ENERGY

BZR – Impact on liquidity and transaction cost

Preliminary findings

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Agenda and key conclusions – to be explained in the following

01 Our approach

02 Impacts on forward markets

03 Correlation and efficiency metrics

04 Impacts on day-ahead and intraday

05 Willingness to participate in the market(s)

Key conclusions

- Investigating two potential impacts with respect to liquidity and transaction costs
  - Potential for increased cost of hedging
  - Potential for reduced competition

1. No strong arguments for concluding that changes in cost of hedging per se represent welfare impacts
   - Redistribution between market participants
2. *If* changes in risks and profit opportunities result in market participants abandoning (or not entering) a market, this might result in welfare impacts

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Different causes in different timeframes – different impacts depending on market participant category

- Relevant timeframes
  - Forward market
  - Day-ahead market
  - Intraday market
- Types of impact
  - Changed competition
  - Cost advantage/disadvantage
  - Willingness to take part in the market

- Market participant categories
  - Trader
  - Industrial or commercial end-user
  - Retailer
  - Producer
  - Integrated utility
- Motivations for trade
  - Hedge: Manage risks
  - Trade: Make profits by carrying risks against a risk premium (proprietary trading)

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Commercial in confidence

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Risk management

- Risks are unavoidable – risk management by a company aims to reduce residual risks to a tolerable risk limit
  - **Tolerate** the risk – no welfare loss or redistribution
  - **Transfer** the risk or parts of it – normally "insurance premium", redistribution but no welfare loss
  - **Terminate or constrain** the activity giving rise to the risk – welfare loss if the result is a less efficient market
- The forward markets provide instruments to manage risks, and hence we start the analysis by investigating impact on forward markets

Proprietary trading

- The aim is to profit from market volatility – not to reduce risks from market volatility
- Trading on your own account using your own capital – trading firms, funds, banks, utilities etc
- Trading is based on technical (trend-following) or fundamental (price forecasting) analysis, also spread trading (delivery periods, area prices, fuels, carbon)
- Different time horizons when taking a trading position
  - The position shall not be kept overnight – intraday trading, or
  - The position shall be closed when a target price is reached, a stop-loss limit is reached or a predefined date or incident is reached, whichever comes first, or
  - The intention is to keep the position until delivery
    - Typically the case for transmission rights, as we observe very little secondary trading in such rights in Europe
- Open positions have to be within risk limits - shorter time horizons enables higher turnover
- High liquidity in the market enables fast stop-loss without changing the price (turnover, market depth and bid-ask spreads are important indicators when deciding trading limits)
- **Smaller open positions from traders if lower liquidity – welfare loss?**

