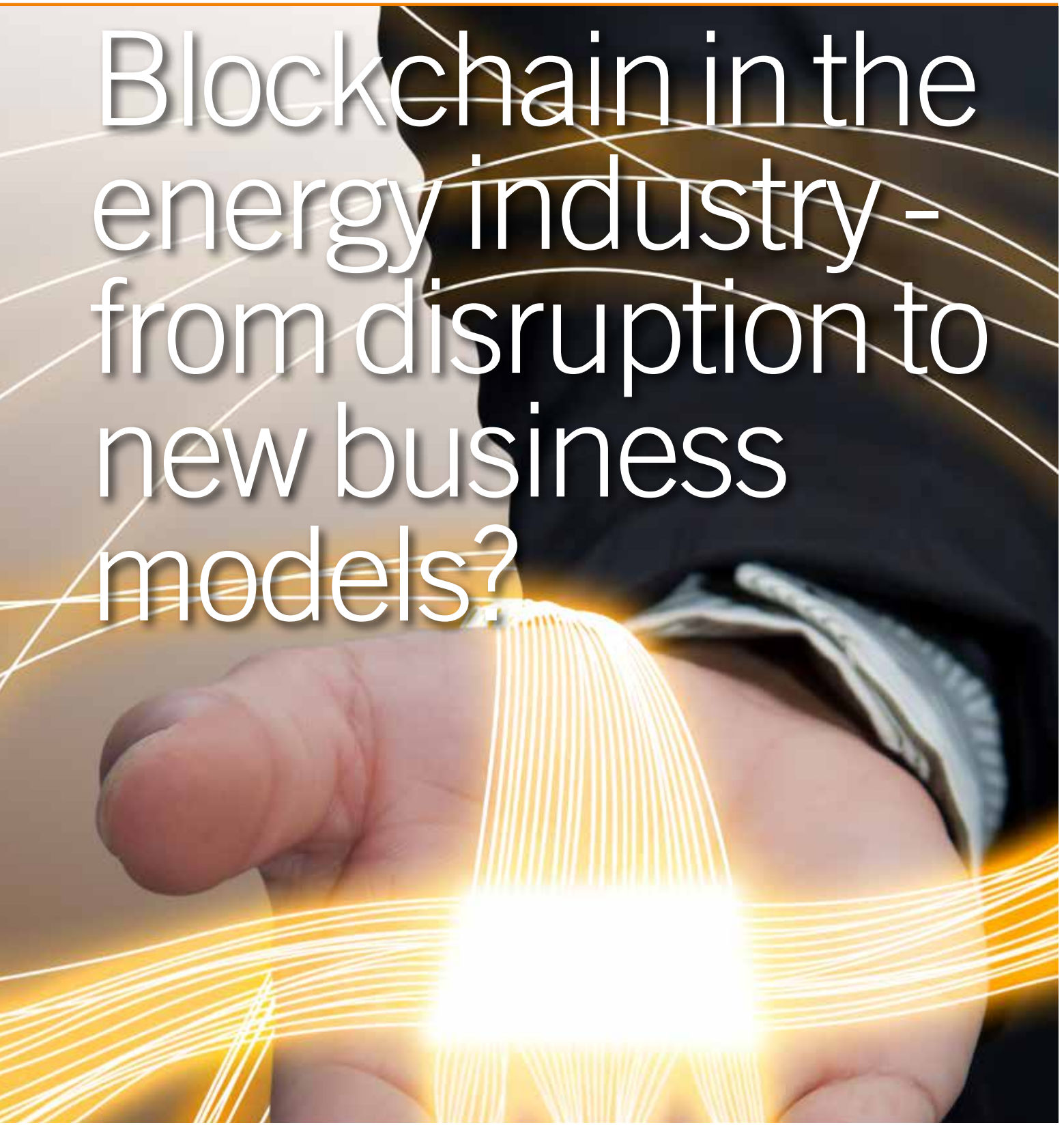
PÖYRY

PÖYRY POINT OF VIEW - MARCH 2017

Blockchain in the energy industry – from disruption to new business models?



