

Can blockchain really be Green?

• Its traceable, tamper-resistant records can help verify ethical sourcing, renewable energy, carbon credits and supply chains rather than leaving 'green' claims as marketing promises.

• Blockchain faithfully records the information it receives, but inaccurate data remains inaccurate. Governance, verification and accountability are therefore more important than technology itself.

• If blockchain is to support sustainability credibly, it must measure energy consumption, emissions, hardware use, and e-waste.

SUSTAINABILITY has moved beyond simply protecting the environment. Today, it reaches into almost every part of the economy — from how products are made and transported to how energy is used, cities are managed, and businesses account for their environmental impact. But as sustainability claims multiply, so does a fundamental challenge: how do we know they are true?

What ties these challenges together is a shared problem: it is hard to verify who did what, and whether claims of 'green' or 'ethical' practice are true. Blockchain has emerged as one answer.

Once associated mainly with cryptocurrency, blockchain now functions as a digital infrastructure that records, validates, and shares information without relying solely on a central authority. Because no single party controls it, records are hard to fake or quietly change, which is exactly what sustainability claims need.

Blockchain is not a sustainable solution on its own; its value lies in linking people, organisations, and data in systems where accountability and traceability matter, spanning product tracing, ethical sourcing, carbon markets, renewable energy, smart cities, and conservation.

But it also raises a critical question: does blockchain's own environmental footprint offset the sustainability gains it enables?

ENERGY AND CONSERVATION

Protecting nature and paying for clean energy are two of sustainability's toughest problems, and blockchain is starting to help with both. Blockchain is a shared digital record that many people can use.

Still, no one can secretly change it, so it can be a real-world environmental action to a record that updates automatically as new data comes in (Mulligan et al., 2024).

On the energy side, a company called Zuno calculates how much electricity cryptocurrency uses and then pays for an equal amount of clean energy to offset it. Its 2022 'Zero Item' trial offset 850 megawatt-hours of electricity, enough to power hundreds of homes for a year.

Another firm, Positive Energy Ltd, uses blockchain to link clean-energy projects with investors and cut funding times in half. On the nature side, a Swiss non-profit called Gainforest pays people directly to look after forests and other natural areas, using live



BY KATRUL NADIA BASRI

AND



BY NOR ASILA NAZMI

International Institute for Halal Research and Training (INHART)

International Islamic University Malaysia (IIUM)

data from each site to confirm the work is really being done.

The same idea works for food: apps like AgriLedger let a shopper scan a code on a piece of fruit and trace its whole journey — the tree it grew on, how it was packed and transported, how it was kept cool, and what it cost.

Each use delivers a real environmental gain — clean energy reaches the grid sooner, forests and wildlife are protected, and waste-free supply chains grow cleaner — while turning a 'green' claim from a marketing line into something anyone can check.

SUSTAINABLE DEVELOPMENT GOALS

Governments have long struggled to track progress on the United Nations' Sustainable Development Goals (SDGs). The data is patchy, updates are slow, and there is little real-time checking.

Blockchain can help by creating a shared, tamper-proof record that different departments can trust and cross-check. Because cooperation often means sharing sensitive information, blockchain networks can be set up so only authorised parties see the details, while the ledger stores just a verification stamp.

Used well, blockchain can support fairer access to money for the poor (SDG 1), safer medical records (SDG 3), cleaner water systems (SDG 6), and direct trading of solar or wind power between neighbours (SDG 7 and SDG 13). It can also help track recycling and cut waste across supply chains (SDG 12, 14, and 15).

There is a catch, though: some blockchain systems use enormous amounts of energy to run, which works against the very climate goals they are meant to support. Smart cities should therefore choose lighter, more efficient blockchain designs, so the technology's own energy use does not cancel out the benefits it delivers.

SUSTAINABLE SUPPLY CHAINS

Few systems carry as heavy an environmental footprint as global supply chains: wasteful, opaque, and hard to hold to account. Blockchain cannot fix every problem, but it gives participants shared access to verified data, making cleaner, greener sourcing far easier to prove.

In agriculture, a blockchain system can log fertiliser and pesticide use against the

final product, so customers can scan a code to trace their food's origin, and fruit traceability platforms are already testing this (Jantapoon, 2026).

Coffee supply chains are testing something similar for certification, with a prototype currently covering the journey from farmer to shipping stage and plans to extend it through processing, retail, and the final cup (Alamsyah et al., 2023).

In electronics, blockchain could track products from raw material extraction through manufacturing and disposal, closing the loop on material flows in a way that cuts landfill waste and unnecessary extraction.

