Microgrid Research Laboratory – experimental validation of energy management technologies

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Microgrid Research Laboratory Wieselburg

In the project *Microgrid Research Laboratory*, the planning, implementation and verification of a microgrid took place at the Wieselburg site. It comprises two buildings and multiple technologies from different energy sectors.

The Microgrid Lab serves as a test bed for:
- The development of products and services such as the microgrid controller and various operating strategies
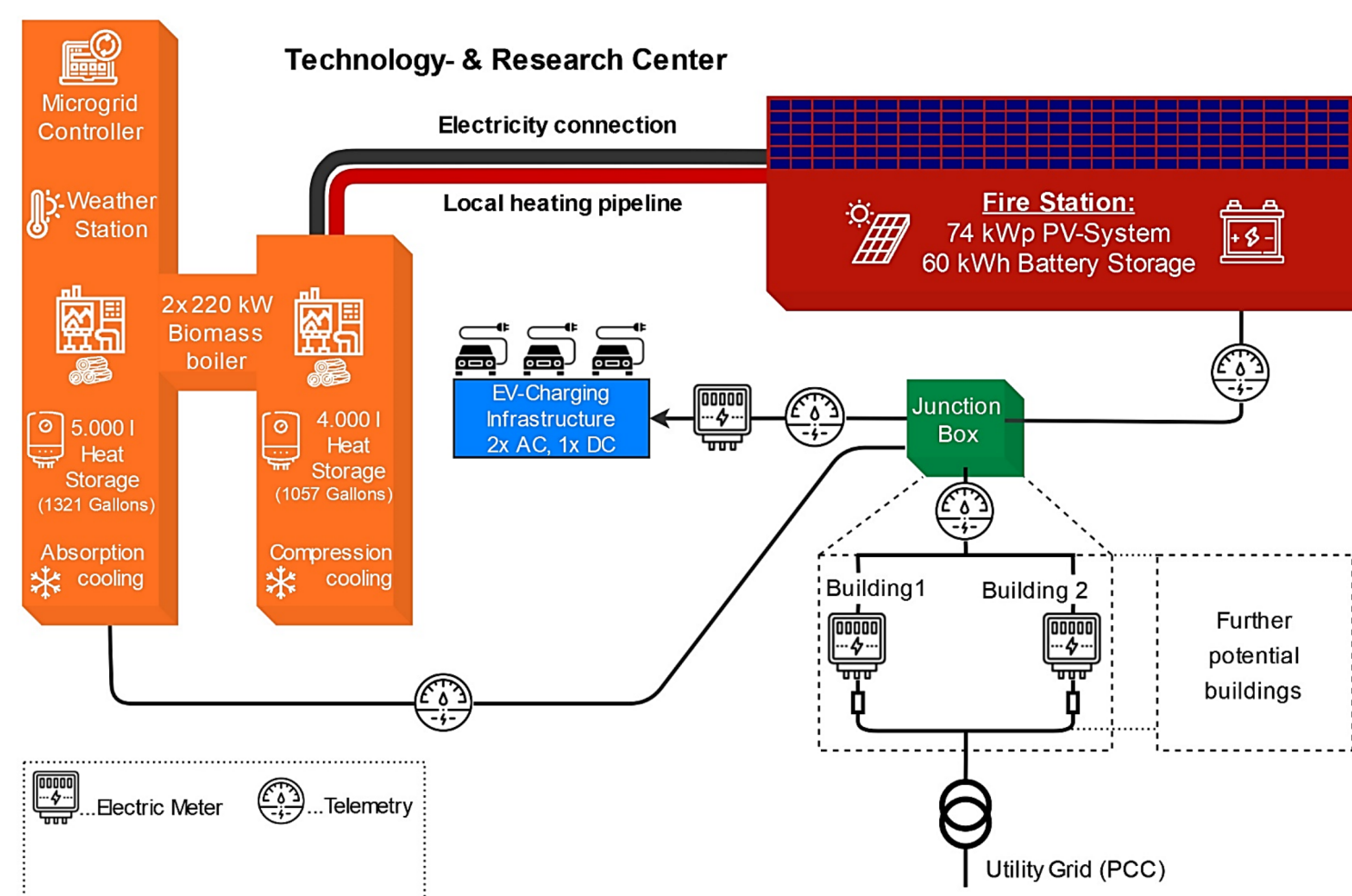- Extended hardware and software components.

