

Market design improvements in the German balancing power market – A fundamental model analysis

ENERDAY 2015 - 10th Conference on Energy Economics and Technology
Dresden – 17 April 2015

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Agenda

- **Motivation**
- **Research question**
- **Methodology**
- **Results**
- **Conclusion**



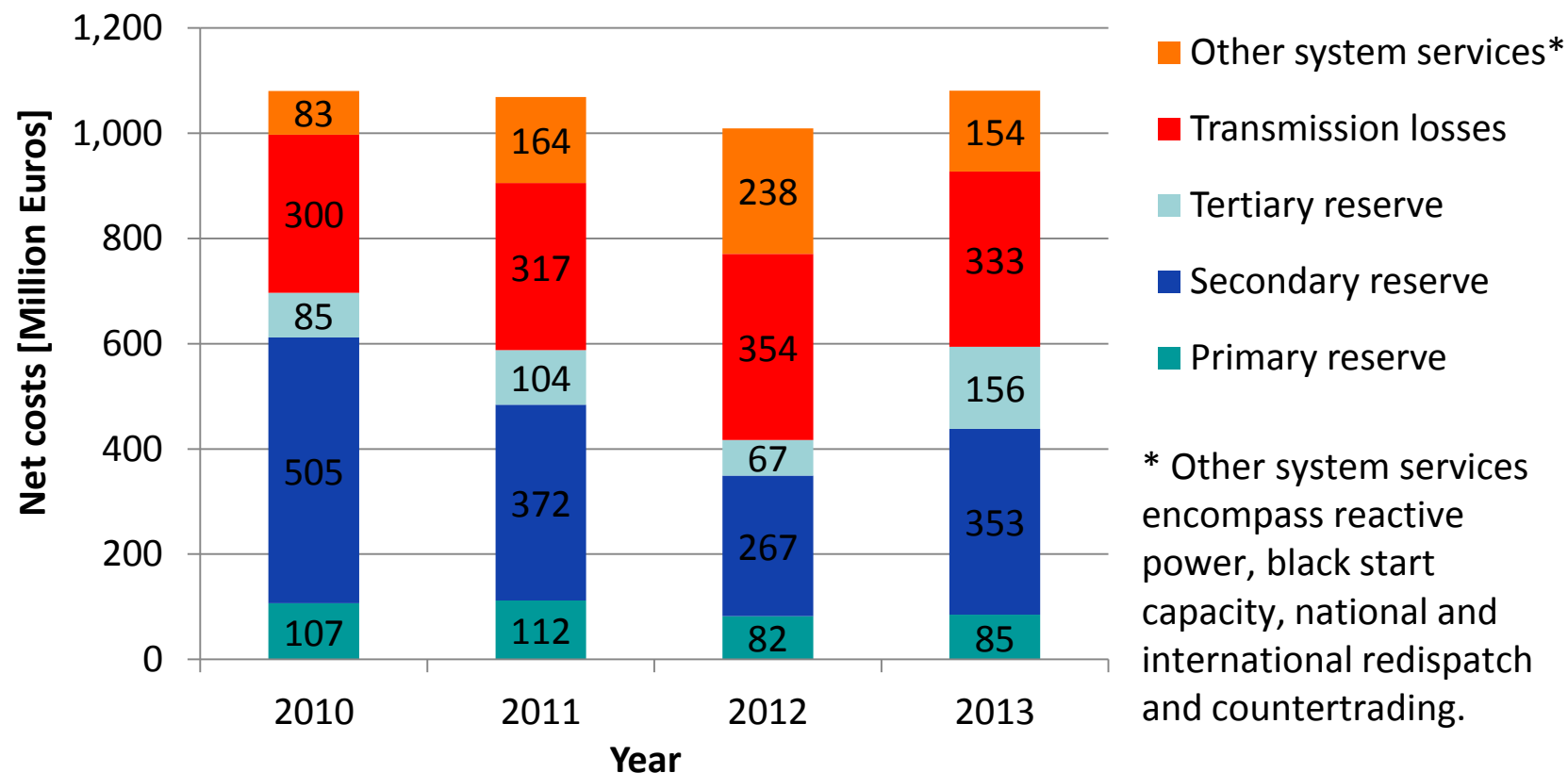
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High costs for reserve capacity

- ▶ Reserve capacity most expensive system service
- ▶ Primary reserve specifically most expensive reserve type



Source: Bundesnetzagentur and Bundeskartellamt (2014)



