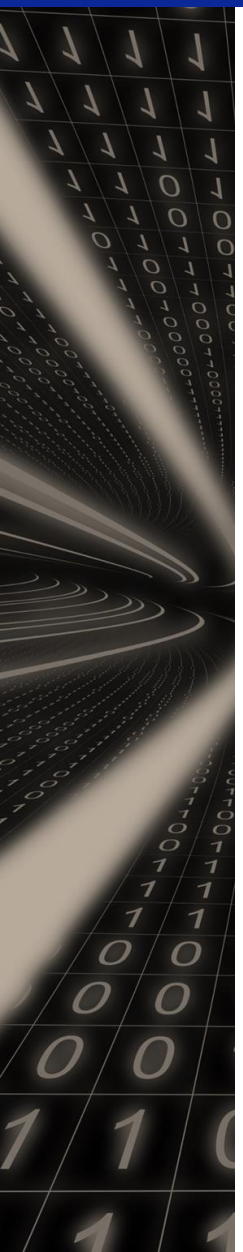
KYOS Webinar

Interconnectors in Europe

Ewout Eijkelenboom & Gianluca Gianotti

10 September 2024

KYOS Webinar – Interconnectors in Europe



Agenda

- 15:00h – 15:10h Welcome and introduction
- 15:10h – 15:35h Interconnectors
- 15:35h – 15:45h Q&A

Speakers:

- Gianluca Gianotti
- Ewout Eijkelenboom

KYOS Energy Analytics

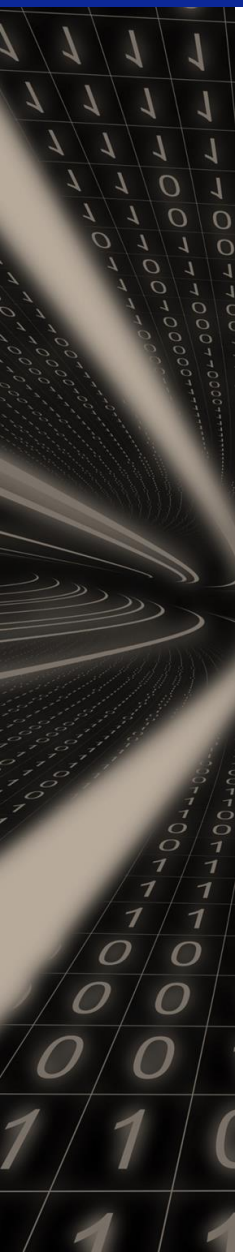
- Activities started in 2002, founded in 2008
- 40+ people, head office in Haarlem, The Netherlands
- Specialists in energy & commodity markets: trading, valuation, risk management
- Combine quantitative background with practical solutions
- More than 100 corporate clients across the world using our software services

SILVER 2023 ecovadis Sustainability Rating

ISO 27001:2017 Certified by Brand Compliance

KYOS

Our analytics – your advantage



Software for energy valuation & optimization

Solutions for valuation, optimization and risk management, coupled with advanced forecasting and price simulations.

Power plants
Renewable generation
Gas storage
Gas swing contracts
Batteries
Options

Software for multi-commodity exposures

The Commodity Portfolio & Risk Management software combines physical commodity management with financial risk reporting and price analytics.

It swiftly reveals the company-wide financial risks in clear reports.

Consultancy

We offer a wide range of top analytical services to companies in the energy and commodity markets. We are specialists in valuation, optimization and risk management.

Our expert services range e.g. from a one-off deal valuation to a complete solution for the risk management of a portfolio of assets and contracts.

Price data

Live or End-of-day market price forward curves are essential for trading, structuring and risk management.

In addition, we have a fundamental model for long-term (>30 year) power prices..

KYOS

KYOS approach to energy assets

- Apply advanced financial models combined with experience of the energy market to value and optimize assets.
  - Models developed by experienced quant team, over past 20 years
  - KYOS is at the forefront of new developments, understanding the market's needs.
  - Continuous feedback from our clients helps us to stay ahead

- Calculate the market value of an asset by optimizing it in the market with a range of trading strategies
  - Use realistic scenarios and trading strategies for the valuation of the market value.
  - Use transparent methodologies and scenarios

Introduction to interconnectors

Interconnectors: flexibility providers

- Decarbonizing: more electricity production coming from intermittent renewable generation
- Increased need for flexibility

Flexibility sources

- The main zero-emissions flexibility solutions for the grid of the future are:

Object of the webinar

Conventional capacity

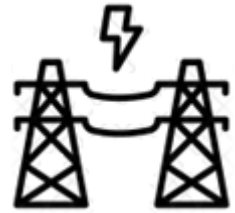
With co-firing of biomass or H2

Storage

Pumped-hydro or batteries

Demand/supply response

Flexible demand



Interconnectors

Transporting electricity between two market zones

Interconnectors: what they are

Definition

- Electricity interconnectors: high-voltage cables connecting neighboring countries
- Examples: NL-BE, NL-GB

