

Balancing of electricity production from photovoltaics (PV) using advanced shortest term forecasts and intraday Markets

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Energie
braucht Impulse

Inhalt

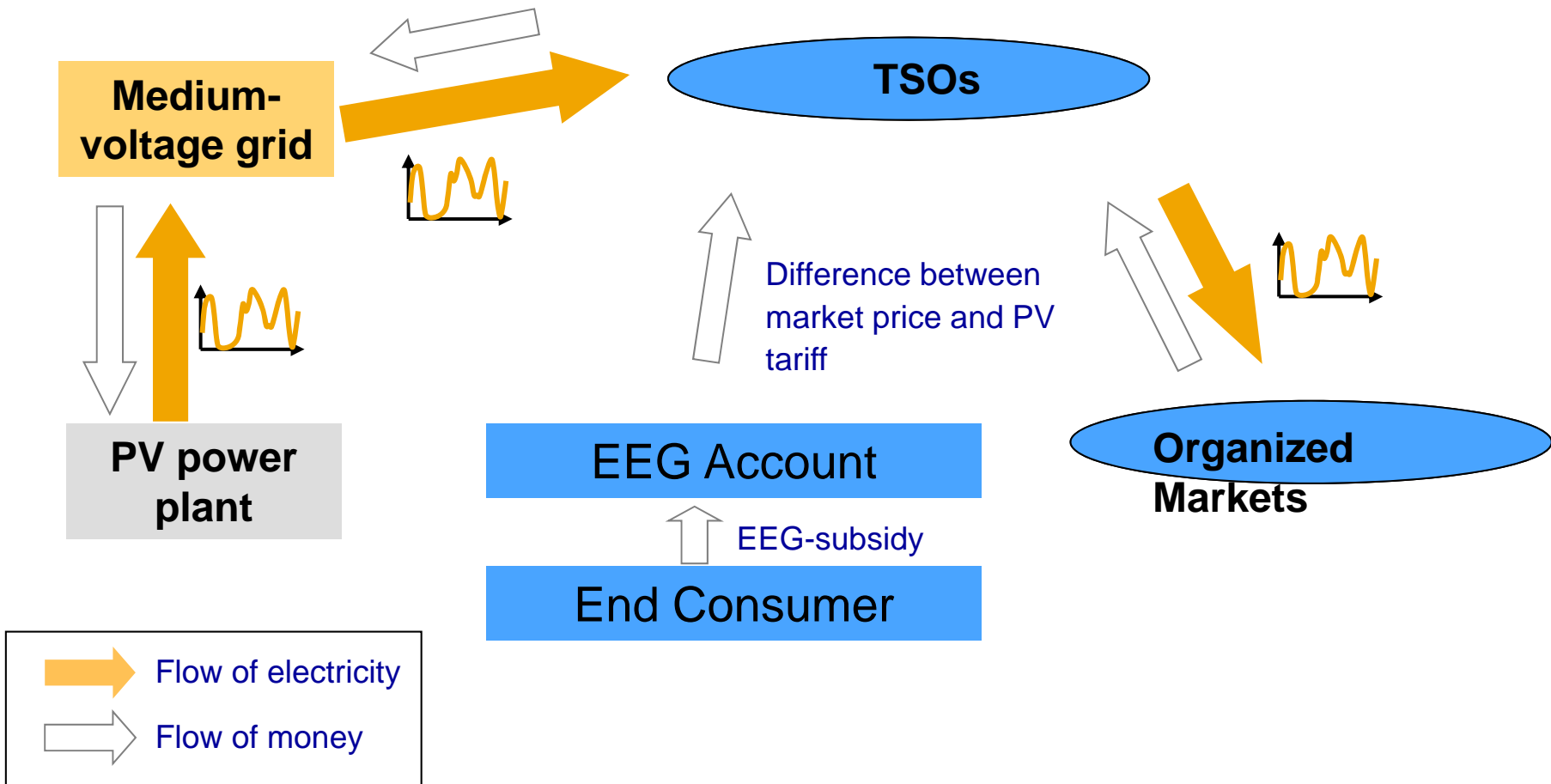
1. Introduction
2. PV market integration
3. PV intraday forecast
4. Conclusion



