

CLIMATE CHANGE CHALLENGES AND BLOCKCHAIN OPPORTUNITIES



Climate change needs immediate and effective actions

Blockchain technology offers potential solutions to barriers impeding mitigation action

Research on governance and business models is needed for developing blockchain-based solutions

CLIMATE CHANGE ACTION CHALLENGES

The Paris Agreement (PA) under the Climate Convention together with the Sustainable Development Goals (SDGs) set the scene for a sustainable future.

The PA aims to limit global warming to well below 2°C. However [current scenarios](#) project a potential global warming of approx. 3 to 3.2°C by 2100, even if all current national commitments are reached.

In order to achieve the PA goal, urgent action is required towards global net zero emissions, shortly after 2050.

For greater ambition, actions need to be accelerated and a number of challenges need to be addressed. Blockchain applications may offer new opportunities in the following areas:



TRANSPARENCY FRAMEWORK & CARBON MARKETS

To date, national GHG emissions data in most developing countries is derived from few and often inconsistent sources and thus only rough national estimates exist.

The PA requires all signatories to provide accurate and robust data of their GHG emissions, to validate assumptions regarding current baseline emission scenarios, to increase ambitions over time, and to track progress made towards national climate commitments.

Cooperative approaches, established in Article 6 of the PA, enable cost-effective global emissions reductions through the exchange of mitigation outcomes across diverse jurisdictions. The international transfer of these mitigation outcomes requires robust accounting to ensure environmental integrity and transparency.



CLIMATE FINANCE

Achieving the PA goals will require sizeable investments; the [International Energy Agency \(IEA\)](#) for example estimates an annual investment average of \$3.5 trillion in the energy sector globally until 2050.

As part of the PA, developed countries have already committed to mobilize \$100 billion a year in climate finance by 2020 to assist developing countries. Despite these contributions, there remains a huge finance gap where private investment is considered a key contributor.

One option is to leverage private finance by providing appropriate incentive structures (e.g. carbon markets) for businesses and industries to transition into low-carbon technologies. Another option is to facilitate investments into profitable low-carbon interventions (e.g. through green bonds or crowdfunding), which are currently inhibited by high friction costs and poorly developed accountability mechanisms.



CLEAN ENERGY

To achieve carbon neutrality by 2050, a rapid shift to clean energy technologies is needed. Fossil fuel-based energy generation accounted for roughly 70% of GHG emissions globally in 2010. However, renewables accounted for an estimated 70% of net additions to global power generation capacity. According to [Bloomberg](#), "Wind and solar are set to surge to almost 50% of world generation by 2050". The [World Bank IFC](#) estimates nearly \$23 trillion in opportunities for climate-smart investments in emerging markets between now and 2030.

A larger deployment of clean energy technologies, particularly wind and solar, lend themselves to decentralization and intermittency. This trend precipitates the need for new market structures and regulations to be introduced, so that energy markets can function effectively.

BLOCKCHAIN SOLUTIONS

Newly evolving technologies, such as blockchain technology (also known as distributed ledger technology, DLT), have the potential to act as a tool to accelerate global actions towards the Paris Agreement agenda and the Sustainable Development Goals.

Key features of blockchain technology, such as an immutable audit trail of transactions, cheap and borderless transfer of values, and automated execution of contracts, can help address challenges to climate action implementation. Specifically, this technology can act as a transparency mechanism that incentivizes emissions reductions, and can provide a decentralized infrastructure to enable new business models in climate finance and clean energy generation.

National accounting of GHG emissions reductions, connected through a ledger recording international transfer of emissions reductions, enables transparency and accountability of all actors. Similarly, financial flows can originate from anyone and anywhere in the world, directed towards specific projects under pre-defined conditions, and with a tamperproof documentation of every transaction.

There are a number of potential applications for blockchain technology in the climate space, the most promising are summarized in the table below.

