



Educational workshop on PPAs and renewable energy certificates

EFET Legal Committee Meeting, 21 September 2023, London



Workshop agenda



Choosing the right renewable PPA –
Jack Rankin, Regional Lead PPA
Transaction Advisory, Pexapark



**Granular certification: introduction
to 24/7 energy matching –** Killian
Daly, Executive Director, EnergyTag



**Role of the PPA in the new
Electricity Market Design proposal –**
Jerome le Page, Chair of the Electricity
Committee, EFET

Choosing the right renewable PPA

Jack Rankin, Regional Lead PPA Transaction
Advisory, Pexapark



European Federation
of Energy Traders

RENEWABLE POWER PURCHASE AGREEMENTS: CHOOSING THE RIGHT PPA

Presentation to EFET Legal Committee

London

21 September 2023

www.pexapark.com





Agenda

- Different transactors and their motivations
- Different types of PPAs and contractual structures
- Trends in PPA structures in key markets
- PPA volume and price structure alternatives
- Balancing management and PPAs
- New developments: PPAs for (green hydrogen) electrolyser projects, additional services for optimal energy management

Our team



Jack Rankin

Regional Lead PPA Transaction – GB & Ireland

- 9 years experience in the energy industry, predominantly focused on project finance off-take agreements in the GB market
- Worked in the energy markets team at a boutique investment bank, advising clients on their off-take arrangements alongside the raising senior financing for client's portfolios
- Hands-on PPA knowledge for GB, Belgium, Sweden, Romania, Ireland, the Netherlands and Germany
- Master of Mathematics and Physics and Bachelor of Science from the University of Warwick

+44 77 6588 3532

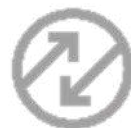
jack.rankin@pexapark.com

Pexapark at a glance



Company founded

August 2017



PPAs supported

27+ GW



Risks monitored

12+ GW



of employees

100+



Offices

Zürich, London,
Madrid, Lviv,
Copenhagen



VISION

Be the Operating
System for Renewable
Energy Players



MISSION

Apply software-powered
solutions to post-subsidy
market challenges

PARTNERS

BloombergNEF

FLUENCE

REFINITIV



S&P Global
Platts

RE-Source

eex

Creating the infrastructure for renewable sales

Contact us for
a demo!

DISCOVER OUR RENEWABLE ENERGY SALES SOFTWARE SUITE

LOWER TRANSACTION COST

Daily PPA fair value
pricing and market quotes



PexaQuote

DETERMINE OPTIMAL STRUCTURE

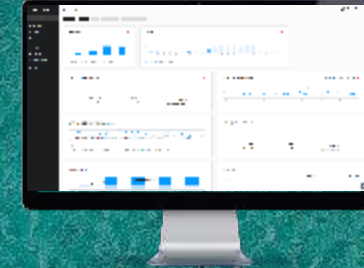
PPA valuation and
risk simulations



PexaQuant

MANAGE ENERGY SALES

Transparent portfolio
management and control



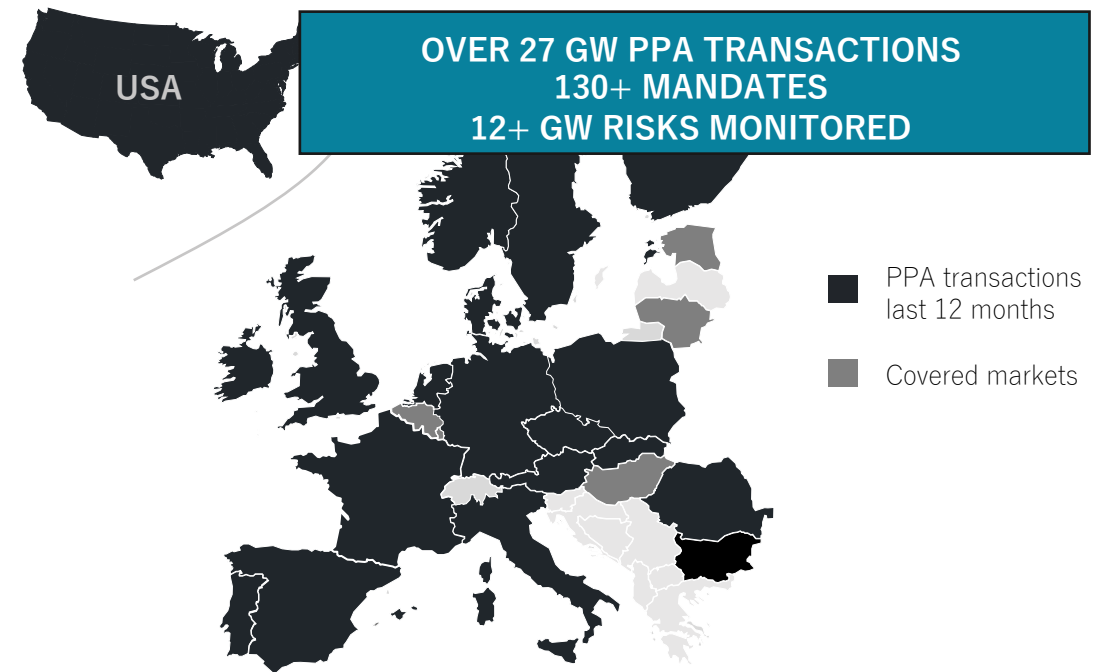
PexaOS

Pexapark enabling PPA transactions

The PPA company providing advisory services, delivering commercially optimised PPAs

- **PPA review.** Commercial review of terms and conditions, assess contract structure, risk allocation and settlement terms
- **Request-for-proposal management.** Design and management of RfQ process (incl. sourcing of off-takers)
- **Pexaquant.** Proprietary quantitative model to calculate fair value, compare PPA structures and optimise hedges
- **Negotiation support.** Ad-hoc tactical and strategic advice, sizing of optimal credit securities and contract terms
- **Full mandates.** Incl. all above activities: PPA transaction management from initial RfQ to strategy and execution

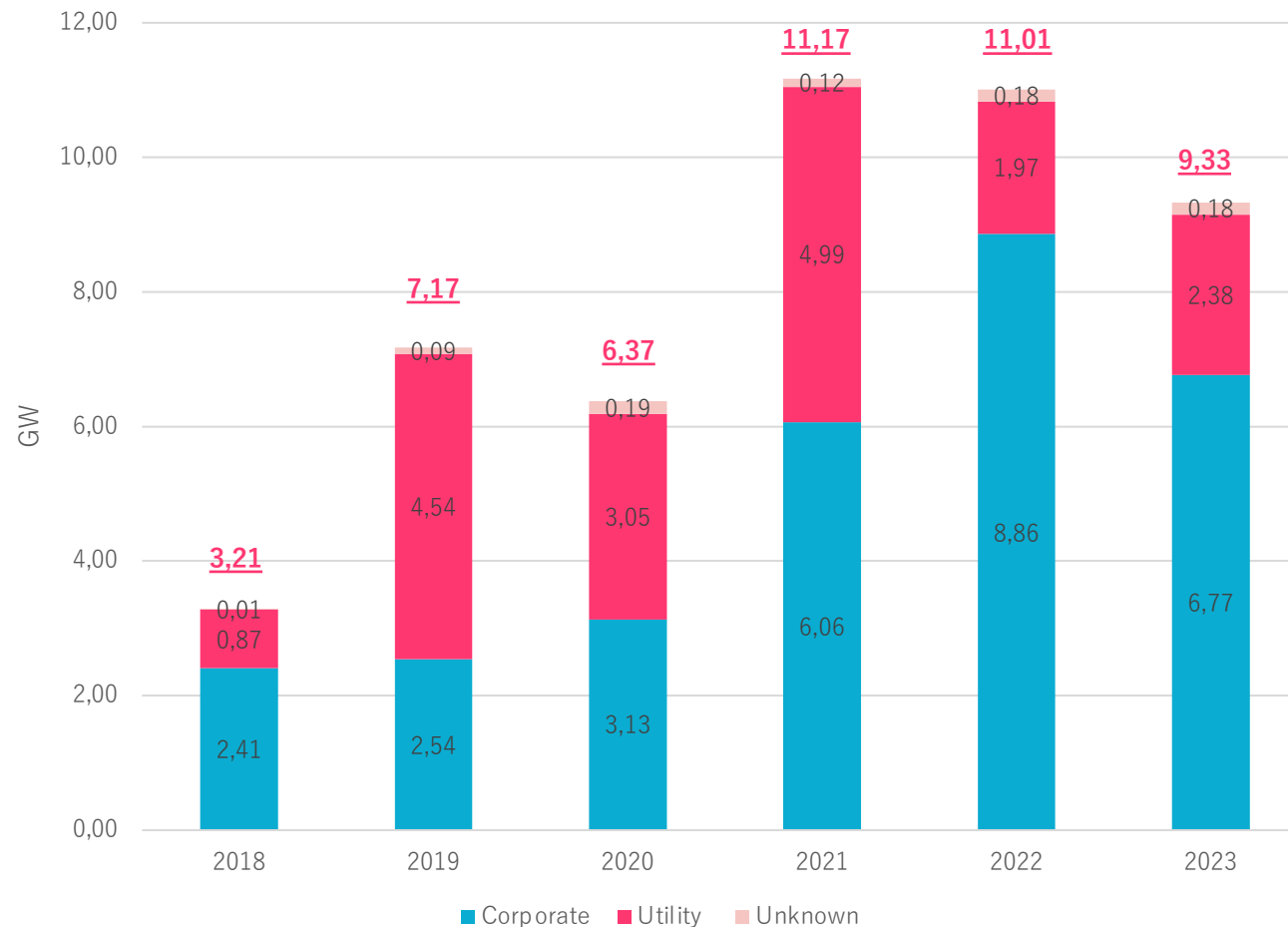
PEXAPARK



Different transactors and their motivations



PPA transaction volumes continue to grow



- The chart on the left shows publicly announced PPA volumes
- **PPA market hit a record in 2021** for deal counts (total 141; 90 in 2020) and volume, **followed by 2022**
- Significant increase in deal volumes with the percentage of **corporate PPAs rising** to 82% in 2022 (62% in 2021, 48% in 2020)*
- The 2023 trend is so far very strong, with 9,33 GW worth of deals signed in just 8 months

Different players

Rise of the PPA

- Rapid growth of renewable PPAs in the past two years
- Ongoing growth: almost **500 GW** of new renewables capacity expected in Europe **by 2030**
- **58%** of projects open to PPAs
- Large uptake in interest from developers / independent power producers (**IPPs**)
- IPPs rely mainly on **institutional investors** or **project finance** to fund projects
- **Utilities** tend to have fewer but **bigger projects** (e.g. offshore wind)

Corporates



Utilities



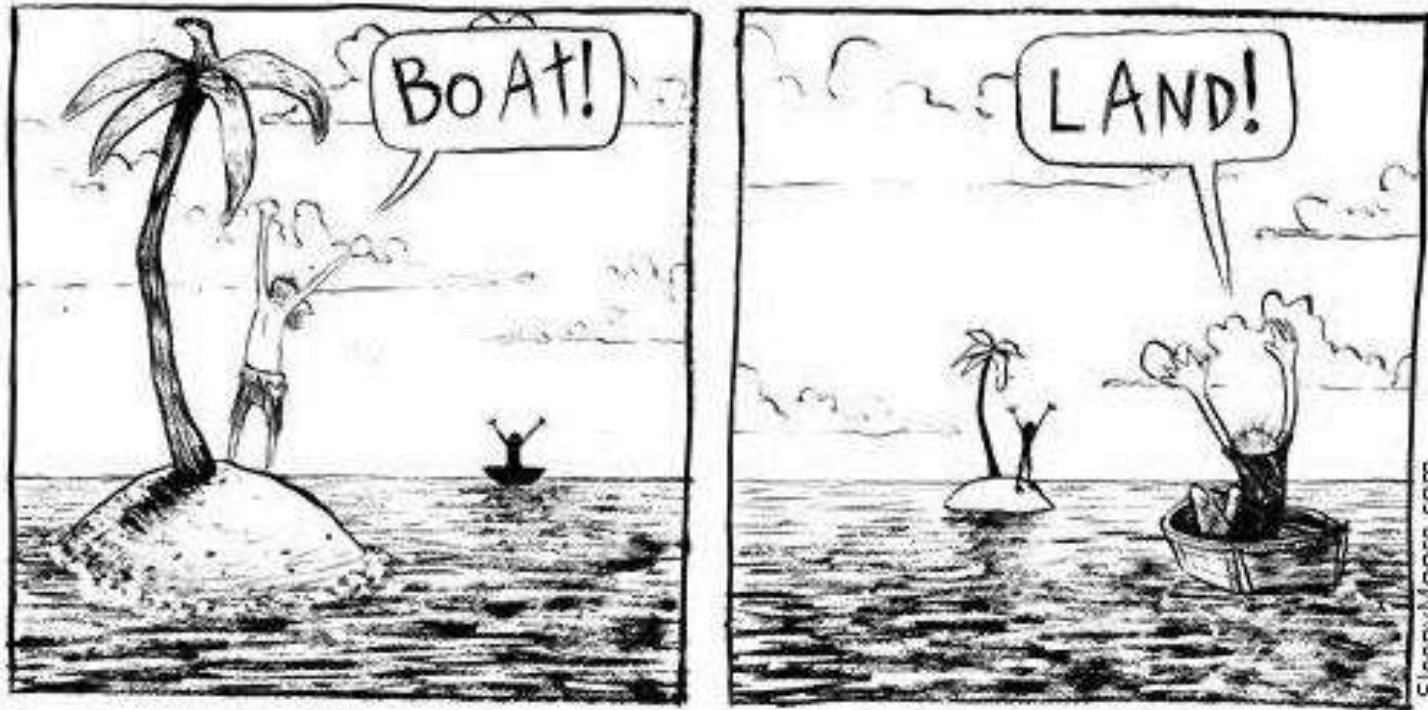
Developers/IPPs



Investors



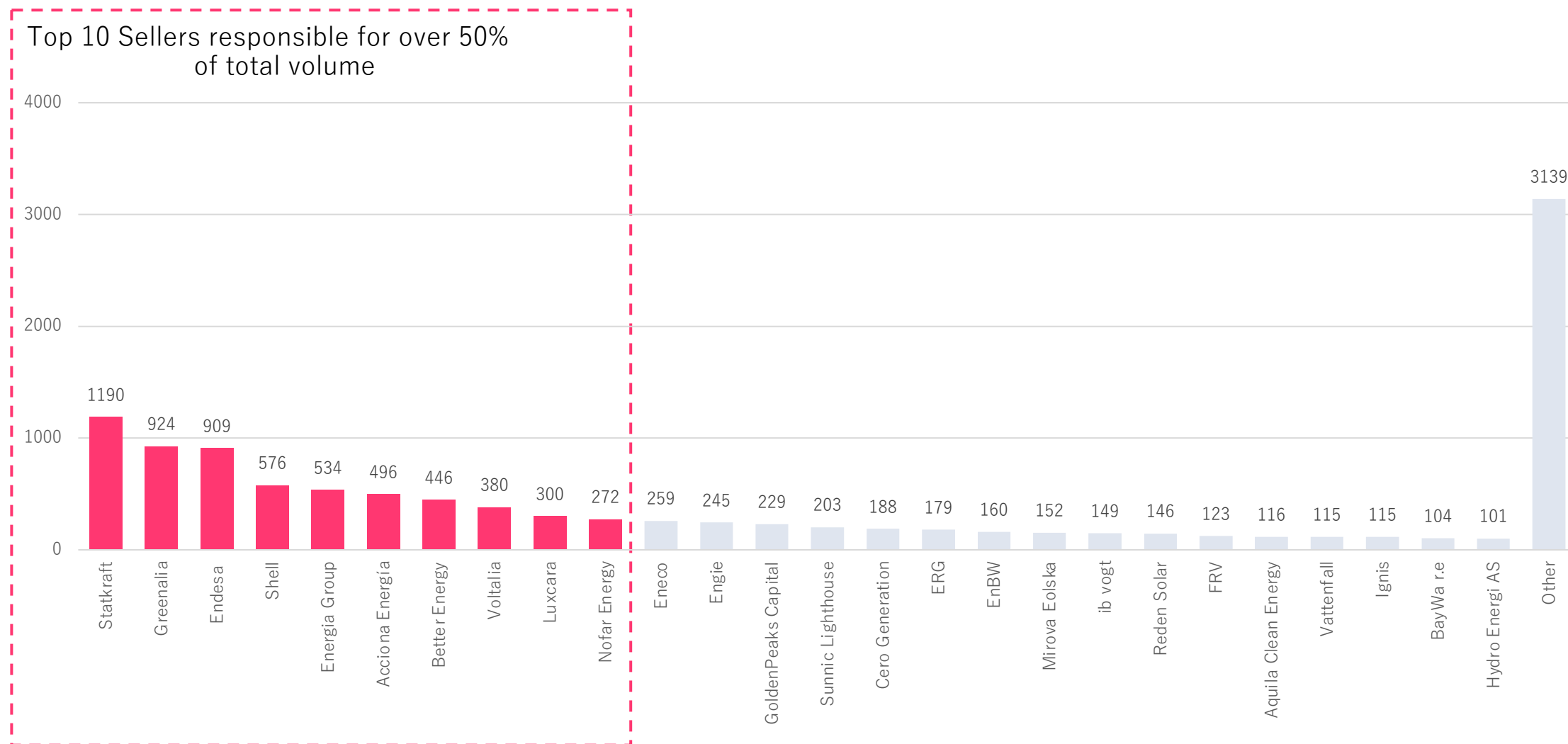
PPA view from an asset perspective



perspective...

