



**1<sup>ST</sup> THOUGHTS ON BLOCKCHAIN AND  
ITS POTENTIAL INSTITUTIONAL  
IMPLICATIONS**

Dr. Marius Buchmann

Jacobs University Bremen

Germany

# CONTENT

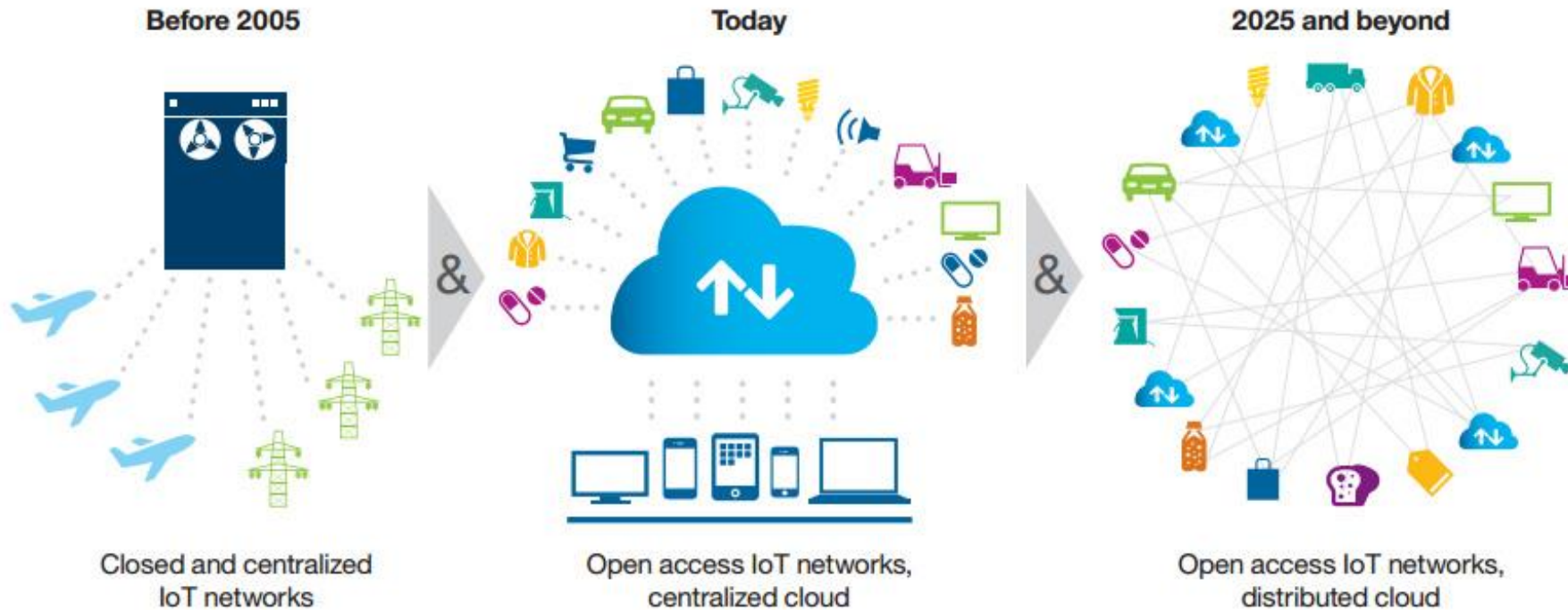
- Brief introduction: The Blockchain – Types, Strengths & Weaknesses
- Application in the Energy Sector: First concepts and future potential
- The institutional side: What if the Blockchain enters the mass market?
- Conclusion

## Key messages

- Blockchain is an interesting technology
- Blockchain is still in its infancy
- Many technological challenges ahead
- Key assumption of this talk: Blockchain overcomes challenges and enters mass market, e.g. in the energy sector
- Then: Institutional implications can be manifold
- Retail business will change, but not be disrupted
- Network operation will become much more autonomous & flexible – Who is the operator?
- Regulation will become easier  
→ regulatory system can change significantly – institutional setup as well?

