Digitalization in the energy world: the role of big data/ AI, Blockchain and cyber security

Christoph Burger and Jens Weinmann, ESMT Berlin
Ljubljana, August 27, 2019
ESMT - a business school with global reach and European identity

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• Founded by 25 leading global companies and institutions
• Based in the heart of Europe in Berlin, with a branch office in Shanghai, China
• Offers a full-time MBA, an executive MBA, a master's in management as well as open enrollment and customized executive education programs

Founders of ESMT Berlin

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Energy activities focusing on downstream innovation
Upcoming book to analyze governance and business model innovation on a global scale

Contents

1. Introduction: The rise of decentralized renewable energy generation

2. Regulatory and policy incentives – establishing governance of decentralized energy systems
   Country analysis: Australia, China, Denmark, Germany, India, Italy, California and New York

3. Business models beyond subsidies – which core competencies are needed?
   Case analysis: Envio Systems, Timo Leukefeld, Entelios, SOLshare, Mobisol, Solarkiosk, Power Ledger

4. The three phases of the energy transformation – top-down and bottom-up

5. Global game changer – leading the future
## Agenda

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The value chain of the energy business is turned upside down: the case of Germany

The revolution is not renewables but the opportunity to produce own energy with increasing complexity for the system and market

Source: Burger/Weinmann (2014/17)
Digitalization investments aim to enable better performance, new networks and services in the light of a new energy world.
## Agenda

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AI is creating opportunities for new service models

- Drones and insect-size robots identify defects, predict failures, and inspect assets without interrupting production.
- Smart wires combine with machine learning to enable real-time power dispatching, and optimize it to current grid load.
- Few technicians remain, but they spend more time on problem solving; in place of logging inspection status by hand.
- Machine learning–enabled forecasting anticipates supply and demand peaks.
- Virtual agents automate call centers, and automatically segment consumers based on service history; machine learning offers early warning of bad debts.
- Drones and insect-size robots identify defects, predict failures, and inspect assets without interrupting production.
- Smart-meter data and machine learning enable utilities to offer services based on usage, weather and other factors.
- Field workforce receives real-time updates to decrease response times and reduce the impact of outages.
- Sensors and machine learning allow for by-the-minute adjustments to maximize generation efficiency.

Source: McKinsey (2017), image source: 3M Switzerland
Envio Systems is leveraging the Internet of Things for a low-cost alternative for building efficiency …

Hardware: 500 EUR
- Smart Climate Controls
- Smart Lighting Control
- Demand Response
- Occupancy Controls
- Failure Detection
- Weather Predictor

Hosting: 5 EUR per controller per month

Reporting System
LEED and BOMA Best Tracking
Real-time Energy Tracking
Mobile and Email Alerts
Security System

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<th>Criteria</th>
<th>envio</th>
<th>Honeywell, etc.</th>
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<td>Payback period</td>
<td>1-2 Years</td>
<td>6-8 Years</td>
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<td></td>
<td>$0.60-$0.80 Per Sq./Ft.</td>
<td>$3-$4 Per Sq./Ft.</td>
</tr>
<tr>
<td>Installation</td>
<td>60 KEUR</td>
<td>240 KEUR</td>
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Source: envio
… while still keeping human control on it

Reza Alaghehband, CEO

1) Device recognition
- Naming conventions of HVAC devices often unclear
- Understand common serial numbers and match them with the category of the device and manufacturer
- Recognize device according to consumption patterns by learning from all the buildings that are part of the Envio database

2) Predictive maintenance
- Train the system to identify potential breakdowns
- Analyze data to recognize patterns (e.g. burst pipe) to trigger preventive actions

“We don’t trust it!
We don’t put the machine in critical aspects applications
If uncontrolled, it may heat up to 90°F (32°C)!"
Blockchain: within the ETIBLOGG (Energy Trading via Blockchain-Technology in the LOcal Green Grid) project, ESMT is analyzing business models, potential and hurdles.

ESMT research questions

- How do business models in energy applications and platforms differ between single providers and consortia?
  ⇒ Qualitative interviews with providers from the energy sector, and non-energy firms, in particular finance/ fintech

- In which fields do executives see the greatest potential and hurdles for implementing Blockchain solutions in the energy sector?
  ⇒ Quantitative global survey among professionals in jobs related to the energy sector.
Based on a global survey in 2019 in energy business, more than 70% see Blockchain as a game changer or with further dissemination likely – an enabler of the transformation?

**HOW HIGH DO YOU ESTIMATE THE POTENTIAL OF BLOCKCHAIN IN THE ENERGY SECTOR?**

- All responses (2019)
- USA & Australia (2019)
- DACH region (2019)
- Germany (2016)

Source: ESMT survey (2019), n=72 respondents, work in progress
The potential of Blockchain within the transformation of energy markets is evenly distributed between platforms/marketplaces and process optimization.

Source: ESMT survey (2019), n=72 respondents, work in progress
Qualitative interviews with key decision-makers in energy-related, financial and multi-sector Blockchain applications were conducted to shed light on the business models pursued.

Source: ESMT research, work in progress
Blockchain used as communication channel with 90% cost reduction and no regulatory hurdles

Value proposition

“It’s not just 20% technical optimization, it is **90% cost reduction**, because this organizational cost disappears. Instead, the nodes need to be hosted in the cloud, which - compared to 5 million - is maybe in the range of 5-10,000 Euro.”

