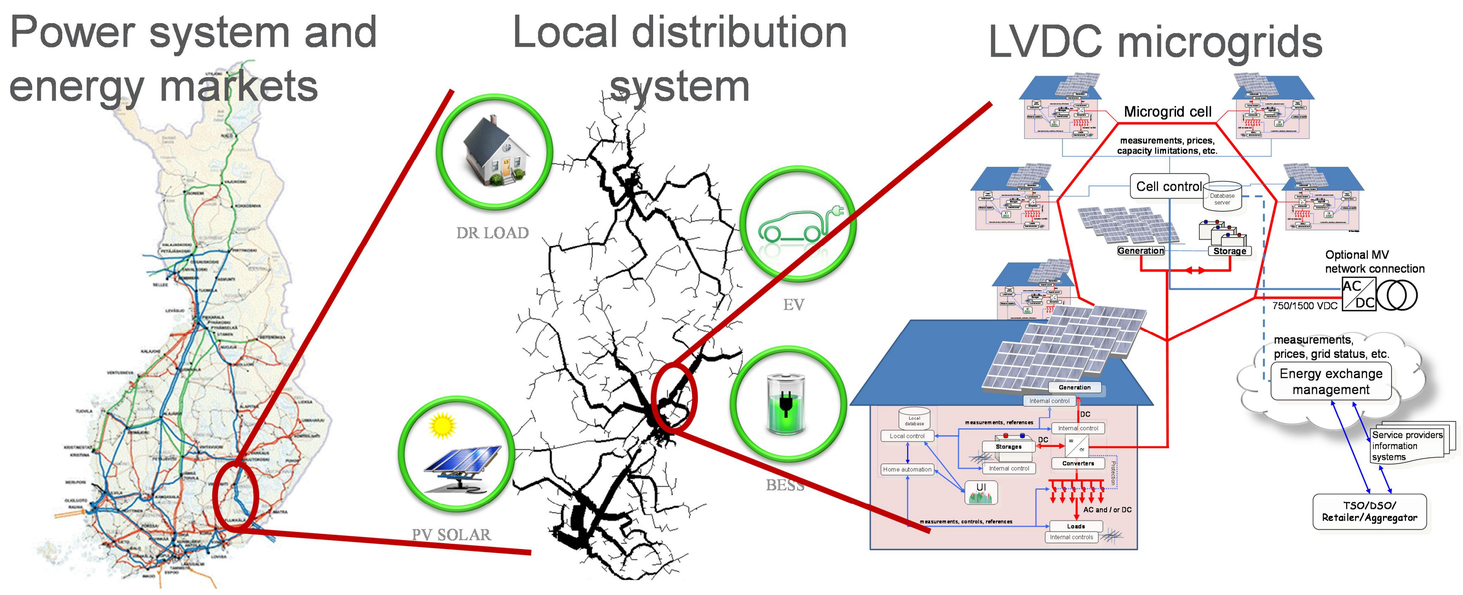
FLEXe

Future Energy System



Microgrid as an active enabler for energy system flexibility

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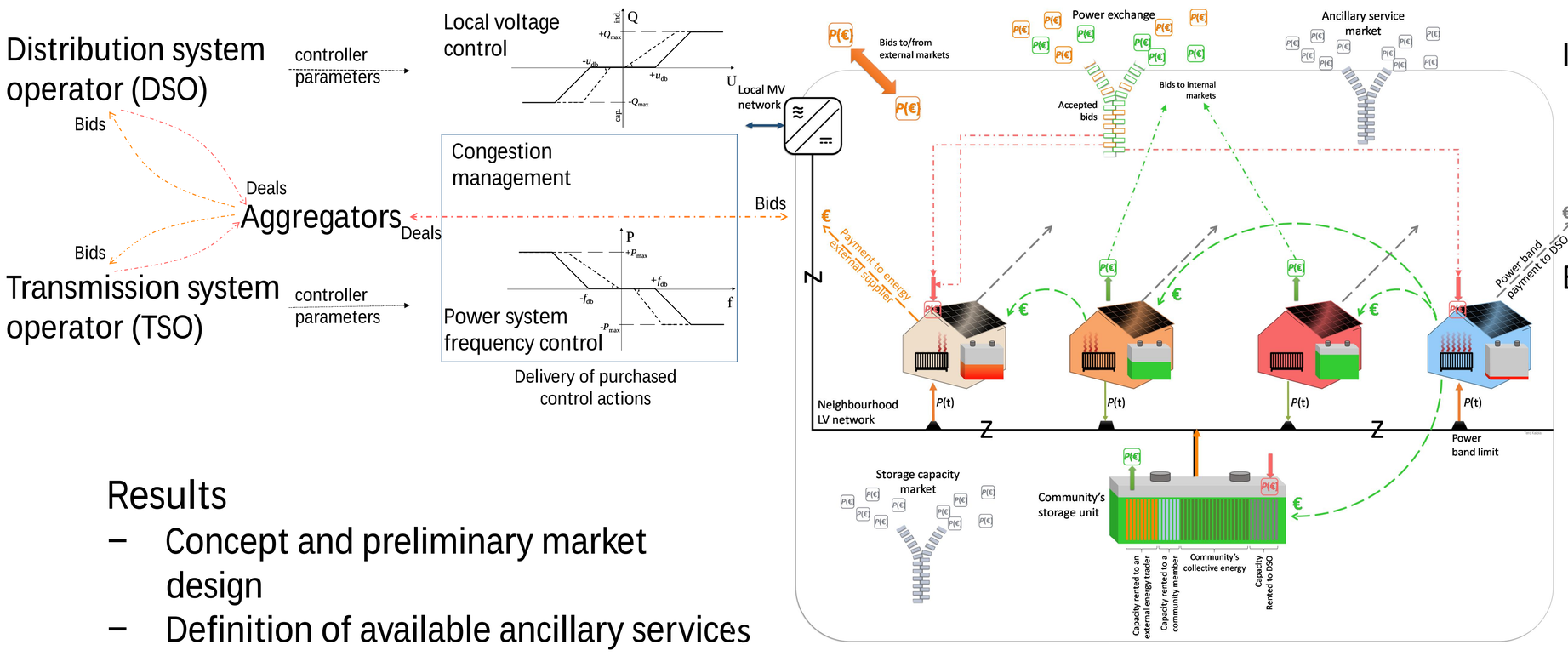
Growing role of weather dependent renewable generation and the pursuit of weather independent power delivery are leading to increasing need of regulating capacity and network investments. Major part of the renewable generation capacity will be connected via building installations into the low-voltage networks next to the loads and consumer-end energy storages. At the same time the distribution companies are boosting the performance of the networks by increasing automation and considering implementation of new network technologies, such as, the low-voltage DC distribution. Consequently, the basic energy resources and infrastructure for realising microgrids are becoming inherently available, and thus, they are one of the key building blocks of the flexible and resilient energy system.



