



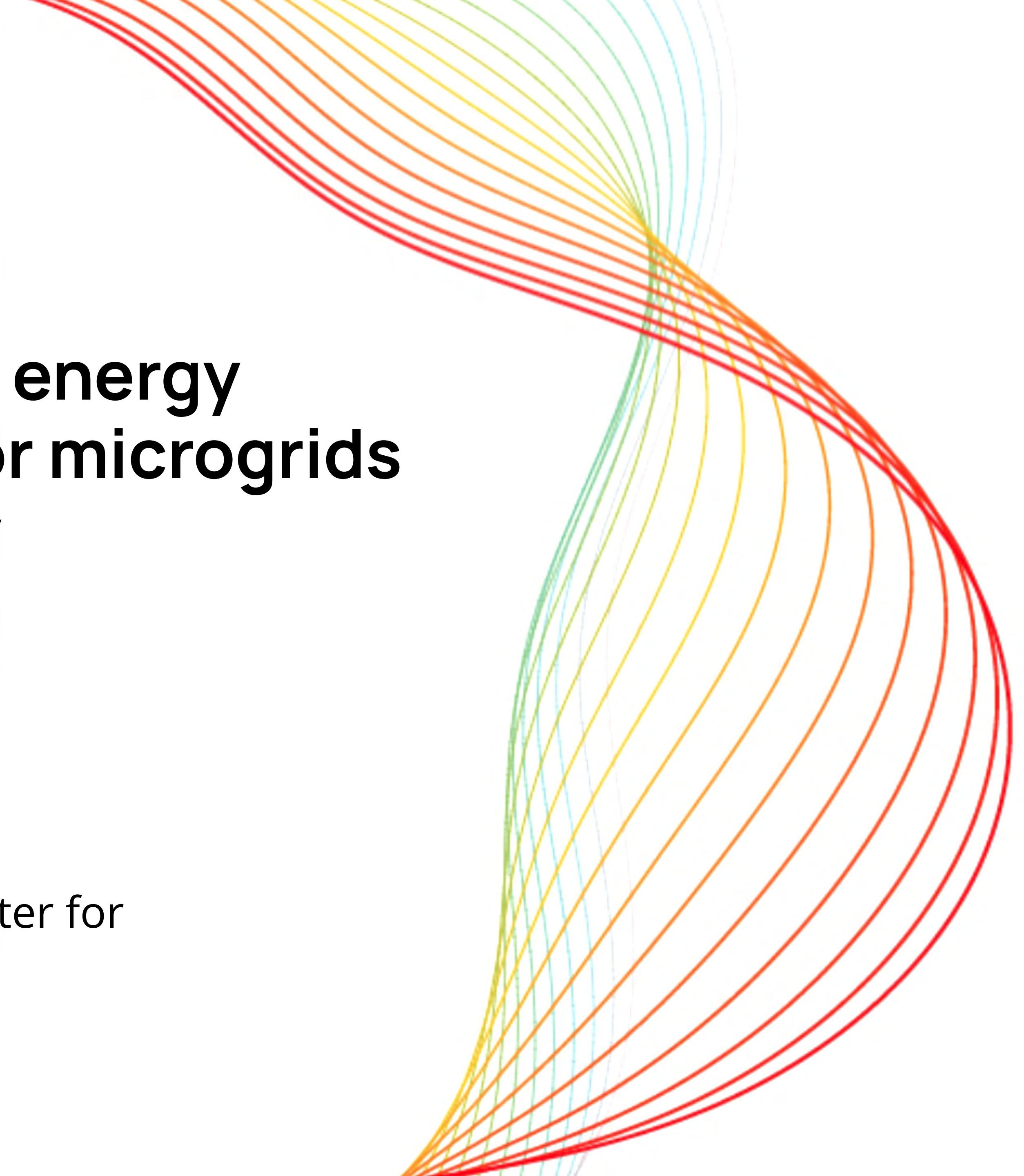
Cutting-edge blockchain and energy management technologies for microgrids as the key to affordable energy for everyone

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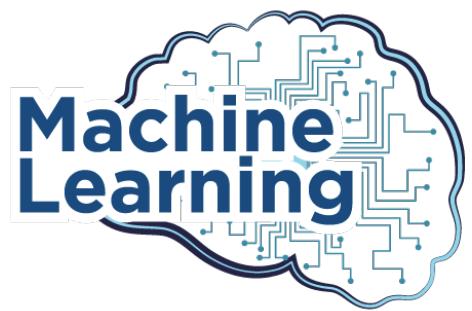
Microgrids' future



125 millions of people don't have access
to electricity or not satisfied with it's quality

Isolated microgrids are recognized as key
to energy infrastructure in a number of regions
including South-East Asia, Africa and Europe

Grid forming platform (GFP)



AI-bots



Hardware-software solution «GFP»

IOT Platform

Auctioning mechanism

Transactive platform

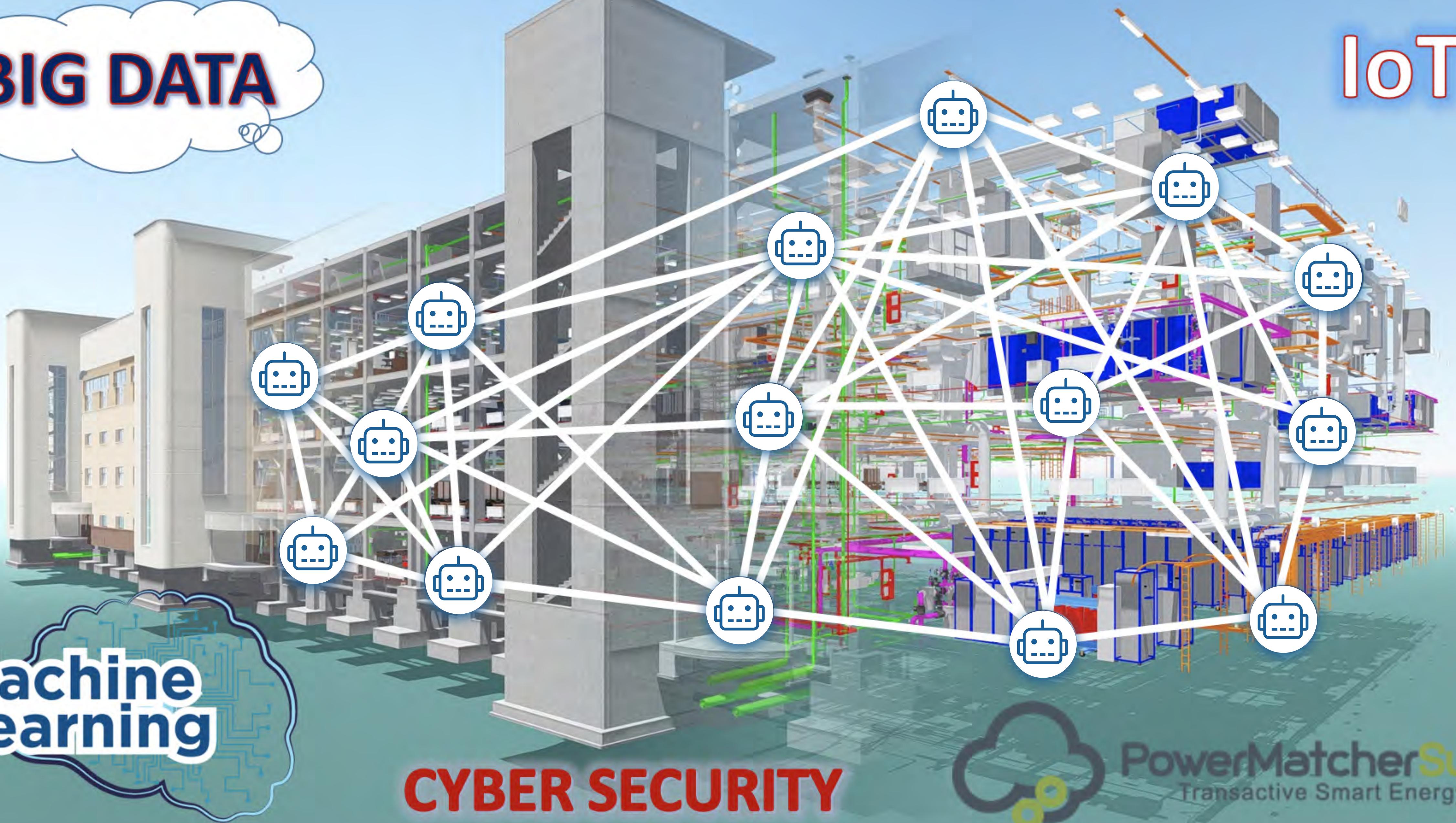
Cyber-security

Existing market solutions for «GFP»