Blockchain guarantees the integrity and security of peer-to-peer transactions

Blockchain technology has the potential to fundamentally change the business world as we now know it. Entire value chains can be revolutionised or even shortened by it – also in the energy industry. How are utilities responding to the phenomenon and how can they better prepare themselves for the change?

Blockchain is a distributed, digital transaction technology that allows for securely storing data and executing smart contracts in peer-to-peer networks.

The story of blockchain technology alone has potential for an Oscar-winning screenplay. If you are interested in it, try searching the terms “Satoshi Nakamoto”’ and “Bitcoin”. But what interests us even more is the disruptive potential of blockchains for the energy industry — the transformative power of this technology, which has been discussed over the past two years with simmering unease, and depending on one’s view, with growing

BRIEF INTRODUCTION TO BLOCKCHAIN

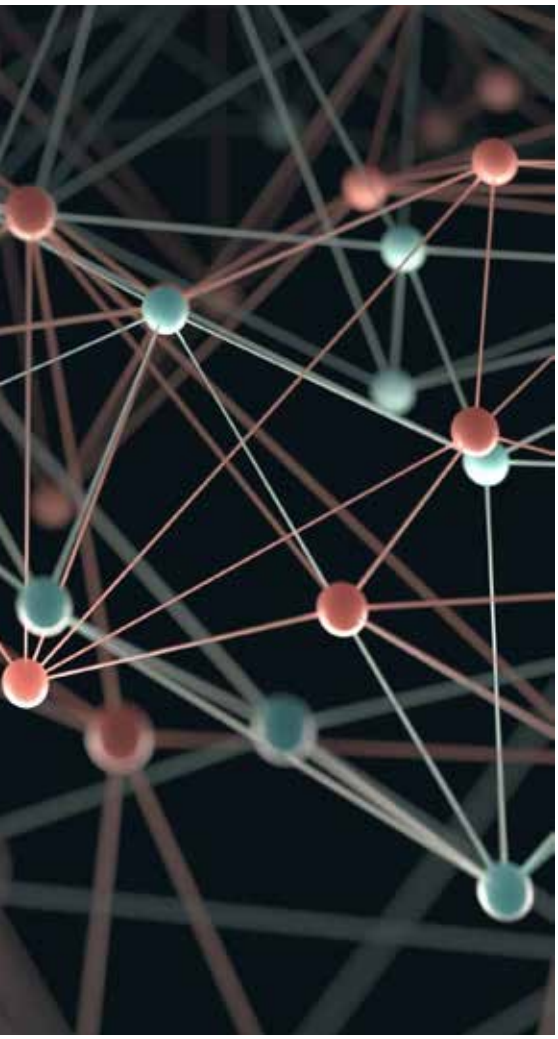
“The Blockchain can be seen as the core of a digital trust machine that people can use to replace the human and labor-intensive processes we have traditionally employed to overcome trust boundaries – such as trusted third parties (banks, notaries, platform providers, certifiers…) or expensive investigations through regulators and audit firms.” - Dr. Christoph Burger, esmt, Berlin

- The Blockchain is a distributed database that maintains a continuously growing list of ordered records called blocks. Each block contains a timestamp and a link to a previous block. By design, blockchains are inherently resistant to modification of the data — once recorded, the data in a block cannot be modified.
- Blocks contain data and programs, batches of individual transactions and executables.
- Transactions are verified by computers run by the network’s users, called nodes, in short intervals. They are distributed, public and encrypted.
- Blockchain applications can be monetary as well as so called smart contracts which are automatically executed once specific conditions are fulfilled.

hysteria or euphoria. Blockchain technology can mean very different things to different people, causing even more confusion.

