INPUT | OUTPUT

THE IO GLOBAL BLOCKCHAIN

SUSTAINABILITY REPORT

Proof of Stake: The innovation that has enabled blockchain to move from carbon contributor to vehicle for sustainability.

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The IO Global Blockchain Sustainability Report

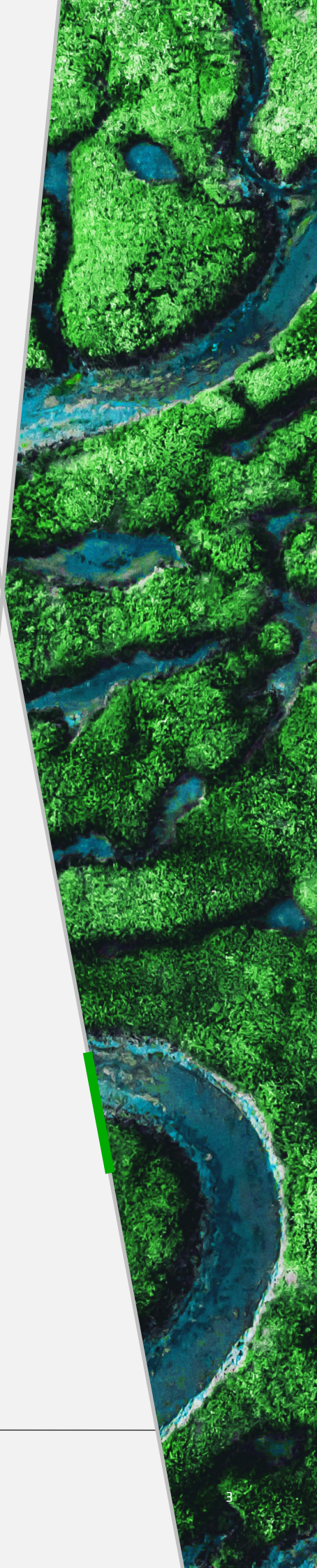
ABSTRACT

Achieving long-term sustainability is fundamentally important to individuals, companies, governments, and the world as a whole. COP26, which takes place from October 31st to November 21st 2021 in the UK, has the stated aim of uniting the world to tackle climate change. In order to effectively and efficiently ensure that impactful changes are made, it is essential that interventions are based on evidence rather than assumptions. Blockchain technologies can play a crucial part in establishing the required chain of evidence for environmental compliance: validating sources of emissions data, informing policy decisions, providing evidence of compliance, and monitoring impacts in a transparent and incontrovertible way.

In principle, blockchains allow an inherently tamper-proof, verifiable and accurate record of everything from supply chains to air quality and emissions data. However, first generation blockchains (such as Bitcoin and Ethereum) have proved to be extremely energy intensive, using vast amounts of energy to verify and secure data. This energy is usually obtained from cheap, but highly polluting, sources. What is needed is a new generation of energy-efficient, environmentally sustainable blockchain technology.

Following years of painstaking, peer-reviewed academic research, IO Global adopted a solution to these challenges, called 'Proof of Stake', which is a significantly less energy intensive way of verifying data. The mechanism can fix the energy usage, high cost, and pollution issues that are inherent to the world's two largest blockchain platforms, Bitcoin and Ethereum. Proof of Stake has been shown to use a fraction of the energy of blockchain platforms which use the first-generation blockchain technology, known as 'Proof of Work'.

To ensure that sustainability-focused initiatives are based on sustainable solutions, policymakers should be made aware of this distinction. Once this is in place, blockchain can then be used to monitor environmental compliance – holding global institutions and businesses accountable and leaving them with nowhere to hide from transparent, auditable data.