	APPLICATION	POTENTIAL ADVANTAGES
	<p>Carbon markets: Enabling mechanism for trading and accounting of mitigation outcomes.</p>	<ul style="list-style-type: none"> • Immutable audit trail of the creation and transfer of mitigation outcomes; • Facilitated trading with various granularity levels and units; • Lower transaction and management costs and increased transaction speed; • Traceability of emissions reductions and certificates trades across countries.
	<p>Climate finance: Facilitating and enabling of climate-smart investments through traceability of financial flows.</p>	<ul style="list-style-type: none"> • Enhanced accountability through traceability of capital flows; • Facilitation of earmarked and results-based financing; • Enabling of automated micro-payments to reduce micro-payments for loan repayment; • Reduced management and transaction costs.
	<p>Clean energy: Enabling prosumer business models for decentralized energy systems.</p>	<ul style="list-style-type: none"> • Enabling of peer-to-peer energy transactions; • Better energy prices for both consumer and producer; • Traceability and certification of renewable energy production; • Facilitated addition of energy generation incentives (e.g. tokens).

RESEARCH AND COLLABORATION

Blockchain technology is still in its infancy and will need considerable research and piloting efforts to mature and achieve large-scale adoption. This applies to both the underlying technology as well as the relevant governance context and business models.

As a university-based organization with vast experience in developing country engagement, [UNEP DTU Partnership \(UDP\)](#) is uniquely positioned to provide a neutral assessment of the potential role blockchain applications can play in the achievement of the Sustainable Development Goals, especially on Energy (SDG 7) and Climate Change (SDG 13). UDP will focus on the assessment of specific climate and development projects to evaluate if the application of a blockchain solution is beneficial. Building on UDP's current competence areas and country engagements, we are well positioned to investigate the most promising blockchain use cases in key climate change and clean energy areas.

TRANSPARENCY FRAMEWORK & CARBON MARKETS

UDP was actively involved in the [Clean Development Mechanism \(CDM\)](#) through research, capacity building, and project development support, and still hosts the [CDM pipeline](#). Based on the CDM experience, UDP is participating in the discussions surrounding the carbon mechanisms of the Paris Agreement.

In the area of climate action transparency, UDP is engaged in the two biggest available transparency support programs:

- As a partner of the [Initiative for Climate Action Transparency \(ICAT\)](#), UDP is responsible for in-country implementation and guidance development.
- In the [Capacity Building Initiative for Transparency \(CBIT\)](#), managed by the Global Environment Facility, UDP is supporting UN Environment with the development of country project proposals, and as part of the CBIT support program UDP is managing the [CBIT Global Coordination Platform](#).

CLIMATE FINANCE

Through the [Adaptation Mitigation Readiness \(ADMIRE\)](#) project, the [Facilitating Implementation and Readiness for Mitigation \(FIRM\)](#) project, and the [NAMAcademy](#), UDP assists country to access various finance options and is providing advisory services on policy and project development. The ADMIRE project supports, in collaboration with local experts and national government representatives, the establishment of sustainable financeable project frameworks that accelerate the integration of private sector action into climate policies. With funding of 3,3 million USD from [Danida](#), UDP has leveraged capital of around 52,5 million USD for 14 projects, ensuring that the Danida investment facilitates scaling up and implementation.

CLEAN ENERGY

UDP is promoting cleaner energy technology transfer and offers analytical support to identify and overcome political, institutional, and financial barriers to increase the uptake of these technologies. Since 2010, a major activity has been the UNEP/GEF [Technology Needs Assessment \(TNA\)](#) programme, involving more than 60 countries over three phases, leading to the formulation of National Technology Action Plans. At another scale, UDP is engaged in facilitating access to energy in rural areas based on decentralised renewable energy solutions, information and communications technology and innovative business models.

In addition, UDP hosts the [Copenhagen Centre on Energy Efficiency](#) and the global energy efficiency hub of [Sustainable Energy for All](#) that supports the achievement of the SDG 7 goal on Energy Efficiency.

UDP's experience in these thematic areas, combined with the research capacity of the [Technical University of Denmark](#) in close collaboration with the [Technology and Innovation Management](#) research group at TU Berlin, constitutes an excellent base for researching the cross-thematic blockchain technology.

TEAM

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UNEP DTU Partnership

UNEP DTU Partnership is a leading international research and advisory institution on energy, climate, and sustainable development. UDP was established in 1990 and operates under a tripartite agreement between the [Ministry of Foreign Affairs of Denmark](#), the [Technical University of Denmark \(DTU\)](#) and the [UN Environment \(UNEP\)](#). Working in over 60 developing countries, our 70 economists and scientists generated a business volume of around 10 million euros in 2017. UDP is funded by DTU, UNEP, and a wide range of international donors.

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