CUTTING THE GORDIAN KNOT

For many, blockchain technology means the Bitcoin blockchain (Satoshi Nakamoto), for others the Ethereum blockchain (Vitalik Buterin), and for yet others virtual currencies or even smart contracts (Nick Szabo). However, it best refers to so-called distributed ledgers, which store peer-to-peer financial and business transactions immutably in a distributed network, and far more critically, legitimise and execute them — in real time.



The ledger is one of the components of each block, which when combined to form a chain — the blockchain — enable direct and immediate peer-to-peer transactions. Blockchains have disruptive potential because, among other things, they ultimately make any middlemen or other intermediaries (banks, financial institutions, utilities, exchanges, distributors, publishers and record companies, among other things) superfluous.

WHY AND HOW IS THIS POSSIBLE?

Conceptually, the technology is based on an alternative organising principle: If your own identity and that of other entities (people, objects) cannot be called into question and interaction with each other can only take place within a pre-regulated framework, this creates a 'chain' of security and trust. In other words: transactions of any kind no longer need to be centrally organised and secured via intermediaries, but are performed peer-to-peer, as integrity and security are guaranteed by the blockchain. Something as easily writeable as it is readable has the potential to fundamentally change the business world as we know it, both economically and socially.

BLOCKCHAIN — WHAT'S HAPPENING?

Blockchain technology gained relevance for the energy sector at the beginning of 2016 with an experiment in Brooklyn, New York (Brooklyn Microgrid, BMG), when owners of PV systems sold their power in the neighbourhood using the Ethereum blockchain without a utility. Barely six months later, Siemens announced its collaboration with the local start-up responsible for the project, Lo3 Energy, to research blockchain microgrids.

While it is still much too soon to speak of a triumph as blockchains must continue to evolve, the technology has the potential to radically change the energy industry. It provides the opportunity for new or more efficient business models, but also risks entirely new companies entering the market. With Cotricity, Consensys, GridSingularity, OneUp, Ponton, or Slock.it, to name but a few, there are many new players who are currently developing entirely new areas of value creation.

A variety of start-ups and established utilities such as Innogy, Fortum and Vattenfall are working hard to test blockchain technology. Possible platforms and distributed database systems (Ethereum, Hyperledger, BigChain, Tendermint, and many more) are striving for acceptance and renown and counting on developing the "killer app" as a key to success.

The first international conference on the topic of "blockchain technology in the energy sector" was EventHorizon, bringing together more than 500 experts, decision-makers from the IT and energy industry, as well as leading start-ups in Vienna, to explore opportunities for cooperation. Following the example of over 70 banks and financial institutions and their R3 consortium, utilities could also attempt to own the technology and stay in the race via such community chains — a kind of consortium.

Add to that a quick peek at the financial industry: Deutsche Bank, Swiss bank UBS, Santander from Spain and the Bank of New York Mellon (BNY) have even gone as far as wanting to specifically establish a new blockchain-based digital currency of their own for settling securities purchases and sales, among other things. Suffering? Fighting for survival? No, simply necessary developments!

An efficient decentralised energy world requires appropriate decentralised technologies

BLOCK BY BLOCK

In truth, blockchain technology can barely justify the current hype around it. Blockchains are not a panacea, but should rather be seen as one of many technologies that could form the basis for next-generation service infrastructure in the energy sector. Many digital services are already possible today even without blockchains.

While many ideas are being developed around the technology, a clear direction of where and with what economic benefits blockchain-based applications could be used is still far from apparent. Research and use would clarify limitations of the technology, for example, limited rate of transactions, long response times between the connected network peers, or the ever-growing volume of data — currently, a complete copy of the Bitcoin blockchain clocks in at some 100 GB.

