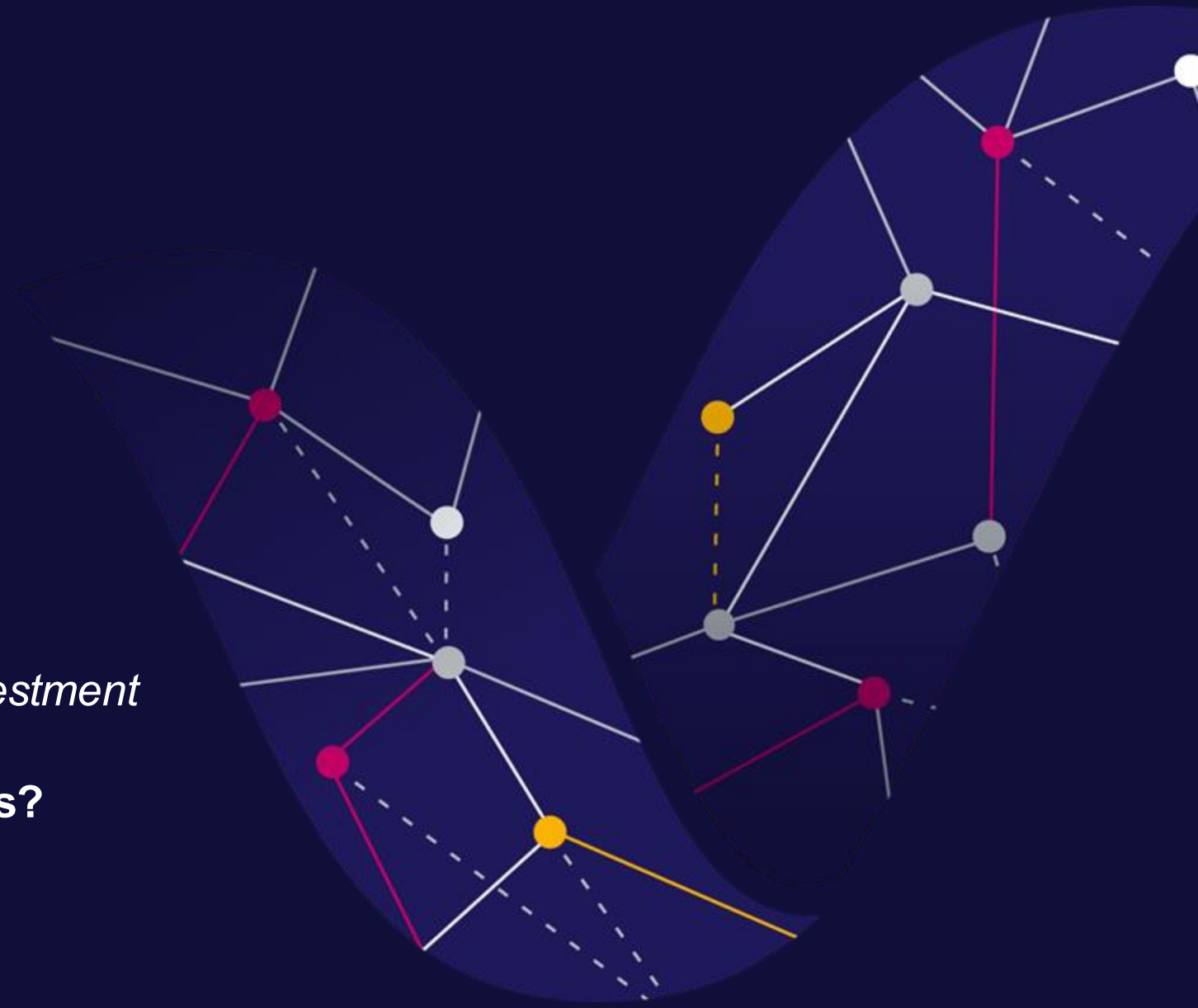
VALLORII

Data-driven products for infrastructure investment

What is the Cost of Capital for AR7 CfDs?

26th June 2025



CONFIDENTIAL

Disclaimer

The following analysis by Vallorii is an independent assessment of the expected risks and fair return requirements related to the UK CfD auctions.

It does not represent the beliefs, assumptions, intentions, or expectations of parties other than Vallorii.

This workshop is presented for information purposes only and does not constitute advice. Vallorii accepts no responsibility nor liability for any use made of any of the information provided to participants.

For the avoidance of doubt, this workshop is not intended to be used by participants to coordinate commercial behaviour. Vallorii does not encourage nor facilitate any form of market coordination.

Agenda

real CoE

Introduction to Vallorii

AR7 Cost of Equity: 9.7% - 10.6%, given risks and return for a Scottish offshore wind asset

1. *Investment environment:* Competition for capital in Energy and infrastructure markets
2. 8.6% implied CoE in AR6
3. 1.0% - 2.0% CoE uplift due to zonal pricing risks and heightened construction risks

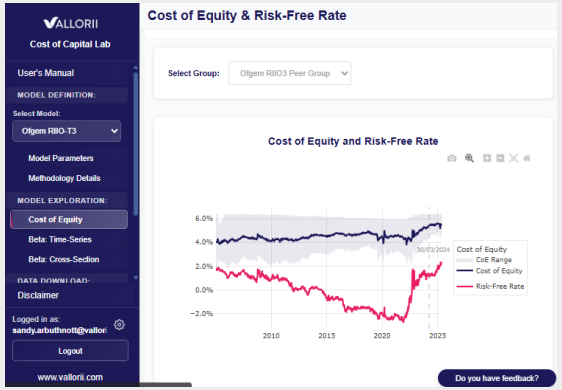
AR7 implied strike price of £74.0 - £89.1 per MWh (2012 prices)

Vallorii provides data-driven valuation tools and expertise for private and public infrastructure assets

Regulatory cost of capital
based on modern financial tools and delivered online

CoC Lab:

Rapid synthesis and analysis on regulatory CoE/WACC for use by utilities & regulators

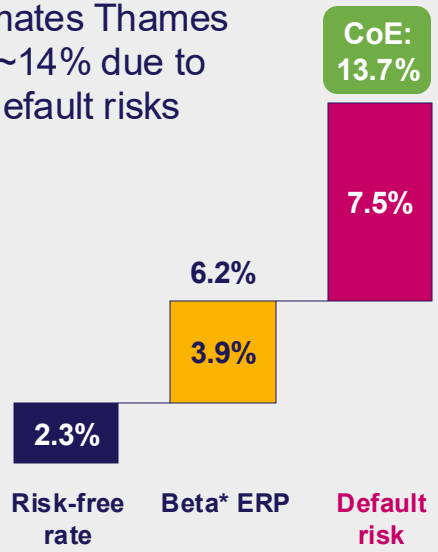


CAPM online toolkit available now

Asset-level cost of capital
Incl. market sentiment and AI-driven asset-specific risk profiles

Case example:

Vallorii estimates Thames Water CoE ~14% due to short-term default risks

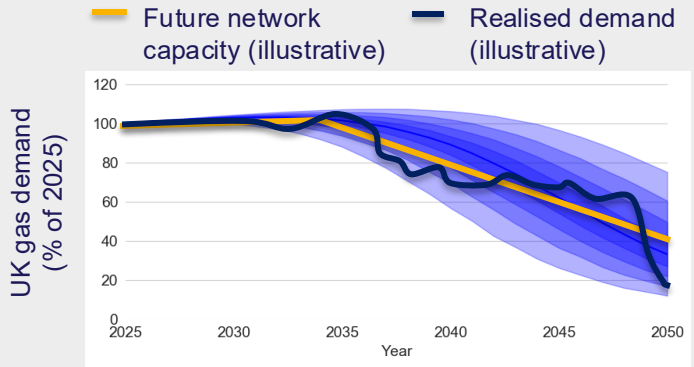


VAPRI tool in development

Asset & portfolio valuation
screening across sectors and regions, incl. rapid sensitivities

Case example:

Flexibility in CAPEX deployment in the gas grid can reduce system costs by £5.5bn given transition uncertainty



Tool available in 9-12 months

Source: Vallorii

The Vallorii team brings together expertise across AI, data science, economics and financial analytics

Sandy Arbuthnott
Oxford/LBS, ex-Bain, engineering, sustainability & program management

Lennart Baumgärtner
Oxford, ex-McKinsey, complexity economics & physics

Anita Bharucha
Cambridge, ex-Whitehall, public sector NED, ops leadership

Cassian Burger
Bocconi/Cass, ex-investment banking

Jorge Cardenas
KIT, ex-Quantum Black, AI product leader

Cassandra Etter-Wenzel
Oxford, ex-OECD, regulatory specialist

Dieter Helm
NED, Oxford Prof of Economic Policy

Cameron Hepburn
NED, Oxford Prof of Environmental Economics

Ranjita Rajan
NED, start-up leadership, PE and sustainability expert

Robert Ritz
Cambridge fellow, ex-Vivid/McKinsey, financial economics

Jennifer Vaughan
Order from chaos

Henry Tian
LSE, Queens, ex-McKinsey data scientist

Fit-for-purpose infrastructure must be based on fit-for-purpose economics, data and models

