# Re-Shaping the Energy Industry With Smart Contracts and Blockchain

by Abang Mohd Iwawan and Lee Zhe Ying

Blockchain, artificial intelligence ("**AI**") and the Internet of Things ("**IoT**") — these rapidly emerging technologies have made inroads into various business sectors over the past decade. While their terminology may feel hackneyed to some, others have been left grappling with their unprecedented rate of evolution.

Blockchain, a form of distributed ledger technology, is a decentralised data gathering and recordkeeping system maintained in multiple computer systems. Built on consensus protocols, it enables secured, real-time transaction recording and verification with minimal risk of manipulation.

Within the plethora of blockchain technologies is the invention of the "*smart contract*", a term first coined to denote "*a set of promises, specified in digital form, including protocols within which the parties perform on these promises*".[1] Put simply, a smart contract is an automated coding mechanism capable of self-execution or self-performance of contractual obligations when specified conditions are met.

In this article, we discuss the applicability, practical limitations, and legal challenges of blockchain and smart contracts within the energy sector.

## Understanding smart contracts

Smart contracts operate differently from traditional contracts. A traditional contract's cadence comprises offer, acceptance and consideration, with parties executing the contract by inking signatures onto paper. If a term is violated, a party's primary recourse is to go to court or arbitration to seek specific performance of the term or recovery of damages from the defaulting party. Similarly, disputes can arise out of a specific term's interpretation. In such instances, parties may have to seek the final determination of a third party (a judge, arbitrator or other contractually designated third party) on the term's interpretation. This involves several third parties, lawyers representing each contracting party, and a judge/arbitrator, making for an inevitably costly and time-consuming dispute resolution process. Even with a favourable judgment/award, execution may remain as a challenging last step.

In contrast, smart contracts dispense with inking parties' agreement on paper. Instead, parties use technology to "draft agreements" via coding, eliminating the ambiguity that can arise when parties' obligations are defined in traditional contractual terms. This is because smart contracts are computer programs composed of "*if/then*" clauses laying out each obligation and eventuality. Once created and formally accepted by both parties, smart contracts can be self-enforcing. In the simplest terms, an agreement could be coded to provide, for example, that:

Scenario A:

> "***IF*** *AMI Sdn Bhd* ***provides 50MW of electricity*** *to the national grid by the 14th day of the month,* ***THEN*** *Tenaga Nasional Berhad* ***will pay*** *AMI Sdn Bhd RM1 million.*"

1 Nick Szabo, "Smart Contracts: Building Blocks for Digital Markets" (1996)

Scenario B:

> "***IF*** *ZYL Construction Sdn Bhd* ***fails to complete*** *construction works by 1.1.2020,* ***THEN*** *ZYL Construction Sdn Bhd* ***will pay*** *RM1 million per day for every single day of the delay until completion.*"

The key feature that sets smart contracts apart from traditional contracts is auto-enforcement: Smart contracts reside in a decentralised system accessible to anyone and require no intermediary. The smart contract system itself establishes the basis for enforcement, largely eliminating the need to refer "disputes" to a third party when seeking to enforce a defaulting party's performance. Building this into unchangeable computer code, with payment assured upon performance, addresses the trust issues that often stymie traditional deals based on a handshake or signature. In other words, parties' agreements are enforced through code instead of the courts.

## How can blockchain and smart contracts be applied in the energy sector?

In line with efforts to effect the secure, reliable and sustainable supply of energy, renewable energy is one of the three sectors in which blockchain technology is currently being trialled in Malaysia.[2]

Across the globe, pilot projects involving peer-to-peer ("**P2P**") energy trading have been gaining traction — in New York,[3] Australia,[4] Japan,[5] Thailand[6] and Singapore,[7] among others. This form of decentralised electricity distribution network, a manifestation of the convergence of blockchain and IoT, often incorporates a self-sustaining smart grid and smart contract system that allows monitoring and recording of electricity consumption, fault detection, and the direct sale of surplus energy between prosumers[8] without the need for intermediaries.

Closer to home, blockchain technology is gradually being embraced by players in the energy sector and is anticipated to bring about positive transformation, including increased efficiency and reduced costs:

> "*The traditional utility business model is now increasingly challenged by market liberalisation, decarbonisation, decentralisation and digitalisation. More and more consumers, especially in developed economies, are becoming prosumers where they are able to generate, store and have the choice to consume their own electricity when the utility tariff is high and sell the excess back to the grid or to their neighbours via peer-to-peer decentralised transactions.*"[9]

*P2P Electricity Trading*

With the objective of encouraging renewable energy uptake and reducing electricity wastage, the Net Energy Metering ("**NEM**") scheme has been introduced to allow consumers to sell excess solar-generated electricity to Tenaga Nasional Berhad ("**TNB**"), Malaysia's national utility company. As part of the Malaysian government's Renewable Energy Transition Roadmap ("**RETR**") with the aim of supplying 20% of the country's energy by 2025, this initiative is envisaged to be expanded to include the development of a P2P energy trading platform utilising blockchain, through which the sale and purchase of surplus energy between system users would be possible. In effect, excess electricity capacity would be treated like a commodity which anyone may produce, consume and sell. The demands for buying and selling electricity are defined as transactions controlled through smart contracts.