Fig. 1: Microgrid Research Laboratory Wieselburg

The following two technologies were experimentally validated at the microgrid test facility:
- Adaptive Model-Predictive Controller (MPC)
- SmartControl concept (real-time communication interface)

Validation of the adaptive MPC-Controller

The methods and procedures shown in Figure 3 have been developed within the Microgrid Lab to validate energy system controllers.
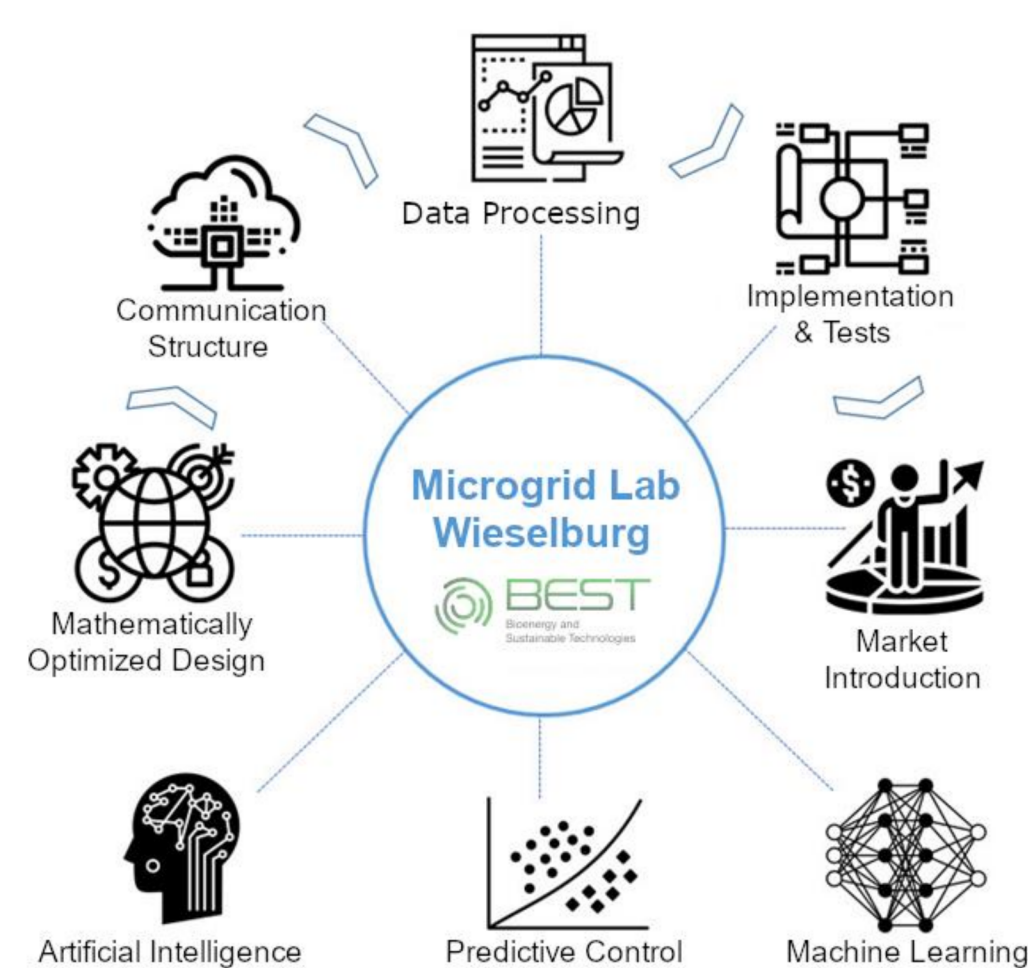

