

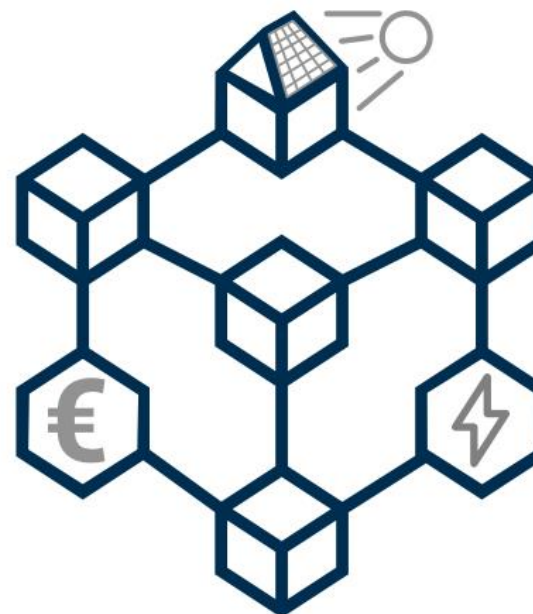
Technical aspects of implementing dynamic electricity prices in the context of a local electricity market

Experiences from the BEST project

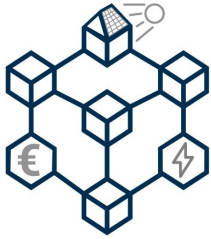
Gefördert durch:



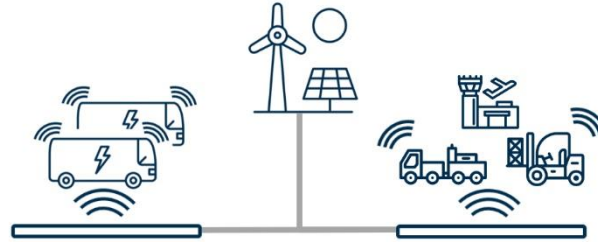
aufgrund eines Beschlusses
des Deutschen Bundestages