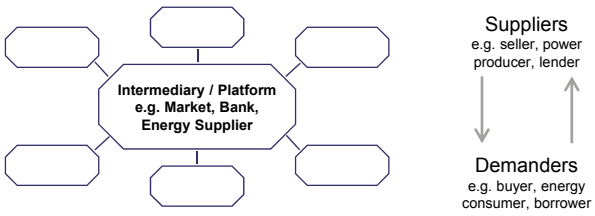
IN DIALOGUE WITH THE PIONEERS

Conversing with programmers and start-ups reveals vague statements rather than concrete information about the efficiency or, especially, any prospects of sustainable blockchain-based business models. Energy suppliers could, for example, evolve towards application or system providers to become enablers of a decentralised power grid, compensating for lost revenues in the energy business with licensing and usage fees. Business models cannot, however, be derived in the classical manner. **Dr Michael Merz**, Managing Director of Ponton, summarises this reverse development:

"Like the technology itself, the development of blockchain-based applications is unusual: While "classic" software development is derived from the specification and the necessary composition of tools results from that, blockchain technology is difficult to "tame" to meet arbitrary requirements. Rather, it is better to find business models that are a good fit for blockchain technology, as only in this way can the potential of the technology be maximally exploited. However, this requires knowledge and creativity at all levels — from finding the business model to selecting the right blockchain technology. Accordingly, the change at these levels can easily develop into a wild roller-coaster ride in the overall design of an application."

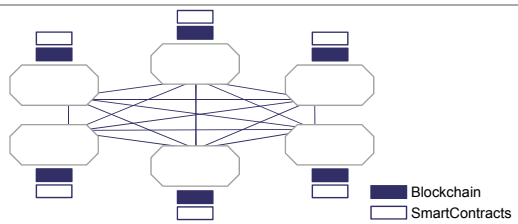
There are many indications that blockchains will gain a foothold in the energy sector — an efficient decentralised energy world requires appropriate decentralised technologies. Blockchains could represent and execute various business processes of the energy world, and would be an ideal instrument for IoT devices to manage their transactions. Blockchains are also useful as a trust-building element to provide transaction logs for energy

