

KYOS Webinar
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A photograph of a wind farm in a snowy landscape. The sky is a clear, pale blue. In the foreground, a snow-covered field has tracks from a vehicle. A row of white wind turbines extends into the distance. In the background, there are some industrial structures, possibly oil storage tanks.

Webinar: Hedging price risk of renewable assets

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KYOS Energy Analytics

Agenda

15:00 – Introduction

15:05 – Getting an edge with hedging

15:15 – Hedging case study

15:30 – KYOS software for renewable power and PPAs

15:35 – Q&A and discussion

15:45 – End of the webinar

Getting an edge with a hedge

The challenge:

- Huge investments in merchant projects
- Investors are exposed to long-term price risks
- Buyer's market for long-term contracts (3+ years)
- Long-term contracts are selling at a discount

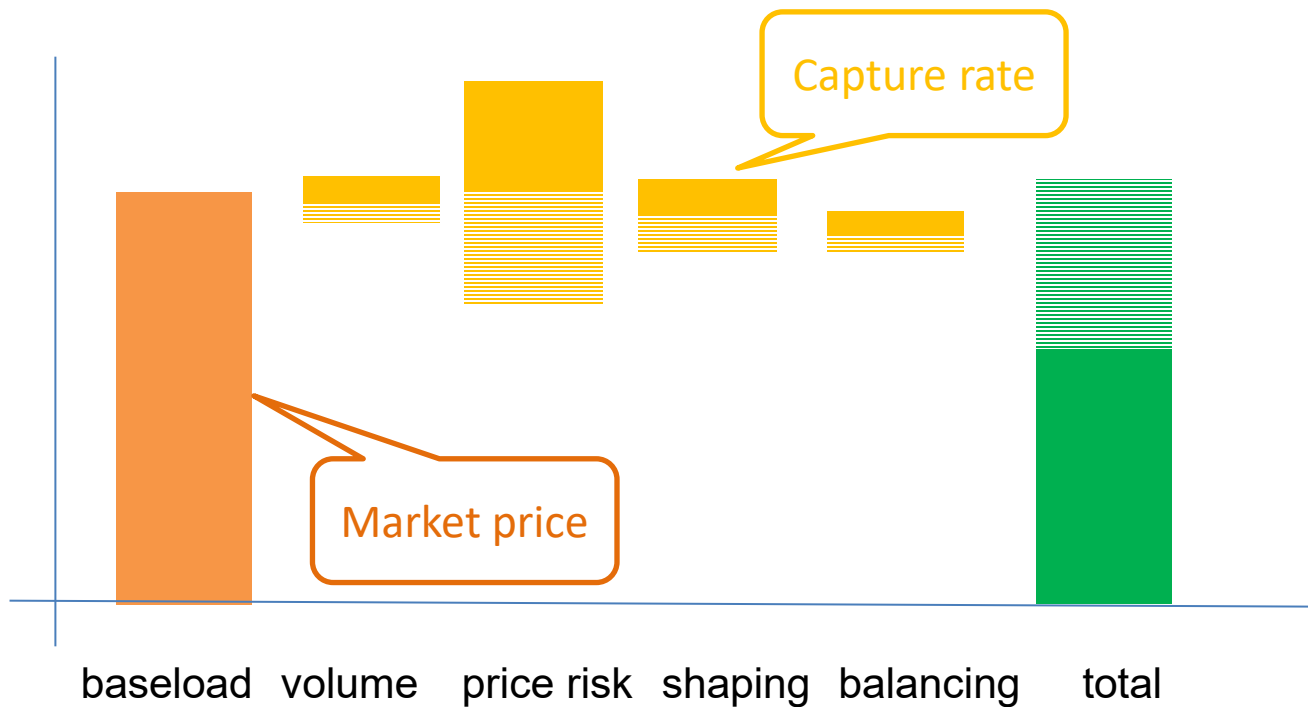


Strong hedging capability creates a competitive edge:

- Reduce risk capital
- Maximize revenues
- Create a larger portfolio



PPA value components and risks



- Each value component has a level of uncertainty
 - understand how to hedge this risk
 - and what risks remain unhedged

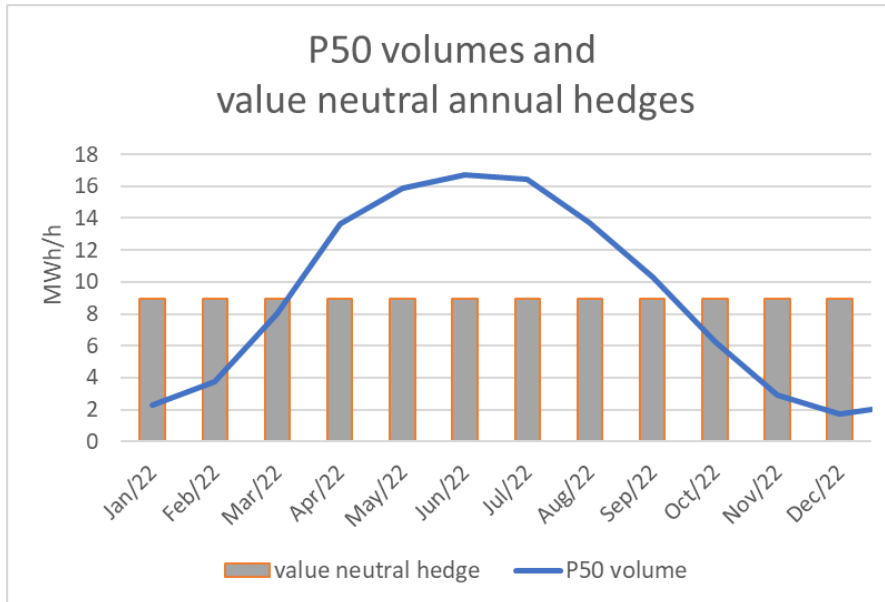
Hedging - different strategies

- Long term PPA (e.g. with corporate) 5-10 year
 - Baseload or pay-as-produced
- Market hedges for shorter period (1-3 years)
 - Annual baseload
 - Monthly baseload profile
- Dynamic:
 - Trade shorter dated products when available
 - Rebalance positions based on prices
 - Stack and roll

