Dublin, 6 March 2018

# **Hedging in energy markets**

# Outline

- Comparing NL-DE with IE-GB markets

- Some general hedging principles

- Proxy hedging

- Minimizing VaR versus EaR

- Hedge performance in NL market with DE forwards
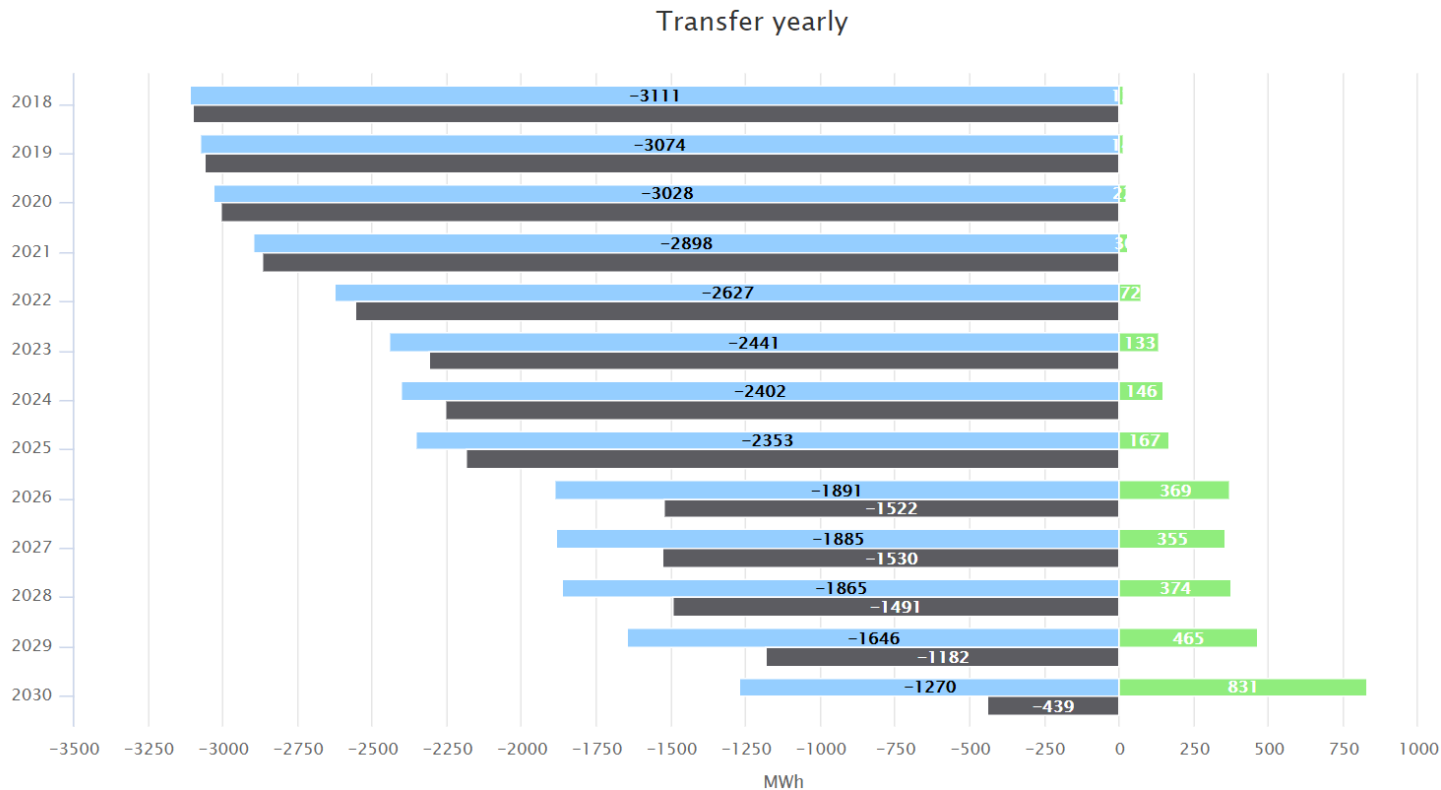
- Conclusion

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# Comparison Ireland with the Netherlands

- Especially 1 large neighbouring country: Germany (vs GB)
- Interconnection capacities have been growing
  - NL-DE: from about 2 to 4 GW
  - NL-DE: market coupling since Nov 2010
- NL: also connections to BE, GB, NO