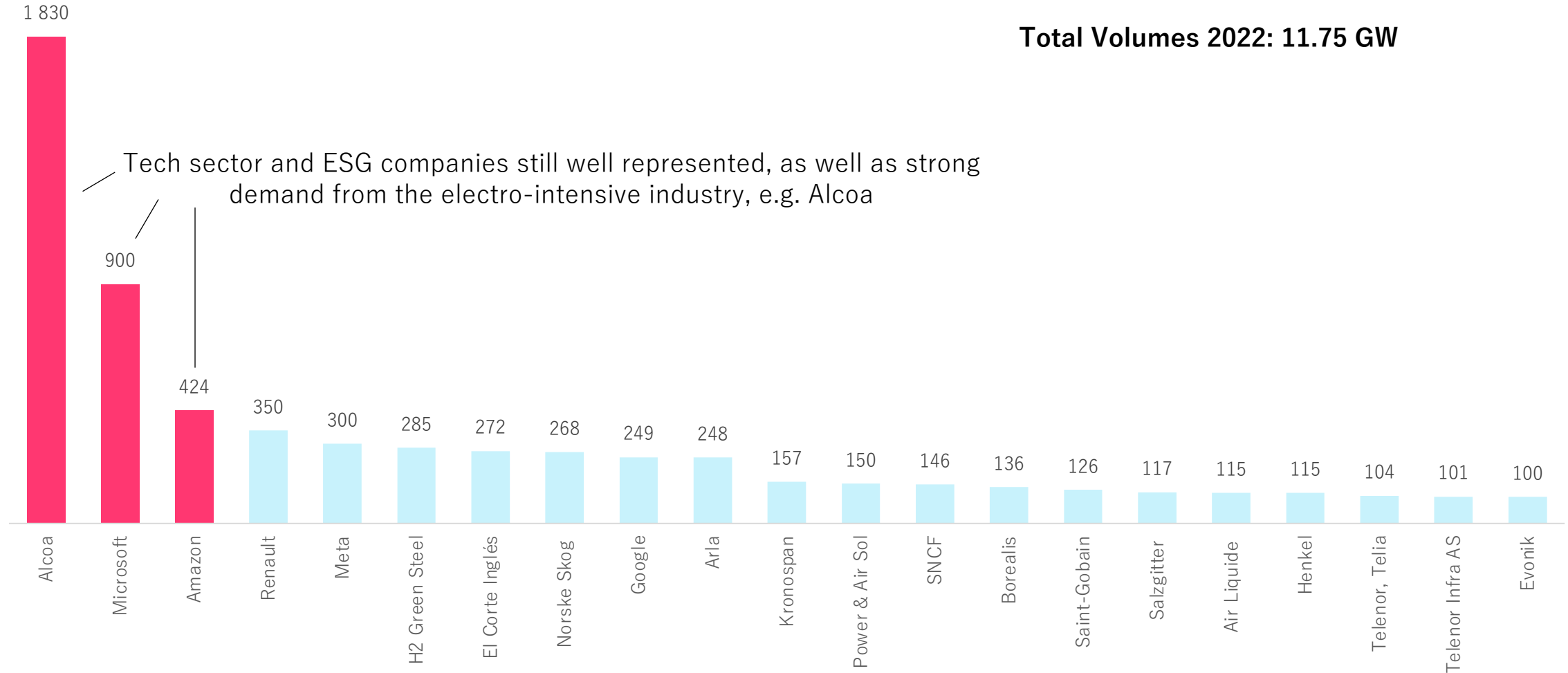
Let's have a look at the pain points and most important aspects for sellers when negotiating a PPA with an offtaker

Many new entrants on the sell side



A diverse corporate offtake market

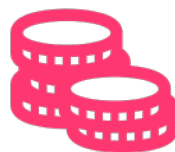
Total Volumes 2022: 11.75 GW



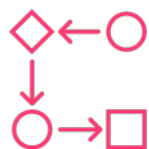
Utility & corporate PPAs: Key commercial differences



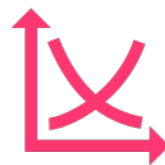
Indexation



Price fixing process



Tendering process



Mark to market exposure



Transaction speed



Guarantee requirements



Execution risk



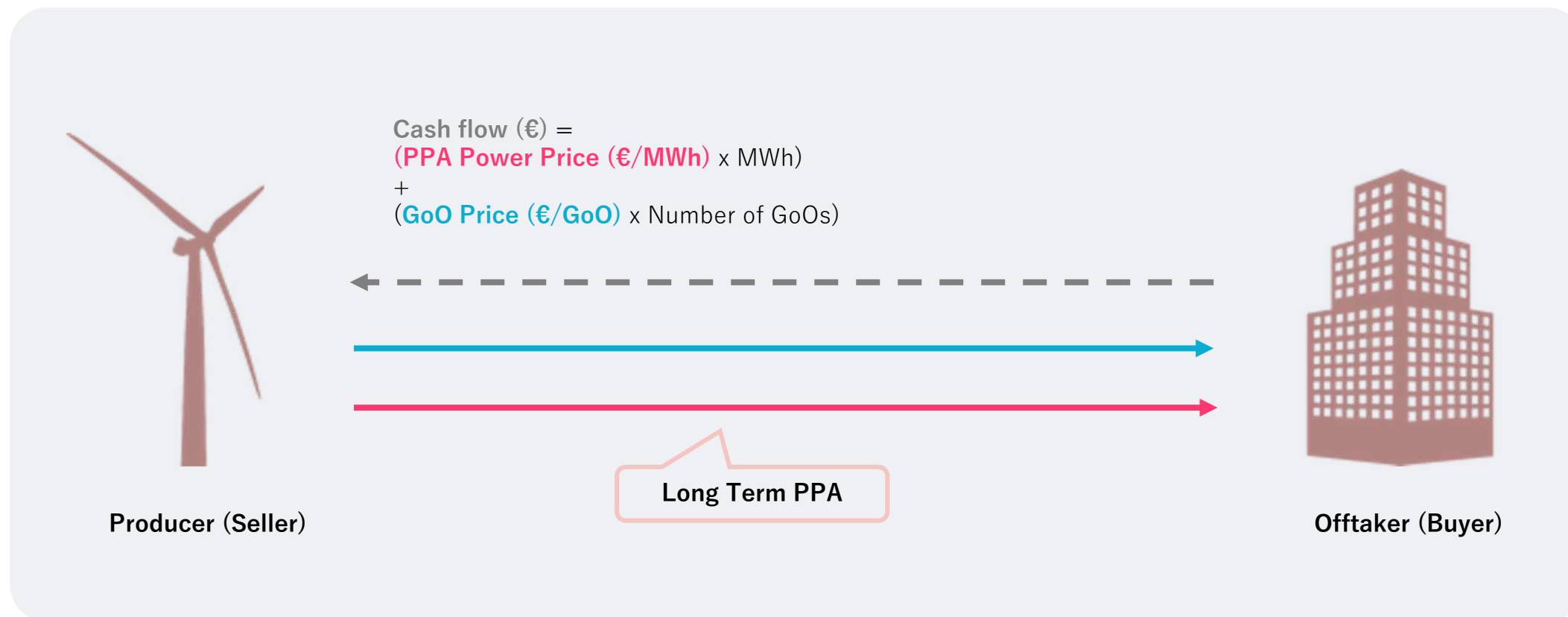
Credit exposure

Different types of PPA and contractual structures



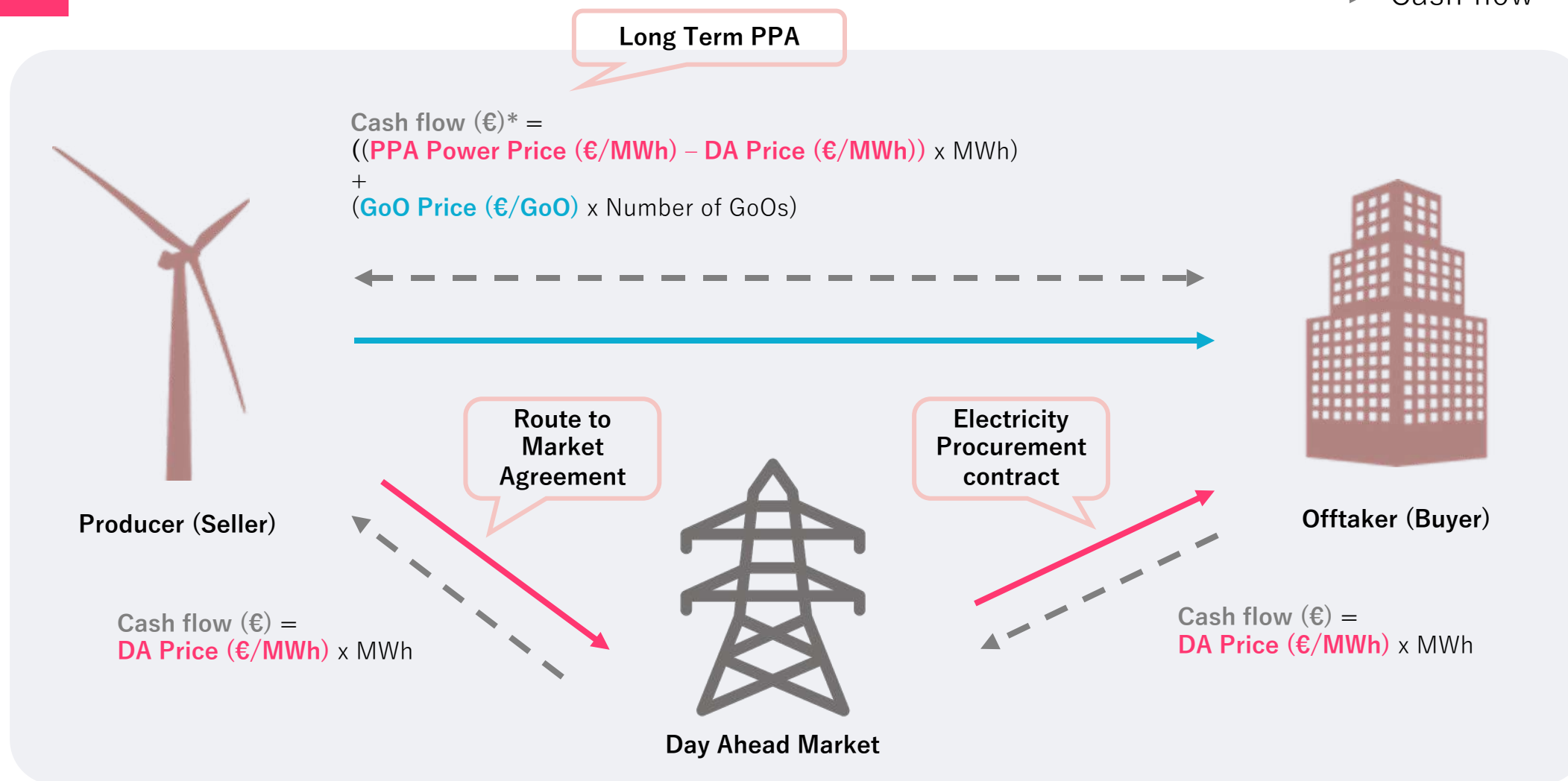
Physical PPAs

- Power flow
- GoO flow
- Cash flow



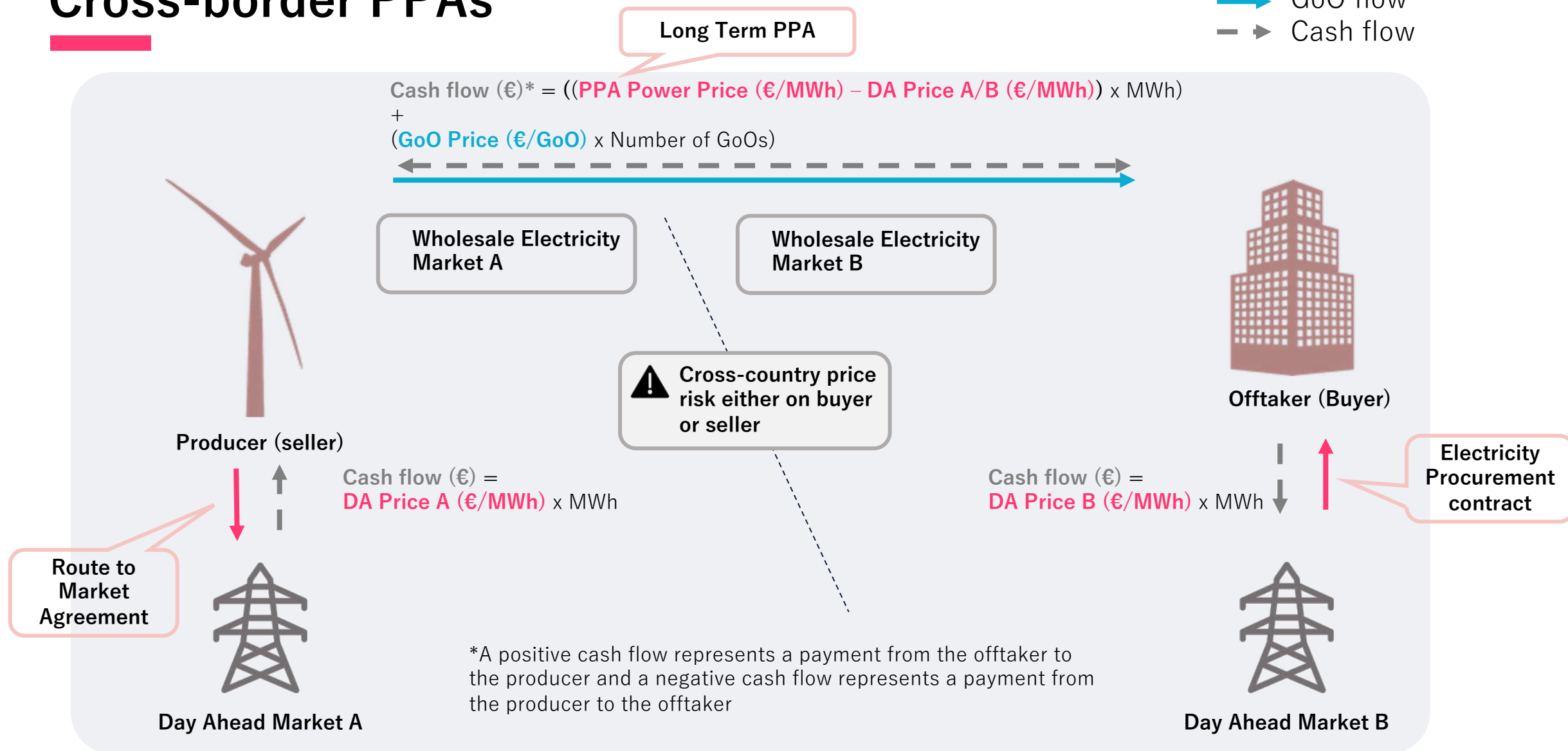
Financial PPAs

- Power flow
- GoO flow
- - - Cash flow



Cross-border PPAs

- Power flow
- GoO flow
- Cash flow



Key differences: Financial vs physical

Parameter	Physical PPA	Financial PPA
Readily available in the market	✓	✓
Buyer receives physical power	✓	✗
Requires the buyer and seller to be present on the same electricity grid	✓	✗
Two-sided cash flow	✗	✓
Can include the transfer of GoOs	✓	✓
Exposes both parties to counterparty risk*	✓	✓
Requires accounting of unrealised value (derivative)	✗	✓