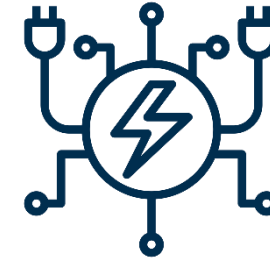
BEST – Project Goals



Blockchain-Based



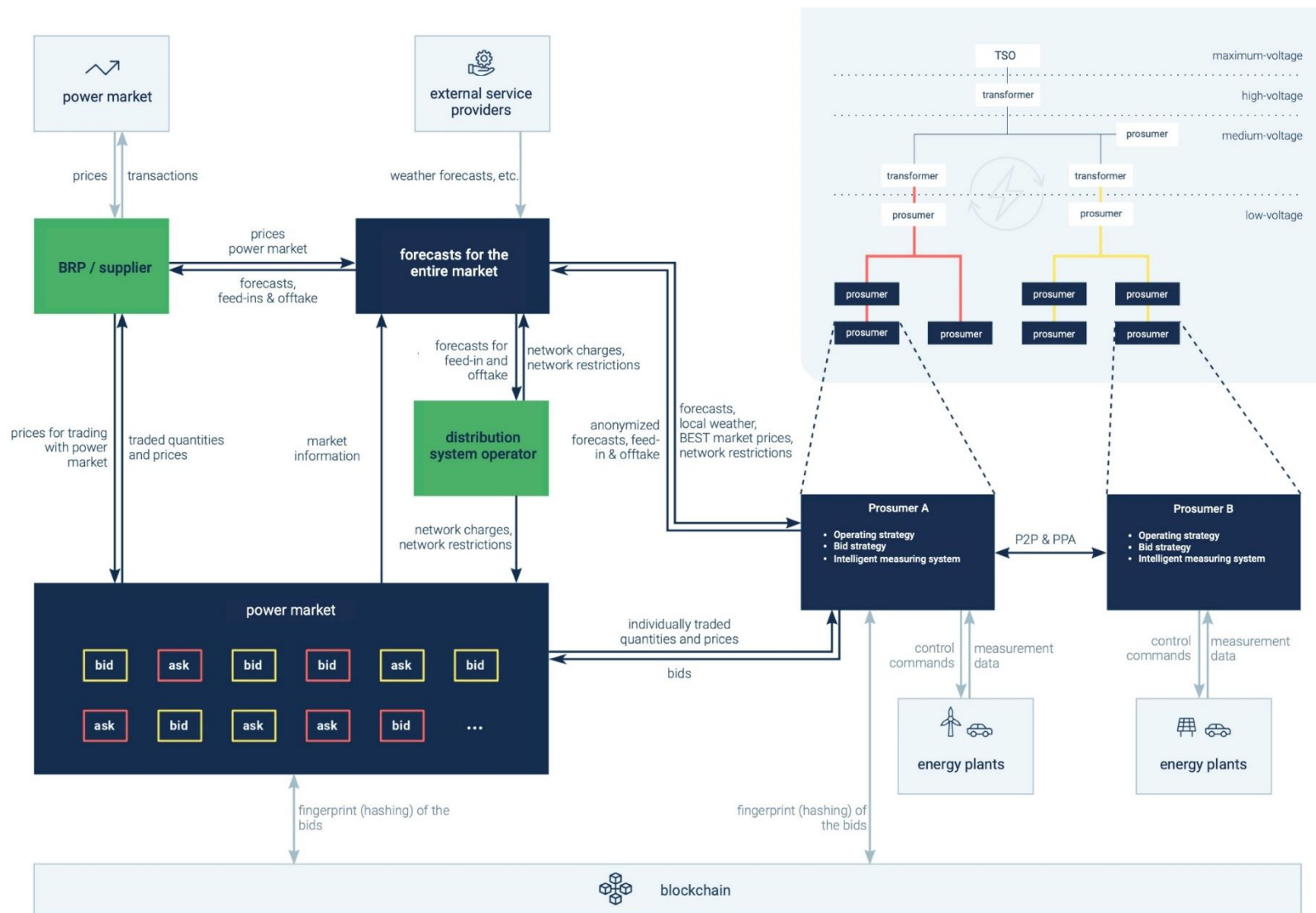
Decentralised Energy Market Design



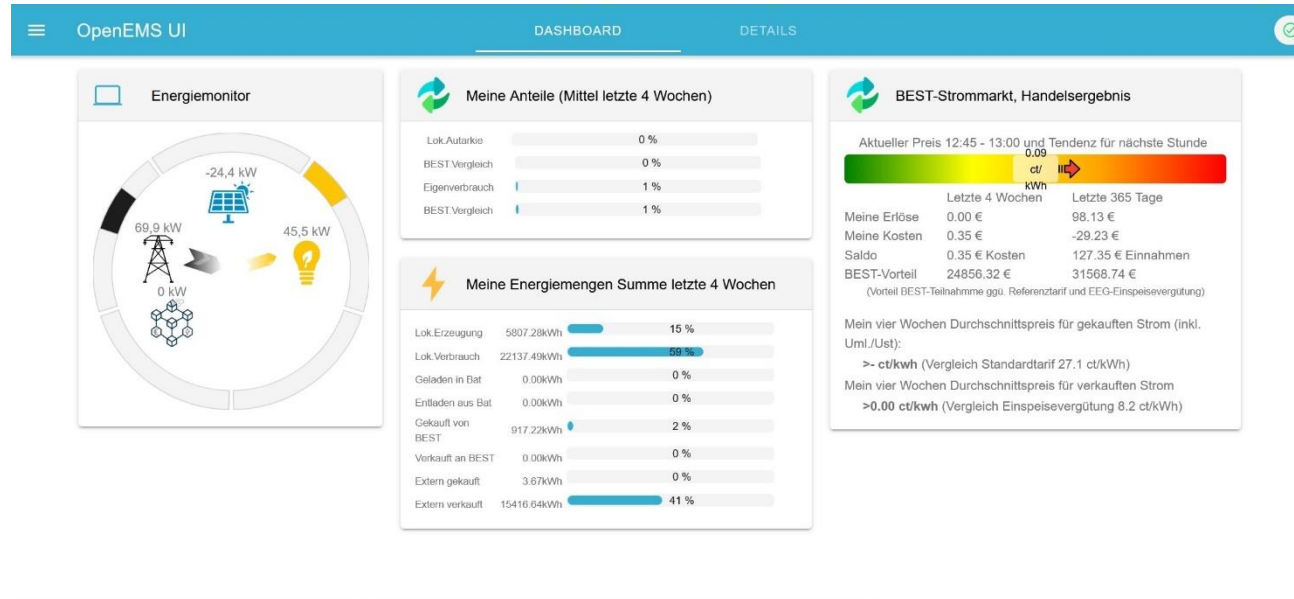
and Management Structures

- Activating flexibility in **small businesses** and households
- Provision of an independent platform for p2p trading
- Combining market and grid efficiency