Source: Vallorii

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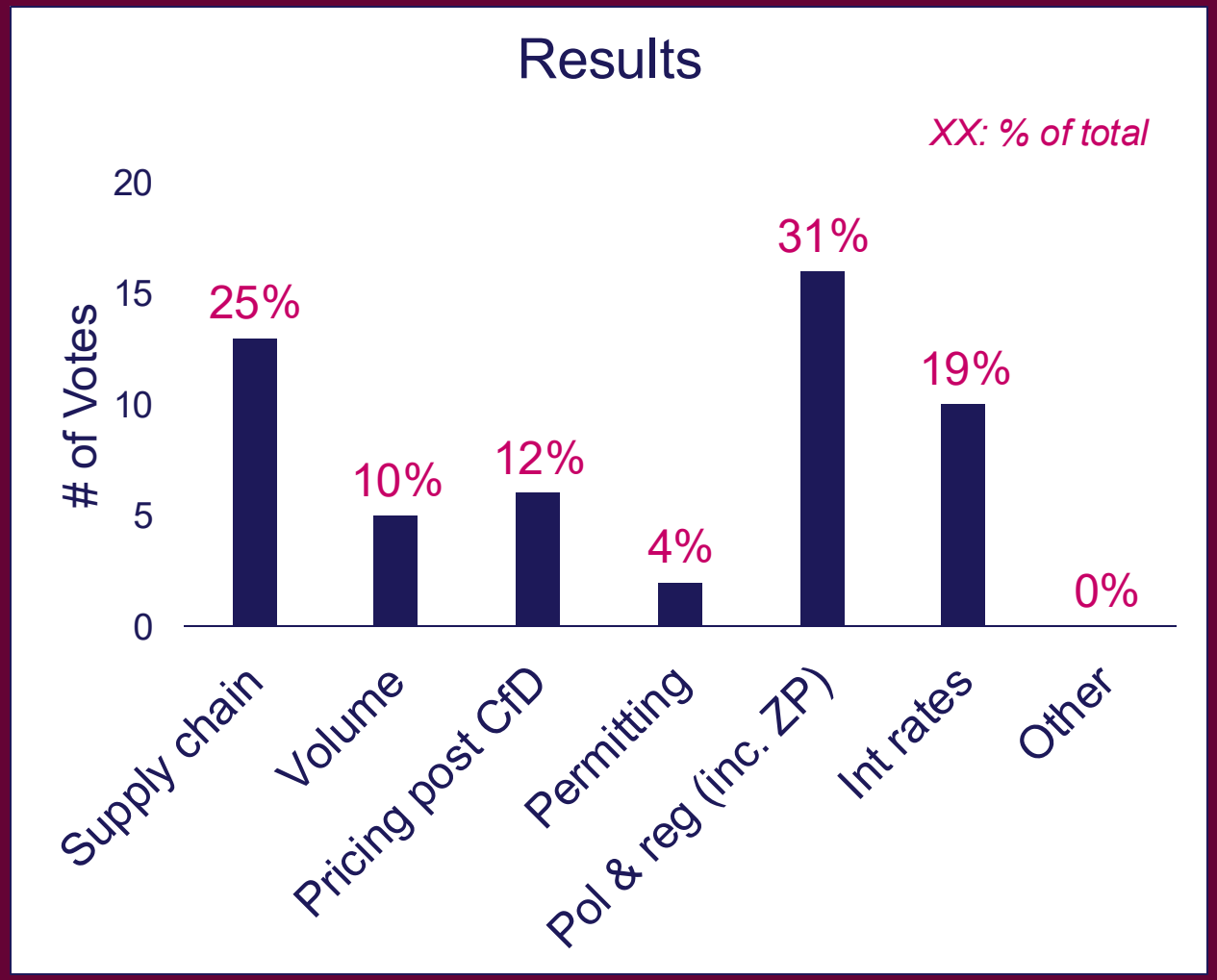
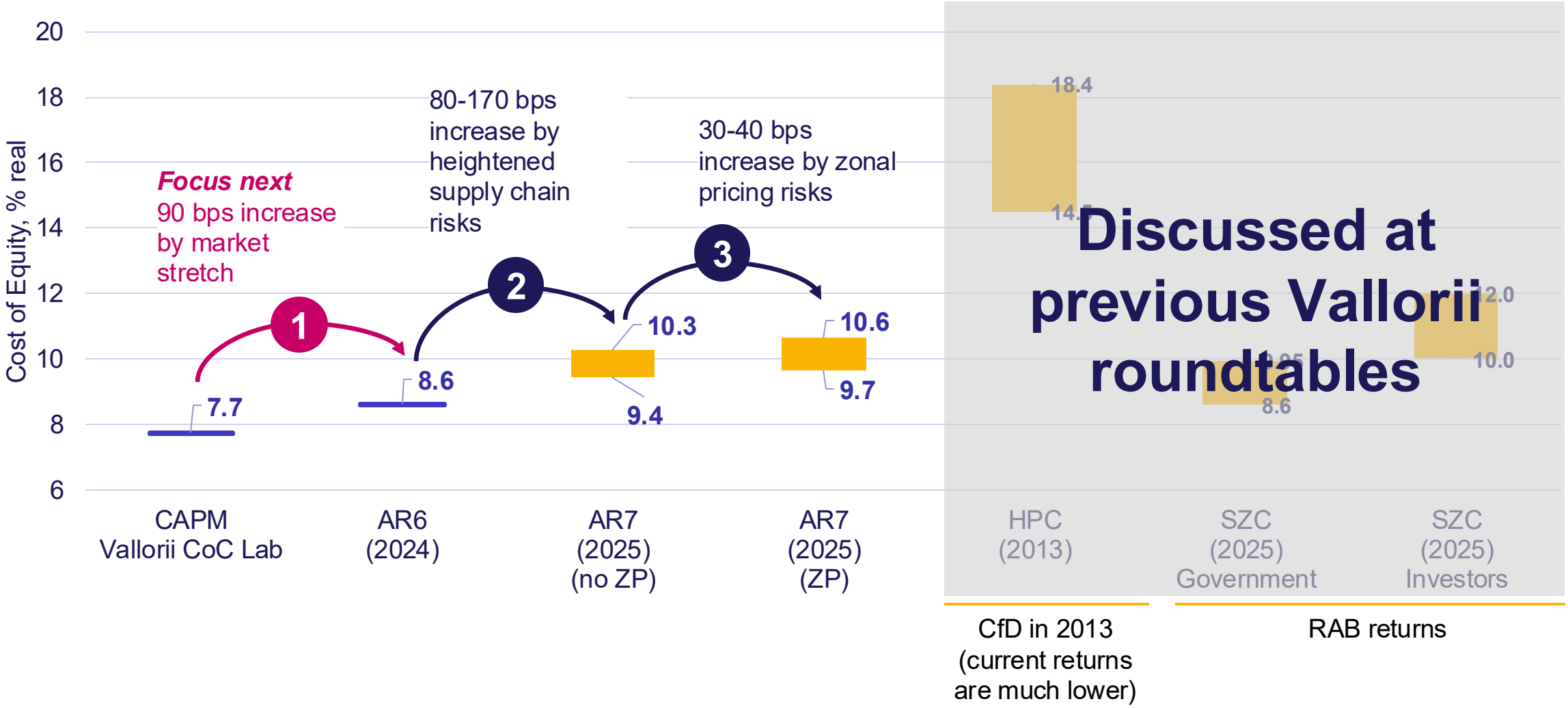
AR7 implied strike price of £74.0 - £89.1 per MWh (2012 prices)

POLL: Which key drivers of risk and return have changed most since AR6?

1. Supply chain & construction
2. Volume
3. Pricing post CfD
4. Permitting
5. Political & regulatory (e.g. zonal pricing)
6. Interest rates
7. Other?