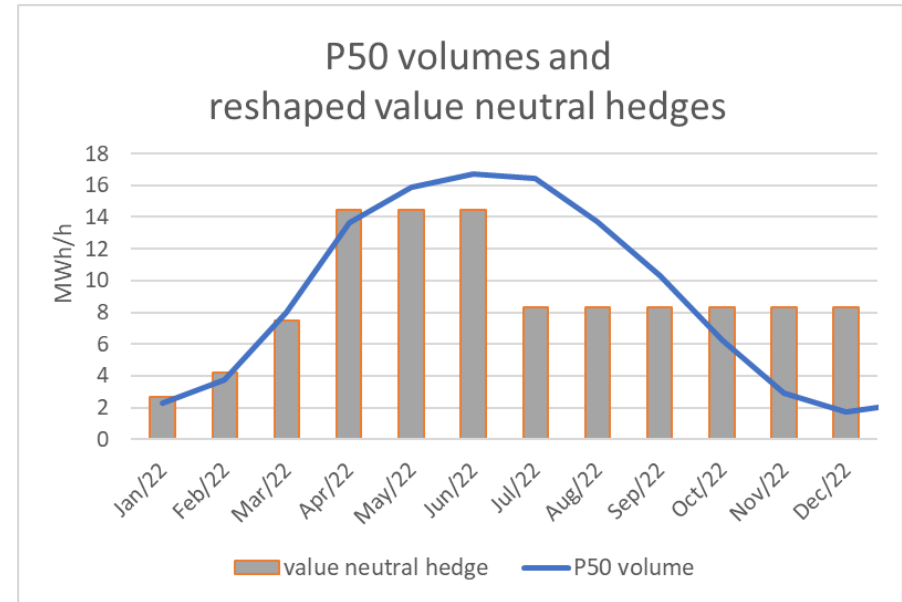
Best hedges are value-neutral rather than volume-neutral:
The expected effective price (capture price) is not the baseload price.
Value hedge is generally lower than P50 volume.

Dynamic hedging (1/2)

- Refine hedging
 - Rebalance hedge based on products becoming tradable
 - Example: initially only years tradable, later this can be reshaped using months and quarters



Initial annual hedge

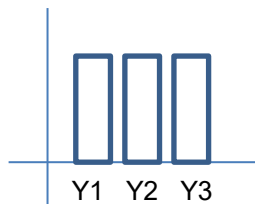


Reshaped hedge

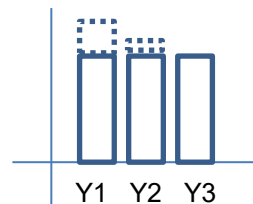
Dynamic hedging (2/2)

- Rebalance positions
 - Initial (value-neutral) hedge based on market prices on first hedging date
 - Forward prices change and therefore exposure
 - This can be re-hedged to better stabilize expected value

