

# Potential and Limitation of Controlled Charging of Electric Vehicle for PV Self-Consumption Maximisation in Private Households

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## FELLBACH ZEROPLUS PROJECT

### Motivation

- PV self-consumption has become a profitable business model for private households in Germany
  - **Can an intelligent charging management EV charging raise the PV self-consumption?**
- The positive environmental aspect of EV only applies when charged with renewable energy
  - **Is it possible to charge the EV with 100 % PV energy generated on-site?**

### Method

- Development of home energy management systems and smart charging stations for charging rates up to 22 kW
- Core of the system is a **forecast based optimization** approach for charging schedule computation
- Two year field test with five families

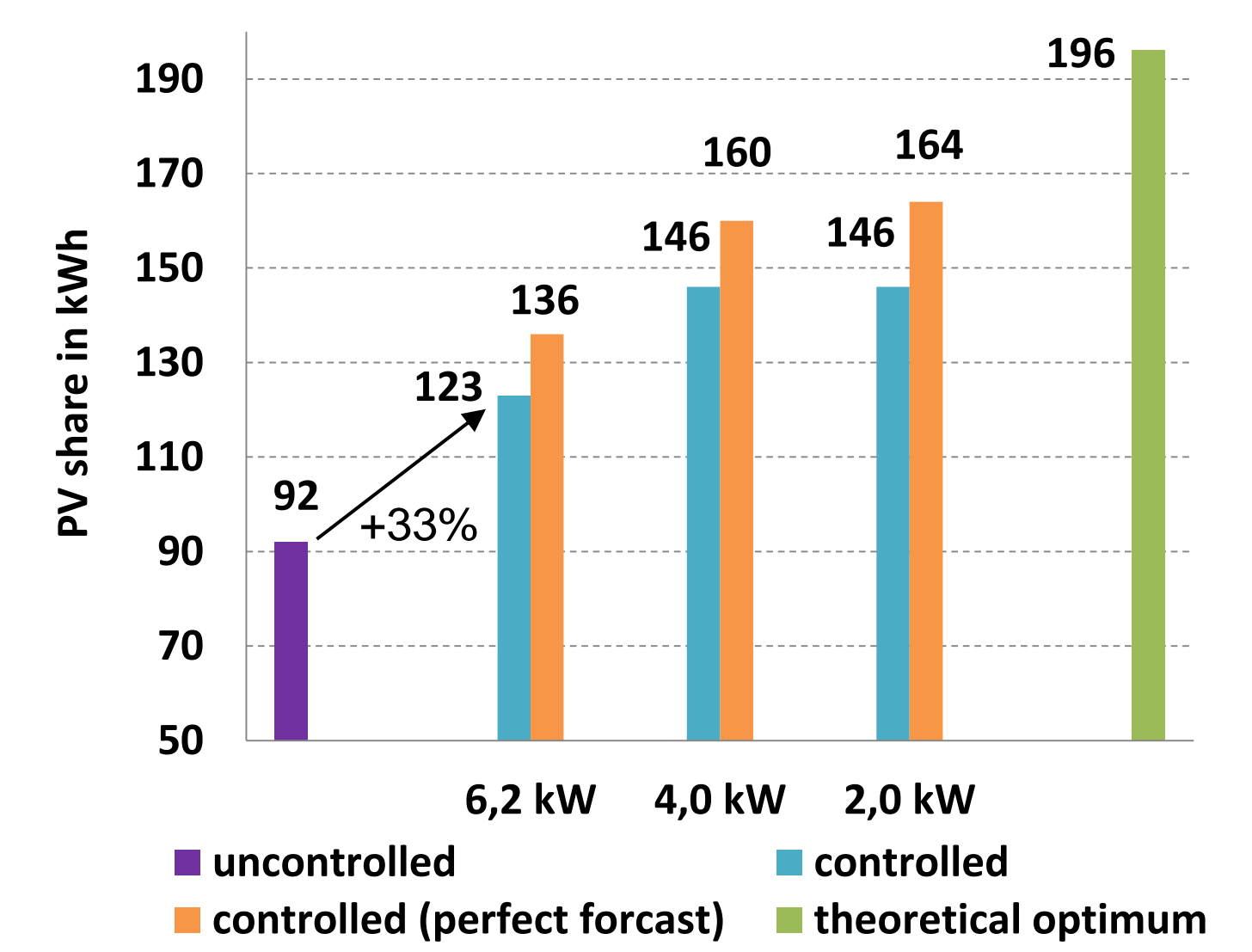
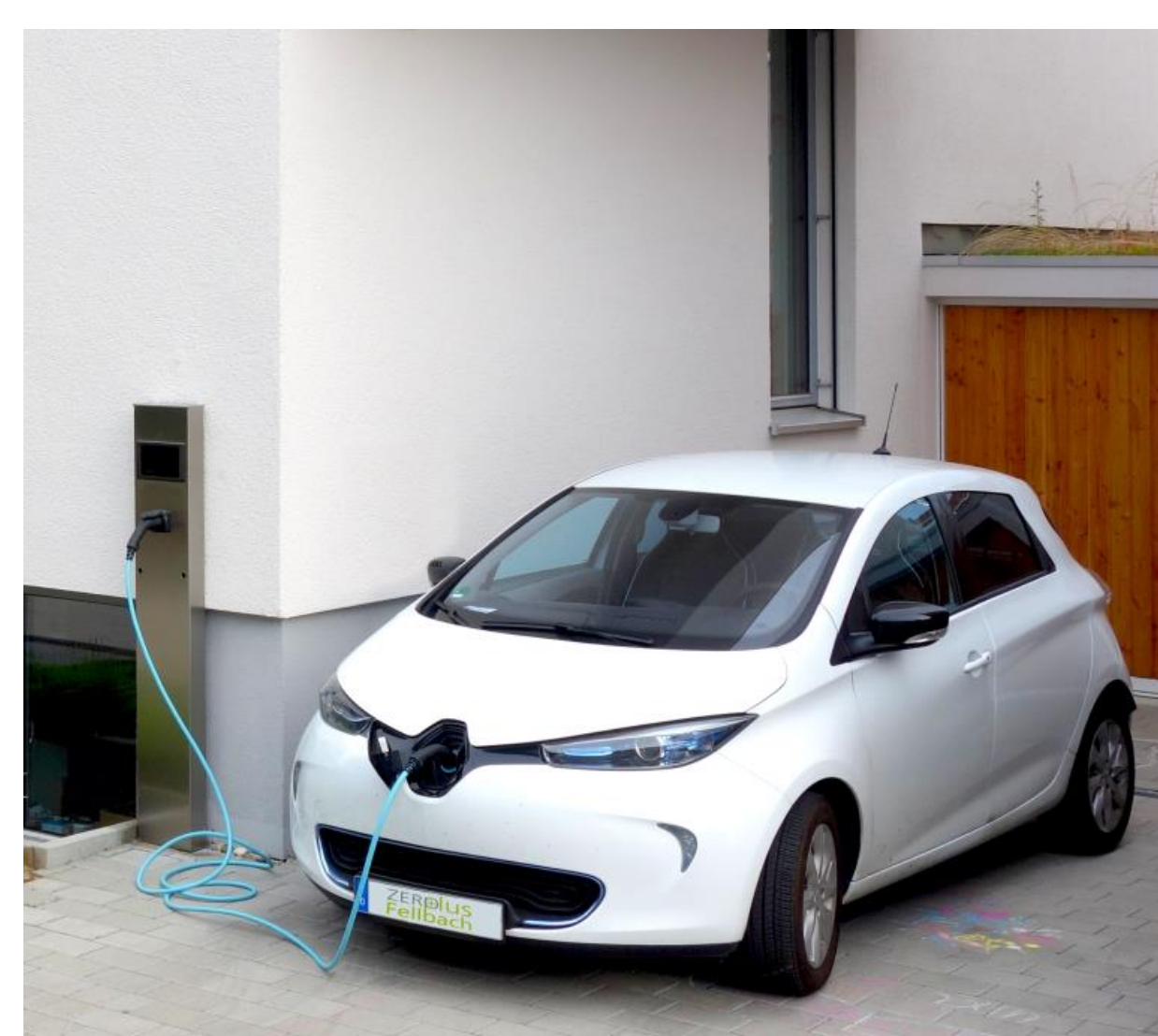
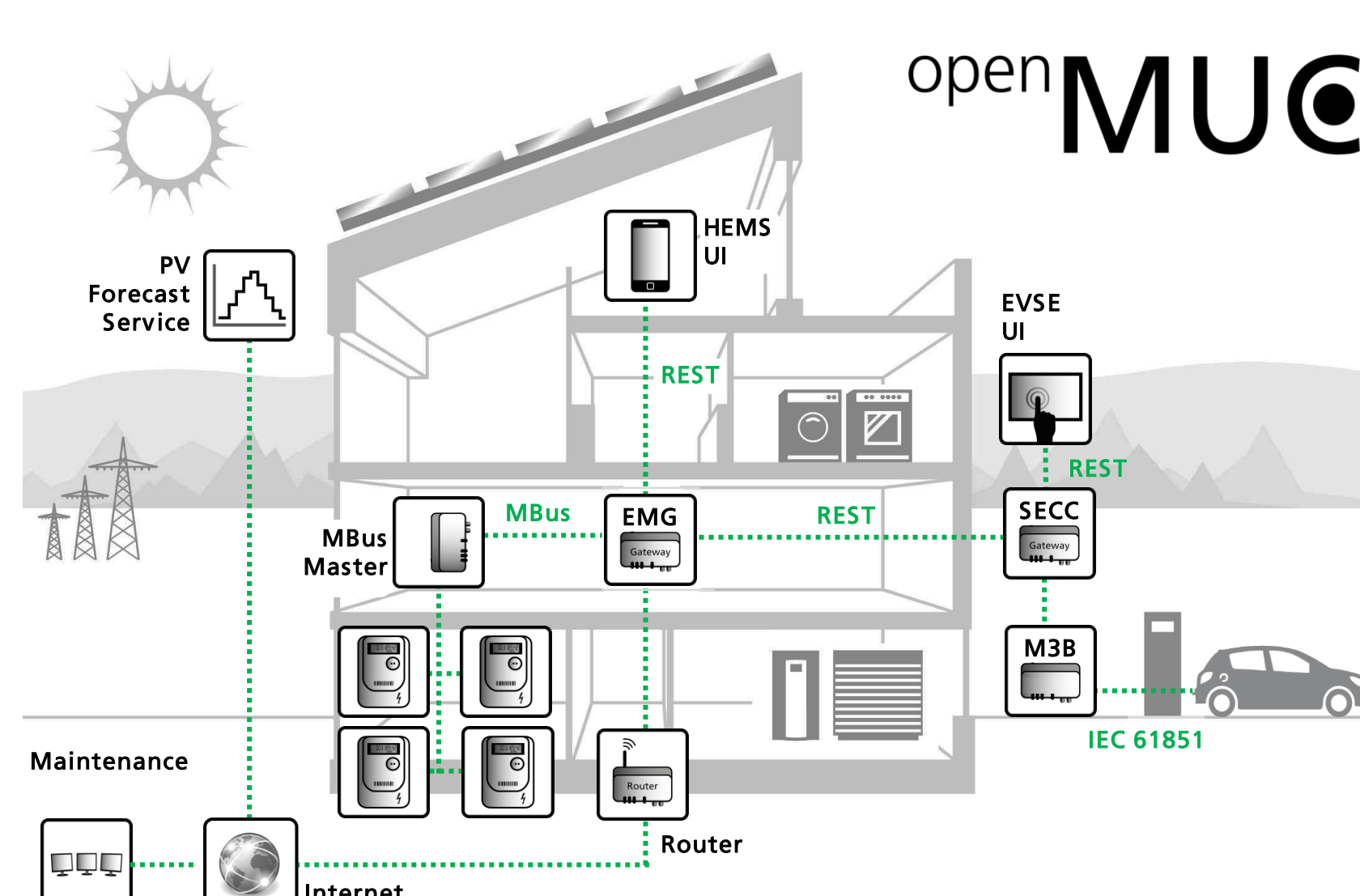
### Analysis