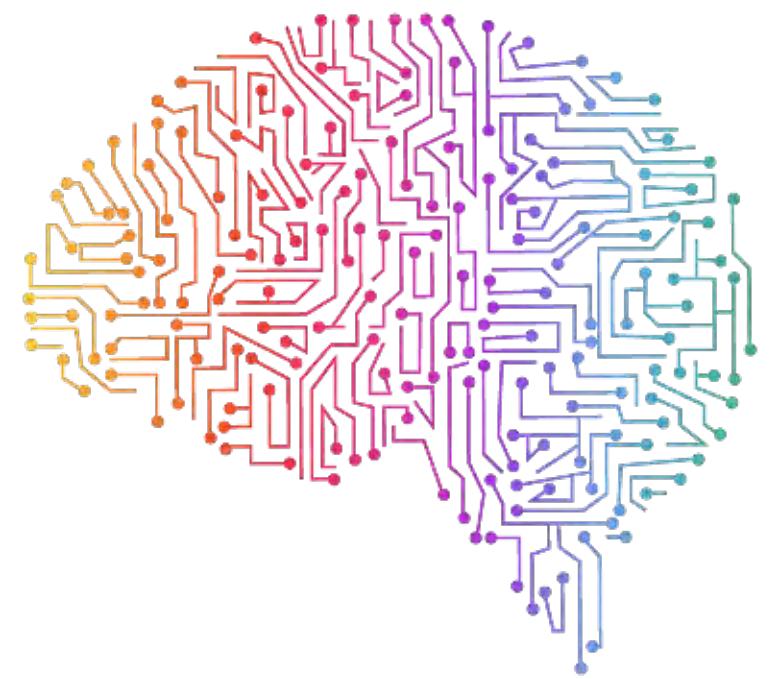


BIG DATA

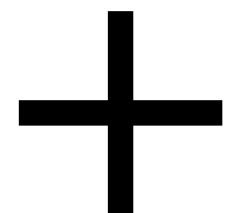
IoT



Realization of such a level of energy technological intelligence for the service is possible through the tool of the IoT and Machine learning of energy equipment



Artificial
Intelligence



Commercial
operator

PARTNER



Software and hardware
services platform for
launching marketplaces
in the utility energy
sector

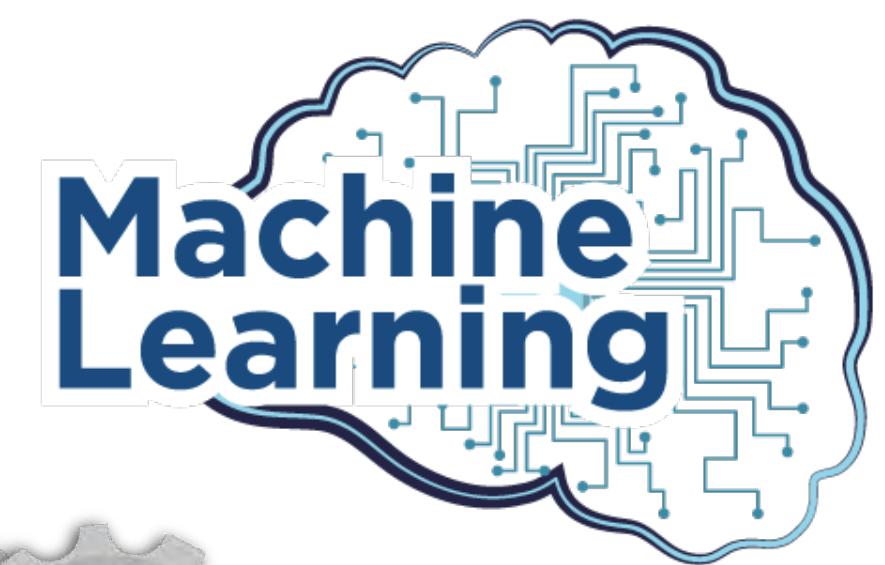
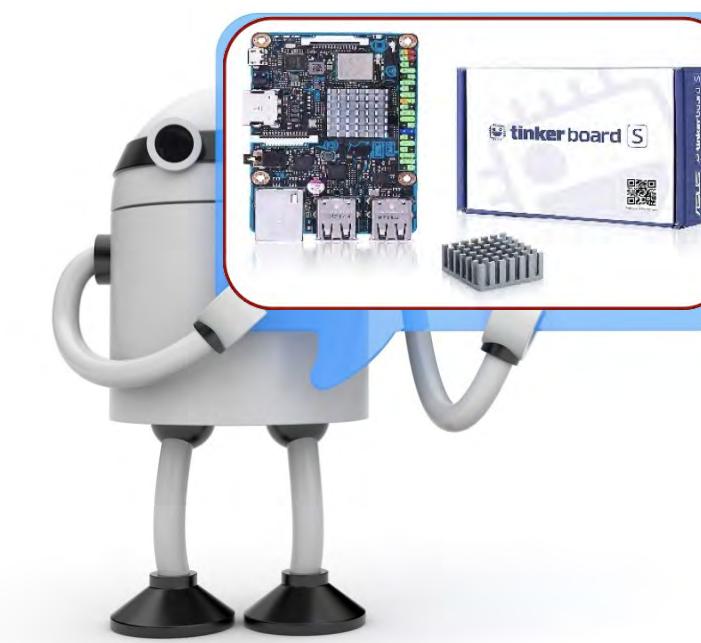
MIPT Data center
port operational
data
data from sensors
energy production
data



Big data

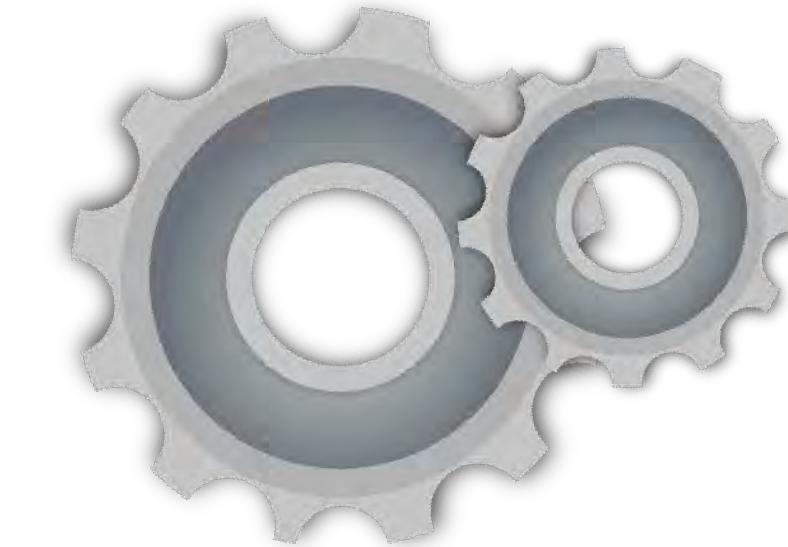


Bot Agents



Servers
operator's, regulator's

Cyber security



Flexibility service

Two-stage economic mechanism:
long and short periods

Project's parameters

1st stage

NTU microgrid equipment – SAS-1,2

Producers:

- Set of solar panels × 2
- Diesel engine × 2

Prosumers:

- Energy storage system × 4

Consumers:

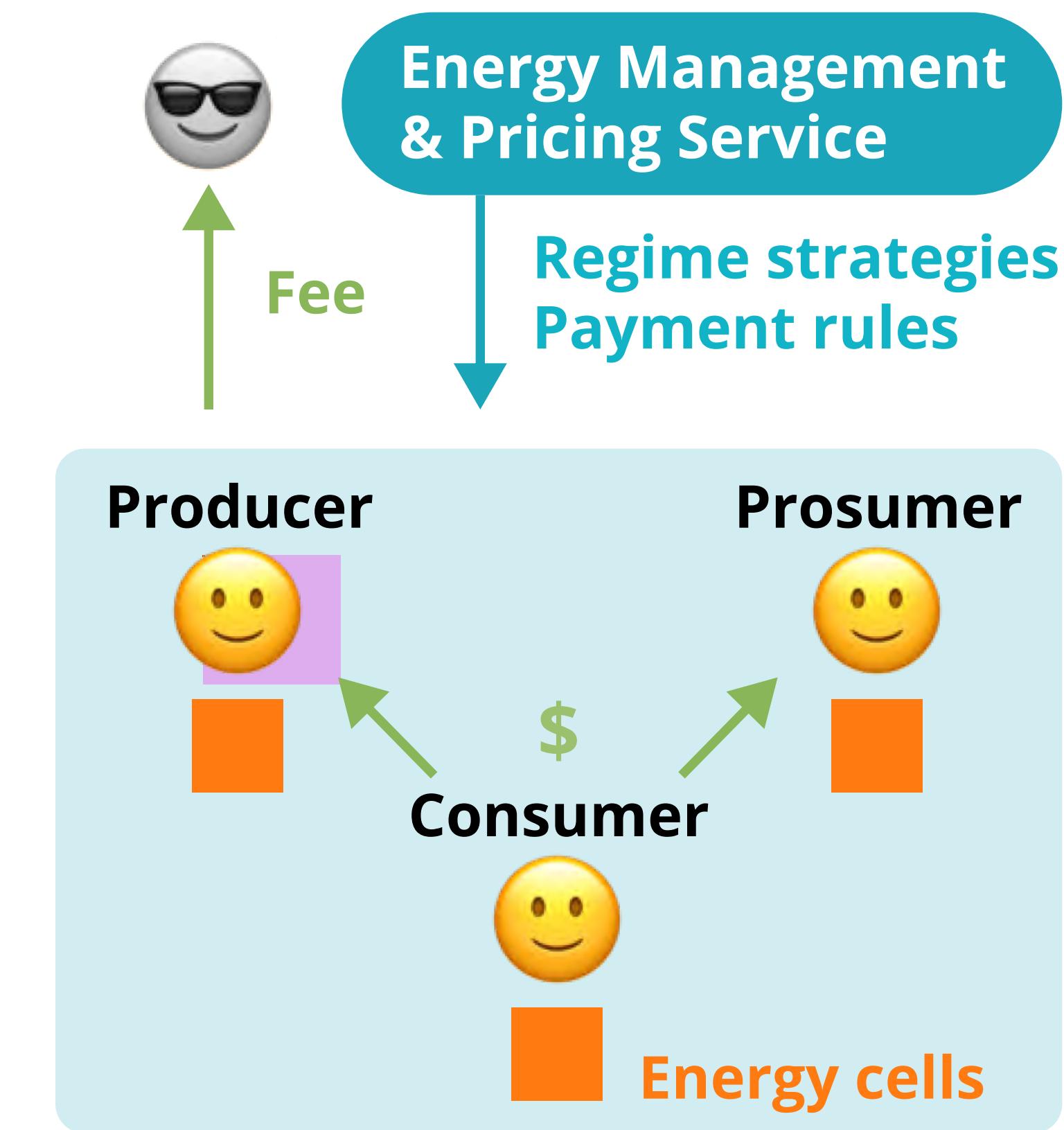
- Programmable load × 2



Microgrid commercial operator

Business model

- Commercial operator manages technical and economical parameters of the microgrid and takes it's fee
- Consumers pay according to weighted average (equilibrium) price
- The criterion for optimizing energy production modes is the minimum price for the consumer



Microgrid management systems



Energy Management System

- Improvement of power quality and reliability indexes
- Loss reduction
- Automatic control
- Optimization of energy costs



Trading platform

- Deep settlements and billing automation
- Instant split of payments
- Reduction of operating costs
- New revenue streams — new services (flexibility management, demand response, pricing signals and peak shaving)

REIDS architecture

Step 1. Registration of new users/participants

Step 2. Setting pricing parameters (for producers, prosumers, operator)

Step 3. Calculation of the optimal producing regime for the next period

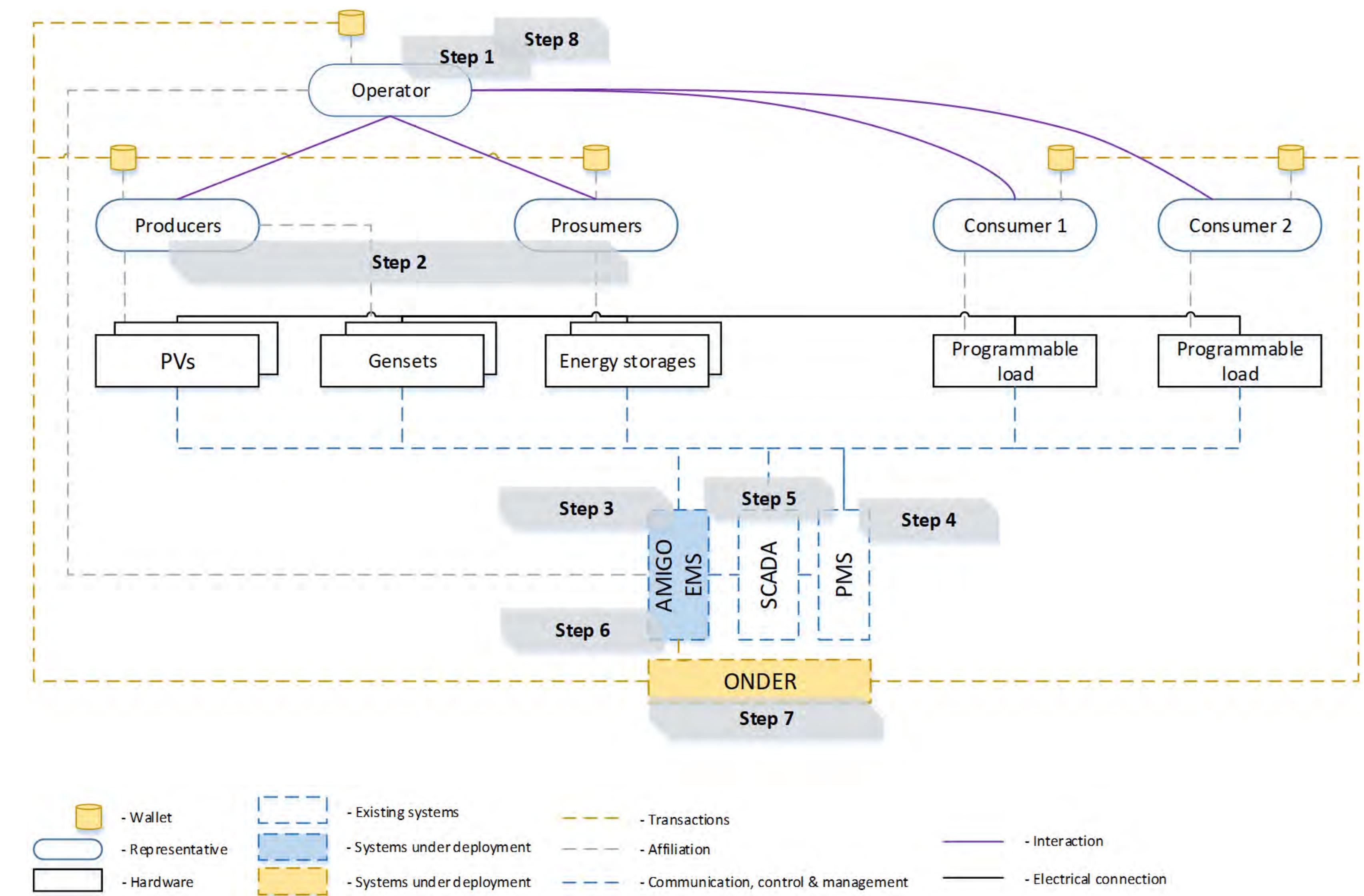
Step 4. Regime execution management

Step 5. Measuring produced and consumed energy

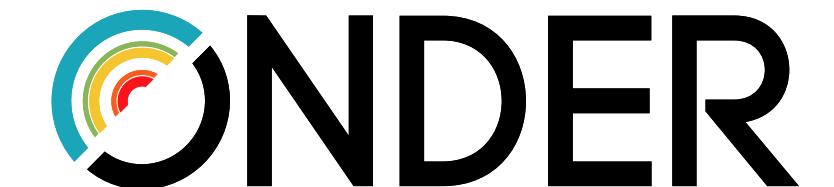
Step 6. Transformation of the measurements data

