

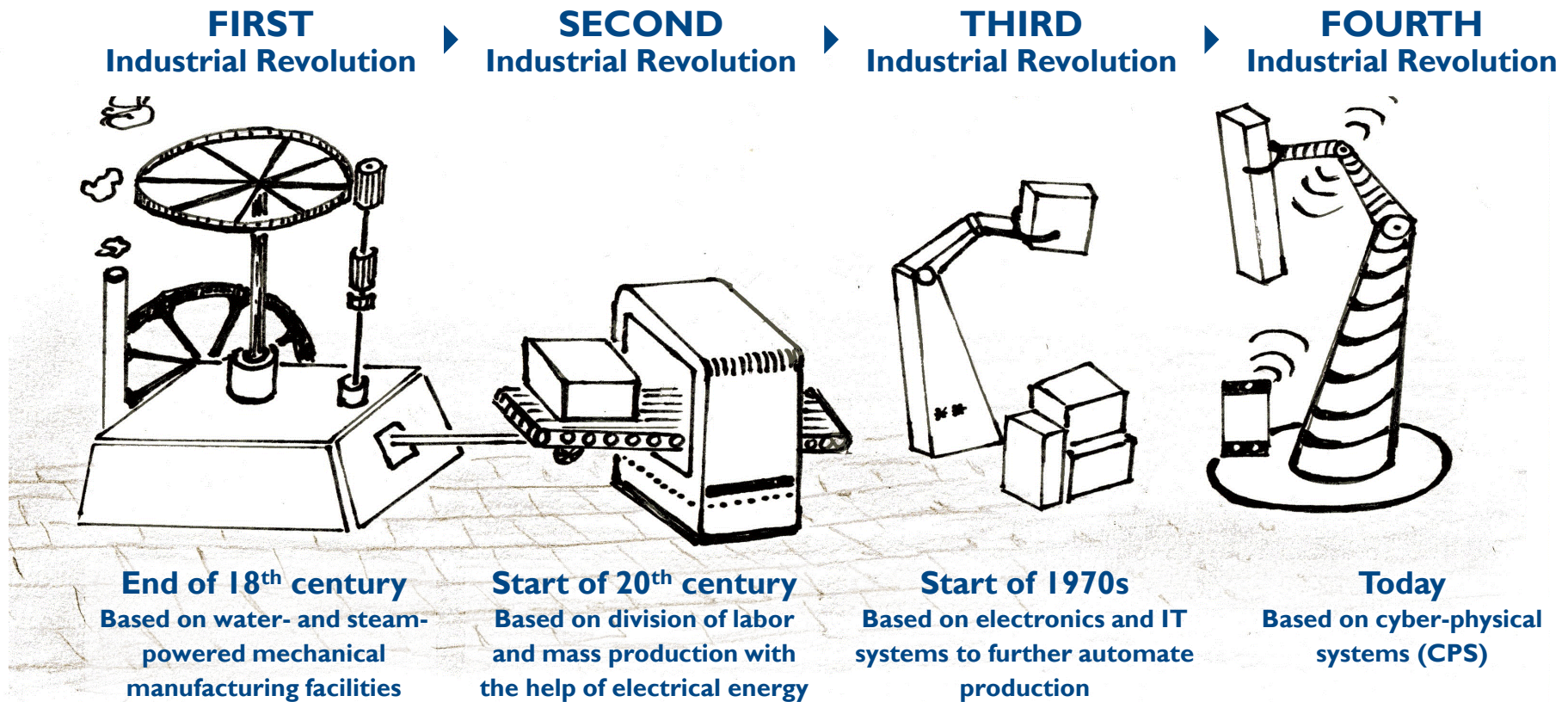
Digitalization & Innovation in Energy sector