1. Introduction: PV Integration in Germany

-> Central role of TSO: Clearing of PV payments and market integration of PV production

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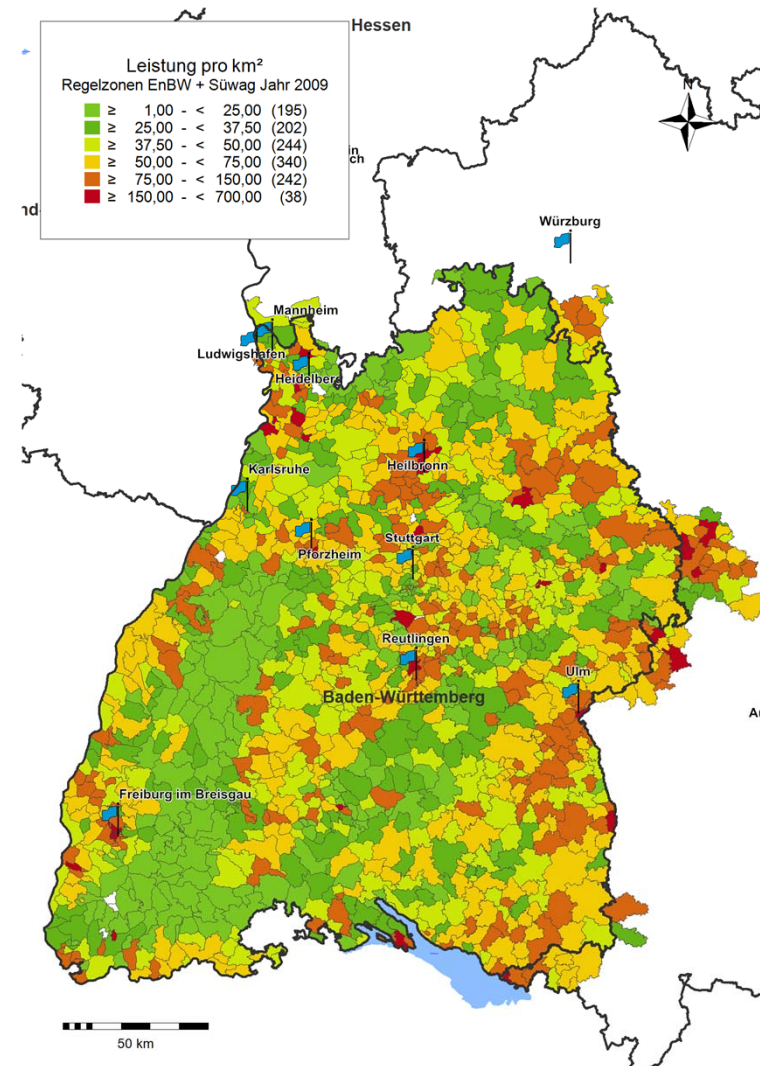