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Research question

▶ **Current market design for primary reserve in Germany**

- Symmetric product
- Auction on Tuesday for following week
- Duration: one week (168 hours)

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
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▶ **Validation** of capacity prices by **fundamental model**

▶ **Case study:** More **flexible market design** – product length **one day**

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
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▶ **Considered years:** **2012 - 2014**

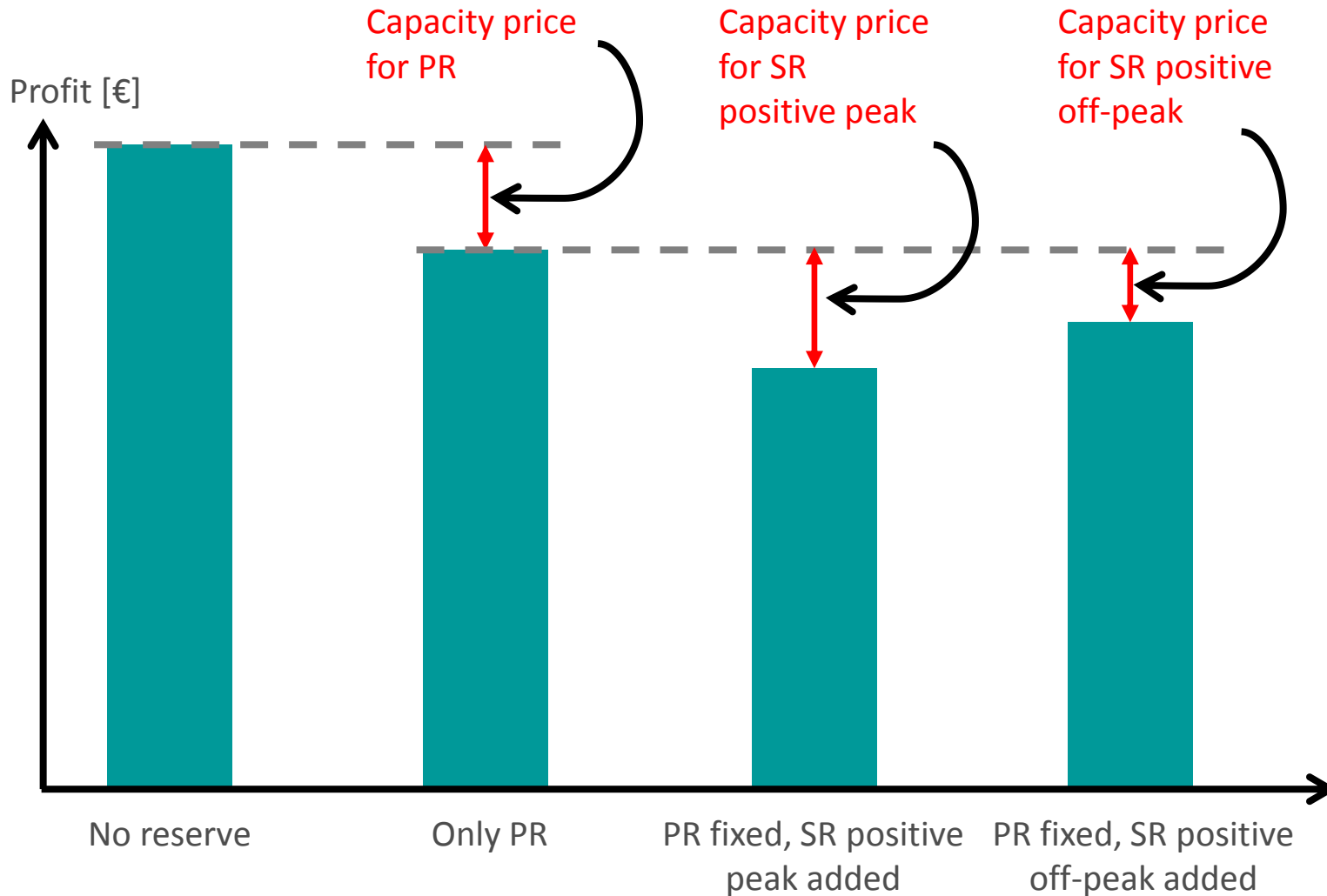


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Profit differences for capacity price calculation