- 485 kWh have been charged in the analysed charging processes
- If EVs are charged without charging management then 92 kWh of this demand could be covered by PV energy
- With controlled charging the PV share was **increased by 33 %** by using the forecast based optimization approach

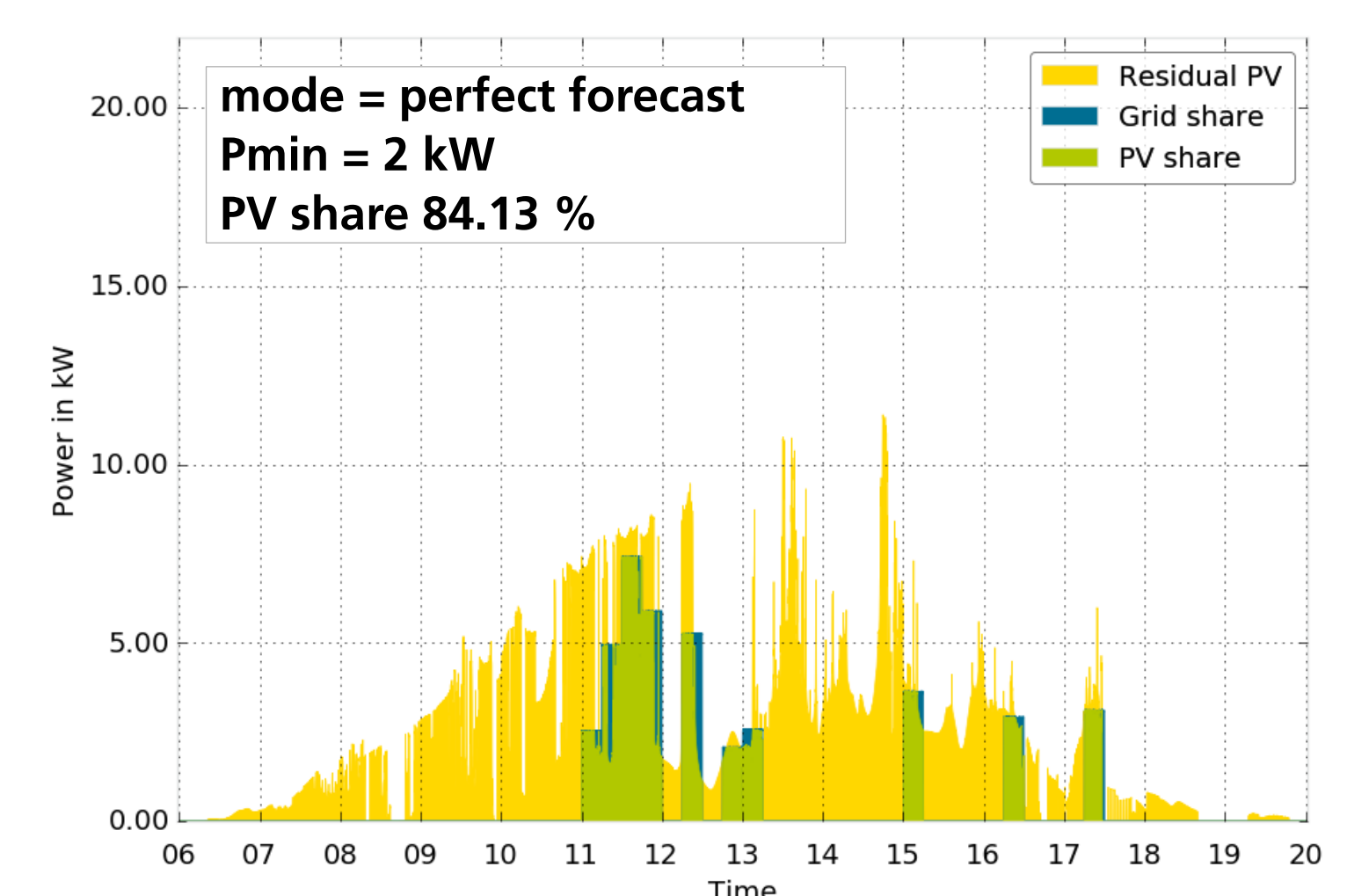
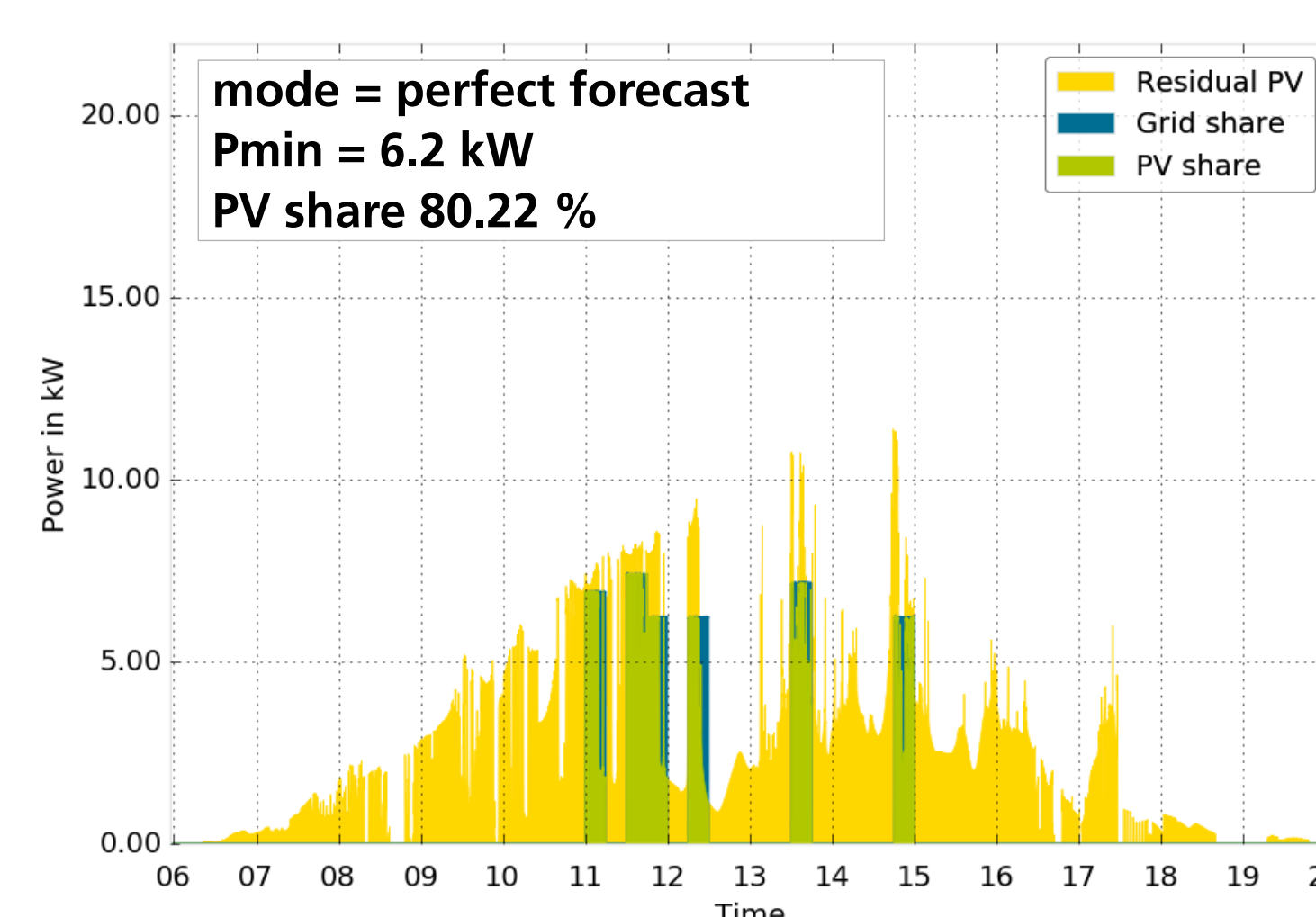
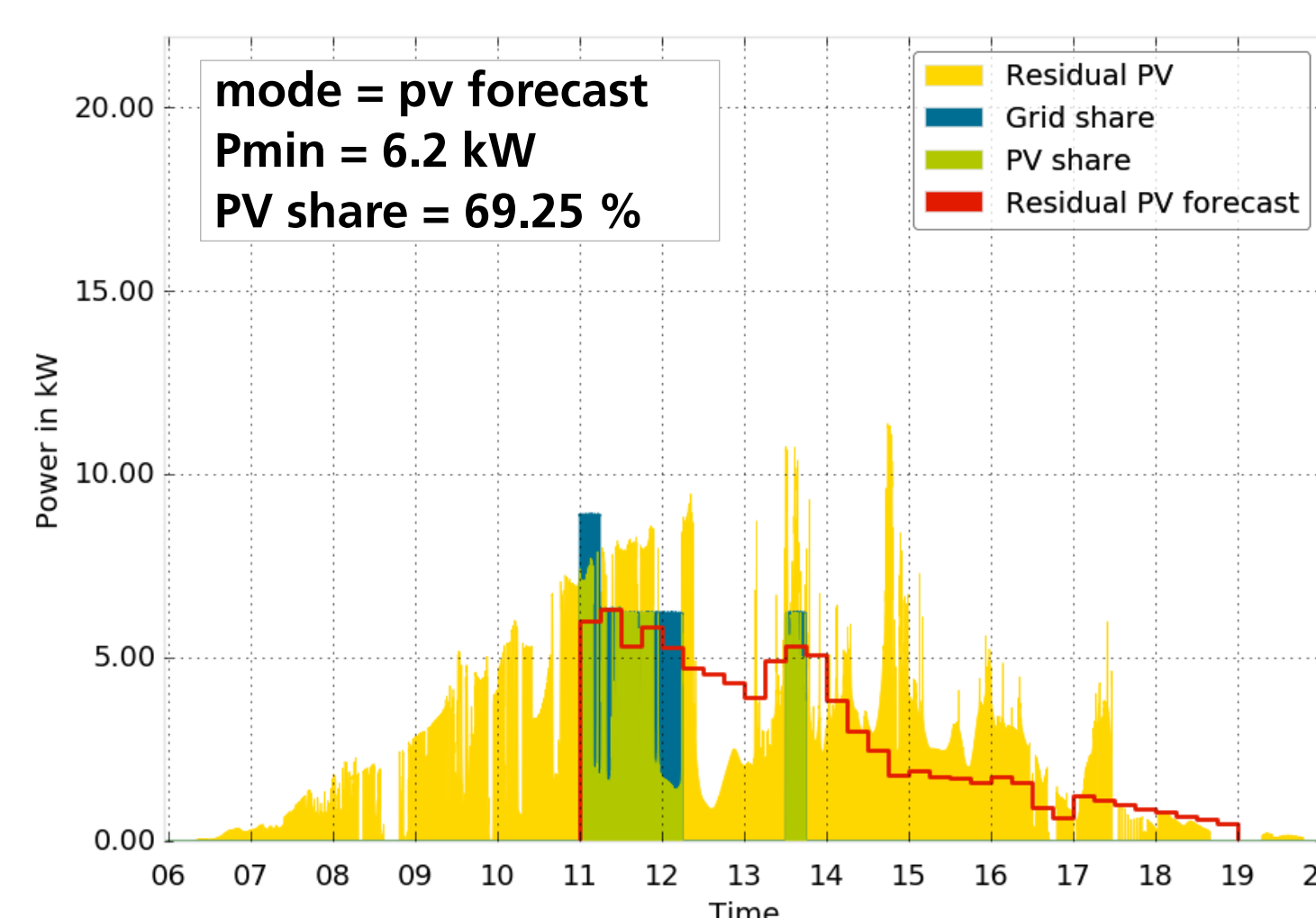
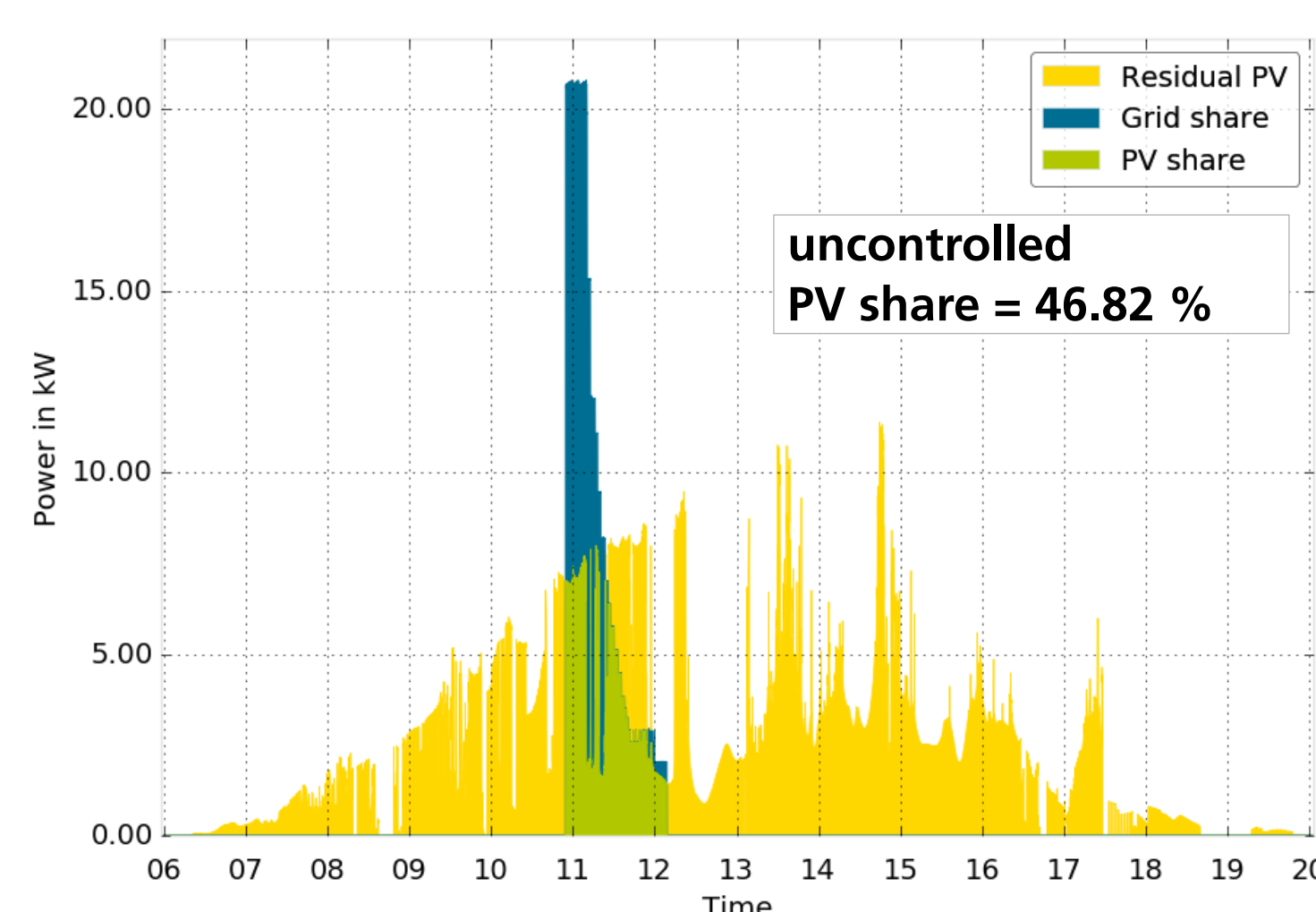
### Conclusion

- Minimal charging power of three-phase charging systems often causes grid usage for typical PV systems of private households, thus charging with 100 % PV energy is not possible
- Lowering minimal charging power yields in a higher PV share
- The forecast uncertainty is another aspect causing grid usage
- The optimization approach will be therefore extended by real time PV monitoring in the next step

## SYSTEM DESIGN AND FIELD TEST



## CHARGING PROCESS ON A PARTLY CLOUDY SOMMER DAY



## CHARGING PROCESS ON A SUNNY WINTER DAY