The advantages of treating electricity as smart property are that it can be controlled via digital devices, and asset

2 Chia Jie Lin, "Three ways Malaysia is trialling blockchain: Interview with Mastura Ishak, Programme Director at the Malaysian Industry-Government Group for High Technology", *Energy Insider* (10 July 2019) <https://govinsider.asia/smart-gov/three-ways-malaysia-is-trialling-blockchain/>.
3 The Brooklyn Microgrid project by LO3 Energy.
4 Trial projects conducted in several cities by Australian blockchain start-up, Power Ledger.
5 Partnership between Kansai Electric Power Company (KEPCO), the second-largest utility in Japan, and Power Ledger.
6 P2P renewable energy trading project in Bangkok launched by Power Ledger in partnership with leading Thai renewable energy company BCPG and Thai property-developer Sansiri.
7 Synergy, an energy trading platform launched by Electrify, a local start-up.
8 Consumers who are producers at the same time.
9 Datuk Ir Ahmad Fauzi Hasan, chairman of the Energy Commission, Malaysia, "Leading the Energy Sector", *Energy Malaysia* (vol. 18, 2019) <https://www.st.gov.my/contents/files/download/112/Energy_Malaysia_18_(Online).pdf>.

ownership can be transferred at low cost without executing an agreement on paper — akin to buying a drink from a vending machine. In the long run, this will bring significant benefit to the public by reducing the control of central authorities, such as wholesale entities.

*Smart grid*

In addition, TNB is looking to invest in smarter grid systems[10] with advanced metering infrastructure and grid automation to maximise the national grid system's reliability and efficiency.

Driven by technological advancement, these transformations in the energy industry worldwide, both ongoing and anticipated, are expected to increase the prevalence of smart contracts — for instance, in the issuance of payments between prosumers and consumers in P2P energy trading and performance of certain actions or transactions when parameters measured by integrated monitoring sensors exceed predetermined thresholds.

## Practical limitations and legal challenges

The advantages of smart contracts are widely known — reduced transaction and operating costs, time savings, minimisation of human error, and security enhancement, to name a few. These are achieved primarily through automation and removing the need for third-party intermediaries. However, like many technological inventions, smart contracts entail challenges in usage, in terms of practicality and legal feasibility. A potential misconception is that the immutable, self-executing code completely eliminates the risk of disputes. In fact, the intersection of contract law and code has created a new area of dispute beyond the proficiency of most lawyers and judges today. Below, we pose four common legal issues with smart contracts relevant to businesses using or looking to adopt smart contracts.

*(a) Validity of smart contracts*

There remains variety of opinion on whether a smart contract can substitute or complement the traditional contract as a matter of legal principle. A fundamental issue frequently raised is whether they can be regarded as valid contracts binding on their contracting parties. Absent the essential elements of a "contract" under common law — offer, acceptance, consideration and intention to create legal relations — smart contracts may be perceived merely as coded computer programs or software facilitating a contract's automatic execution, rather than as the contract itself.

*(b) Inability to enforce subjective standards*

Even if legally valid in principle, smart contracts are still unlikely to be capable of fully replacing traditional contracts in the foreseeable future as a matter of practice. As it stands, smart contracts still require human intervention, presence and judgment in negotiating terms, codifying agreed terms into software to define the desired outcome when certain conditions are matched, and

10 "TNB to invest RM2.7b into Grid of the Future", *The Star* (15 May 2018) <https://www.thestar.com.my/business/business-news/2018/05/15/tnb-to-invest-rm2pt7b-into-grid-of-the-future/>; Pamela Largue, "TNB investing in smarter grid for Malaysia", *Smart Energy International* (15 May 2018) <https://www.smart-energy.com/industry-sectors/smart-grid/tnb-smarter-grid-malaysia/>.

storing contracts on the distributed ledger. This requires contracting parties to possess the technical knowledge and coding expertise necessary to produce an acceptable automated mechanism for executing a smart contract.

Moreover, while they may bring significant efficiencies to simpler contracts, they are incapable of self-enforcement where performance is tied to a subjective standard. Most contracts are bound to include provisions whose application or execution rests on human assessment and monitoring of qualities or conditions incapable of measurement by software. An example would be a termination clause in a power purchase agreement entitling a party to terminate either on the ground of a *force majeure* event that prevents a party from "*substantially*" performing any "*material*" obligation under the agreement, or upon the occurrence of an event of default that cannot be cured with the exercise of "*reasonable*" diligence. Such a clause would likely give rise to differing interpretations of the terms "*substantially*", "*material*" and "*reasonable*".

*(c) Irrevocable nature*

Performance under a smart contract, once triggered by a matched condition, is automatic and irrevocable. This may cause difficulties or inconvenience to parties who wish to modify terms or reverse transactions made. Consequently, if there is a system glitch (e.g. defective coding or cyberattacks), the damage suffered could be irrevocable especially where the other party's identity is unknown, such as in "pure smart contracts" consisting of only machine-readable code.

*(d) Governing law*

Blockchain exists on a network of computers with nodes and users typically based all over the globe. In the absence of an express provision on the issue, determining the applicable jurisdiction and governing law may be difficult and onerous, potentially engendering satellite disputes.

## Where next for smart contracts?

Smart contracts are a powerful tool and particularly useful for transactions involving the fulfilment of straightforward and unambiguous conditions, such as payment in exchange for goods supplied. However, there exist challenges and practical limitations to their adaptability, hurdles which will continue to morph and evolve in step with the rapid pace of technological advancement overall.

Nevertheless, their benefits should not be overlooked. In the energy sector, smart contracts may eventually serve as a sustainable system that combines clean resources, flexible markets and cost-effective solutions for the generation, distribution and consumption of energy. In tandem with or even in place of traditional contracts, smart contracts have the potential to become complex, powerful systems.

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