Hedging

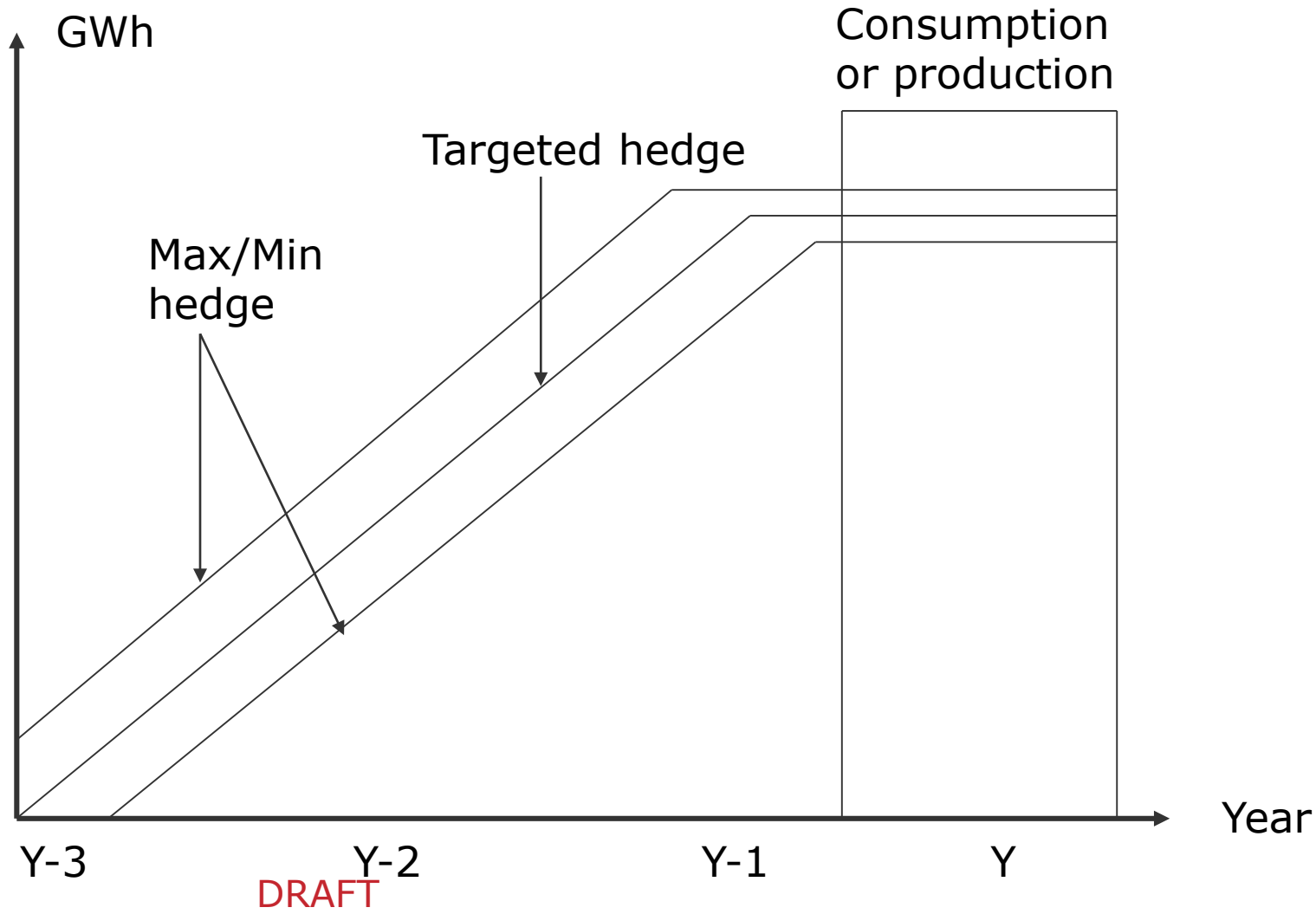
- The aim is to reduce risks from market volatility – not to profit from market volatility
- Hedging is an integrated part of the core business – industrial and commercial users, retailers, producers and integrated utilities
- A **perfect hedge** eliminates **all risks**
  - Price risks are eliminated if 100 % correlation to the underlying price movement is achieved
  - Volume and profile risks are eliminated if the volume in the hedge follows exactly the volume bought or sold in the core business
  - No new risks shall appear (from the hedge) such as counterparty risks, operational risks, taxation, …
- High "insurance premium" if all risks are to be eliminated
- Fixed-price contracts covering all bought or sold electricity are perfect hedges during the contract period but zero hedge when the contract period ends
- Structured contracts can give good hedge but often high insurance premium
- A **portfolio strategy for hedging** means that the company can gradually develop its wanted level of hedging by using standardized contracts with different volumes for different maturities

Hedging strategy

- Defines which risks to be hedged and which risks to be left unhedged – often board decision
- The aim is to find a balance between wanted risk reduction and "insurance costs" – **acceptable risk level at acceptable costs**
- Hedging strategies are based on risk analysis, analysis of possible hedging instruments (including proxy hedging) and correlation analysis (**sufficient correlation and cost-efficient**)
- The hedging strategy prescribes for producers and consumers often intervals for percentage of the volume to be hedged at different times before the delivery period
- Retailers often make back-to-back hedging when concluding fixed-price contracts
- Mechanical hedging strategy – dynamic hedging strategy (hedging not dependent or dependent on price expectations)
- Transmission rights are difficult to include in a hedging strategy – no secondary trading makes gradual development impossible

Possible strategy for "mechanical" hedging

- Whether the hedging starts years or months before delivery depends on type of activity, risk preferences, …, and relevant transaction and hedging costs
- The cost of hedging depends on efficiency of available hedging opportunities, which in turn depends on i.a. correlations