PR = primary reserve; SR = secondary reserve

Overview of fundamental model

Model assumptions

**Spot market
prices (day-ahead)**

**Installed capacity
(thermal and
pumped hydro storage
power plants)**

- Technical and economic parameters
- Power plant operator
- Fuel- and CO₂-price

**Demand for primary,
secondary and
tertiary reserve**

Model work flow

1. Primary reserve:

- Optimal dispatch spot market only
- Cost optimized capacity reservation from all power plants
- Capacity prices as opportunity costs

2. Secondary reserve:

- Cost optimized capacity reservation from all power plants
- Capacity prices as opportunity costs
→ For positive/ negative and peak and off-peak product

3. Tertiary reserve:

- Cost optimized capacity reservation from all power plants
- Capacity prices as opportunity costs
→ For positive/ negative and every 4 hour block

Results

Per pool:

- Reserved capacity
- Capacity prices for primary, secondary and tertiary reserve
- Working prices for secondary and tertiary reserve

**Total costs for
capacity reservation
and call**



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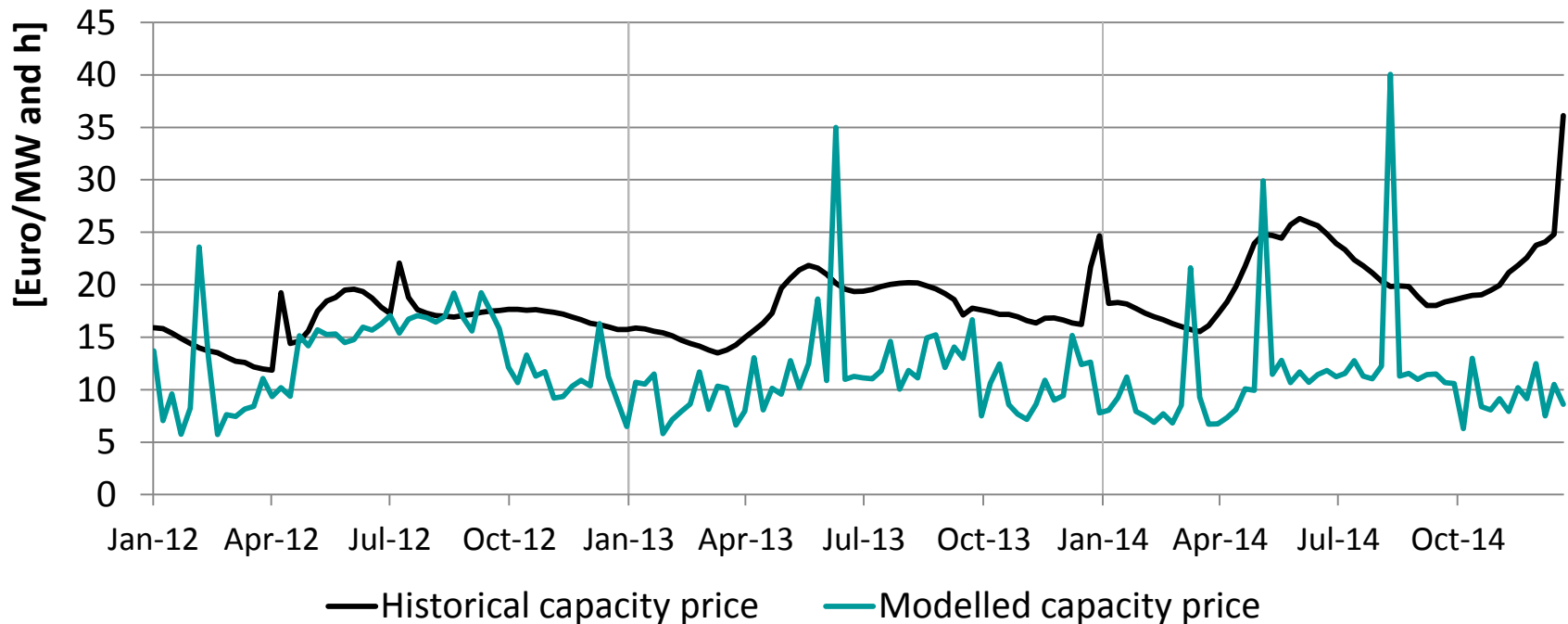
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Validation of primary reserve capacity prices

- ▶ Historical capacity prices in summer months usually higher than in winter
- ▶ Seasonal pattern also reflected in modelled prices
- ▶ Modelled capacity prices are more volatile depending on day ahead spot prices