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# Interconnection flows expectation

- The Netherlands has been a net importer of German power

- Nuclear phase-out in Germany and coal/lignite plant closures will lead to a more balanced situation

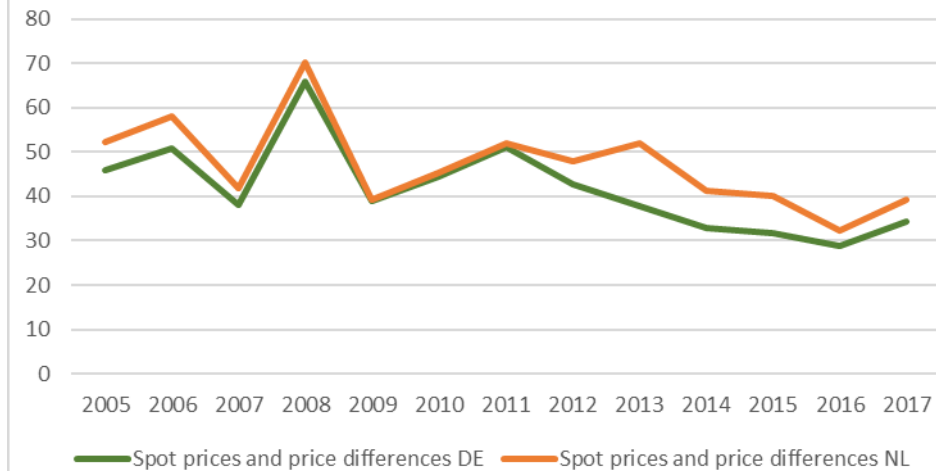- At the same time, transmission capacities will grow further

## Transfer yearly

| Year | German Power → Dutch power | Dutch power → German Power | Dutch power → German Power Net transfer |
|------|------|------|------|
| 2018 | −3111 | | |
| 2019 | −3074 | | |
| 2020 | −3028 | 2 | |
| 2021 | −2898 | 3 | |
| 2022 | −2627 | 72 | |
| 2023 | −2441 | 133 | |
| 2024 | −2402 | 146 | |
| 2025 | −2353 | 167 | |
| 2026 | −1891 | 369 | −1522 |
| 2027 | −1885 | 355 | −1530 |
| 2028 | −1865 | 374 | −1491 |
| 2029 | −1646 | 465 | −1182 |
| 2030 | −1270 | 831 | −439 |

MWh

Legend: ● Dutch power -> German Power  ● German Power -> Dutch power  ● Dutch power -> German Power Net transfer

Source: KYOS fundamental modelanalysis

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# Price differentials NL - DE

- Variations in market structure
- E.g.: Energiewende Germany: massive growth in renewables from 2011 onwards
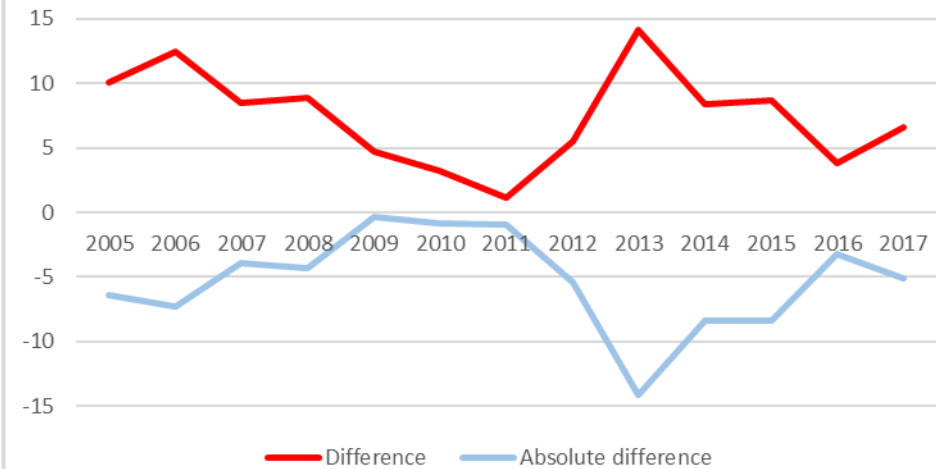- DE and NL markets 'coupled' since Nov-2010: most equal prices in 2011



Average spot prices Netherlands and Germany

Spot prices and price differences DE — Spot prices and price differences NL



How often are hourly prices equal in NL and DE?

