



BTL



INTERBIT

# Powered by Blockchain

Reinventing Information Management in the Energy Enterprise





# Table of Contents

---

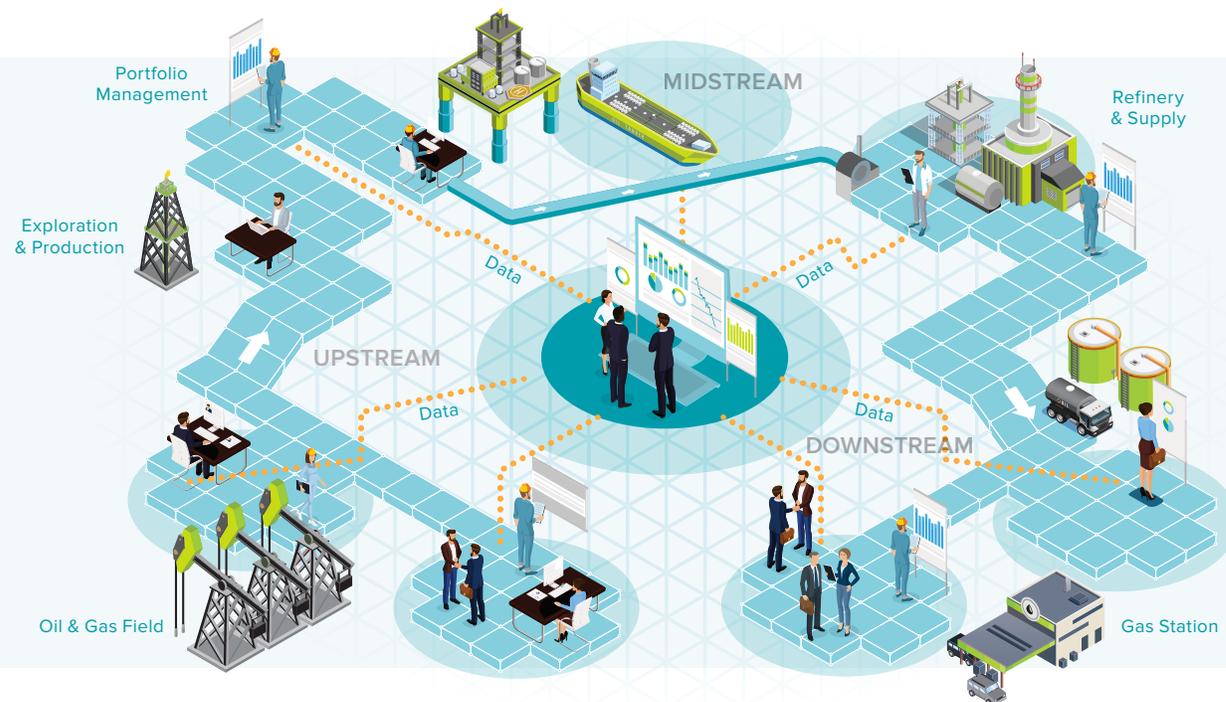




The image features a tall, complex metal structure of an oil rig in the foreground, set against a background of an industrial site with various tanks and buildings. A semi-transparent teal overlay covers the entire image, and a white network diagram with nodes and connecting lines is superimposed over the scene. The text is centered within a teal rectangular box.

After publicly debuting in the financial domain, blockchain technology is garnering incredible attention for its applicability across sectors, showing particular fit as a foundational technology in the energy sector.

**Important issues facing energy companies** – large information technology capital expenditures, increasing cyberattack sophistication and frequency, and accelerating adoption of connected sensors – are inspiring a fundamental rethinking of how data is structured, validated, protected, and transmitted. Blockchain has emerged as an elegant, secure, and scalable solution that is applicable across the enterprise, from gas field to end customer.



“Blockchain has emerged as an elegant, secure, and scalable solution that is applicable across the enterprise, from gas field to end customer.”

