

# Intraday markets and balancing the renewables boom

Montel's SEE Energy Day  
4th April 2024, Belgrade

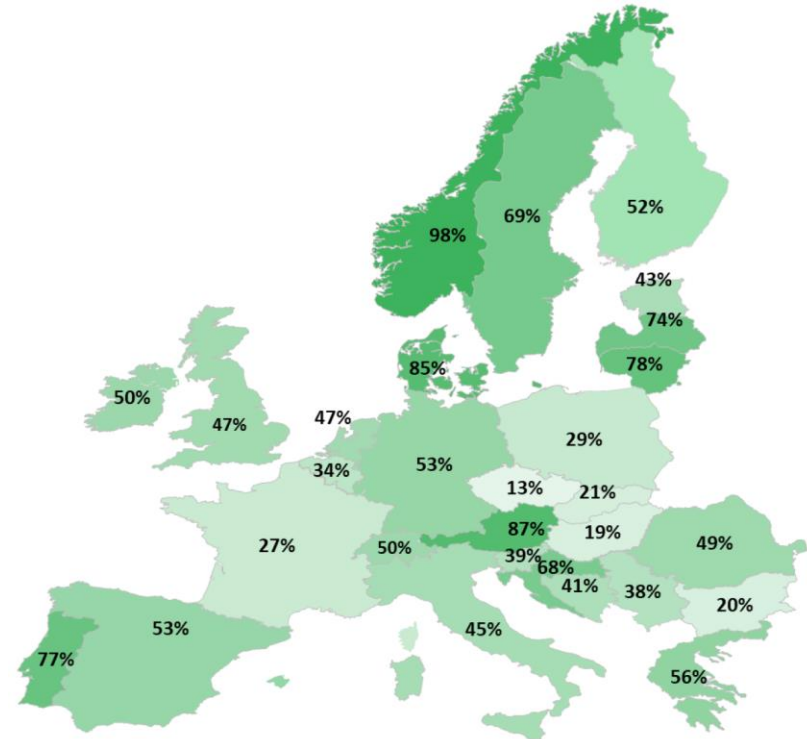
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# Intraday and renewables – why do they belong together?

- High share of renewables in the generation mix and a high volatility of power production typically correspond with high volumes traded in intraday and balancing markets. This is due to forecasting inaccuracies that persist beyond the moment of the day-ahead (DA) auction nominations and therefore additional quantities need to be “balanced out” even after the DA trading already stopped.
- Trading closer to delivery is one of the most obvious consequences of growing RES capacity.
- Also, market design moves away from intraday auctions and evolves towards continuous intraday trading solutions.
- The renewables share in Germany, Spain and Greece passed 50% for the first time; SEE countries show high contributions to their supply. We must bear in mind, that the figures are still a combination of low demand and renewables growth.