Ownership

- Jointly owned and operated by the TSOs of the two neighboring countries (e.g. BritNed for the NL-GB interconnector)
- Merchant (e.g. ElecLink operates a merchant cable between FR-GB)

Roles

- Besides providing flexibility, interconnectors serve a variety of roles:

Supply optimization

Especially weather-related, critical for decarbonization

Security of supply

Balancing, resilience, lowering price spikes

Price convergence

In the long term across Europe

Cost reduction

Price convergence brings efficiency

Market liquidity

Capacity auctions provide trading opportunities

Interconnectors: capacity allocation

- Different capacity allocation mechanisms are being used:

Long-term

Physical Transmission Rights

- Allocated via explicit auction
- Capacity is nominated or compensated (UIOSI) based on Day-Ahead results

Financial Transmission Rights

- Allocated via explicit auction
- Nominations are not possible. Capacity is compensated based on Day-Ahead results

Daily & intraday

External EU borders

- Similar to physical long-term auctions: transmission rights are allocated via explicit auction and have to be nominated

Internal EU borders

- Capacity is allocated via implicit auction within Day-Ahead and Intraday market coupling (SDAC, SIDC)

→ The payout of interconnector capacity in one direction corresponds to the realized positive difference in spot power prices between the two market zones, minus interconnector losses

KYOS

Valuation of interconnector capacity

Introduction to capacity valuation

- Valuation of interconnector capacity is extremely important for market players
  - **Tradable intrinsic value**:
    - Can be locked in without any risk by using forward products that are tradable on the market
    - Only depends on spread between settlement prices of forward products and interconnector losses

In practice

Example: value capacity between NL and GB in the NL→GB flow direction for Oct-25

ICE Endex settlements prices for the Oct-25 product on 27/08/2024 (GB converted to €/MWh)

After discounting 3% losses

	NL	GB	Spread
Baseload	94.57	105.01	7.29

7.29 **Intrinsic value for Oct-25** (direct flow)

  - **Total value**:
    - Is higher than intrinsic value, but it can not be locked in without any further risk
    - Can only be calculated using a structured approach

Approaches to capacity valuation

- KYOS developed 2 different approaches to estimate the total value of interconnector capacity:

Statistical approach

- Value is derived from a combination of historical data and Monte Carlo simulations of forward prices
- Current market conditions and potential developments are priced into market settlement prices and volatility assumptions used to generate the price simulations

Granularity:

- monthly

Application:

- general purpose within the liquid horizon

Fundamental approach

- Value is derived from fundamental modeling of power supply/demand using KYOS' proprietary model KyPF
- Includes future changes to fundamental market conditions (e.g. capture rates, demand) across a variety of weather scenarios

Granularity:

- hourly

Application:

- fundamental what-if analysis
- short-term weather-based analysis
- valuations beyond the liquid horizon

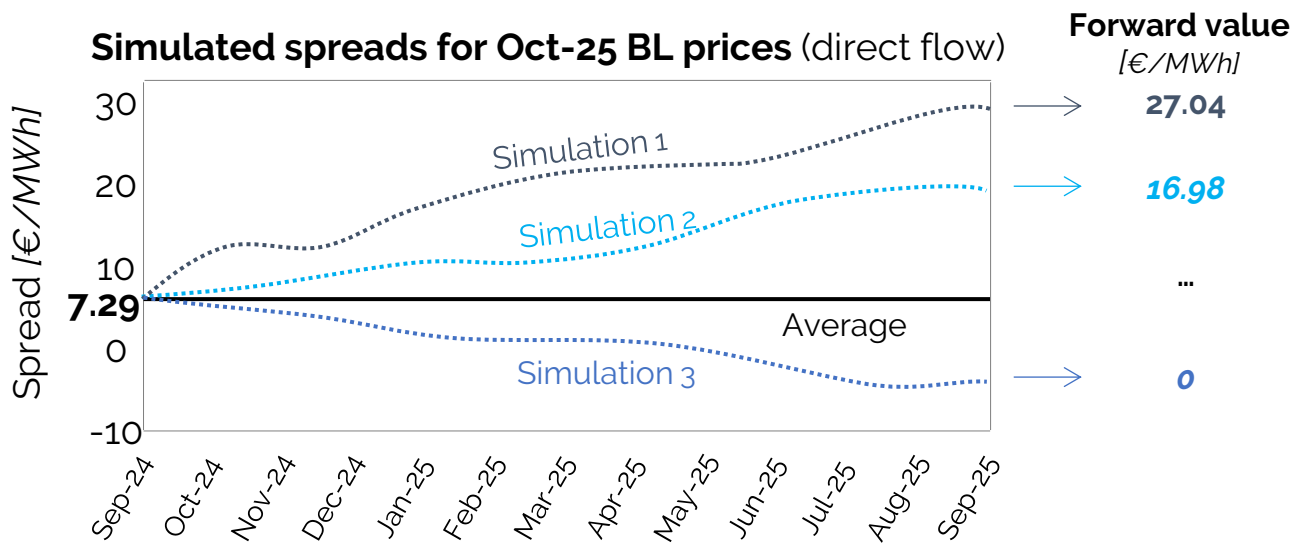
Statistical approach (1/2)