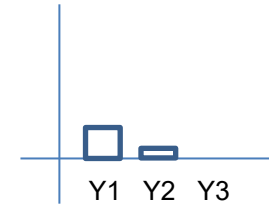
Today: initial delta hedge



1st rehedge date: calculate new delta hedges



Trade difference in market

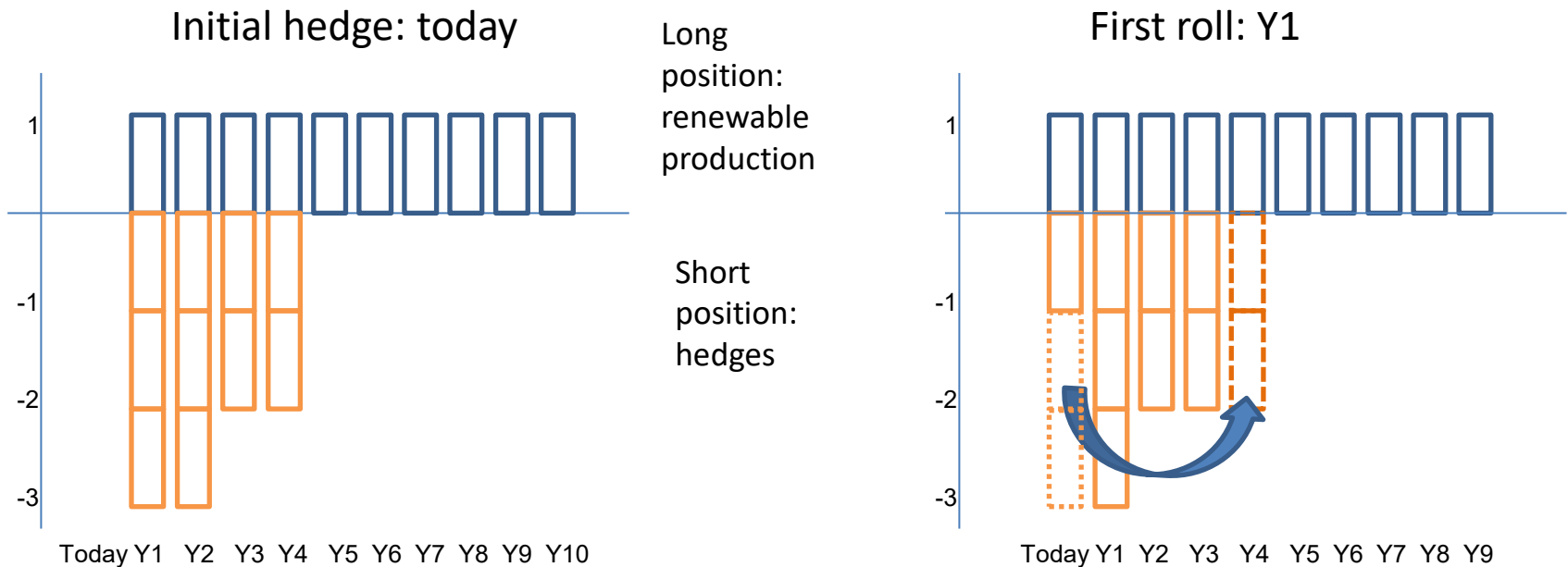


- Requires advanced system with price simulations:
 - On each rehedge date, calculate for each simulation, new forward exposure
 - Average over all simulations is new value neutral delta hedge

Dynamic hedging - Stack and roll

Stack and roll strategy:

- Hedge illiquid periods with liquid periods
- Roll position when they become tradable



- In KYOS software: combined with dynamic position rebalancing for optimal risk reduction

Case study for hedging PPA price risk



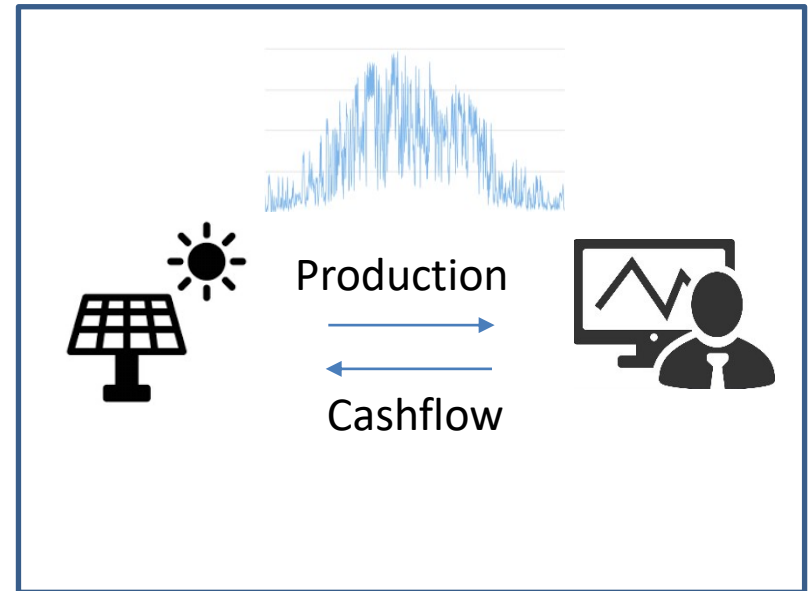
Hedging strategies

Case study

Solar project in Germany.

Asset owner wants to evaluate hedging possibilities

5 year reporting period



We analyze 3 different strategies

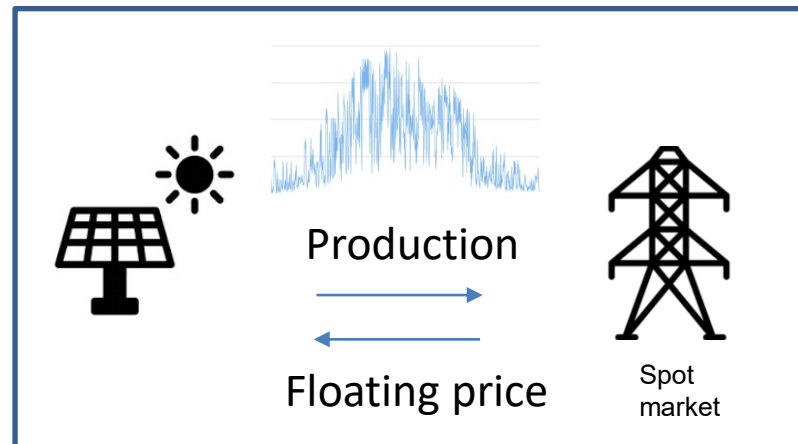
- Sell in market, no forward hedging
- Hedge with annual baseload hedge at fixed price
- Hedge with stack and roll strategy + rebalance