Current transaction model

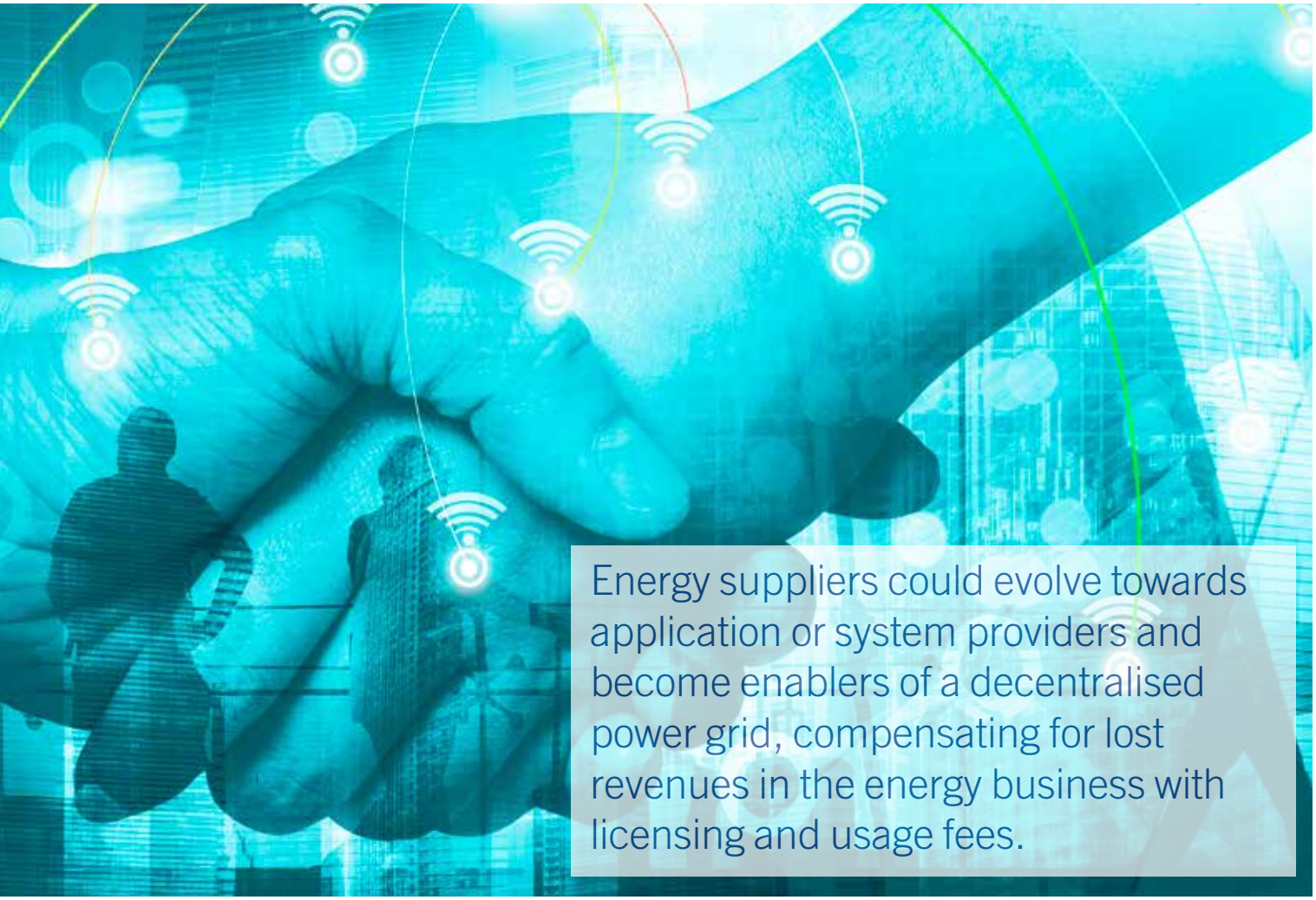


- Current transaction models require third-party intermediaries and associated with processing fees.
- Transaction data are centrally stored, required data security is an elaborate process.

Blockchain based transaction model



- Storage of the transaction data is decentralized in the Blockchain, identical for all users – Smart-Contracts used to define individual rules to execute transaction fully automatically.
- The Blockchain allows parties to carry out transactions directly between themselves without the use of a trusted intermediary.



Energy suppliers could evolve towards application or system providers and become enablers of a decentralised power grid, compensating for lost revenues in the energy business with licensing and usage fees.

to automate proof of origin. But **Ewald Hesse**, CEO of GridSingularity, sees an even more fundamental development before that:

"With the Internet, TCP/IP created new degrees of freedom for disruptive business models and led to an information revolution. Blockchains, having a similar fundamental character, show many parallels to the development of TCP/IP and promise a revolution. Nevertheless, the topic of blockchains is currently overhyped and as with any technology, the expectation hype will "crash" again short-term. However, this will not be the end of the blockchain. We are currently developing the next generation of blockchains for the energy industry, which protect privacy, are fast enough, and have the usual interfaces, for example to power plant control systems. The "core technology" or platform on which the various applications can be offered will be freely available and enable a wide community to achieve acceptance and change in the energy market. The technology will be owned by a charitable foundation, the Energy Web Foundation, which is headed by another non-profit, the Rocky Mountain Institute."

Blockchain would be ideal for business processes managed by IoT devices

BRAVE NEW BLOCK WORLD

A look ahead promises a fully automated future. With decentralised, autonomous organisations — DAOs for short — in conjunction with artificial intelligence (AI), any transaction between machines can be performed, including the roles of asset management and property. Optimisation of the transaction layer for distributed systems and their associated infrastructure is at the forefront of developer efforts — "AIs become AI DAOs, everywhere, AIs now own stuff, you can't turn them off and you've just given them control of all your resources," prophesied **Trent McConaghy**, founder and CTO of BigchainDB last year.