Vallorii Price of Risk Model (VAPRI) estimates 9.7 - 10.6% Cost of Equity based on current capital market stretch and offshore project risks



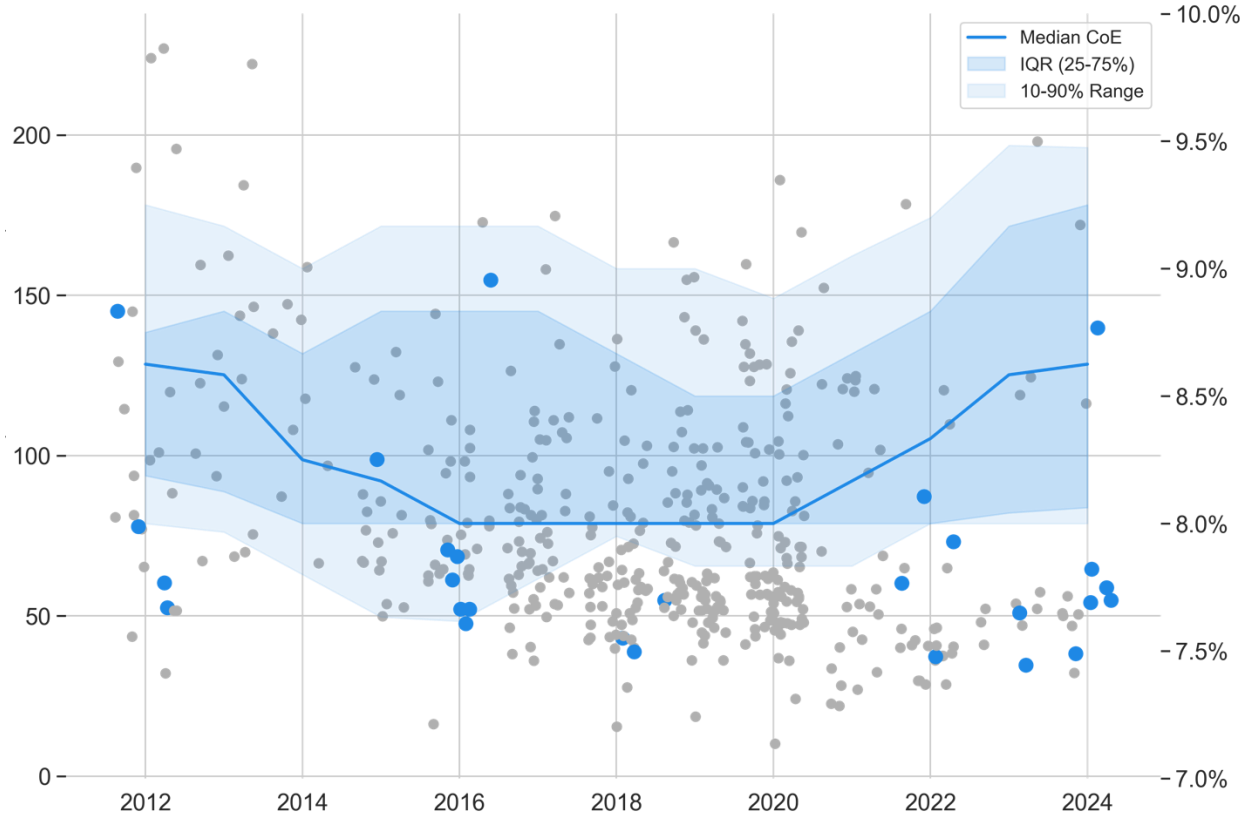
Source: AURES II Database and European Government Strike Price Reports, DESNZ, Vallorii CoC lab, Vallorii Valuation lab
CAPM assumptions: Peer group of renewables funds - UKW, BSIF, FGEN, FSFL, NESF, ORIT, TRIG; 7% total market return, 1.18 relevered beta estimated using Harris-Pringle approach using 0.7 project gearing, 25% tax rate, debt-beta of 0.075, raw beta estimated using 3, 5, 10y estimation window, RfR defined as 20y real gilt yield

1) CfD strike prices across UK and Europe fell until 2020 but have since plateaued due to ~90bps increase in CoE and heightened CapEx

Historical CfD strike prices across technologies

CfD strike prices, £/MWh (2012 prices)

Offshore wind



Implied CoE, %

Strike prices for offshore wind declined until 2020

However, since 2022, prices have plateaued and even risen in some cases, due to:

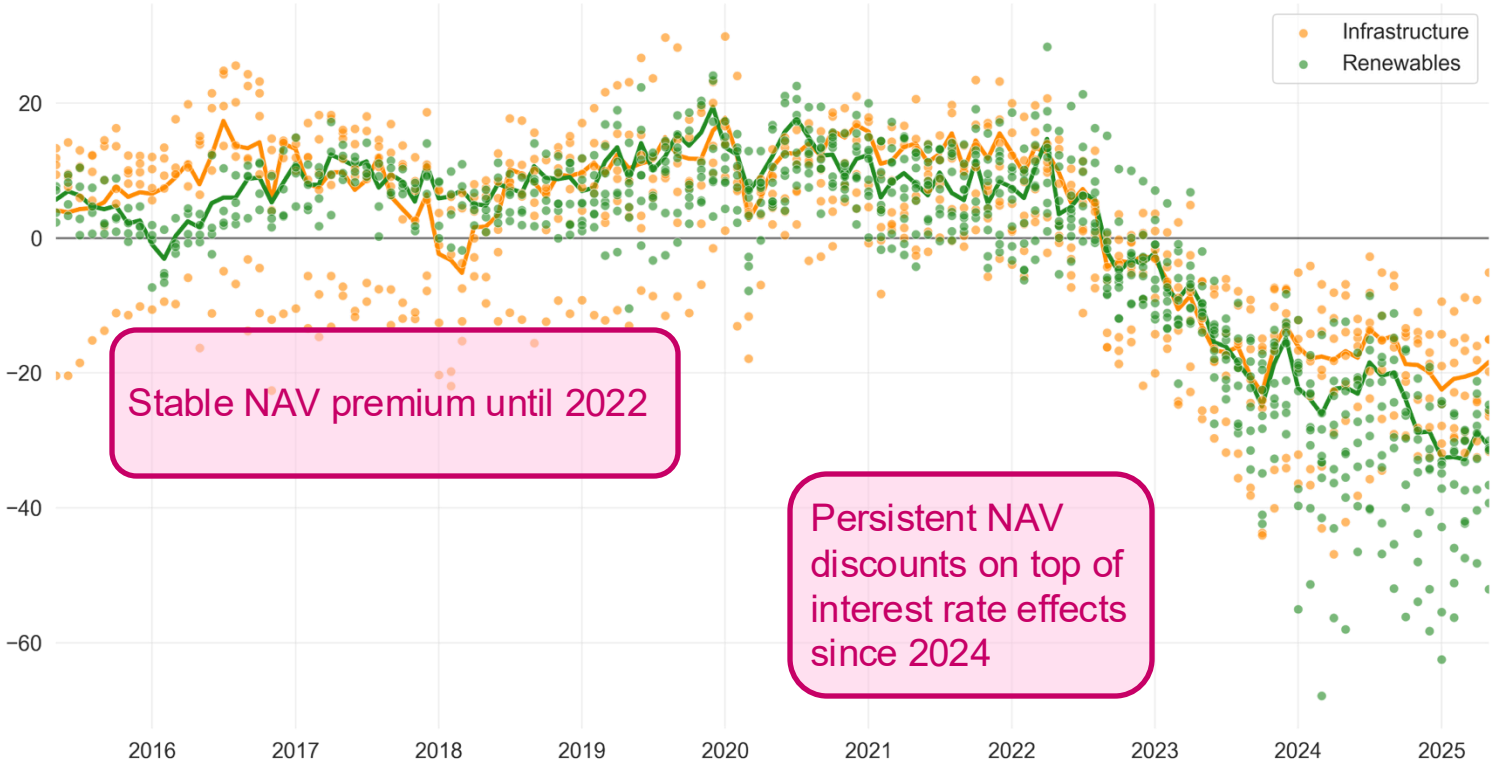
- **Increase in CoE** due to interest rates and market pressure
- **Stagnating cost declines** in equipment and installation costs

Source: Vallorii harmonization of AURES II Database and European Government Strike Price Reports, negative and 0£/MWh strike prices (arising from significant subsidies) have been removed, Baumgärtner & Farmer (2025)

1) Increased market pressure, especially interest rates, drive equity fund discounts and 20 - 40% increase in required risk premia

High interest rates and growing global investment need has squeezed the infrastructure funds market and increases required returns

NAV premium/ discount



We use NAV premium/discount for infrastructure and renewables funds to estimate current market squeeze.

Intuition:

- Increased risk-free rate since 2022
- Increased global investment need since 2024
- Increased competition for capital requires additional incentive for risk taking