Blockchain, simply described, is a data-management technology that is shared, validated, and updated collectively by participants on a network. Instead of maintaining duplicate databases on respective infrastructure, participants on a blockchain network jointly manage one synchronized record of authority that is accessible at any time by all participants, yet unalterable without consensus. Conducive to automation and security, blockchain promises to become foundational information management infrastructure that will be deployed across the entire enterprise more economically than conventional IT infrastructure.

Executives across industry are taking notice. In Deloitte’s December 2016 survey of over 300 executives at companies with \$500 million or more in annual revenue, almost 30% reported investment of at least \$5 million dollars in blockchain solutions. Over half the respondents indicated that their companies would “be at a competitive disadvantage if it did not adopt blockchain technology.”<sup>1</sup>

Numerous blockchain pilot projects are underway in the energy sector, reimagining processes throughout supply chains, risk management departments, back office operations, and compliance offices.

The blockchain-enabled energy enterprise can be visualized today. Imagine gas pipelines, equipped with connected sensors, communicating securely and reliably with one another, autonomously updating volume, temperature, and flow pressure measurements in real-time over a platform that does not require costly central IT infrastructure to broker information.

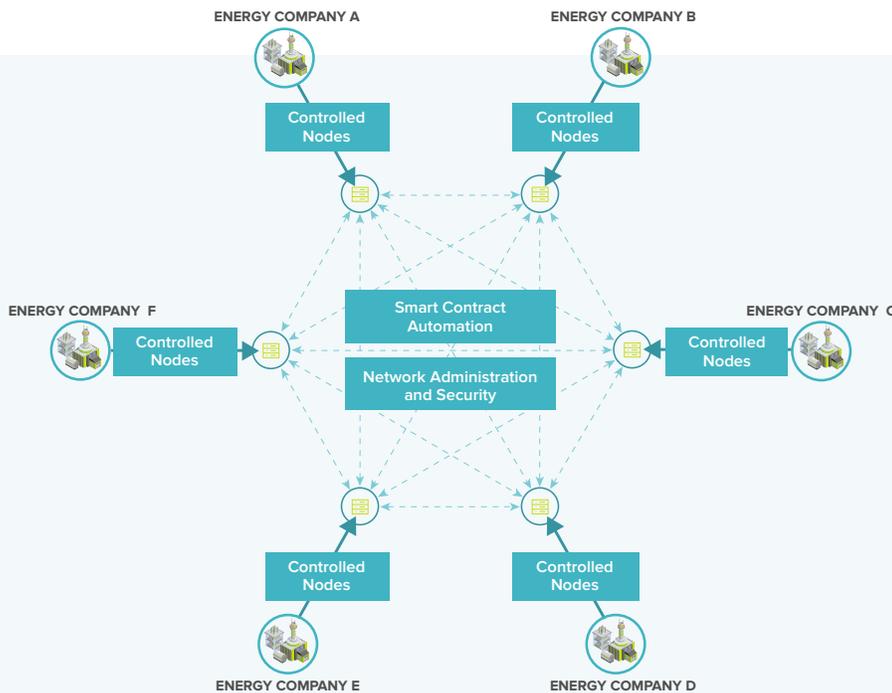
“Over half the respondents indicated that their companies would ‘be at a competitive disadvantage if it did not adopt blockchain technology.’”

<sup>1</sup> Deloitte. Deloitte blockchain survey 2017: Blockchain reaching beyond financial services. 2017.

Operators update gas nominations from the field that are instantly validated and recorded on an immutable ledger that is, by design, transparent to all authorized participants in the supply chain and unalterable by malicious external actors. Gas operators at terminals and subterminals record allocation updates on the platform, creating an authoritative and reliable information audit trail that both eliminates the need for labour-intensive reconciliation processes, and reduces expenditures pertaining to redundant, geographically dispersed IT infrastructure.

The reliable, real-time ledger of transactions informs traders at risk management trading desks who then hedge currency and volume disruption risks on a blockchain platform that enables faster payment and settlement times, larger trading volumes, and an immutable audit trail.