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- Efficient hedging opportunities should be developed for generators, retailers and consumers to mitigate future price risk in the area where the operate (Preamble (3))
- Assessment whether the forward market provides sufficient hedging opportunities in the concerned bidding zones (Article 30 (3))
- Analysis of whether the **products or combination of products** offered on forward markets shall be considered as an **appropriate hedge**
    - **Sufficient correlation** (Article 30 (4 a))
    - **Efficient** (Article 30 (4 b))

Correlation

- Straight forward analyses of correlation between potential hedge portfolios and prices in the delivery period
  - Focus on **comparing the average prices** from one period to the next
    - E.g. average of prices in the local bidding zone over the hedged period compared with average of prices of the underlying products for the hedge portfolio over the same period
  - Hourly or daily averages are not relevant
  - Quarterly and yearly averages are relevant for consumers and producers as they are focused on quarterly and yearly results
  - Shorter term averages relevant for retailers, depending on their contract portfolio
- Observation period: some years
  - Several rather than few (every year is often different, avoid black swans)
- No basis for defining knockout criteria/thresholds (e.g. 'not good' if correlation coeff. < x)
  - The aim is acceptable risk level at acceptable costs – overall assessment needed

Efficiency – changes in risk premium

- The difference between futures prices for a delivery period and the realized day-ahead prices during the delivery period can be seen as a risk premium (measured ex post)
- Zero risk premium over time (no systematic difference) can be expected when the hedging interests for buy and sell are equal
- When more buying interest than selling interest, a positive risk premium can be expected – buyers need to attract also traders to fulfil their hedging needs
  - Rational traders are profit-seeking and sell contracts only when they expect a positive risk premium
- When more selling interest than buying interest, a negative risk premium can be expected – sellers need to attract also traders to fulfil their hedging needs
- Changes in risk premium will arise if a new bidding zone gets skewed hedging interests between buy and sell and these changes increase if fewer traders participate in the market
- Increased risk premium give **redistribution but no welfare losses unless reduced willingness to take part in the market persists over time**

Ex post risk premium in CWE contracts 2010-2018

- The average of daily closing prices during Y-1 for the year-ahead contract for Y,
  - minus the average of hourly day-ahead prices during Y, €/MWh
- Illustration under preparation

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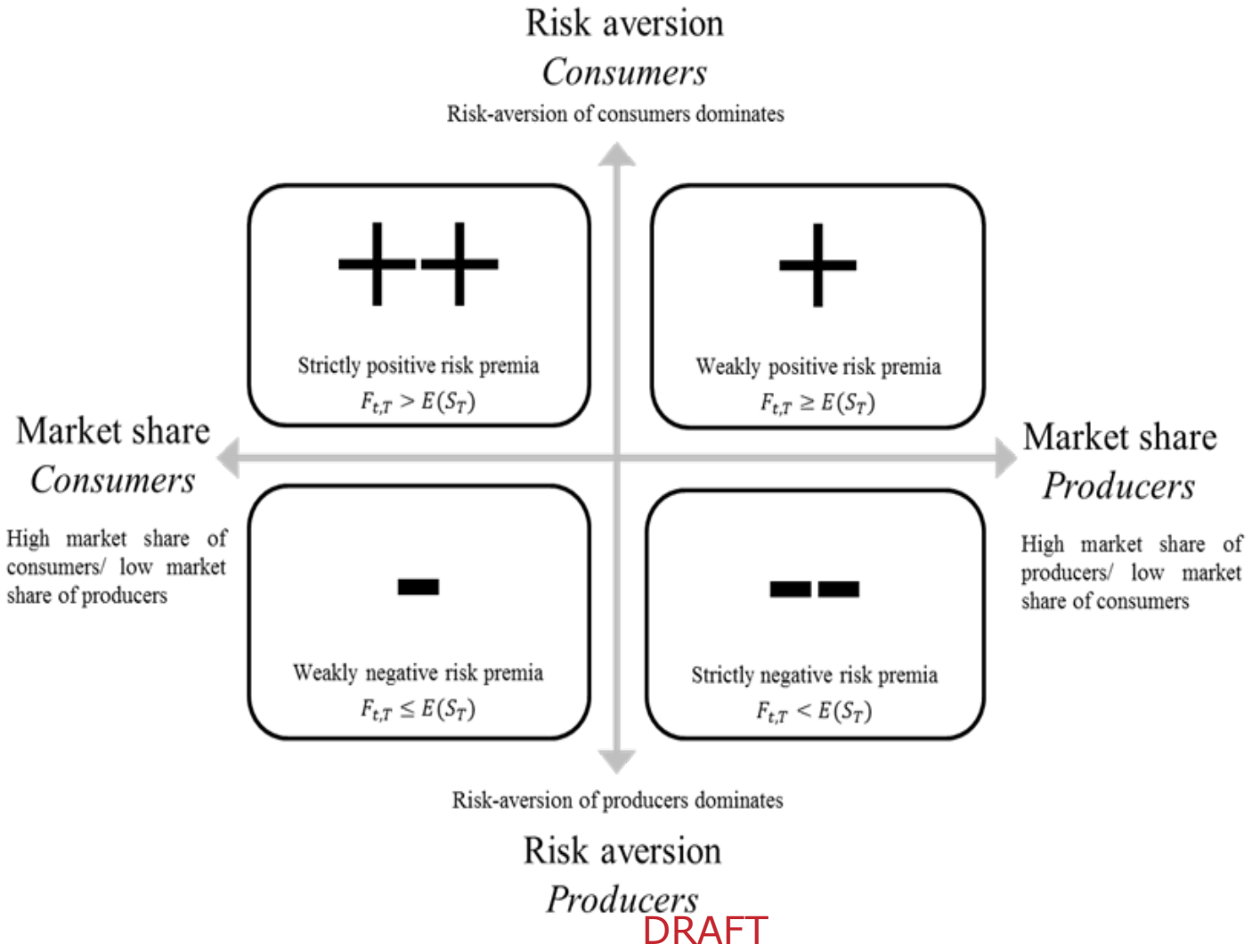
Diagram: DNV GL calculations based on EEX and EPEX Spot data