Fig. 2: Methods and procedure for the validation

The Model Predictive Control (MPC) framework enables the controller to adapt to changing framework conditions, such as spot market prices, in order to achieve optimal economic and/or CO_2-emission savings as shown in Figure 3.
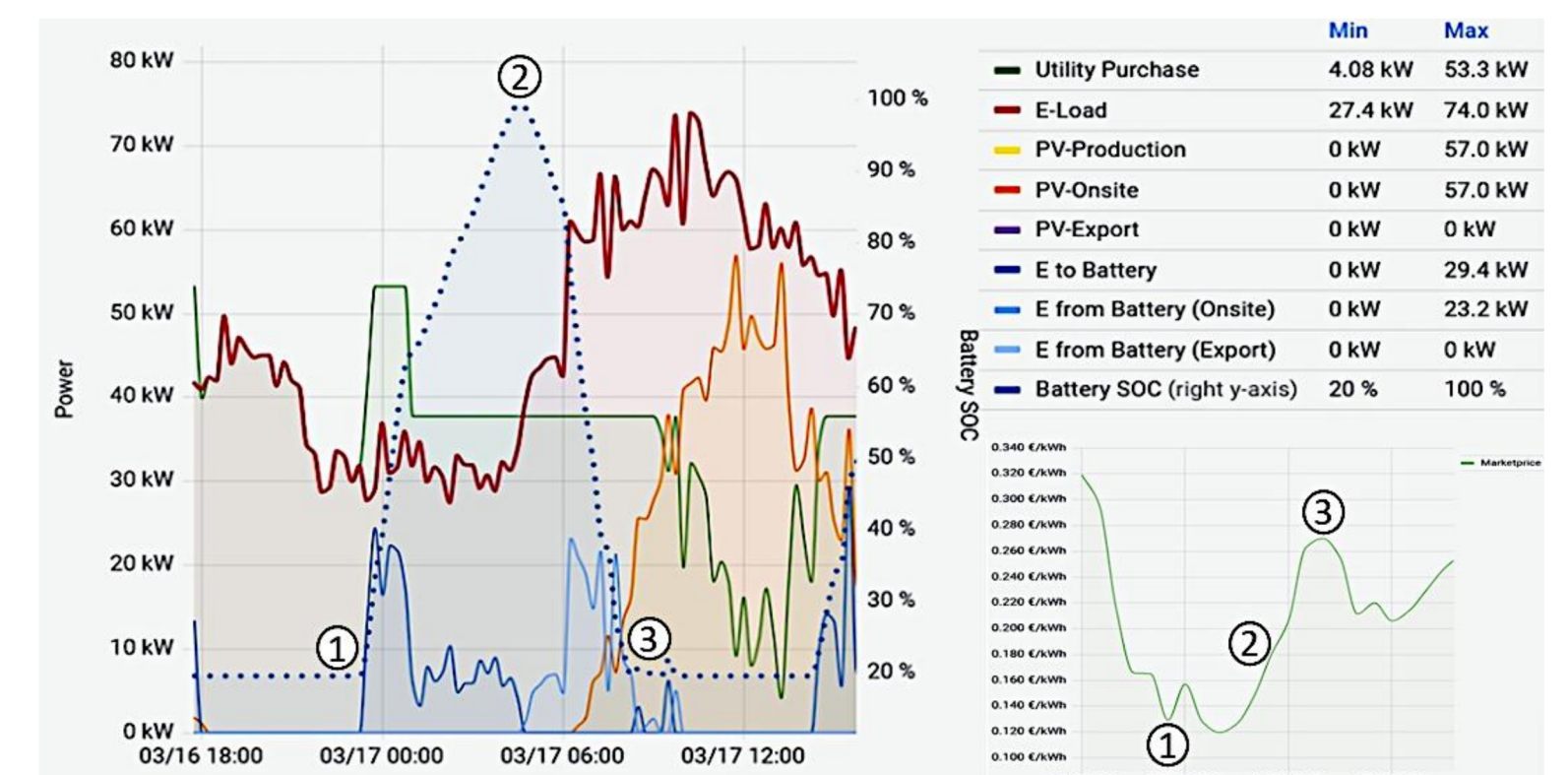