International round table: New energy Czech Republic

5th April, 2019

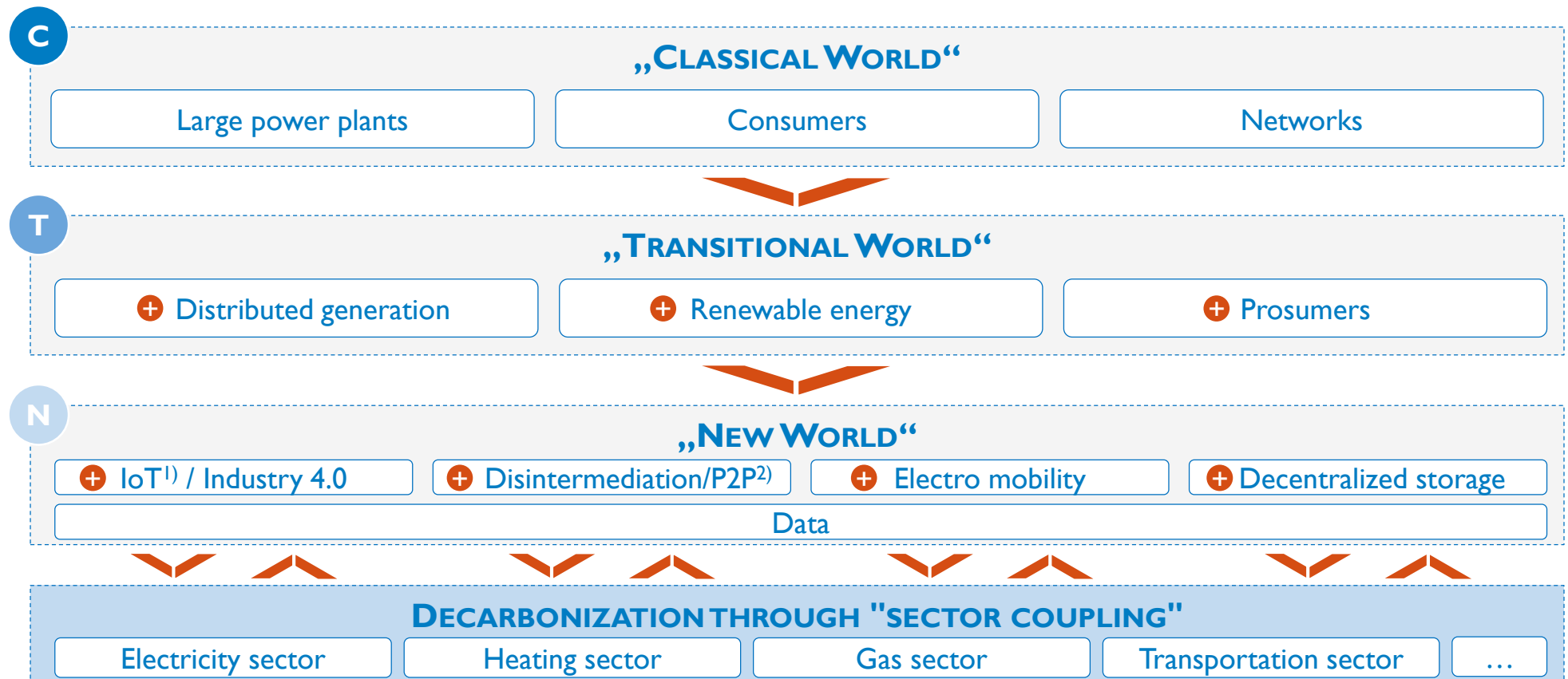
Industry have evolved from manual labor towards computerization. The next step are independent cyber-physical systems with M2M communication

Four Stages of the Industrial Revolution



Energy market is undergoing a transformation from the classical world to a decentralized data-driven new energy world...

