

A modular energy management system for multi-energy systems

BEST Days

6th Central European Biomass Conference – CEBC 2020

Graz, 22nd of January, 2020

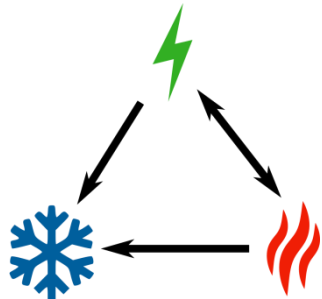
Daniel Muschick, Valentin Kaisermayer, Andreas Moser, Markus Gölles



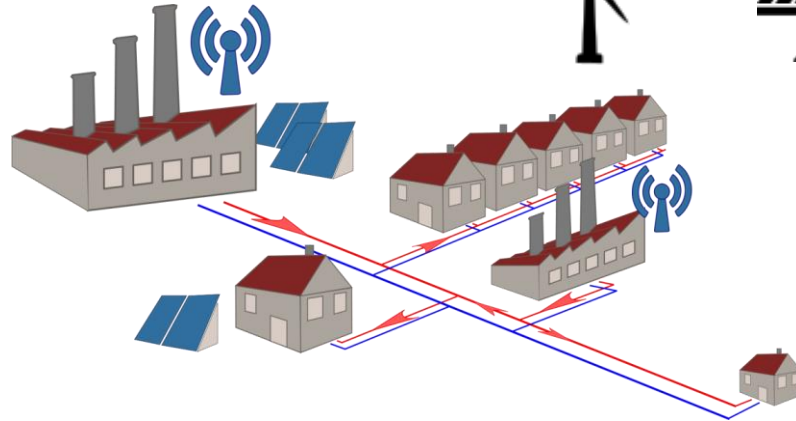
Motivation for Optimization

Growing complexity of **integration in networks**
(variable tariffs, energy market)

Integration of **renewable**,
but **volatile** energy sources



Increased **coupling**
between sectors



Need to ensure **economical** and
ecological energy supply

Motivation for Predictive Control Strategies

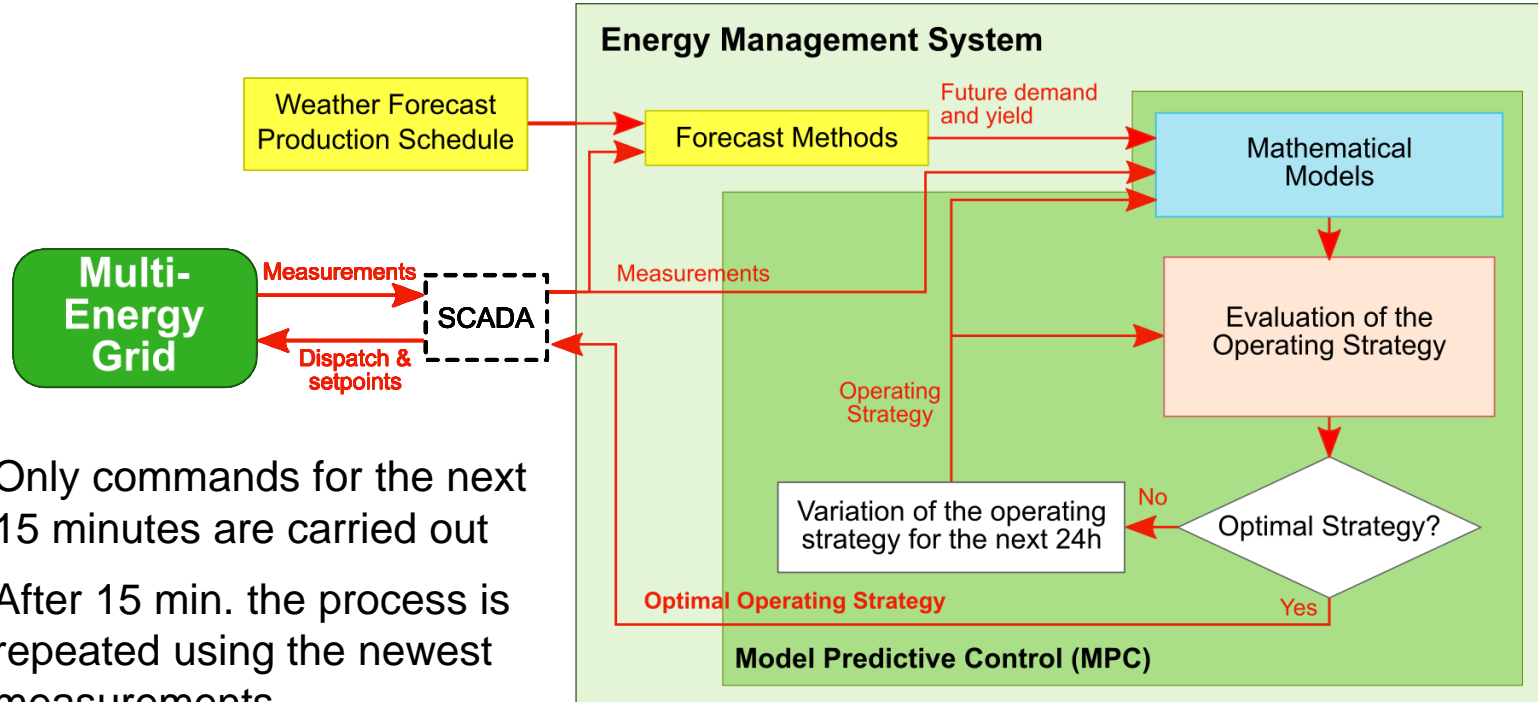
- We need a **forecast** of the yield from renewable sources, of the energy demand and tariffs...
- ... for an effective **buffer & battery management** ...
- ... and a cost-efficient **unit commitment** of the producers