There are many regulatory barriers to overcome. Structural requirements of the regulated energy market are also barriers to blockchain-based business models, meaning that the technology's value proposition cannot be fully developed today. Nevertheless, topics such as digitisation and robotics are already on the agenda in the EU. Legal experts are expecting the first landmark decisions this year: there is a recommendation by the European Parliament to the European Commission about new civil-law rules for robots. In addition, the role of the prosumer could well be strengthened, to change the nature of the industry's value chains.

FOUR PHASES OF BLOCKCHAIN DEVELOPMENT

Blockchain 1.0	Contains the application of virtual crypto currencies as an option to other digital payment systems, better known as Bitcoin.
Blockchain 2.0	Expands the use of Blockchain to Smart-Contracts and more sophisticated financial instruments, like bonds, mortgages and property transactions – in short, any type of transaction between two parties that can be implemented digitally. Smart-Contract also allows a fully automatic execution of transactions
Blockchain 3.0	Visonary concept will be reached when Blockchain is deployed in Big Data and predictive task automation. Smart-Contracts would be evolved to decentral, autonomous organizational units, with own laws and a high degree of autonomy.
Blockchain 4.0	Multichains will be established as Dr.Gavin Wood described in Polkadot: Vision for a heterogeneous multi-chain framework

READY. STEADY. ...

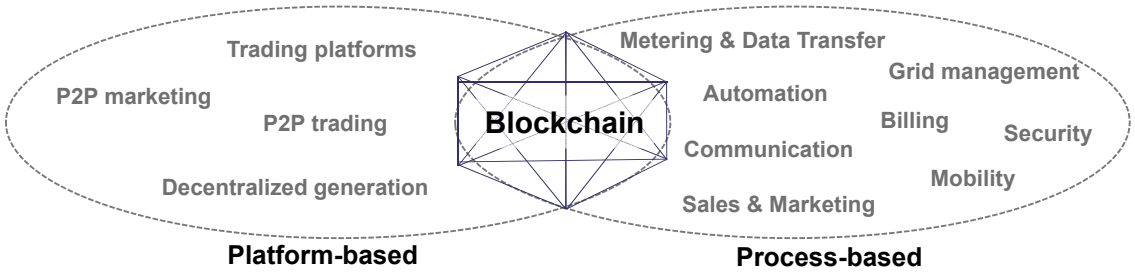
Although utilities should actively engage with blockchain technology, there is no reason to be alarmed. The technology is still very young for use in the energy sector. Blockchain technologies work wherever transaction costs exceed the transaction value - processes in high temporal resolution (real-time energy economy) become necessary. However, both the related opportunities and risks are already apparent. They should be examined with respect to each company's own position and strategy in order to derive strategic options. For the majority of companies, the fast-follower strategy is possibly the most appropriate one, but future proofing the business is even more important.

