carbon Credits

We setup a blockchain based registry to ensure full carbon credit lifecycle is being tracked.

3

Conduct Research & Development

We foster carbon credit markets' ecosystem in collaboration with key stakeholders.

4

Capacity Building and Training of Carbon Talents

We work with higher education institutes and NGOs to upskill and grow the carbon talent pool in Asia.

William Chan



Asia Carbon Institute

- One of the founding members
- Founding Officer, Management
- Director of Asia Carbon Institute Limited
- Steering Committee member

Background

- Financial market product investments & advisory, carbon credit developments, cap and trade, voluntary carbon market
- Investments and advisory in "green projects" since 2007, covering sectors such as solar curtain walls, wind farms, EMC/EPC, EVs, clean energy distribution, mining waste utilisation, e-bike systems, nano carbon fertilisers, and bio-materials
- COO, private equity/credit investment, fund management, investments, CIMA/SFC/AMAC licensed corporations
- Former CEO of a State-Owned Enterprise's Carbon Assets Management
- CPA (AICPA since 1994)

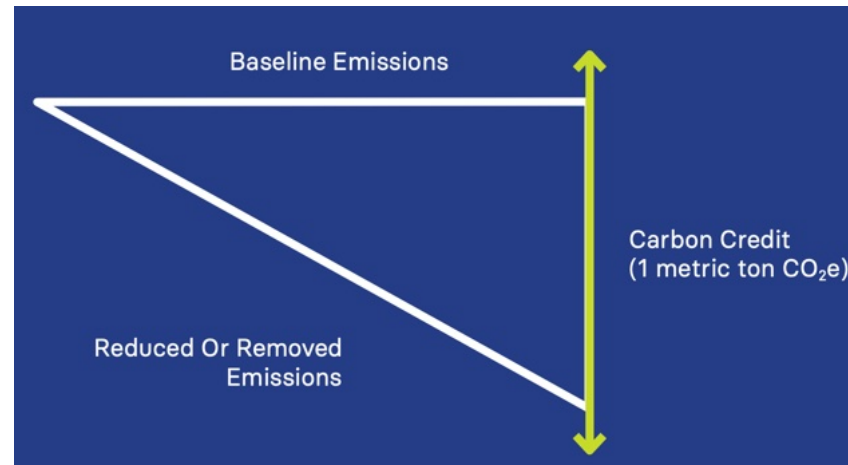
Today Agenda for DMRV

1. Carbon Credits – Voluntary Carbon Markets, MRV
2. Digital MRV: Key Impacts and Major Challenges
3. Role Play – Simulation & Participation
4. Case Study – ACI DMRV Pilot Programme
5. Takeaway
6. Q&A

1. Carbon Credits

What is a Carbon Credit?

- A tradable “good” = **one ton of greenhouse gases reduced or removed from the atmosphere**
- Can be used to offset carbon emission → can be part of Net Zero
- Can be traded in **compliance** and/or **voluntary carbon markets**



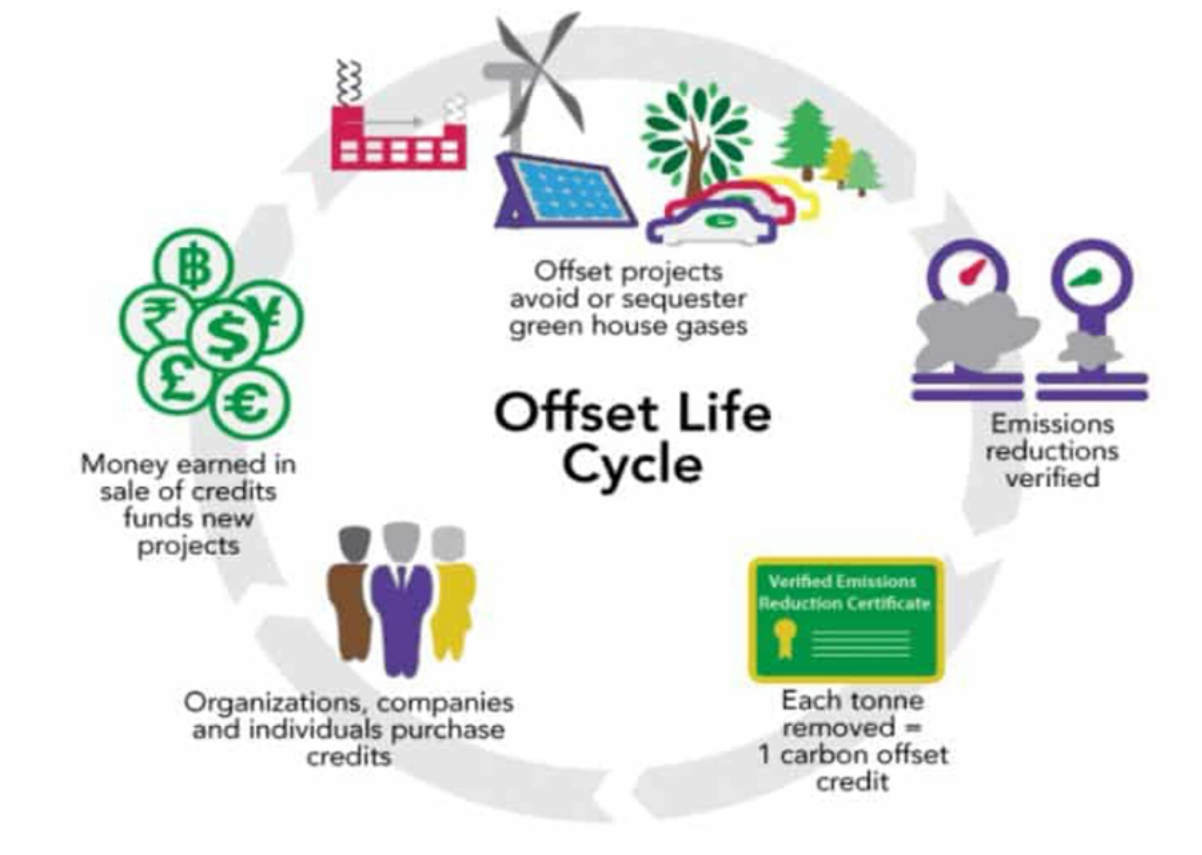
Source: <https://beyond-alliance.org/wp-content/uploads/2021/11/Carbon-Credit-Basics-for-Business-10-02-22-EDF.pdf>

