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Integration of PV Power and Load Forecasts into the Operation of Residential PV Battery Systems

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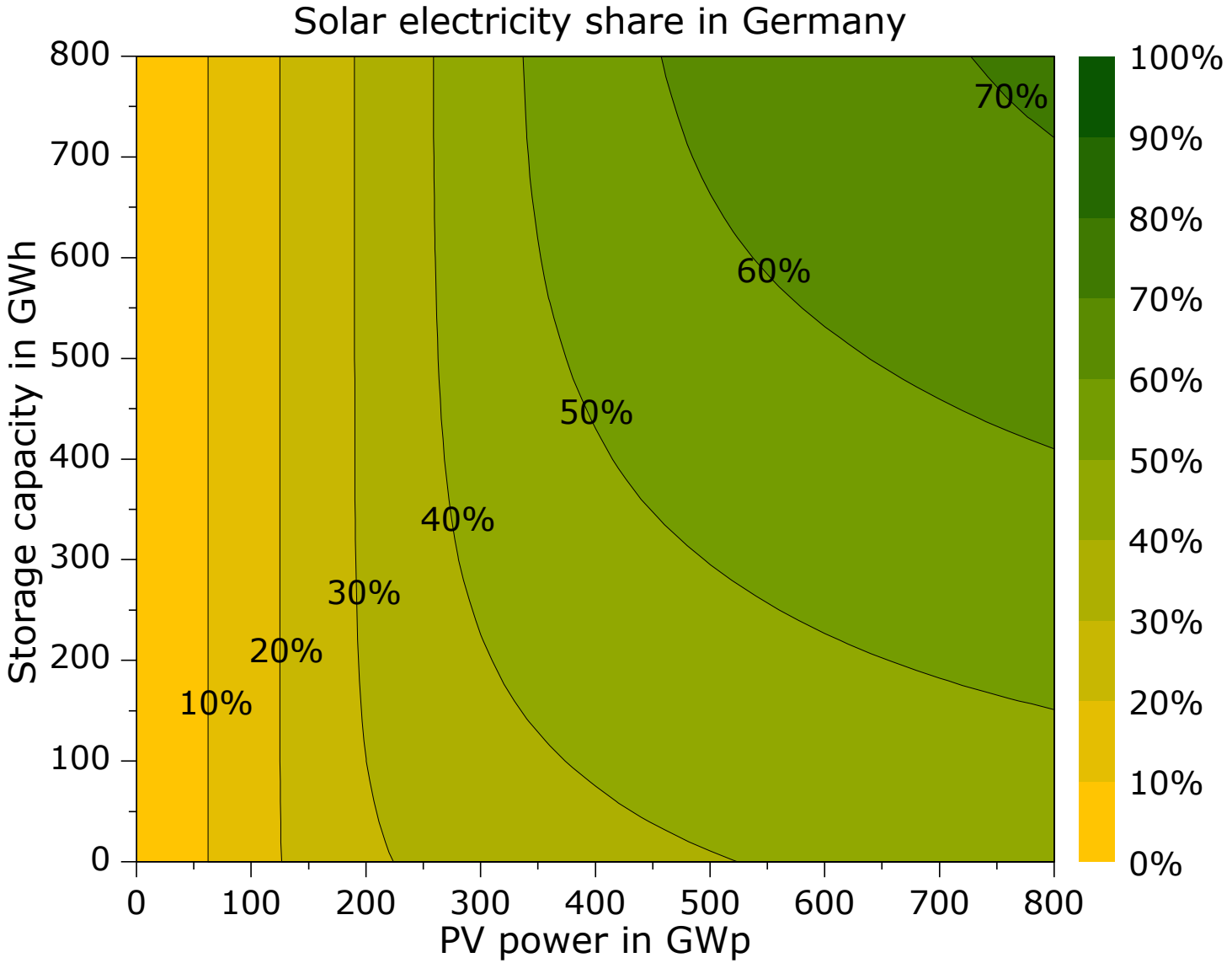
Potential of the solar electricity supply in Germany