HOW WE CAN HELP

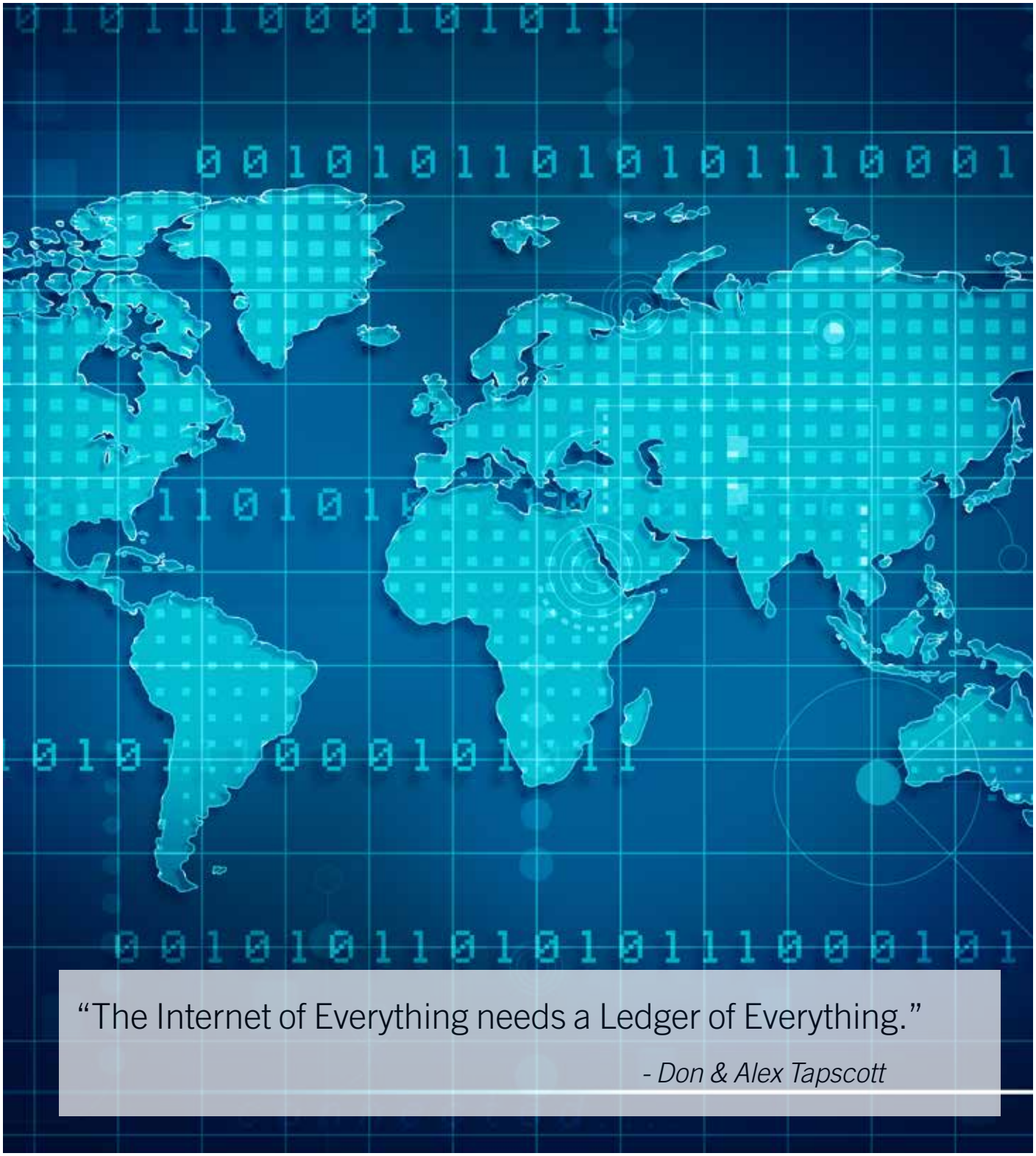
Pöyry's management consultants follow and analyse opportunities and risks posed by new technologies as a way of technology trend-scouting. We offer dedicated technology and understanding of the industry and address the important strategic questions after the what, when, where, how, who.

Contacts:
robert.schwarz@poyry.com,
roland.lorenz@poyry.com

Point of contacts and opportunities in the value chain of energy



Source: Pöyry and dena/ESMT 2016


"The Internet of Everything needs a Ledger of Everything."
- Don & Alex Tapscott

PÖYRY
The connected company

About the Pöyry Point of View

Staying on top of your game means keeping up with the latest thinking, trends and developments. We know that this can sometimes be tough as the pace of change continues...
At Pöyry, we encourage our global network of experts to actively contribute to the debate - generating fresh insight and challenging the status quo. The Pöyry Point of View is our practical, accessible and issues-based approach to sharing our latest thinking. We invite you to take a look – please let us know your thoughts.

Pöyry has a global office network - please visit www.poyry.com/contacts for your nearest office.

Consulting. Engineering. Projects. Operations.

Smart solutions across power generation, transmission & distribution, forest industry, chemicals & biorefining, mining & metals, transportation and water.
5500 experts. 40 countries. 130 offices.

Photos: colourbox.com

PN 0041 2017/03 VI

www.poyry.com