Blockchain and Clean Energy

Imagining a Smarter Future in the Kingdom of Morocco

The elusive technology has the potential to cut out market intermediaries and address key logistical and infrastructural challenges.

The energy grid is not as smart as we might assume.

Despite a global surge of interest and investment in sustainable development initiatives and renewable energy production, the technology we use to track and sell the clean energy we produce is frustratingly inefficient.

The picture looks something like this: meters at renewable plants typically write information into a spreadsheet that is sent on to a regulatory body, where the data is entered into another database and a "certificate" is manually created. These certificates are then passed on to buyers and sellers connected by market intermediaries who often rely in turn on other parties for verification. Transactions carried out in this way often take months to complete.[i]

One thing is clear: the current process for selling renewable energy is messy, expensive, and time-consuming. As our energy grid moves toward an increasingly distributed model, with the adoption of small generation and storage systems like solar panels, wind installations, and batteries, we need a better way to manage a wide range of energy transactions moving forward.

Experts believe that we may have a solution in everyone's favorite buzzword: **blockchain**.

What is blockchain?

A blockchain is a shared record of transactions (a list of who owns what) maintained by a decentralized computer network. As opposed to the traditional databases kept by governments and banks, for example, a blockchain has no central administrator. Computers on the network are responsible for verifying transactions via a complex, secure process referred to as "mining" (official bitcoin mining guide **here**, more details later in this article) and adding their details to the blockchain. The updated blockchain is then synchronized via the internet and instantly visible to all who have access to the network. The result is what is referred to as a distributed ledger, a secure, transparent list of transactions that allows members to prove ownership at any given time.[ii]

Still don't understand? Here's a **breakdown** that should clear things up.

Most people associate blockchain technology with Bitcoin, which uses a blockchain operating system to transfer the cryptocurrency between individuals. However, the underlying value of distributed

ledger technology – giving a network of users access to a shared data set – can be applied to a number of industries.

Applications to the energy grid

Our energy grid is a perfect example of an industry ripe for blockchain innovation.

Today, the grid consists of a vast network of large power plants and a growing number of smaller, distributed generators and storage systems. The challenges inherent to this structure, ranging from efficient and balanced asset utilization to large-scale integration of renewable production, are obvious. Added to these challenges is the sheer scale of the electric grid and the number of different market players and data sources involved in energy transactions.

Consider how a blockchain-based system could address the following issues:

Automation via "smart contracts"

Smart contracts are one of blockchain's most attractive features for automating business processes. Think of them as chunks of code that can mimic contracts by tracking the fulfillment of a specific set of obligations by different parties.[iii]

On the energy grid, smart contracts integrated into a blockchain-based platform could allow for the execution of peer-to-peer energy transactions free of unnecessary intermediaries, similar to what Siemens-backed grid builder LO3 has envisioned with its **smart grid neighborhood in Brooklyn, NY**. LO3 allows neighbors to buy and sell electricity produced from devices like solar panels via an app, with production data monitored by sophisticated sensors and meters.

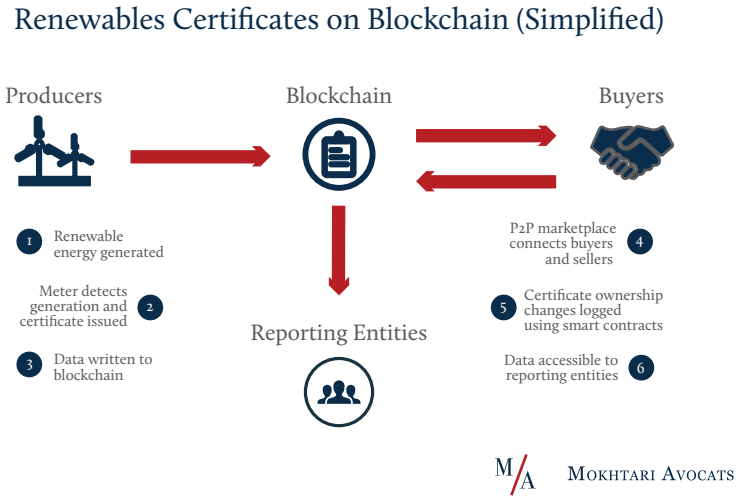
The same logic behind these micro grids could be applied on a much larger scale, where smart contracts could automatically monitor the relationship between energy producers and consumers and execute transactions based on fluctuations in energy costs, grid conditions, and any other factors that can be modeled contractually.[iv]

Reducing transaction costs, accounting errors, and settlement time

Let's think about the current certificate system for renewable energy. If meters at renewable plants were instead connected directly to a blockchain, this would eliminate the need for an intermediary managing party and would allow buyers and sellers to access a public ledger of energy data.