This white paper aims to illuminate blockchain's transformative potential in the energy sector and to clarify the underlying technology for energy company stakeholders who are just now beginning to sense the blockchain opportunity.



## Blockchain at a Glance

**Blockchain is a protocol for a distributed database**, collectively operated by participants on a network. All manner of information can be submitted and stored on a blockchain. Blockchain technology also enables automated information transmission and transactions amongst participants in a secure, transparent, auditable, and trustless manner. Trustless means that the reliability of the data on a network does not depend on faith in counterparty responsibility. The blockchain platform, by design, guarantees such reliability.

Each participant on a blockchain network must maintain at least one node, and each node maintains a synchronized record of

network transactions on the cloud or local IT infrastructure. This is how a blockchain is physically distributed. While a network participant maintains the data set locally and has unfettered access to it, that member cannot unilaterally alter or add to the record. Additions or changes to information on a blockchain must be authorized by other members of the network through an automated consensus mechanism. This distributed decision-making is the innovation that enables confidence in a blockchain in the absence of a central authority to oversee or validate submissions or changes.

A key feature of blockchain is that records, once added in a block, are permanently stored and impossible to tamper with. This is a characteristic referred to as immutability. Data that is to be recorded in the block is inputted into a cryptographic algorithm which converts it into a reference code called a hash that cannot be reverse-engineered. This hash, unique to the specific data being recorded, is like a digital fingerprint.

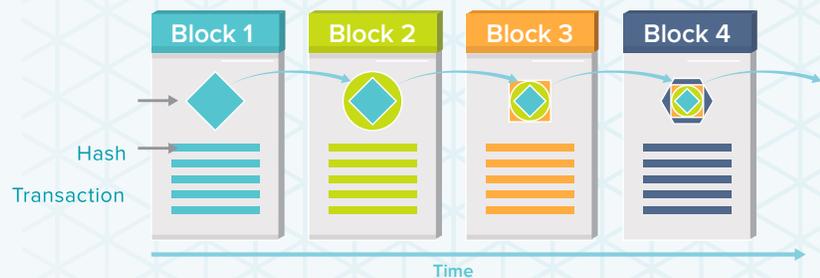
# Blockchain's Value in the Energy Organization

As blockchain technology applies to any context in which transactions or messaging take place, the business cases for blockchain in the energy organization are numerous. As a foundational piece of enterprise technology, blockchain adoption can at once impact operational costs, capital expenditure, risk management, and security. Oil and gas companies are exploring blockchain's promise to revamp inefficient internal processes and achieve significant reductions in operating costs through the automation of record keeping and messaging, the digitization of the supply chain information flow, and the elimination of reconciliation, among many other data management use cases.

“Blockchain lends itself particularly well to rule-based activities that are prone to human error and require time-consuming reconciliation processes.”

In addition to its own hash, a block being added to a blockchain contains the hash of the previous block. This reference pattern exists going back to the original block, and it is that which creates immutability. Any attempt to alter a historical block's content will change its hash, and a mismatch between that block and the subsequent block's hash will be automatically flagged and clearly visible to other nodes on the network which will not validate it. The change to the record, in this case, will not occur.

## Data Structure of a Simple Blockchain



Prior to blockchain technology, legitimate objections to sharing a database existed. Potential loss of control, human error bringing data integrity into question, and the potential for counterparty defection all presented unacceptable risk. Only a burdensome data confirmation process or a central authority acting as trust broker could reduce discrepancies and disincentivize defection. Blockchain technology is an elegant solution to these concerns.

Transactions can also be automatically executed on a blockchain through business logic, also known as smart contracts. These are pre-written computer programs that define the conditions under which a transaction is executed. To illustrate, if an invoice is to be paid over a blockchain network, a smart contract will include relevant details, such as account information and vendor name, and the event that will trigger the payment.

Blockchain is, by design, secure from tampering, transparent to every member on the network in real time, and reliable due to automated mechanisms that require agreement on the validity of information. If the benefit of blockchain could be distilled into one concept, it would be: trust in a networked world.