Strategy 1 – sell in spot market

Asset owner markets full output in day-ahead spot market

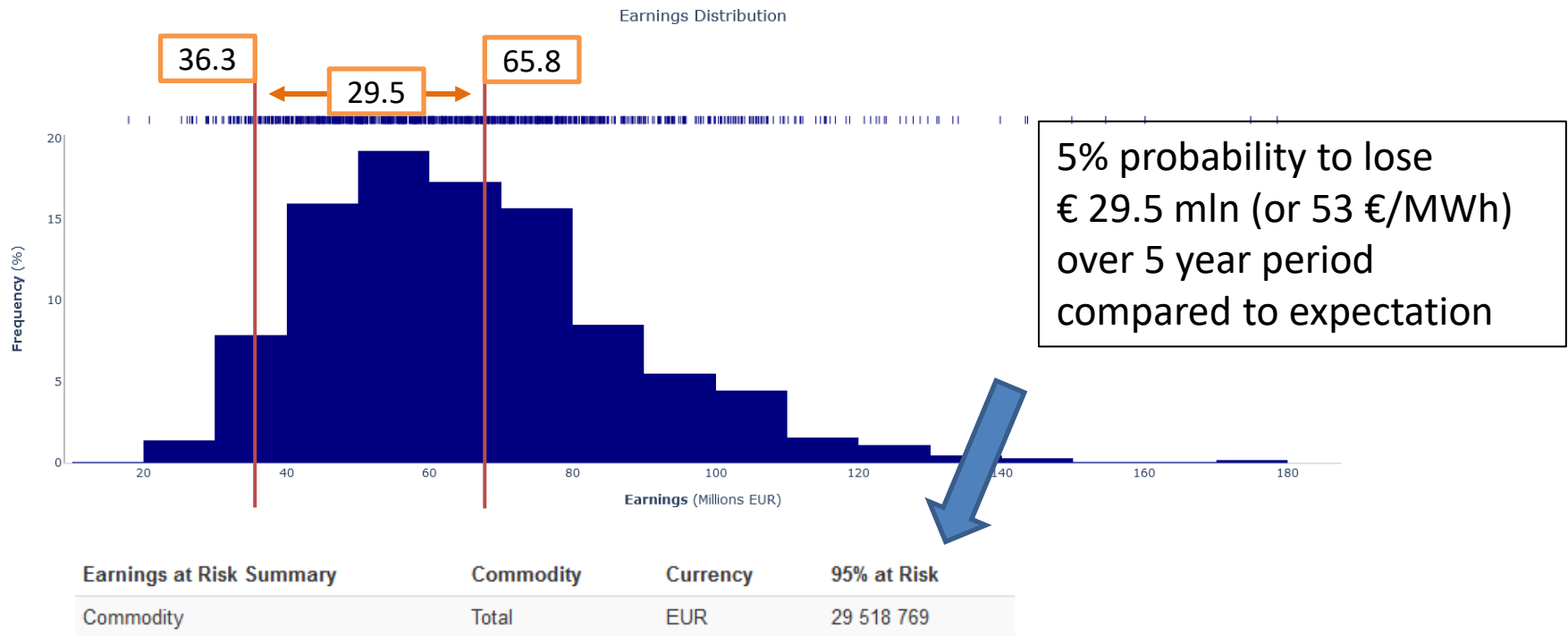
Directly via market access provider or as floating price PaP PPA

- Baseload price risk (large!)
- Risk of changes in price shape and capture rate
- Forecast errors lead to imbalance costs



Strategy 1 – Results in high risks

- We look at the distribution of earnings over a 5 year period (KYOS PPA software)



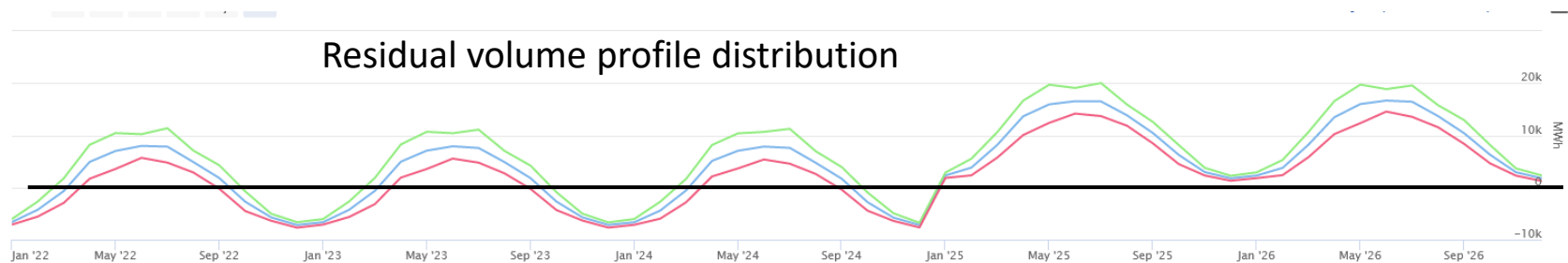
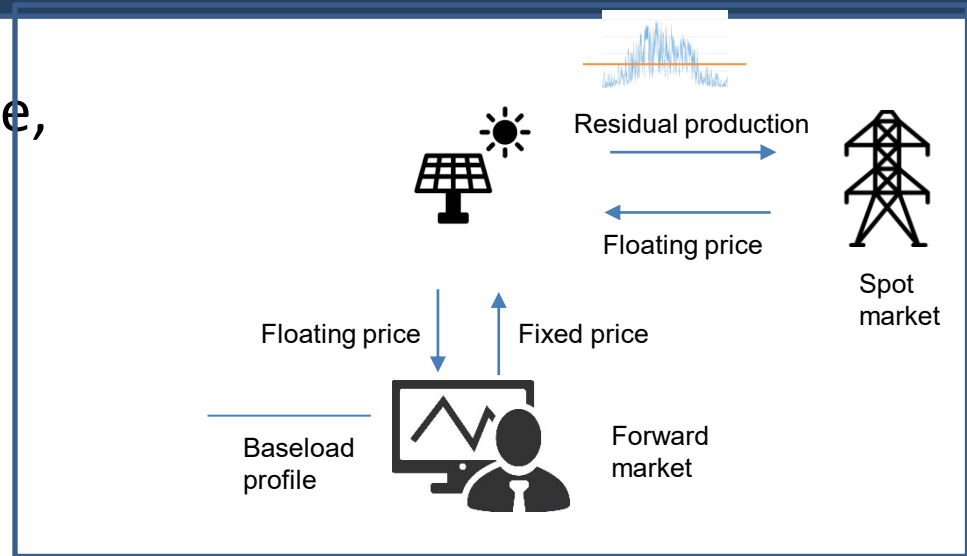
- Very wide earnings distribution, primarily price risk