Renewable generation as % of supply, 2023



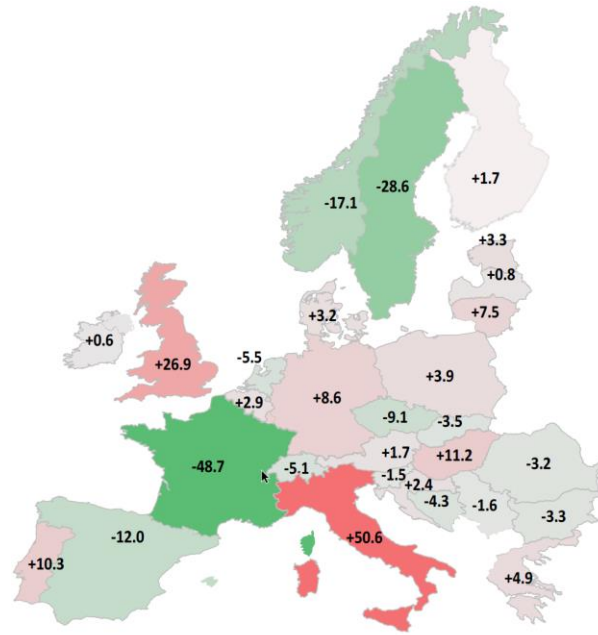


# Cross border exchange

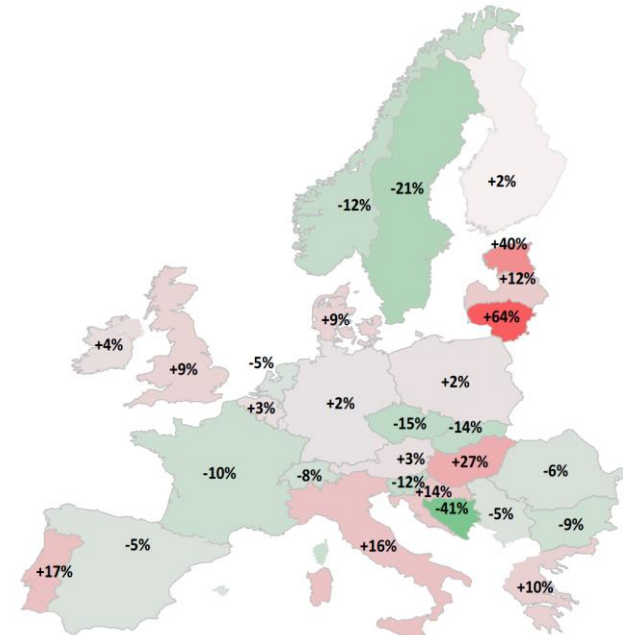
Imports and exports are a “tricky” feature in modelling

- France and Sweden were Europe’s largest exporters of power in 2023, Italy the bigger importer
- Germany was a net-importer for the first time in 17 years, whilst GB also reverted to imports
- Mixed picture in SEE. Mostly low absolute imp/exp values due to the market size, but not necessary if considered in relation to demand

Net imports, TWh: 2023

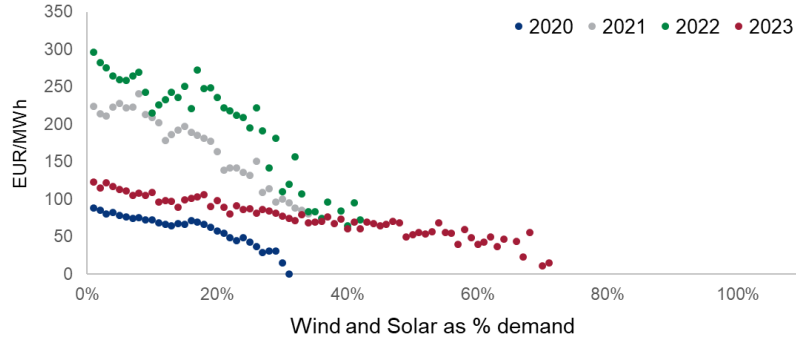


Net imports as % demand: 2023

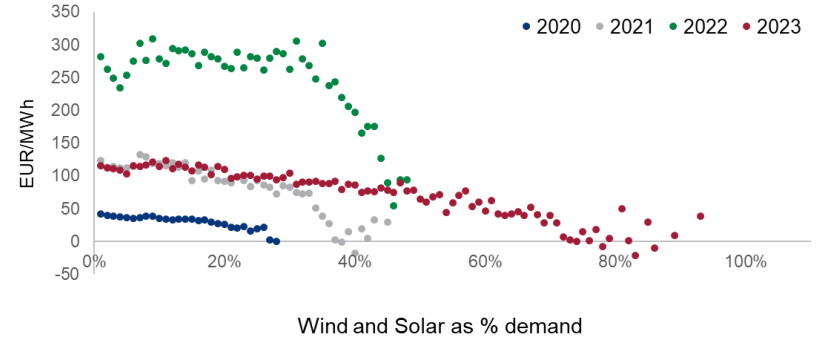


# The influence of RES supply growth on market prices

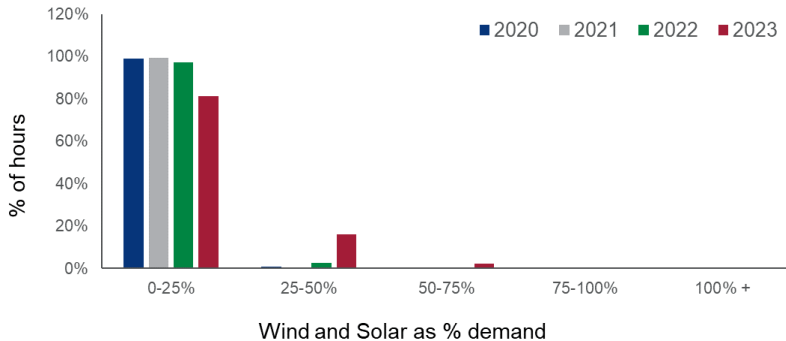
## Market price against W+S penetration: Bulgaria