Fig. 3: Adaptive control strategy in action

In Fig. 3, the behavior of the adaptive controller is shown as follows:
(1) Spot price reaches minimum level, battery starts charging
(2) Spot price increases, battery starts to discharge
(3) Battery is discharged

Validation of the SmartControl concept

Project SmartControl: Development of holistic control processes for decentralized energy systems.
- Automated measurement
- Data acquisition & processing and monitoring visualization
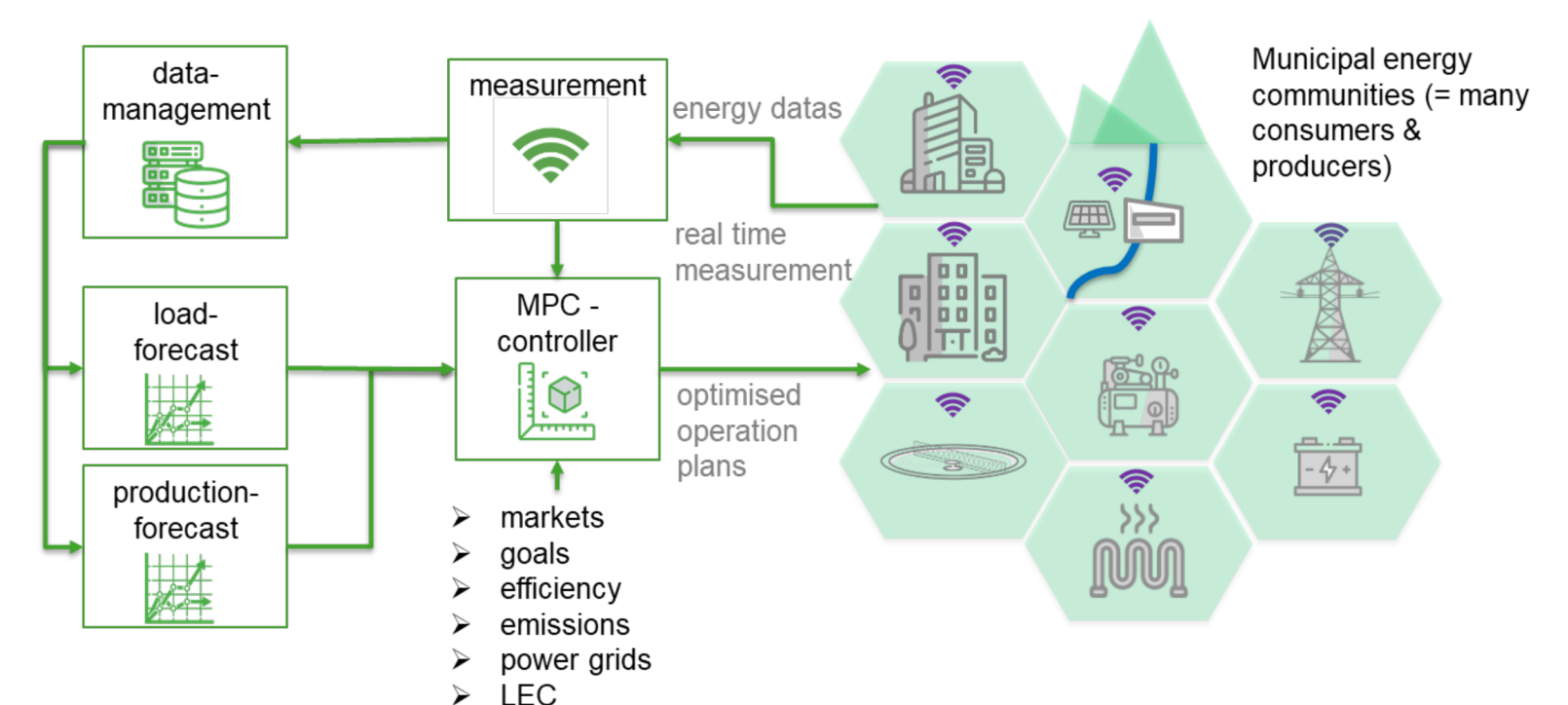- Forecasts & integrated MPC controller