Source: Vallorii, data source Factset, NAV premium of main infrastructure funds

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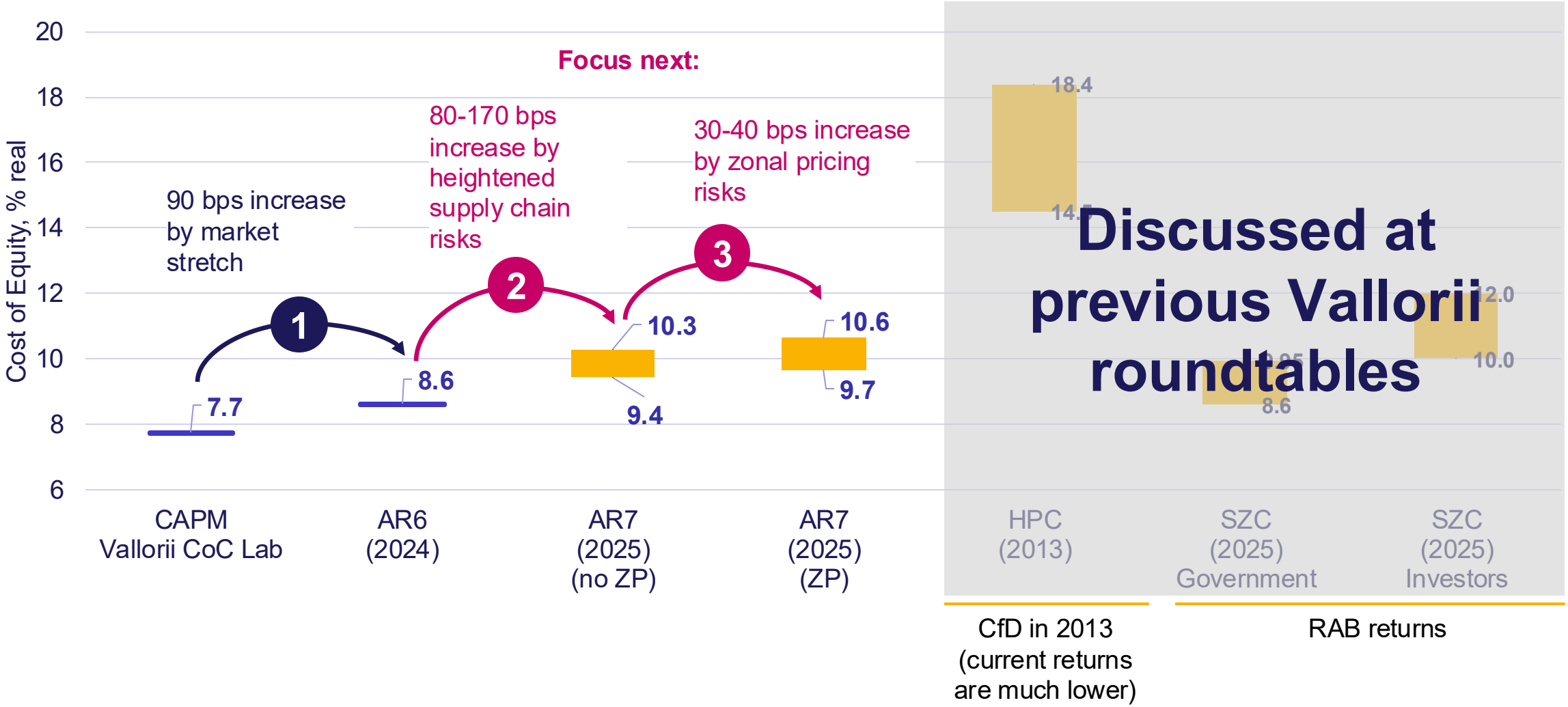

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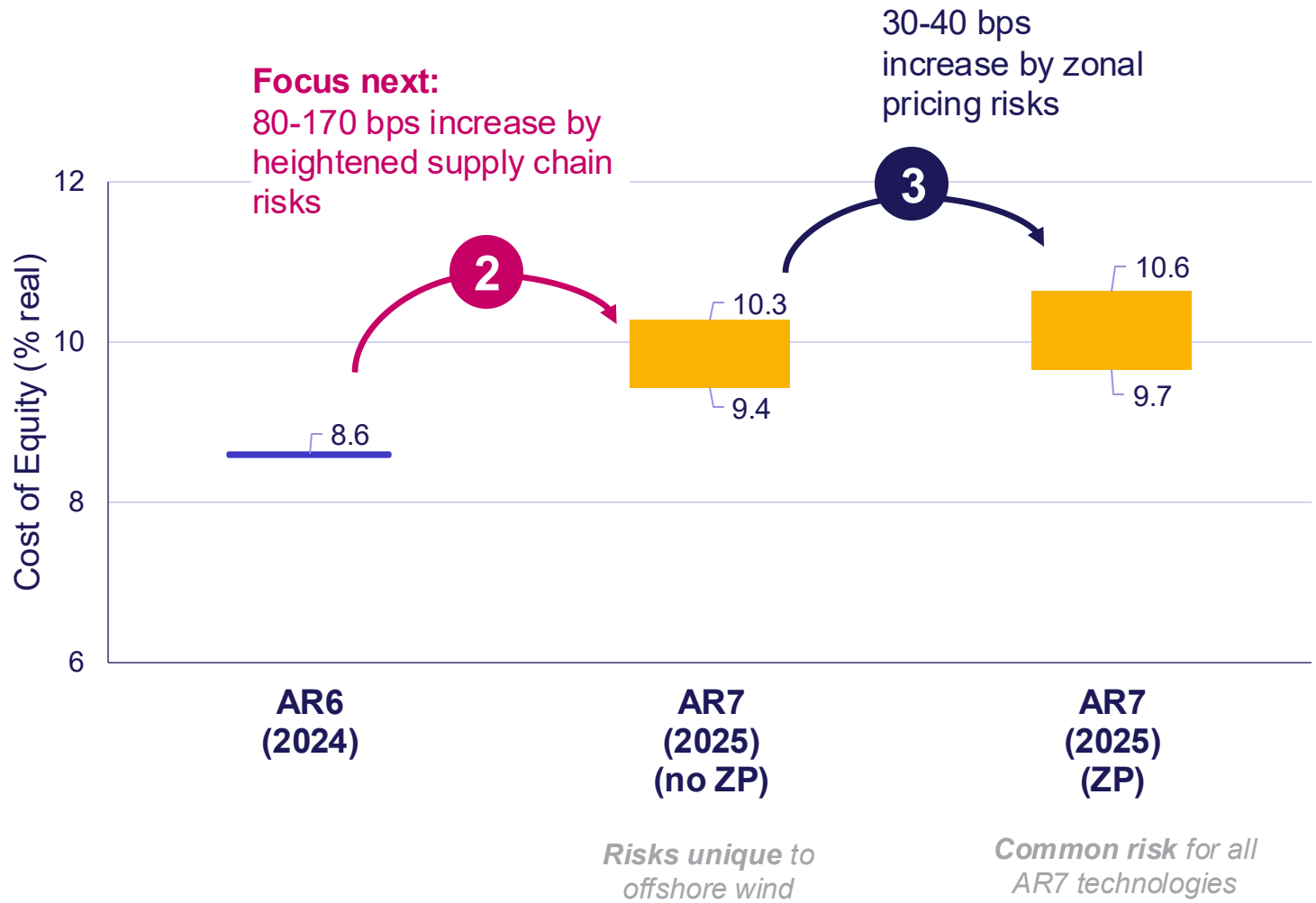
Vallorii estimates 110-210 bps CoE increase for AR7 offshore wind assets due to heightened construction risks and zonal pricing debate

2 significant risks since AR6 raise CoE by 110 – 210 bps

2 Significant **construction cost overruns** observed in offshore wind projects

3 **Live zonal pricing discussion** increases uncertainty of cash flows

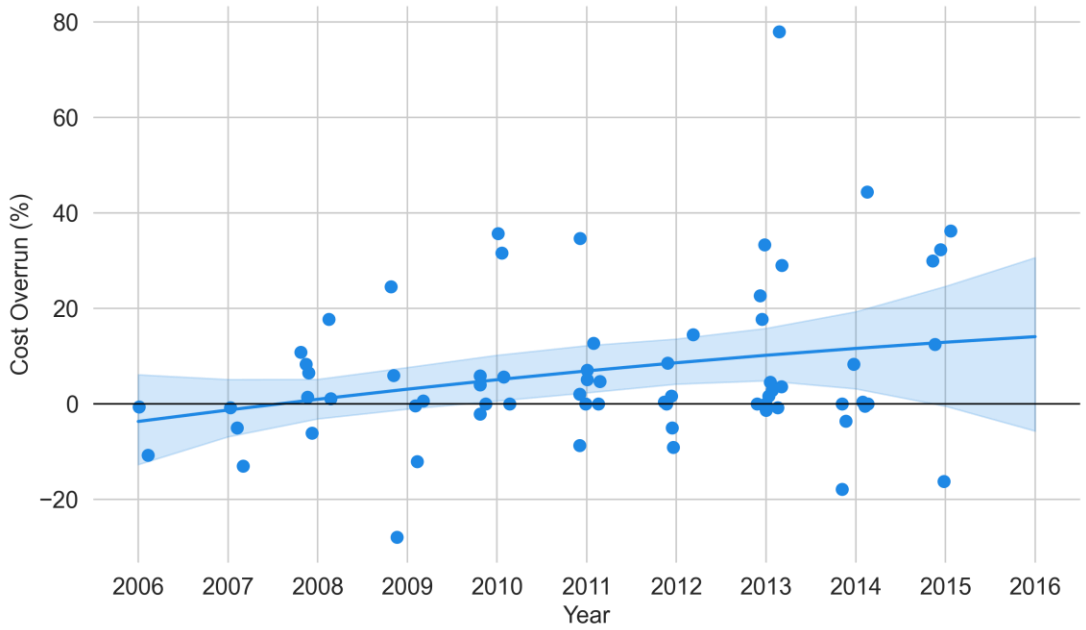
- **UK political risk index** has not moved substantially since AR6
- **Merchant risks** have not substantially changed since AR6
- ... *Other risks to be considered in the future*



Assumptions: 70% gearing, 5% real cost of debt, CAPEX = 3.1m GBP/MW in 2025 price, OPEX = 99.2k GBP/MW in 2025 price, offshore wind capacity factor = 0.55, 25% tax rate, CAPM CoE of 7.73%, 30 year asset lifetime

2) Offshore construction cost risks rose 25% between 2010 and 2015, largely due to increased supply chain pressures