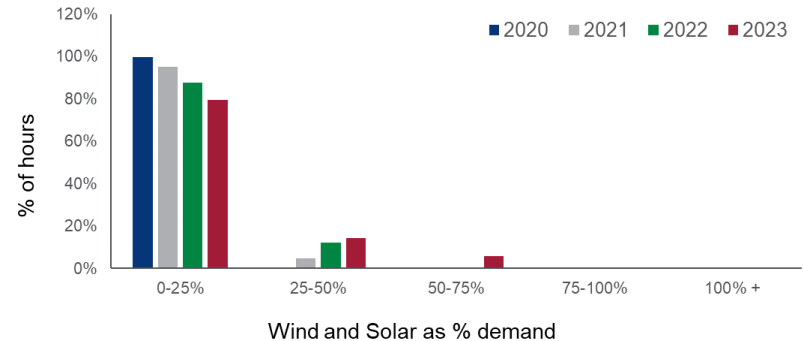
## Market price against W+S penetration: Hungary



## Distribution of wind and solar share: Bulgaria



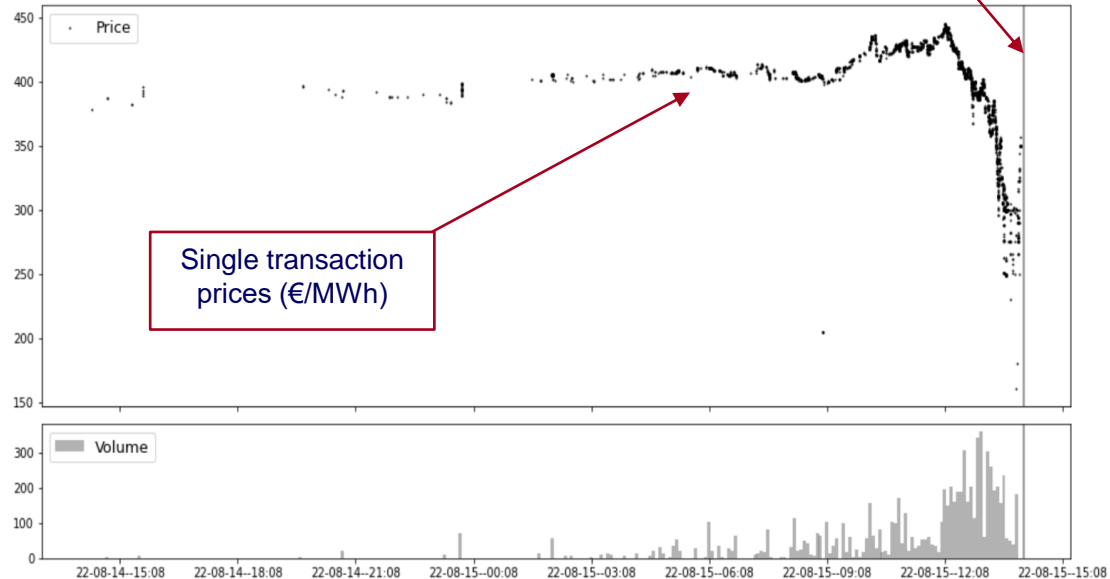
## Distribution of wind and solar share: Hungary



# Continuous Intraday trading: the principles

- Continuous trading == continuously changing price
- Orderbook permanently opened during trading period with its Ask and Bid entries
- Multiple possible target variables for a price model
- Volumes distribution unequal
- Potential fundamental price drivers might deviate compared to other markets / trading environments (for instance DA)
  
- Model design not obvious!