Step 7. Transactions execution (including the calculation of the equilibrium factual price for each 15 min)

Step 8. Data analysis and reporting

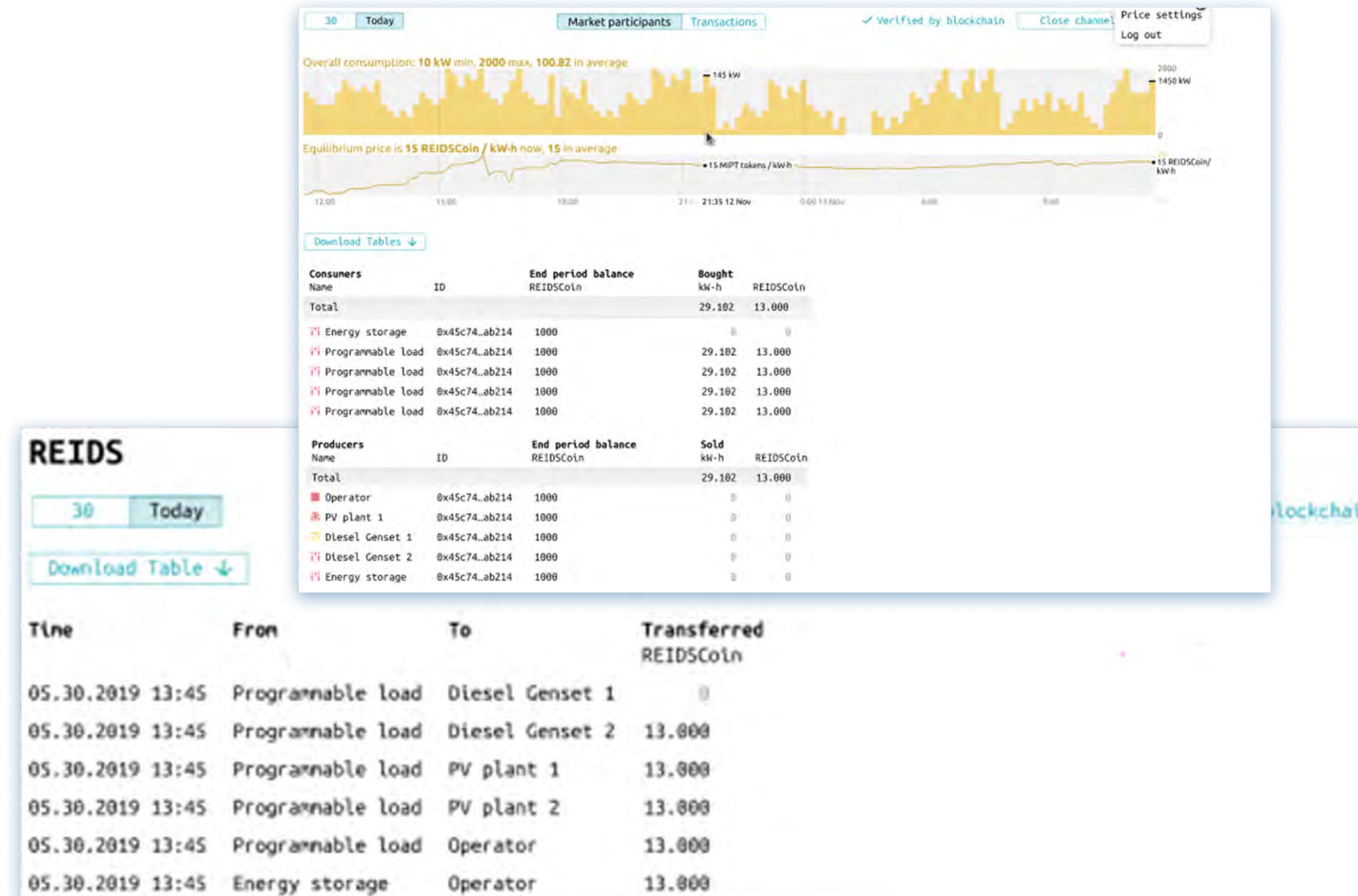


ONDER features



That are tested in the 1st stage:

- API for EMS system
- Participant's price settings interfaces
- Physical volumes of energy transferred
- Pricing algorithm for energy exchange



ONDER features

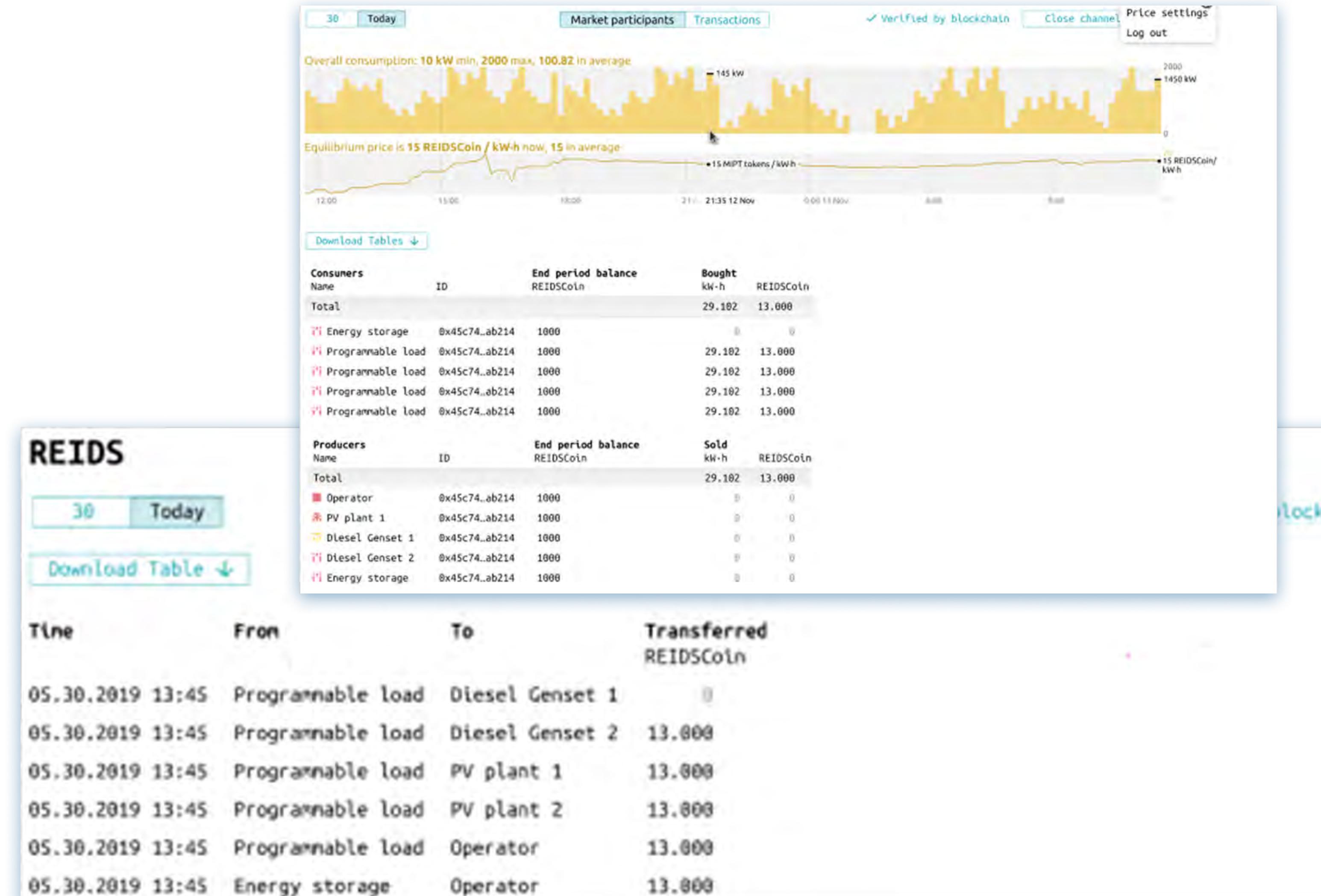


That are tested in the 1st stage:

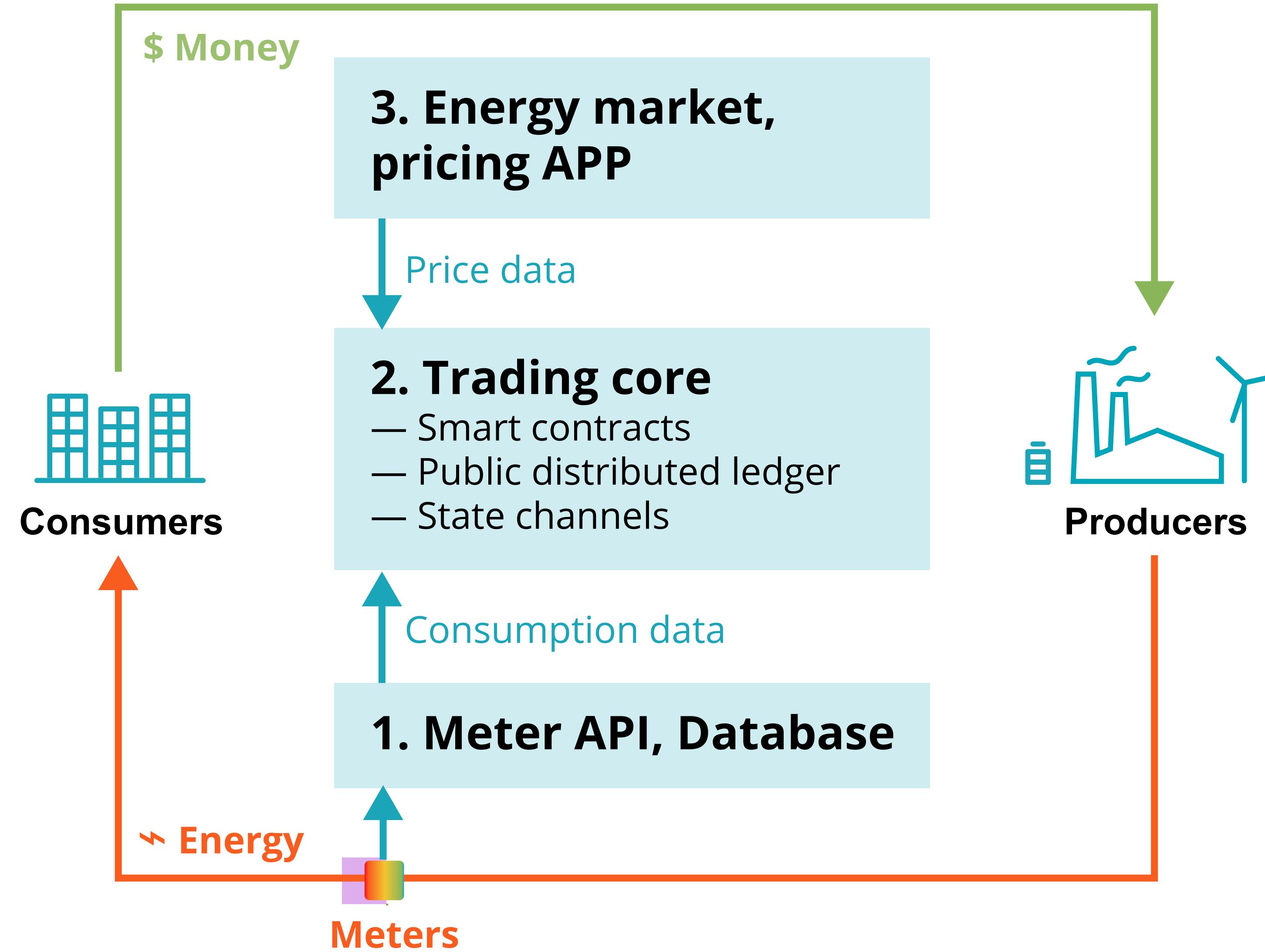
Metering data notarization (anchoring) in a public blockchain

Transactions execution and monitoring:

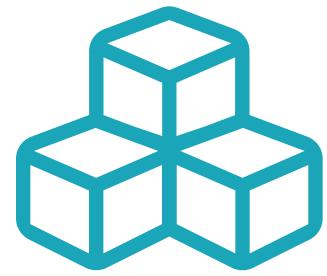
- virtual meter nodes
- solidity smart contracts
- state channels technology
- ERC20 tokens and wallets
- UI for the microgrid Operator and participants



ONDER platform



Technological capabilities



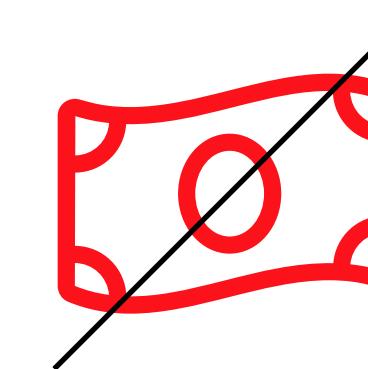
Distributed ledger technology
immutability of physical data



State/debt channels technology
high-frequency, low-cost transactions



Smart contracts
transactions that everyone trust



Token indifferent
client's any token entity



Friendly to existing hardware and environment
high interoperability to accounting systems, economic models, bank API