Strategy 2 – Hedge with annual baseload hedge

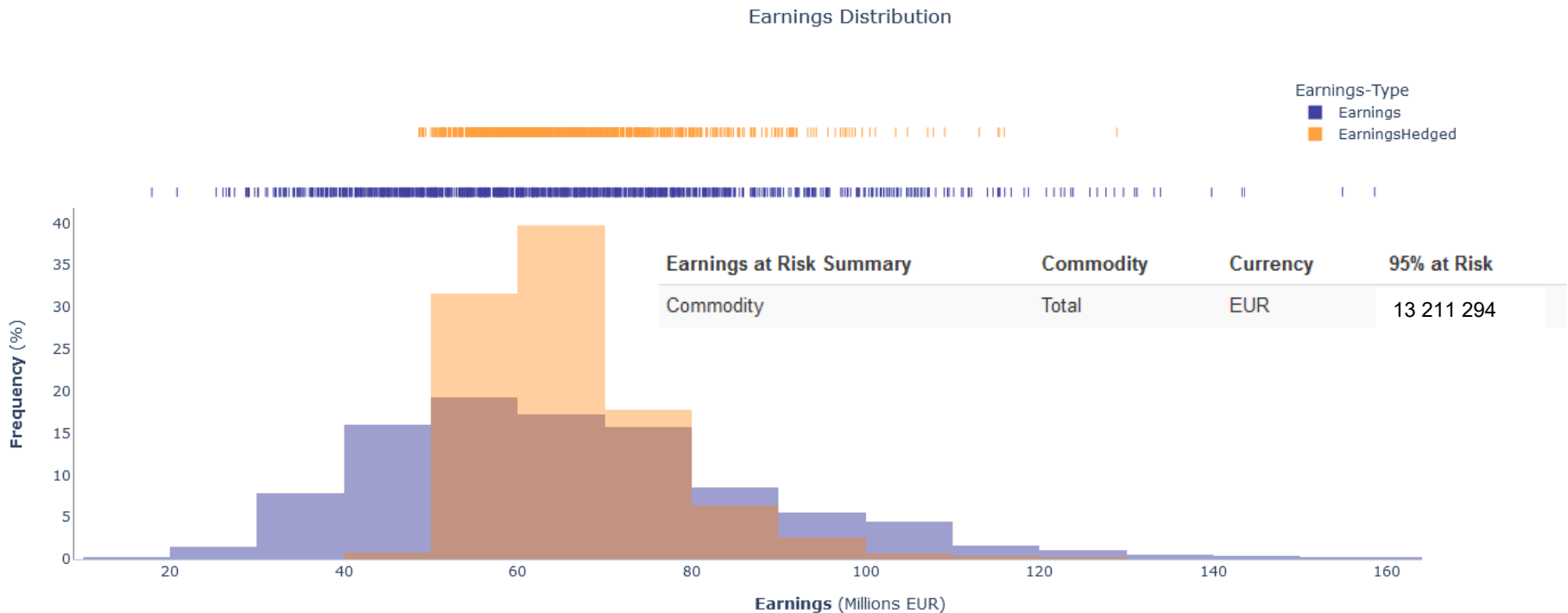
Asset owner sells fixed price, baseload, 3 year, value neutral hedge

Main remaining risks:

- Shape risk
- Volume risk
- Imbalance risk
- Price risk after year 3



Strategy 2 – clearly risk reducing



- Strong reduction of earnings risk: from 29.5 to 13.2 mln € for the 95% 'worst case' result.
- Main part of remaining risk in unhedged years 4+5

Strategy 2 – improvements

- Shape baseload profile in monthly blocks
- Find counterparty to trade year 4 and 5 directly, probably selling at a large discount
- Stack-and-roll:
 - Place the exposures of longer horizons (4+) into shorter-term contracts (1-3 years)
 - Every year, roll from short-term to long-term *tradable* contracts
 - Rebalance delta exposure resulting from price changes

Strategy 3 – Stack and roll

Advantages

- Way to hedge price exposure of illiquid long-term periods
- Intuitive approach

Disadvantages

- Requires enough liquidity in the forward market. Every year requires large position changes and you may be squeezed.
- Requires capital to deal with margin calls (MtM losses).
- Trading costs to make rolls each year.
- Risk of breaking correlations between the years. Example roll:
 - Buy (back) 2023 year contract @ 100 €/MWh
 - Sell 2025 year contract @ 60 €/MWh

Strategy 3 – Stack and roll

Earnings Distribution



- Earnings-at-Risk further reduced from 13.2 to 9.9 mln €
- More positive: number of ‘bad’ scenarios is much lower

KYOS approach to valuation & risk assessment of PPAs and renewable projects



KYOS approach

- Each project and PPA is unique:
 - Location and technology
 - Market and regulation
 - Contractual parameters
- But all project and PPA assessments require insight in:
 - Expected volumes, prices and cash-flows
 - Distribution of volumes, prices and cash-flows
 - Possibilities to reduce risk with the right structures and hedging strategies

KYOS Analytical Platform

Complete software solution for valuation and risk management of renewable assets and PPAs.