Product: 2022-08-15, h14-15, continuous trading, Germany

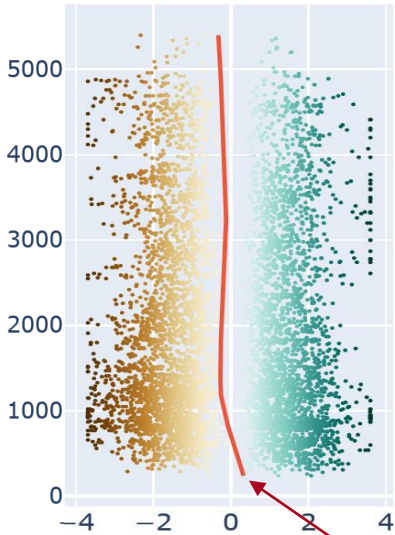


Source: Wood Mackenzie, EPEX

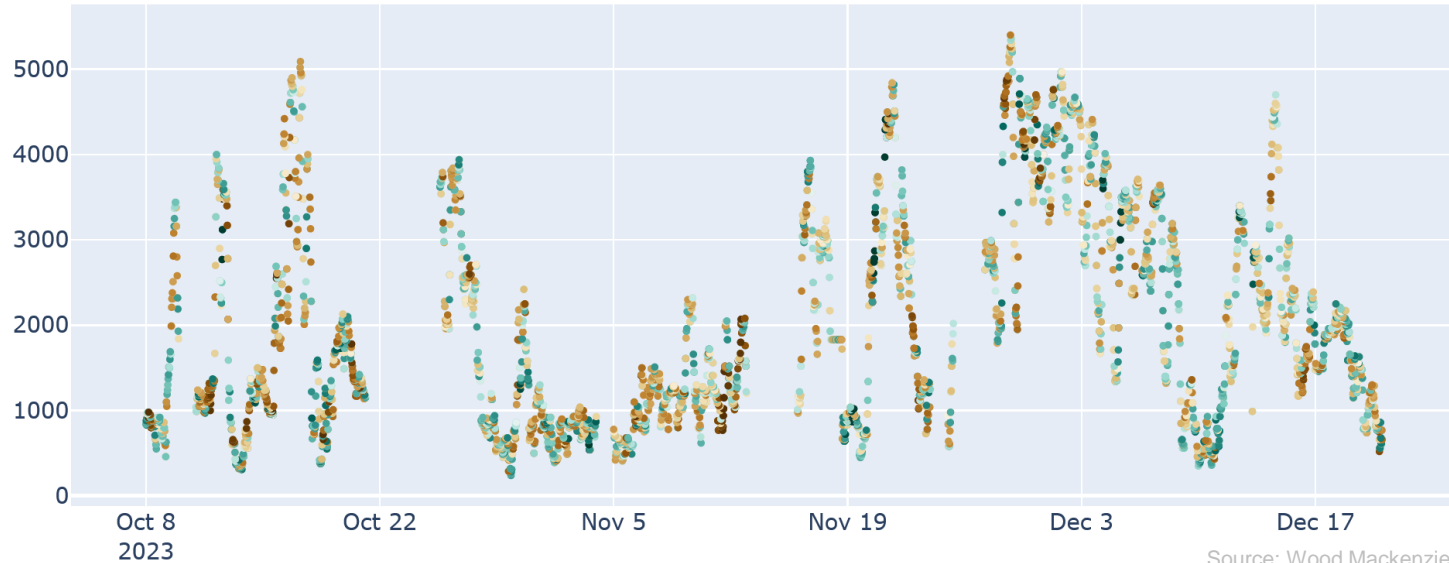
# Univariate predictive power of real time data

Example: **aggregated hard coal generation** in Germany. Impact on price change of the **order book mid price** in the last 60 minutes of XBID market phase; continuous hourly intraday market at the EPEX

OB mid price change



DE aggregated hard coal generation measured by the Wood Mackenzie's EMF sensors



Source: Wood Mackenzie

LOWESS regression line as indicator of predictive power of a feature

Color map ranging between **brown** and **green** (lowest to highest value for price change)

