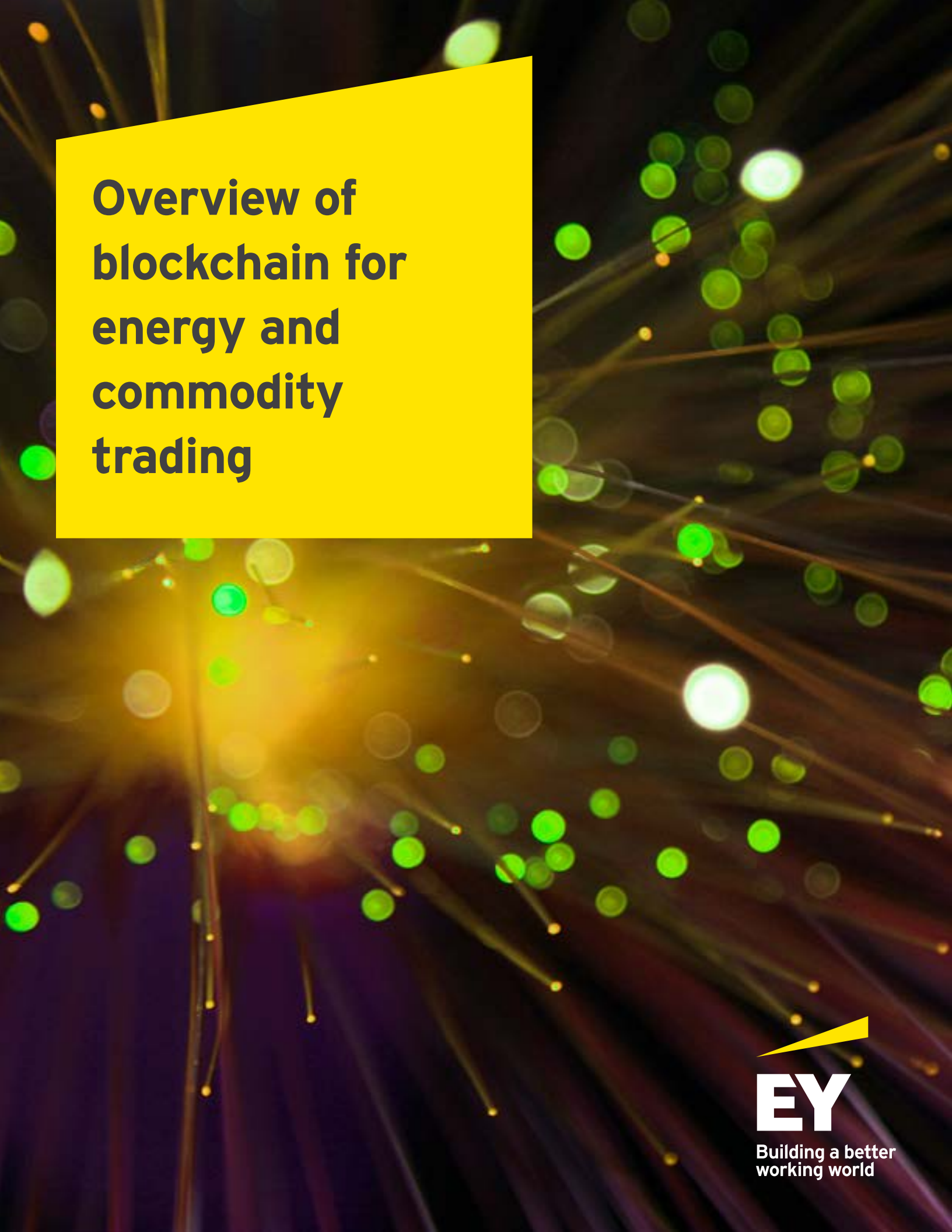

Overview of blockchain for energy and commodity trading

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Building a better working world

Power of blockchain

Energy and commodity trading companies execute thousands of transactions per day to extract significant trading profits. Companies have invested millions to build out multiple systems and a complex array of automated and manual processes to manage key risks. As a result, these companies incur significant costs to maintain the infrastructure and manage the underlying risks, while still being exposed to key risks due to the constructs of the markets they operate within. Energy and commodity trading blockchain technology has the ability to transform the energy and commodity trading market space resulting in market efficiencies and significant cost savings for traders. While blockchain technology is still in the relatively early stages of development, the potential uses are broad and promising. The financial services sector has led much of the charge so far as it relates to trading and risk management, but EY and leading energy and commodity trading clients are working to develop powerful applications using blockchain technology for the energy and commodity transaction life cycle.

What is blockchain?