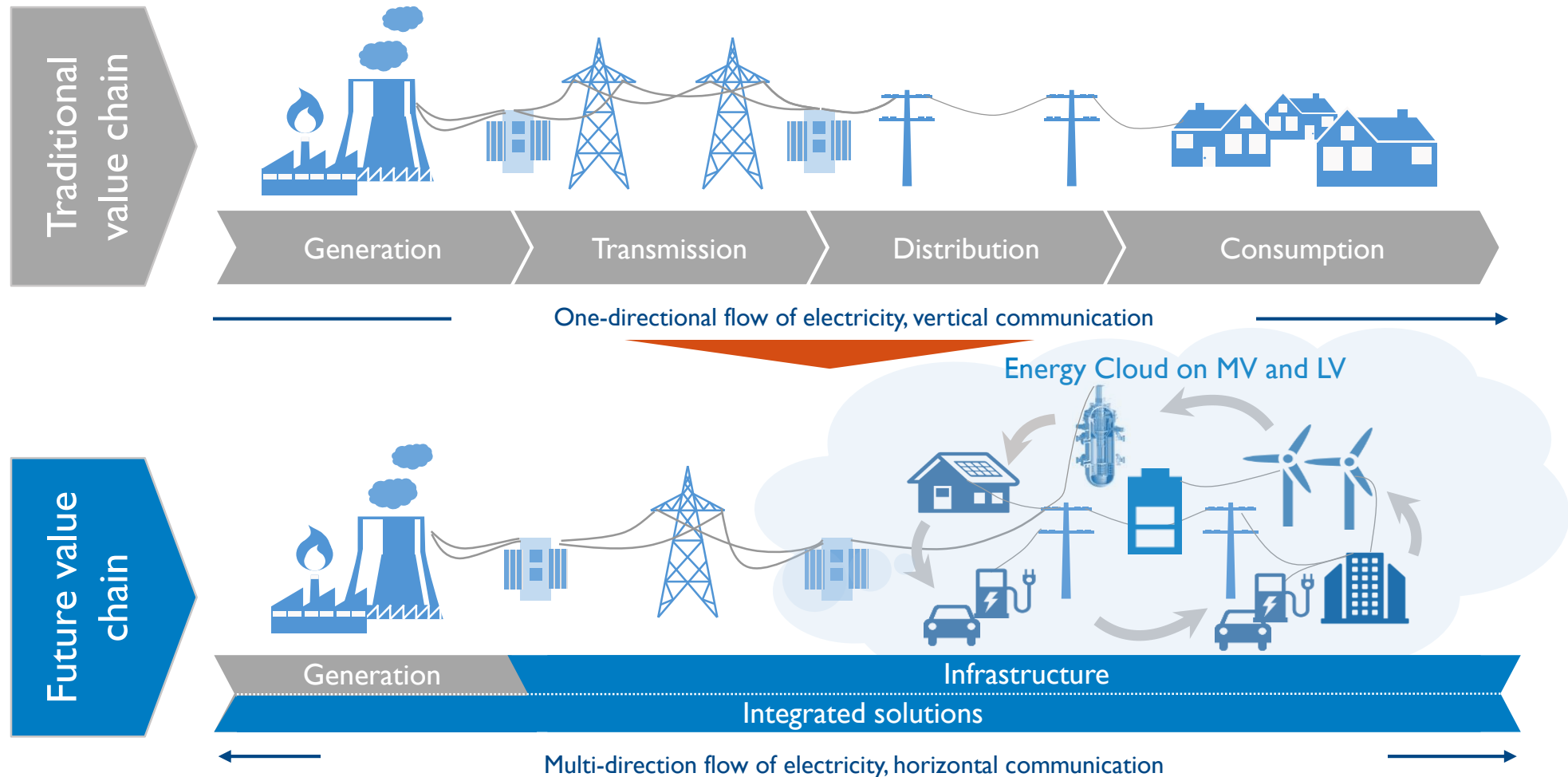
Change in the energy industry



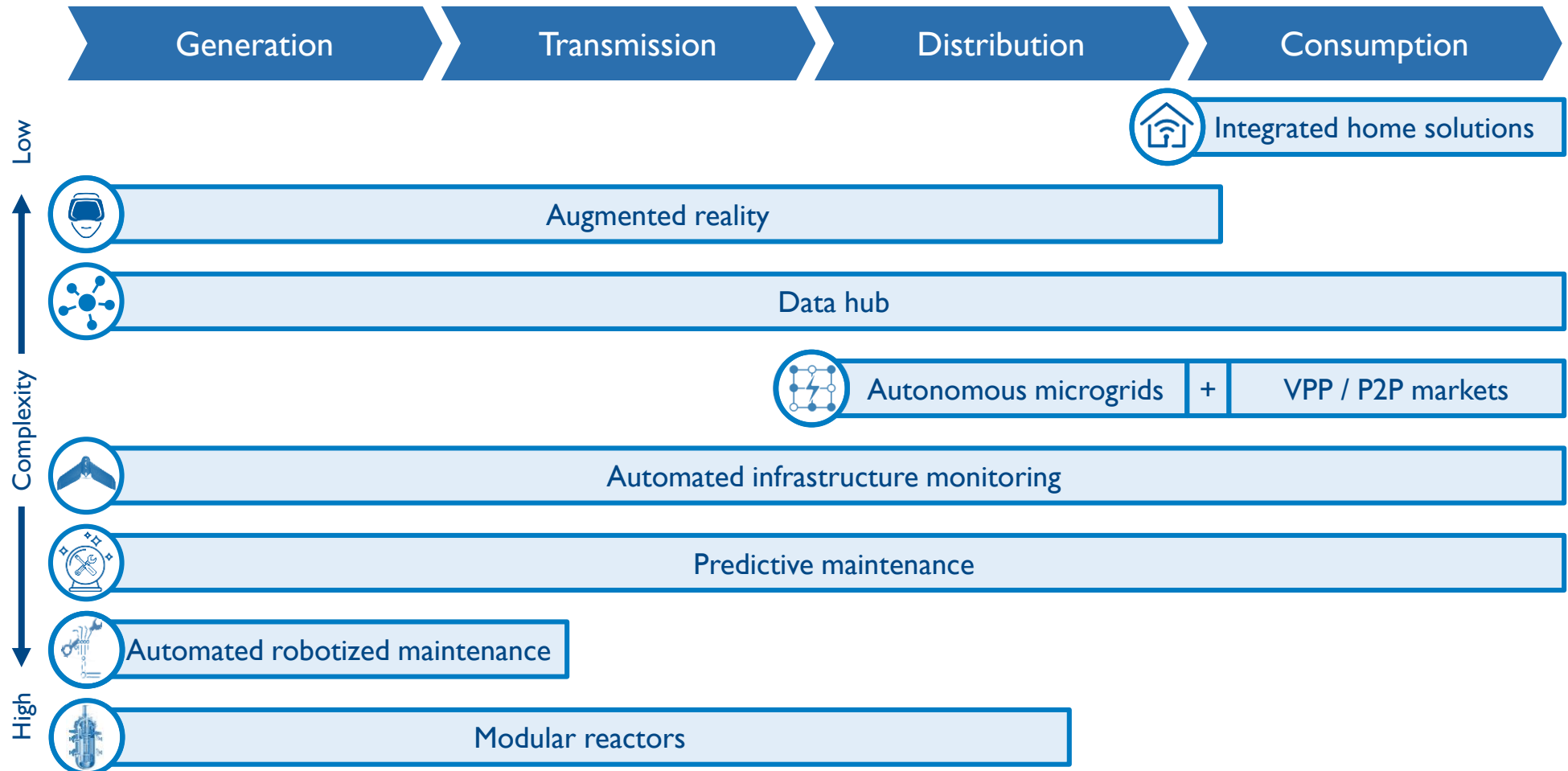
Source: Arthur D. Little

1) IoT - Internet of Things; 2) Peer to Peer

...which disrupts traditional value chain



To keep pace, energy companies have to adopt innovation leading to higher efficiency and operational excellence

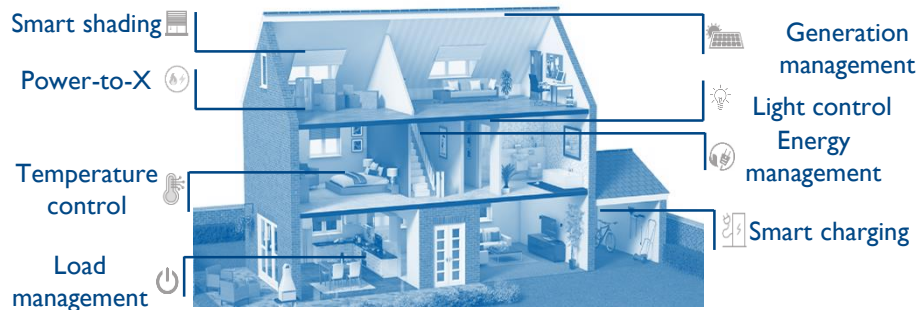


Source: Arthur D. Little

Integrated home solutions turns houses into smart homes. Augment reality provides in-field workforce information and instructions