1. Introduction: PV integration at EnBW TSO

-> Highest PV density of all TSOs / Integration complex due to geography



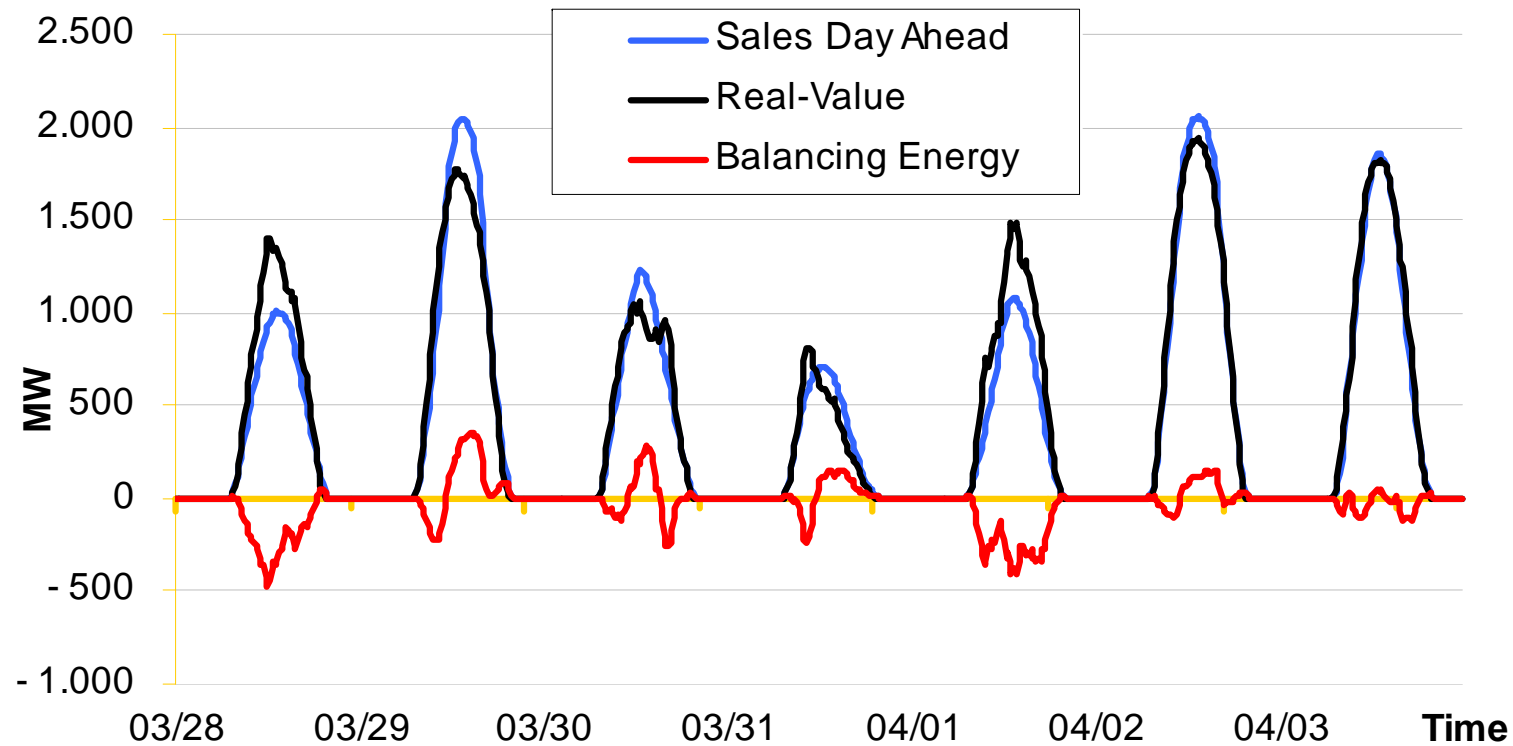
- › PV characteristic at EnBW TSO
 - › Capacity exceeds 3 GW end of 2010
 - › Highest PV density of all German TSOs
- › Market Integration
 - › High fluctuations because of small area
 - › Heterogenous weather due to geographical situation (Schwarzwald, Schwäbische Alb)
 - › Forecasting difficult
- › RES-E Clearing
 - › Over 180,000 PV installations with different tariffs
 - › More than 1 billion € payments totally



2. Market Integration of PV: Solely Day Ahead

-> Operational requirements moderate / Works good on mostly sunny days / Significant forecast errors on rainy days...