The sign of the risk premium depends on which side of the market has the highest risk aversion and whether the market is skewed



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Efficiency – changes in transaction costs (other than the risk-premium)

- Transaction costs encompass the costs of trading a contract
  - Explicit costs as exchange fees, clearing fees, brokerage commissions
  - Internal costs for systems and administration
  - Costs due to bid-ask spreads
- Explicit costs and internal costs vary more due to the total volume from a firm – an extra bidding zone will normally not change explicit costs and internal costs significantly unless it means that an extra platform has to be used or a new system has to be acquired
- No extra transaction costs when the buyer and seller meets at the "real" price within the bid-ask spread
- Extra transaction cost for the buyer if they meet at a higher price than the "real" – the seller gets the corresponding profit
  - Extra transaction cost for the seller if they meet at a lower price than the "real" – the buyer gets the corresponding profit
- Increased bid-ask spreads thus give **redistribution but no welfare losses unless reduced willingness to take part in the market persists over time**

Are average bid-ask spreads the relevant measure?

- Exchange markets, auctions, brokers etc. are often described as price discovery processes
  - A real market value exist, but prior to a transaction, this value is not known
  - The bid-ask spread is the starting point for this process
- The role of a broker is to assist in closing the bid-ask spread
  - Brokers have a higher market share in less liquid contracts
- Exchange bid-ask spreads in less liquid contracts are often the maximum allowed market maker spread
  - OTC spreads are often lower
- Hedging is normally not done on an hourly or daily basis (see above)
  - Time is normally available for hedgers to give brokers time to reduce bid-ask spreads and reveal the 'real' price
  - The average of exchange bid-ask spreads is therefore not a relevant measure
- The average of the best bid-ask spread per week (exchange and OTC) is a more relevant measure when assessing the efficiency of different hedging instruments

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Impacts in day-ahead and intraday markets

- Less turnover and market depth per bidding zone when production and consumption are split between the new bidding zones
- Market depth is not so important for efficient price formation in day-ahead and intraday auctions but more important in continuous intraday trade
- Liquidity depends on whether a new smaller bidding zone become an isolated price area or most often become part of a larger price area
- Reduced redispatch decreases possibilities for inc-dec gaming in the day-ahead market
- An extra bidding zone will normally increase total turnover in SDAC and SIDC
  - Less reductions in XB capacities
  - Market based transactions day-ahead and intraday instead of special regulations and redispatch
  - XB power transfer between bidding zones has to be done in SDAC or SIDC
    - This includes company-internal transactions crossing a new BZ border
  - XB intraday trade is now often stopped when day-ahead trade results in congestions within a bidding zone

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Changed willingness to take part in the market because of liquidity and transaction costs changes?