→ We need a predictive control strategy





Principle: Model Predictive Control



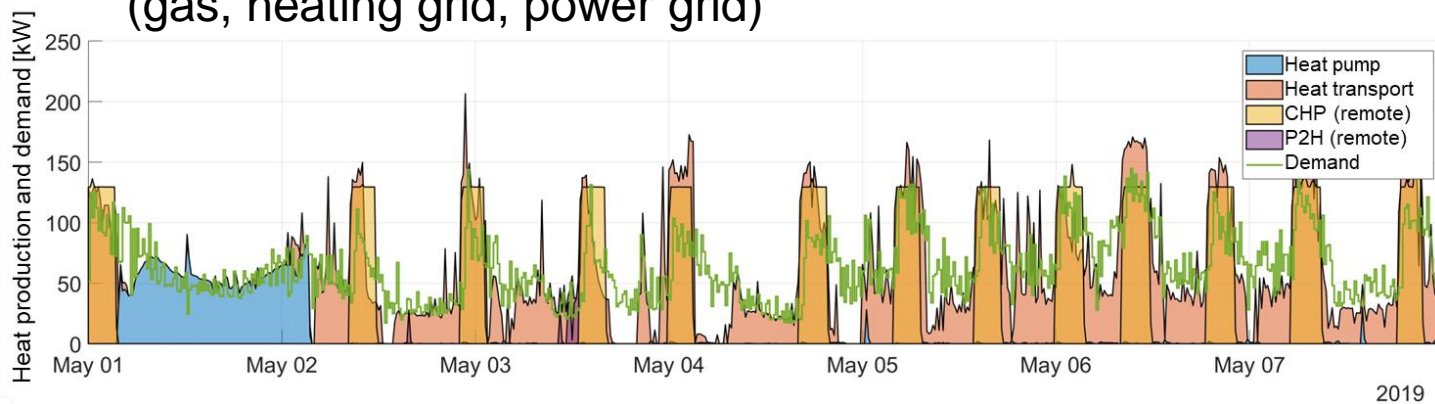
- Only commands for the next 15 minutes are carried out
- After 15 min. the process is repeated using the newest measurements

→ „Moving horizon“- principle Optimization → Control

Energy Management System



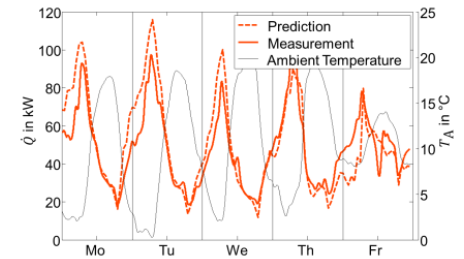
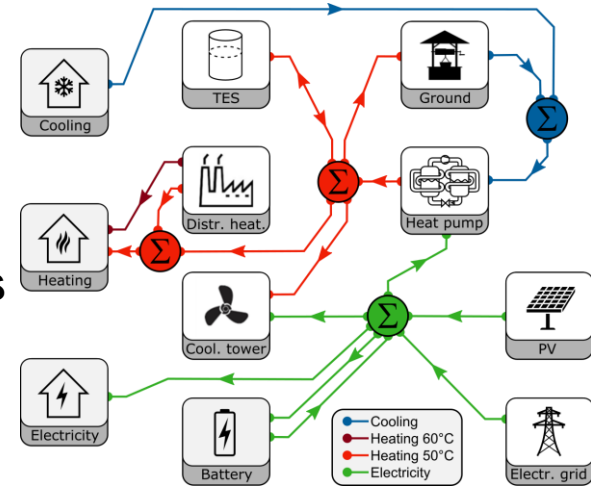
- **The EMS delivers an Operating Strategy**
 - Unit dispatch (on/off), set points
 - Charging / discharging of (thermal) storages and batteries
 - Selling / purchasing energy from networks (gas, heating grid, power grid)