Spot prices and price differences Equal price



Spot price differences Netherlands and Germany

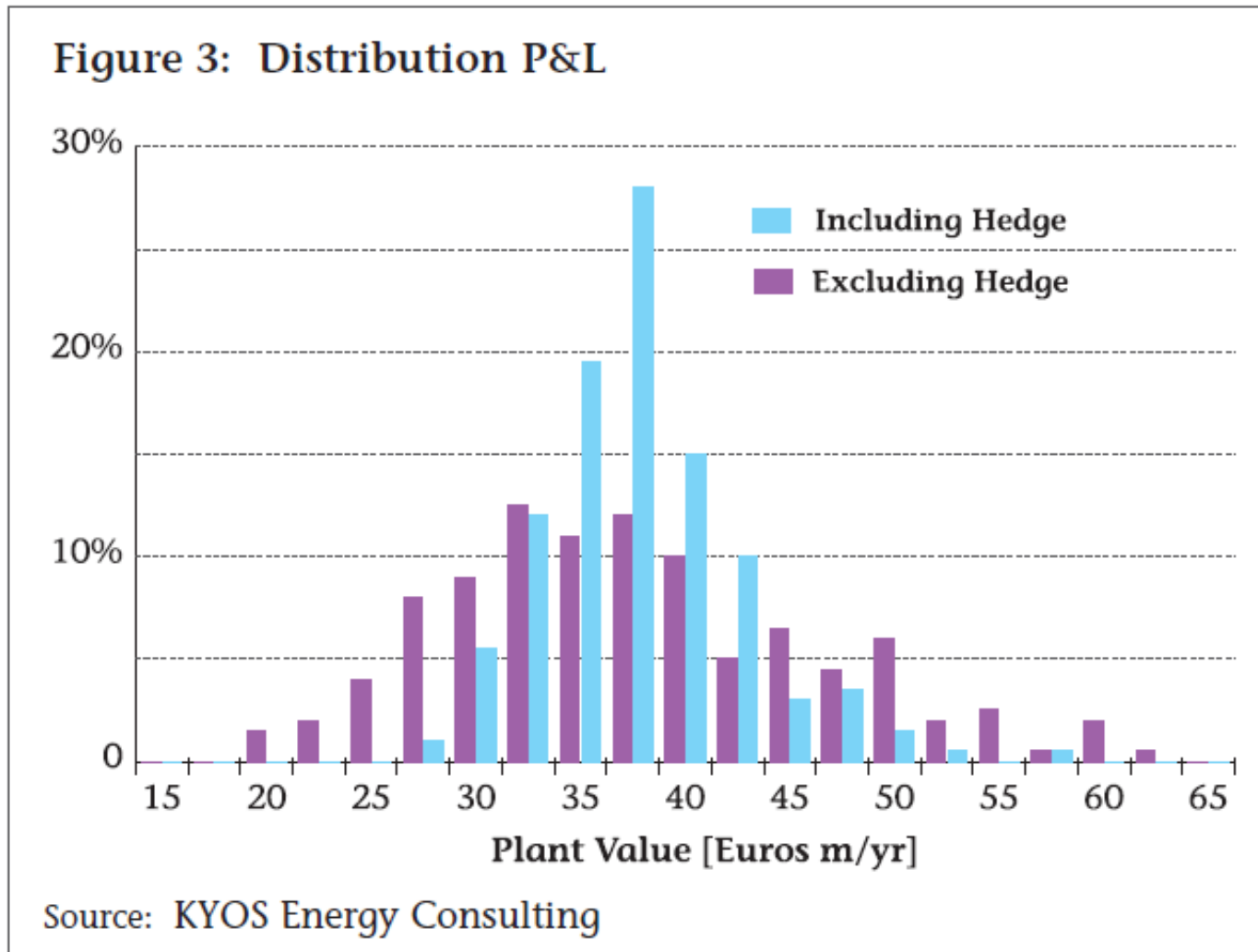Difference — Absolute difference

# DE power forwards good hedge for NL power?

- German power market is the most liquid in Europe

- Dutch power market players can use German power forwards as a proxy hedge for their exposures

- What is a proxy hedge?