Voluntary Carbon Markets (VCM)



Source: <https://eos.com/blog/carbon-markets/>

Carbon Ecosystem

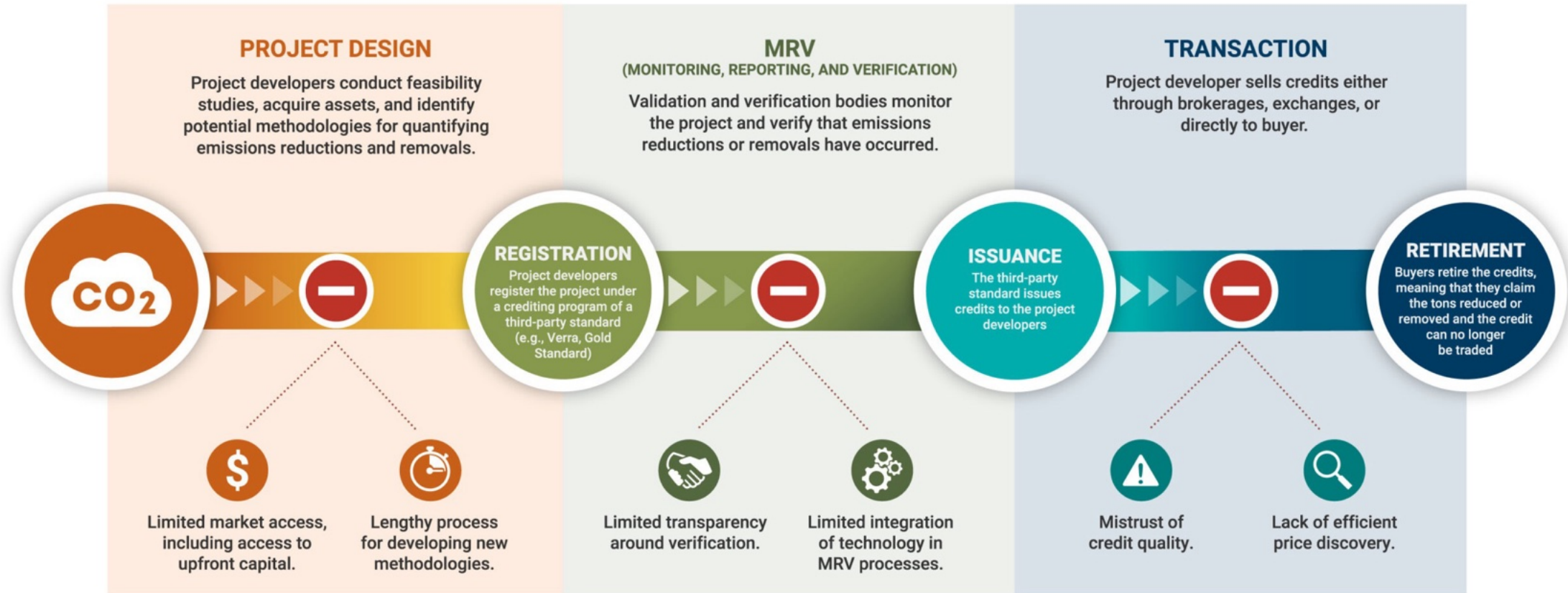


Source: <https://carboncredits.com/who-certifies-carbon-credits/>

What is MRV?

- **M = Monitoring** (including management, monitor and measurement)
- **R = Reporting** (continuous effort to track and report)
- **V = Verifying** (verify the validated projects via its monitoring and reports)
- MRV = all **measures** taken to collect data on emissions, GHG mitigation activities, and impacts e.g. methodologies, assumptions, and data parameters...
- Assess changes in GHG emissions **before and after** GHG mitigation activities
- Quantify, report and verify actual emissions **over time**
- Track and evaluate the **impact of GHG mitigation activities**