INTRODUCTION

Amidst rising temperatures, melting icebergs and extreme weather events, it is more urgent than ever for us to find a path to a sustainable future and clean up global energy usage. However, we may be walking down that path blind. The decisions we make are only as good as the data they are based on. Governments, global organizations and companies have been plagued by inaccurate, false or incomplete data, which makes it impossible to understand the true extent of environmental impact and to enact meaningful change. Demonstrating compliance and monitoring the actual and direct results of interventions are equally important, but even more difficult to achieve. We need to engage companies and individuals at a global level.

Innovation is needed to ensure that we take the right actions to preserve the future of the planet. Embracing energy-efficient technologies is crucial, and blockchain is a natural candidate. The core components of blockchain technology – transparency, data auditability, security, privacy, and process efficiency and automation – can help create a system for verifying environmental data, something that today is a huge problem.

While blockchain has the tools to clean up global supply chains and practices, it has historically not been a credible solution because, until recent innovations in the technology, it has been hugely energy inefficient. Early blockchain platforms such as Bitcoin and Ethereum are, at the time of writing, consuming the energy equivalent of entire countries, namely Chile and Bangladesh, and this is increasing. This is because of the blockchain technology that they use to verify data, which is known as 'Proof of Work'. Under this mechanism, computers compete to be the first to solve a randomly generated, complex cryptographic puzzle. The first participant to find the solution earns the right to add the next 'block' of data to the chain, so is rewarded with cryptocurrency. Commonly referred to as 'cryptocurrency mining', this uses, and wastes, a huge amount of computing power: many hours or days of computation are needed to produce a single block of data to add to the chain, with **98% of the computers involved failing to produce transactions**, meaning that most of the energy used in Proof of Work cryptocurrency mining is wasted.

Moreover, this energy usage is likely to be a vast underestimate. The hypothesis of this report is

INTRODUCTION **CONTINUED**

that the methods used to calculate the energy usage of the leading Proof of Work based blockchain platforms, Ethereum and Bitcoin, fail to take account of all the real-world circumstances that inform the behaviour of cryptocurrency miners, limiting our understanding of the true extent of the environmental damage from that activity.

However, in the same way as the internet expanded from a few wide-area computer networks in the 1960s to the launching of the World Wide Web in the 1990s, new blockchain platforms have emerged that solve the energy usage problem. These use 'Proof of Stake' technology. Pioneered by IO Global and based on rigorous, peer-reviewed academic research, Proof of Stake selects participants to create blocks based on the amount of the associated cryptocurrency that they control (or the 'stake' they have in the network). With no global computational race taking place to earn the right to validate the next block and earn a cryptocurrency reward, this approach uses a fraction of the computational power of Proof of Work blockchains. Leading Proof of Stake networks such as Cardano are estimated to use 0.01% of the energy of Bitcoin – **10,000 times more efficient.**

This report will discuss the data-accuracy challenges common to global institutions striving for sustainability, and how blockchain could provide an answer. It will also analyse the environmental impact of Proof of Work blockchains, and the potential for next-generation Proof of Stake solutions to transform not just the global blockchain industry, but clean up supply chains and hold businesses and governments more accountable for their sustainability practices worldwide. It will delve into case studies showing where this change is already under way – from a strawberry farmer in New Hampshire who is living off-grid and contributing to the maintenance of the Cardano blockchain using a solar panel and two tiny Raspberry Pi computers, to a 'rancher-centric' supply chain project in Wyoming which uses blockchain and Internet of Things technology to ensure all beef is sustainably and responsibly sourced.

THE DATA GAP: **HAMPERING WORLDWIDE SUSTAINABILITY**

From the index designed to track the energy use of Bitcoin to the Lifecycle Assessments (LCA) of products and supply chains that inform EU regulations, data lies at the heart of sustainability. However, all of our efforts to record and reward progress towards a greener, cleaner planet depend on the accuracy and security of the data itself. This isn't as easy as it sounds. In this section, we will look at the direct impact that a lack of transparent data has on governments, businesses, consumers and regulators

HAMPERING THE PARIS CLIMATE ACCORD

With governments worldwide under pressure to meet the stringent requirements of the Paris Climate Accord, timely and effective action is essential. But emissions data estimates vary wildly, with levels of some emissions from India and China so uncertain that **experts say that their records are plus or minus 100%.** The EU Emissions Trading Scheme market has even been corrupted by fraud, including emissions allowances theft. Without reliable emissions data, any commitments made in the Paris Climate Accord and at conferences such as COP26 will not stand the test of time.