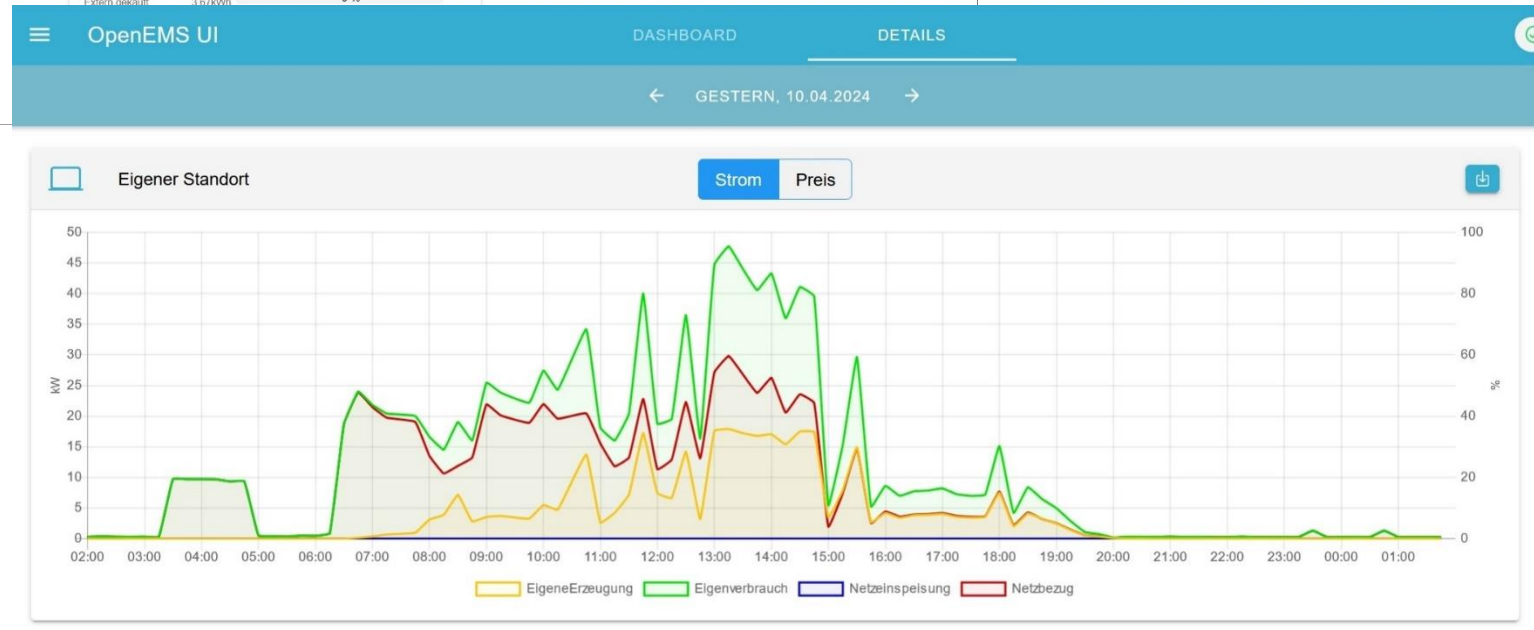
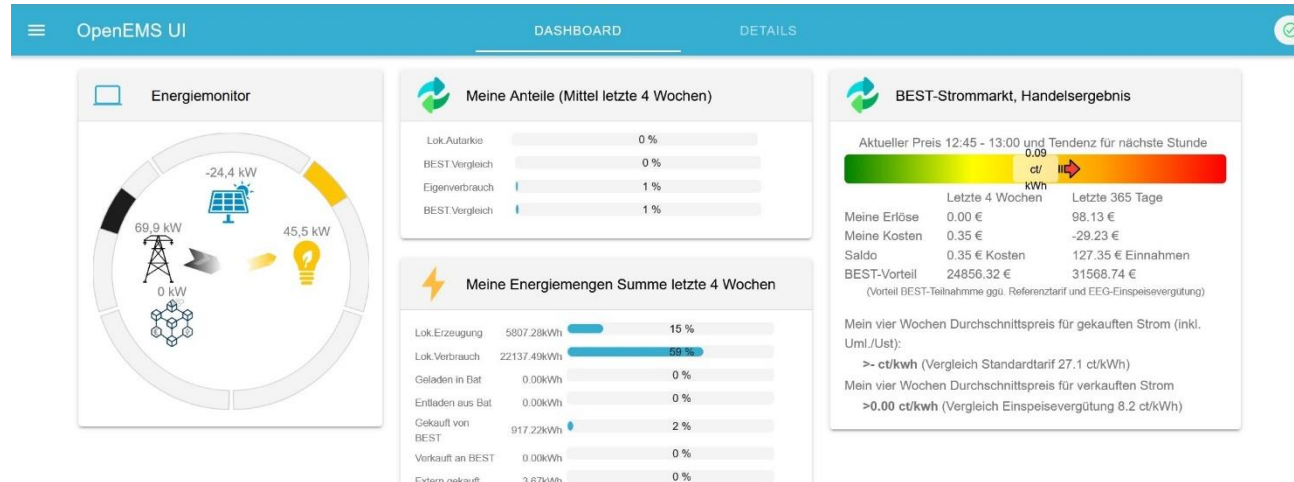
Local Electricity Trading System