  - Actual exposure is to prices in market A (= NL, or IE)

  - Hedging is with instruments in market B (= DE, or GB)

- Proxy hedging effectiveness depends on:

  - Correlations in price returns (short-term)

  - Similarity in price movements (long-term)

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# Hedge result: risk reduction



Figure 3: Distribution P&L

Source: KYOS Energy Consulting

# Hedging

**Hedge**

A hedge is a position created to offset an exposure to price fluctuations in some opposite position (or market) with the goal of minimizing the exposure to unwanted risk

**Power plant hedge**

- Sell Power on forward market
- Buy fuels (gas/coal) on forward market
- Buy $CO_2$ credits on forward market
- Don't forget fx hedges (e.g. $CO_2$ is traded in EUR, Power/Gas in GBP)

Remember: hedge is done to minimize market risk, not operational (technical) risk

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# Plant hedging: decisions

1. **When to hedge? Over what horizon?**
   - *Today, next week, next month*
   - *Everything at once, or gradually over time*

2. **Adjust hedge over time?**
   - *Static or dynamic hedge*
   - *Rolling intrinsic or delta*

3. **What products to use for hedging?**
   - *Baseload, peakload*
   - *Calendar, season, quarter, month*

4. **Volume or value?**

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# Optimal hedge ratio

**Intuition:**

High correlation ($\rho_{PF}$) between returns in your open position (P) and your hedge instrument (F), means a better hedge (it's worth hedging)

High volatility of open position ($\sigma_P$) relative to volatility of hedge instrument ($\sigma_F$), means I need a sizeable hedge
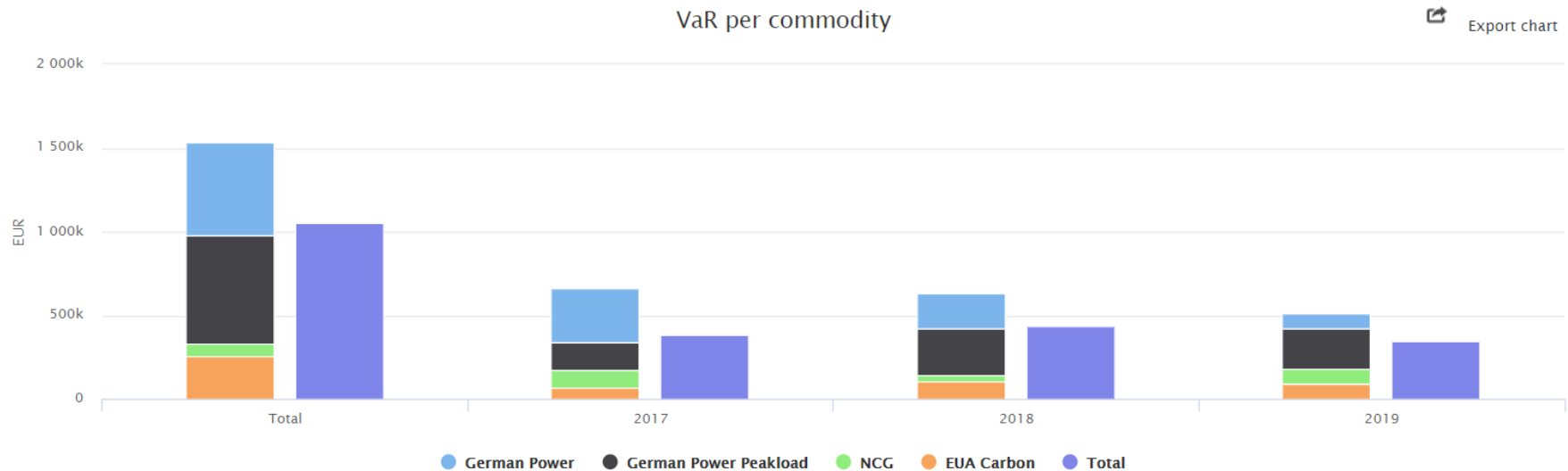
**Definition:**

$$h^* = \rho_{PF} * \sigma_P / \sigma_F$$

**Implication:** if you hedge an exposure in market P (=NL, IE) with products of market B (=DE, GB) you should reduce the (value-based) hedge volume in proportion to the correlation. Correlation is not 100%!