It would also help eliminate defective metering caused by human error or malfunctioning equipment. Using smart contracts, we could eliminate the need for third-party certificate verification by coding in certification protocols. Transactions between buyers and sellers could be executed instantaneously and logged immediately without the time and cost associated with credit operations or the likelihood that unintentional accounting errors arise, all in a secure, encrypted environment.

In many ways, this elimination of unwieldy intermediaries is the core value proposition for introducing blockchain to the energy grid. Today, it can take anywhere from 60 to 80 days for an electricity producer to get paid.[v] If transactions were settled instantaneously, logged, and verified using blockchain, capital flow for producers could be rapidly accelerated, making it easier to get new energy projects off the ground.



Efficient Grid Usage

As the energy grid receives more input from renewable sources, the fluctuation in the amount of energyon the grid at a given time becomes more drastic.[vi] This makes sense when you consider how solar and wind sources produce at different rates depending on how sunny or windy it is. To cope with these fluctuations, we need a smarter grid that can ramp up and scale down production automatically to avoid overloads. A blockchain-based grid, integrating and monitoring production from different sources, would allow us to create a smarter grid that maximizes asset usage and reduces costs as much as possible.

Security

The decentralized nature of blockchain, whereby every member of the network keeps their own up-to-date copy of the ledger, means that the technology offers an incredibly secure alternative to centralized databases. Hacking or tampering with the records in one location cannot compromise the integrity of the ledger, given that these changes will not be verified and added to the blockchain. When we're talking about the energy grid, the benefits of avoiding data manipulation of this sort are obvious.

Blockchain in Morocco

When the Office des Changes announced that transactions carried out using "virtual currency" constituted an infraction in November 2017, it seemed like the end of months long speculation about the future of cryptocurrencies in the Kingdom. However, this stance was called into question shortly after the announcement by a joint **press release** from the central bank, Bank Al-Maghrib, together with the Ministry of the Economy and Finance and the Financial Market Authority. In the statement, the three bodies recognized Bitcoin as a financial instrument (mode de paiement) but fell short of any outright ban on it or other cryptocurrencies. Instead, the statement focused on consumer protection and the associated risks.

This disconnect between the Office des Changes and the central bank was confirmed by a **statement** from the head of Bank Al-Maghrib, Abdellatif Jouahri, who claimed that "from an economic theory perspective, Bitcoin is not a currency." He went on to add that Bitcoin is more a "financial asset" than a currency, in direct contradiction to the Office des Changes' initial ban.

Regardless, and luckily for aspiring Moroccan innovators and developers, no such ban on blockchain technology exists. After all, neither the Office des Changes nor the central bank would have grounds to ban the development of what is essentially just code. What this means is that little stands in the way of incentivizing and investing in Moroccan blockchain solutions.

Time to catch up

In the energy sector, we're already seeing blockchain innovation from companies around the globe. In Germany, IBM has partnered with grid operator TenneT and launched an ambitious **blockchain-based platform** to integrate renewable energy produced by solar and batteries into the grid. In Australia, too, the government recently awarded $8 million to blockchain startup Power Ledger for a **project** focused on distributed energy systems. Renewables-based tokens like SolarCoin, which aims to incentivize a "global rewards program for solar electricity generation" by issuing the cryptocurrency to individuals and commercial producers of solar electricity, are also attempting to "shift the cost of renewables production" and encourage new developers to participate in the sustainable revolution. Saudi Arabia's ACWA power became the first major energy company to adopt SolarCoin when it announced earlier this year its plans to collect the cryptocurrency for the energy it produces.[vii]

So why not Morocco?

The Kingdom enjoys solar insolation rates among the highest on Earth and aims to supply more than half of all energy from renewable sources by 2030 under its national energy strategy. Coupled with the growing interest of Moroccan investors and innovators in blockchain technology (albeit mostly as the technology applies to banking and finance operations), this suggests that Morocco is particularly well positioned to welcome blockchain innovators interested in revolutionizing the energy sector.