Fig. 4: Holistic control of decentralized energy systems

The concept of real-time communication (measurement and operation) was successfully tested and evaluated in the Microgrid Lab together with the HABWerk energy management system (open source solution: openHAB).
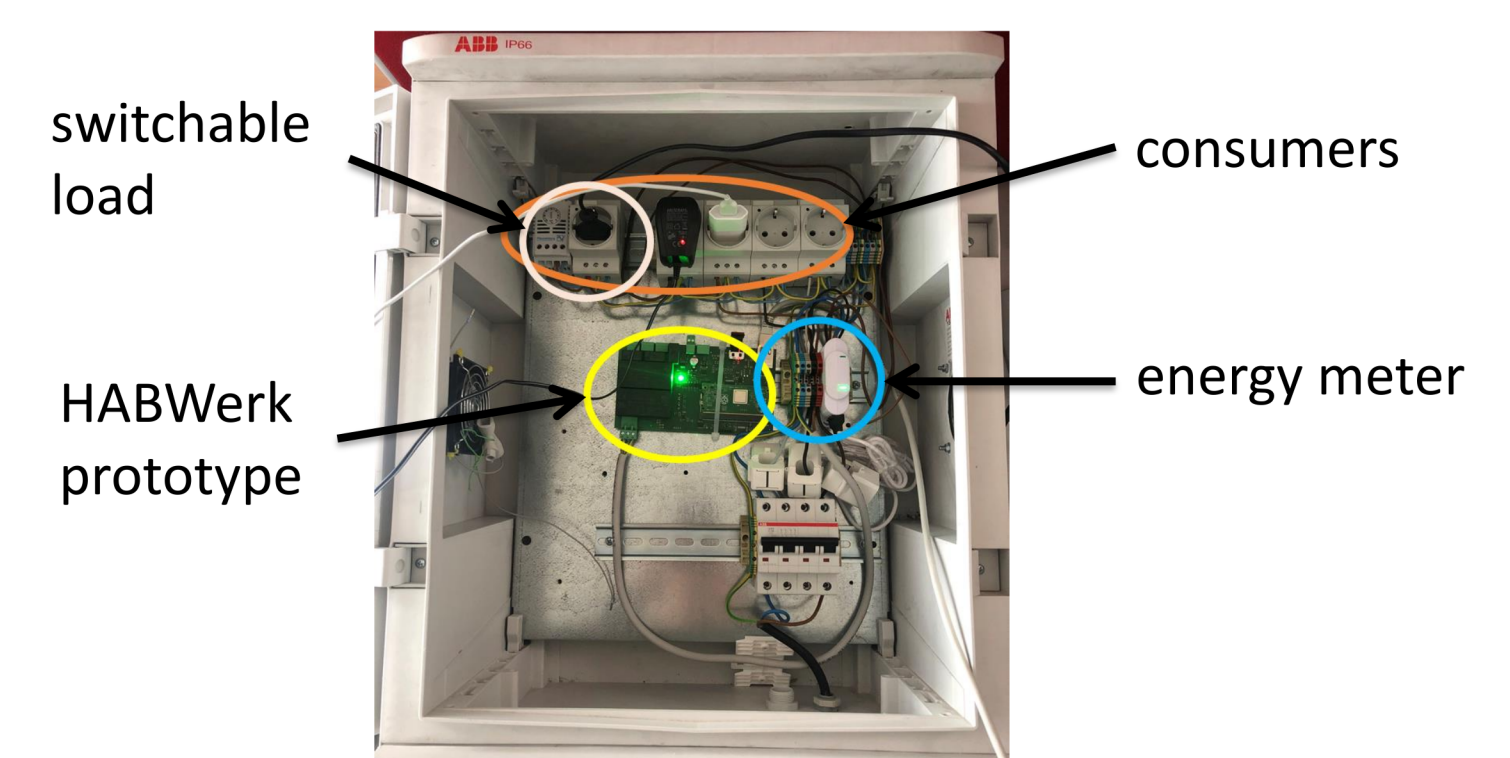

Fig. 5: Test stand with a HABWerk prototype and first successful test of the developed REST/JSON cloud communication interface

Acknowledgements