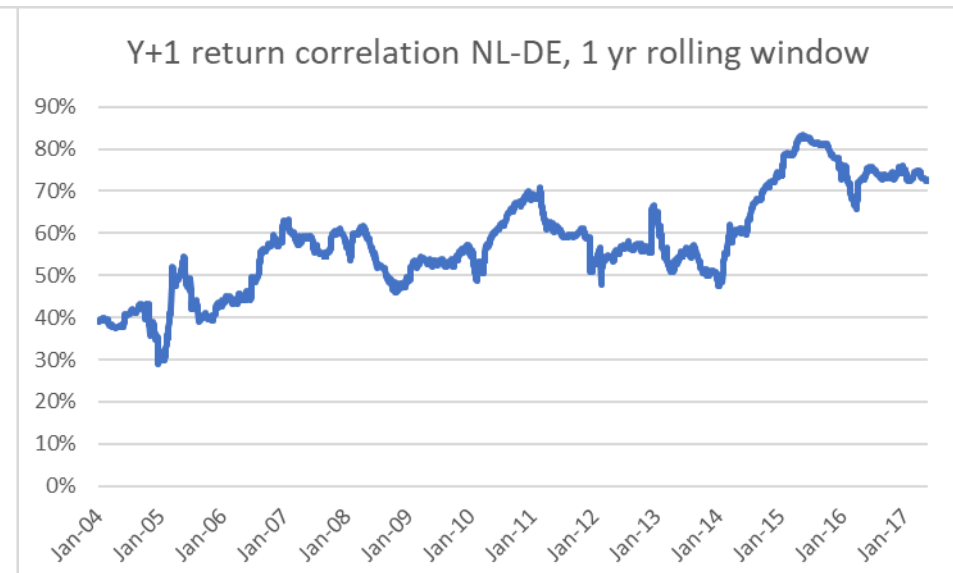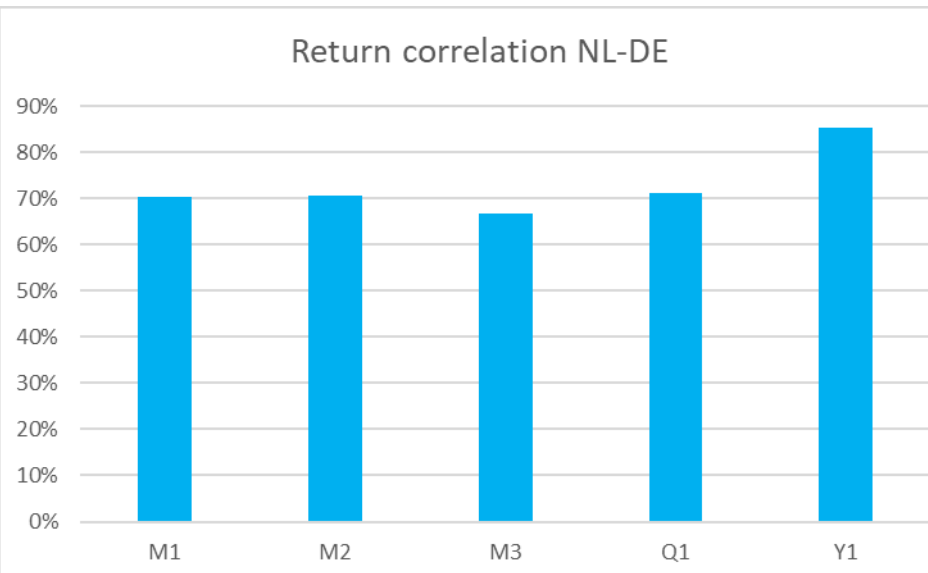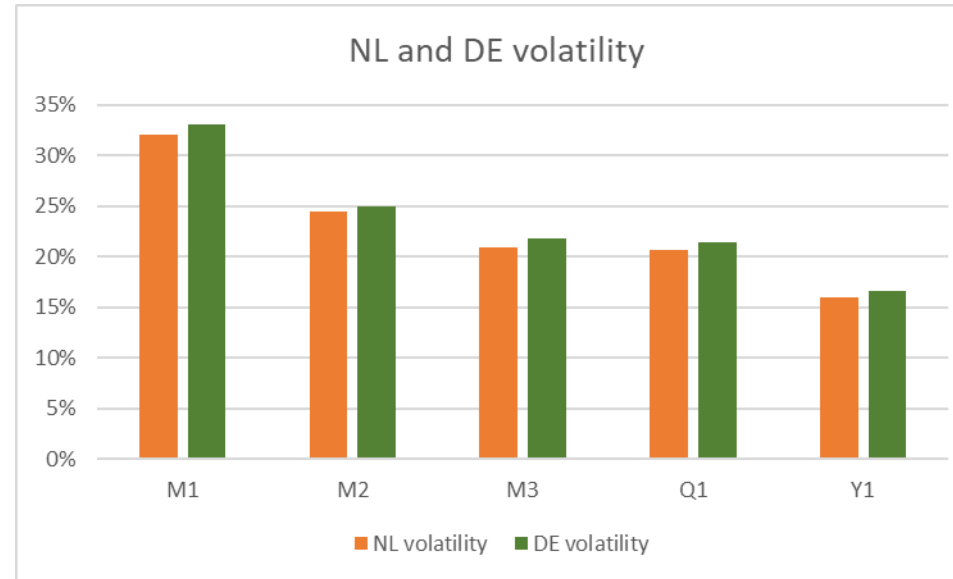KY☼S

