

INTELLIGENT CONTROL SYSTEM OF ENERGY DISTRIBUTION WITHIN MICROGRID

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SESSION

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SC D2

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- SESSION **2018 CIGRE**
- •Regions with electricity shortage or lack of power supply
- •Complicated active-power flow control in case of distributed generation
- •Incorrect relay protection functioning in microgrids with RES
- •The lack of demand response





Automated Demand Response



PROPOSED SOLUTIONS



Intelligent microgrid based on Personal Power Units:

•Energy storage and Renewable energy sources (RES)

•Power supply control system based on Multi-agent principles

•Flexible loads and Building automation technology









INTELLIGENT POWER SUPPLY SYSTEM



Personal Power Unit (PPU) – the node of intelligent power supply system



Energy accumulation

•Power rescheduling using trading on energy "local market"

•Generation and consumption prediction, Flexible loads

•RES and gas generators integration

Step 1: auction preparation

•When agent decides to buy a certain amount of energy, it creates an "energy auction" sending invitation messages to its neighbors.

•Every agent decides whether to take part in auction or not, and then sends an answer back





Step 2: primary auction

•Trade starts

•Every agent sends its bid and receives bids from other agents. If received price is lower than last offered price, agent decides whether to contil ue the trade and reduce its price, or to stop the trade



Step 3: secondary auction

•However, if further price reducing is impossible, agent doesn't leave the trade. It tries to create secondary auction: the auction between its neighbors, that doesn't take part in primary auction (of node "I").

•The main purpose of secondary auction is to reduce agent minimal price and return to primary auction



Step 4: returning to primary auction

•In case of successful secondary auction, agent returns to primary auction and continues the trade with other agents



Step 5: auction ending

 Trade stops and agent buyer concludes the contract for energy transition with a winne of the trade.

•Energy transition starts



MULTI-AGENT SYSTEM. TEST RESULTS







0 1 3

time, h

Current charge

Generation Consumption

18 19 20 21 22 23

MULTI-AGENT SYSTEM. TEST RESULTS

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MULTI-AGENT SYSTEM. MAIN FEATURES





- •Market mechanism for local markets in microgrid
- •Self-organization and self-configuration of microgrid. Easy horizontal scaling.

•Automatic self-recovery after transmission line faults. Advanced relay protection mechanisms.

- •Microgrid power supply optimization.
- •Demand response.