The total value of interconnector capacity is given by two components:

-> forward value and hourly value

Forward value

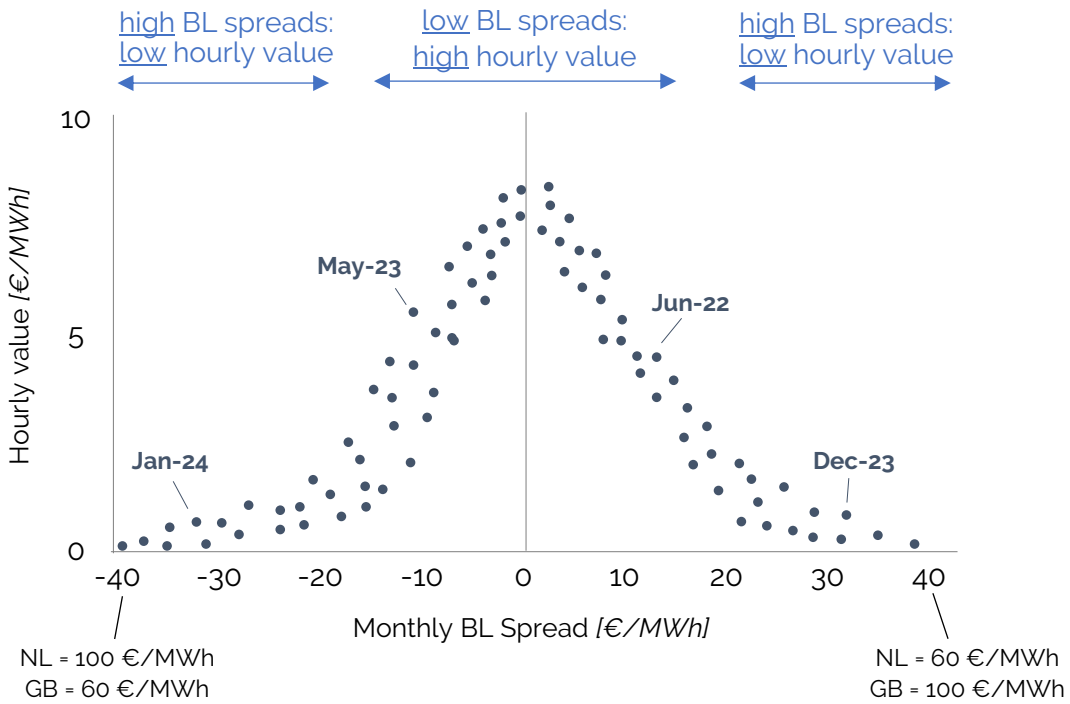
- Derived from fluctuations in forward prices (and spreads) before start of delivery month
- Estimated using Monte Carlo simulations of (cointegrated) forward prices



Statistical approach (2/2)

Hourly value

- Derived from fluctuations in hourly spreads during delivery month, on top of monthly BL spread
- Estimated using historical data to connect hourly value with monthly BL prices and spreads



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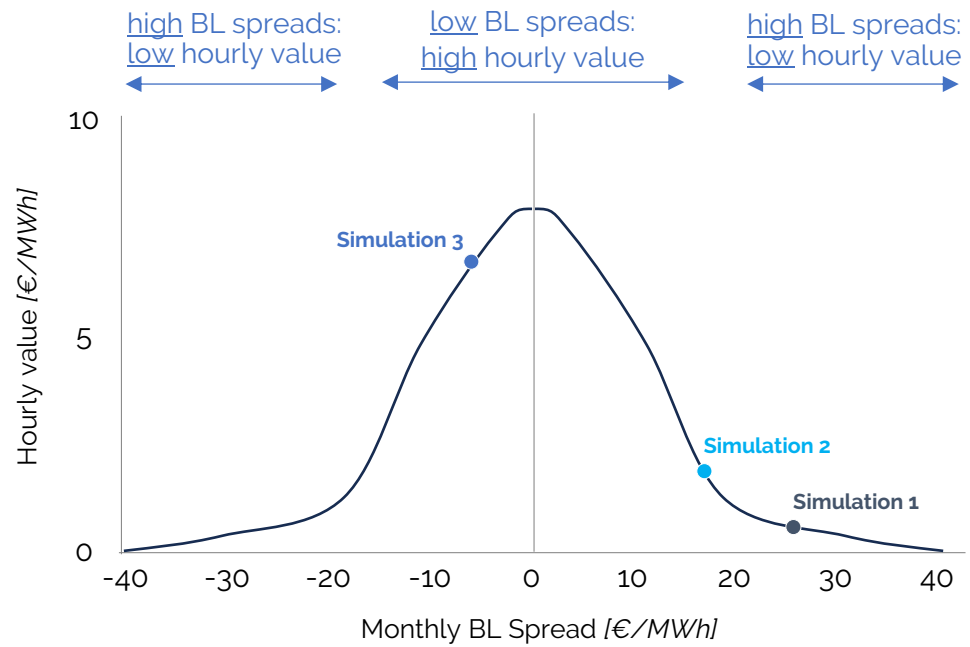