Data: PV (EEX 2012), load (ENTSO-E 2012), gross electricity consumption 600 TWh/a

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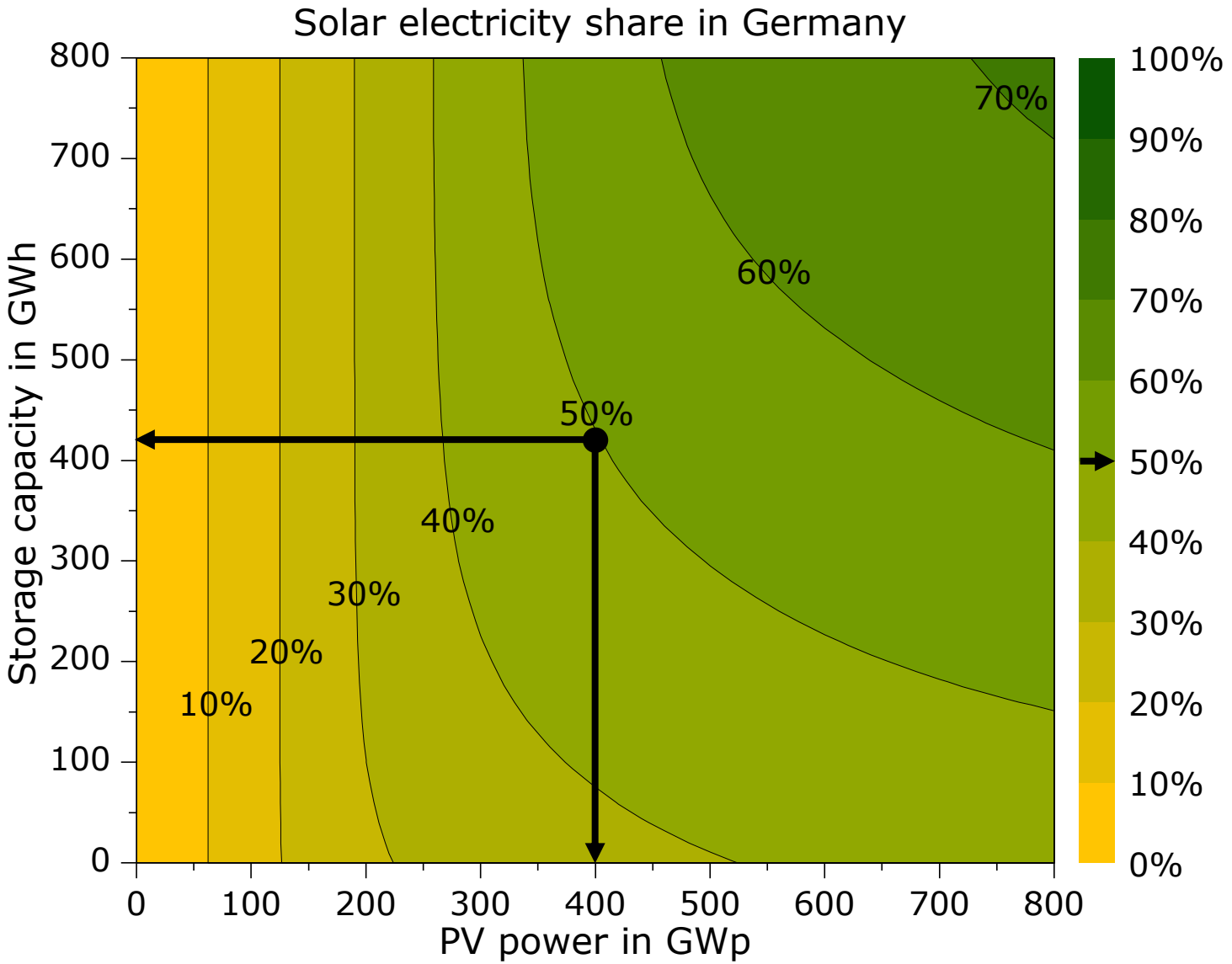