Main elements:

- Long-term price curves (KyPF fundamental model)
- Volume and price simulation (KySim)
- PPA valuation (KyPPA)
- Portfolio risk management (KyRisk)

All delivered in a user-friendly, on-line Platform



PPA Assessment



Test Ewout Eijkelenboom ▾

[Settings](#) [Price data](#) [Time series](#) [Curves](#) [Assets & Contracts](#) [Analytics](#) [Custom analytics](#) [Reports](#) [Logs](#)

KyPPA [Prototype](#) [Templates](#)

KyPPA

[Create profile](#)

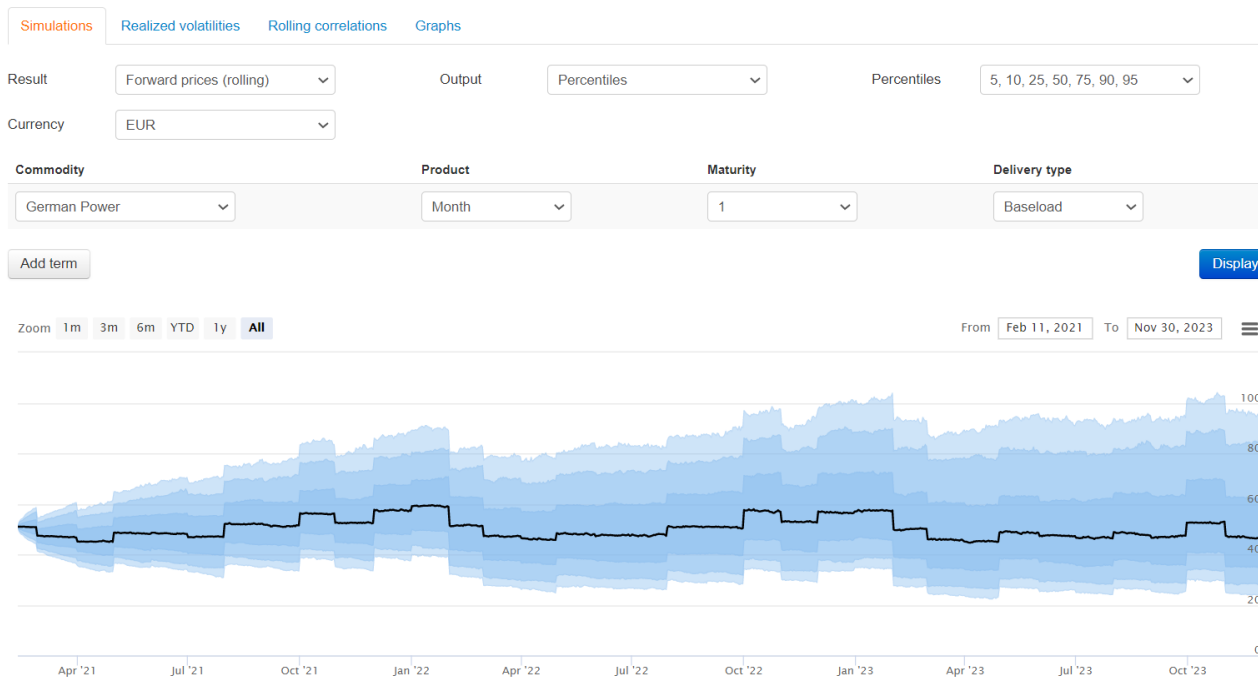
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<input type="checkbox"/>	6	Example DE Wind Indexed Price Cap/Floor	DE power for Halle	<input checked="" type="checkbox"/>	3	Yes ✎	Last result ▾
<input type="checkbox"/>	7	Example DE Solar Fixed Price	DE power for Parchim	<input checked="" type="checkbox"/>	3	Yes ✎	Last result ▾
<input type="checkbox"/>	9	Demo RO Solar Fixed Price	RO power with solar demo	<input type="checkbox"/>	1	No ✎	Last result ▾
<input type="checkbox"/>	10	Demo RO Solar Spot Index	RO power with solar demo	<input type="checkbox"/>	1	No ✎	Last result ▾

KyPPA module:

- Out of the box standard PPA pricing structures
- Possibility to define your own pricing structures

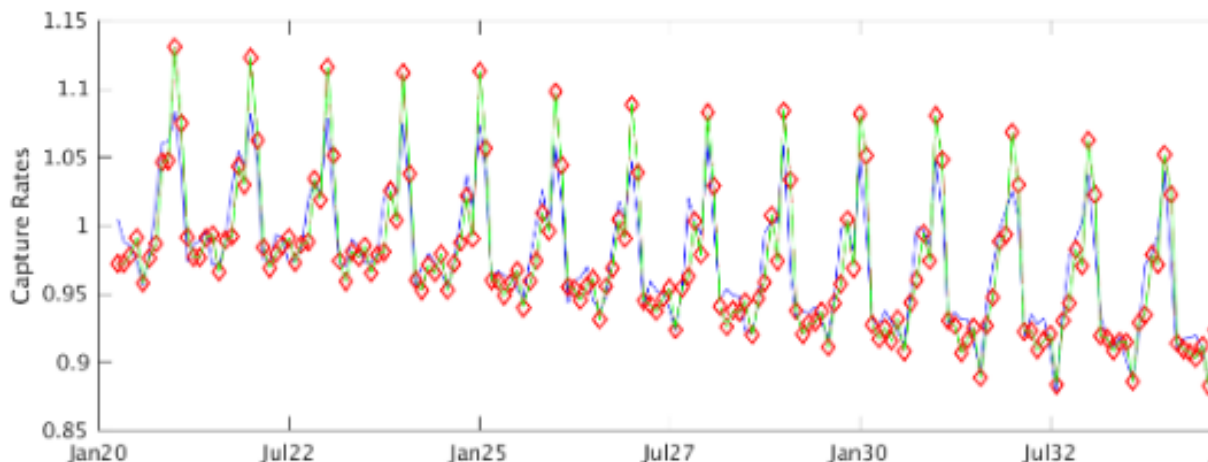
Simulate prices and volumes

- A single forecast of power prices is not enough
- Monte Carlo simulations of power prices:
 - Forward prices and hourly spot prices
 - Arbitrage-free: on average equal to forward curve