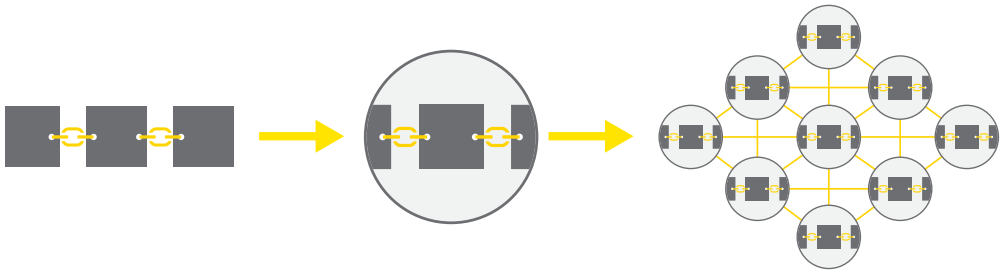
Blockchain technology is a way to structure data without the need for a central authority. As illustrated in **Visual 1: Distributed ledger structure,** one aspect of blockchain is a distributed database that hosts shared records. The database stores records in blocks rather than collating them in a single file. Each new block is then "chained" to the previous block, in linear, chronological order, using a cryptographic hash; as a result, records cannot be revised and any attempted changes are visible to all participants. This process allows blockchains to be used as ledgers, which can be shared and corroborated by anyone with the appropriate permissions. These distributed ledgers can be spread across multiple sites, countries or institutions.

Visual 1: Distributed ledger structure

A blockchain is made up of a series of blocks containing validated transactions.

Each block is attached to the previous block, thereby making it extremely difficult to corrupt, helping to combat fraud and allow for accurate and complete information.

This chain of blocks is then stored and replicated across the network, enabling a distributed ledger.



Types of blockchains

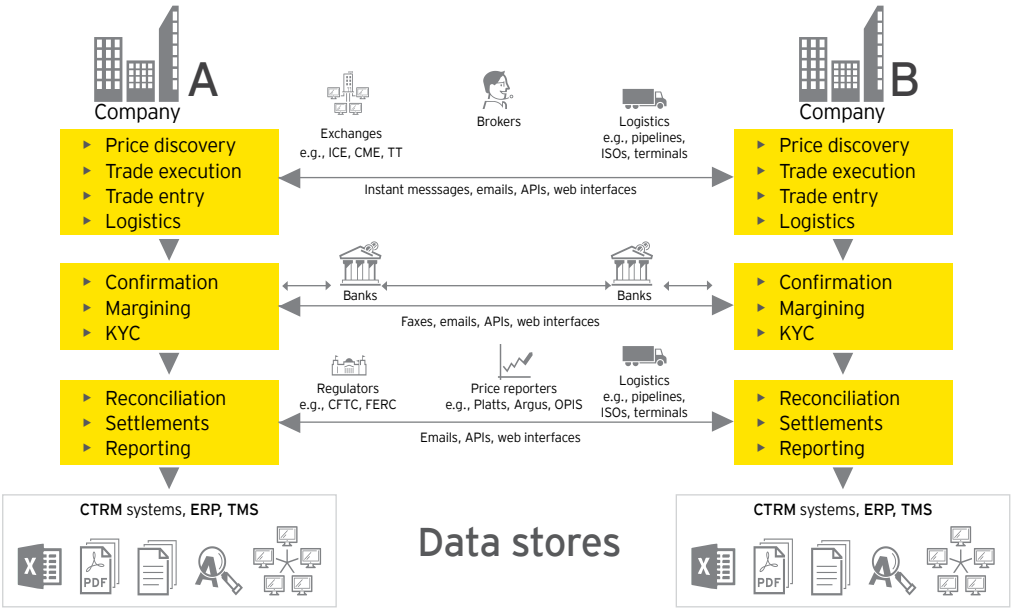
Based on the participants, blockchains are categorized as public, private or hybrid. This is similar to comparing the public internet and a company's intranet.

- **Public and permissionless:** Public and permissionless blockchains resemble bitcoin, the original blockchain. All transactions in these blockchains are public and no permissions are required to join these distributed entities.
- **Private and permissioned:** These blockchains are limited to designated members, transactions are private, and permission from an owner or manager entity is required to join this network. These are often used by private consortia to manage industry value chain opportunities.
- **Hybrid blockchains:** An additional area is the emerging concept of sidechain, which allows for different blockchains (public or private) to communicate with each other, enabling transactions between participants across blockchain networks.

Blockchain and the energy and commodity transaction life cycle

The energy and commodity transaction life cycle, even for simple transactions, involves a multitude of processes within each company and across market participants. The counterparties have to verify and reconcile transaction data multiple times from execution through settlement of the transaction. Additionally, through the transaction life cycle, a company may need to interact with other counterparties, exchanges, brokers, logistics providers, banks, regulators and price reporters. As illustrated in **Visual 2: Energy and commodity transition life cycle,** a web of data interfaces, systems and processes are required to facilitate these interactions. In addition, organizations must maintain their own internal manual processes, systems and controls to maintain an accurate view of transaction data throughout the transaction life cycle.