	Forward value [€/MWh]		Hourly value [€/MWh]		Total value [€/MWh]
Simulation 1	27.04		1.11		28.15
Simulation 2	16.98	+	2.31	=	19.29
...	...		...		...
Simulation 3	0		7.12		7.12

Total value for Oct-25 (direct flow) **14.66**

Fundamental approach (1/2)

- KyPF determines the future hourly prices across 40 European bidding zones by recreating full supply and demand situation

KyPF inputs

For each European market zone:

- Power plant fleet
- Electricity demand
- Renewable capacity
- Storage capacity
- Electrolyser capacity
- Interconnector capacity
- Fuel and carbon prices

KyPF outputs

Hourly power price results for each market zone across several scenarios:

	Scenario 1 (S1)		...	Scenario 10 (S10)	
	NL	GB	...	NL	GB
01-Oct-2025 0:00	127.08	129.72	...	124.87	124.87
01-Oct-2025 1:00	117.52	119.45	...	117.02	115.58
01-Oct-2025 2:00	109.77	109.77	...	106.91	105.90
...	...	...	...	...	...
31-Oct-2025 21:00	130.06	135.42	...	111.46	102.56
31-Oct-2025 22:00	114.58	117.75	...	94.59	91.45
31-Oct-2025 23:00	111.87	111.87	...	85.32	78.98
Monthly BL price	117.52	119.48	...	116.73	131.91
Monthly BL spread	-1.62		...	11.22	

Fundamental approach (2/2)

- First, we use the hourly prices across all the scenarios to derive a relation between monthly BL spread and total value….

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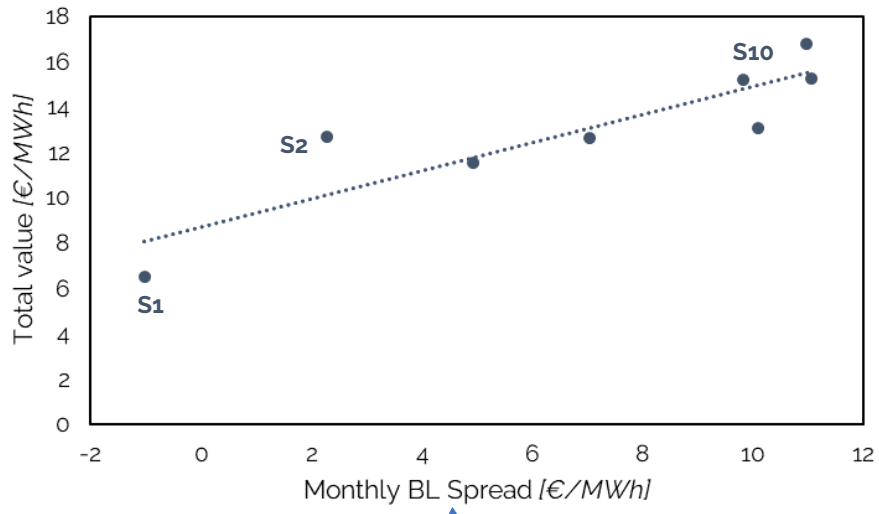
Sum of hourly spreads



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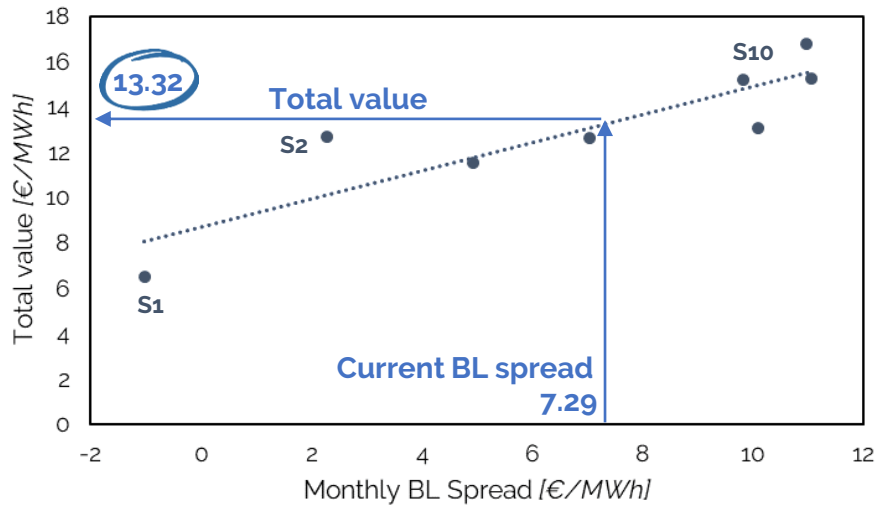