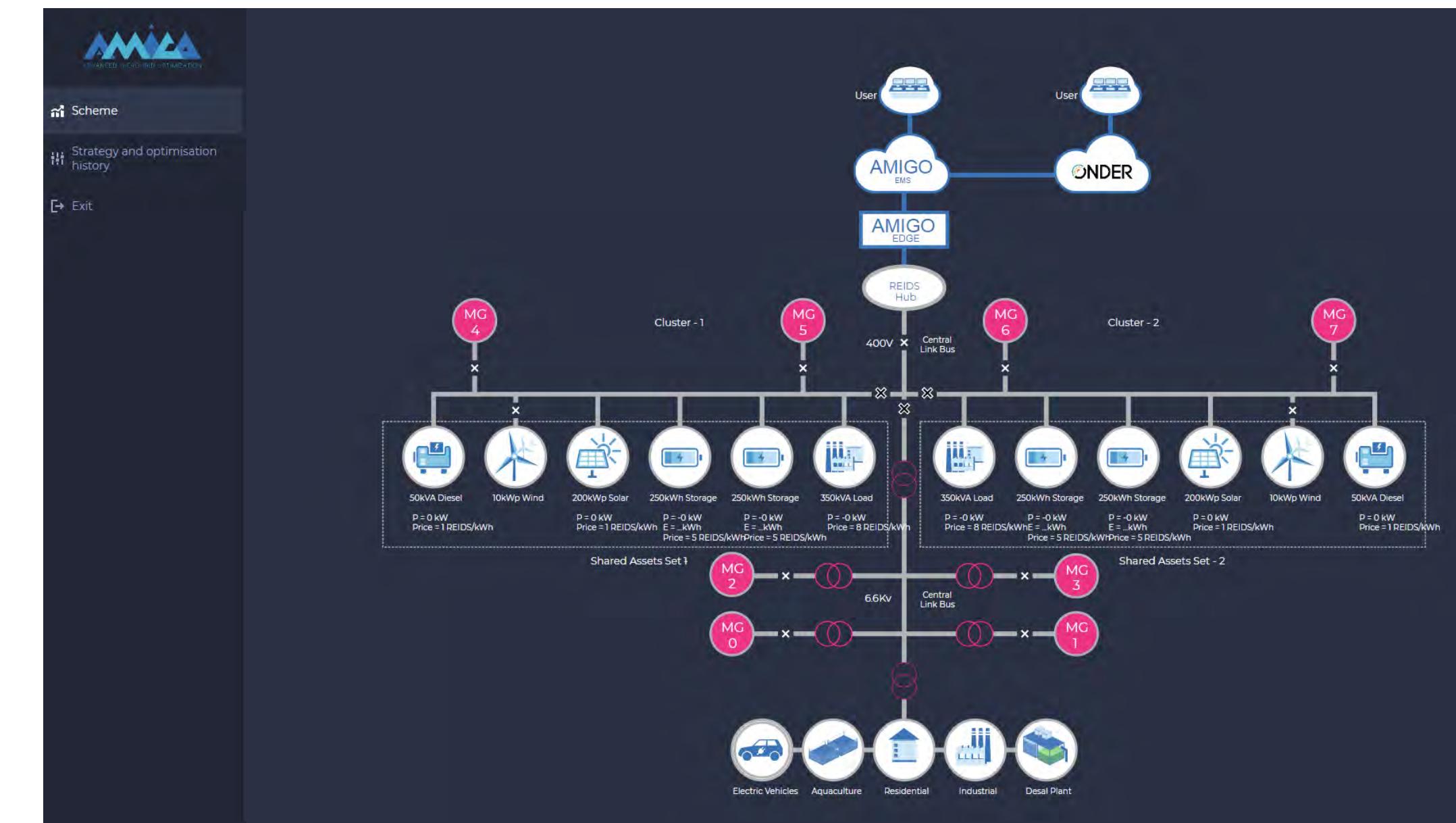
AMIGO features



That are tested in the 1st stage

Short-term optimization strategy (day-ahead for each 15 min):

- Active power optimization
- Development of energy storage operating strategy
- Minimizing starts and stops of generators
- Maximization of energy usage from solar
- Electricity procurement profile planning for each prosumer
- Metering data notarization (anchoring) in a public blockchain
- Transactions execution and monitoring:
 - virtual meter nodes
 - solidity smart contracts
 - state channels technology
 - ERC20 tokens and wallets
 - UI for the microgrid Operator and participants



AMIGO features



that are tested in the 1st stage:

Forecasting consumption and RES production, taking into account:

- Calendar
- Weather forecasts
- Measurements archive for the current year



Three-level Amigo optimization



Long-term

1 year

Accounting technical condition of equipment

Production program balancing

Accounting equipment maintenance and repair

- Linear programming

Short-term

24 hours

Active power optimization

Development of energy storage operating strategy

Minimizing starts and stops of generators

Maximization of energy usage from solar and wind

Electricity procurement profile planning

- Dynamic programming

- Integer linear programming

Operative

15 minutes

Planned power flow study

Operative control actions refinement (1 minute discretization)