Offshore wind construction cost overruns have increased historically

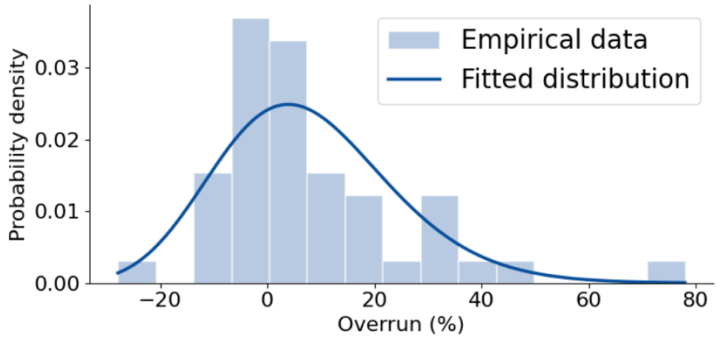


Increased turbine sizes made offshore installations more complex, driving increase in cost overrun risks

As turbines and hubs continue increasing in size and complexity, trend of even higher cost overruns is expected to continue

Cost overrun shocks can be modelled as a stochastic DCF

a. *We model overrun distribution using global database of offshore wind costs*



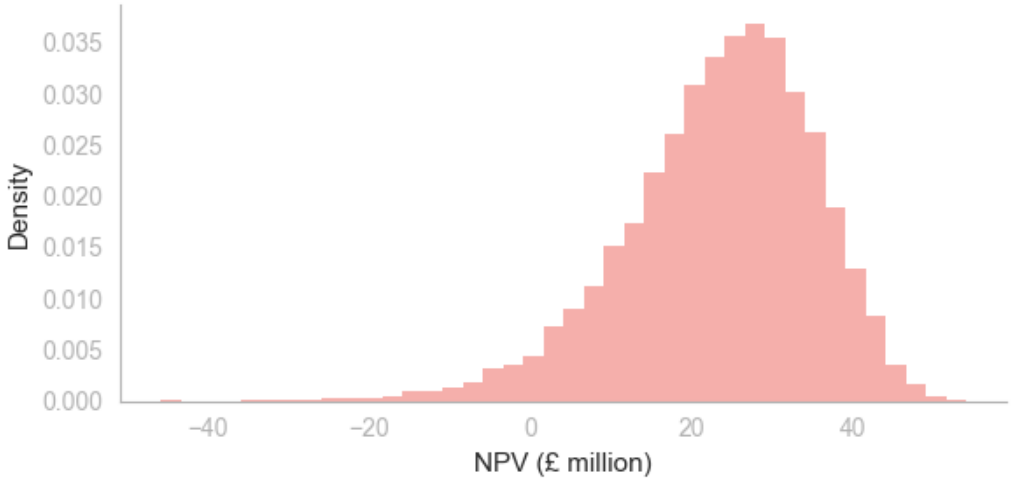
b. *DCF model simulates cost overrun shocks 10,000 times*

Source: Sovacool (2025) Beyond Economies of Scale, AURES II Strike Prices, and Vallorii Analysis;
Assumptions: 70% gearing, 5% real cost of debt, CAPEX = 3.1m GBP/MW in 2025 price, OPEX = 99.2k GBP/MW in 2025 price, offshore wind capacity factor = 0.55, 25% tax rate, CAPM CoE of 7.73%, 30 year asset lifetime, 3 year construction period

2) Supply chain risks raise the required CoE by 80 – 170 bps due to the uncertainty in construction costs and timelines

Stochastic DCF

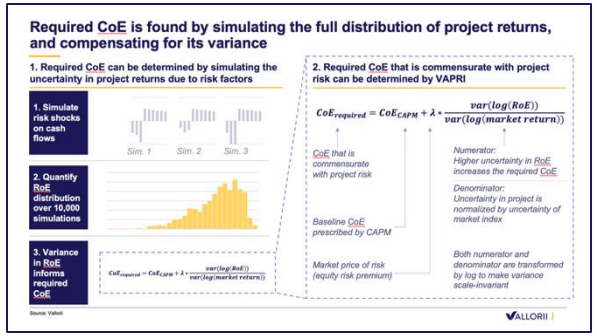
Stochastic DCF is translated into a stochastic NPV distribution



From 10,000 simulations of project cash flows**, project return** (median NPV, RoE, …) **and risk characteristics** (variance, 95% VaR, …) can be quantified exactly

Fat-tailed cost overruns propagate into a fat-tailed NPV distribution, with rare severe overruns driving extreme downside risk

Return distribution is translated into CoE using VAPRI



VAPRI currently leverages an intertemporal asset pricing model that extends CAPM to translate return risk into mean return requirements

Source: Sovacool (2025) Beyond Economies of Scale, AURES II Strike Prices, and Vallorii Analysis
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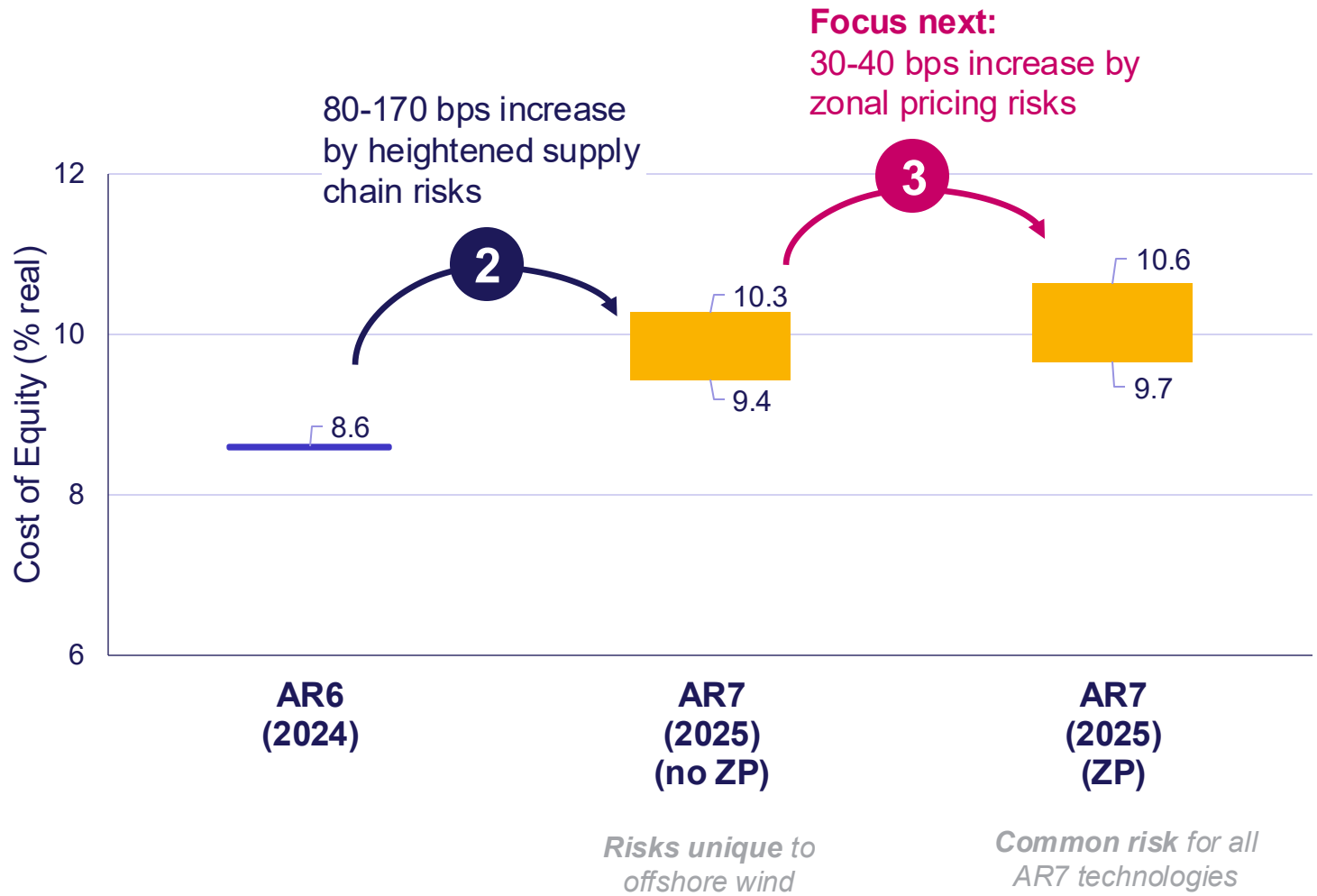
Merchant risks have not substantially changed since AR6

Other risks to be considered in the future



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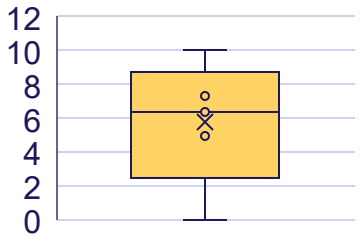
3) Zonal pricing introduces additional risks: uncertain TNUoS savings, curtailment, and merchant prices