→ To-date in Europe, the majority of PPAs are physical

Trends in PPA structures in key markets



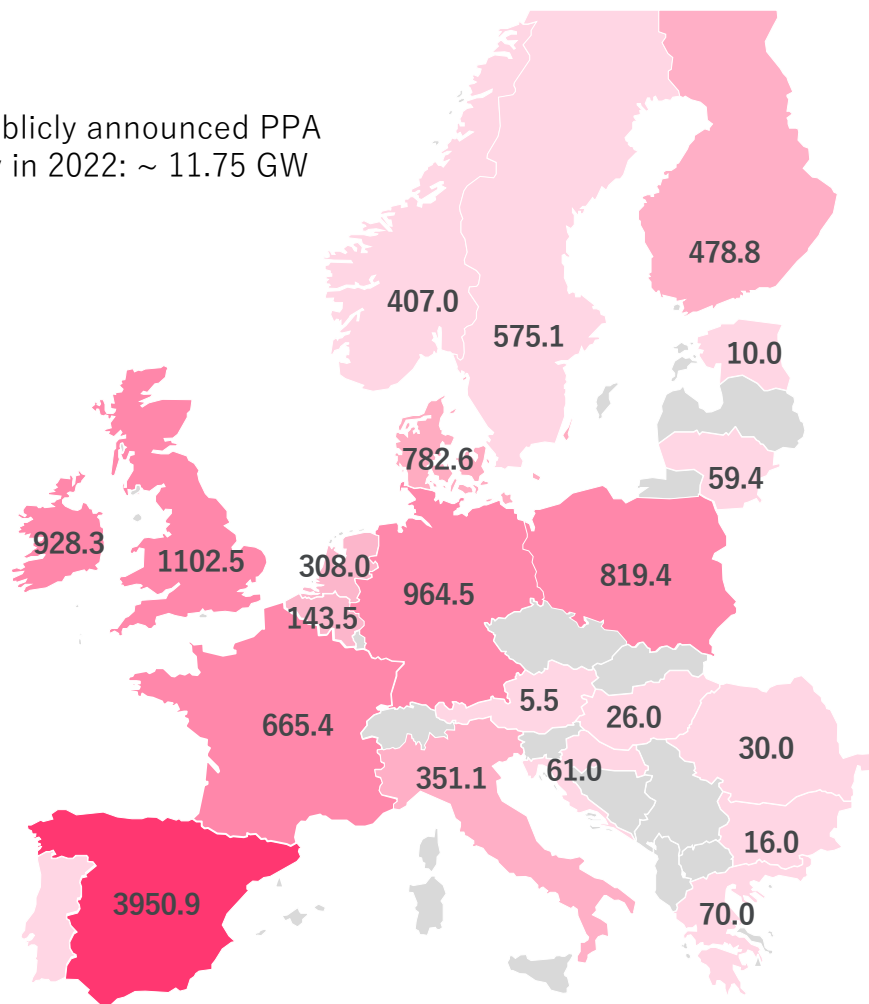
The PPA wave keeps spreading

MW

3951

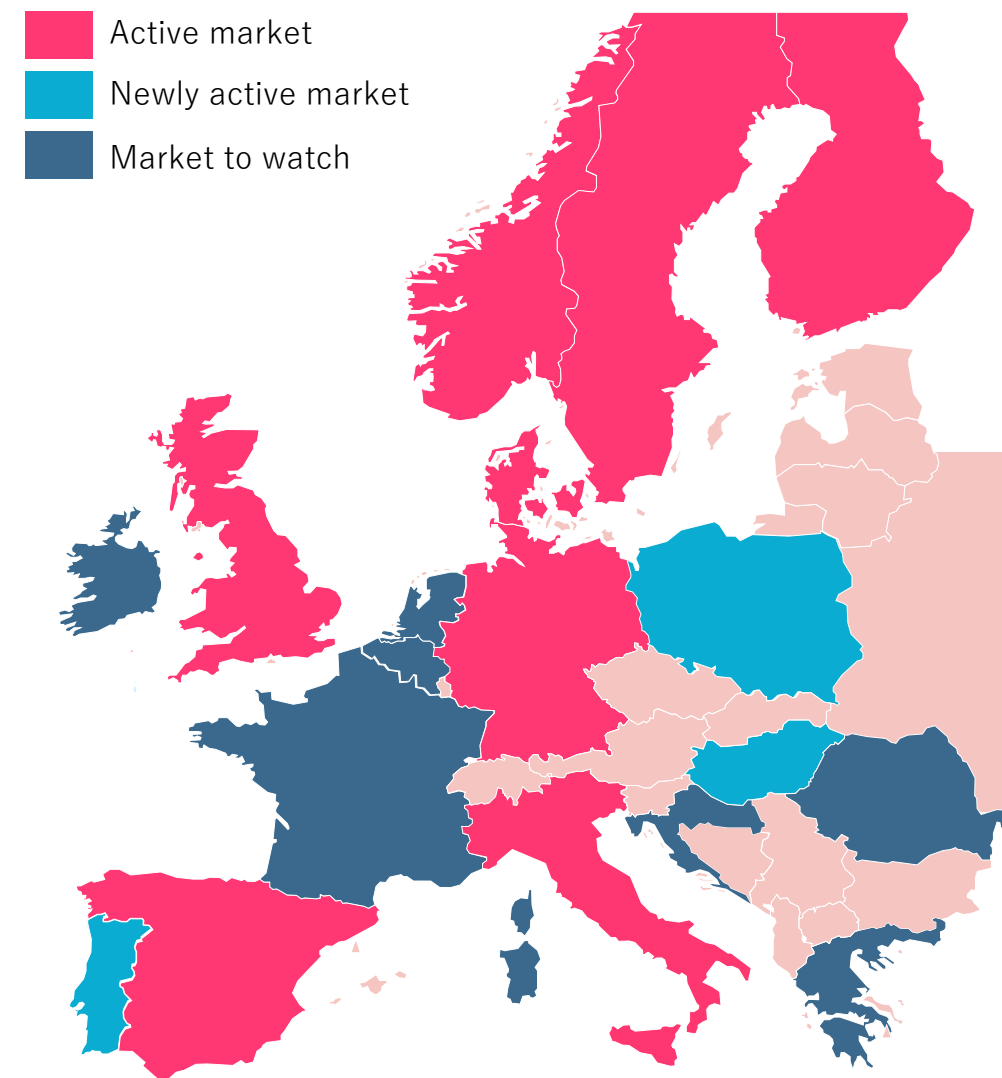
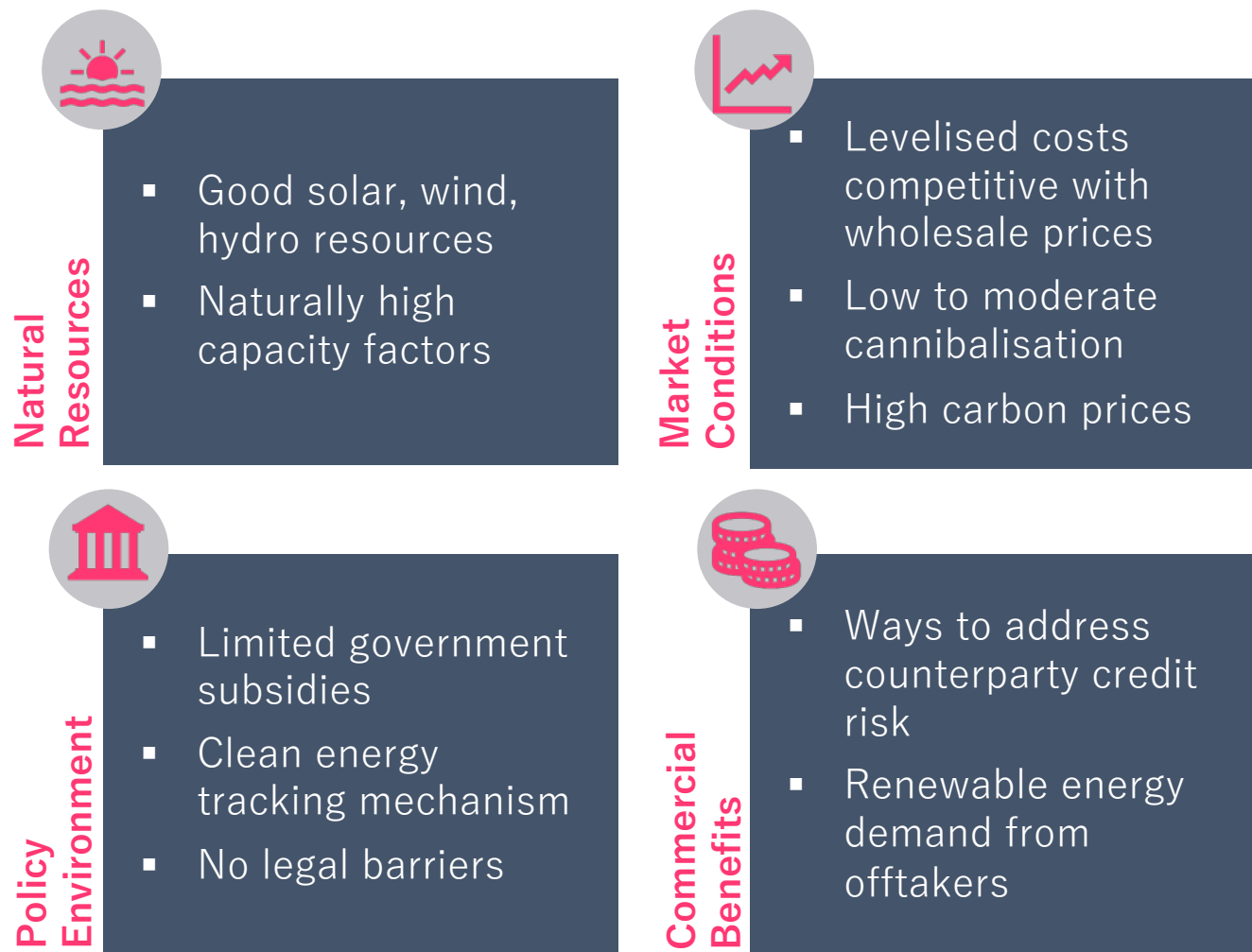
Total publicly announced PPA capacity in 2022: ~ 11.75 GW

5



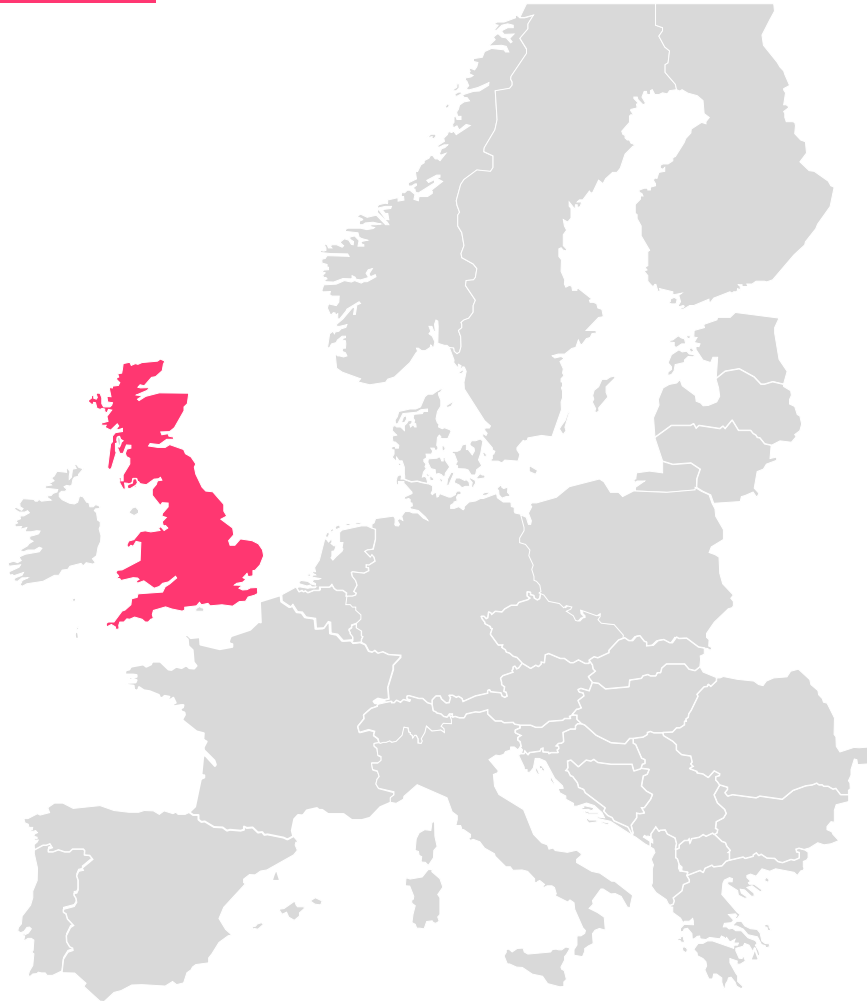
- 2022 - Spanish solar PPAs are still leading the market with almost 4 GW disclosed contracted capacity
- Slow-down in the Nordics, few new deals in Norway and Sweden. The biggest growth was registered in Germany, Finland and Poland
- **“PPA wave” is spreading** to new markets Poland, Romania, Bulgaria, Greece and the Baltics

Hot or not – Characteristic of an attractive PPA market





Great Britain: On the verge of 2nd Wave?