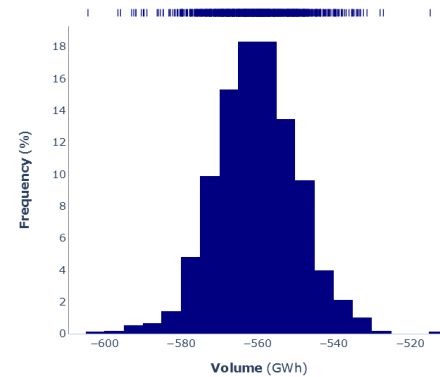
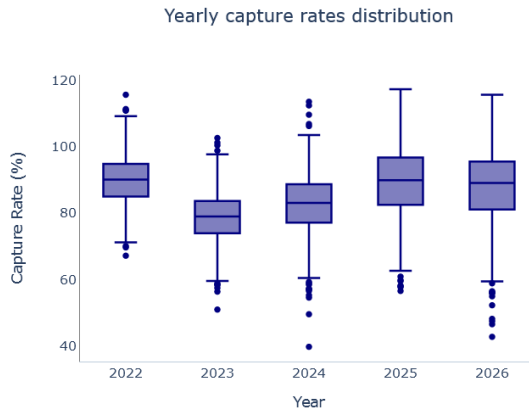
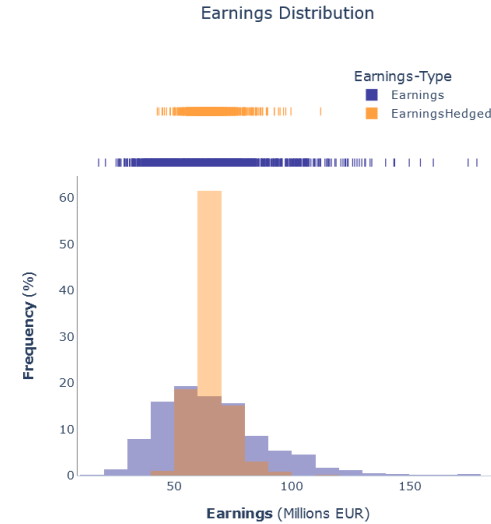
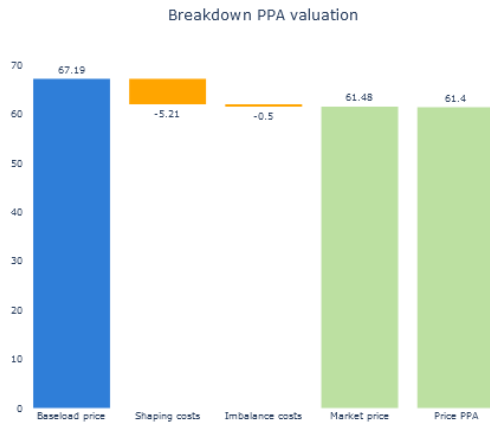


Simulate prices and volumes

- A single scenario of production forecast is not enough
- Production is negatively correlated to power prices
- Simulate weather and renewable power:
 - Smart historical sampling from historical years
 - Imposing a negative correlation with the power prices to meet the expected capture rates



PPA risk assessment



- Assess value and risk profiles per project and per PPA, with or without hedging strategies

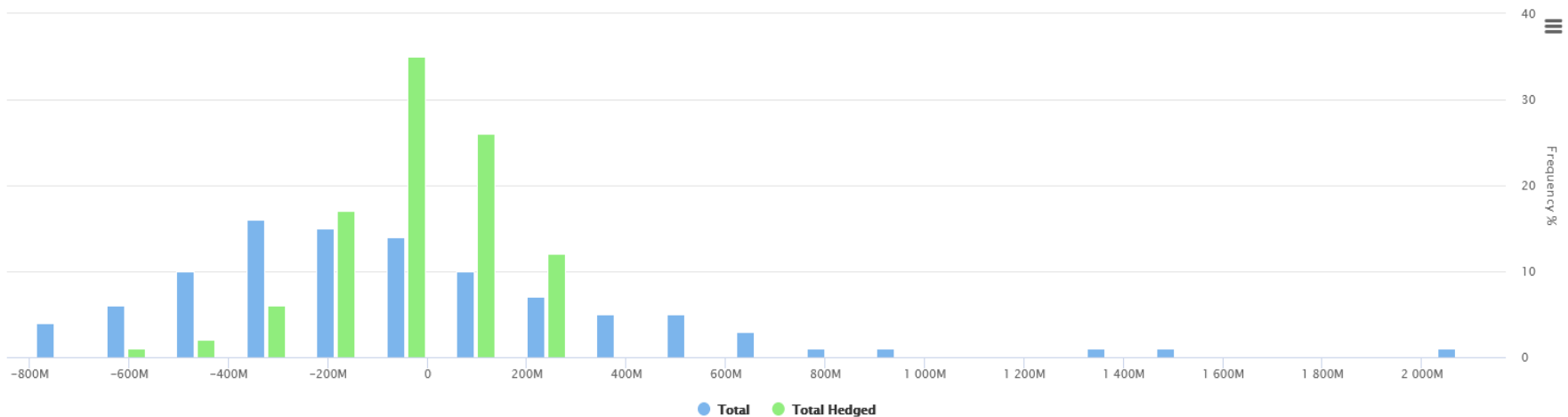
Portfolio risk management

Earnings at Risk Cash-flow at Risk Volumes at Risk

Earnings at Risk Summary	Currency	95% at Risk	95% at Risk (hedged)
Commodity: Total	EUR	399 538 718	190 977 997