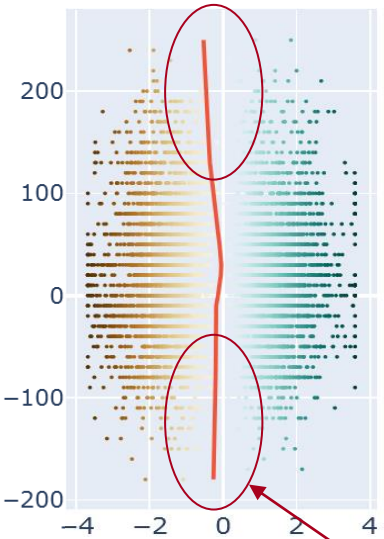




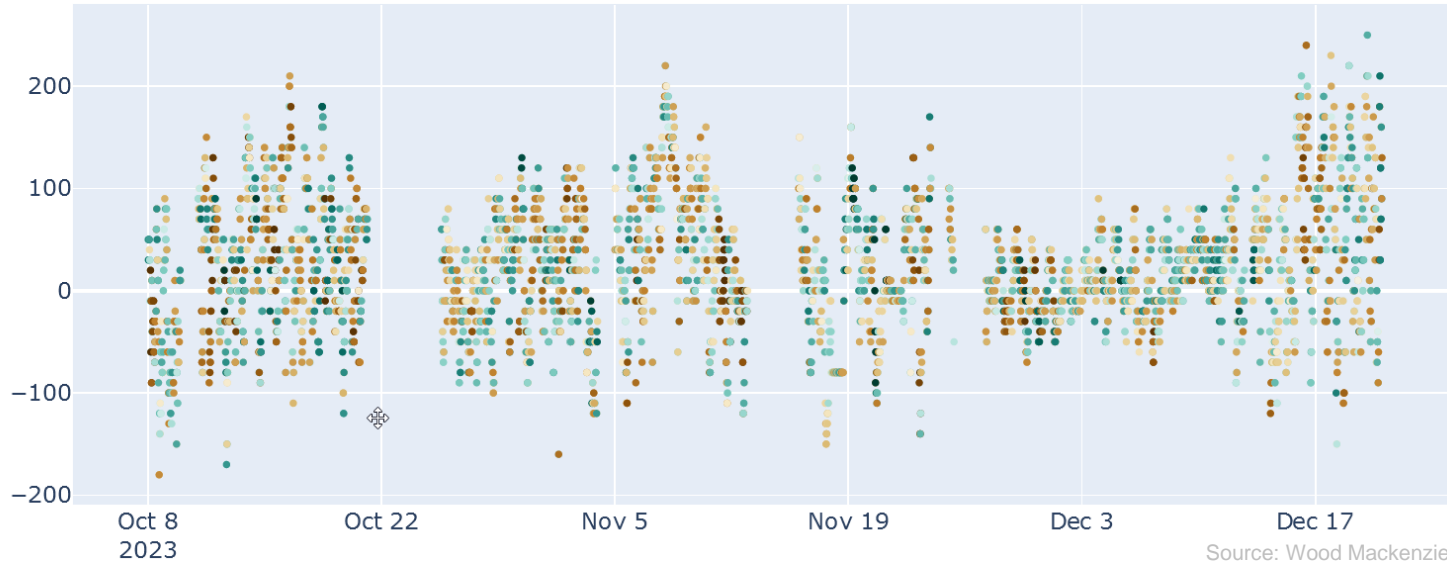
# Univariate predictive power of real time data

Example: one of the 110kV **transmission lines** in Germany. Impact on price change of the **order book mid price** in the last 60 minutes of XBID market phase; continuous hourly intraday market at the EPEX

OB mid price change



110kV transmission measured by the Wood Mackenzie's EMF sensors



Source: Wood Mackenzie

Different LOWESS regression line shape.  
Feature disqualification or not?



# EMF sensor network expansion plans in the Balkans (2024)

## Electro-Magnetic Field (EMF) Sensors

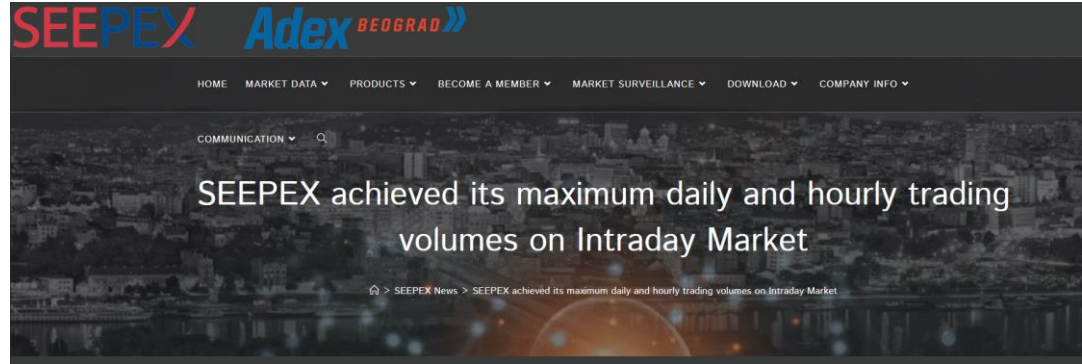
Measures magnetic fields on transmission lines and converts to power flow