- Increased bid-ask spreads make stop-loss more expensive for traders but increase the profit potential from entering into contracts
  - Lower market depth reduces open position limits for traders
  - Less liquid contracts gets smaller volumes of short-term trading
  - Less liquid contracts reduces the number of traders active in the contract
  - Higher volumes from traders with the intention to keep a position until delivery are conceivable
- Hedging needs can be satisfied but potential for **higher transaction costs** for hedging
  - Increased search-time and potentially higher risk-premium
- This can heighten the barrier to entry for new market participants
- This negative effect is reduced if proxy hedging instruments are efficient
- Small interconnection capacities and prices at variance with neighbouring bidding zones makes proxy hedging less efficient

Changed competition?

- Dominant generator(s) or retailer(s) in a new bidding zone can give poor competition and potential to abuse of market power
  - The potential for abuse of market power may undermine trust in the day-ahead and thereby undermine or prevent a local forward market
- Impact on competition even more complicated if dominant company is vertically integrated – an integrated company has a natural hedging and is less dependent on the forward market for hedging
- Dominant market player(s) in a bidding zone increases the risk for unexpected reverses for a new entrant
- Poor competition and high potential to use market power can
  - Deter new entrants
  - Frighten some incumbents to terminate or constrain their activities
- Extensive interconnections with neighbouring bidding zones can essentially reduce the potential to use market power for dominant generator(s) or retailer(s)

Competition – Residual Supply Index

- Measures the extent to which extent a generator's capacity is necessary to supply demand taking into account other generators' capacity, import capacity and the TSOs reservation of reserves
  - RSI is a continuous variable, typically used to measure the potential for the largest participant to 'dictate' prices
  - If several participants are fairly equal in size, a natural approach would be to calculate the RSI for each one
- $RSI_{player\ i}^{hour\ t} = \frac{Total\ capacity - Company\ i's\ relevant\ capacity}{Total\ demand} = \frac{\sum_{player\ j \neq i} ProductionCapacity_j \times Availability_j + Import\ capacity}{Load^t + TSOreserveRequirement^t}$
- $RSI_{player\ i}^{year\ y} = \frac{\sum_{t=1}^{T} RSI_{player\ i}^{hour\ t}}{T}$

- The formula above concerns the potential for setting a price above 'competitive' import prices
- The RSI was first used to analyse the California power crisis, by Analji Sheffrin