# Optimal hedging to minimize VaR

- The hedge which minimizes the Value-at-Risk (VaR) is based on:
  - value/delta hedge, and
  - optimal hedge ratio
- Note: Value-at-Risk is the 'maximum' loss in market value over a short horizon (e.g. 1 day) with a certain confidence (e.g. 95%)

# Analysis of NL and DE forward price returns

Using forward price data from 2005 to 2017:

- Volatility term structure similar
- Correlations lower close to maturity
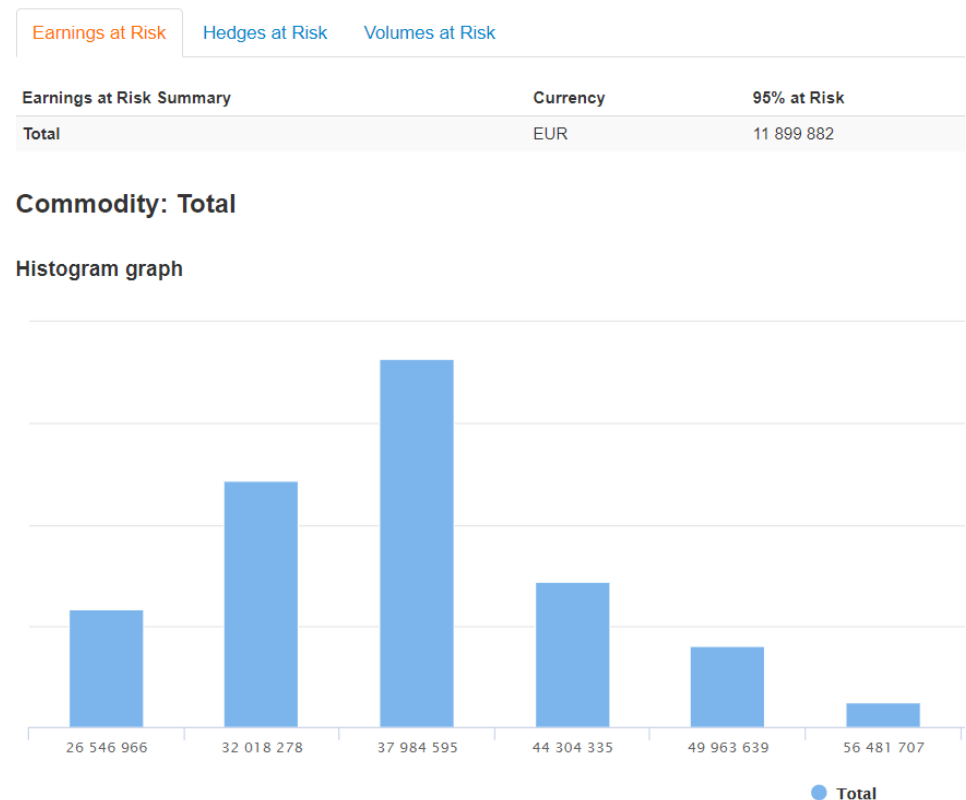- Forward correlation has increased

# Minimizing VaR or other risk metric?

- VaR is a suitable risk measure in liquid markets, where market value can be accurately measured and managed

- VaR is less suitable for an asset portfolio, especially if there is significant spot price risk

- For example, if a power producer sells the expected power production (or delta exposure of the plant) forward:

  - The 'hope' is that the expected plant value (today) is eventually realized (in the future)