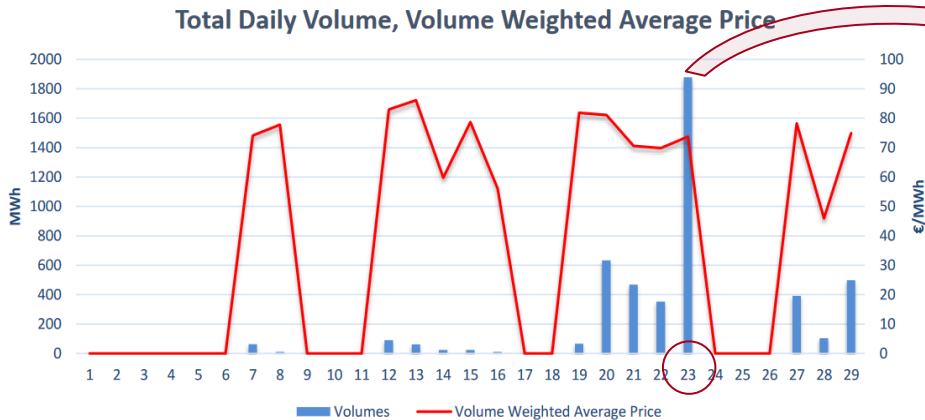
Country	Plant Name	Country	Plant Name
<b>Albania</b>	Banje	<b>Croatia</b>	Senj
	Moglice		Velebit
	Vau i Dejes		Peruca
	Koman	<b>Montenegro</b>	Pljevlja
	Fierza		Perucica
	Ashta	<b>Kosovo</b>	Bajgora wind Farm
	Fang		Kosovo A&B
<b>Croatia</b>	Djale	<b>Slovenia</b>	Avce
	Dubrava		Doblar
	Dubrovnik		Drava River Hydro
	Jertovec		Krsko
	Lesce		Sostanj
	Orlovac		Zlatolicje
	Plomin		

# Growing Intra Day volumes

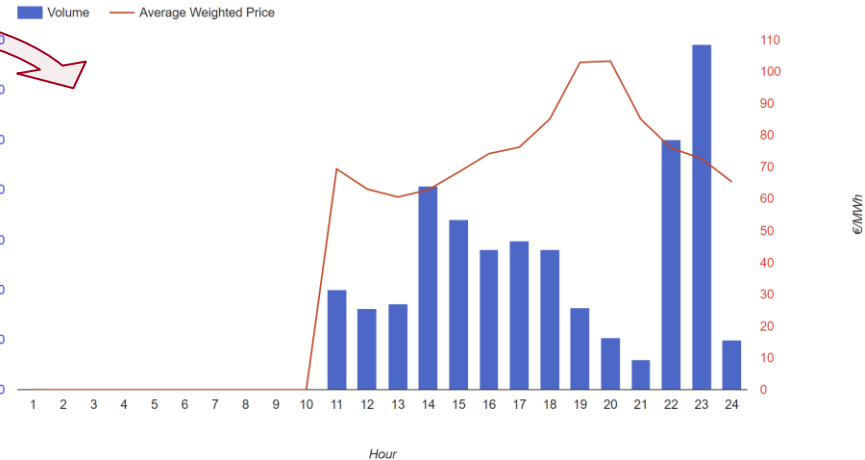
- Serbian ID Volumes not yet sufficient for fundamental price forecasting
- BUT -
- growing!



Total Daily Volume, Volume Weighted Average Price



Daily Hour Average Weighted Price and volume chart on 2024-02-23



# Conclusions

- Growing share of (volatile) renewables in the generation mix stimulates trading closer to delivery (in general), including intraday trading.
- Continuous intraday trading might be seen as evolution of auction-based solutions.
- For the day ahead trading, SEE markets do show fundamental relations observable in CWE or the Nordics. The same can be expected for continuous intraday trading with increasing volumes triggered by the *renewables boom*.
- Modelling techniques for intraday prices, effective in markets with sufficient liquidity (as demonstrated by the example of Germany), are expected to become functional in the SEE regions as traded volumes increase.
- Effective forecasting in continuous intraday markets requires access to data available in real time (trading, generation, exchange data etc.)

# Thank you!

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