- …then, we find the total value corresponding to the current BL Spread for the month (7.29 €/MWh)

Use cases

- A structured approach to the valuation of interconnector capacity serves several use cases:

Interconnector operators
Value assessment and auction timing

Traders
Fair value assessment and hedging optimization

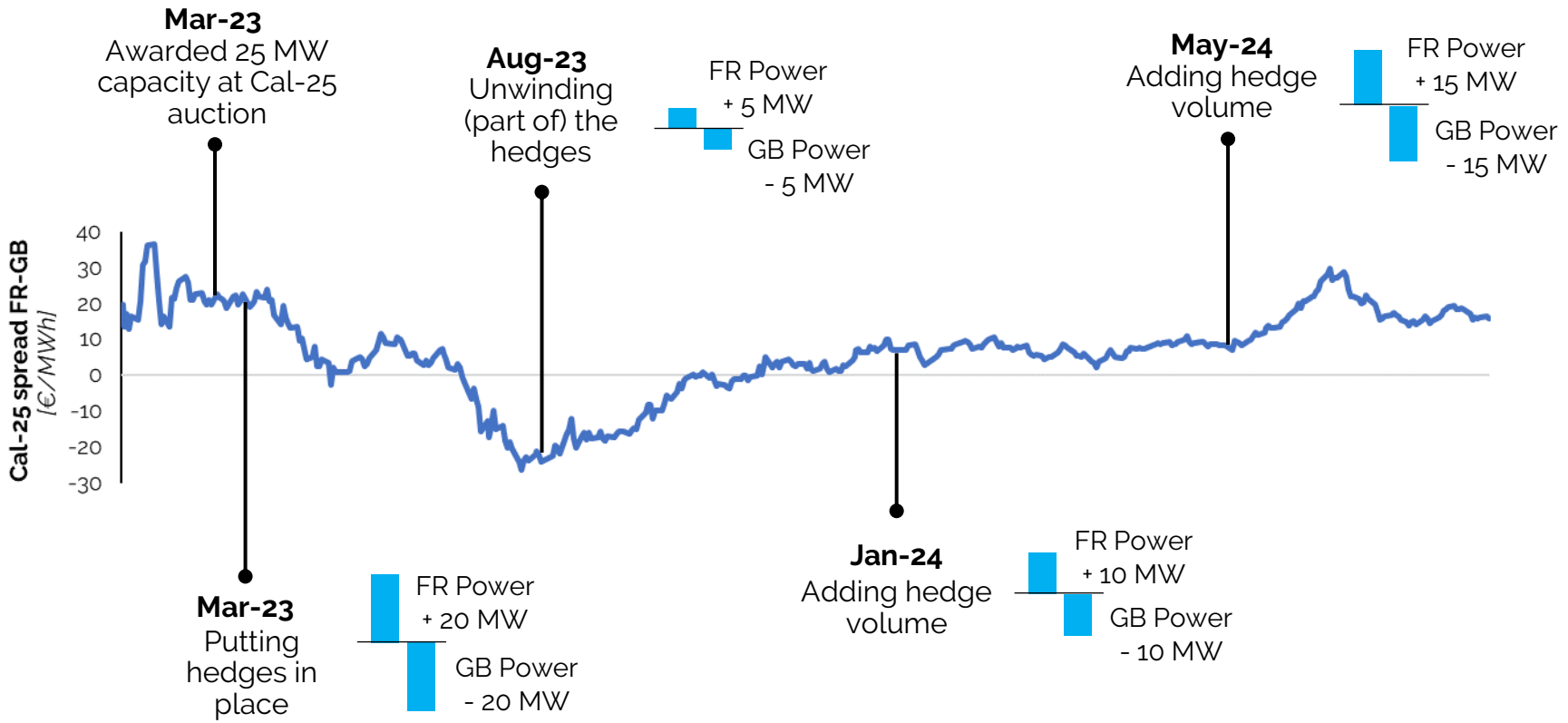
Risk managers
Valuation of capacity and hedges