  - If revenues in the spot market are lower than expected by X million Euro, then this should be compensated by a forward hedging profit of X million Euro.
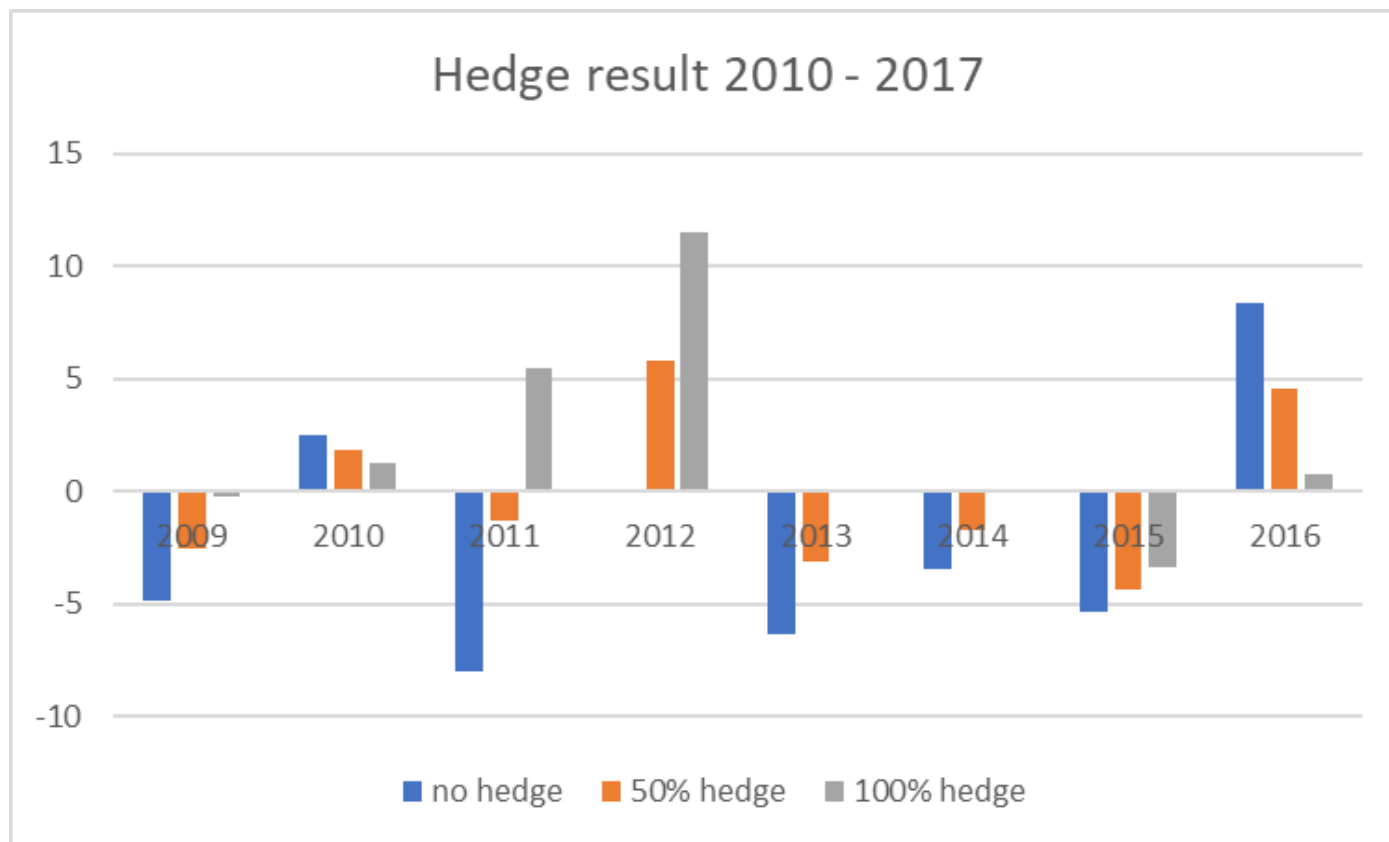
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# Earnings-at-Risk (EaR)