Reactive power and voltage optimization

Providing reserved equipment in case of emergency

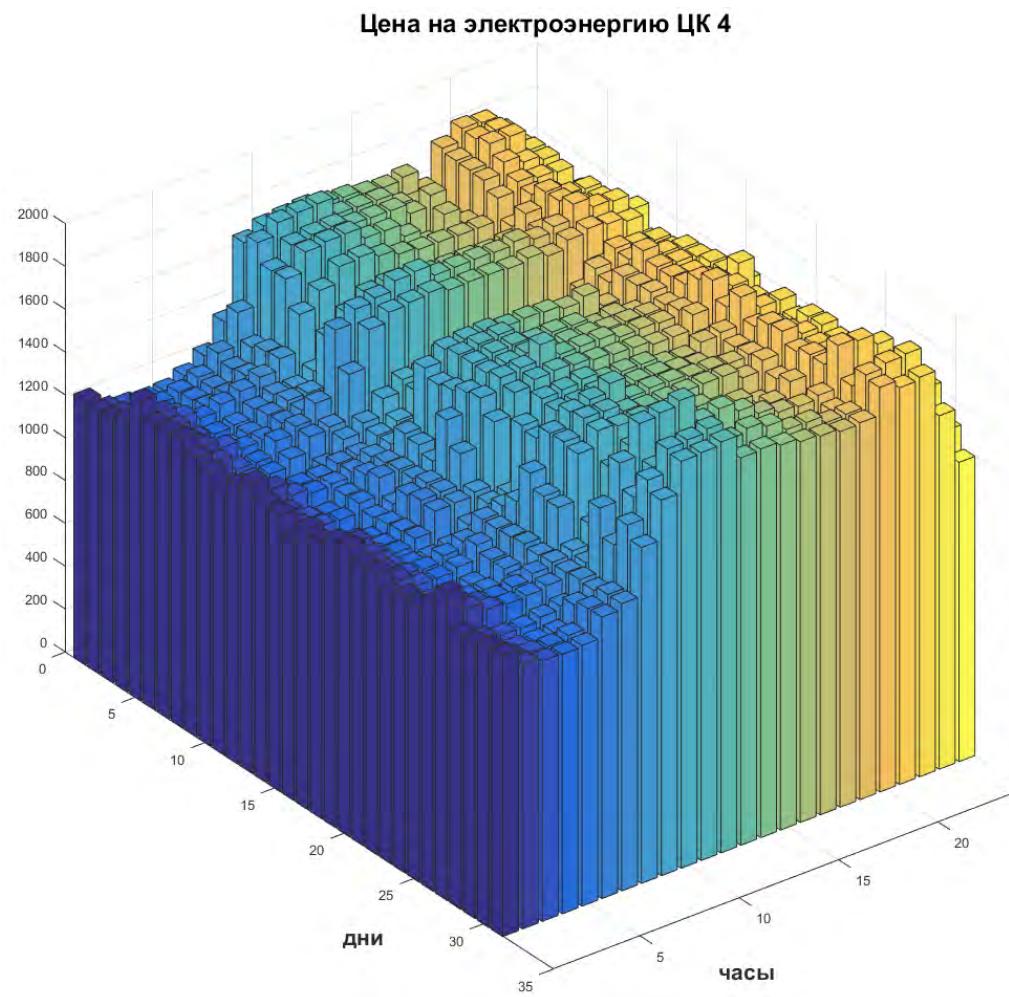
- Linear programming

- Quadratic programming

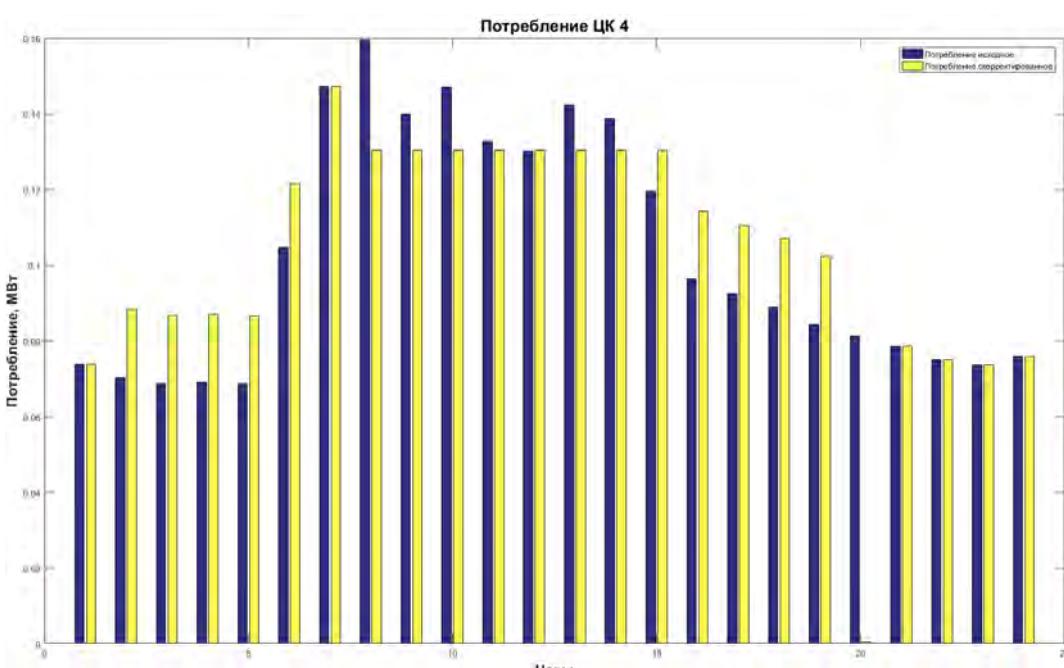
- Power flow studies

- Interior point method

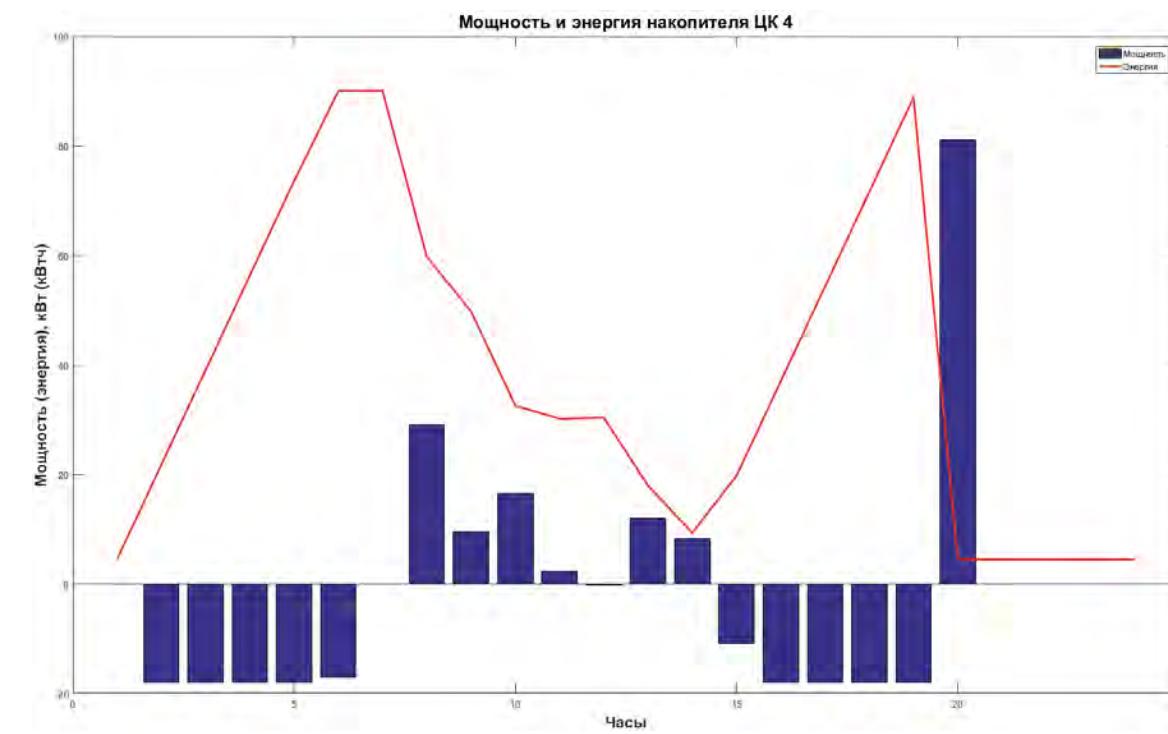
Amigo Short-term optimization



Energy cost analysis

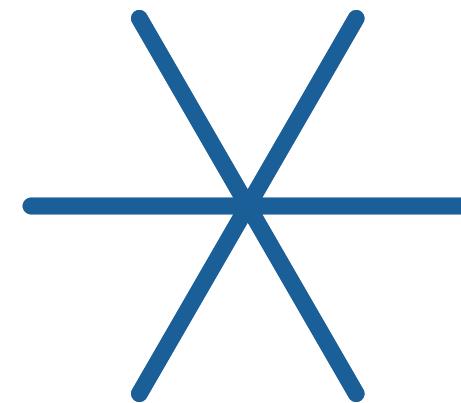


Load profile analysis

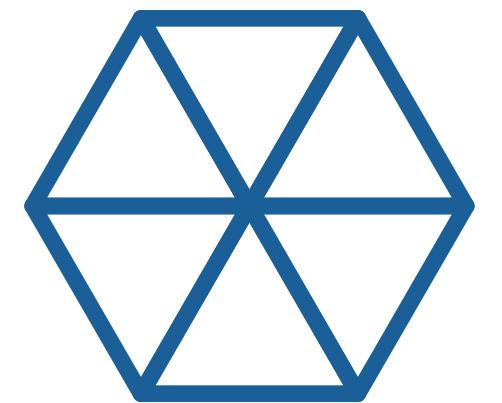


Controllable equipment
operating strategy

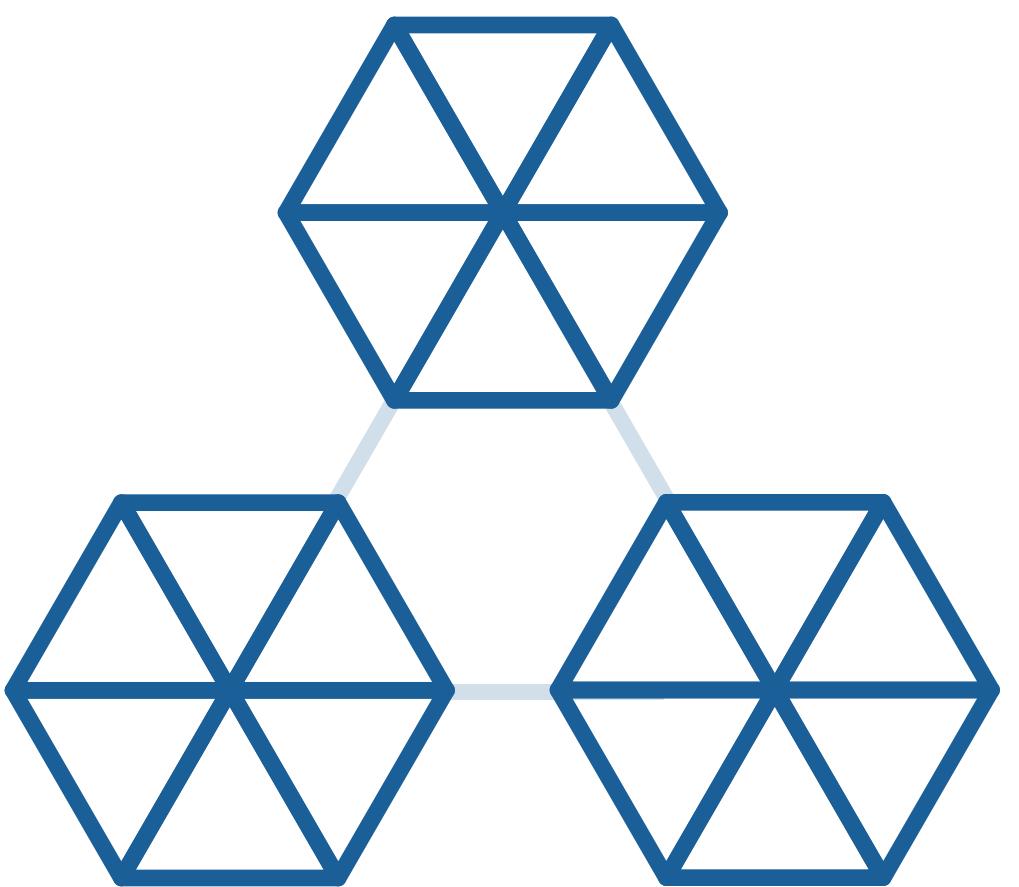
We develop the System to make the trend possible