Internal power exchange
- Energy cost minimisation
- Efficient use of local renewable resources
- Preparation to emergencies
- Internal power balancing

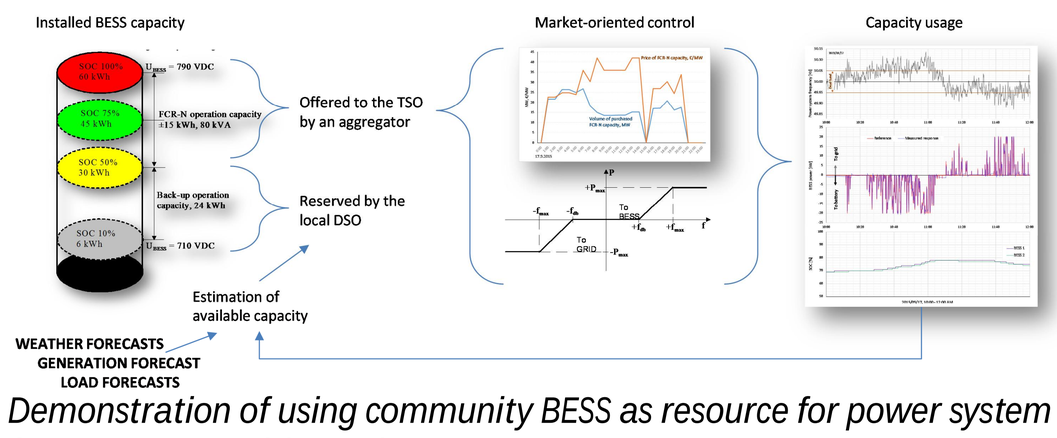
External power exchange
- Energy cost minimisation
- Maximisation of profit from ancillary services
- Need to cover microgrid power/energy surplus/deficit

Scalable architecture
- Household scale
- Block scale
- Neighbourhood scale

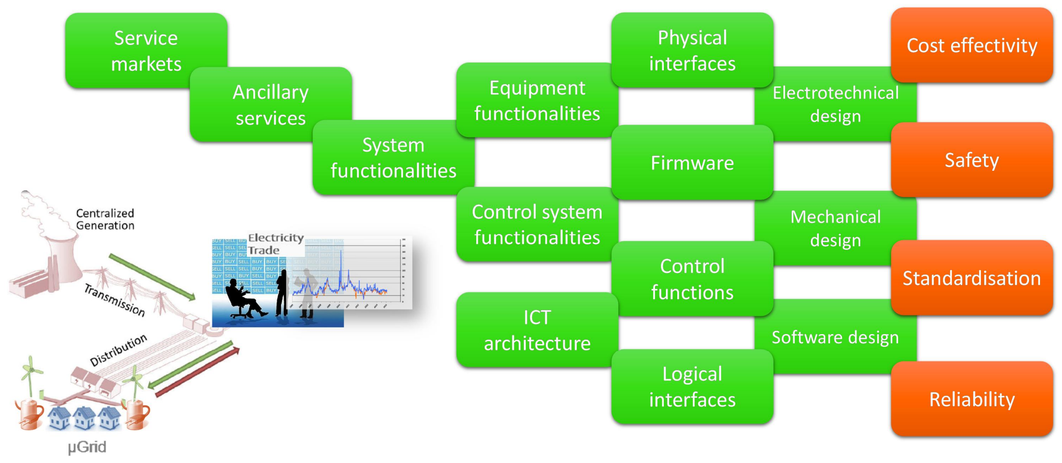
A concept of µGrid having automated internal power exchange markets that are interfaced with respective external markets

Results
- Concept and preliminary market design
- Definition of available ancillary services based on inherent technical functionalities
- Demonstration of technical key functionalities
  - Independent off-grid operation
  - use of community battery as resource for FCR-N
  - MV network reactive power compensation

Further research topics
- Electricity market models
  - Internal power exchange markets
  - Integration with external markets
  - Grid operating business
- Development of the market-oriented control algorithms
  - Allocation of the resources between markets
  - Optimal of microgrid operation
  - Transmission and distribution system operation
- Value of flexibility provided through microgrids
  - Consumer perspective
  - Business perspective
  - Socio-economic perspective
- Knowledge and technology to enable the change
  - Simulation models for studying market and grid impacts
  - Methods for market forecasting
  - Methods for system and network planning
  - Interaction between forms of energy: heat-electricity-cooling



Demonstration of using community BESS as resource for power system frequency control (FCR-N)



Flexibility services in microgrid systems engineering

Microgrid:
A small-scale power system that can operate independently or in conjunction with the interconnected main grid