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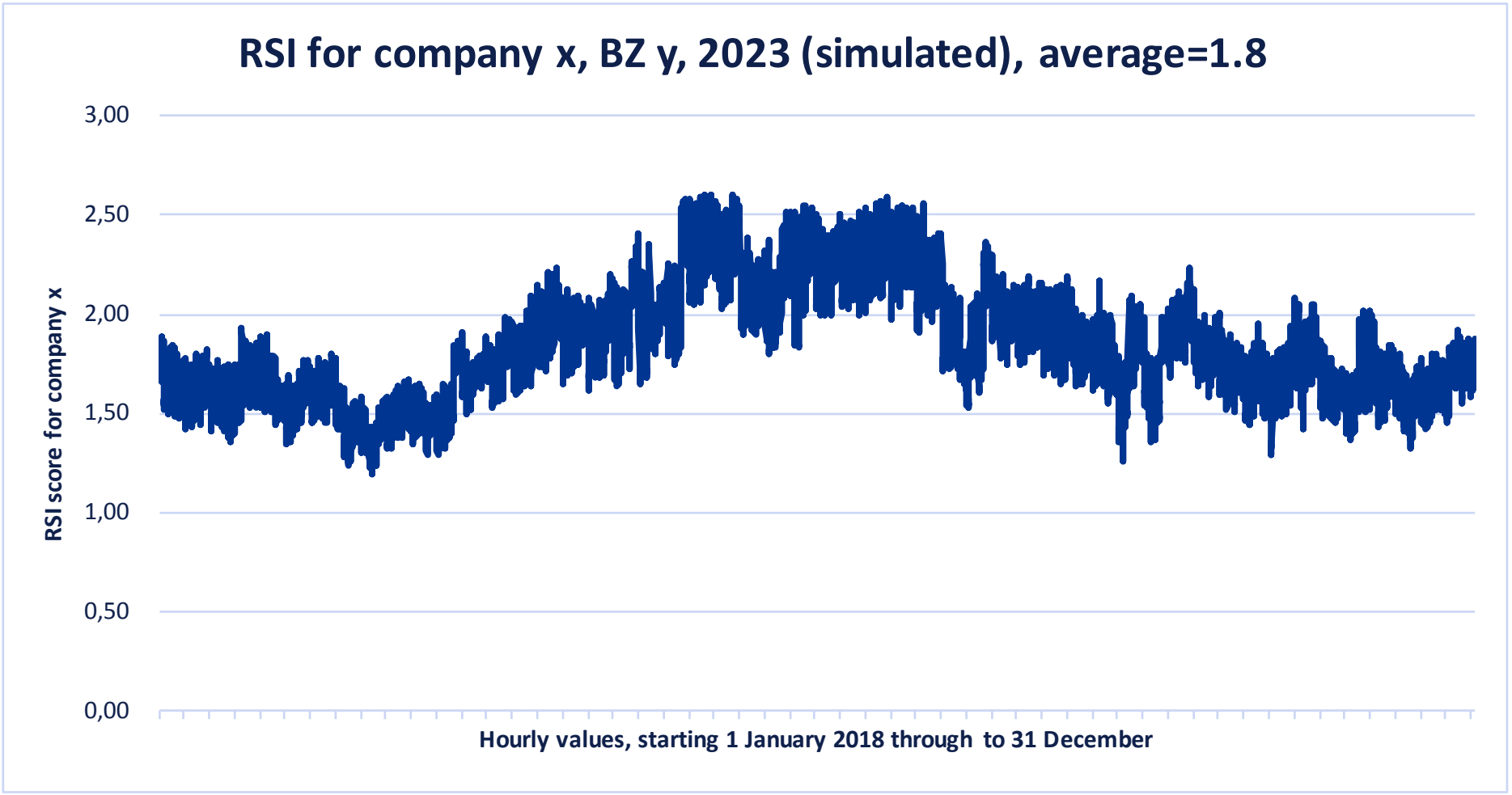
Example, exploring potential for lifting price above adjacent zones



- 4 companies > 10 % market share
- The largest having a market share of 46%
- Extensive interconnections
- Not a single hour < 1
  - For all hours, the dominant player is not necessary for market clearing

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Competition – HHI

- Hirschman-Herfindahl index of concentration (HHI) is defined as the sum of the squares of the market shares of all companies in the market
- The relevant market is the price area which includes the bidding zone
- Simulation can for a year show how the bidding zone is included in different price areas and the number of hours the bidding zone is included in the different price areas
- A time-weighted HHI for the bidding zone can then be calculated in the following way
  - Calculate HHI for all the price areas the bidding zone will be included within
  - Multiply these HHI with the hours the bidding zone is included in a certain price area
  - Sum these products and divide by 8760 hours

Number of retailers indicates retail competition

Total number of electricity retailers to final consumers, 2003-2017

	2003	2010	2017
Belgium	45	37	60
Bulgaria	8	36	57
Czechia	365	324	389
Denmark	113	33	39
Germany	940	>1 000	1404
Estonia	42	41	46
Ireland	6	8	12
Greece	5	11	19
Spain(*)	375	202	291
France	166	177	185
Croatia	1	3	9
Italy	390	268	638
Cyprus	1	1	1
Latvia	1	4	26
Lithuania	8	15	22
Luxembourg	11	11	10
Hungary	12	36	42
Malta	1	1	1
Netherlands	42	36	48
Austria	160	129	171
Poland	175	146	190
Portugal	5	10	27
Romania	8	56	105
Slovenia	8	16	21
Slovakia	18	77	71
Finland	>100	>100	>100
Sweden	127	134	171
United Kingdom	24	22	47
Norway	223	184	197
Montenegro	:	:	5
North Macedonia	1	3	19
Serbia	:	:	19
Turkey	5	466	216
Bosnia and Herzegovina	:	:	26
Kosovo*	:	:	3
Moldova	:	:	4

: data not available

(*) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.