Regulators
Assessing price spreads

KYOS

Application example

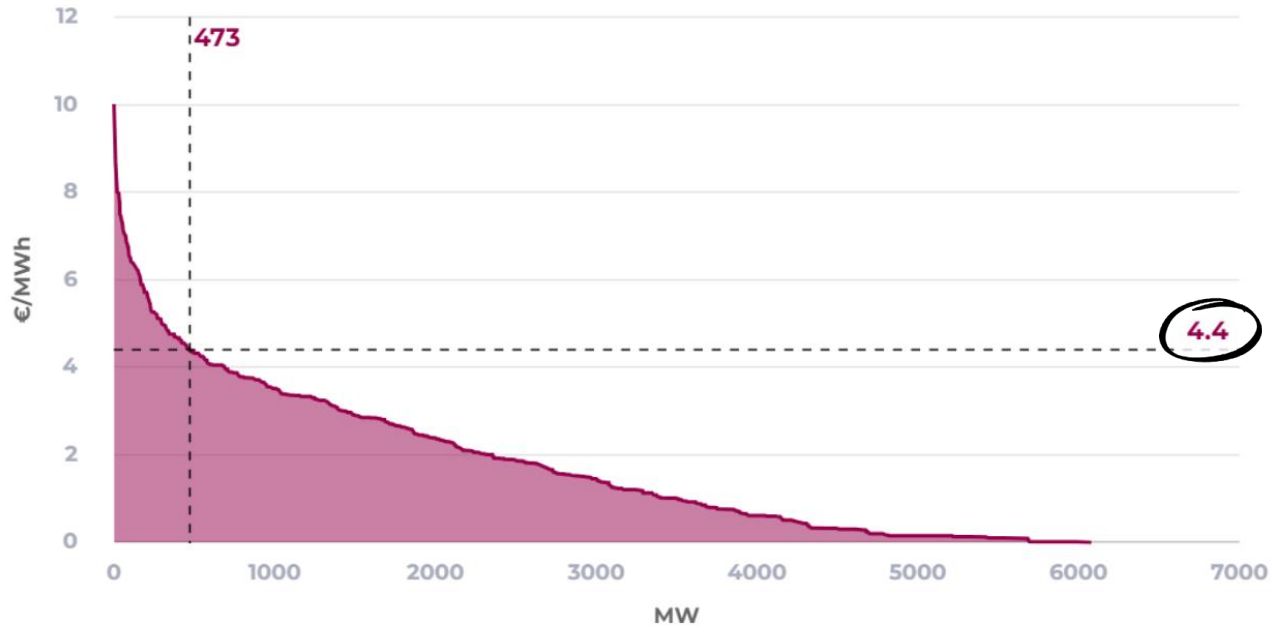
- A structured approach to value interconnector capacity and hedges allows a market player to delta hedge the interconnector capacity in its portfolio (e.g. FR-GB capacity for Cal-25)



What we offer – ad-hoc valuations

- KYOS offers ad-hoc valuations of interconnector capacity with view on upcoming auctions
- Our models were used to support interconnector operators with assessing interconnector value and forecasting auction results

Example of Auction chart of NL-BE Cal-24 auction
(from jao.eu)



Auction result

What we offer – customized report

- KYOS offers regular customized reports on interconnector value and hedges

Example report

Example Valuation Report - NL-GB

Based on settlements 27/08/2024

Realized settlements

Product	NL-GB			GB-NL		
	Hourly Spread*	DA Auction	LT Auction**	Hourly Spread*	DA Auction	LT Auction**
Q1-24	7.24	6.17	9.81	1.51	1.15	2.01
Apr-24	11.80	10.88	13.09	7.43	7.13	1.60
May-24	21.61	21.31	18.13	3.21	2.64	1.20
Jun-24	21.32	20.99	16.06	4.06	3.09	2.27
Jul-24	-	-	-	-	-	-
Aug-24	-	-	-	-	-	-

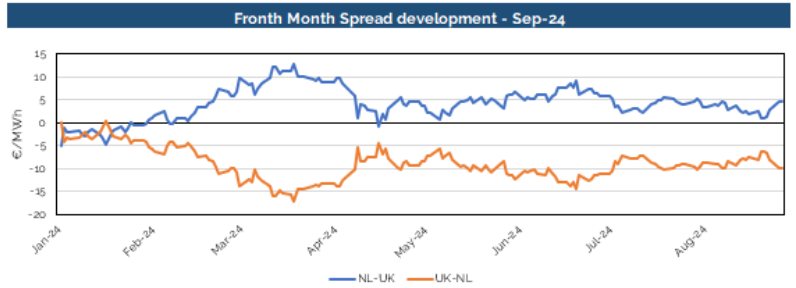
*Hourly Spread of positive hours - **Average spread of all auctions