Role of MRV in Life of Carbon Credits

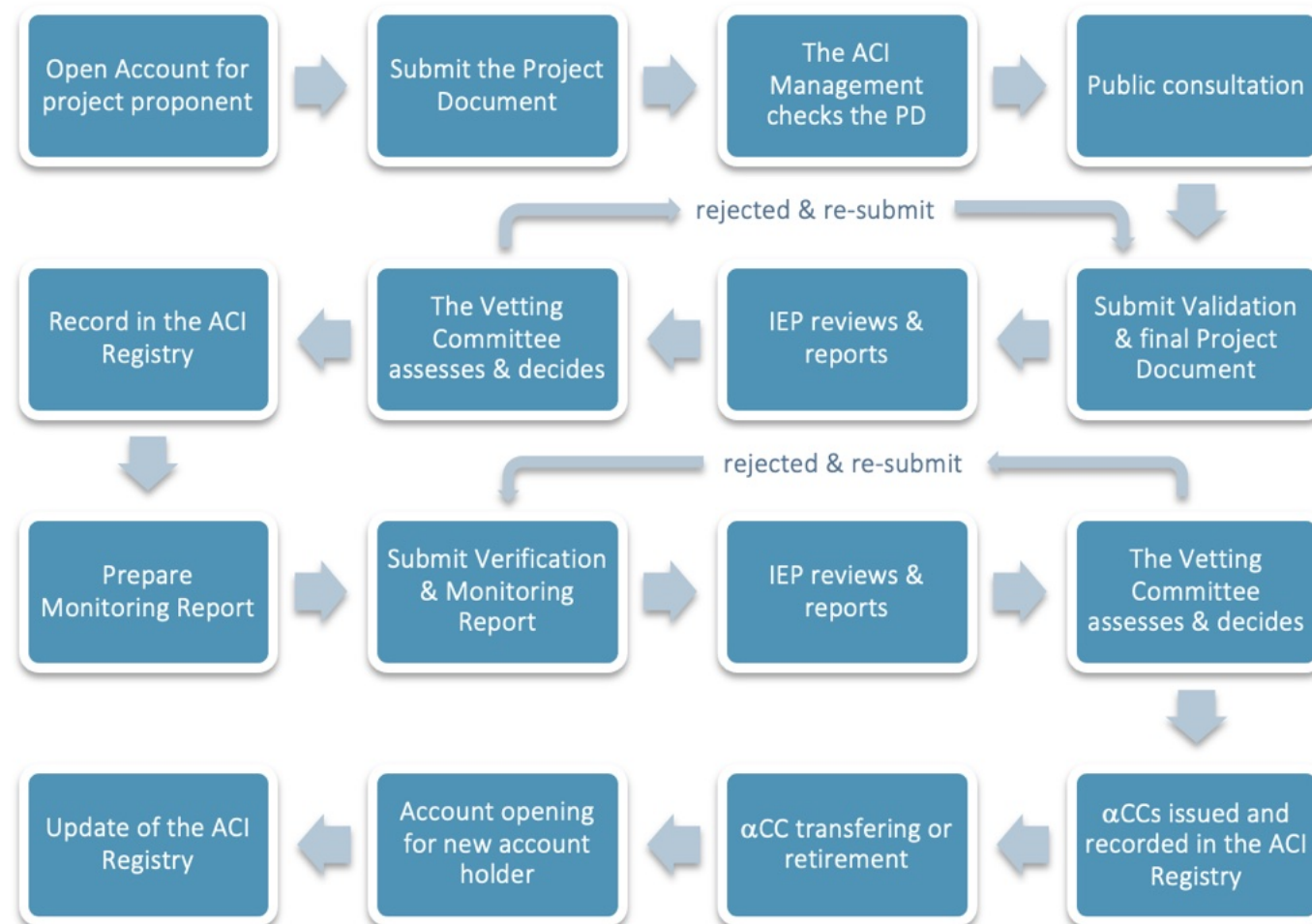


Source: <https://rmi.org/how-to-build-a-trusted-voluntary-carbon-market/>

Conventional MRV for GHG Mitigation Projects

- Measurement
 - **Manual collection, input and handling** of project data
 - Travel to remote areas sometimes
- Reporting
 - **Monitoring reports** manually written
- Verification
 - Step-by-step **audit** of monitoring reports
 - **Manual review** of paper and electric records
 - Field visits required

A Typical Program Process

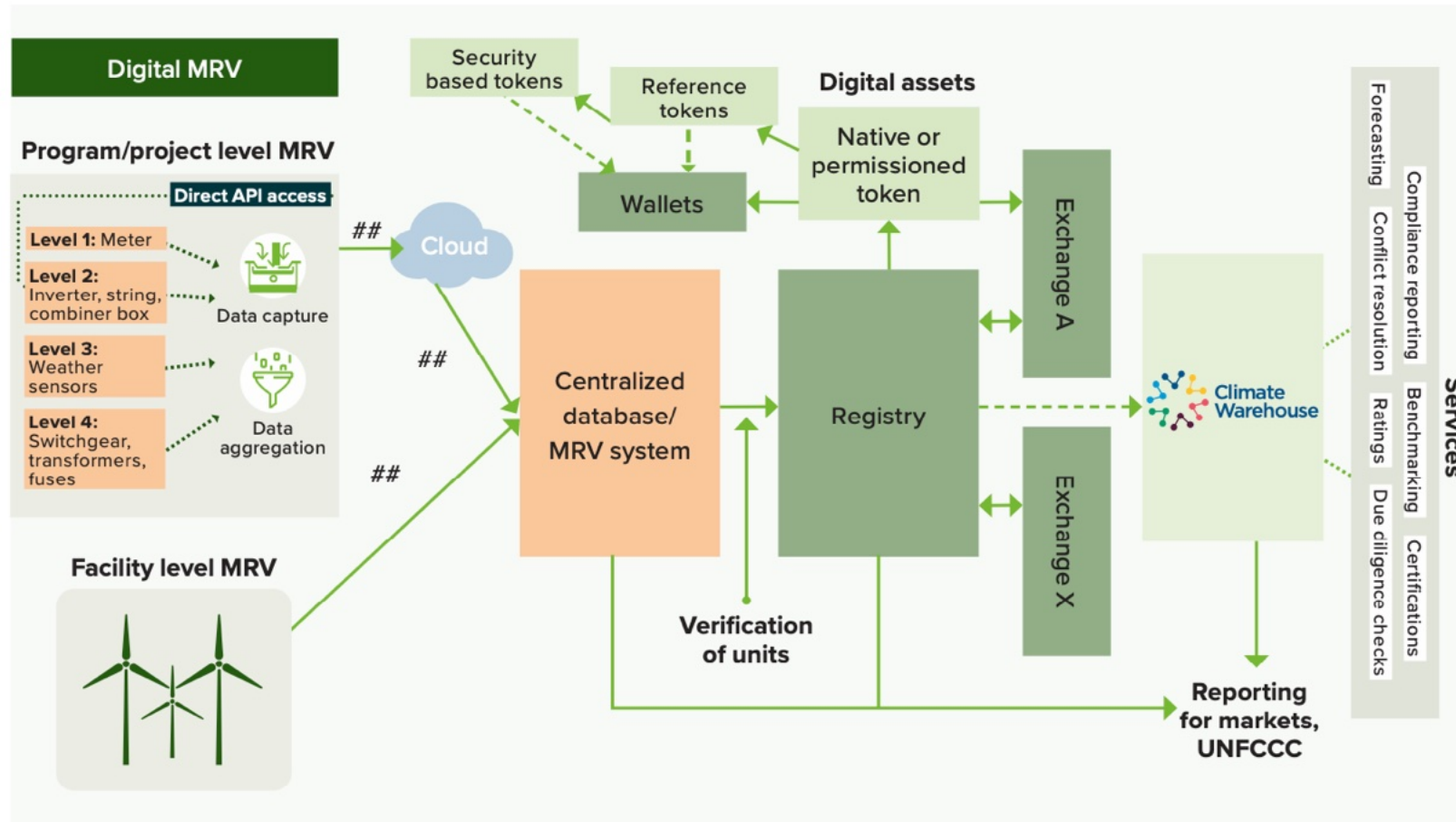


Limitations of Conventional MRV

- **Cheaper** or **Costly**
- **Quality** of data
- **In-transparency**
- **Flexible** or **inflexible**