A CONVOLUTED SUPPLY CHAIN HIDING THE TRUTH OF ENVIRONMENTAL COMPLIANCE

With the rise of Corporate Environmental & Social Governance (ESG) evaluations, which assess organisations' performance based on social and environmental factors, businesses are also increasingly introducing initiatives and policies to demonstrate positive environmental actions. As a result, businesses will often impose environmental requirements on the suppliers at the top of their supply chain. While this works in theory, in practice these suppliers will often pass work down the chain, with no reliable or forthcoming data on the lower tier players, which often violate sustainability standards. In order to ensure a clear picture of the overall environmental impact of their products and services, businesses need to demand, and ensure, a full environmental audit is carried out from the top to the bottom of the supply chain.

This is increasingly important given the changing nature of the consumer. Forrester, the leading technology analyst house, has charted the emergence of the values-based consumer, with consumers becoming increasingly sensitive to the social and environmental impact of their purchases. Also detailed by Forrester research, there is increasing consumer pressure for environmental sustainability, with **61% now seeking energy-efficient brands** while **47% buying organic produce.**

However, inconsistent and incomplete environmental data may be masking the true environmental impact of many companies and misleading consumers during purchases. According to a report by leading management consultancy firm McKinsey & Company, **over 80% of the environmental damage** caused by multinational corporations is not caused directly by the companies, but indirectly through obscure, complex, convoluted supply chains. Globalisation has made the process of environmental data collection and oversight across supply chains more complex, and

THE DATA GAP: HAMPERING WORLDWIDE SUSTAINABILITY CONTINUED

more difficult. This can threaten the reputations even of supposedly green technologies as exemplified by the unsustainable rare-earth metal mining and production practices used to produce electric vehicle batteries.

In response, Lifecycle Assessment studies are now frequently employed to record and reduce the environmental impact of products and services across their life cycles. Yet, given the convoluted nature of supply chains, these studies are likely to also fall victim to inaccurate, inconsistent and incomplete environmental data from supply chains stretched across the furthest reaches of the world.

HINDERING REGULATORY EFFORTS

Inaccurate data is also compromising broader regulatory efforts to reduce environmental harm. Even supposedly independent institutions such as inspection agencies may be vulnerable to outside interference, especially in regions without a strong civil society, democratic institutions and legal oversight. They can also fall prey to poor information, verification or methodologies. For example, the US Environmental Protection Agency admitted most emissions 'factors', a representative value used to estimate emissions from various sources, are unreliable due to problems such as poor accounting for emissions from aging equipment.

Clean Development Mechanism projects in the developing world, which allow a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement an emission-reduction project in their country, has also fallen victim to false data. In fact, research from leading accountancy firm PwC has found that **15% of companies covered by carbon regulations** said they had witnessed fraud, embezzlement or corruption in Clean Development Mechanism projects. Common types of fraud range from exaggerating the starting point for emissions to make any reductions seem larger to repeat selling of the same project by falsifying records.

Furthermore, we have even recently witnessed allegations that the Roundtable on Sustainable Palm Oil, a certification watchdog with **4,000 members** which aims to transform markets to make sustainable palm oil the norm, is covering up deforestation through fraudulent auditing of palm oil plantations. It was also alleged that carbon offsetting schemes used by major airlines to cancel out carbon emissions by protecting forests are based on misleading data overstating the risk to forests or the role of the scheme in protecting them. We have also seen studies indicating that Chinese government-controlled air quality monitoring stations are under-reporting pollution levels. With even global NGOs struggling to access accurate data, it's no wonder that we are falling short of the goals of the Paris Climate Accord.