Blockchain usage

“That is just a **communication channel**. You can compare that with a chat service for example, with the Yahoo Messenger – before it was decommissioned, is been used as a **tool to offer and accept offers between traders**.”

Hurdles

"One is a **technical pain point** …If it is a high frequent market, Blockchain won't work for the execution because **we always have a delay.**” …

"And the second pain point has absolutely **nothing to do with the technology** …there have been brokers who attempted to establish a new platform and they all **failed in dragging liquidity** from the existing platforms..” …

"If you have this multilateral trading facility (MTF), which simply said is like an exchange, you have a bunch of **regulatory requirements to fulfill** and that is a very complex situation.”

Financing

“Instead of having this foundation approach, we first start this as a service. Market participants will pay a fee of **€500 per month**, including 500 transactions per month. If it goes beyond 500 transactions per month, it will be charged on the basis of additional transactions.”

Source: ESMT research, work in progress
<table>
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<th>Value proposition</th>
<th>Blockchain usage</th>
<th>Hurdles</th>
<th>Financing</th>
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<td>“The solutions are categorized in three dimensions. The first dimension is <strong>join</strong>, the second is <strong>coordinate</strong>, and the third is <strong>build</strong>: software as a service, like subscription, you have cloud services, and you have consulting application services.”</td>
<td>“In my view, first are the typical value propositions that are addressed and delivered by Blockchain technology: first transparency, second trust; third, speed or acceleration concerning processes; and fourth, a wallet, the security dimension. Therefore <strong>trust, security, speed, acceleration.</strong>”</td>
<td>“We use Hyperledger Fabric, only because we truly believe that it is the only really enterprise-ready technology, it’s really important to have technology that is <strong>capable to run these high performance numbers.</strong>”</td>
<td>“It’s a heterogeneous approach with services offerings coming out of different areas within our company, like <strong>consulting, architectural services, software as a service cloud, and so on, as the solutions are very different.</strong>”</td>
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<td>“We <strong>develop software</strong> for the decentralized network (platform), facilitate meetings, and produce or develop customized software for some of our affiliates, like IT services, or license payments. It’s very similar to <strong>Linux Red Hat business model</strong>, on the one side Linux made an open source software, on the other side Red Hat made money with services. So you can consider our organization as a mixture between Linux and Red Hat in one.”</td>
<td>“Our affiliates tend to use the <strong>Blockchain as little as possible</strong>, because it costs money to use the Blockchain. So, usually it’s being used for coordination purposes, for access rights, for value transactions, for a recording of provenance, and so forth. But as little as possible. Generally, <strong>coordination of rights or of ownership of assets.</strong>”</td>
<td>“We have a bigger problem on the <strong>privacy issue</strong>. Where we developed a couple of features around privacy, but of course, it’s easier in a private chain.”</td>
<td>“Besides fundraising, cash flow. It will be combination of cash flow based business models, which is as I said before, the <strong>Red Hat business model</strong> and a mixture of <strong>token economics.</strong>”</td>
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Source: ESMT research, work in progress
Cyber security: a study by Alert Logic indicates that 37% of respondents estimate that their firm’s sensitive data had been breached in the past 12 months.

Sources of cyber attacks

Business models

- Industrial espionage
- Blackmailing
- Influencing (e.g. M&A)

Source: https://www.designnews.com/industrial-machinery/new-age-hackers-are-ditching-smash-and-grab-techniques/28836791746541, retrieved on 06.08.2019
Example smart meter infrastructure: while Blockchain might provide a solution for cyber risks, smart meter infrastructure is specifically vulnerable at the edge.

What is your opinion on cyber risks in relation to blockchain technology? (in percent)

- Blockchain is a strong concept for secure transactions as it has an immutable distributed ledger.
  - Strongly agree: 22%
  - Agree: 56%
  - Undecided: 18%
  - Disagree: 2%
  - Strongly disagree: 2%
  - I don’t know: 8%

- Our cyber security strategy and policy sufficiently cover security risks due to blockchain use cases.
  - Strongly agree: 4%
  - Agree: 8%
  - Undecided: 27%
  - Disagree: 33%
  - Strongly disagree: 16%
  - I don’t know: 12%

- Blockchain use cases bring new security risks to an organization.
  - Strongly agree: 2%
  - Agree: 51%
  - Undecided: 25%
  - Disagree: 12%
  - Strongly disagree: 4%
  - I don’t know: 6%

- We have implemented specific measures to deal with the security risk of blockchain use cases.
  - Strongly agree: 2%
  - Agree: 18%
  - Undecided: 33%
  - Disagree: 27%
  - Strongly disagree: 14%
  - I don’t know: 16%


- **Technical failures**
  - Antiquated, insecure protocols

- **Institutional/ regulatory failures**
  - Cost-driven regulation of distribution grid service operators

- **Organizational failures**
  - Insufficient knowledge of distribution grid operators
Summary

Chapter 1
What drives digitalization in the energy world? – a short teaser
- The value chain of the energy business is turned upside down: the case of Germany
- The revolution is not renewables but the opportunity to produce own energy with increasing complexity for the system and market
- Digitalization investments aim to enable better performance, new networks and services in the light of a new energy world

Chapter 2
What is the role of big data/ AI, Blockchain and cyber security? – potential and challenges
- AI is creating opportunities for new service models with providers (e.g. Envio) still controlling it by humans
- Blockchain is seen as a game changer or with further dissemination likely providing process and platform solutions with no hurdles for implementation up to many hurdles when using tokenization
- Cyber security is getting more important while smart meter infrastructure is specifically vulnerable at the edge