2. DMRV

Shift towards Digital MRV

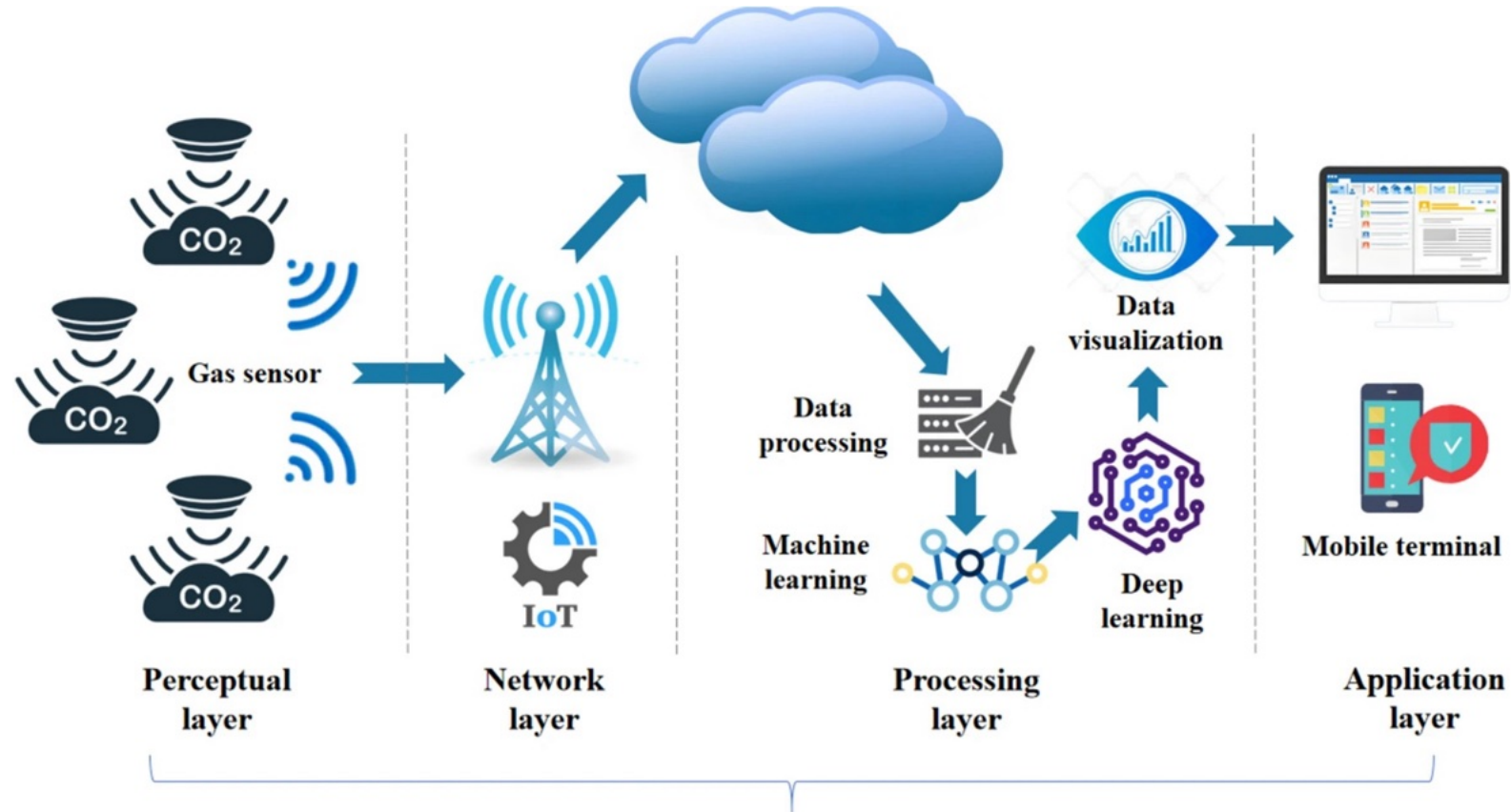


Source: <https://openknowledge.worldbank.org/entities/publication/65c60731-7b65-5ab6-a083-9c4243183607>

Marco Drivers for DMRV

- Emerging **Technology**: AI, blockchain, satellites, smart sensors, etc
- International Compliance: Paris Agreement (Article 6), **ICVCM**, CORSIA
- Corporate Demand: **Net-zero pledges**, investor & ESG pressure
- Market Expectation: requirement from carbon registries, fraud prevention, **greenwashing** concerns, double-counting avoidance
- **Big data** era, tools and applications

IoT Sensor and Artificial Intelligence



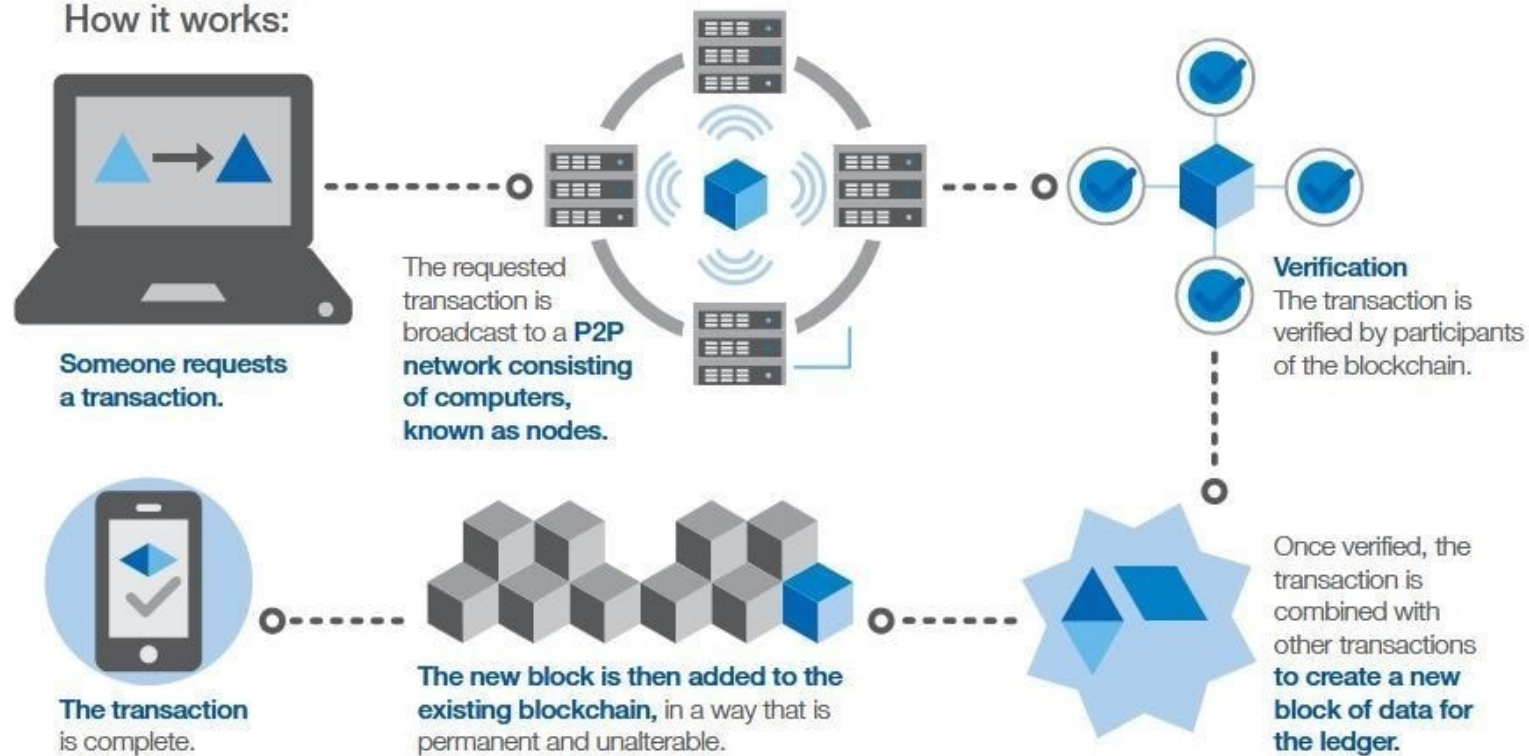
Source: <https://link.springer.com/article/10.1007/s10311-024-01799-z/figures/3>