Taking this into account, cleaning up environmental practices is impossible without first cleaning up monitoring and data collection practices for environmental data. In order to create a system where businesses, governments and organisations can be held to account for unsustainable practices and work together for a greener future, we need an effective solution which gives everyone access to the same transparent, accurate, tamper-proof data.

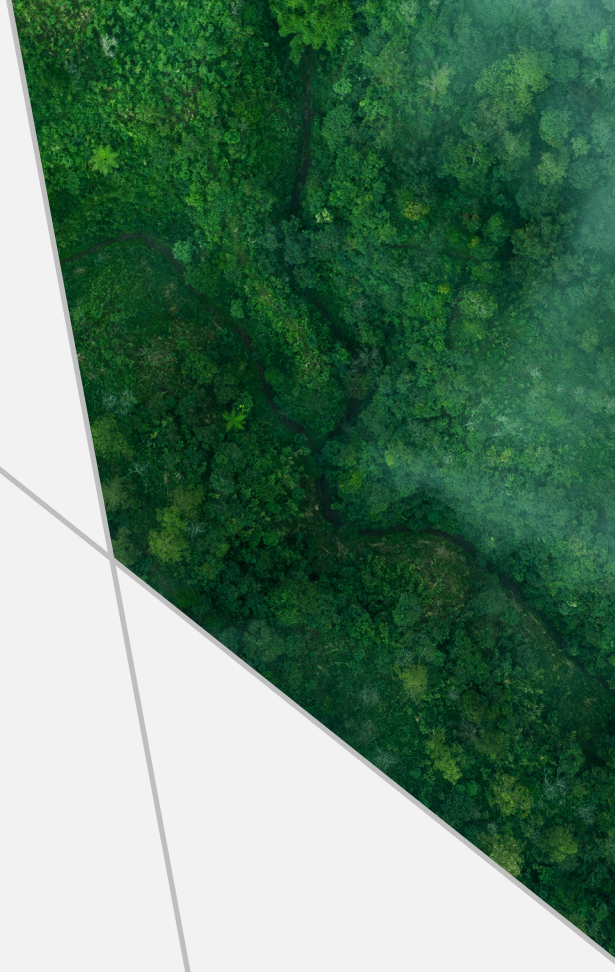
BLOCKCHAIN:
A SOLUTION BY DESIGN

The core competencies of blockchain technology, namely transparency, data auditability and accuracy present a viable solution to the data problem. The technology is already in use by a number of global enterprises such as Walmart to ensure accuracy of data in supply chains, as well as Maersk and IBM, which are working on cross-border, cross-party transactions that use blockchain technology to help improve process efficiency and Nestlé's farm to plate tracking pilot.This is because it creates a tamper-proof, verifiable and accurate record that can deal with everything from supply chains to air quality and emissions data.

There is an urgent need for an accurate system for the collection and monitoring of environmental data that provides full traceability and is independent of intermediary institutions. The expertise and resources required to ensure full traceability of all data, products and services has previously proven to be prohibitively expensive and complex for smaller suppliers, countries or organisations. And even when organisations could afford it, verification by third-party institutions such as environmental inspection agencies was sometimes subject to manipulation and falsification, as we saw with the Roundtable on Sustainable Palm Oil covering up deforestation. Even well-intentioned schemes can be subject to fraud in emerging markets with poor standards of measurement, data management and verification. This means that otherwise environmentally conscientious companies may be unaware of ongoing harmful practices in their supply chain due to blind spots in their data collection practices which also hamper regulators and consumers from making informed decisions. More accurate and more transparent environmental data would enable smarter regulation and standards and ensure ethical suppliers are recognised as such.

Centralized environmental data collection also creates a single point of failure, potentially vulnerable to damage or destruction of data via cyber-attacks on data repositories.