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Operation strategies of PV battery systems

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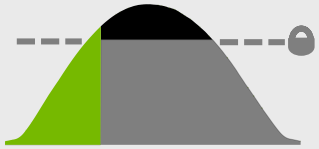
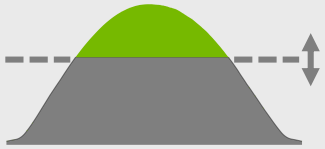
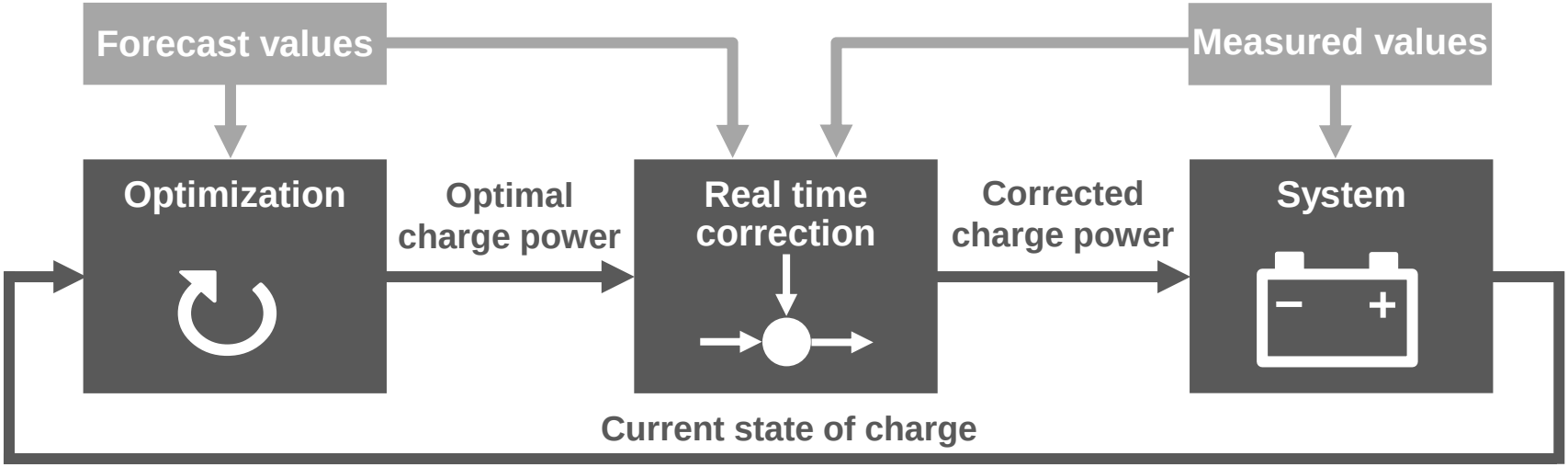
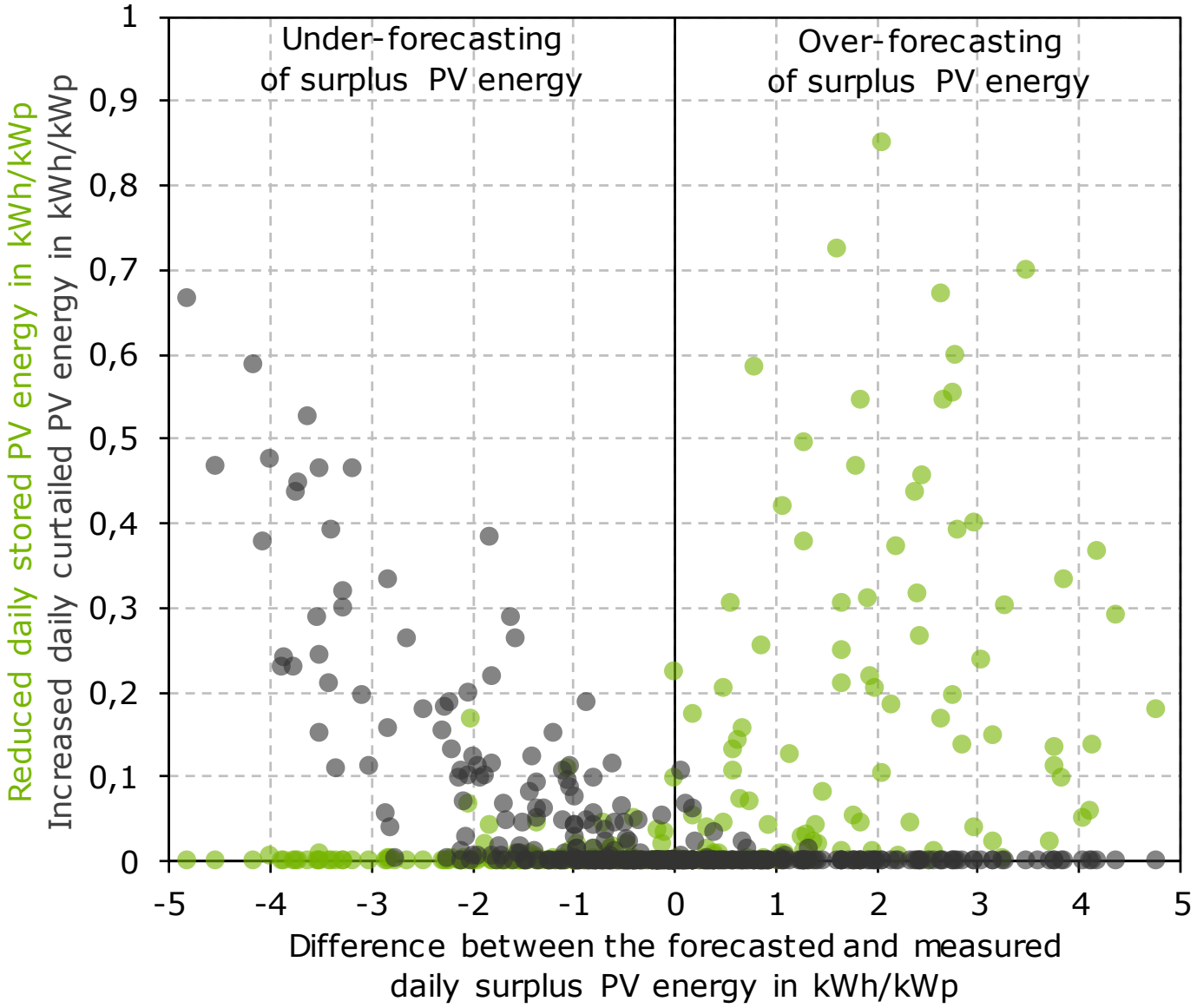
- Battery charge
- Grid feed-in
- Curtailment
- Feed-in limit