Blockchain

What is it?

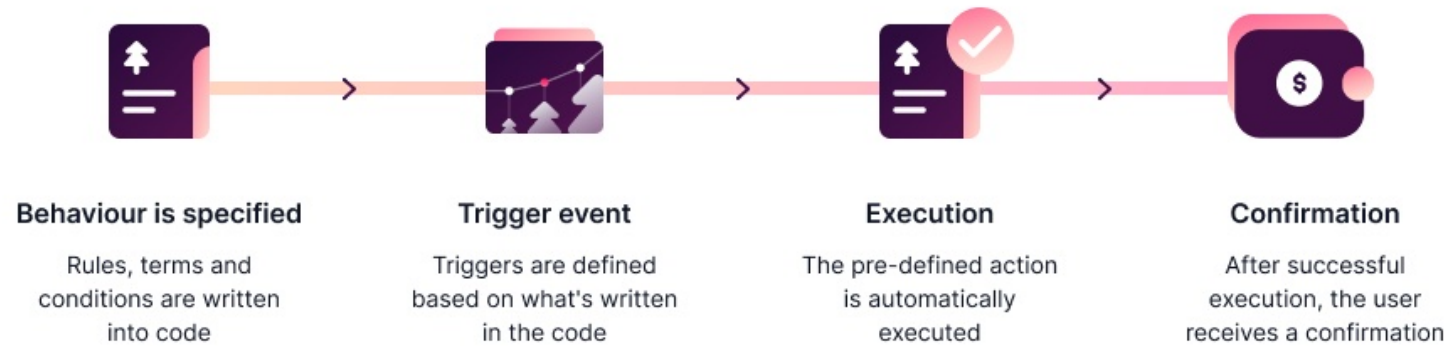
The **blockchain** is a decentralized ledger of all transactions across a peer-to-peer network. Using this technology, participants can confirm transactions without the need for a central certifying authority. Potential applications include fund transfers, settling trades, voting and many other uses.

How it works:



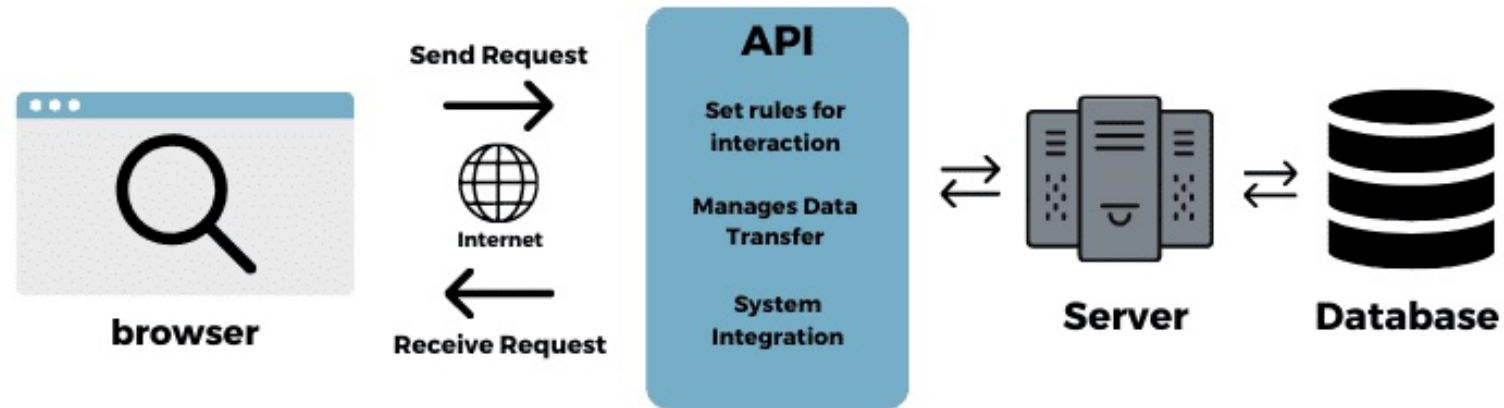
Source: <https://www.weforum.org/stories/2018/09/8-ways-blockchain-can-be-an-environmental-game-changer/>

Smart Contracts



Source: <https://blog.toucan.earth/wef-blockchains-for-climate-action/>

API (Application Programming Interface)