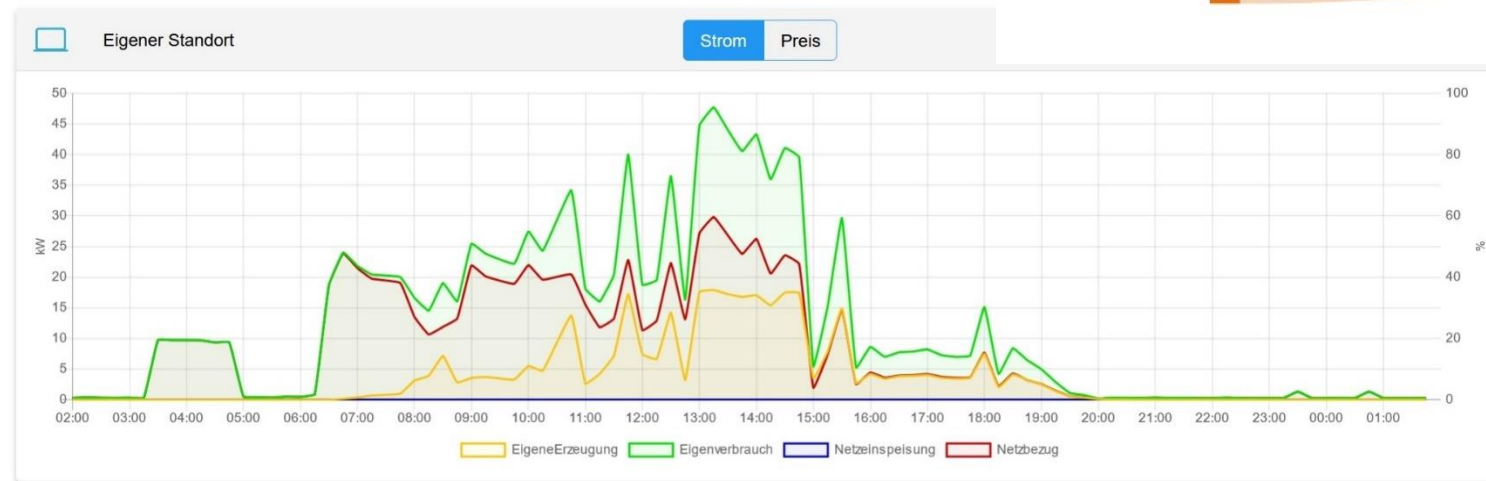
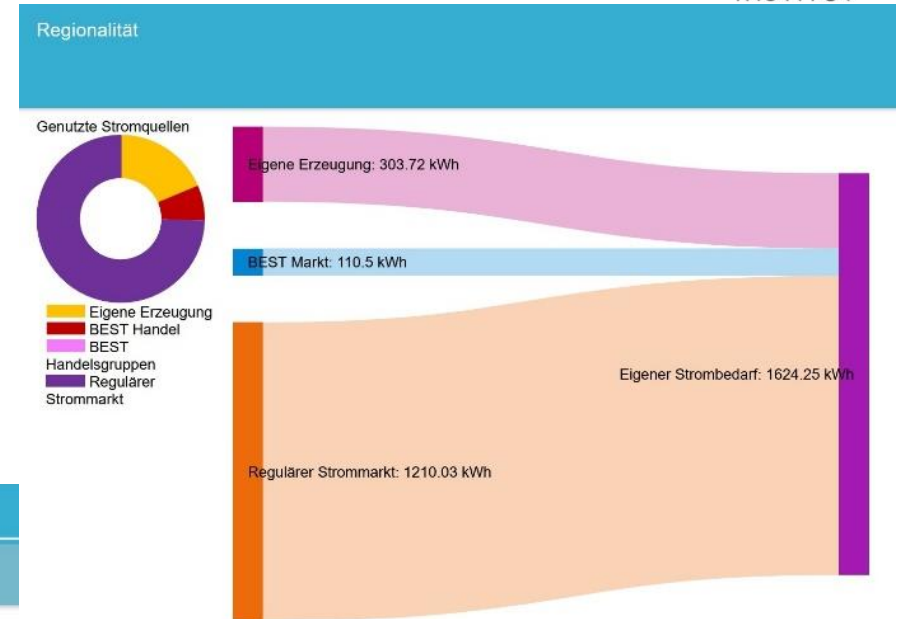
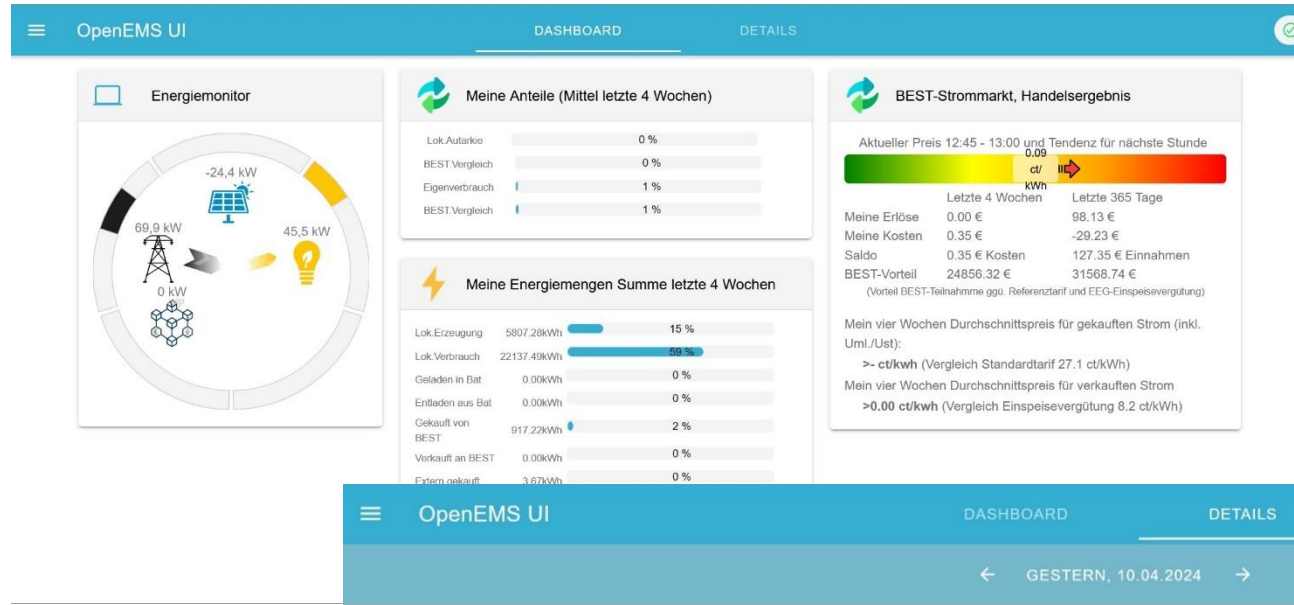
Status Quo: Prosumer GUI