- Mature, large, professional PPA market due to the additive nature of the Renewable Obligation (RO) subsidy which began in 2002
- Considerable activity in the short-term utility PPA market. Few utilities will execute long-term PPAs due to concerns regarding cannibalisation increasing profile risk costs
- Long-term PPA market is dominated by corporates, driven by green credentials rather than pure economics
- Regulatory barriers to storage development have been reduced over the last 3-4 years and GB now has the most developed storage market in Europe
- PPA activity in GB has dropped in the past year, due to the dominance and success of the CfD scheme

PPA Prices¹

- Baseload 76.47
- Wind PAP 66.75



Germany: The land of PPA plenty



The Market

- 15+ experienced, professional and solid offtakers bidding for long-term PPA business on the back of the most liquid forward market in Europe
- Not one but *many* PPA sub markets: new build solar, zero-bid offshore projects, Post-EEG Ü20
- Most frequent contracts:
 - 10yr PaP (solar) ¹
 - Ü20 1-2yr PaP (wind)

PPA Prices²

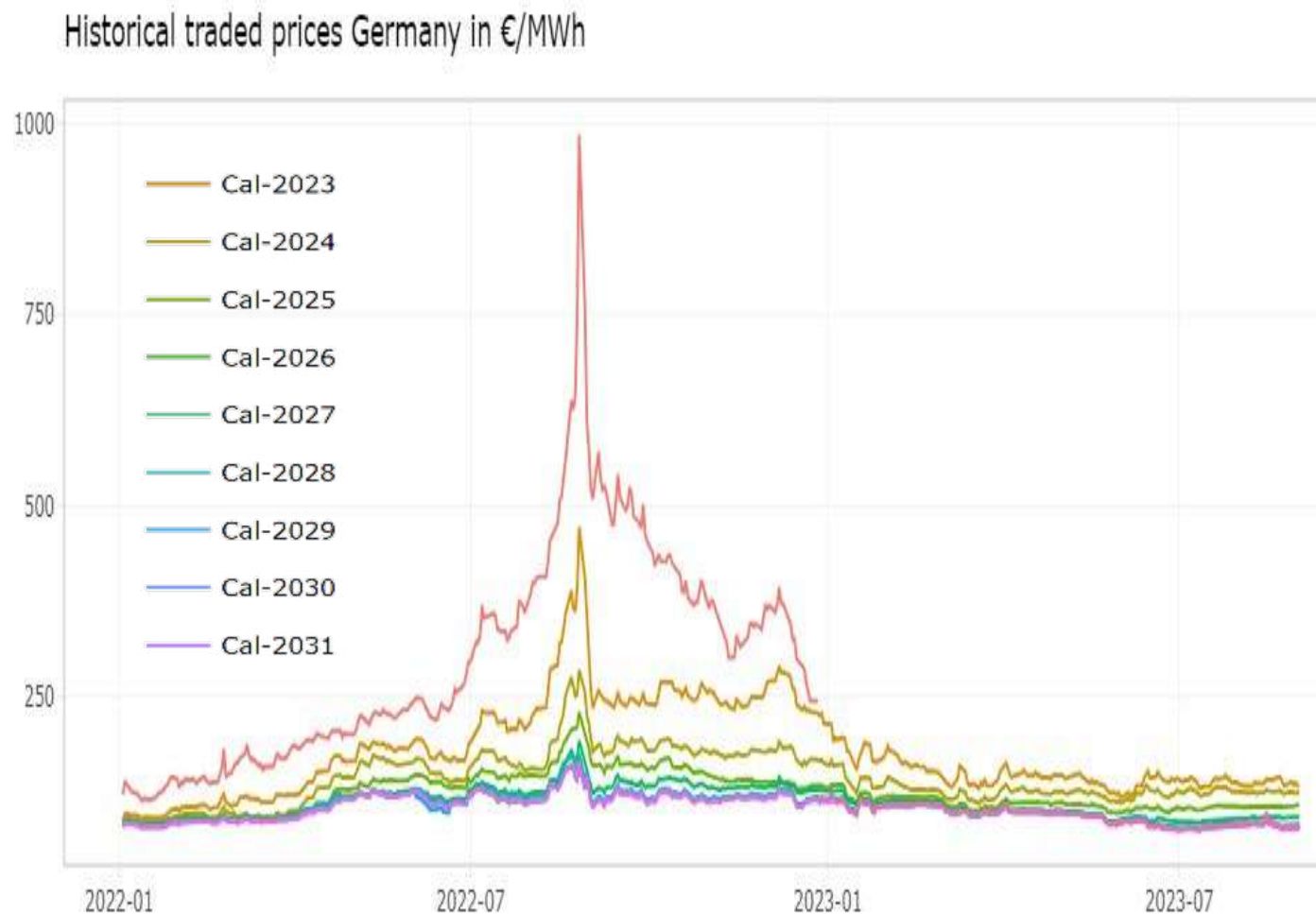
▪ Baseload	83.25
▪ Wind PAP	63.81
▪ Wind Offs PAP	71.73
▪ Solar PAP	63.51

Pexapark country
report available

¹ Pay-as-produced PPAs transfer capture risk from seller to buyer.

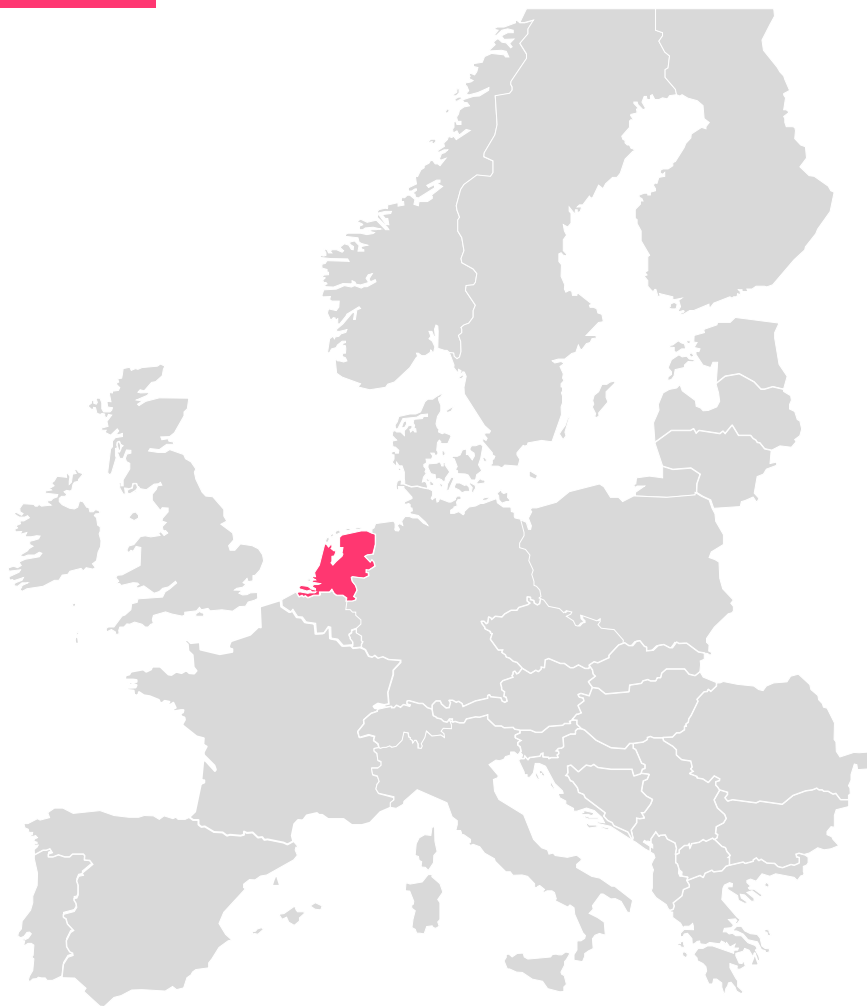
² Source: PPA Pricing September 01, 2023. Start Date: 1.1.2024. PPA tenor: 10 years. Without balancing, GoO & credit costs

German forward prices: Historical traded prices



- It is imperative to monitor the forward curve (power calendar futures) as it is the main driver for PPA prices
- Power markets have been highly volatile since Q1 2022, with some alternating bullish and bearish weeks
- Despite the unprecedented volatility, the market level can be favourable for PPA sellers
- On the other hand, offtakers often increase their risk discount at high price levels, to reflect volatility uncertainty
- Since Q1-23 we have seen price levels come down, due to the mild winter which alleviated gas shortage concerns

Netherlands: Offshore it blows



The Market

- PPA market mostly focused on **offshore** projects, and expected to grow for PV and onshore wind after 2025 when the SDE++ subsidy is expected to end for new entrants
- +10 credit-worthy offtakers with the market being dominated by high-tech corporates like Amazon and Google, and corporates in the chemicals industry
- Most frequent contract: 10-15y offshore wind PPAs. With the increase in market prices, and the decreasing SDE subsidy levels, interest in PPAs has picked up, but has yet to materialise into signings

PPA Prices¹

- Baseload 68.56
- Wind PAP 46.62
- Wind Offs PAP 48.86



Spain: Largest PPA market in Europe



The Market

- Spain is the largest PPA market in Europe, with high degree of maturity and interest from both utilities and corporates
- The main obstacle to date has been regulatory intervention and uncertainty, as well as slow permitting. January 25th saw a big batch of grid connection permits awarded which will create a ketchup effect in the market
- Onshore wind PPAs have increased significantly due to more preferable terms in the market than in government auctions. Onshore wind volumes have been popular with buyers due to its complimentary profile to PV
- Hybridisation, co-locate wind, PV and batteries is a trend

PPA Prices¹

- Baseload 57.10
- Wind BLM 50.58
- Solar PAP 39.97

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Italy: PPA boom underway



The Market

- Italy's PPA market was struggling with a long permitting process, but recent improvements (moving decision-making to a national level from municipal) has increased number of permits, particularly in the Lazio region
- A PPA boom is now underway, the number of disclosed PPAs more than doubled from 2021 to 2022, and projected to increase significantly in 2023
- Standard contract structure: 10 year PPA on PUN basis with solar capture risk (either "PaP" or hourly solar profile)¹
- The zonal spread ("the CCT") constitute an additional risk element for sellers
- CCT hedging is expensive on individual asset basis but can potentially be manageable for well-sized portfolios

PPA Prices on PUN basis²

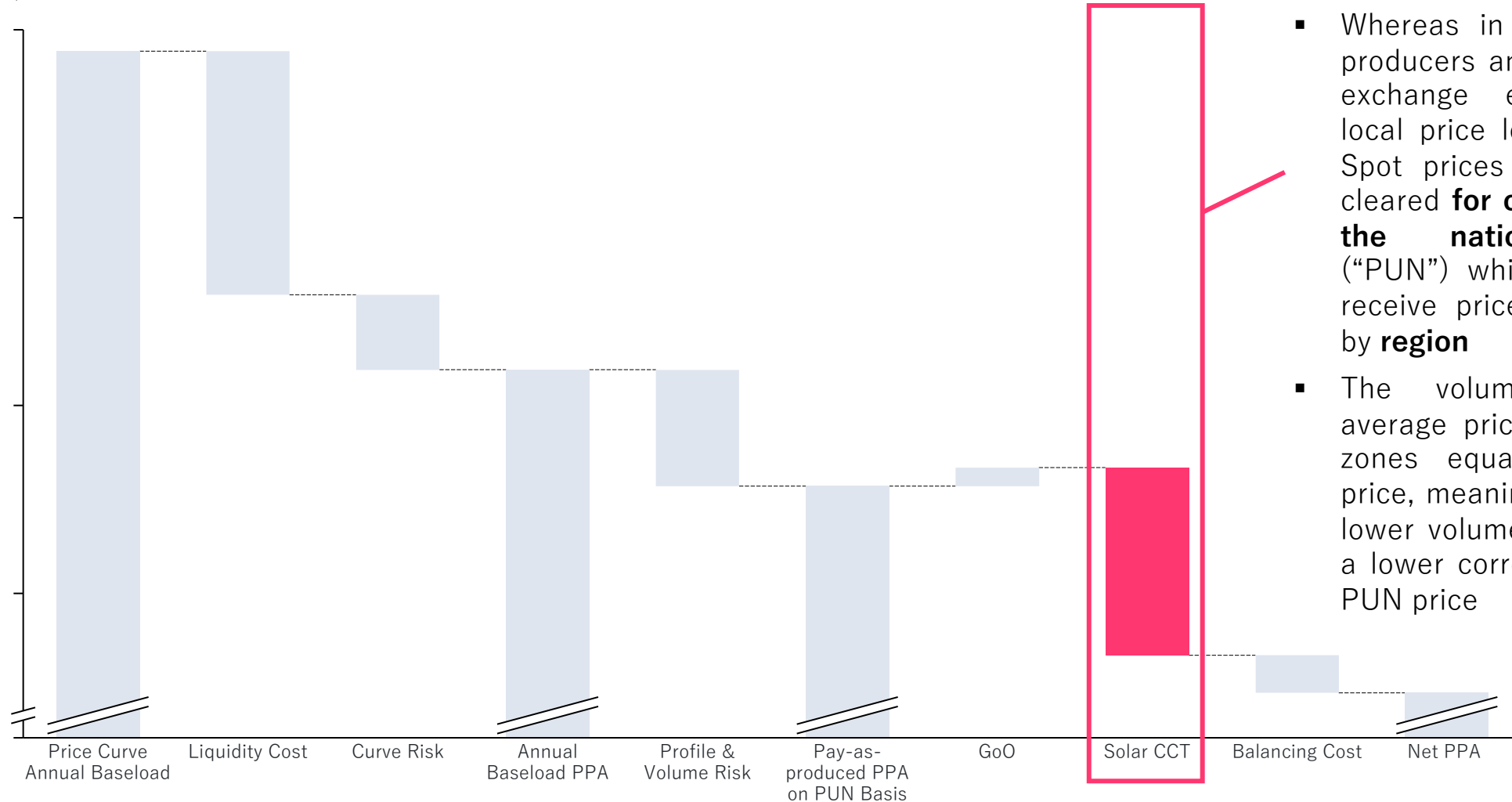
- Baseload 85.55
- Solar PAP 71.22

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The Italian PPA market is unique in Europe that investors must deal with an additional factor - the CCT Spread



EUR/MWh



- Whereas in the Nordics, producers and consumers exchange electricity at local price levels, in Italy Spot prices are typically cleared **for consumers at the national price** (“PUN”) while **producers** receive prices that differ by **region**
- The volume weighted average price of all local zones equals the PUN price, meaning zones with lower volume levels show a lower correlation to the PUN price

Poland: Renewables here we come!