Often reconciliations are manual actions, as taxing as they are tedious. Using a distributed ledger has the potential to eliminate the need for reconciliations, with participants having access to one accurate record.



– EY, *Blockchain and the Capital Markets Journey*

## Streamlining Operations

**Blockchain provides an elegant solution** to current systemic inefficiencies in operations. Workflow activity processes, transactions, and data management across the enterprise can be streamlined by operating on a blockchain network. Blockchain lends itself particularly well to rule-based activities that are prone to human error and require time-consuming reconciliation processes.



### **Take the gas volume reconciliation process as an example.**

The current process of moving gas from field to subterminal to terminal is burdened by legacy processes and labour intensive manual activities that often result in reported flow volume discrepancies between counterparties. These discrepancies necessitate a data reconciliation

process that has been reported to consume multiple days per month.

Examining a standard gas volume information management process reveals its vulnerability to mistakes.

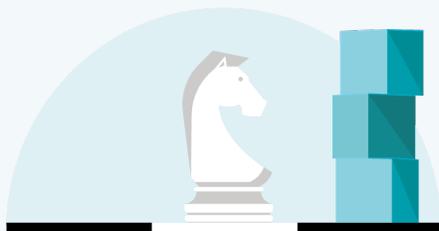
The standard process involves:

- ◆ Gas nominations originating upstream sent as PDF attachments via email
- ◆ Shared inboxes, with access by several operators
- ◆ Manual entry of nomination data into gas balancing and portfolio management software
- ◆ Unaccounted for updates that lead to data discrepancies among counterparties
- ◆ Manual searches through filed PDFs to find the latest nomination updates

This fractured information management process becomes particularly burdensome when counterparties are not subsidiaries of the same parent company, but of different entities sharing resource ownership or separate elements in a supply chain. In the absence of a single authoritative audit trail of gas volume updates, a time-consuming reconciliation process is required.

Blockchain technology not only removes these vulnerabilities from the information management process, but eliminates the need for reconciliation altogether. Reconciliation is baked into the process of adding data to the chain. Data entry errors are eliminated, as entries inconsistent with information held by counterparties will not be validated and added to the record. Such inconsistencies will automatically be flagged for operators or volume management teams to resolve immediately. A transparent and synchronized distributed ledger provides immediate settlement and an authoritative record of gas estimates, when they were provided, and who signed off on them.

These are the characteristics of blockchain technology that foster its applicability to numerous processes across the enterprise, whether they be confirmation, invoicing, data management, or messaging.



**Another example of blockchain's impact on back-office processes** can be found in risk management departments in which confirmations and post-trade reconciliation also create drag.

Blockchain, once again, eliminates the need for these post-trade processes. Real-time shared access to a blockchain enables all counterparties to simultaneously view any

transaction on an immutable record that has been confirmed by consensus.

This instant verification, shared access to the record, and elimination of post-trade activities speeds up transaction settlement. Rapid settlement times and reduced collateral requirements drop credit risk to negligible, translating into higher trading volumes.

Blockchain further impacts by reducing capital costs associated with conventional IT infrastructure and eliminating fees paid to third-party brokers.

Implementing blockchain as a foundational technology within the energy enterprise promises replication of this operational transformation across all processes in all departments in which transactions occur, information is transmitted, and an audit is required.

“

Blockchain could have a profound effect on post-trade settlement through streamlining, mutualising and cutting costs of the process. By using distributed ledger technology, the need for reconciliation of proprietary databases is eliminated.”

”

– PWC's Beyond Automated Advice



MAX.GROSS	32,208 KGS
TARE	7,258 KGS
NET	16,000 LBS
	24,948 KGS
	55,000 LBS

# Capital Expenditure and Connected Devices

As mentioned, blockchain technology impacts capital expenditures in IT departments as redundancy is built into the blockchain platform itself and computing power is distributed among nodes on the network.

The arrival of a solution that lowers capital expenditures is timely for an industry that is on the cusp of an exponential rise in data collection, transactions, and computing requirements with the adoption of connected devices throughout the enterprise – otherwise referred to as the Internet-of-Things (IoT).