	Without feed-in limitation	Fixed feed-in limitation through curtailment	Dynamic feed-in limitation
			
Max. self-sufficiency	+	+	+
Relieving the grid		+	++
Forecast-based			+

Control scheme of forecast-based operation strategies

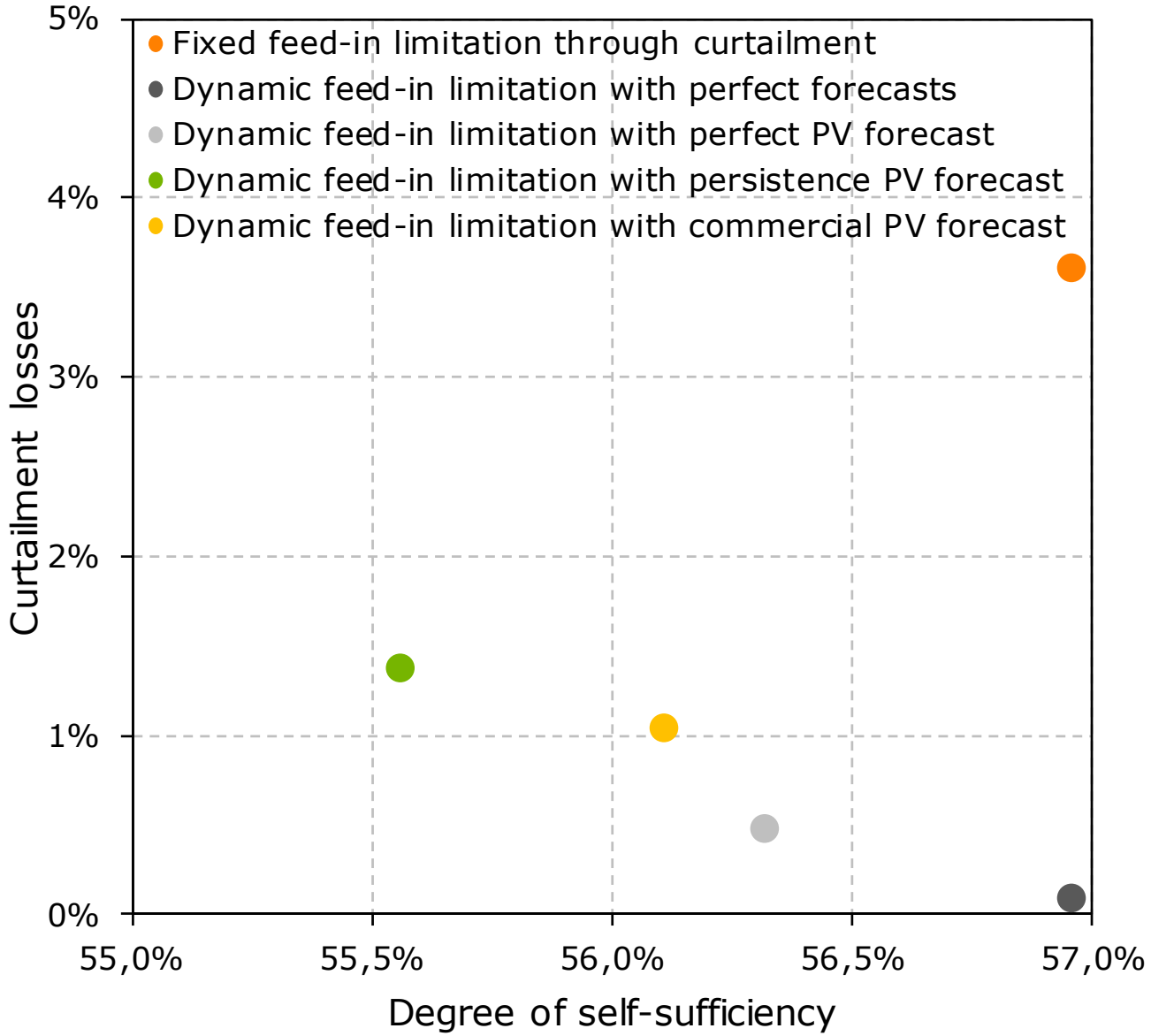


Impact of forecast errors on the daily energy yield



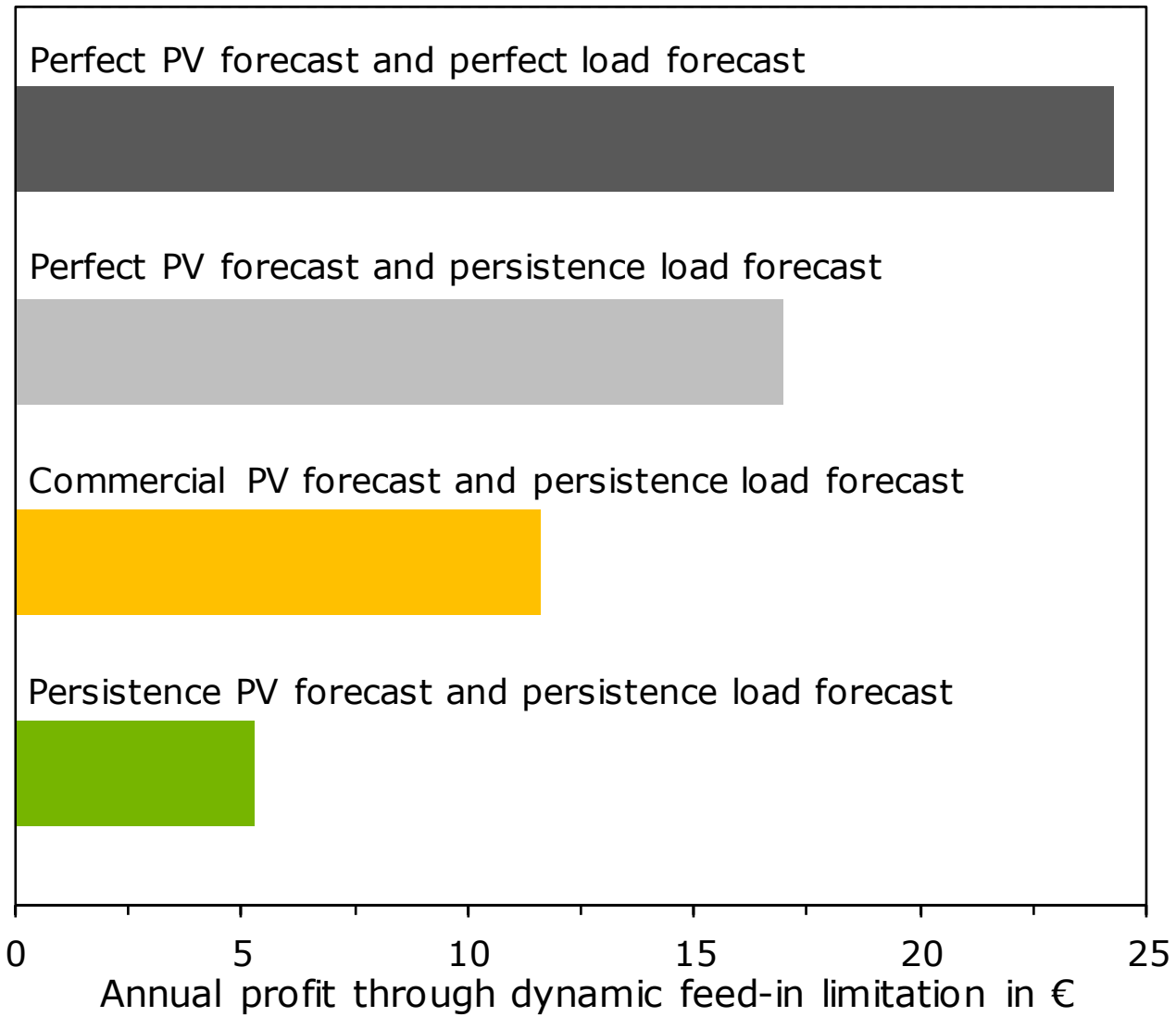
load demand 5.3 MWh/a, PV power 5 kWp, battery capacity 5 kWh,
persistence PV and load forecasts in comparison to perfect forecasts