The Market

- Market ignited in 2019, but only began exhibiting significant activity in 2021, which continued through to 2022, with much interest from corporates and limited number of utilities
- Due to recent market intervention, a reduction in appetite for long-term deals from utilities has been observed
- As a coal dependent country, renewable cannibalisation is currently low but will likely increase as renewable build-out increases
- Project owners are opting out of subsidy schemes to cater to the immediate needs of corporates for affordable and clean energy
- Most frequent contract: 10-year virtual onshore wind corporate PPA for new build projects

PPA Prices¹

- | | |
|------------|--------|
| ▪ Baseload | 428.47 |
| ▪ Wind PAP | 318.04 |

Pexapark country
report available



General market observations

Continued elevated prices and high volatilities of energy commodities

Continued high pressure on commodity prices and RE project CAPEX caused by global supply disruption and delays

Delayed contract closures with offtakers and increased reluctance to provide PPA price quotes

High regulatory uncertainty due to political interventions

Major shifts in the markets, regulation and risk appetite triggered by Russian invasion and commodity prices

Increased number of opportunities in the short-term PPA market

Limited availability of PaP structures, high risk discounts applied

Exiting of subsidy mechanisms on the rise, e.g. CfD mechanism, FiT (EEG)

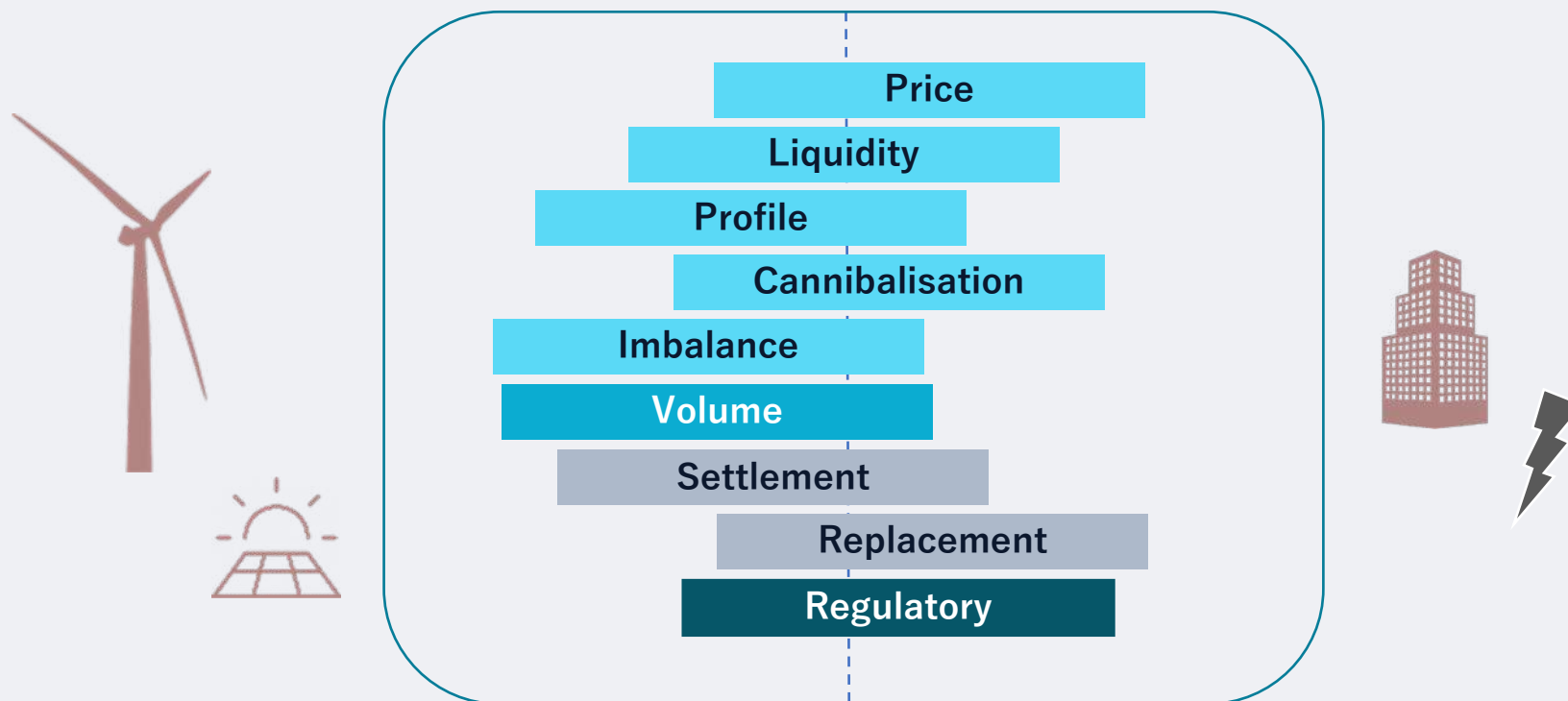
Continuous high interest of corporates in PPAs despite high price volatility and RE electrification rate

PPA volume and price structure alternatives



Risks involved in producing and selling energy

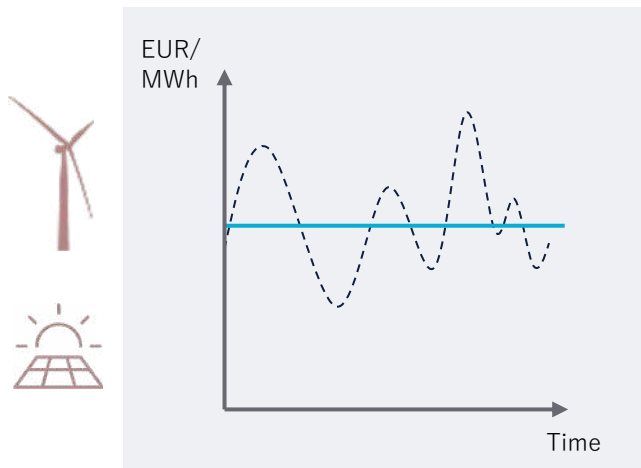
Exposure to uncertainties when producing and selling energy



Common PPA price structures and risk allocations

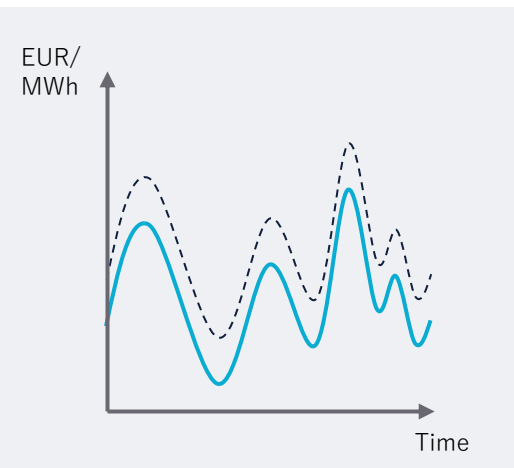
— PPA Price
- - - Market Price

Fixed Price



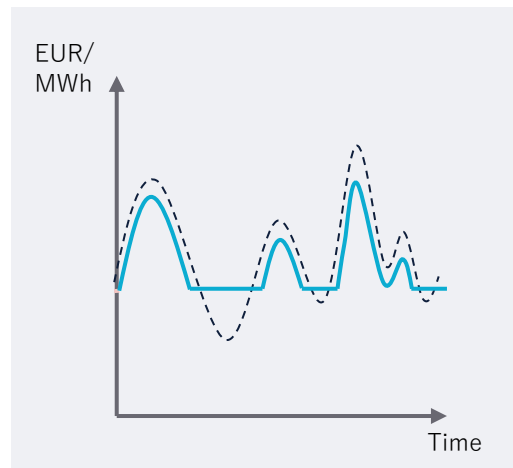
Sale of electricity at a fixed price regardless of market prices; “pay-as-you-go” in case fixed price is paid for any volume produced

Floating Price



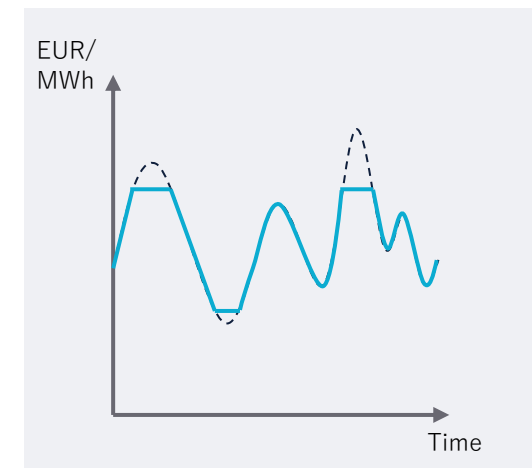
A “Market Access” contract for the sale of electricity at market prices, usually with linkage to day-ahead prices

Floor Price

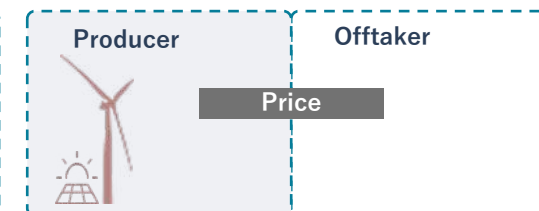
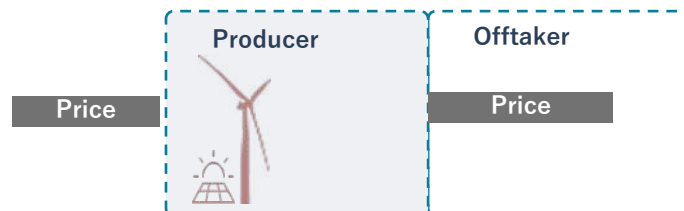


Sale of electricity at a minimum price (“hidden put option”) plus participation from benefits of higher market prices

Collar Price



Sale of electricity at market prices within a minimum (“hidden put option”) and maximum price (“hidden call option”) band



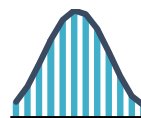
Description of common PPA volume structures



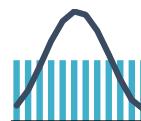
Pay-as-Produced: Sale of electricity at a fixed price regardless of market prices; a fixed price is paid for any volume produced.



Fixed hourly profile: A contract that commits the producer to sell a fixed shape over a year. The difference between the actual volume produced and the fixed shape in each settlement period is settled at the spot market, resulting in a cost or gain for the seller.



Monthly baseload: A contract that commits the producer to sell a fixed baseload volume of energy for every hour over a month. The difference between the actual volume produced and the fixed volume in each settlement period is settled at the spot market, resulting in a cost or gain for the seller.

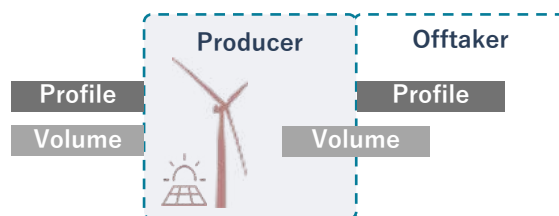
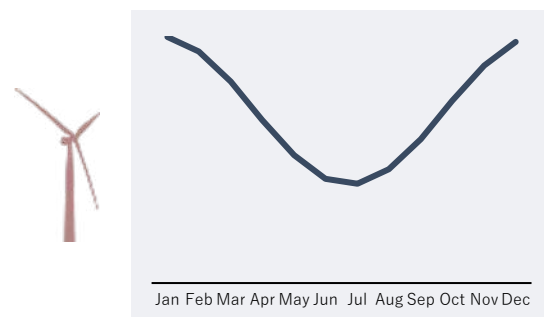


Annual baseload: A contract that commits the producer to sell a fixed baseload volume of energy for every hour over the year. The difference between the actual volume produced and the fixed volume in each settlement period is settled at the spot market, resulting in a cost or gain for the seller.

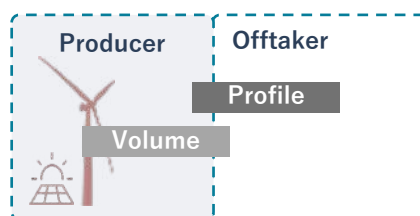
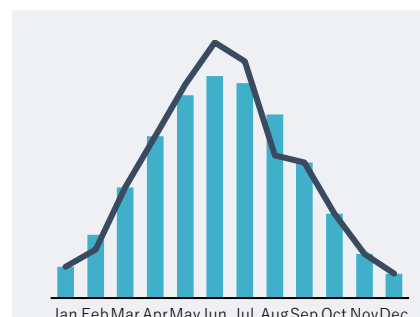
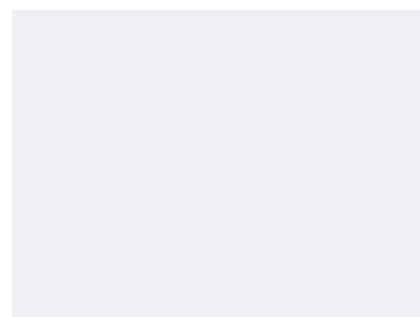
Common PPA volume structures and risk allocations

— Production profile
 ■ Contract profile

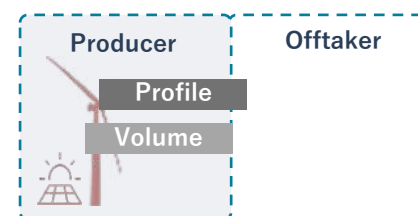
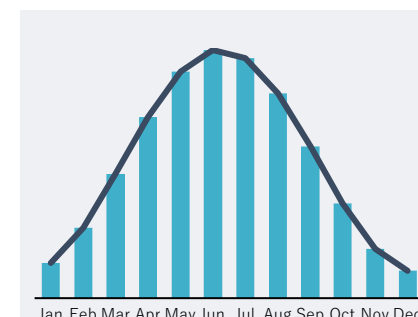
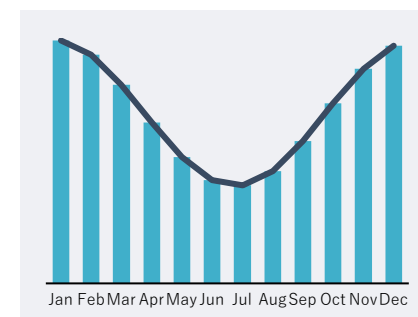
Pay-as-Produced



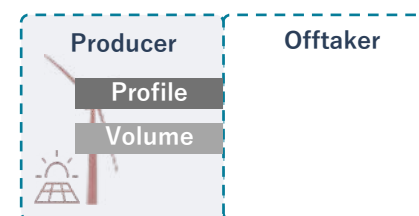
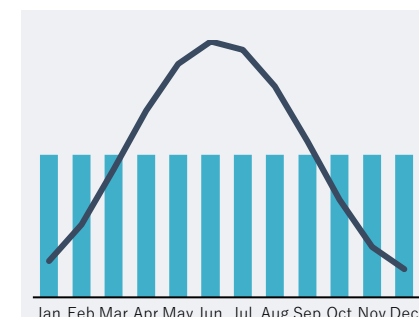
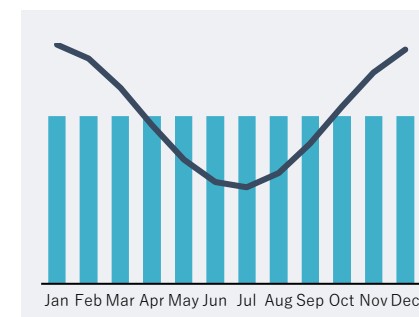
Fixed Hourly Profile