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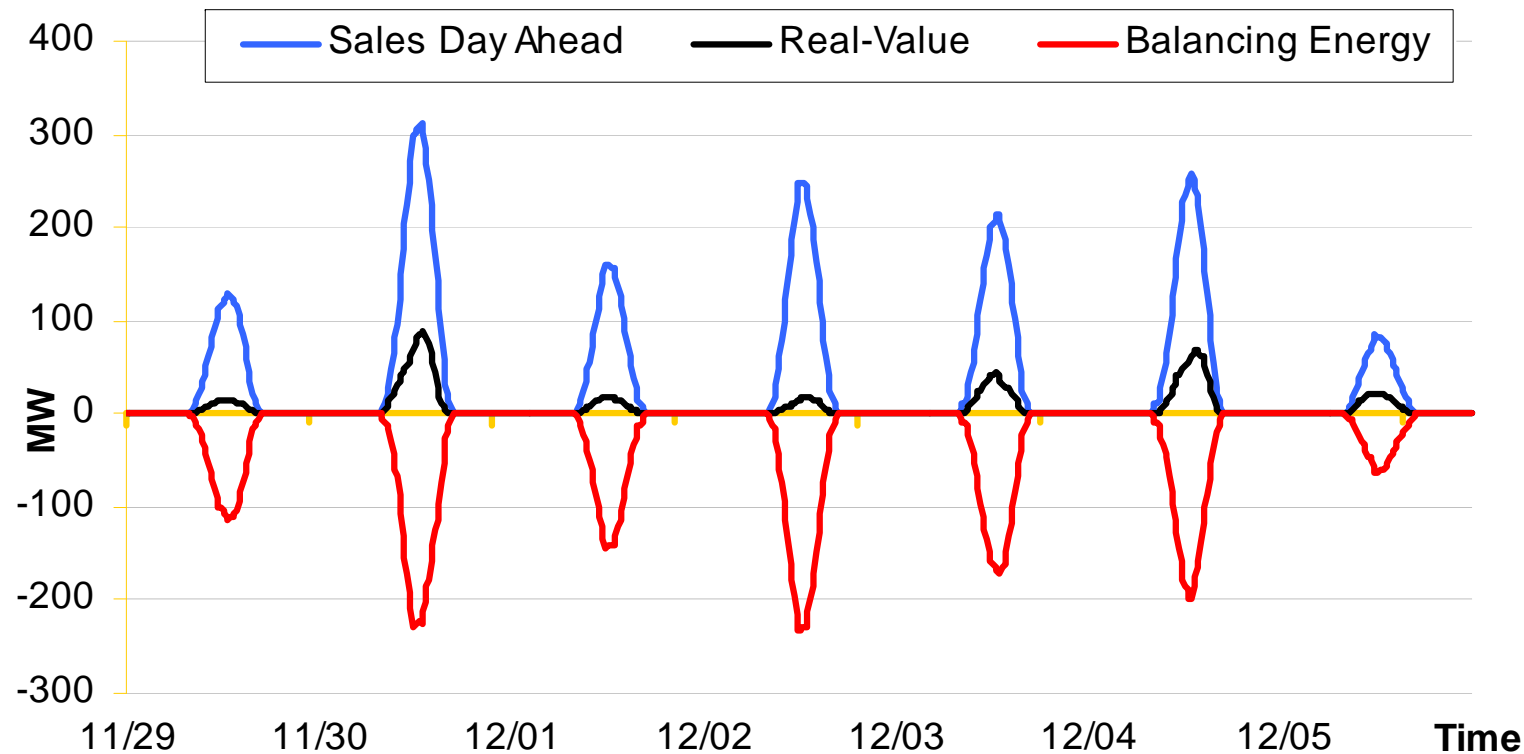


1. Day ahead marketing of the PV in the EnBW grid area based on forecasts
2. Forecast errors are balanced with balancing energy

2. Market Integration of PV: Solely Day Ahead

-> ... extreme forecast errors on weather situations like snowfall and fog / More than 1 GW forecast error possible