Even Free of the environmental concerns of Proof of Work platforms, next-generation, Proof of Stake blockchains are a potentially game-changing solution to the problem of creating secure, trustworthy and transparent environmental data. Through the simultaneous verification of each block of data by a network of thousands of computers, blockchain enables environmental data to be validated without the dangers associated with this being done by a single, central party. This creates a system for verifying environmental data safeguarded against manipulation or falsification as it does not rely on the need to rely on human verification. This means that it would be almost impossible for any one party to retrospectively falsify environmental data and everything from emissions inventories to the lifecycle environmental impact of a product or service would be preserved in perpetuity.



BLOCKCHAIN: A SOLUTION BY DESIGN CONTINUED

Blockchain has the potential to enable an accurate, permanent, always-available and accessible record of everything from air quality and emissions records to the lifecycle impact of every product.

This change is already underway. For example, a blockchain-based food traceability system trialled by Walmart successfully reduced the time needed to trace the provenance of mangos from **7 days to 2.2 seconds**.

When used in combination with Internet of Things technologies, blockchain could dramatically improve visibility and control over everything from pollution to deforestation by creating a trustworthy, instantly accessible and traceable data trail. Next generation blockchains can even collect information directly and automatically from 'Internet of Things' sensors such as Radio Frequency Identification (RFID) tags, which uniquely identify an object, animal or person. By using these tags, users can bypass the need to rely on human data inputs to ensure the trustworthiness of the data being recorded.

For example, cattle ranchers in Wyoming use RFID chips and Internet of Things devices to record and upload unique data on individual cattle to the Cardano blockchain. This project, 'Beefchain', gives consumers trustworthy, complete, accurate data on the provenance of premium beef. The project allows small scale producers to prove their beef has been sustainably and responsibly produced, without expensive infrastructure.

When combined with other technologies such as Internet of Things networks, data analytics and machine learning, blockchain could create a globally accessible and actionable, secure and permanent single source of truth on the environment.

STATE OF PLAY:
THE ENVIRONMENTAL IMPACT OF PROOF-OF-WORK CRYPTOCURRENCIES IN 2021

However compelling its credentials may be, blockchain hasn't been an appropriate solution for large scale environmental data collection and verification, due to the huge energy consumption of Proof of Work platforms like Ethereum and Bitcoin – which as mentioned previously consume the energy equivalent of entire countries.

We have long known that the Proof of Work protocols underpinning blockchain-based systems such as Bitcoin and Ethereum have a significant environmental impact. These systems rely on an energy-intensive, global computing arms race where many computers compete to be the first to solve a randomly generated, complex cryptographic puzzle, with the first participant to solve it earning the right to add the next 'block' of data to the chain, being rewarded with cryptocurrency. This is the process known as 'cryptocurrency mining' and creates a hugely inefficient system where around four million computers worldwide are constantly crunching numbers, with an astounding **98% that will never get the number first** and so will never verify the transactions, despite the huge electricity outlay. This means that the majority of machines are pointlessly using up energy, and producing heat.

It is inherent in the technology underpinning Proof of Work blockchains like Bitcoin and Ethereum for the cryptographic puzzles to become progressively harder. This means increasingly greater processing power is needed to solve them and adapt to changing requirements, so the network grows more energy-intensive. The need for ever greater processing power has driven the creation of 'mining rigs', with **one mining centre in Kazakhstan alone running 50,000 rigs**. These rigs consist of specialized high-powered computers using Application-Specific-Integrated Circuits (ASICs) that consume huge amounts of electrical power. These produce an environmental footprint beyond their processing power as they often overheat and require energy-intensive internal and external cooling (in addition to lifecycle emissions during production and recycling).