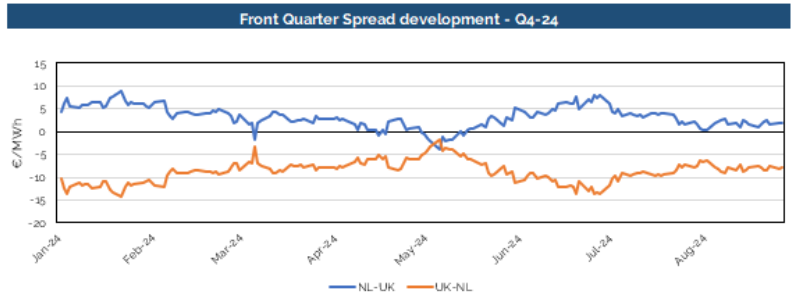
Forward valuations

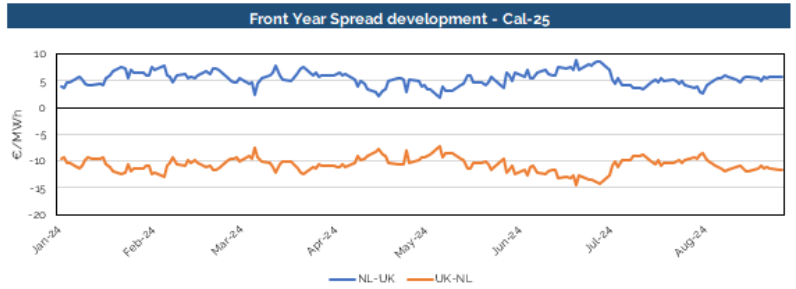
Product	NL-GB			GB-NL		
	Tradable Intrinsic	Extrinsic	Total value	Tradable Intrinsic	Extrinsic	Total value
Sep-24	4.54	3.52	8.07	0.00	3.28	3.28
Oct-24	0.00	6.45	6.45	0.00	5.52	5.52
Nov-24	2.28	8.08	10.36	0.00	6.02	6.02
Dec-24	4.85	7.74	12.59	0.00	5.69	5.69
Q1-25	5.27	7.85	13.13	0.00	6.65	6.65
Q2-25	12.90	3.81	16.71	0.00	2.98	2.98
Cal-25	6.83	6.47	13.30	0.20	5.43	5.63
Cal-26	3.97	6.03	10.00	0.70	5.49	6.19

Hedge statistics

Product	NL-GB		GB-NL	
	Hedge volume [MW]	P&L [k€]	Volume [MW]	P&L [k€] (statistical)
Sep-24	50	0.88	10	-1.56
Oct-24	20	54.00	5	10.04
Nov-24	30	72.75	-	-
Dec-24	-	-	-	-
Q1-25	40	-48.81	30	232.98
Q2-25	30	-845.40	20	42.53
Cal-25	60	-3590.29	40	1552.11
Cal-26	-	-	-	-