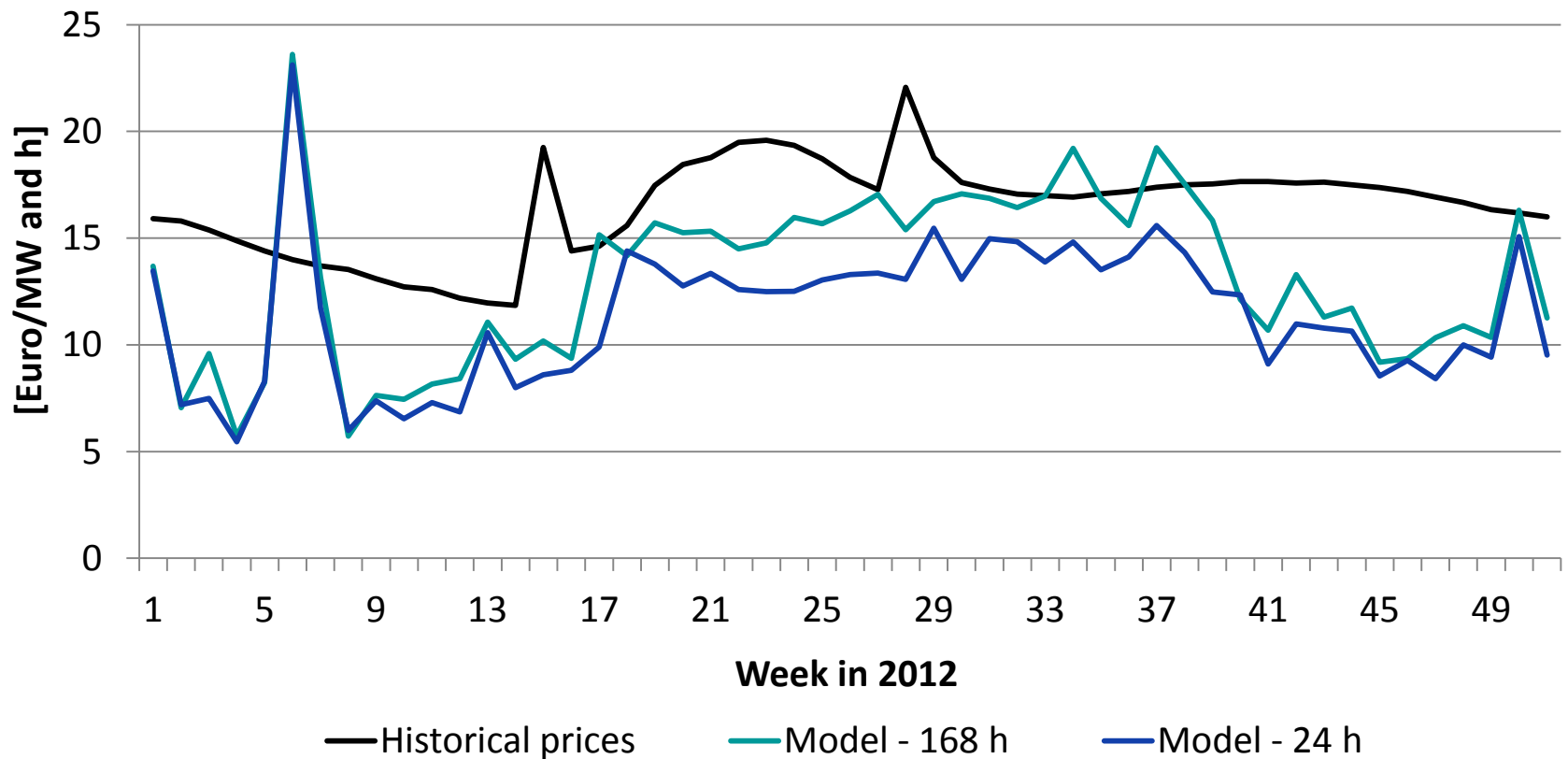
Volume weighted average prices



Capacity prices for different market designs

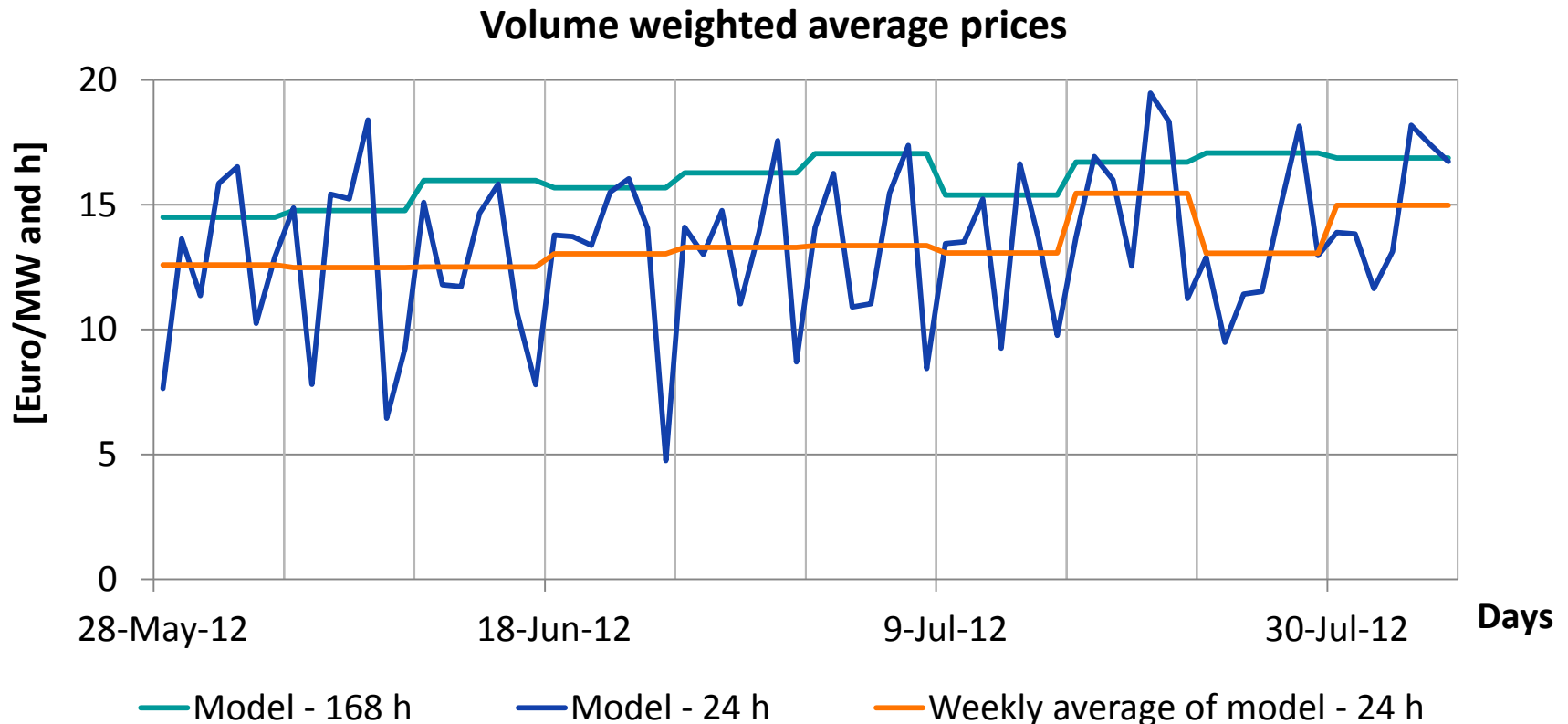
- ▶ Capacity prices for 24 h bidding periods especially in the summer months lower than for weekly bidding periods

Volume weighted average prices



Capacity prices for daily auctions

- ▶ Daily prices for different week days vary partly considerably
- ▶ Difference between the weekly average of the daily prices and the prices for weekly bidding periods about 1.2 to 4 Euro/MW and h



Possible savings due to market design change

► Model results show cost decrease potential of more than 10 %

Volume weighted average capacity prices [Euro/MW and h]	Year		
	2012	2013	2014
Historical prices	16.49	17.63	20.88
Weekly auction (<i>model results</i>)	13.11	11.27	10.99
Daily auction (<i>model results</i>)	11.42	9.77	9.80
Difference between weekly and daily auction (<i>model results</i>) (and in percent)	1.69 (-12.9 %)	1.50 (-13.3 %)	1.19 (-10.8 %)



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Conclusion

- ▶ Fundamental model reproduced seasonal pattern of primary reserve capacity prices.
- ▶ Fundamental capacity prices vary much more from week to week depending on spot prices than historical prices.
- ▶ Today's bids of power plant operators seem to include a risk premium for unfavourable spot prices.
- ▶ Shorter lead time could lead to more than 10 % lower capacity prices for primary reserve with product length of one day.



Thank you for your attention!

Any questions?



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Provided capacity for primary reserve from different power plant types (average week for 2012)