A TNUoS saving

ZP may eliminate[1] generator-side transmission charges, but **sub-zonal TNUoS is likely**

TNUoS savings (GBP / MWh, 2025 prices)

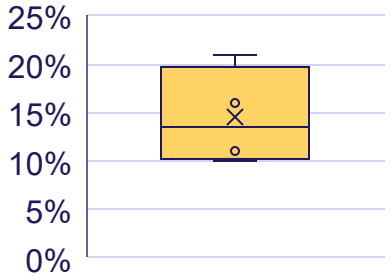


B Volume-risk

When volume is curtailed, asset gets no CfD top-up

Volume risk can drive up **to 21% curtailment**

Wind curtailment as a % of wind generation in Scotland

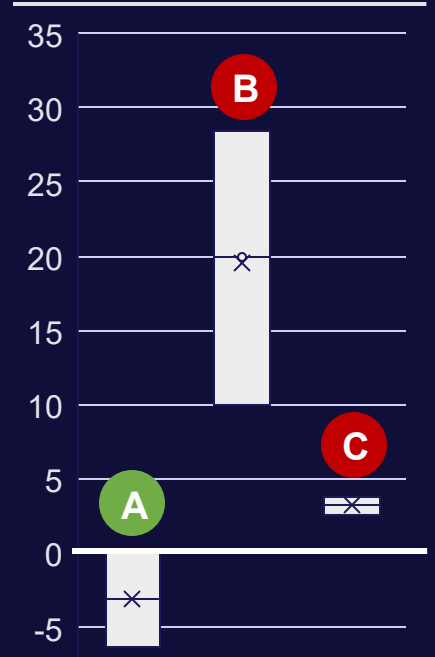


C Price-risk ("merchant tail")

After 15-year CfD, power is sold at a lower Scottish zonal price

Small impact and time-value discounting

Literature estimates of strike price bid impact from ZP (GBP, 2022 prices)

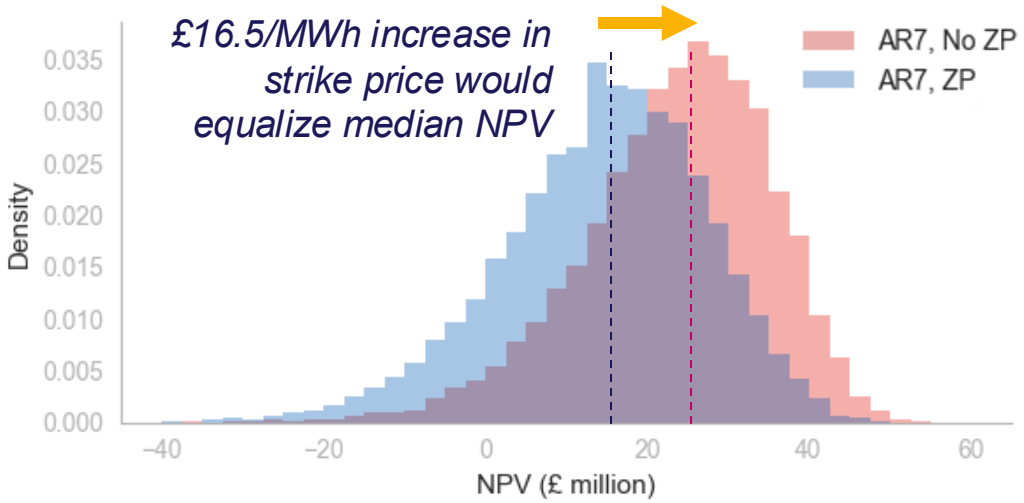


Sources: Effects of Zonal Pricing on strike prices: Frontier (Feb 2025) on TNUos, price and volume risk; Frontier (Oct 2024) on price risk; UK Energy Research Center (Apr 2025) on volume risk; Wind curtailment in Scotland: https://en.wikipedia.org/wiki/Wind_power_in_Scotland, https://www.drax.com/wp-content/uploads/2022/06/Drax-LCP-Renewable-curtailment-report-1.pdf, https://reports.electricinsights.co.uk/q4-2024/wind-becomes-britains-largest-source-of-electricity-in-2024; TNUoS savings: https://committees.parliament.uk/writtenevidence/36322/pdf, https://www.renewableuk.com/media/z5rnyj45/210524_tnuos_paper_final_for.pdf; 1. We assume TNUoS savings have a lower bound of 0, because it is possible that an intra-zonal TNUoS remains

3) Zonal pricing risks raise the required CoE by 30 – 40 bps due to the uncertainty in CfD volumes and TNUoS charges

Stochastic DCF

Stochastic DCF is translated into a stochastic NPV distribution



From 10,000 simulations of project cash flows**, project return** (median NPV, RoE, …) **and risk characteristics** (variance of NPV, 95% VaR, …) can be quantified exactly

Zonal pricing does not substantially change the variance of NPV, because its distribution is not fat-tailed

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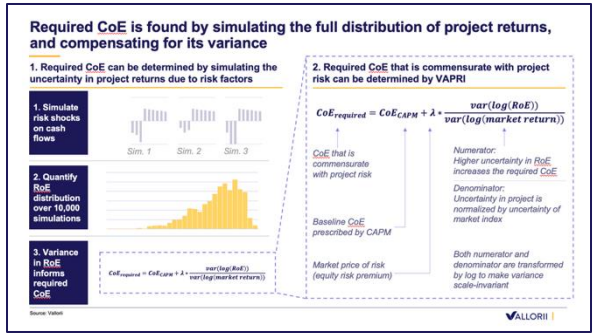

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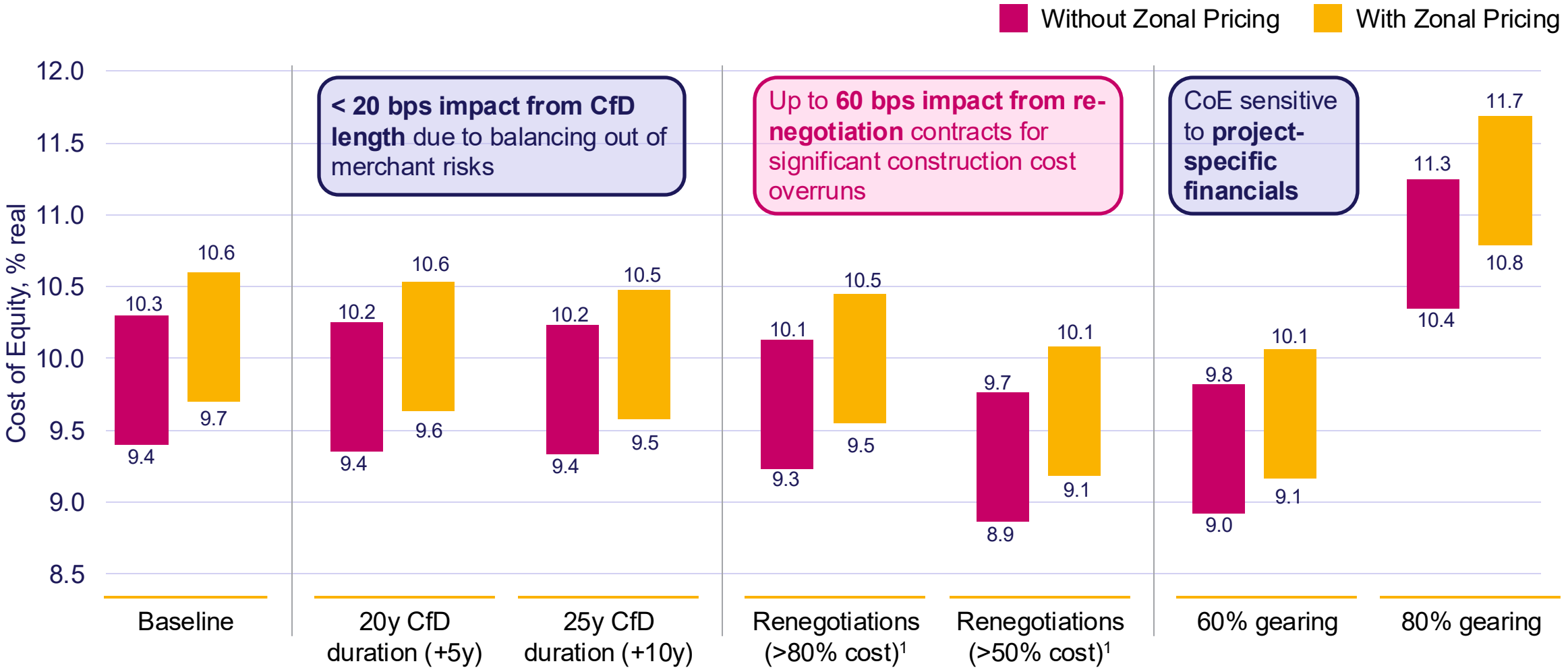
Sensitivity analysis shows government support on cost overrun renegotiation could have lower required CoE by up to 60 bps