Commodity: Total

Histogram graph

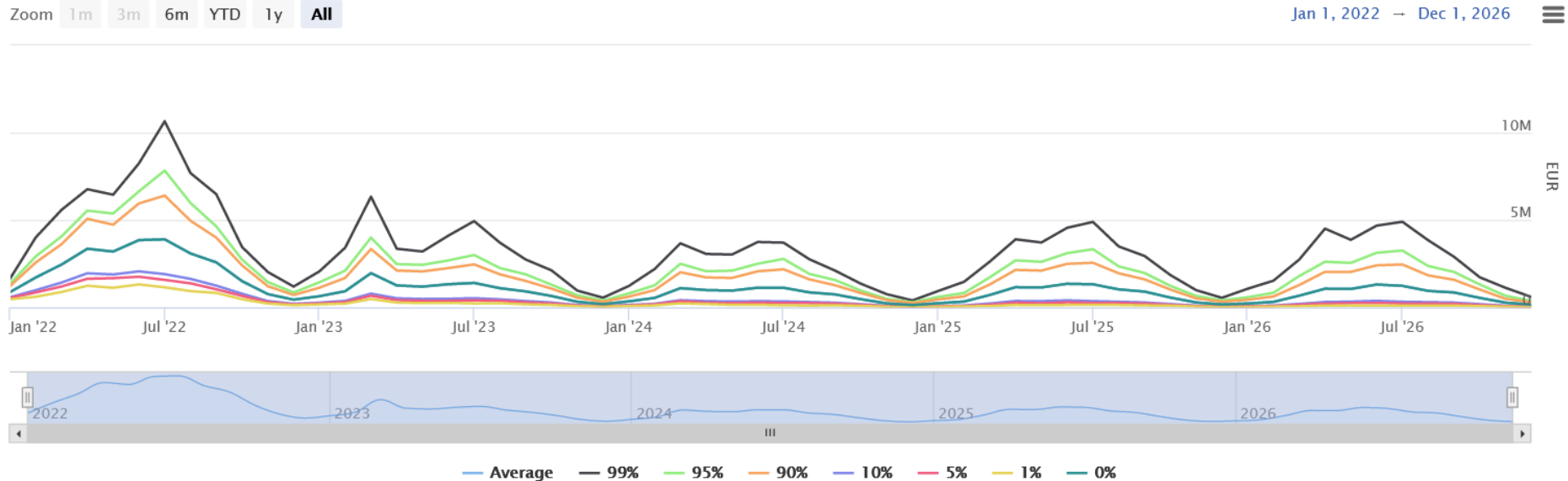


Kyos Energy Consulting

- Full risk profile of one project or portfolio of projects
- Include effect of hedging strategies, static or dynamic

Portfolio risk management

Monthly Earnings Distribution



Kyos Energy Consulting

[Show/hide monthly earnings distribution table](#)

- Monthly distribution of earnings: cashflow planning

KYOS PPA services

KYOS supports all players in the renewable energy sector

Project
developer

Bank/investor

Aggregator/
Utility

Corporate

- Valuation support during PPA negotiation/M&A activities
- Regular PPA valuations for accounting and trading purposes
- Support with arbitration cases

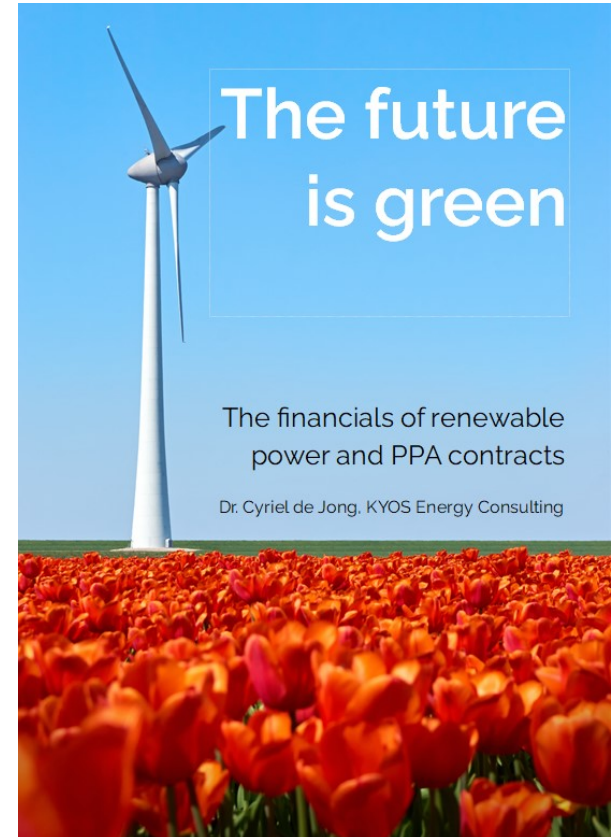
- KYOS Analytical Platform - complete tool to capture and manage PPAs
- Manage portfolio of renewable assets
- Python scripts allows user to create own PPA pay-off formulas
- Detailed risk reports for managers and analysts

Thank you

Time for Q&A

For a demo, please contact us on
info@kyos.com

E-book will be sent to you by e-mail



We look forward to supporting you in the rapidly changing energy sector!

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