# THE BIG PICTURE – FROM WEB 2.0 TO WEB 3.0

## INCREASE PRIVACY & SECURITY + AVOID DATA MONOPOLIES

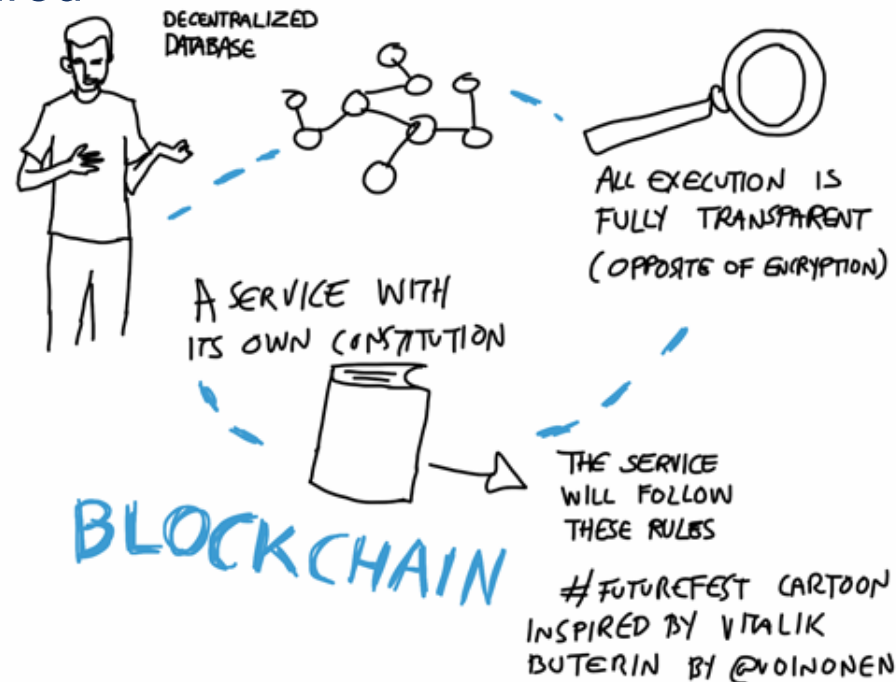


Source: IBM, 2015, Device Democracy

- The basics of Web 3.0
  - no central point of control
  - ownership of data
  - dramatic reduction in hacks and data breaches
  - interoperability
  - permissionless blockchains
  - uninterrupted service

# WHAT IS THE BLOCKCHAIN?

- distributed, shared & public ledger
- creates trust via different proof-of-X processes
- no single authority for supervision required



- blockchain was first developed to operate BitCoin
- BitCoin is an application that runs on a blockchain
- similar to Email via the internet
- intention of the developers: decentralize (ideal distribute) trust to reduce central oversight