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Status Quo: Prosumer GUI



Aspects of the Local Electricity Market

- Blockchain
- Security architecture
- Market with corresponding logic
- Compliance with legal regulations
- Local IT hardware infrastructure
- Local schedule creation / machine learning
- Manufacturer-independent (home) energy management systems (H)EMS
- Integration into energy industry
- Grid information integration

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| IET Energy Systems Integration



ORIGINAL RESEARCH

Design and evaluation of architectural framework for a secured local energy market model based on distributed ledger technologies

Godwin C. Okwuibe^{1,2}  | Thomas Brenner² | Muhammad Yahya² |
Peter Tzscheuschler¹ | Thomas Hamacher¹

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Heim, J.-R./Hagemann, A. (2022):

System der Netzentgeltbildung in Deutschland – Überlegung zur möglichen Einführung differenzierter (variabler) Netzentgelte innerhalb des einzelnen Verteilernetzes
EWeRK 4/2022, S.140

Heim, J.-R./Noack, T./Hagemann, A. (2022):

Umsetzung von Erneuerbaren Energie-Gemeinschaften und der Netzentgeltsystematik in Österreich
EWeRK 6/2022, S.230-34

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Critical Aspects: Scheduling and AI



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Zhiwei Han
PhD, Electrical Engineering
Researcher
fortiss GmbH

Local predictions

1. Individual consumption and generation patterns: models must be trained on the basis of **individual data sets**
2. Important influencing factors such as shading by clouds cannot be mapped