Energy Management System Modular Framework

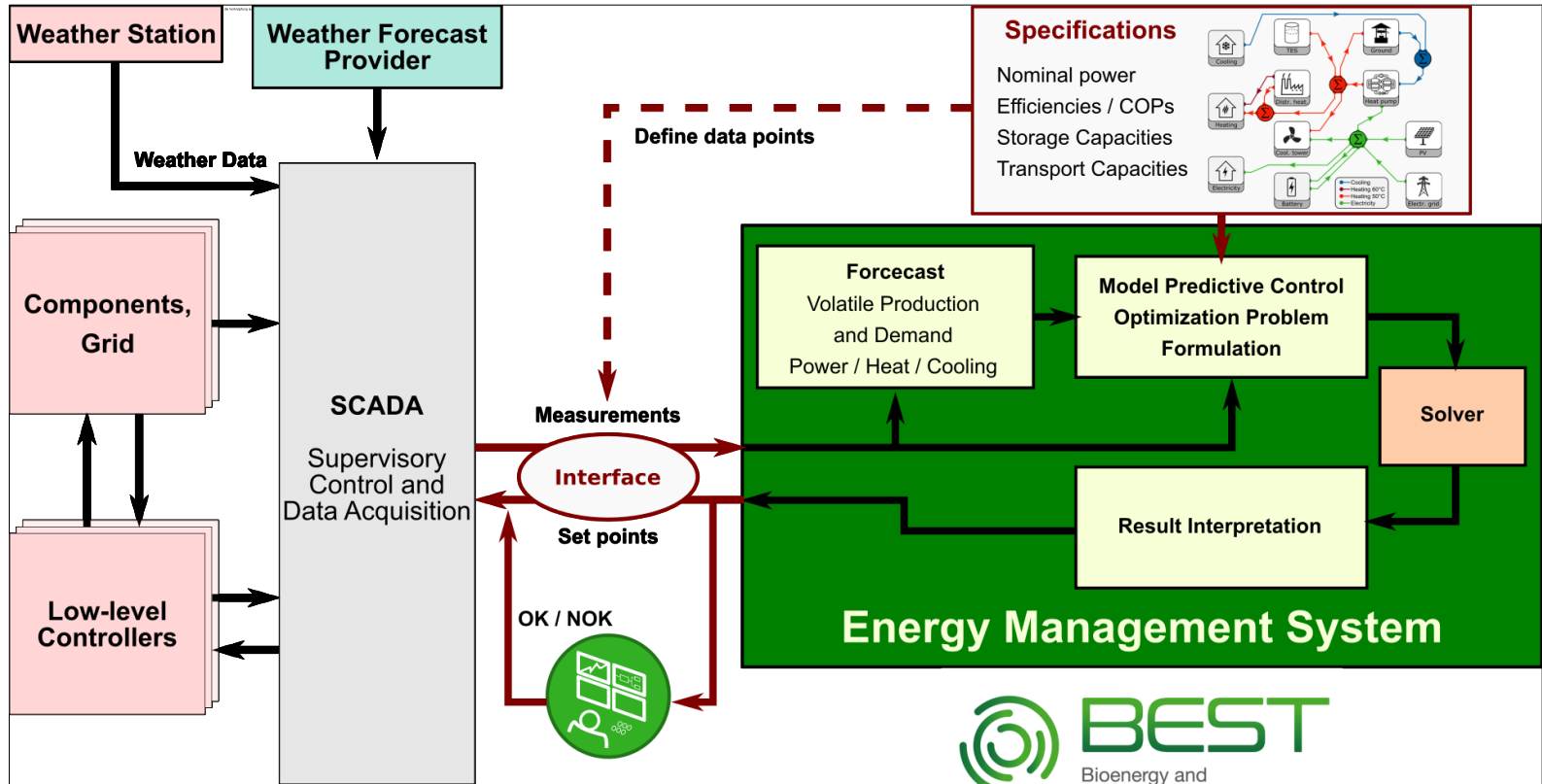


- The operating strategy is **derived automatically** from a given configuration
 - Simply connect **standard building blocks** for typical technologies (gas boiler, CHP, thermal storage , ...)
 - **Load and yield profiles are estimated automatically** by self-learning algorithms based on measurement data and weather forecasts