# TWO CRITERIA FOR DIFFERENT BLOCKCHAINS – ACCESS AND SUPERVISION

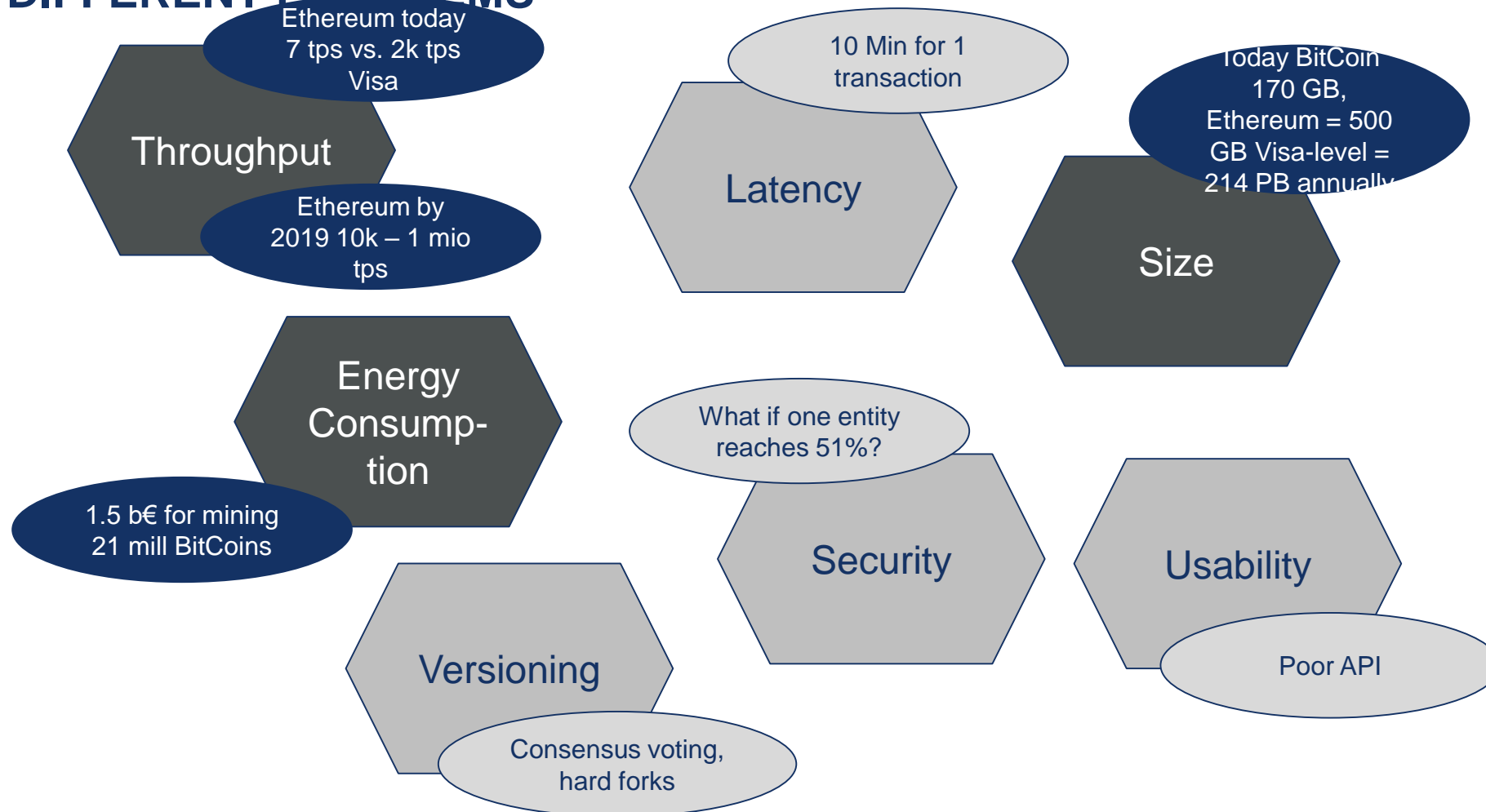
## HYBRID/CONSORTIA BLOCKCHAINS VERY IMPORTANT FOR THE ENERGY SECTOR



	Public	Hybrid	Private
Access	Open read/write permissionless	Permissioned read and/or write	Permissioned read and/or write
speed	Slower	Faster	Faster
Security	Proof-of-Work/ Proof-of-stake	Proof-of-Work/Proof-of-Stake / Proof-of-Authority	Proof-of-Stake / Proof-of-Authority
Identity	Anonymous/pseudonymous	Known identities	Known identities
Asset	Native assets	Any assets	Any asset

- Permissionless –
  - everyone can join, not limits for membership
  - Consensus decisions
  - Nobody can later historic record or delete blocks
- Permissioned
  - Access limited by one party or a consortium, members only
  - Consensus decisions
  - Owner can later historic record or delete blocks

# TODAYS CHALLENGES OF BLOCKCHAIN – SCALABILITY & ENERGY CONSUMPTION ARE AN ISSUE OF PROOF-OF-WORK BLOCKCHAINS – NEWER CHAINS DON'T HAVE THESE BUT DIFFERENT PROBLEMS



## Different solutions under investigation

- With Proof-of-stake (PoS) more than 100.000 tps possible
- Sharding: nodes split up to verify transactions (Node 1-10 verify transaction 1-100, nodes 101-200 verify transactions 101-200 etc.)
- State channels for coins already applicable >10k tps

# NETWORKS: ASSET OWNERSHIP WILL NOT BE AFFECTED, BUT OPERATION CAN MAKE USE OF SMART CONTRACTS E.G. TO FACILITATE LMP

## Network Operation Hypotheses:

- Based on smart contracts smart meter can coordinate production and consumption. Furthermore, in case of network congestion or other requirements for flexibility, smart contracts can autonomously initiate the required measures, for example in response to prices. Network operation thereby becomes an automated task, supervised by the network operator for security/legal reasons. Blockchain could facilitate LMP on the distribution grid level.

## Key argument

- We can use smart contracts to define “If-Then-” processes related to the physical exchange of electricity between distributed generators and consumers
- Automated protocols can engage in case of emergency
- Network operator can see all past, current and future transactions to supervise and plan grid operation
- While Network asset ownership will remain with the current incumbents, the question arises whether they will be the best entity to operate a largely digitized grid?
- What is preferable, centralization or decentralization in network operation in presence of a largely automated and autonomous grid?



ELECTRON

Grid Singularity

# INSTITUTIONAL IMPLICATIONS – REGULATION

## Regulation Hypotheses:

- If each network operator uses a blockchain for all transactions and if the regulator has full access to this blockchain, then information asymmetry can be reduced.

## Key argument

- Information asymmetry results in complex task of regulation
- Network operators are always under the suspicion of fraud
- Regulator gains full transparency about network operators actions
  - Third party access
  - Cross-subsidies
- Transparency can help to address new tasks to the operators (grey areas)





# BLOCKCHAIN COULD SIMPLIFY REGULATION, BUT MIGHT IT ALSO CHANGE THE INSTITUTIONAL SETUP OF THE ENERGY SECTOR?

## The different goals of regulation

- Avoid strategic investment withholding by TSOs
- secure third party access (TPA) to the markets in generation, trade and retail
- prevent discriminatory behavior by network owners/operators against other (i.e. not related) generation companies
- increase retail competition

With increasing involvement in market activities discussions about further unbundling of DSOs (beyond legal unbundling) are intensifying

- Blockchain might offer an alternative to further unbundling if applied correctly