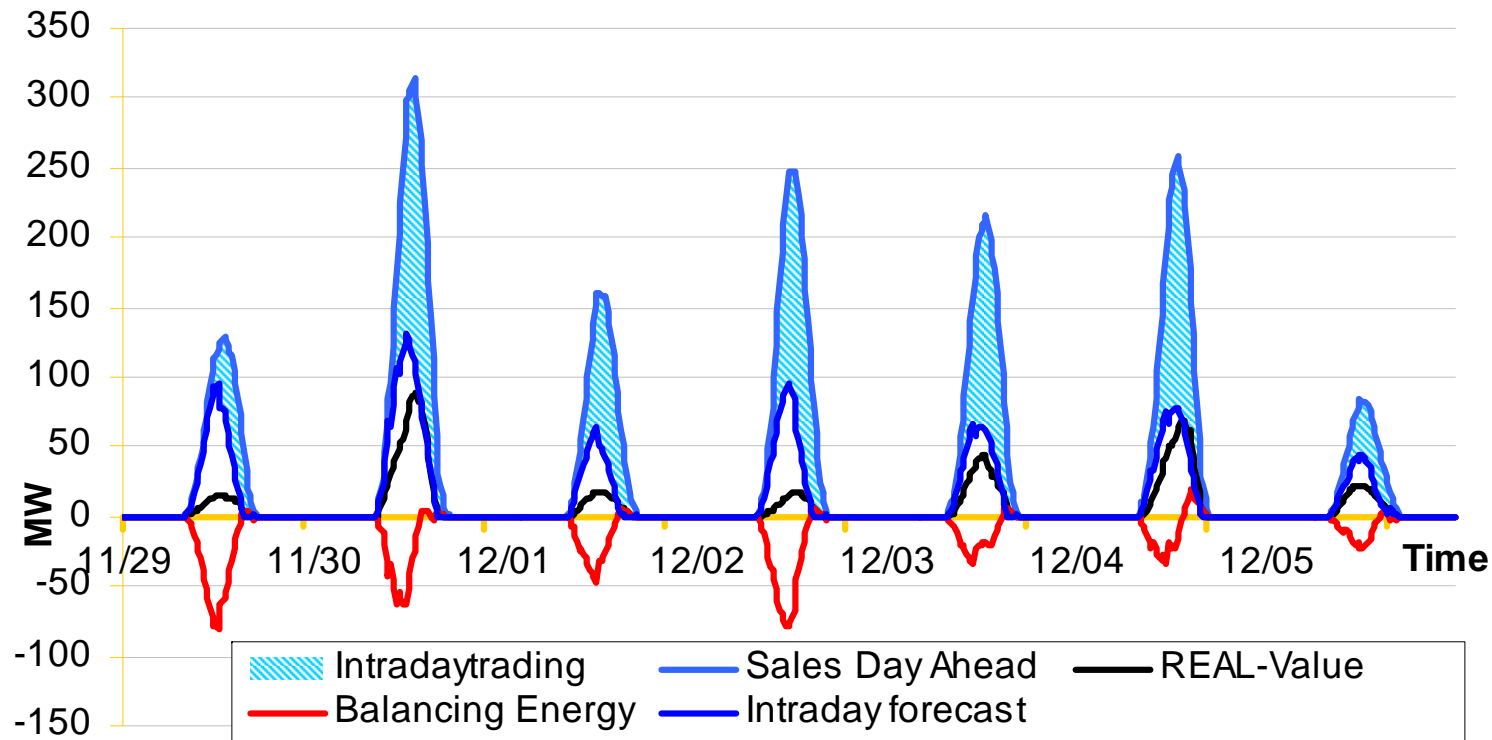
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- › Day ahead integration leads to high costs due to high demand of balancing energy!
- › In the long run with further growing PV capacities demand of balancing reserves will increase!