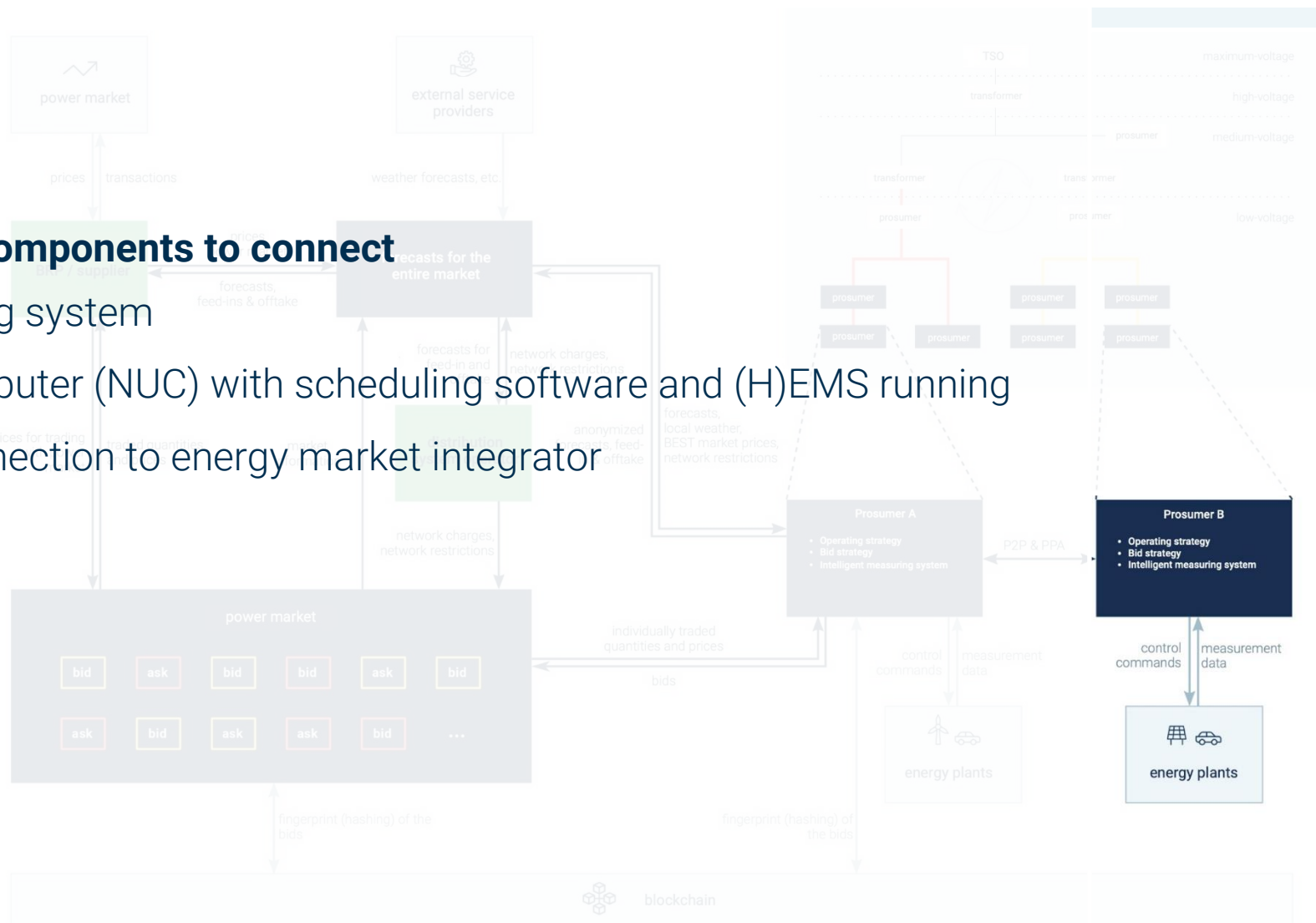
Trading

1. There is no meaningful historical training data for markets that change significantly or for new markets that emerge
2. Volatility of predictions may cause discrepancies between the planned and effective power grid extraction/feed

Overview: Technical connection

Necessary components to connect

1. Measuring system
2. Mini computer (NUC) with scheduling software and (H)EMS running
3. Data connection to energy market integrator



Critical Aspects: IT Infrastructure / Measuring



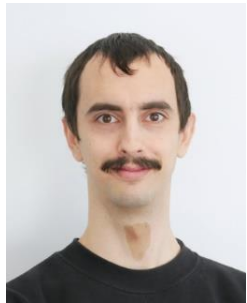
Felix Förster
M.Eng. System Engineer
Energy Systems Engineer
OLI Systems GmbH

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The **high heterogeneity** of the participants creates the need to

- Record the "actual" status via **onboarding check**
 - Recorded and evaluated existing **network technology, measurement concepts** and **communicative interfaces**
- Followed by **installation plan** of the technical and organizational measures still to be implemented in order to get the customer to a "BEST-ready" state
- Process is **time-consuming** and involves employees with **different skillsets**

Critical Aspects: (H)EMS

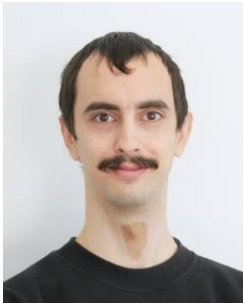


Stefan Schirmeister
M.Sc. Technical Computer Science
Research Associate
Reiner Lemoine Institut