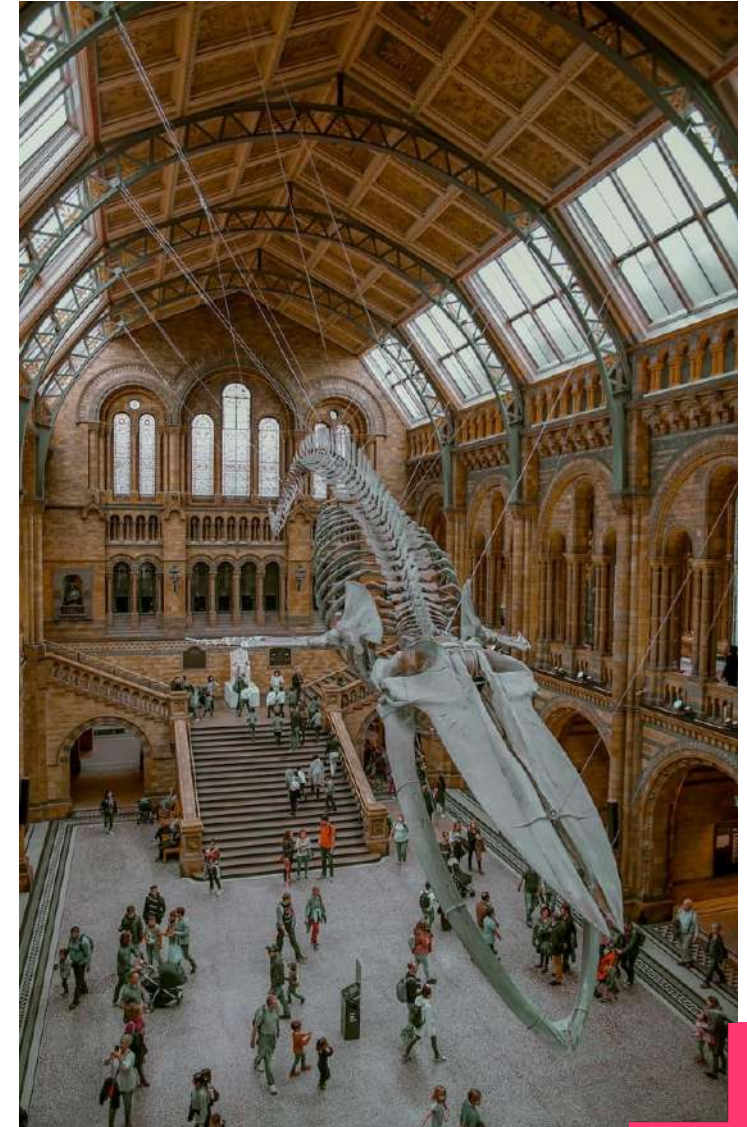
Monthly Baseload



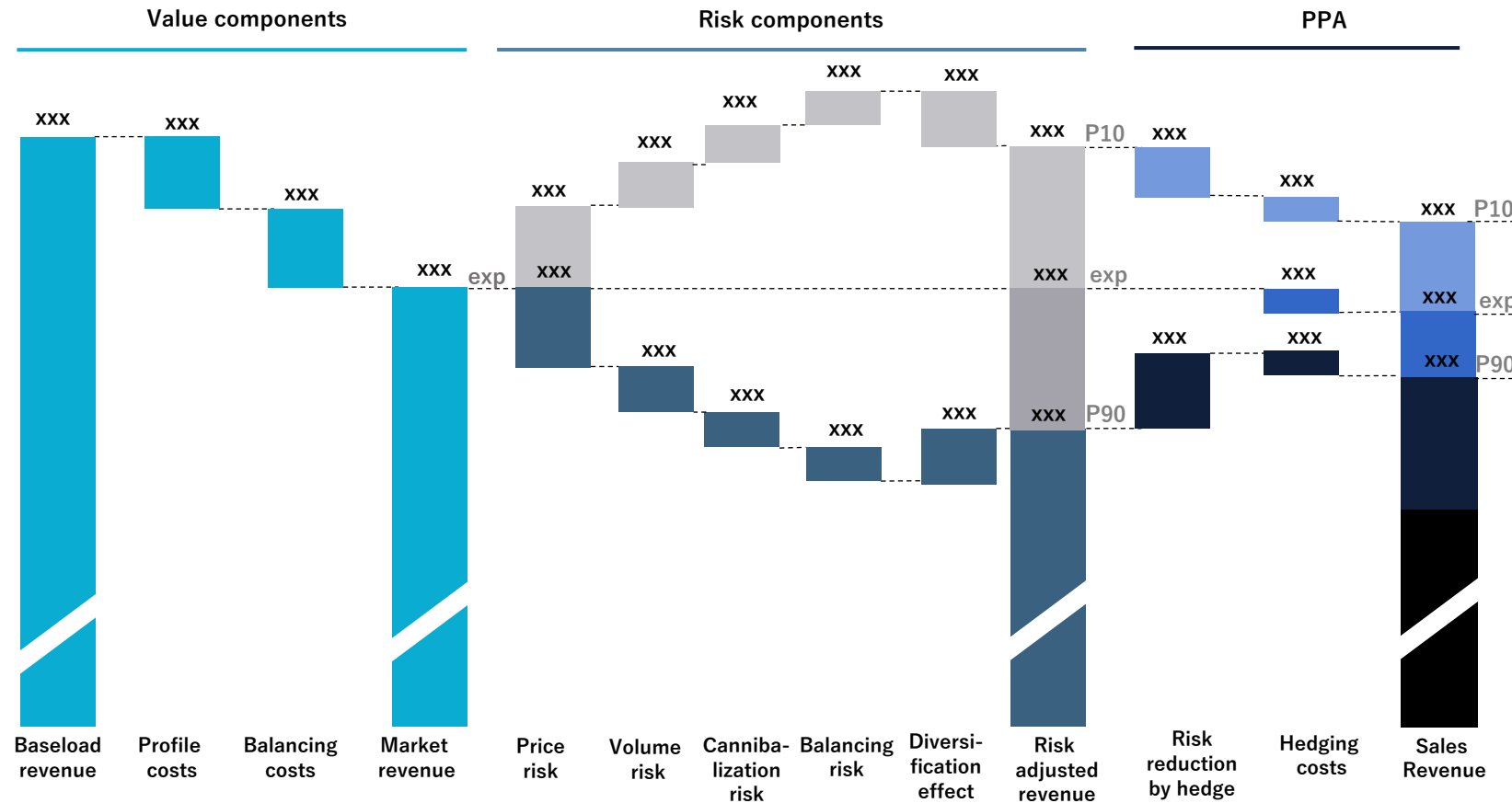
Annual Baseload



Balancing management and PPAs



PPA Pricing – where does balancing sit?



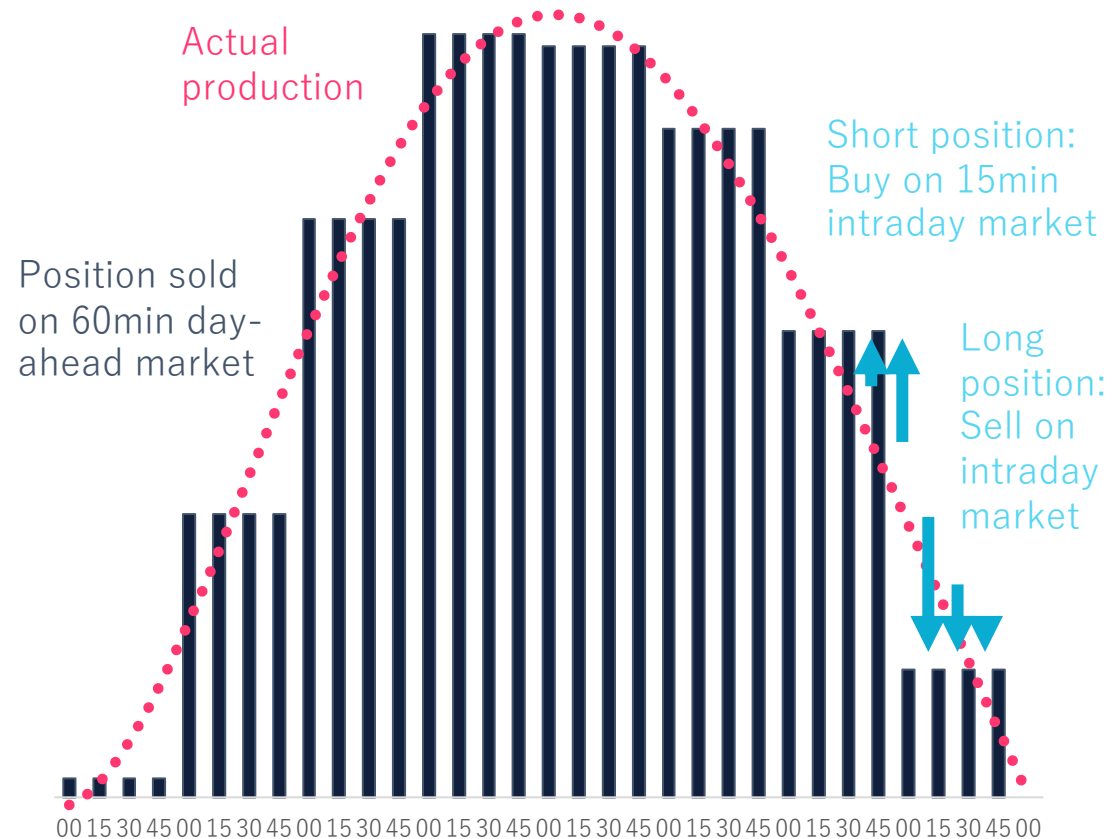
Imbalance costs –Balancing demand and supply

- **Renewable production** is subject to **forecasting uncertainty** until the moment of delivery. With hedges usually done on a day-ahead basis, or at the very latest a few hours prior to realisation, the **portfolio is mostly non-flat** at delivery
- **Imbalance exposure** is measured based on forecast error (difference between forecasted energy production D-1 and actual generated energy), and the price spread between the day ahead market prices and the respective imbalance price
- Responsible for the imbalance market is the **system operator** who settles discrepancies between amounts of electricity a producer contracted to generate, and the amounts actually generated
- **Balance Responsible Party** bundle multiple producers and consumers and pays/settles with system operator (TSO)
- **Design of imbalance market** is critical for assessing the costs and risks (single/dual pricing, combined or separate balancing of production/consumption, time, frequency)



Balancing: An increasing problem with solar ramps

- Simultaneity of solar production leads to steep ramps in the shoulder hours in the morning and evening
- Large changes in feed-in within one hour
- 60min day-ahead market not granular enough to cover this
- Increased 15min trading required on intra-day auction and continuous market
- Solar balancing costs increase with buildout



Risk: Balancing



- Although Balancing Cost is built in as value components, there is risk that must be accounted:
 - The **cost associated with balancing** may fluctuate substantially throughout a contract, due to variations in the quality of forecasting, volatility of balancing prices, etc. The associated source of financial risk is termed '**balancing risk**'

New developments: PPAs for (green hydrogen) electrolyser projects, additional services for optimal energy management



PPA market trends

1

**The Squeezing of
the classical 10y
PPA market**



2

**The Rise of Next
Generation Utilities**



3

**The Ascent of the
Mega Corporate
Buyer Class**



PPA market trends

4

**Short term PPAs
here to stay**



5

**Battery and other
energy storage**

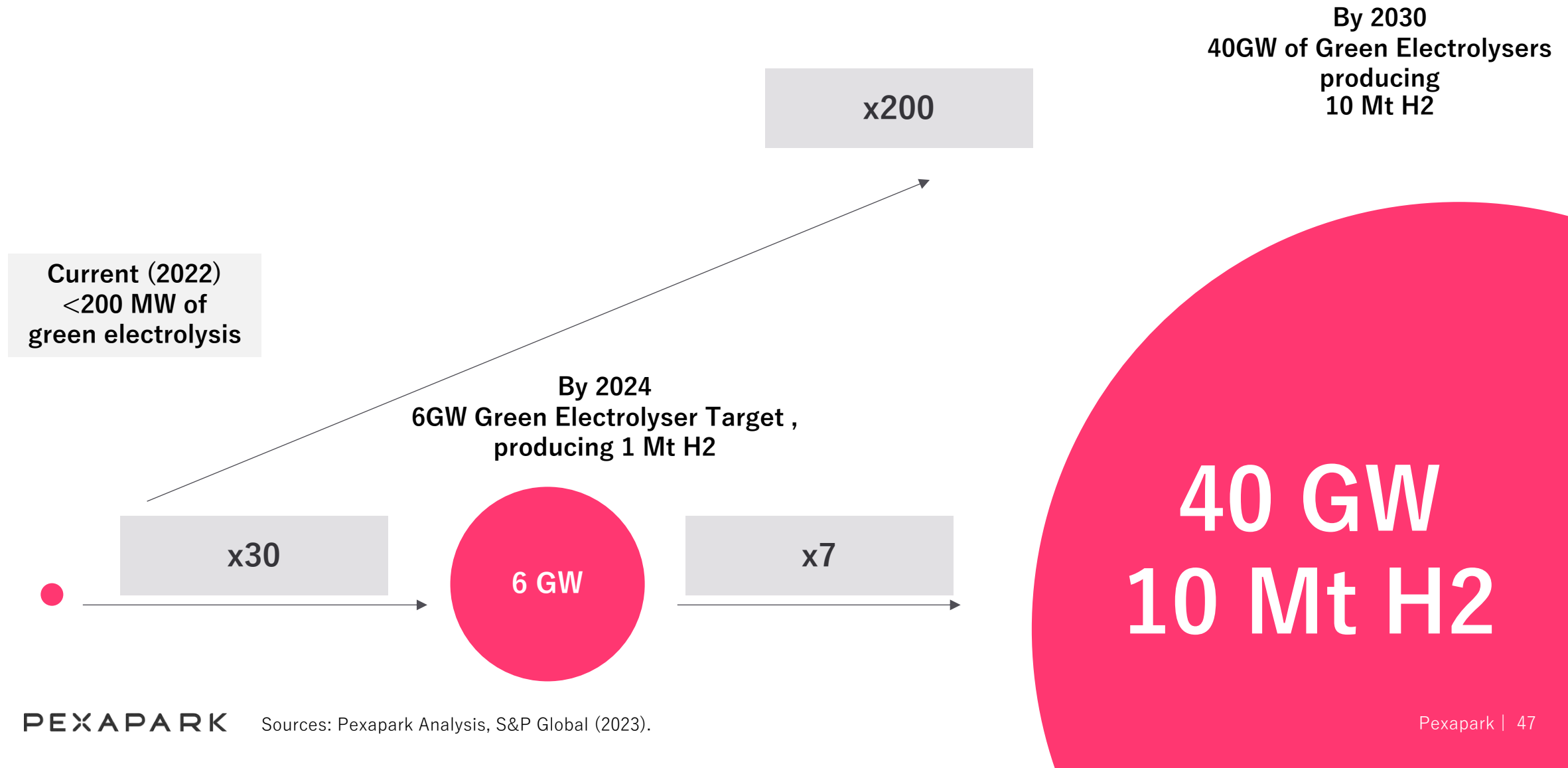


6

**Offshore: big, bigger,
biggest!**



THE EU'S GREEN HYDROGEN PRODUCTION TARGETS REPRESENT AN 200-FOLD GROWTH OF THE GREEN HYDROGEN MARKET



THERE ARE FOUR ROUTES TO PRODUCE GREEN HYDROGEN IN THE DELEGATED ACT

Route	Description	Requirements
1 Direct Connection 	The hydrogen facility is connected via a direct line to a new renewable electricity generation asset.	The electrolyser is directly connected to a renewable asset, which has not come into operation earlier/more than 36 months before the H2 plant and the electrolyser does not draw electricity from the grid . The renewable asset may receive subsidies.
2 Grid Connection in a bidding zone with > 90% RE-Share 	The hydrogen production facility is connected to the grid, and the share of renewable electricity in the grid was higher than 90% in one of the previous five years.	The electrolyser is only allowed to operate for a certain amount of hours , which has to be less than the maximum hours allowed, equivalent to the share of the renewable electricity in the bidding zone. (yearly max hours = RE share * 8760 hours)
3 Grid connection with renewable PPA 	The hydrogen production facility is connected to the grid, and the electricity used is "demonstrably" renewable.	See next slide

Additional route for grid-connected assets:

4



During Imbalance Periods

Requirements:

The electricity is consumed during imbalance settlement periods, reducing the need to redispatch renewable energy sources by the same amount.

The requirements for renewable PPAs adapt over time

Route	Requirement	Timeline	
3  Grid connection with a renewable PPA	Additionality (Art. 5)	1 Jan 2028 No additionality criteria applied before 1 Jan 2028	1 Jan 2038 Additionality requirements for electrolyzers that have come into operation after 1 Jan 2028: - RES asset COD ≤ 3 years before electrolyser COD and RES asset did not receive financial support → Bidding zones with low emission intensity are exempt from additionality criteria (≤ 64.8 g CO₂e/kWh) Additionality criteria applied to all existing and new projects
	Geographical Correlation (Art. 7)	Requirements are met if: - RE asset under the PPA in same bidding zone (BZ) as electrolyser, or - RE asset under the PPA in offshore BZ connected to BZ of the electrolyser or - RE asset and electrolyser are in interconnected BZ with day-ahead price in the BZ of the RES asset ≥ day-ahead price in the BZ of the electrolyser	
	Temporal Correlation (Art. 6)	1 Jul 2027 Requirements are met if: Monthly electricity produced under the PPA is ≥ electricity consumed by the electrolyser	1 Jan 2030 Requirements are met if: Monthly electricity produced under the PPA is ≥ electricity consumed by the electrolyser, - or if the electricity stems from onsite storage, charged in the same month as the production occurred, → but member states can introduce an hourly matching Requirements are met if: Hourly electricity produced under the PPA is ≥ electricity consumed by the electrolyser, - or if the electricity stems from onsite storage, charged in the same hour as the electricity production occurred. Additionally, the requirements are met if: - The electrolyser operates during hours with day-ahead prices ≤ 20 EUR/MWh or ≤ 0.36 * the price of an EUA



「Thank you」

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PEXAPARK

Wiesenstrasse 5, Schlieren 8952, Switzerland
www.pexapark.com | hello@pexapark.com

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Granular certification: introduction to 24/7 energy matching

Killian Daly, Executive Director, EnergyTag



Granular Certificates - Why? How?