Integrated home solutions



Integrated home solutions turns current houses into fully connected smart homes

Demands

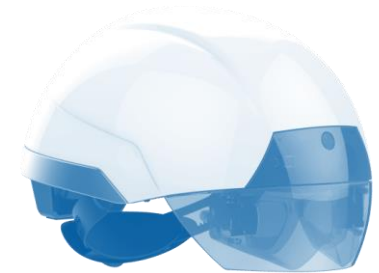
- Broadband connectivity
- Communication technologies: NB-IoT, Sigfox or LoRa
- Small and remotely accessible sensors and devices

Benefits

- Increased customer comfort and satisfaction
- Energy savings and bill reduction
- Higher flexibility and easier grid management



Augmented reality



Augment reality aims to provide in-field workforce with broader sets of options

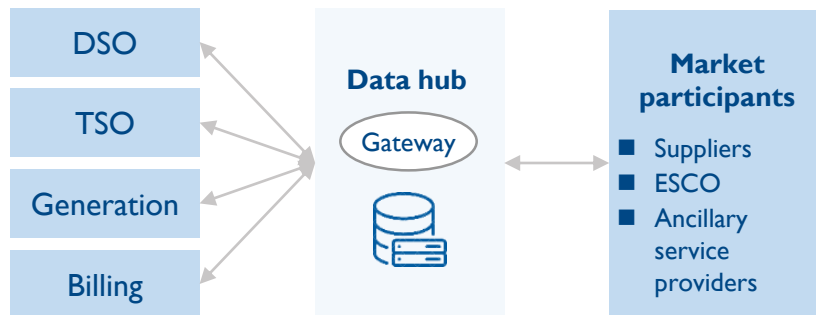
- Modern hand-held devices or in-built heads up displays
- Interconnected data platforms with information

- Increase efficiency of workers
- Increase quality of performed work
- Reduction in work-related injuries

Data hub provides platform for market data exchange and grid operation. Autonomous microgrids and P2P market enable local network balancing



Data hub



Platform or data center enabling smooth exchange of key market data between various market participants

Demands

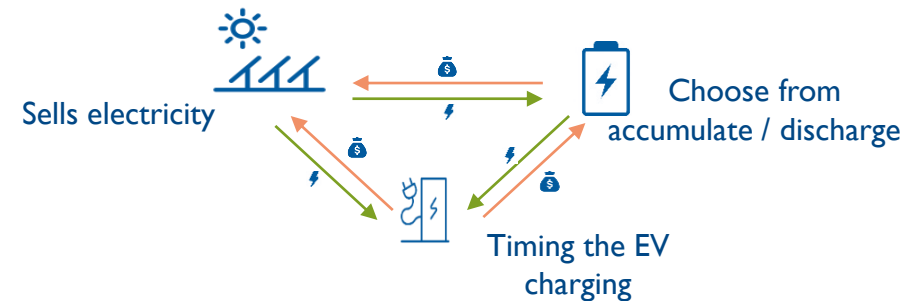
- IT platforms for data integration
- Integration of IT systems of market participants
- Correct setup of legal framework

Benefits

- Increase data availability and transparency
- Enabling of ancillary services (ESCO, aggregation...)
- Improved grid management and balancing