Steps Towards an Implementation





Implementations

- **First demonstrator at small heating grid in Großschönau**

- Proof of concept

- **Demo at Innsbrucker Kommunalbetriebe**

- Two connected thermal storages, waste

- Operational since the beginning of the h

- **Production Facility Trier**

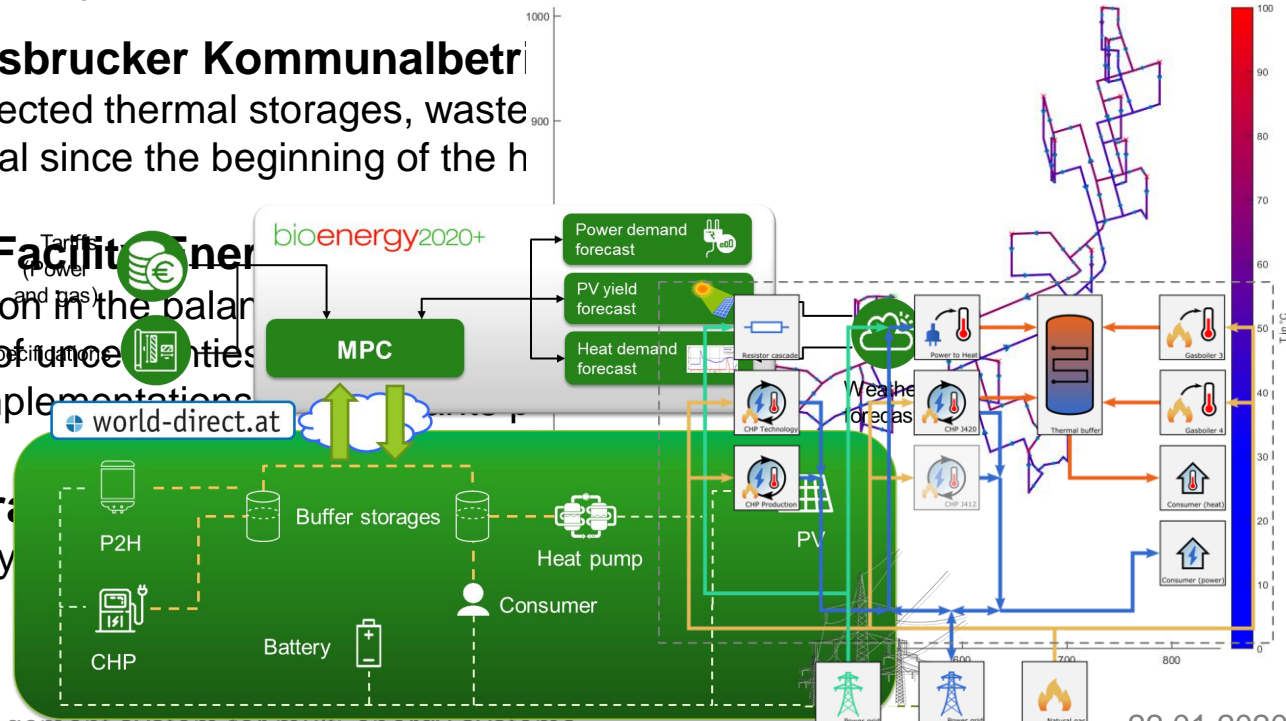
- Participation in the balance

- Handling of uncertainties

- Further implementations

- **... and several**

- from family

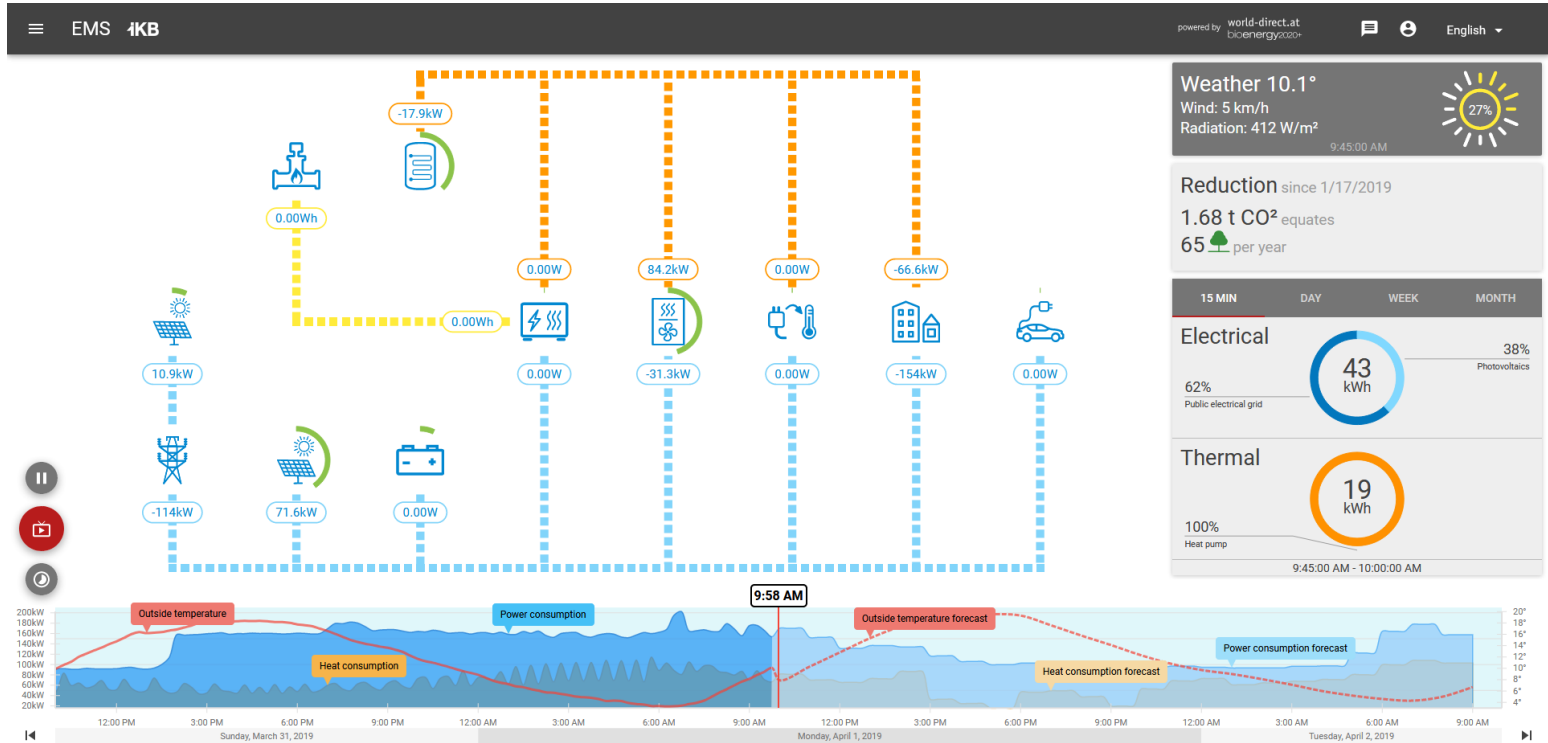


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First Results: Demo @ IKB Dashboard © World-Direct