Connected devices are proliferating throughout the world at an astounding rate. The McKinsey Global Institute projects the number of connected devices to hit 25 billion by 2020, up from 4 billion today.<sup>2</sup> Along with this astounding growth in IoT comes enormous promise, and the energy sector is among those expected to benefit most. Ubiquitous connected sensors will provide data in real-time that can be used to make enormous strides in operational efficiency.

## These gains arise from:



Predictive maintenance, emergency avoidance, and reduced down-time



Efficient resource allocation, accurate modelling, and optimization of projects and operations



Fewer accidents, faster disaster response, reduced environmental impact, and lower risk to workers



Reduced capital requirements arising from lower inventory costs due to connected supply chains and just-in-time inventory

Current energy sector IoT deployments include connected sensors that measure the flow and characteristics of oil and gas in pipelines, autonomous vehicles and drones that monitor stretches of land, and devices that transmit real-time environmental metrics at extraction sites. A 2015 Cisco study asserted that an oil and gas company with \$50 billion in revenue could increase profit by \$1 billion with effective deployment of IoT technology.<sup>3</sup>

A large proportion of the value derived from IoT will be achieved through interoperability: the process of connected devices communicating and operating autonomously in concert. Industry is only beginning to explore interoperability. To illustrate, the McKinsey Global Institute determined that only 1% of the data received from an oil rig fitted with 30,000 sensors was actually translated into value, and that even that was “mostly for anomaly detection and control, not optimization and prediction, which provide greatest value.”<sup>4</sup>

The trajectory of IoT adoption is clear. What is also clear is that the shift from today’s device numbers to the masses of connected devices that a company will employ over the next decades requires enormous IT capital expenditures related to computing power and data center redundancy.

<sup>2</sup> McKinsey Global Institute. Unlocking the Potential of the Internet of Things. June 2015

Blockchain technology supports all manner of device-to-device transaction, whether that be messaging, coordination, or data sharing. Decentralizing IoT networks using blockchain technology promises to increase the bottom-line impact that the Cisco report identified. Instead of expanding centralized IT infrastructure to broker the real-time torrent of transactions among devices, a machine-to-machine communication model would apportion the storage, computation, and redundancy requirements among the distributed devices themselves. The capital expenditure associated with storage and computational infrastructure would be included to a great degree in the cost of the devices.

## Securing the Enterprise

In 2016, the Federal Bureau of Investigation released a bulletin warning enterprises of a stunning rise in a threat called BEC – business email compromise.<sup>5</sup> The scale is significant. Since October 2013, the agency reported ‘actual or attempted’ losses of \$3.1 billion globally. According to a BCG report, the oil and gas industry is a favorite target of cybercriminals, and the value chain is particularly vulnerable to cyberattack due to its complexity and broad scope.<sup>6</sup>

In BEC, cybercriminals hack a vendor’s email account, and intercept invoices sent as PDF attachments by a legitimate vendor, proceeding to change the destination bank account details before sending the invoice back on its way. Within the purchasing company, nothing is seen as amiss until the actual vendor makes noise about the missing payment, by which time the money is gone.

Blockchain’s immutable record and consensus mechanism work to avert this type of threat. If vigilance fails when a compromised invoice arrives, and a transaction is initiated, it would be flagged as invalid as soon as it was broadcast to the network. Since the invoice account details would not match those in the record, consensus would not be reached, and the transaction would not be executed. A lapse in diligence upon payment data entry would not be punished by a loss to cybercriminals. The account discrepancy would be immediately apparent to all members on the blockchain, and an audit would uncover the attempted fraud. In all manner of transactions, it is this immutability and consensus that protects against compromise.

Another example of blockchain’s security utility is in boundary protection, ranked as the top industrial control system weakness for the last two years by the United States Department of Homeland Security.<sup>7</sup> Boundary protection refers to the measures taken at the enterprise information perimeter to protect internal data and assets. The perimeter includes work devices that access the Internet and sensors that sit outside a company’s physical domain, but connect with an internal network.