STATE OF PLAY:

THE ENVIRONMENTAL IMPACT OF PROOF-OF-WORK CRYPTOCURRENCIES IN 2021 CONTINUED

Proof of Work-based cryptocurrency mining often uses dirty electricity because industrially sized mining operations tend to be concentrated in countries with low energy prices and a high proportion of fossil fuel-based energy, such as:

11.2%

Russia

18.1%

Kazakhstan

35.4%

OF THE BITCOIN'S GLOBAL ENERGY FOOTPRINT WAS GENERATED IN THE US AS OF AUGUST 2021

The United States

Estimates suggest up to **61% of the power used to fuel Bitcoin** comes from fossil fuels. Others estimate that the total Bitcoin carbon footprint cancels out the entire greenhouse gas emission reductions of electric vehicles, or that it has the same annual carbon footprint as New Zealand.

In a paper published last year, it was also estimated that each **$1** of Bitcoin value created **$0.49** in **health and climate damages** in the US and **$0.37** in China.

Various methods have been used to evaluate the environmental impact of blockchain platforms such as Bitcoin and Ethereum. These reveal that Bitcoin **consumes around 110 Terawatt Hours** or energy per year, more annually than Argentina, or the equivalent to Malaysia or Sweden. Ethereum has similarly been calculated to use as much energy as Chile, and to produce a tonne of CO_2 for every Non-Fungible Token, or NFT (a unique digital certificate of ownership, which is stored on the blockchain and can be sold and traded) which is created on its platform.

THE DATA GAP:
MASKING THE TRUE SCALE OF BITCOIN'S ENERGY USE

Yet as striking as the figures outlined above are, they are subject to many uncertainties. Gaps in the methodologies used to evaluate the energy footprint of some cryptocurrency networks means that we may be dramatically *underestimating* the energy use and the carbon footprint of Proof of Work networks such as Bitcoin and Ethereum.

Some of the best sources of information on blockchain's energy usage can be found at the Digiconomist Bitcoin Energy Consumption Index and the Cambridge Bitcoin Energy Consumption Index. However, even these resources acknowledge that they have gaps in their methodologies which lead them to make broad – and not necessarily accurate, assumptions. For example, the Digiconomist index makes assumptions around the price of bitcoin and the resulting behavior of cryptocurrency miners, such as the kind of hardware they will use. The Cambridge Index similarly makes assumptions about hardware preferences and energy consumption.

Yet when the speed of mining performance increases earnings for miners, it becomes economical to use more energy-inefficient mining hardware, such as GPUs and CPUs that have additional cooling requirements. When the speed of mining performance is higher, market participants may choose to buy older and cheaper (but less power-efficient) mining hardware. For example, the University of Cambridge's Centre for Alternative Finance attempts to track consumption by monitoring the total number of hashes produced by miners and looking at the efficiency of Bitcoin mining equipment. Analysis has confirmed that fluctuating circumstances in the crypto mining market, such as higher mining speeds and Bitcoin prices, trigger the most high powered, highly energy-inefficient cryptocurrency mining activity. What's more, with Bitcoin prices jumping **276% in 2020,** it has become more profitable to use less efficient equipment. As a result, with significant variations in the hardware used depending on mining performance and market conditions, the energy footprint of Bitcoin could be significantly worse than previously thought.

With no way of getting a clear picture of precisely how much energy these Proof of Work blockchain networks use, and the possibility that they could be using more than we think, the use of more energy efficient solutions is essential in order to avoid blockchain projects like Ethereum and Bitcoin continuing to use the equivalent energy of entire countries unchecked, which could be large enough to hamper global sustainability efforts.

A NEW DAWN FOR BLOCKCHAIN: **PROOF OF STAKE**

However, innovations in blockchain technology mean that excessive and wasteful energy consumption may be a thing of the past. This has evolved over the course of blockchain generations. Bitcoin and Ethereum are the best known examples of first and second generation blockchains respectively – the first generation created the infrastructure for processing transactions and keeping records, and the second introduced increased functionality, such as smart contracts, which remove the need for an intermediary to enable and execute contracts. These have been followed by highly advanced, third generation blockchains such as Cardano. These platforms solve many of the problems associated with the first two generations to the technology, including transaction speed, compatibility with existing banking and global transaction systems, the ability to meet the needs of infrastructures and markets on a global scale and, crucially, environmental sustainability.