Detailed table (2003-2017) available in 'Source data for tables and graphs'

Source: Eurostat

Metrics indicating impacts on liquidity and transaction costs

Correlation and efficiency

- Correlation*
- Risk premium
- Bid-ask spread

Willingness to participate

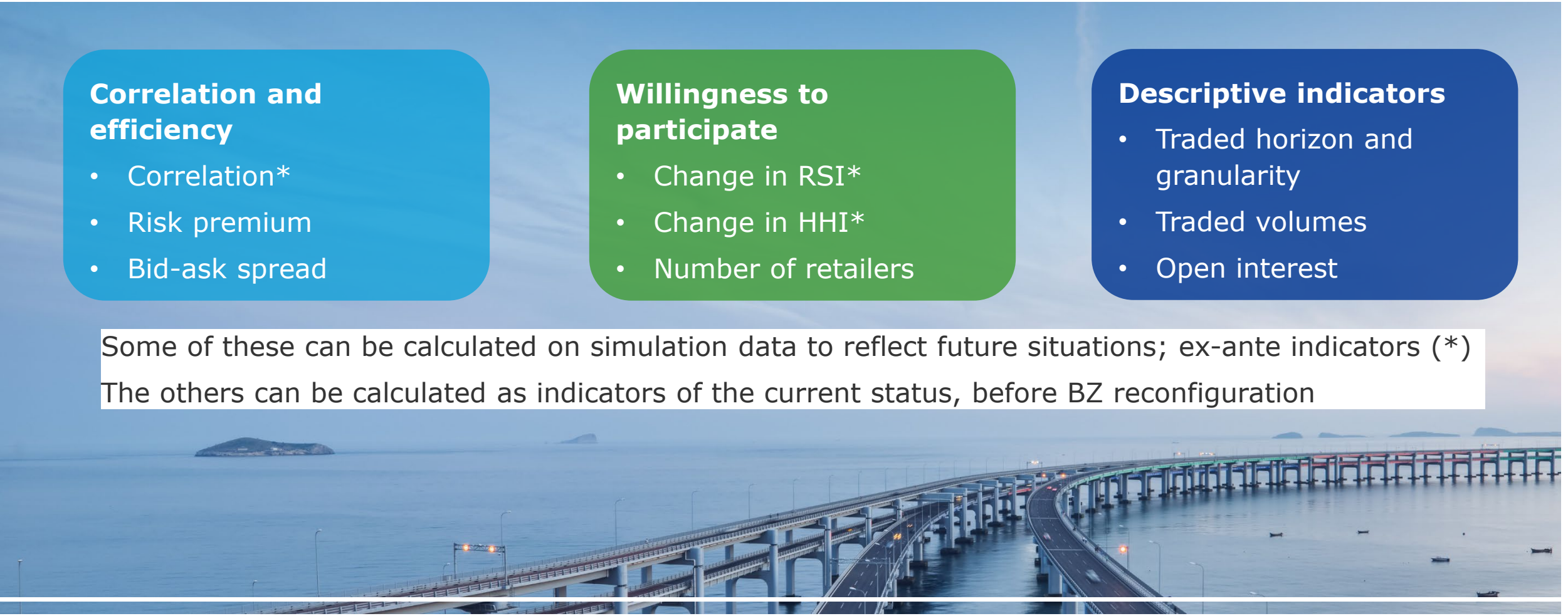
- Change in RSI*
- Change in HHI*
- Number of retailers

Descriptive indicators

- Traded horizon and granularity
- Traded volumes
- Open interest

Some of these can be calculated on simulation data to reflect future situations; ex-ante indicators (*)

The others can be calculated as indicators of the current status, before BZ reconfiguration



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Questions or comments?

Also, written comments possible by 10 January.

Please contact us directly (Jorgen.bjorndalen@dnvgl.com); cc to Acer/Rafa (rafael.muruais-garcia@acer.europa.eu)

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