Appearing disproportionately upstream in the oil and gas supply chain, boundary vulnerabilities are set to multiply with the increased adoption of connected devices. A 2015 EY report indicated that securing the enterprise “will become exponentially more difficult as IoT connects more devices, software, machines, and humans.”<sup>8</sup> From a security perspective, the proliferation of connected endpoints,

“  
According to a BCG report, the oil and gas industry is a favorite target of cybercriminals, and the value chain is particularly vulnerable to cyberattack due to its complexity and broad scope.”

<sup>3</sup> Cisco. A New Reality for Oil & Gas. 2015

<sup>4</sup> McKinsey Global Institute. Unlocking the Potential of the Internet of Things. 2015.

<sup>5</sup> FBI Boston. FBI Warns of Dramatic Increase in Business E-Mail Compromise Scams. Dec. 2016.

<sup>6</sup> BCG.Perspectives. Countering the Threat of Cyberattacks in Oil and Gas. March 2016.

often outside an organization's physical domain, increase exposure to tampering or entry by malicious actors, an event that has become unfortunately familiar.

Blockchain's design limits the influence that a hijacked device can have on the network. If a device on the network is compromised, the immutability of the blockchain record protects historical information from being changed, and the nature of the decentralized consensus mechanism means that the device cannot successfully execute rogue transactions.

Furthermore, the network can be configured to continue operating despite node failures. If a compromised or malfunctioning node is not operating properly, the system can adapt. If a node's proposals to the network are consistently deemed invalid, the remaining nodes on the network will identify that something has gone awry, and will collectively cut that faulty node off due to "bad behavior."

In the face of increased cybersecurity vulnerability and rising threats, blockchain technology emerges as a new line of defense due to its unique distributed design.

“  
In the face of increased  
cybersecurity vulnerability  
and rising threats,  
blockchain technology  
emerges as a new line of  
defense due to its unique  
distributed design.  
”

<sup>7</sup> Deloitte. Deloitte blockchain survey 2017: Blockchain reaching beyond financial services. 2017.

<sup>8</sup> EY. Internet of Things: Human-Machine Interactions that Unlock Possibilities. 2016.



The energy companies running blockchain pilot projects are taking first steps toward a restructuring of information management that will reform back office processes, supply chain management, and security practices.

## Summary

**The examples in this paper provide a glimpse of blockchain's potential in the energy sector.** The contexts in which blockchain applies – with its immutable record, reliability derived from consensus, and potential to automate processes – are myriad. This is evidenced by the fact that blockchain pilot projects are currently exploring configurations and measuring value across the entire energy enterprise, from supply chain to security.

The energy companies running blockchain pilot projects are taking first steps toward a restructuring of information management that will reform back office processes, supply chain management, and security practices. The complete elimination of costly current requirements such as reconciliation practices and third-party brokers is not an incremental improvement. It is a fundamental change that is increasingly being demonstrated as viable at a time when concerns about torrents of newly-available data, the mass deployment of sensors, increasing machine-to-machine communication, and rising security threats demand a move from legacy processes and technical debt to a scalable, automatable, and trustless solution.

## About BTL and Interbit

**Interbit is a permissioned, multi-chain, proprietary blockchain platform designed for the enterprise.** Interbit reduces IT infrastructure along with streamlining the development of enterprise ready applications.

Operating from both Canada and the UK, BTL is a front-runner in the development of blockchain technology. BTL has built high profile solutions for leading energy companies that showcase the capabilities of its Interbit platform including an energy trading and commodity reconciliation platform.

To learn more about Interbit and its applications in the Energy sector, talk to us: [info@btl.co](mailto:info@btl.co)



---

2880-1021 W Hastings St  
Vancouver, BC, Canada,  
V6E 0C3

110-803 24th Ave SE  
Calgary, AB, Canada,  
T2G 1P5

One Canada Square, Canary Wharf  
London, United Kingdom,  
E14 5AB

---

[info@btl.co](mailto:info@btl.co)