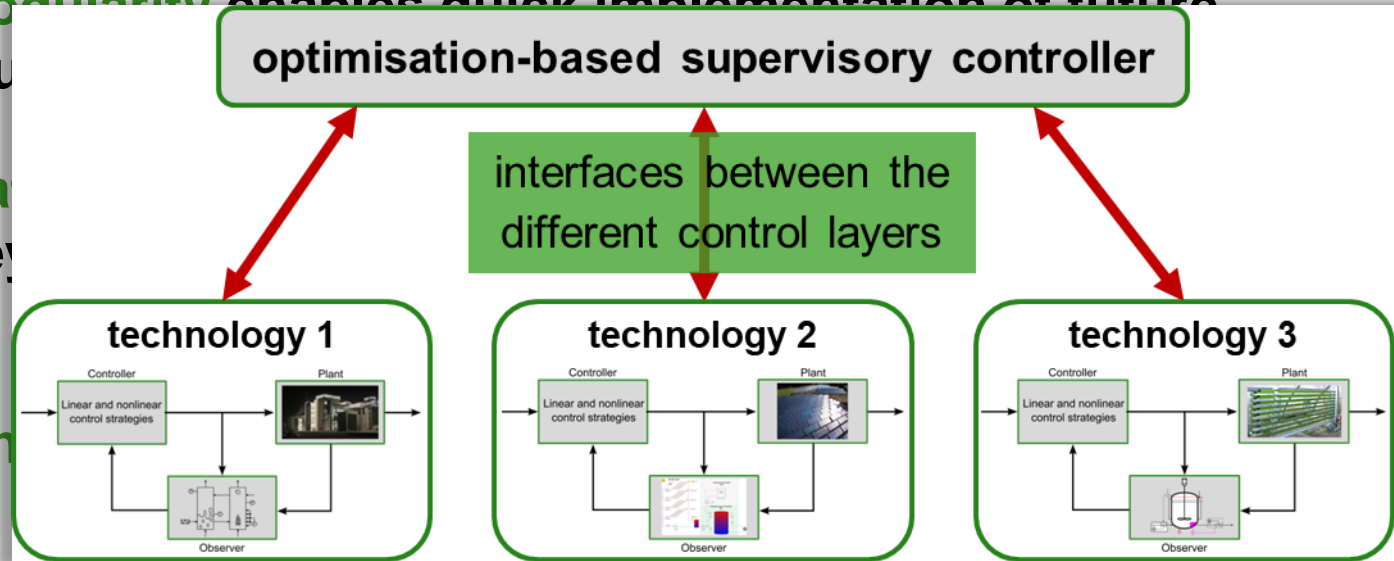


Conclusion & Outlook

- **Modularity** enables quick implementation of future multi-energy systems

- **Data** based

- **Online**



- **Demand side management**
- **Varying temperature levels**

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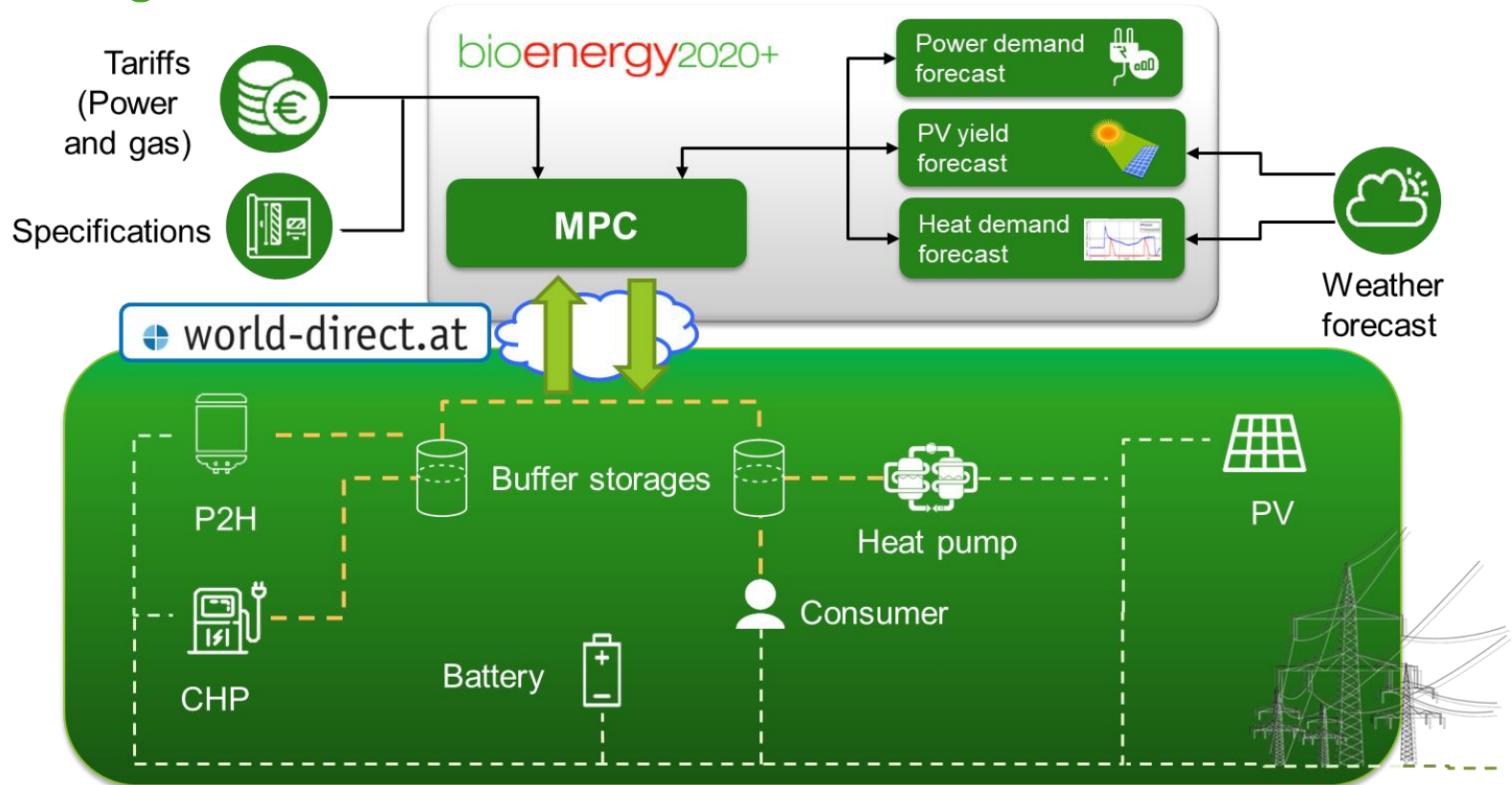
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First results from implementation
Building complex in Innsbruck (AUT)

First Results: Building complex in Innsbruck (AUT)