Killian Daly - Executive Director : 21st September 2023 - Online

What's EnergyTag?

NGO Driving Innovation in Energy Tracking

1

Standards

Set Granular Certificate Standard

- ✓ Published **world's only granular emissions tracking standard**
- ✓ **Supported by** 100+ organisations including UN Energy

2

Markets

Coordinate & Drive Better Markets

- ✓ **12 Pilots** with 1 TWh tracked.
- ✓ **Optimal PPA and tracking design**

3

Policy

Advocate For Better Corporate Policy

- ✓ EU - RED III / H2
- ✓ US - Clean H2
- ✓ Global - GHG Protocol

Our Standards Strives for Global Harmonisation



Global Stakeholders

Consumers



*We connect a global
granular tracking
ecosystem*



Suppliers/Markets



500+ Organisations

5 Continents

\$4+ trillion Market Cap

EnergyTag



24/7 Tracking



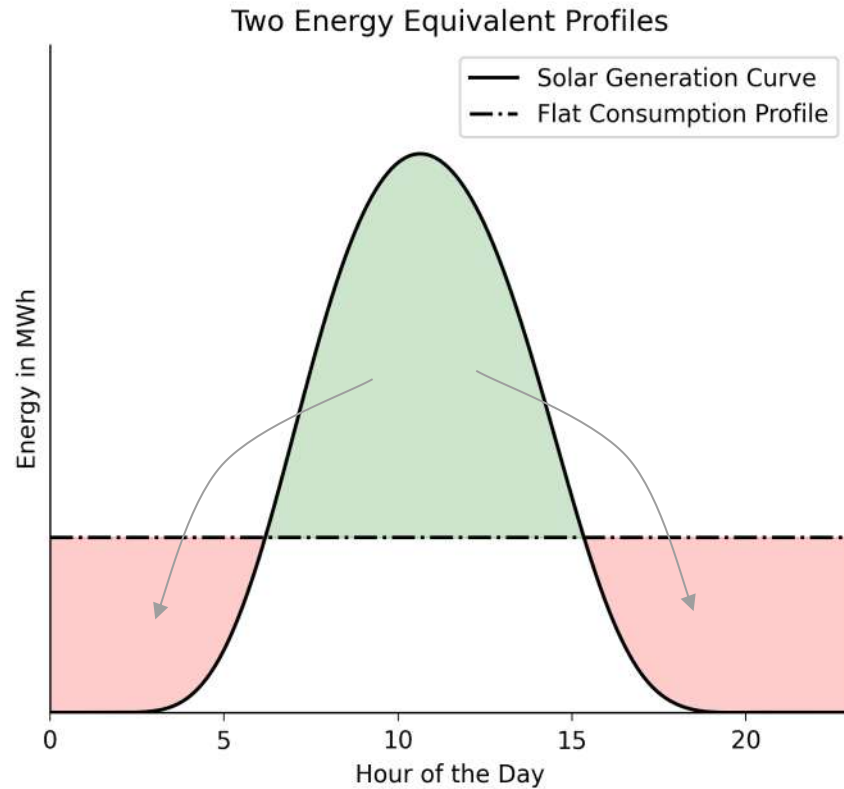
Governments & NGO



Why Granularity?

Today's Green Accounting does not reflect Grid Realities

Temporal Mismatch between Consumption and Generation



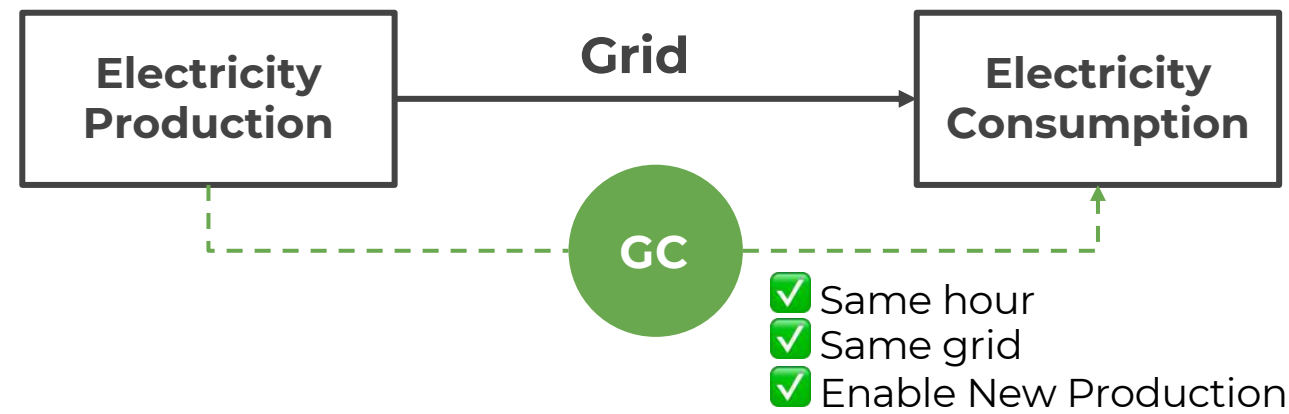
Ex: Companies purchase solar certificates to cover 100% of their load - even during the night

Locational Mismatch between Generation and Consumption



Ex: A Belgian company can source green electricity from Iceland.

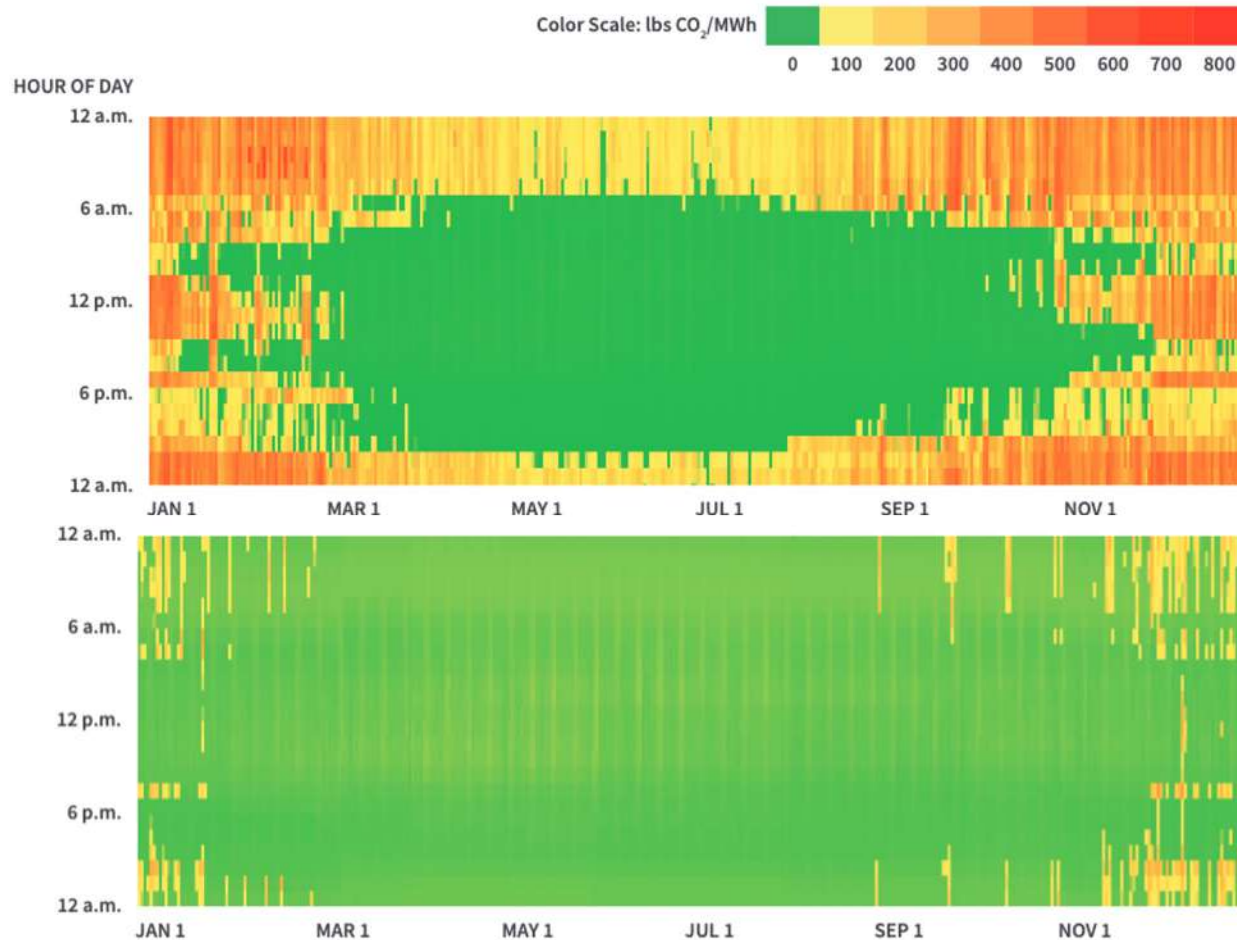
Granular Accounting Refines Tracking Accuracy



ANY!
*CBAM, Steel, H₂,
Data Center etc..*

	Today		Granular
Temporal	Annual (⚠ Forget Flexibility)	→	Hourly ✓ Incentivise
Deliverable	Continental (⚠ Ignore Grids)	→	Same grid ✓ Focus on Congestion

Granularity is more realistic,



Coarse

- **100% Annual** matching leaves **gaps** in the portfolio.
- **Zero-emissions is not True Zero**

Granular

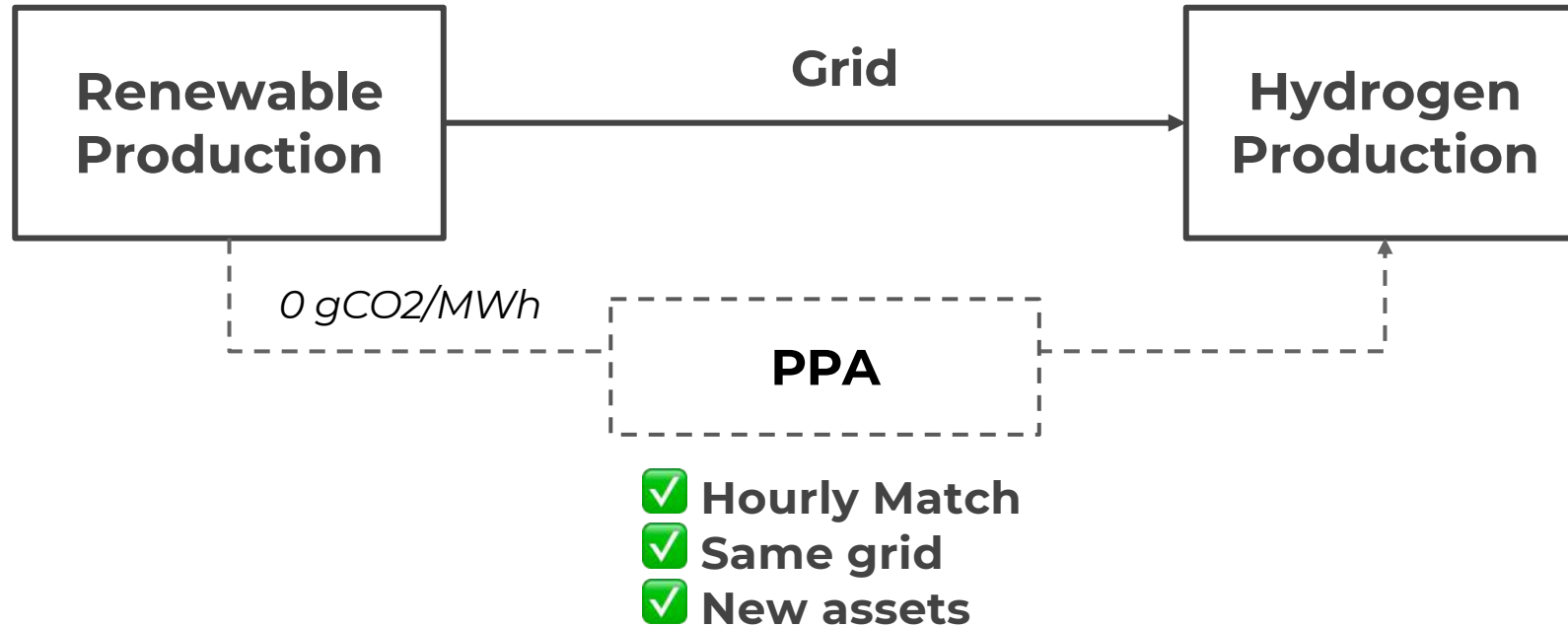
- **99% hourly** fill the gaps with a signal for **storage / clean-firm**.
- **Zero means zero**

Granular Accounting is Becoming Law

Law	Institution	Government Doc	Doc Citation	Status
EU 24/7 Hydrogen Standard	European Commission	Adopted Delegated Act	Article 4.2.(c) "The renewable liquid and gaseous transport fuel of non-biological origin is produced: (i) during the same one hour period as the renewable electricity produced under the renewables power purchase agreement"	Adopted ▾
US Government 24/7 Target	US Government	Presidential Executive Order 14057	Sec 203 "match use on an hourly basis to achieve 50 percent 24/7 carbon pollution-free electricity"	Adopted ▾
UK 24/7 Hydrogen Standard	UK Department for Transport	RTFO Guidance for Renewable Fuels of Non-Biological Origin	Para 2.19 "temporal correlation between electricity generation and electricity consumption must be demonstrated. This can be demonstrated over a settlement period of up to 30 minutes"	Adopted ▾
UK 24/7 Low Carbon Hydrogen Standard	UK Department for Business, Energy & Industrial Strategy	Low-carbon hydrogen standard	Sec 7.1.3 "Real time tracking of generation and consumption (temporal correlation) is required across all 30-minute consignments."	Adopted ▾
VertVolt 24/7 Green Label	ADEME (French Agency for Ecological Transition)	French Government VertVolt Standard	Criteria 4.4 (Translated) "Half-hourly rate of coverage of customer supply consumption by the production of contracted facilities."	Adopted ▾
Irish Climate Action Plan (24/7 for Large Energy Users)	Irish Government	2023 Climate Action Plan	Pg 134 "More granular certification processes will be required, including 'time stamped' guarantees of origin, so that energy intensive users can demonstrate that they are using zero emissions electricity during the same hour and geographical location to match all of their consumption on a 24-hours a day, seven days a week basis."	Adopted ▾
German Ammonia Import Tender, 24/7 (900 m€)	German Government	Government Tender	English Summary	Adopted ▾

- Regulators use Granular Accounting to **ensure fossil free green products** and claims
- **100s of TWh** are already embedded.
- If EAC systems don't evolve, **alternatives may emerge** leading to double counting.

EU Green Hydrogen Needs Granular by 2030



- EU Plans **10 million tons** of hydrogen **Imports** by 2030.
- Granular GOs are needed to ensure administrability at scale.
- More hourly matching → more renewable hydrogen → more margin.