Problems to consider

To understand some of the concrete challenges associated with implementing blockchain technology in Morocco and elsewhere, it's important to have a firm grasp of the mining process that allows for transactions to be validated and added to the blockchain. Here's a quick summary from Medium's **The Blockchain Review** that should help clear things up:

> "When a digital transaction is carried out, it is grouped together in a cryptographically protected block with other transactions that have occurred in the last 10 minutes and sent out to the entire network. Miners (members in the network with high levels of computing power) then compete to validate the transactions by solving complex coded problems.[viii] The first miner to solve the problems and validate the block receives a reward. (In the Bitcoin Blockchain network, for example, a miner would receive Bitcoins)."

This reward-driven cryptographic process (often referred to as the "Proof-of-Work protocol") is at the heart of blockchain's fundamentally secure and open nature. However, the mining process is understandably demanding from an energy perspective and has led to blockchain's reputation as an environmentally destructive technology. According to the Energy Web Foundation, a non-profit focused on blockchain in the energy sector run by leading energy companies, the mining process (i.e. the computing power required) associated with validating a single bitcoin transaction is estimated to consume as much electricity as an average American home does in a week.[ix] This means that the sum total energy required to power the world's Bitcoin transactions over a single day is equivalent to the

annual energy consumption of countries like Denmark or Ireland.[x]

Using excess thermal energy from electricity production has proved to be a viable way to offset the energy demands of mining, allowing power plants and data centers to capitalize on the heat they produce by channeling it into mining operations. In Morocco, miners may have missed out on opportunities to utilize thermal energy in this way. According to some estimates and discussions with Moroccan blockchain experts, miners might have been able to generate close to 30 billion dollars (around 20% of global bitcoin production) over the last 2-3 years by using excess heat from the Noor 1 plant in this way.

In countries like China, low electricity prices help miners enjoy steady profits despite fluctuations in the price of cryptocurrencies. Still, the overwhelming energy problem posed by mining isn't sustainable everywhere and has created a demand for innovation within the blockchain world, namely focusing on transaction validation methods that do not involve mining or in some way cut back on the energy required. One alternative to the Proof-of-Work protocol is the **"Proof-of-Stake" approach**, whereby a consensus algorithm provides mining opportunities to users on the network based on the proportion of tokens they own. This technology is fairly new and thus far limited in its large-scale implementation. Ethereum, the cryptocurrency with the second largest market capitalization in the world, plans to make the switch to Proof-of-Stake sometime this year.

Looking ahead

For blockchain technology and mining to be implemented in Morocco, innovators will have to find a way to avoid this massive power demand and underlying use of cryptocurrency mining operations for validating transactions.

Recently, Soluna Technologies, a blockchain-oriented company that plans to generate its own renewable energy, announced that it was developing a blockchain computing facility in Morocco. The goal is to provide alternative energy resources in a period when cryptocurrency mining has become
energy-wasting. To mitigate this, the new startup will have its computing infrastructure powered by its own 900 megawatt (MW) wind energy plant.

So long as the Office des Changes maintains its hardline position on Bitcoin and other cryptocurrencies, this will continue to be the most significant barrier to blockchain development in the renewables sector in the Kingdom.

For now, however, the future remains bright. Global interest in blockchain technology – and indeed in its specific use in the energy sector – continues to swell. As the demand for a streamlined renewable energy market increases and with public interest in peer-to-peer energy transactions likely to follow suit, Moroccan investors and innovators would be wise to get onboard with this new energy revolution.

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Who we are

Founded by Ghalia Mokhtari and two local partners in 2017, Mokhtari Avocats is a boutique law firm specialized in projects, financing, and corporate matters across a range of sectors in Morocco and North Africa.

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As a local market player, we maintain strong connections to small and medium-sized Moroccan enterprises and are deeply committed to assisting their business development in Africa and the Middle East.

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Ghalia is a specialist in projects and banking law with expertise in the energy, infrastructure, and real estate sectors. She regularly advises borrowers, financial institutions, funds, energy companies, corporations, and governments on a range of transactions, including projects, public-private partnerships (PPPs), acquisitions, construction issues, and Moroccan regulation matters.

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