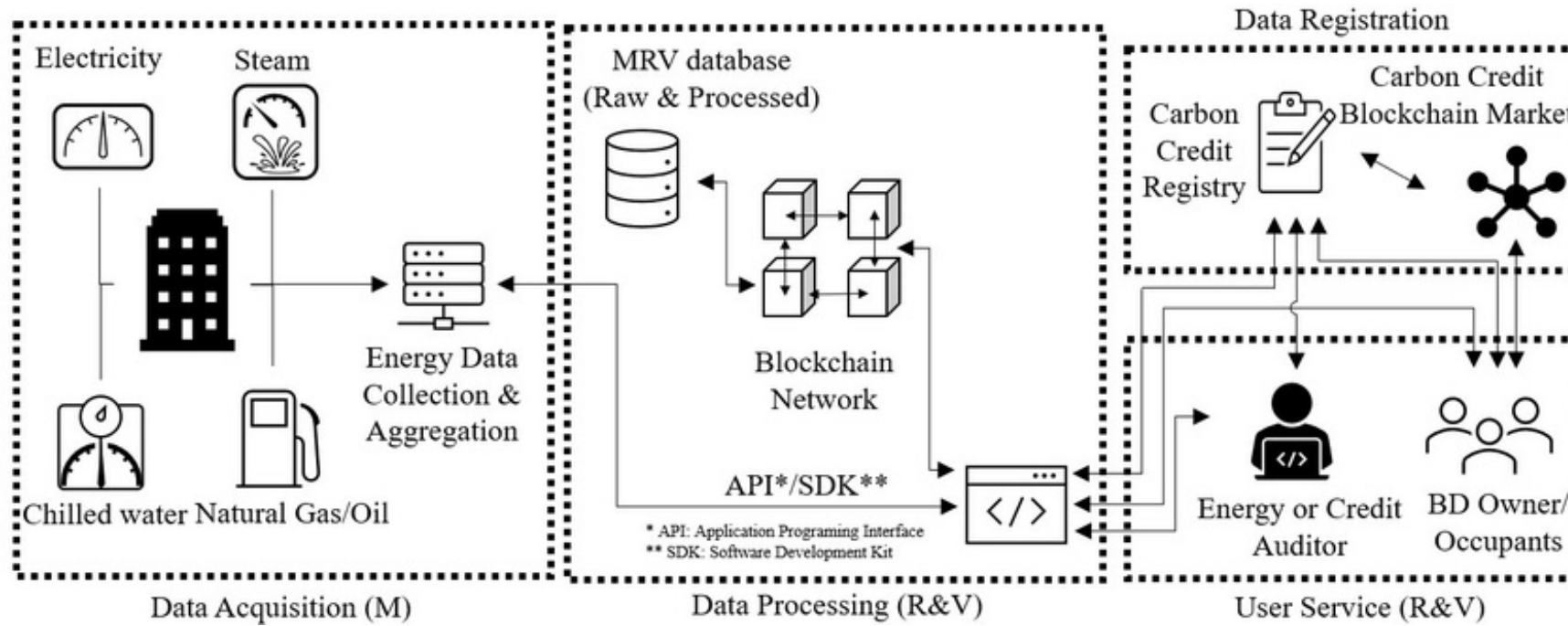


Source: <https://blog.dreamfactory.com/what-is-an-api-integration/>

DMRV for GHG Mitigation Projects

- DMRV = End-to-end **digitalisation** using digital technologies to automate the MRV process
- Measurement
 - Data collection, transfer and analysis in **real time**
- Reporting
 - **Automatic reports** generated based on the methodology
 - **Data integrity checks** enabled
- Verification
 - Monitoring reports verified by the DMRV system
 - **Software tools** to ensure the workflow aligned with the methodology

DMRV at project level



Source: Woo, Junghoon & Newman, Richard & Shojaei, Alireza & Fatima, Ridah & Tian, Yifeng. (2020). A New Blockchain Digital MRV (Measurement, Reporting, and Verification) Architecture for Existing Building Energy Performance. 10.1109/BRAINS49436.2020.9223302.

Micro consideration using DMRV

- Is traditional MRV costly or **time-consuming**?
- **Data scope** changed and enlarged?
- Are **technologies** applicable/available for all industries and practice?
- Any compliance, **regulatory constraint** in relevant jurisdictions?
- How is the **cost & benefit** for digitalization?
- Which industries should **adopt** DMRV?

Industry-Specific considerations of DMRV

- Forestry: **Remote** sensing technologies required, **permanence** issue, monitoring over **large areas** and a **long period** of time
- Agriculture: Cost factor and limited knowledge to utilise digital technologies for **smallholder farmers**, community acceptance to new technologies
- Power Sector: Energy output tracking, remote control
- Manufacturing: **Scope 3 emissions**, leakage issues, upstream/downstream supply chain
- **And more...**

Summary of Key Benefits over DMRV

	Traditional MRV	Additional Benefits from DMRV
Application of collected data	<ul style="list-style-type: none">Measuring and reporting emissions solely	<ul style="list-style-type: none">More efficient for peer review and enhancementBetter assessment on additionality
Data collection and quality of data	<ul style="list-style-type: none">High costs for fragmented site processingHigh demand of training and succession plan	<ul style="list-style-type: none">Automated and integrated, reducing human factorsHigh precision and consistency in data
Transparency of data	<ul style="list-style-type: none">Data are sometimes collected on paperDocuments can be mismanaged	<ul style="list-style-type: none">Links to data origins, connected through a blockchain database management system
Flexibility	<ul style="list-style-type: none">Set at project start for data collection scopeDifficult to adjust and support changes	<ul style="list-style-type: none">Collect a wider scope of data at low additional costEasier to store and adapt for later supportMore flexible for data analytics

3. & 4. Case Study

DMRV Pilot Project: Bike Sharing Program in HK

- Objective: Utilise the data of LocoBike to test the DMRV process of ACI
- **LocoBike** → IoT → Data integrity check → Methodology calculation → Verification → Carbon credit issuance → **αCC** Registry → Finance Market

Methodology - Traffic Conditions & Bike Usage in HK



Picture sources:

<https://www.scmp.com/comment/letters/article/2142621/hong-kong-central-where-traffic-control-highlights-class-divide>; <https://www.timeout.com/hong-kong/sport-and-fitness/best-cycling-routes-hong-kong>;
<https://media.timeout.com/images/105869828/1920/1440/image.webp>; WR studio/Shutterstock; Wang Sing/Shutterstock; Leonid Andronov/Shutterstock; Iroshbrugh/Shutterstock; leungchopan/Shutterstock

Additionality - Traffic Conditions & Bike Usage in HK

South China Morning Post

Hong Kong officials give green light to bike-sharing firms

The government is backing the fast-growing bicycle-sharing business in the city, with two new operators planning to open shop soon.

22 Jun 2017



South China Morning Post

Hong Kong's bike sharing brand Gobee shuts down amid high operating costs

Hong Kong's first bike-sharing brand Gobee to close down just over a year after launching ... Gobee.bike, Hong Kong's first bike-sharing service...