2. Market Integration of PV: Day Ahead and Intraday

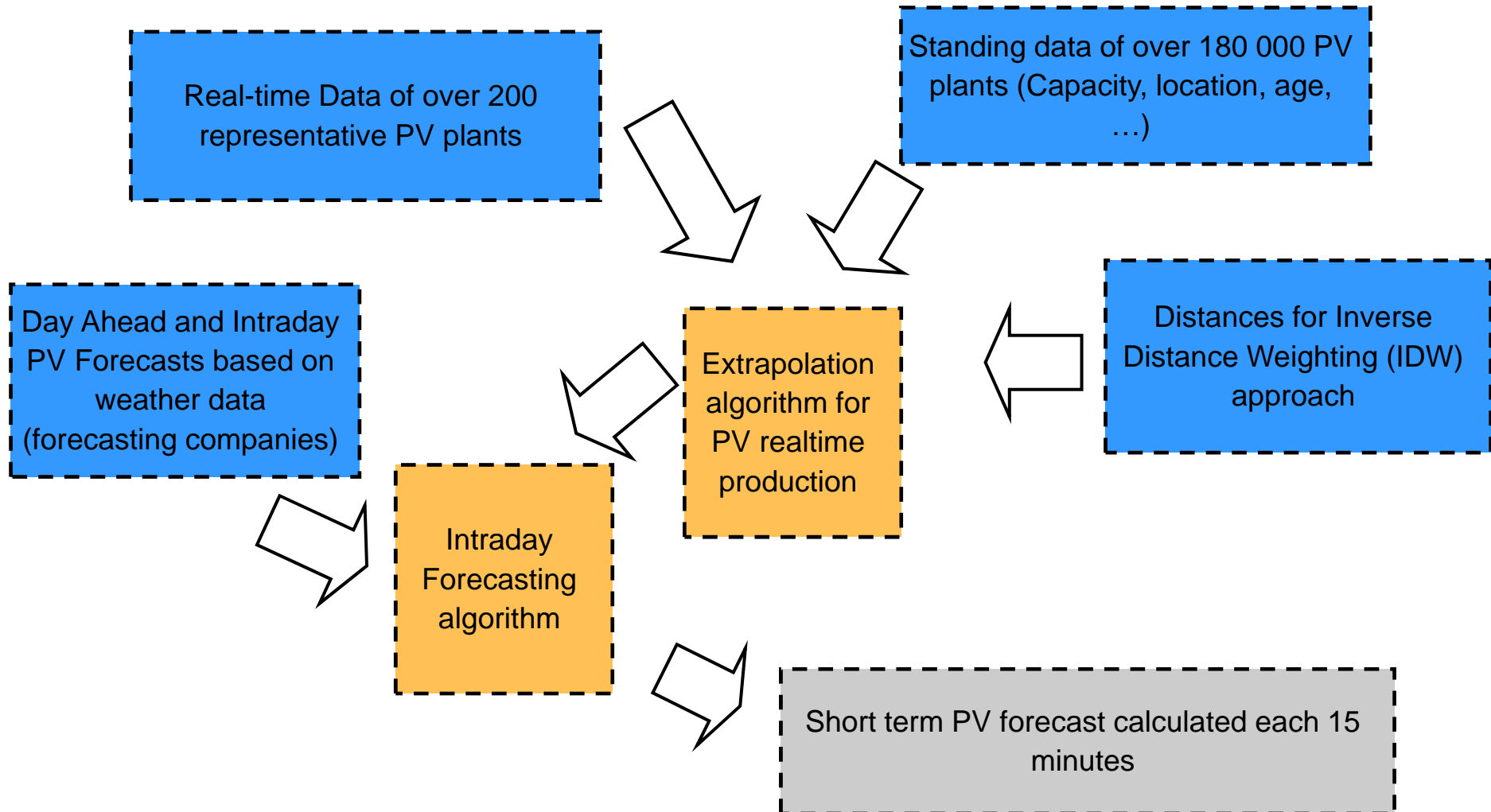
-> Operational requirements high, especially intraday forecasting / Significant reduction of balancing energy



1. Day ahead marketing of the PV in the EnBW grid area based on forecasts
2. Trading differences between Day-Ahead and Intraday forecast (continuously 24/7)
3. Remaining forecast errors are balanced with balancing energy