Visual 2: Energy and commodity transition life cycle



Through the application of blockchain technology there is the opportunity to streamline internal processes and processes shared with external market participants. This can fundamentally change the landscape of energy and commodity trading. Through streamlining these processes, there is potential for significant savings (e.g., reduced labor costs, reduced manual and semi-automated process related effort, reduced capital costs through faster settlements and reduced technology costs through reducing the dependency on multiple systems). While savings estimates vary based on a company's existing market activities, organizational structures, processes and technologies, some companies have estimated potential savings in the range of 30–60%. EY is conducting industry studies to further quantify the estimated savings across the industry.

Internal processes such as deal validation, risk management and compliance monitoring, as well as external-facing processes such as confirmation, trade reconciliation, chain of custody documentation and settlements provide clear use cases for the application of blockchain technology. The technology also enables the expansion of trading to new digital assets, such as the planned Royal Mint Gold product through the CME Group and the Royal Mint Group. A five-point test that EY applies for assessing the fit of blockchain for a particular process that can be applied to trading processes, includes the following five questions:

1. Are there multiple parties in this ecosystem? Blockchains get more secure with more parties in the network, one participant networks are not especially secure.
2. Is establishing trust between all the parties an issue? Blockchains improve trust between participants by having multiple points of verification.
3. Is it critical to have a tamper-proof permanent record of transactions? Blockchains create permanent records that cannot be edited or deleted.
4. Are we securing the ownership or management of a finite resource? Core logic in the system is designed to prevent double counting of assets, record ownership and transfers.
5. Does this ecosystem benefit from improved transparency? Blockchains are transparent by design — where ownership or control of assets is public and transparent by design.

Several high-profile pilots that applied blockchain to specific processes within their transaction life cycle have confirmed the applicability of blockchain to energy and commodity trading processes. These include:

- A global commodity trader performed a pilot, working with two banks, which applied blockchain technology to the letter of credit process for crude cargo transactions.
- A global commodity trader, working with a bank and technology partner, developed a commodity trade finance platform to facilitate US crude oil transactions.
- A group of European energy companies including Wien Energy, BP and ENI completed a pilot with the technology company BTL Group Ltd., supported by EY, which applied blockchain technology to the portfolio reconciliation process.
- A group of more than 20 European energy companies joined a trial project to execute wholesale power and natural gas transactions on a blockchain-enabled platform.

EY believes the most compelling value proposition for the application of blockchain technology to energy and commodity trading is in the development of a private blockchain-enabled ecosystem that covers the entire transaction life cycle from end-to-end. Simply put, the use of blockchain as the mechanism for price discovery and trading, all the way through to back-office settlements and payment. The potential cost savings and process efficiencies are too compelling to ignore. Practical challenges may exist for implementing this broader ecosystem approach, for example regulatory education and incumbent's incentives, however, identifying the ultimate value proposition and building toward that goal offers the potential to do the following:

- Design the initial architecture with extensibility and scalability from the onset. In other words, the design could be capable of covering the standard transaction life cycle and could support a large number of participants and transactions.
- Develop individual processes and functionality iteratively (e.g., modules for confirmations, margining, actualization, settlements) and integrate these in a seamless way. This particularly allows for prioritization of processes with greater benefit case and lower short-term challenges to be built early.

EY ran the 2016 Start-up Challenge focused on blockchain for energy trading to validate this thinking. Based on this, EY has now established the Blockchain for Energy Trading Working Group. The Working Group comprises several leading energy companies and will pursue an ecosystem driven approach to design an end-to-end framework for the application of blockchain technology to the energy and commodity trading life cycle. As the Working Group advances, we will seek to address key industry questions around the design of the ecosystem, its tangible value proposition and the readiness of incumbents to participate in it.

How EY can help

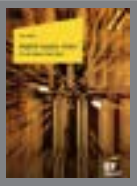
EY's Commodities Markets practice provides comprehensive assistance on a global basis to energy and commodity trading companies. Our cross-functional and global team of professionals offers a deep and diverse experience of the industry and understands the specific issues and commodity nuances. We are leaders in the application of blockchain technology and emerging technologies for energy and commodity trading. We also provide clients with advice across a spectrum of topics including business transformation, technology support, regulatory compliance, hedge accounting, quantitative advisory, internal controls and audit.

Other insights from EY

- **Blockchain:** How this technology could impact the role of the CFO

- **VIDEO: Blockchain and the future of audit** – transforming the finance function

- **The digital supply chain**
  - Data
  - Analytics
  - Machine Learning
  - IoT
  - Blockchain



- **VIDEO:** Tackling blockchain, EYQ, Alex Tapscott, Northwest Passage Ventures

For more information about how EY Commodities Markets can help your organization with the application of blockchain technology, or with broader energy and commodity trading topics, please contact:

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