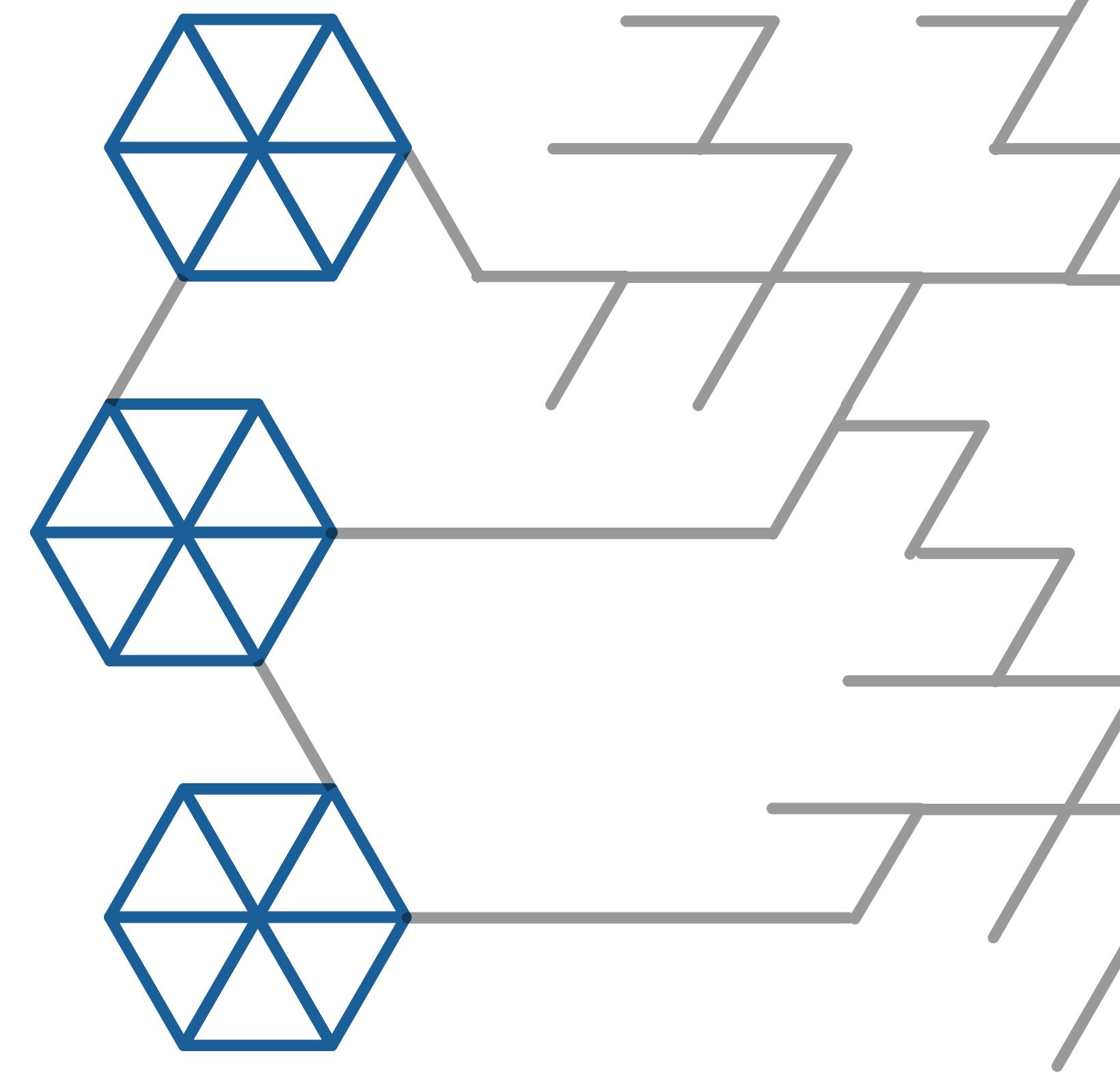
1 microgrid
with EMS



Demand response
Local energy market
based on p2p



Several local
energy markets



Centralized grid with local
energy markets and behind
the meter systems

System development

Service Apps

Local energy market
with auction

Multi-microgrid
with p2p

Meter2cash

Demand
response

Platform core

Auction
engine

Decentralization in transactive
system (with Raspberry PI)

Bank API

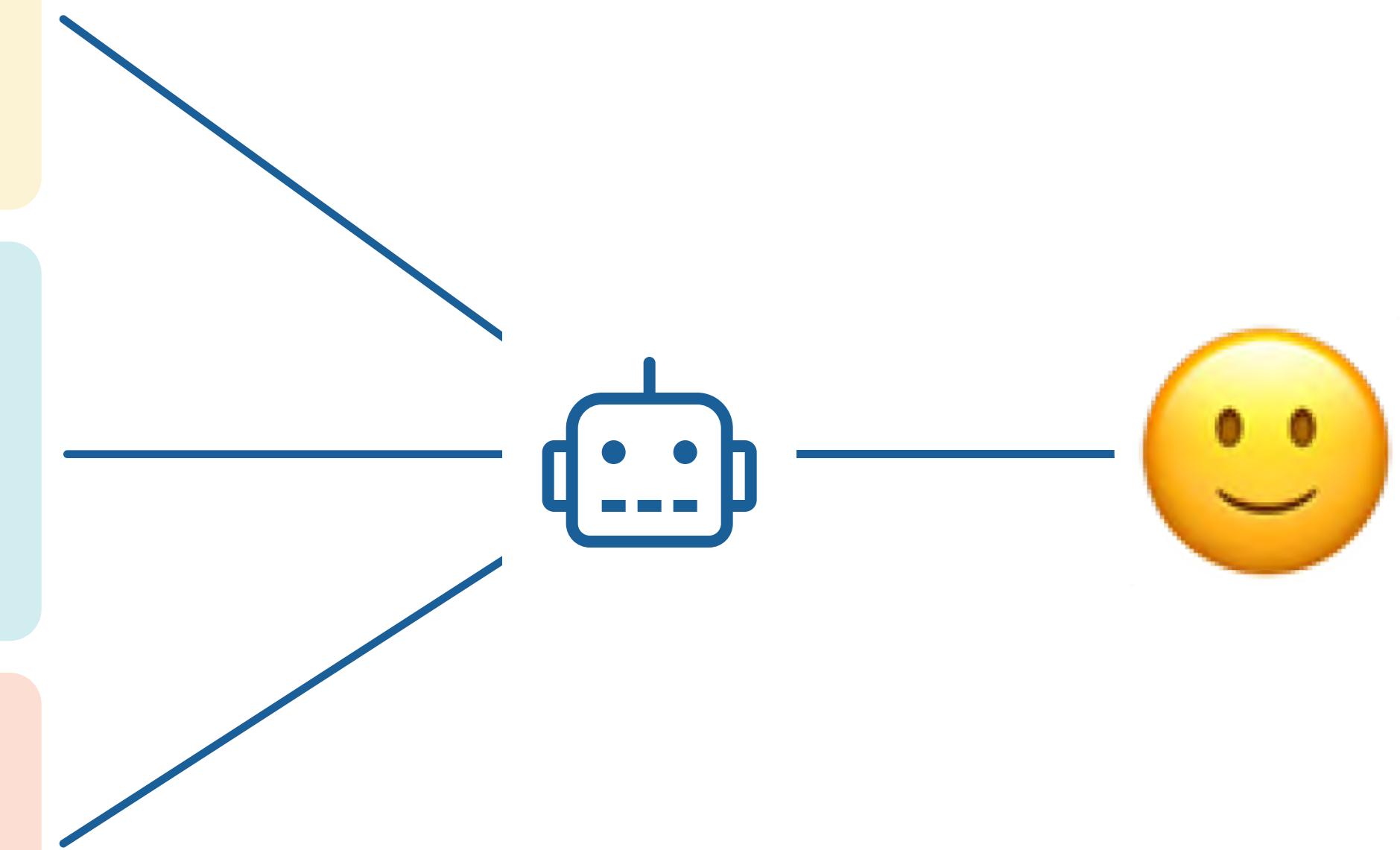
IoT

Energy equipment



Distributed Energy resources

Invertors Storages



Thank you!

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