Source: Vallorii Valuation lab

1. Cost overrun renegotiation defined as: If cost overruns exceeds [threshold], then strike price increases 20%

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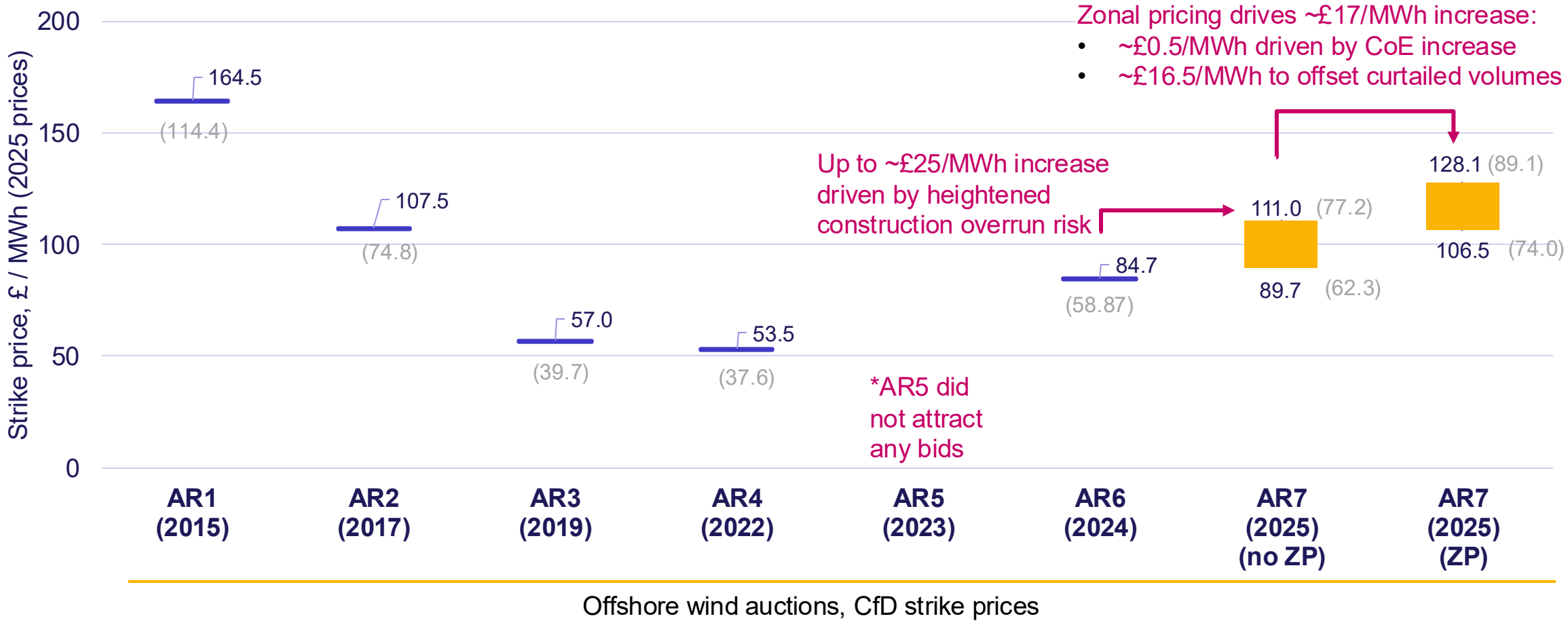
Implied strike prices for AR7 auctions are implied to be substantially above recent auctions and current wholesale market prices

(XX) 2012 prices



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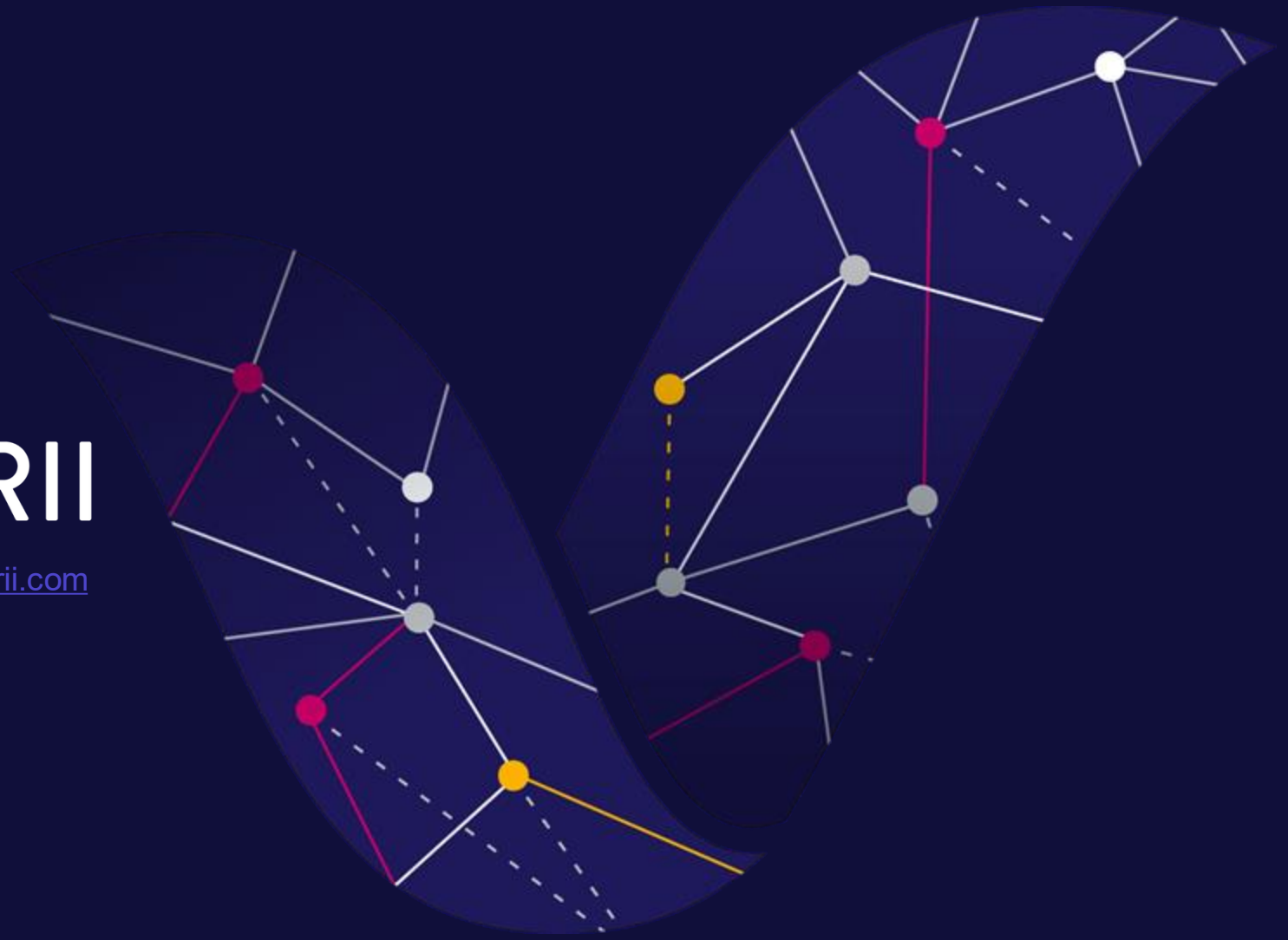


Vallorii Membership – Outlook for 2025
Aligning risk and return; allocating risks to balance affordability/investability

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Key events		ED3 Framework	Cunliffe report Spending review	RIIO DD REMA AR7	LHR runway	UKRN CAPM update	LDES guidance RIIO ED3 SSMC	Autumn Budget 5G auct. timeline	TAR	RIIO FD CMA PR24 decision		
Events	**Apr** *Regulatory sub-group – CAPM and alternatives*	**May** *Energy transition – optionality & transition risks*	**Jun** *CEO/CIO dinner*	**Jul** *Large projects – choice of model, construction risks*		**Sep** *Market sentiment and Cost of Equity*	**Oct** *Regulatory sub-group*	**Nov** *Valuing new opportunities*		**Jan** *TBC*		**Mar** *TBC*
Brief-ings			**Jun** *CfD auctions – how CoC impacts upcoming bids*		**Aug** *Use of PFIs for large infra projects*		**Oct** *Why does valuation matter for infra reg?*		**Dec** *Int. comparison of CoC models*		**Feb** *TBC*	
Res-earch	*Scenarios vs Forecasts*	*How to choose a CoC model?*	*CfD auctions*	*RAB vs CfD*		*Valuation vs CoE*	*Risk matrix for new infra asset classes*					
Plat-form	**CoC Tool release**	*Model Comparator*	*RfR Forecasts integration*	*Additional CAPM features* *Data Validator*	*Attribution Logic*	*Spread comparator*	*Audit trail*	*Integration initial risk factors*		*Comparator with infrastructure funds*		