Autonomous microgrids and P2P market



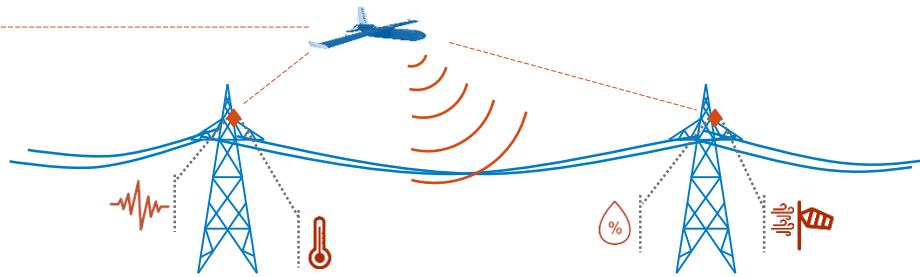
Autonomous microgrids and P2P market enable local network balancing and matching generation with consumption

- Change of IT architecture to distributed system
- Broader penetration of AMM and DECE
- Development of available accumulation

- Increased flexibility and consumer cost savings
- Lower demands on distribution and transmission grid
- Significant improvement of IT security

Drones or IoT sensors are capable to deliver autonomous monitoring. Monitoring data can be used to predict faults and failures

Automated infrastructure monitoring



Monitoring tools such as drones or IoT sensors are capable to deliver unmatched level of monitoring

Demands

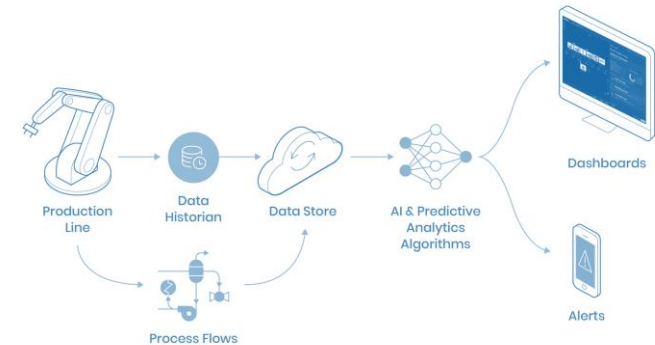
- Nationwide coverage by IoT signal
- Legislative changes regarding low-altitude drone flying

Benefits

- Higher network reliability (SAIDI, SAIFI)
- Operational improvements reducing OPEX



Predictive maintenance



Using high density monitoring data for machine learning based prediction could repair precedes actual failure

- Implemented high quality and density monitoring
- Regulator accepting predictive based maintenance and preventive asset replacement

- Higher network reliability (SAIDI, SAIFI)
- Timely repairs and replacement lowering required CAPEX and OPEX

Robotization of manually performed increases efficiency. Modular reactors offer accessible and generation nearby consumption



Automated robotized maintenance



Automation and mechanization of manually performed tasks

Demands

- Accessible 5G network
- Further development in robotics

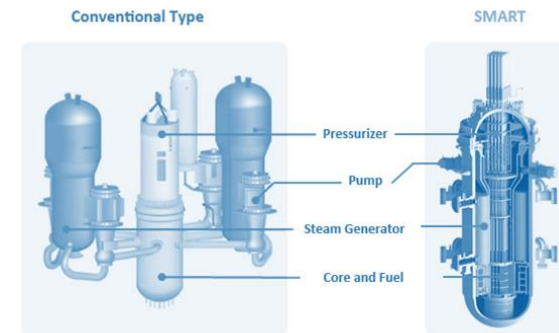
Benefits

- Increase operational and maintenance efficiency
- Higher network reliability (SAIDI, SAIFI)
- Reduction in work-related injuries

Source: Arthur D. Little



Modular reactors



Cogeneration by scaled-down conventional uranium reactors and polonium radioisotope thermoelectric generator

- Cost efficient scaling down
- Legislative changes regarding hazardous materials

- Energy sector decarbonization
- Increase in energy security



Arthur D. Little has been at the forefront of innovation since 1886. We are an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries. We navigate our clients through changing business ecosystems to uncover new growth opportunities. We enable our clients to build innovation capabilities and transform their organizations.

Our consultants have strong practical industry experience combined with excellent knowledge of key trends and dynamics. Arthur D. Little is present in the most important business centers around the world. We are proud to serve most of the Fortune 1000 companies, in addition to other leading firms and public sector organizations.

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