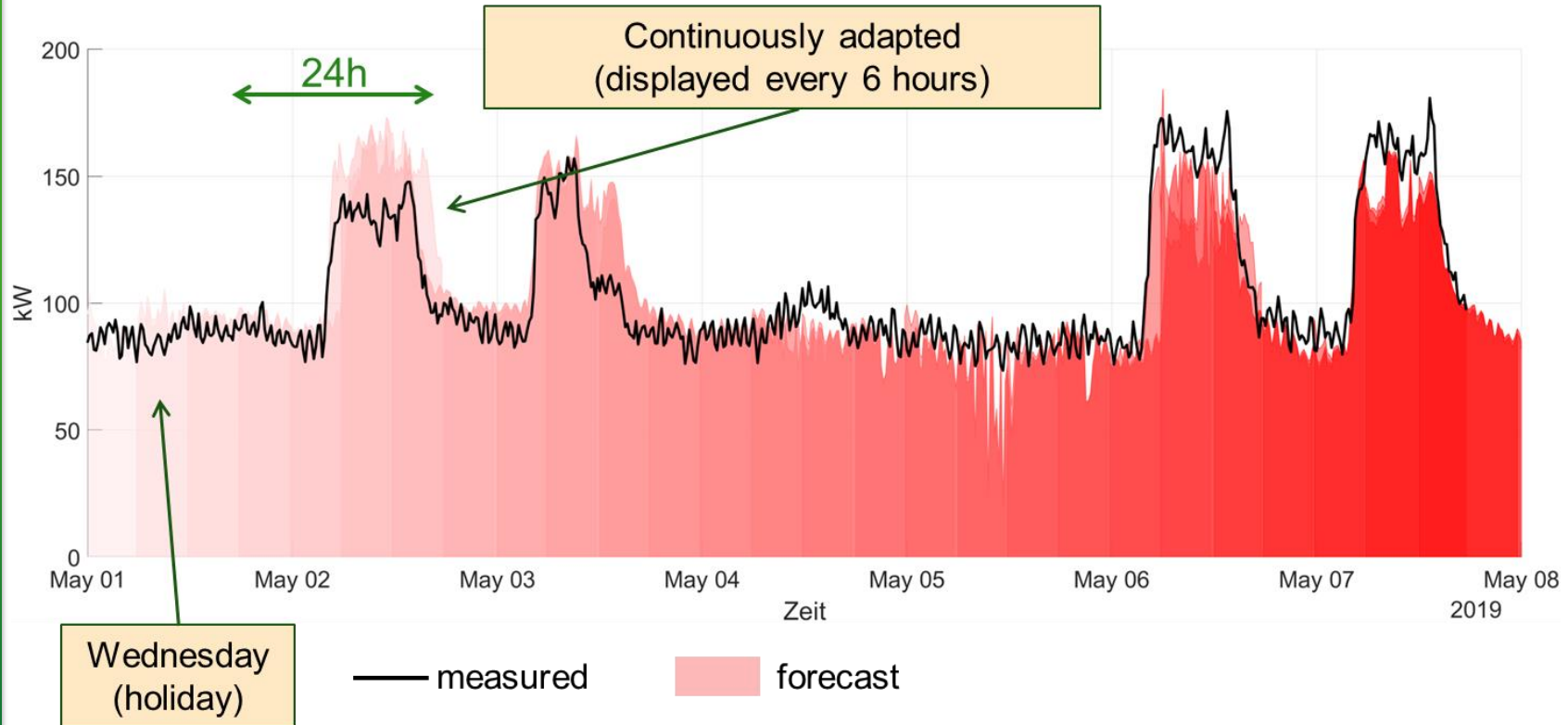
Configuration





First Results: Building complex in Innsbruck (AUT)