Source: Vallorii

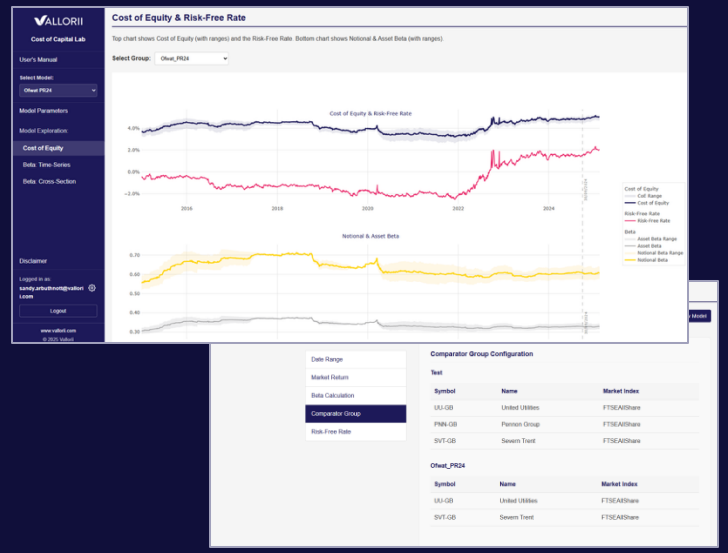
Membership

- **Exclusive member's portal,** insights, and roundtable conferences
- **First Founder Members** joined
- **5 roundtables** since October 2024
- **Initial regulator sub-group** meeting

Insights

- **CAPM thematic paper** circulated widely
- **Working papers** circulated for comments
- Detailed discussion of CoC modelling approach and assumptions, and integration with your scenarios

Analysis and Tools



- **Automated and interactive tool** on cost of equity modelling and forecasting
- **Custom reports** available on demand

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Required CoE is found by simulating the full distribution of project returns, and compensating for its variance

1. Required CoE can be determined by simulating the uncertainty in project returns due to risk factors

1. Simulate risk shocks on cash flows

2. Quantify RoE distribution over 10,000 simulations

3. Variance in RoE informs required CoE

$$CoE_{required} = CoE_{CAPM} + \lambda * \frac{var(log(RoE))}{var(log(market\ return))}$$

2. Required CoE that is commensurate with project risk can be determined by VAPRI

$$CoE_{required} = CoE_{CAPM} + \lambda * \frac{var(log(RoE))}{var(log(market\ return))}$$

CoE that is commensurate with project risk

Baseline CoE prescribed by CAPM

Market price of risk (equity risk premium)

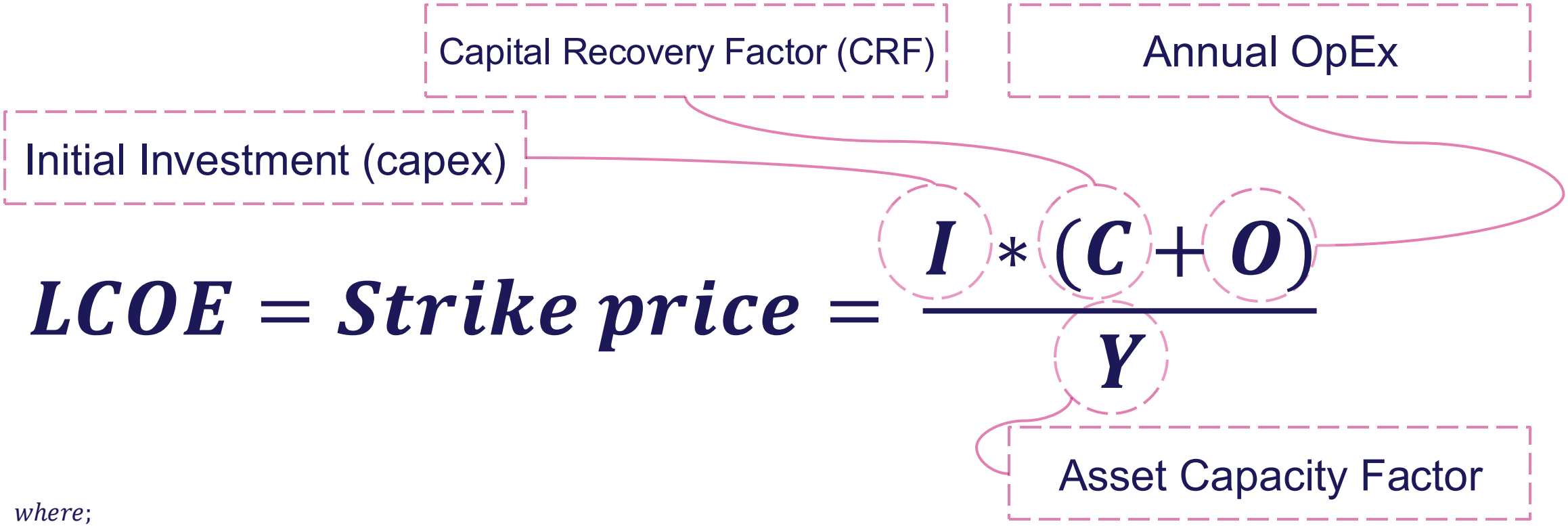
Numerator: Higher uncertainty in RoE increases the required CoE

Denominator: Uncertainty in project is normalized by uncertainty of market index

Both numerator and denominator are transformed by log to make variance scale-invariant

Source: Vallorii

LCOE is a function of initial investment, the cost of capital, operational costs and an assets effectivity



where;

$$Capital\ Recovery\ Factor = \frac{1}{\sum_{t=1}^{T} \frac{1}{(1+D)^t}}$$

$$D = debt\ ratio * K_d + equity\ ratio * K_e$$

User's Manual
MODEL DEFINITION:
Select Model:
RenewablesFunds 7% T
Model Parameters
MODEL EXPLORATION:
Cost of Equity
Beta: Time-Series
Beta: Cross-Section
DATA DOWNLOAD:
Downloads
MODEL COMPARATOR:
Comparator
Disclaimer

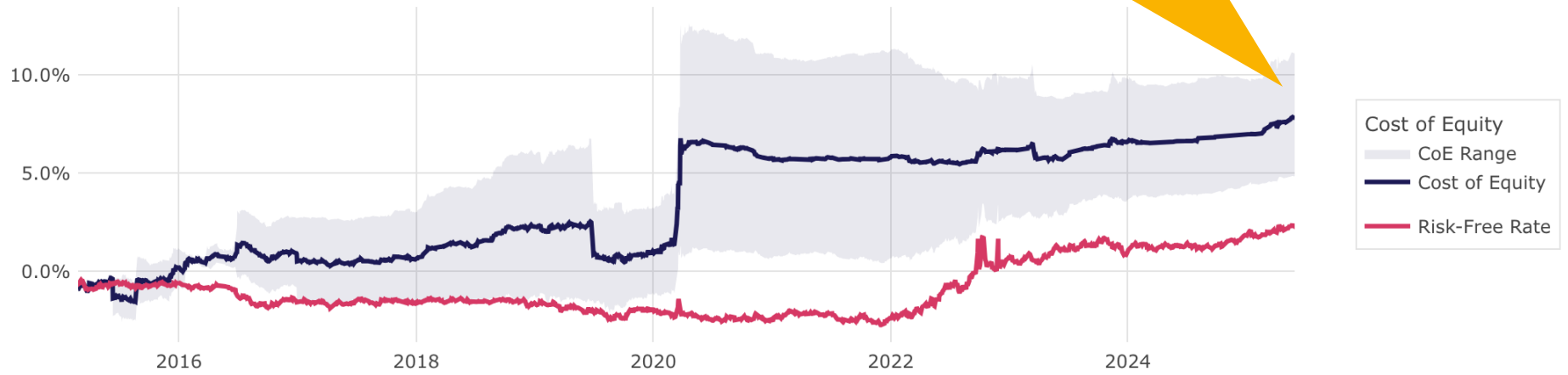
Logged in as:
henry.tian@vallorii.com

Cost of Equity & Risk-Free Rate

Visualize cost of equity trends over time with confidence intervals and risk-free rate comparisons on the top chart. The bottom chart shows notional beta and asset beta trends over time.

Select Group: Renewables funds

CAPM-based CoE (Offshore Wind comparators, real): **7.73%**



CAPM assumptions: Peer group of renewables funds - UKW, BSIF, FGEN, FSFL, NESF, ORIT, TRIG; 7% total market return, relevered beta estimated using Harris-Pringle approach using 0.7 project gearing, 25% tax rate, debt-beta of 0.075, raw beta estimated using 3, 5, 10y estimation window, RfR defined as 20y real gilt yield

Sensitivity analysis shows government support on cost overrun renegotiation could have greatest effect on lowering required CoE

	Category		AR7 (no ZP): CoE delta (bps)	AR7 (ZP): CoE delta (bps)
CfD contract sensitivities	**CfD Duration**	20 years	↓ -5	↓ -7
		25 years	↓ -7	↓ -12
	Cost overrun renegotiation[1]	Cost overrun >80%	↓ -17	↓ -15
		Cost overrun >50%	↓ -54	↓ -52
Project sensitivities	**Gearing**	60% gearing (from 70%)	↓ -48	↓ -54
		80% gearing (from 70%)	↑ 95	↑ 109
	Asset life	-10% lifetime years	0	↓ -2
		+10% lifetime years	0	↑ 1

1. Cost overrun renegotiation defined as: If cost overruns exceeds [threshold], then strike price increases 20%