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- Only very **few devices are OpenEMS ready**
 - Initiatives such as EEBus, attempt to **ensure compatibility** - currently very low availability in the field

Critical Aspects: (H)EMS

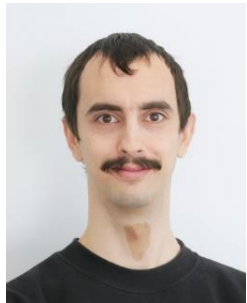


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- Control of systems was not possible
 - **Liability**
 - No customers with OpenEMS-ready controllable systems

Critical Aspects: Integration into Energy Industry



Sebastian Steuer

Business Development and Product Management
e-regio GmbH & Co. KG

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- **IT-System landscape** at energy suppliers **inflexible** and difficult to expand
- Encountered **insufficient data quality** to migrate data to new systems
- **Dependencies** prevented individual solutions from being replaced without changing several systems at the same time

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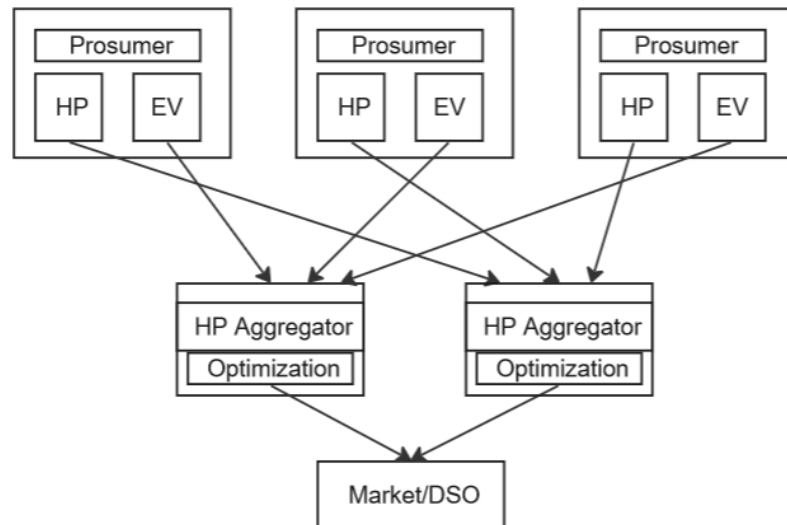
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- **IT-System landscape** at energy suppliers **inflexible** and difficult to expand
- Encountered **insufficient data quality** to migrate data to new systems
- **Dependencies** prevented individual solutions from being replaced without changing several systems at the same time
- No sufficient **monetary incentives** for customers
- Households and companies want **long-term price security**
 - **Price caps**
 - **Participation in generation capacities**

Overview: Proprietary Cloud vs. (H)EMS

Proprietary EMS & Cloud Services

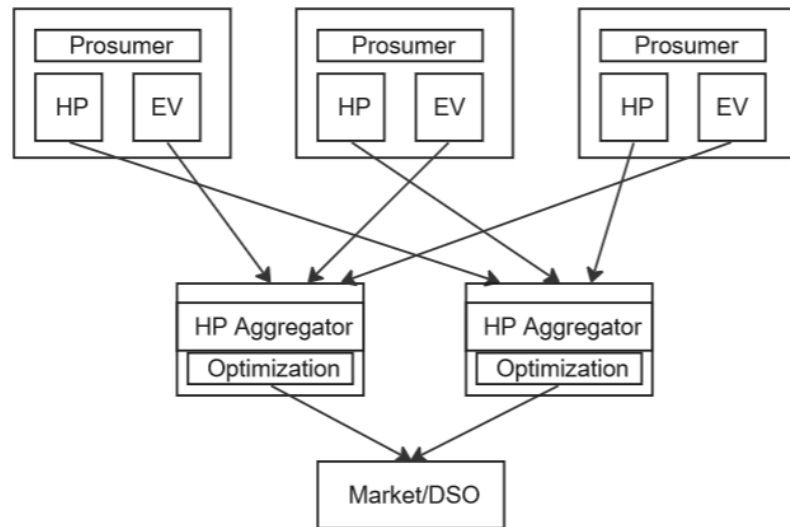
- ✓ Simplified operation
- ✓ Minimized compatibility issues
- ✓ Optimal tuning for manufacturer-specific devices
- ✓ Support and warranty