Annual energetic performance of different forecasts



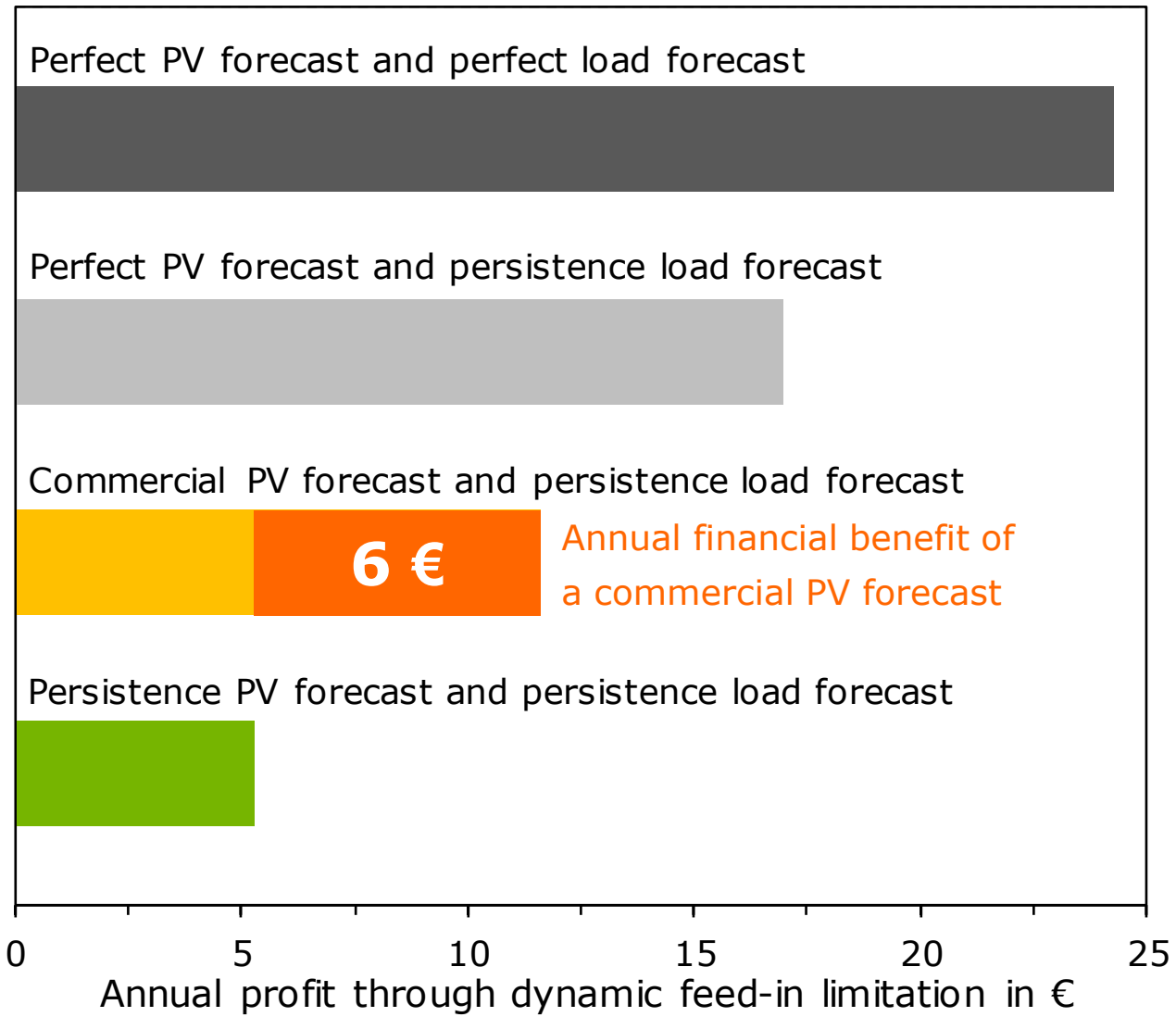
load demand 5.3 MWh/a, PV power 5 kWp, battery capacity 5 kWh

Annual economic performance of different forecasts



load demand 5.3 MWh/a, PV power 5 kWp, battery capacity 5 kWh
feed-in tariff 0.12 €/kWh, retail electricity price 0.28 €/kWh

Annual economic performance of different forecasts



load demand 5.3 MWh/a, PV power 5 kWp, battery capacity 5 kWh
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Conclusion

- The conjunction of PV systems with storage devices is of decisive importance to **realize high solar shares**.
- **Forecast-based operation strategies** have the capability of feed-in peak shaving and self-sufficiency optimization as well.
- The dynamic feed-in limitation can be seen as an **economically efficient measure** to improve the grid integration of PV.
- Only **small financial benefits** by adding commercial PV forecasts instead of persistence PV forecasts were identified.
- **Locally created PV forecasts** may render the purchase of commercial PV forecasts in residential applications obsolete.