This sustainability is achieved through an innovative mechanism for verifying transactions, pioneered by leading research and development company IO Global. The mechanism, known as 'Proof of Stake', is a significant advance on the energy-intensive Proof of Work system that underpins blockchains like Bitcoin and Ethereum. Proof of Work incentivises cryptocurrency miners to compete to be the first to solve a computationally complex cryptographic puzzle, to earn the right to validate the next block of data on the blockchain, earning a cryptocurrency reward, like Bitcoin, in the process. Proof of Stake based systems selects participants to create new blocks based on the amount of cryptocurrency they hold, or their 'stake' in the network. This system requires minimal electricity. In fact, Proof of Stake systems, like Cardano, use ten thousand times less, or under **0.01% of the energy of Bitcoin.**

The foundations of Proof of Stake were pioneered by leading cryptographic researchers at IO Global, while developing the Ouroboros protocol for the world's leading Proof of Stake blockchain, Cardano.

The first blockchain system to be developed based on peer-reviewed scientific research, Cardano is also the first provably secure proof-of-stake blockchain, built using higher assurance code which means that the Cardano blockchain has never been hacked.

While this report argues that the true environmental footprint of Proof of Work blockchains has been underestimated, it also outlines the potential for Proof of Stake blockchains to take centre stage as the solution to the global energy data gap and create a more accurate digital record of our environmental footprint, and for the tech to replace environmentally harmful blockchain architectures.

THE STRAWBERRY FARMER RUNNING A STAKE POOL FROM TWO SOLAR PANELS

On first reading, the ability to contribute to the running of a global financial network with just a Raspberry Pi may seem like a distant possibility. However, for participants in the Cardano network, this is already a reality. Below, we explore the story of Wayne Cataldo, a New Hampshire farmer who owns a quarter acre of strawberry fields and also runs a Cardano stake pool – which is where a group of cryptocurrency holders merge their resources to increase their chances of validating transactions, and then share the rewards – with two solar panels and three Raspberry Pi's drawing just 15 watts of electricity.

As an inventive child, Wayne loved experimenting with disassembling and fixing cars and eventually computers. He later turned his hobby into a productive career for VMWare, fixing and reconfiguring IT equipment for hundreds of businesses.

After initially experimenting with Bitcoin mining on virtual machines, he began turning his technical skills to finding an environmentally friendly way to verify transactions across a financial network with minimal energy from renewable sources. He discovered the Cardano network, which uses **under 0.01% of the energy of the Bitcoin network,** and lowers hardware costs allowing anyone with the desire and skill to become a successful stake pool operator.

He then created a successful stake pool run by batteries made from reclaimed battery cells and powered from a single solar panel. The ingeniously powered stake pool has seen some upgrades since then, and now uses just one Mac M1 Mini using only 6 Watts to produce blocks. For relays it uses two Raspberry Pi, the tiny low-cost, low-power environmentally friendly computers designed to democratize computing. It is thus able to verify transactions at a tiny cost with both energy-efficient hardware and renewable power.

This small project serves as a microcosm of how a large global system could be sustainably powered using low-cost, open source mini-computers and renewable energy sources.

CREATING TRANSPARENT, SUSTAINABLE SUPPLY CHAINS

Lifecycle Assessments are a popular tool for evaluating the whole-lifecycle impact of products and services, but they rely on the quality of the data inputs from every part of the supply chain. They are therefore hampered by inconsistent records across a geographically diverse array of suppliers. This means that environmentally harmful practices from deforestation to pollution can creep into the supply chains of major companies through gaps in the data trail.