Overview: Proprietary Cloud vs. (H)EMS

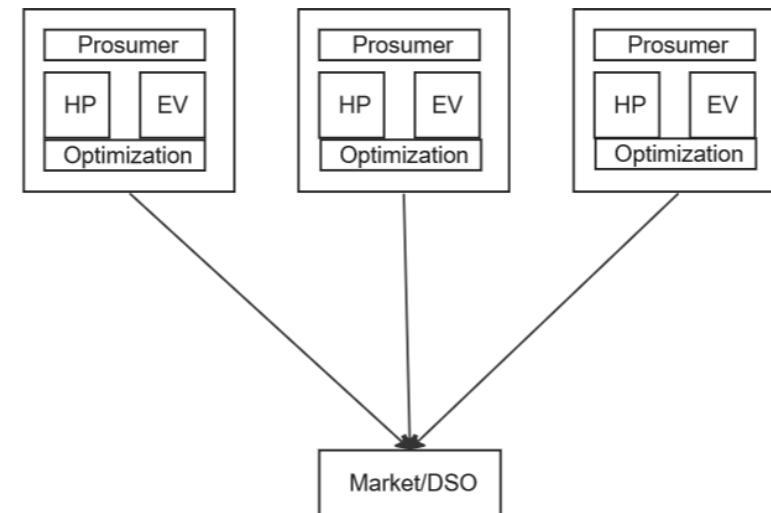
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Independent (H)EMS

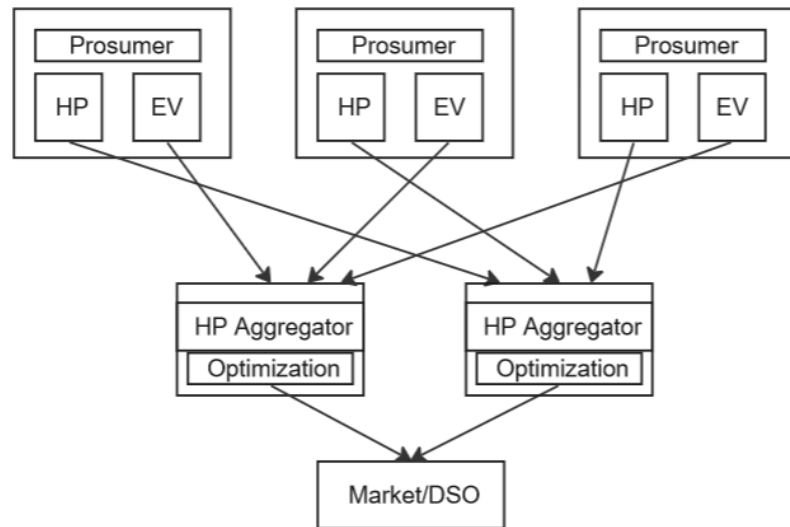
- ✓ Integrates devices from various manufacturers
- ✓ No lock-in effects
- ✓ Cost-effectiveness: Utilizes potentially cheaper components
- ✓ Enables optimization of interdependent devices
- ✓ Control over own data



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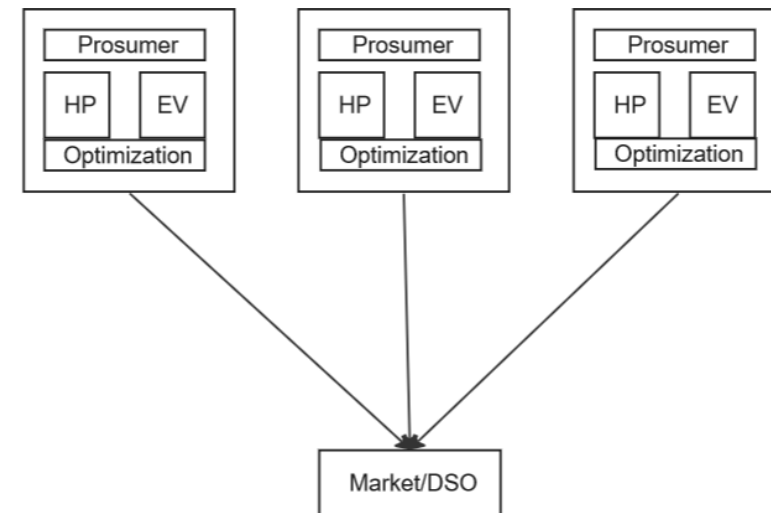
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Faster availability of flexibility in the market when marketed by aggregators

Conclusions & Future Work

- > most things are possible, little is economically viable and scalable so far
- > grid integration is still in its infancy

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➤ Open standards

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- Open standards
- Grid integration
 - Market control vs. grid-side control commands
 - Information in advance for local planning

Conclusions & Future Work

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- Open standards
- Grid integration
 - Market control vs. grid-side control commands
 - Information in advance for local planning
- Investigation of price reaction dynamics for different scenarios

Thank you for your attention!



We support you!

- ... Partnerships
- ... Research cooperations
- ... Joint project applications



Dipl. Ing.

Friederike Reisch

Project Development

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