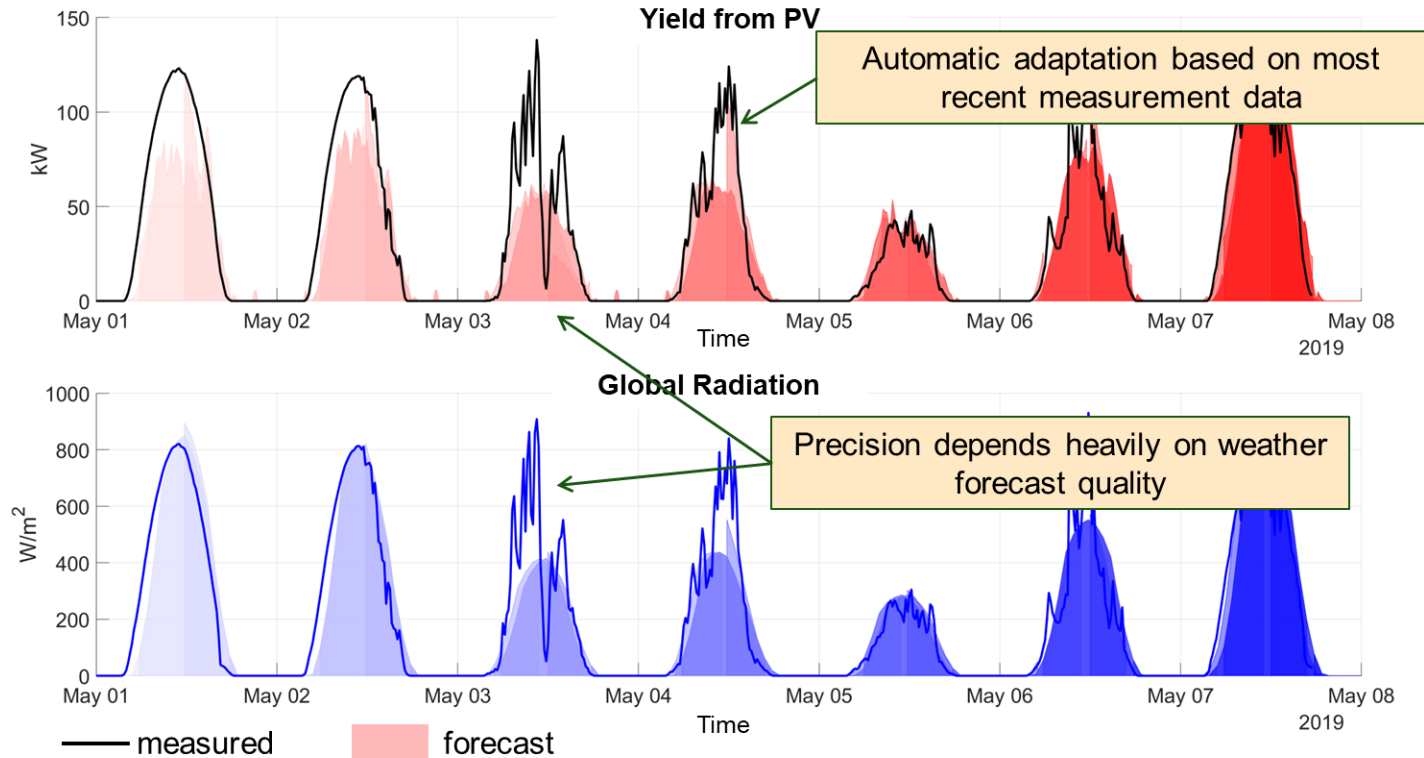
Demand forecast – Electrical Power





First Results: Building complex in Innsbruck (AUT)

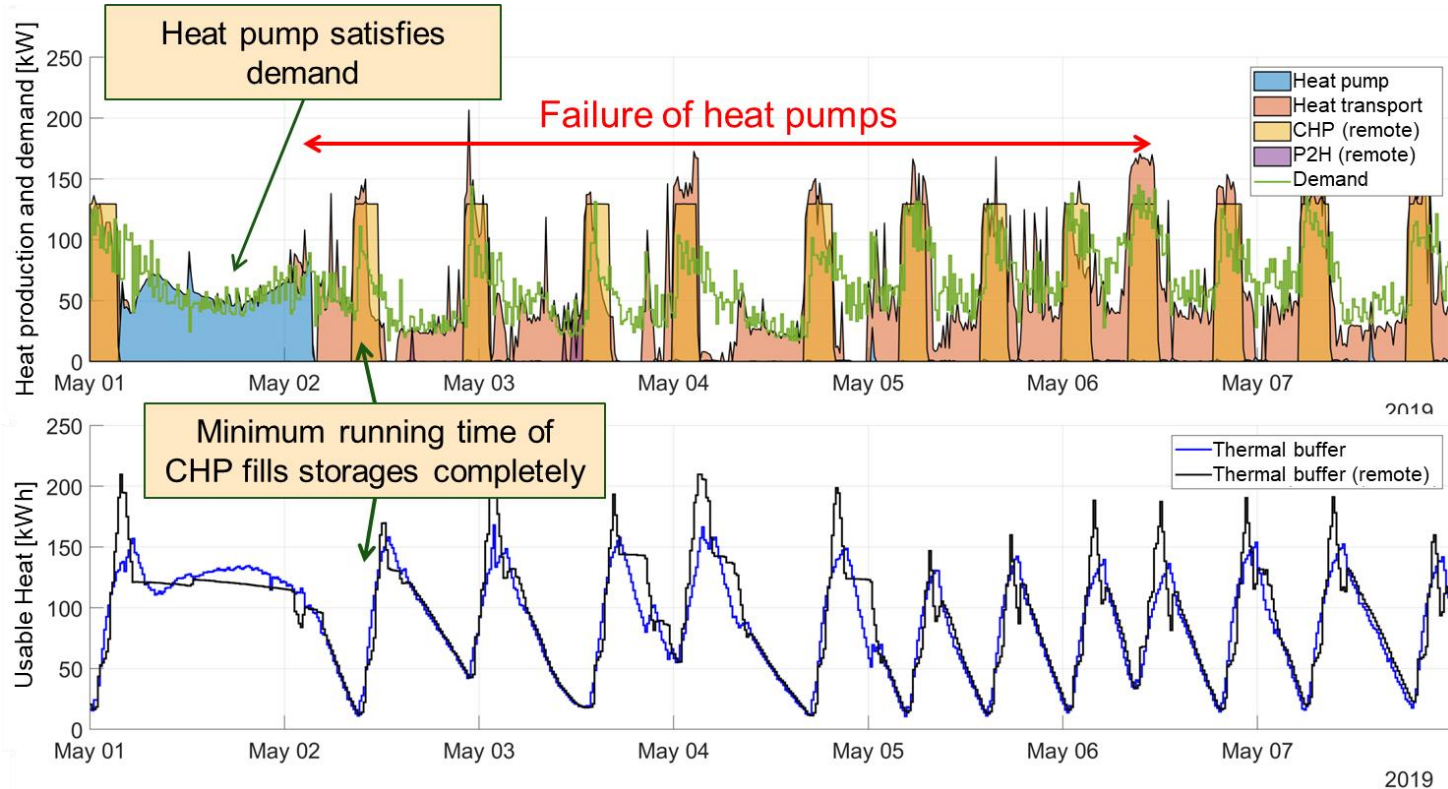
Yield Forecast - Photovoltaics





First Results: Building complex in Innsbruck (AUT)

Control Strategy





First Results: Building complex in Innsbruck (AUT)

Control Strategy