10 Jul 2018



South China Morning Post

Cycling in busy areas of Hong Kong not feasible

In April, the bike-sharing start-up Gobee.bike services was launched with 1000 bicycles for hire on cycling tracks in the New Territories,...

13 Jun 2017



Earth.Org

Hong Kong Is Missing Out on 'Bike-Friendliness'

According to a global survey, Hong Kong is ranked 84th out of 90 cities in terms of "bike-friendliness". While Hongkongers have not exactly...

2023年7月5日



South China Morning Post

Is Hong Kong safe for cyclists following spike in fatal bike accidents?

Cycling deaths in Hong Kong tripled in the first half of this year, with seven riders dying from accidents on the road.

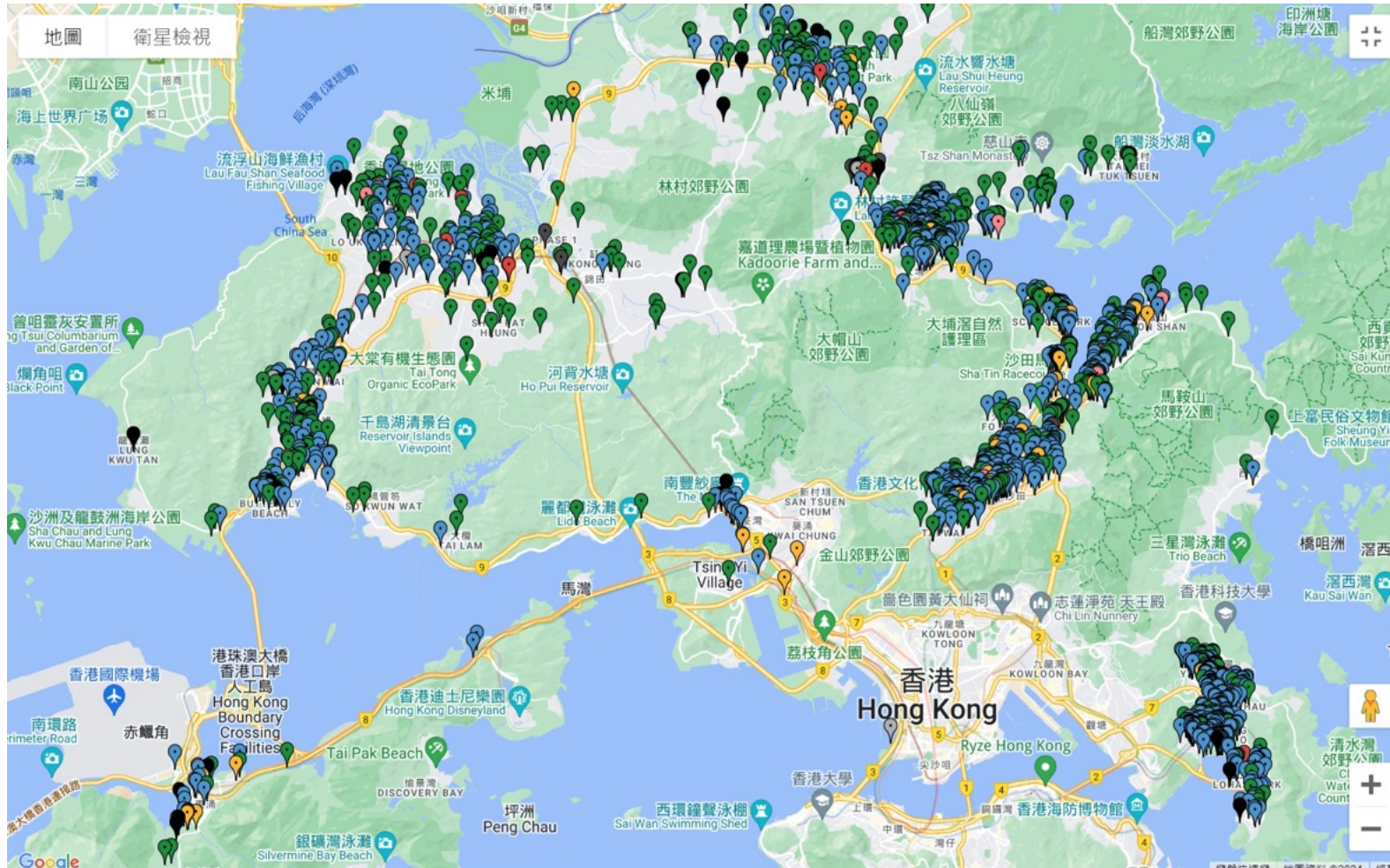
5 Aug 2024



News source:

<https://www.scmp.com/news/hong-kong/economy/article/2099420/hong-kong-officials-give-green-light-bike-sharing-firms>; <https://www.scmp.com/tech/apps-gaming/article/2154555/hong-kongs-first-bike-sharing-brand-gobee-close-down-just-over-year>; <https://www.scmp.com/comment/letters/article/2098129/commuters-cannot-cycle-busy-urban-areas-hong-kong>; <https://earth.org/hong-kong-is-missing-out-on-bike-friendliness/>; <https://www.scmp.com/news/hong-kong/transport/article/3273281/hong-kong-safe-cyclists-following-spike-fatal-bike-accidents>