Regulators, consumers and corporations are therefore being misled about the true environmental footprint of many products and services. In an era of environmentally conscious consumers, this also damages brand reputations and sales. A recent study concluded that **94% of consumers** are likely to be more loyal to a brand that offers supply chain transparency, while MIT Sloan found people are willing to **pay up to 10% more** for products by brands that offer a high degree of transparency on product origin.

Cardano Foundation, the independent Swiss-based non-profit that oversees and supervises the advancement of Cardano and whose sustainable, energy-efficient Cardano blockchain was built on peer-reviewed scientific research, recently partnered with ScanTrust, a company that provide supply chain traceability to Fortune 500 enterprises and SMEs in **over 168 countries,** to create a pioneering blockchain-based supply chain traceability solution. Research and development company IO Global developed an authentication and verification solution that allows the Cardano blockchain to be used as a public audit platform to verify suppliers, securely record supply chain data and validate product provenance. The new partnership utilizes ScanTrust's secure QR codes combined with the high-speed low-cost Cardano blockchain to create an immutable record of every product's lifecycle, creating full transparency over the end-to-end environmental credentials of all products.

CREATING TRANSPARENT, SUSTAINABLE SUPPLY CHAINS **CONTINUED**

Baia's Wines, a family vineyard making artisan wines in Georgia, now exports to over a dozen countries and one of its co-owners recently made the coveted **Forbes 30 Under 30 List.** It has recently begun a proof-of-concept implementation of the new Cardano-Scantrust that will connect metadata on the Cardano blockchain to Scantrust QR codes on Baia's wine bottles destined for international markets. This will provide complete and detailed visibility over every stage of the product's journey, from source to sale.

It offers a small example of how next-generation proof-of-stake blockchains could help clean up global supply chains by providing transparent, trustworthy data. They could allow ethical, environmentally beneficial artisan producers to prove their sustainable credentials and tap into export markets for major brands. Crucially, by enabling both brands and their suppliers to record and reward ethical practices and producers, they could create a self-reinforcing cascade of sustainability across supply chains where each tier of supplier can monitor and improve the sustainability of those further down.

CONCLUSION

Against a backdrop of increasing global concern about climate change, there is growing public and government pressure for more sustainable products and services. Consumers are increasingly empowered and willing to call out companies engaged in practices such as deforestation while governments and industry bodies are taking tougher action on climate change. Yet the entire effort hinges on our ability to trace the true environmental impact of everything from **'carbon offset schemes'** to opaque and complex supply chains, as well as increasingly popular blockchain platforms.

Just as Gresham's Law states that bad money drives out good money when it becomes impossible to tell them apart, environmentally harmful suppliers and practices drive out ethical ones when poor data makes it impossible to distinguish between them.

Blockchain could lead the way in providing a genuinely independent, transparent way of validating environmental claims and circumvents institutional corruption and error, democratizing sustainability by giving everyone the same access to transparent, verifiable environmental data. This innovation is already underway with projects like Scantrust and Baia's Wines, and with the development of Proof of Stake, blockchain can now provide a sustainable solution to global environmental data issues.

The future possibilities are even greater. Recent research shows that blockchain systems such as Cardano could process transactions at close to the current bandwidth limitations of the internet. This would allow the creation of a digital record-keeping system that could capture the end-to-end environmental footprint of entire industries in granular detail.

Crucially, these Proof of Stake networks would also create a system which is run by and open to all of its participants, from a banker on Wall Street to a strawberry farmer in New Hampshire.

Perhaps more important than the technology itself is the way in which this would empower future citizens to hold businesses to account, by giving them equal access to environmental data. This could boost public trust in everything from sustainability certifications to climate science. By taking the authentication of all environmental records out of the hands of institutions, blockchain offers a solution to the perennial question: **"Who watches the watchmen?".**

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RESOURCES

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IOHK Research,
Blog: Why they're calling Cardano the green blockchain

CONTACT MEDIA@IOHK.IO

to arrange an interview with an IO Global spokesperson