The same approach turns sustainability and safety certification from a one-off paperwork exercise into a continuously verified process. Blockchain will not replace auditors or regulators, but it can take over repetitive checks, freeing their time for the judgement calls that genuinely need a person.

HALAL INDUSTRY

The halal industry offers one clear example of these dynamics at work, where ethical and environmental integrity matter as much as the ledger behind them.

Blockchain creates decentralised and timestamped records that are difficult to tamper with. A consumer could trace a product from raw material through processing, transport, warehousing, and distribution, with all stakeholders sharing one digital record instead of separate databases.

When everyone shares one network, it closes information gaps and gives a clear, end-to-end view: where a product came from, whether sourcing claims are true, and where fraud might be happening.

It also builds trust between suppliers and encourages collaboration instead of guarding their own data. A single record also shows whether certification is updated.

Not every document needs uploading. For example, sensitive files can stay in a secure database while blockchain stores only a timestamp, reference, or cryptographic fingerprint.

TRUST IN PEOPLE

Blockchain is not a truth machine: if it is fed with bad information, it will record a lie as faithfully as the truth. People must therefore still verify what goes in and govern the system honestly.

Certification labels will not disappear,

Blockchain for a Greener, Sustainable Digital Ecosystem

FROM CLAIMS TO CREDIBILITY - THE VERIFICATION GAP



Global sustainability claims are currently hard to verify and easy to fake.

THE TAMPER-PROOF RECORD



Blockchain creates a shared ledger that no single party can quietly change.

SEED-TO-SHELF TRACEABILITY



Consumers scan codes to trace food origins, pesticide use, and ethical certifications.

THE ENERGY FOOTPRINT CATCH



Heavy computing power can cancel out the environmental benefits blockchain provides.

CHOOSING EFFICIENT DESIGN



Modern systems must use 'lighter' designs to maintain a net-positive environmental impact.

TECHNOLOGY RECORDS; PEOPLE VERIFY



Accuracy depends on the ethical stewardship of those entering the data.

but assurance in future may mean more: a scannable digital journey covering origin, production, transport, and sustainability indicators, giving stakeholders credible evidence without exposing every commercial secret.

'Indeed, Allah commands you to render trusts to whom they are due and when you judge between people to judge with justice.' (Surah An-Nisa', 4:58)

That same duty of trust shapes how these tools should be used. Blockchain, artificial intelligence, sensors, smart contracts, and digital platforms together could help build a more transparent and resilient green economy.

But only if organisations redesign inefficient processes and stay anchored to real ethical and environmental values, not just marketing claims. For all its strengths, blockchain can record and verify, it cannot, by itself, supply trust.

Many faith and ethical traditions frame people as stewards entrusted with the earth's resources. In Islam, this is the principle of *khilafah*, *hukam* as *khilafah*, or trustee, charged with using and safeguarding creation

responsibly rather than exploiting it. Seen this way, a product's green credentials are as much a matter of trust as its ingredients. Technology keeps the record, but people remain responsible for what goes into it: suppliers must give accurate information, manufacturers must stand behind their claims, and auditors must verify honestly.

Blockchain's future in any green economy therefore depends on governance first, technology second: who enters data, who checks it, and who is accountable when something goes wrong.

HIDDEN ENVIRONMENTAL COST

Blockchain offers clear advantages for supply chains, but it also carries an environmental cost. The older, more common way of running a blockchain requires huge amounts of computing power, burning through electricity and hardware, an irony for a technology often promoted as a sustainability fix.

Never, less energy-hungry designs are a much better fit for sustainability-focused projects. Policymakers and companies should assess a system's overall footprint: electricity use, emissions, hardware, and e-waste, rather

than assuming digital automatically means sustainable.

As carbon markets grow alongside net-zero targets, blockchain could make carbon data more traceable and auditable, with smart contracts automating credit transactions and closing information gaps between buyers and sellers.

Only when that footprint is measured and accounted for can blockchain credibly earn its 'green' label, rather than simply borrowing one. Blockchain, then, is neither the green saviour it is often sold as, nor a technology to dismiss outright.

Its value lies entirely in how it is governed and used: chosen well, it can verify carbon credits, trace halal and ethical supply chains, and connect renewable energy to the people who need it; chosen poorly, it simply adds another energy-hungry layer to systems already under climate pressure.

For the governments, companies, and industry players now weighing whether to adopt it, the real question is not whether blockchain is green; it is whether they are willing to build and govern it that way.

— @green