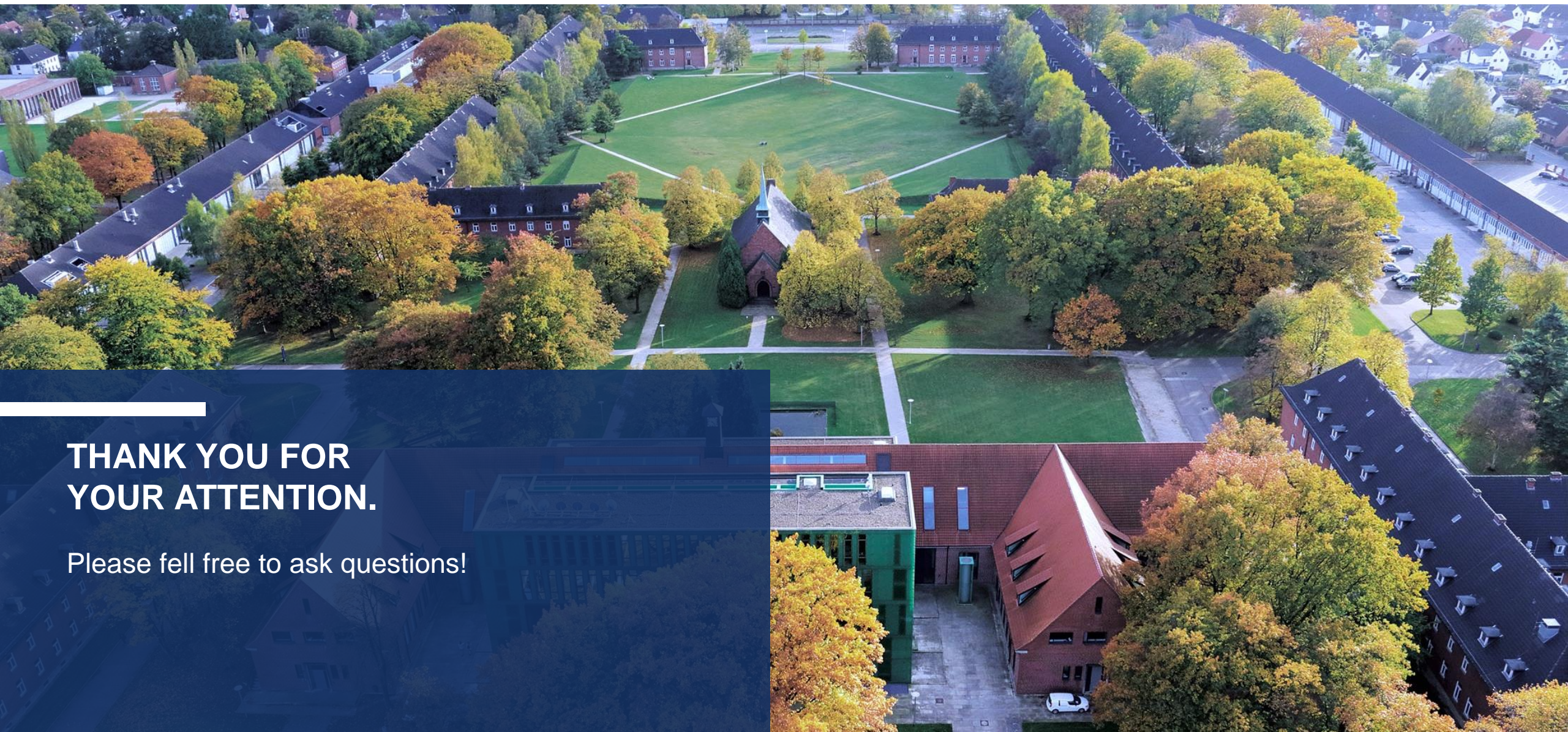
# Key questions from an institutional perspective – does this technology have the potential to change the structure of the energy sector – yes, but to which extent?

If blockchain becomes applicable to the energy sector, then

- costs for retail might be reduced
- retail and wholesale get closer and might merge
- network operation can reach high level of automation – who has the ability to operate such a system?
- regulation: If all transactions can be supervised by regulator and applications are white listed, then we can think of a very different structure of the supply chain:
  - do we still need (further) unbundling, if blockchain provides single point of truth for all market participants and regulators: no-cross-subsidization possible, how about other discrimination concerns? Strategic investment withholding?



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**THANK YOU FOR  
YOUR ATTENTION.**

Please feel free to ask questions!

## CONTACT



**Jacobs University Bremen**

**Dr. Marius Buchmann**

Campus Ring 1  
28759 Bremen  
Germany

+49 421 200 4868

[m.buchmann@jacobs-university.de](mailto:m.buchmann@jacobs-university.de)

[www.jacobs-university.de](http://www.jacobs-university.de)

**Blog:** [www.enerquire.com](http://www.enerquire.com)

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