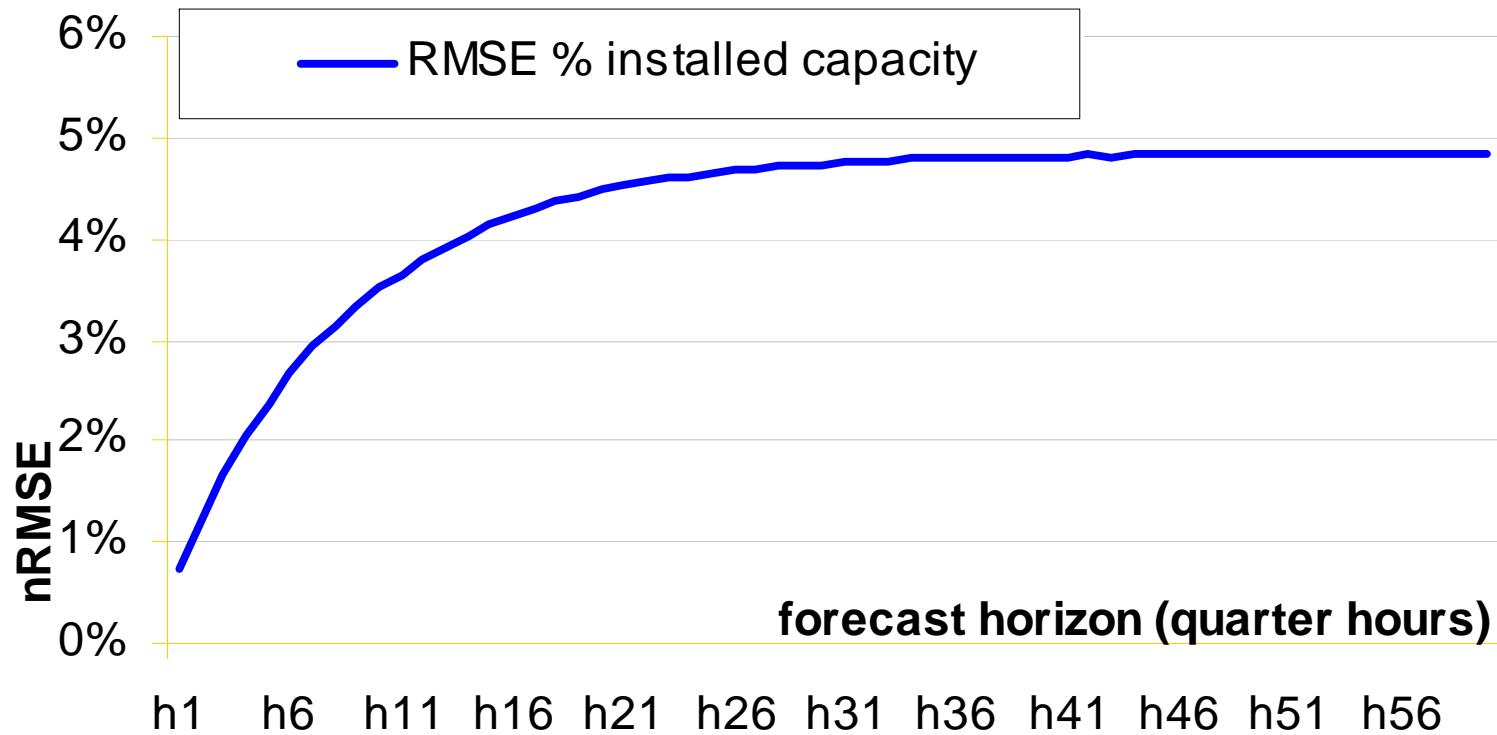
3. PV Intraday Forecast: Basic structure

-> Two steps approach used / Real-time PV production important to reduce forecast error



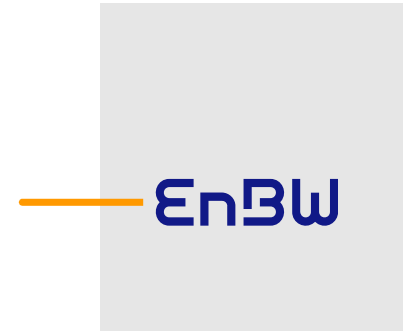
3. PV Intraday Forecast: Results

-> nRMSE is reduced from about 6% (day ahead) to 3% (intraday gate closure)



- > Forecast Error and balancing energy is reduced by about 50% through intraday forecasts
- > Integration costs decrease between 25% and 50%

4. Conclusion



- › Day Ahead PV Integration
 - › With moderate operational requirements efficient in the last years due to relatively low PV capacities
 - › PV forecast errors likely to become dominant in the balancing system in the next years due to growing PV capacities
- › Day Ahead and Intraday PV Integration
 - › High operational requirements like 24/7 trading and intraday forecasts
 - › PV integration costs will decrease up to 50% compared to day ahead only approach



Thanks for your attention!

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