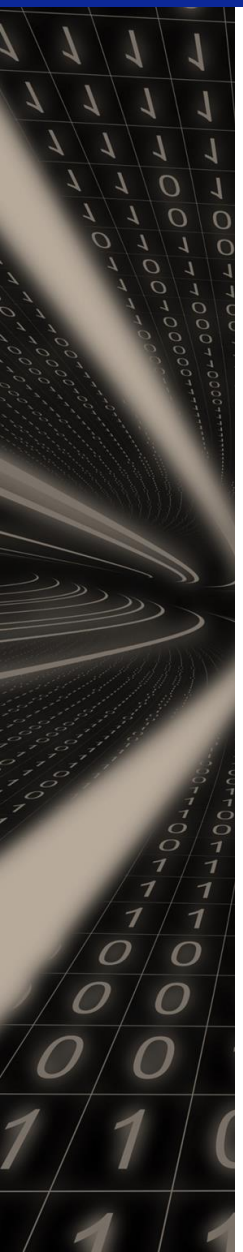


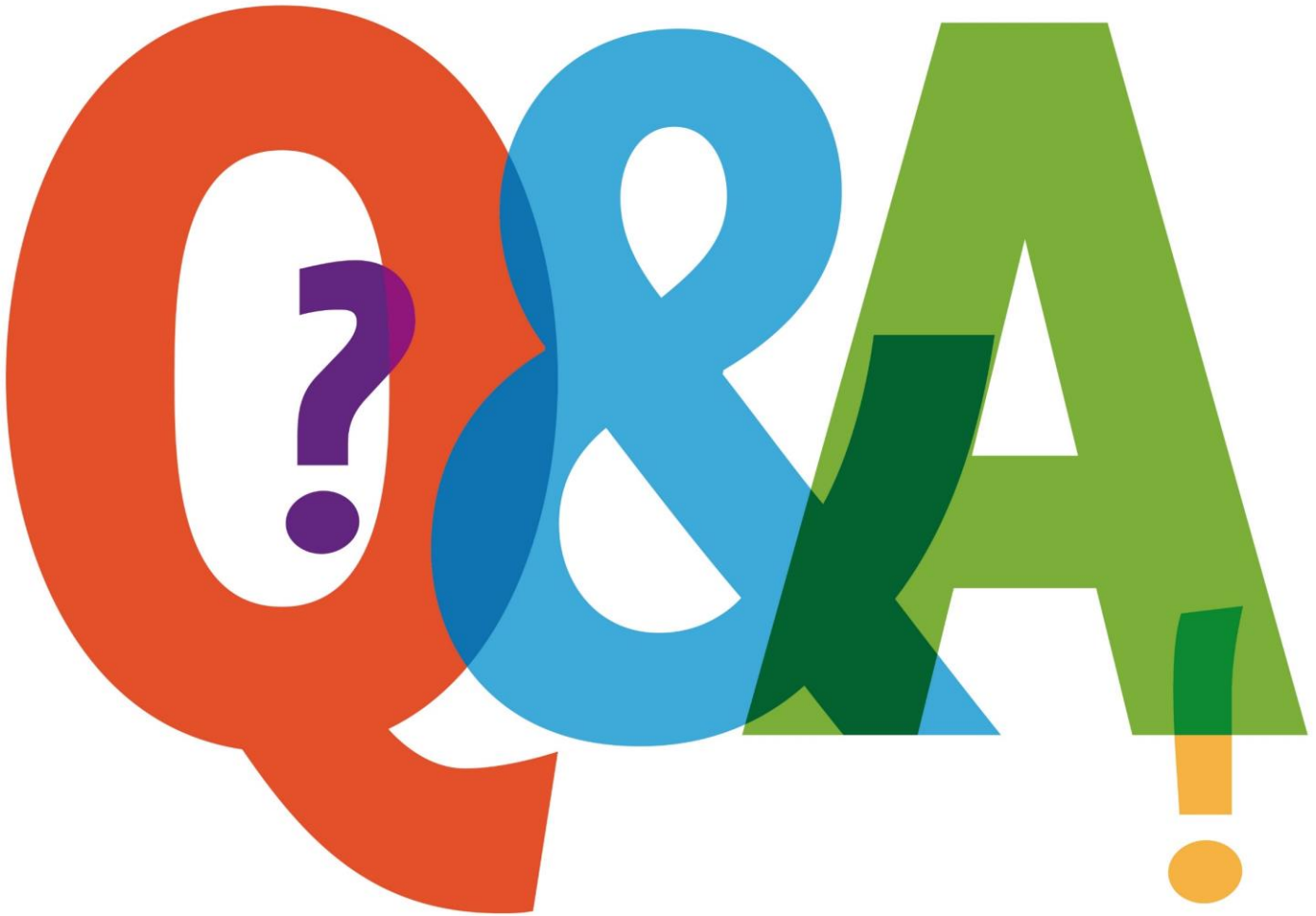


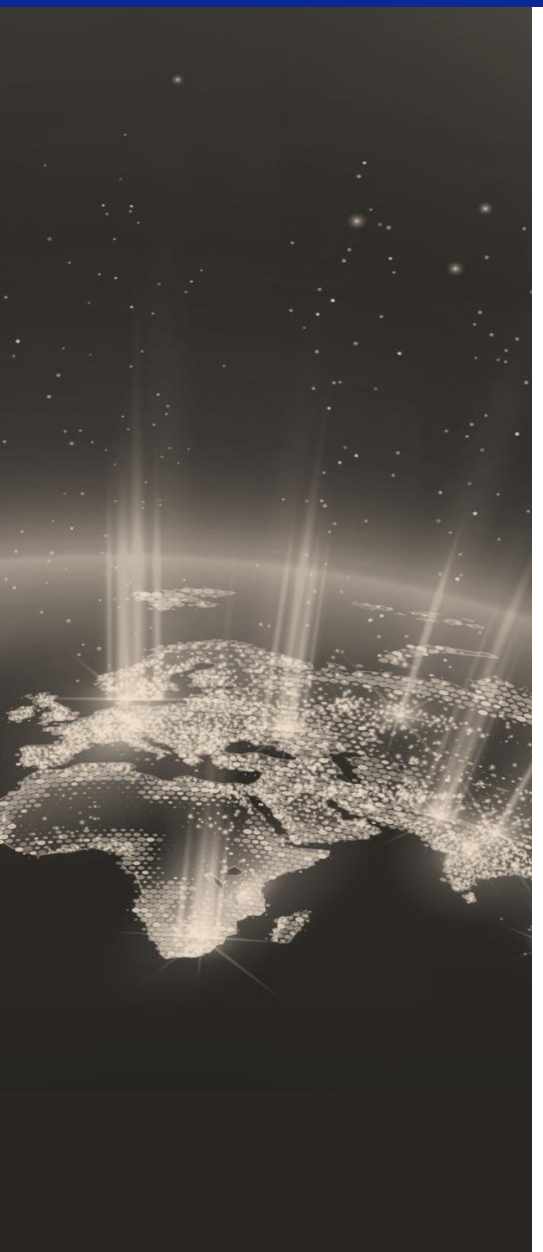
Some useful free publications

See: https://www.kyos.com/knowledge-center/

Questions and Answers







We look forward to supporting you with the right tools and advice in the rapidly changing energy sector!

KYOS

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