- EaR is similar to VaR, but:
  - Focusses on realized earnings during the delivery period
- Minimizing EaR and VaR may lead to somewhat different hedge volumes.
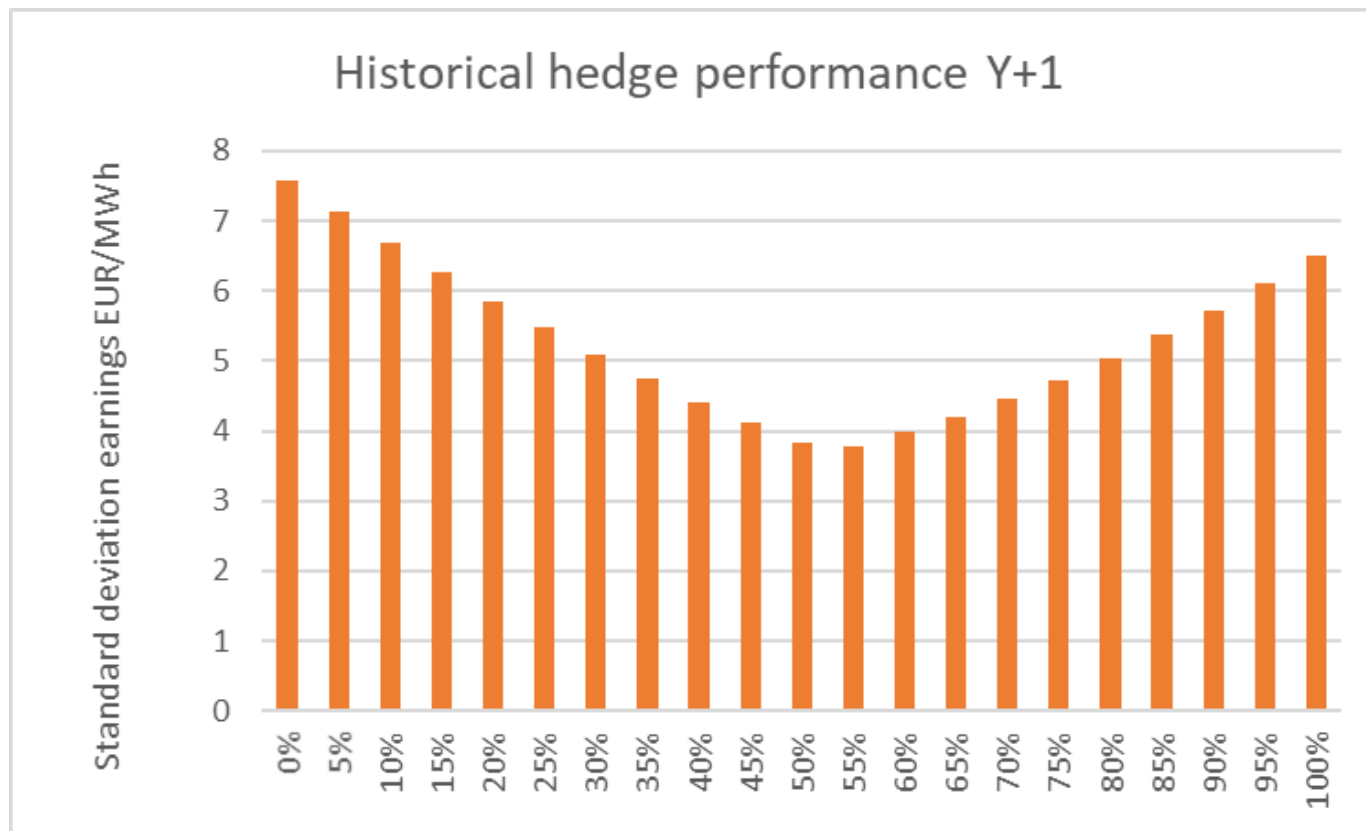
# Historical analysis DE hedge for NL market

- We are 1 MWh long in year Y, in NL
- We sell x MWh forward in DE
  - In year Y-1 we gradually sell the Y+1 forward product
- We assess P&L for different levels of x (= hedge ratio)



Hedge result 2010 - 2017

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# Analysis continued

Optimal hedge ratio, historically: 50%

May be different over other horizons, and also when considering other hedging strategies (e.g. involving quarterly and monthly products, peak versus base, etc.)



Historical hedge performance Y+1

# Conclusion

- Forward trading in IE market is likely to remain illiquid

- Proxy hedging with other products may be needed

  - With fuels? Don't trust (static) fundamental models!

  - With power forwards in GB? Don't overhedge!

- Try to assess optimal hedge volumes, and monitor performance over time

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