Coverage of LocoBike in HK

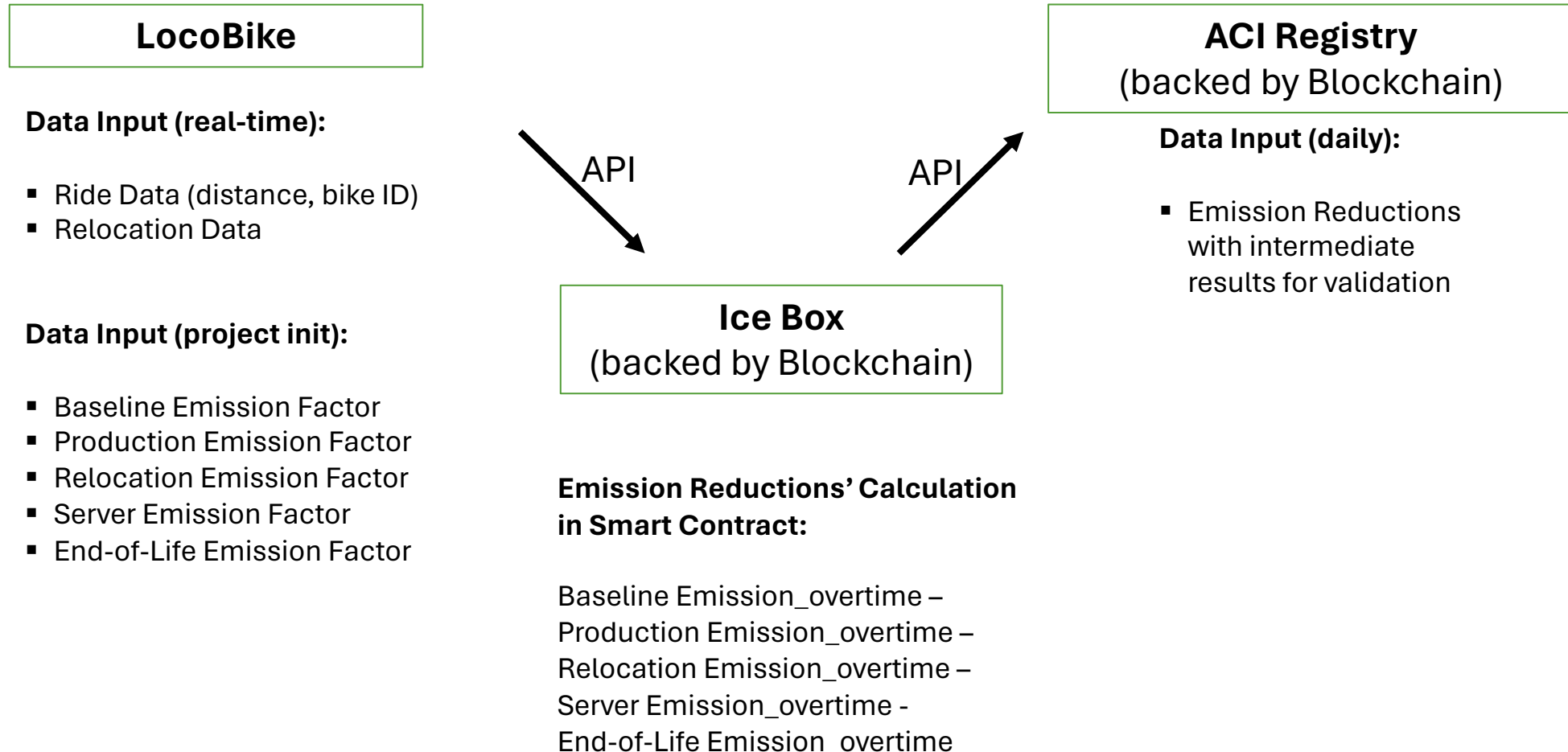


Source: LocoBike

Parameters around the Project

- Launch year: 2017
- User base: number of registered users
- Fleet size: number of bikes
- Daily rentals: number of bike rentals per day
- Average trip duration: time per ride
- Riding distance: per user and per annum

DMRV: API Connectivity & Smart Contracts



Blockchain realized in ACI Registry

- The DMRV pilot project is **registered** on the blockchain.
- All data input and output of the smart contracts is **recorded**.
- Each day of the carbon emission reductions is assigned a **unique identifier**.
- Data **cannot be altered**.
- Anyone can view the blockchain and **trace** the origins of the carbon credits.

Results and Impacts

- 8-week **real-time** GHG emission reduction data after undergoing DMRV, ready for carbon credit issuance at ACI Registry
- A feasible and demonstrative example of utilising DMRV for carbon credit issuance
 - **Efficient** data collection via IoT
 - **Enhanced data integrity** after systematic checks
 - Increased **data transparency** via blockchain
 - **Standardised** and streamlined compliance, reporting, and verification
 - **Increased understanding** of DMRV among stakeholders
 - Enhanced **industry confidence** in developing and verifying DMRV-backed GHG mitigation projects

Challenges – Project Proponent

- **Limited understanding** on ADDITIONALITY principle, overconfident for their data coverage and quality
- **Project Developer** focus on conventional project documents and methodologies, lack of IT knowledge, used to window-dress
- Another layer of **communication and (upfront & ongoing) management**, i.e. data collectivity and connectivity; what, when, where, how...

Challenges – ICE Box

- **Precise, live data** collection & connection
- **Upfront** definition and scope for smart contract setup
- Filtering of **invalid data** and management, check and disposal
- **Business model** in the ecosystem
- **Blockchain** (technically) setup and maintenance

Challenges – VVB

- **What, where, when, and how** to test the data
- **Audit approach** - system audit, live or back test?
- How deep or wide should be the coverage? How about the **SMART Contract, security, APIs**? Any industry practice consent?
- Conventional approach enough, as a **gatekeeper**?
- The other end extending to **IoT audit**? ISO audit on equipment?
- Same underlying question on all of the above – **role, scope and responsibilities**
- Do they have the right resource and capability to **face the challenges**?

Challenges – Registry

- **Certification** of ICE Box platform, how to ensure the quality for its role in the ecosystem?
- **Process** to cater BOTH MRV and DMRV
- **VVB** (qualification) requirements and terms of cooperation
- **How much data** needed for the certification, disclosure, maintained at ICE Box/Registry
- **Certification** – live vs. past data; data discount, credits buffering, reserve, time lag...
- **Transparency** vs. data **confidentiality**; commercial sensitivity, IP, privacy...

5. Takeaway

What is your vision?

- DMRV enhances data integrity, constituting an essential component of credible carbon credits and facilitating the growth of the VCM.
- Forward looking: Increasing role of DMRV in VCM
 - Market increasingly demands for tamper-proof data
 - Technological advancements make DMRV less costly
 - New regulations (e.g. Article 6 and ICVCM's Core Carbon Principles) emphasise on robust MRV
- A need of change in the ecosystem – new tools and capability of VVBs

Development of DMRV

- **Early Adoption Phase**

- Verra and Gold Standard are reviewing DMRV via implementing public consultations and **pilot scheme/projects**.
- Corporate buyers increasingly demand DMRV-enabled credits for transparency.
- ACI launched and completed its DMRV pilot programme

Major Challenges in Implementing DMRV

- Economic: High upfront **costs** for technology integration
- Technical: Lack of technical **expertise** and **capacity** in some jurisdictions; Interoperability between different digital MRV platforms; **Cybersecurity** risks and **data integrity** concerns
- Regulatory: Lack of unified **global standards** for DMRV for verification



Contact Us

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