RED III Amendments - Granular GOs

Recital 43 (Encourages Granular GO)

*“To facilitate digital innovation in that field, Member States **should, where appropriate, enable issuing guarantees of origin in fractions and with a closer to real time timestamp**”*

Article 19.2 (Enables smaller size)

*“ A guarantee of origin shall be of the standard size of 1 MWh. **Where appropriate, such standard size may be divided to a fraction size**, provided that the fraction is a multiple of 1 Wh.”*

Article 19.7.(a) (Standard time-stamp)

*“(a) the energy source from which the energy was produced and **the start and end dates of production**, which may be specified:*

*(ii) **for renewable electricity**, in accordance with the **imbalance settlement period** as defined in Article 2, point (15), of Regulation (EU) 2019/943.’;*

The Global Emissions Standard is Changing

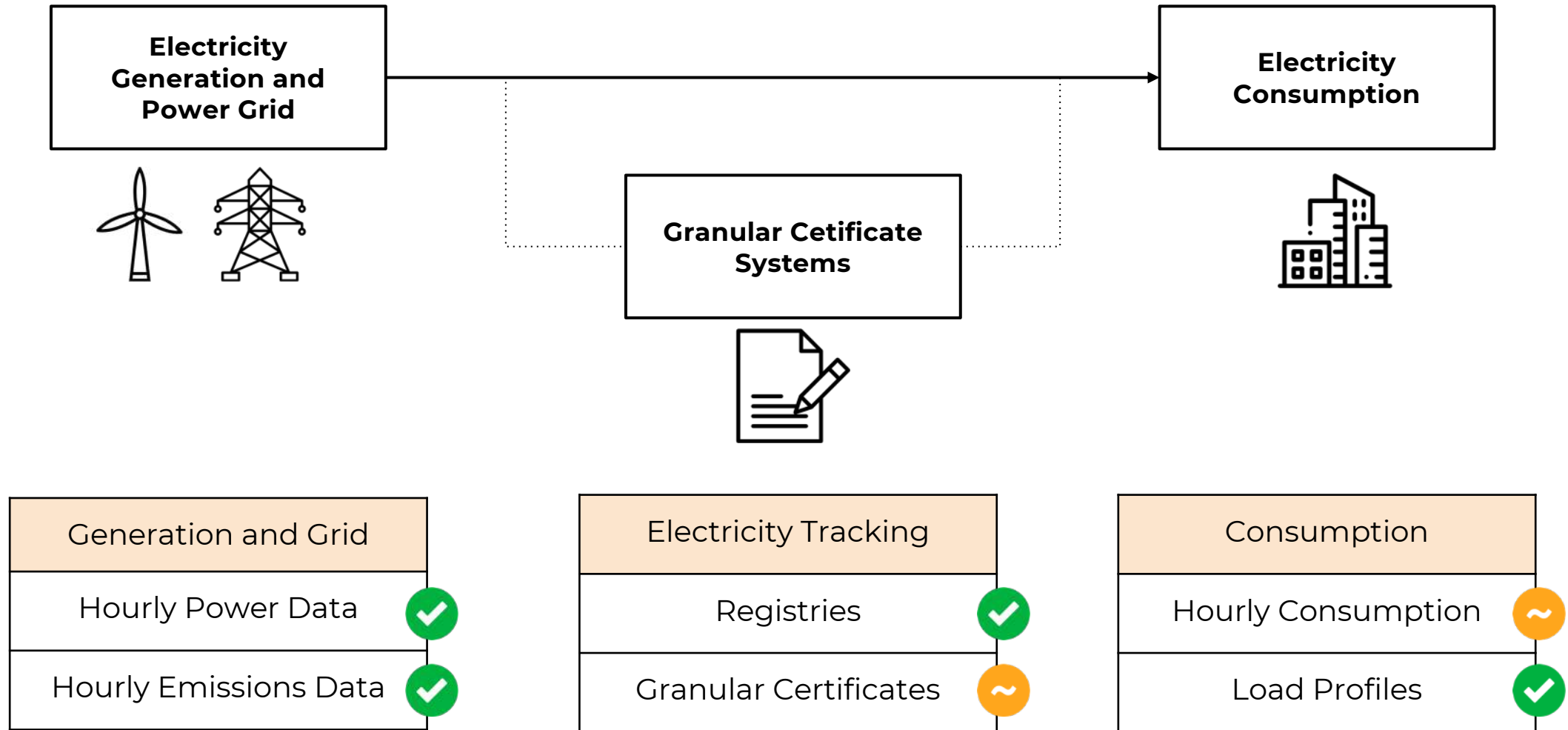


- **9 of 10 companies Fortune 500 Companies** use GHG Protocol.
- **GHGP is being updated**
changing emissions tracking

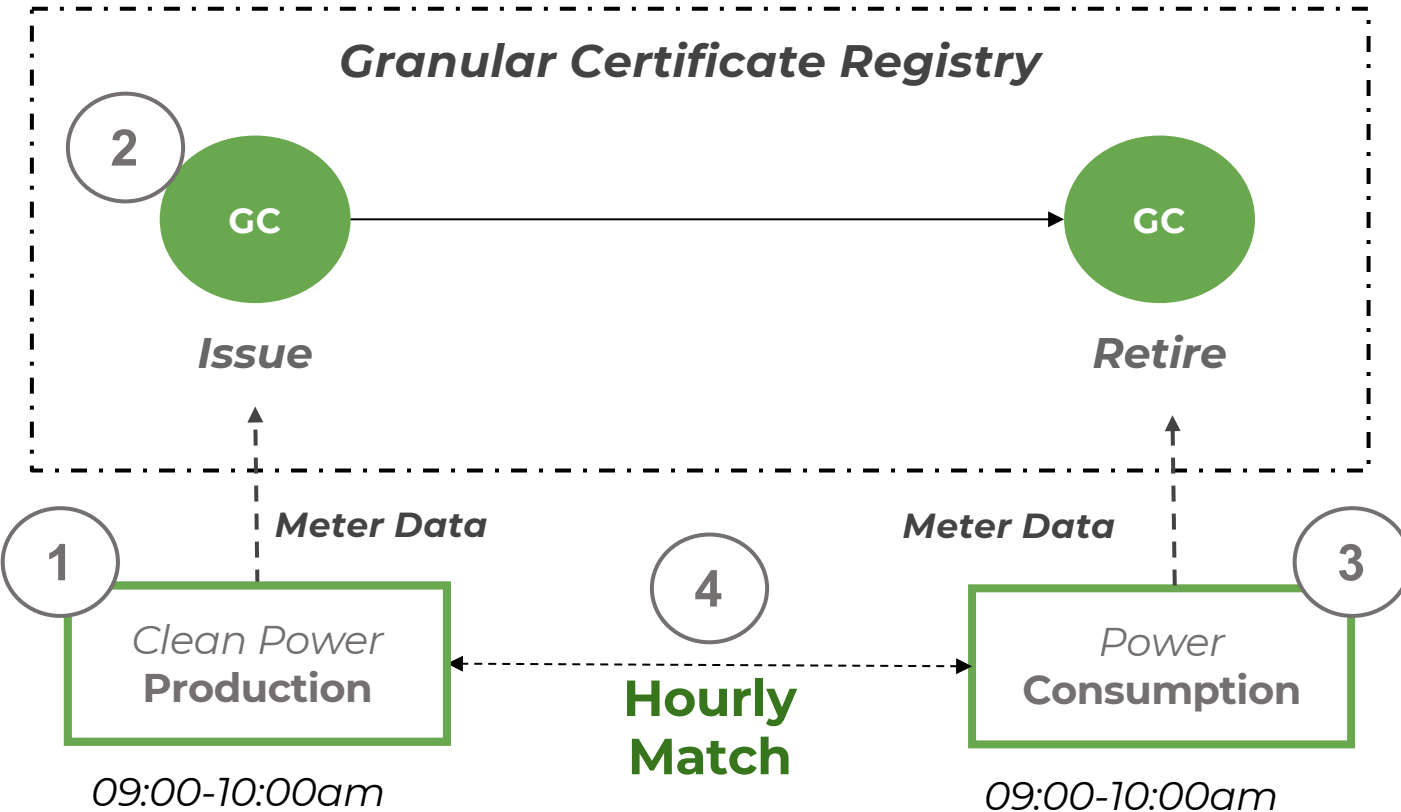


How to do Granular Accounting?

Data and Tools for Granular Accounting Are Emerging



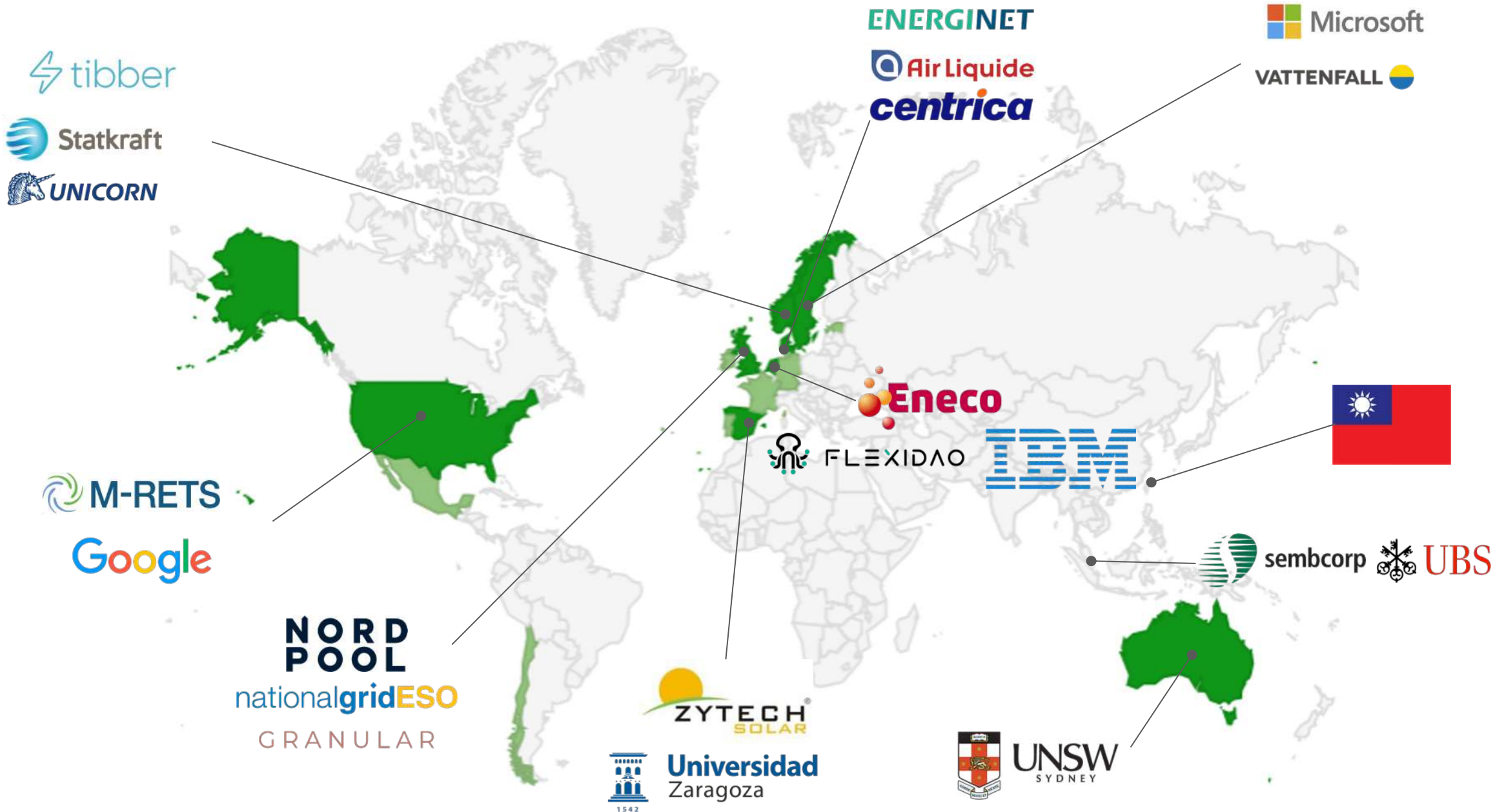
Hourly Matching Is Harder, But Not Hard



4 Simple Steps

1. **Production** data metered
1. **GCs Issued** ensuring unique attributes.
1. **Consumption** data is metered
1. **Hourly match** of production/consumption.

TWhs of Granular Tracking Are Done Today.



GWs of Granular PPA are Already Signed

> 1 GW

New!
 → Guarantee of %
 matching
 → Better clean hedging

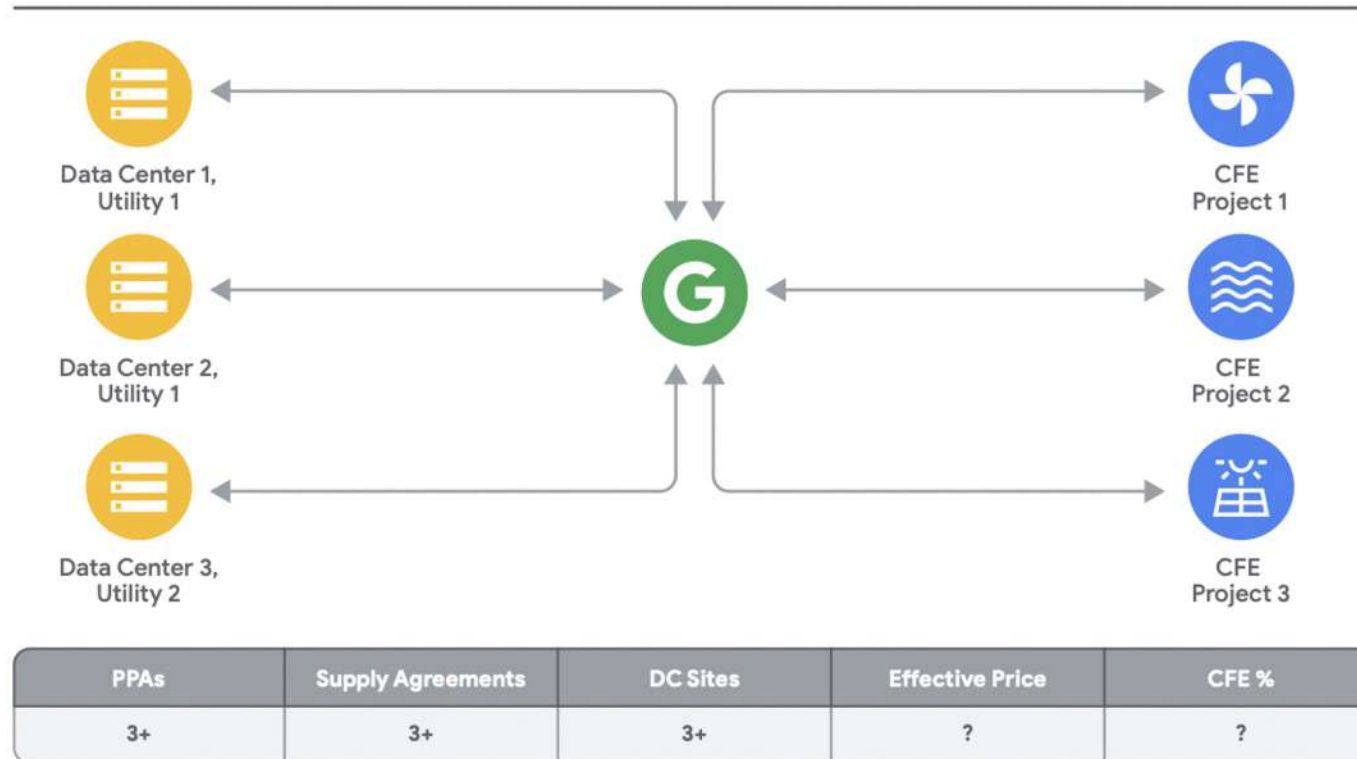
New!
 → Storage
 → Clean-firm

Deal	Buyer	Supplier	Volume	Hourly	Region	Deliverable	Additional	Signed In	Term	Price	Techno
Google Virginia 24/7	Google	AES	500 MW	90%	US - PJM	Same Grid	YES	2021	10 Years	Fixed	Solar PV, Wind, Li-Ion Battery
Google 24/7 Germany	Google	Engie	152 MW	~80% (by 2022)	Germany	Same Grid	YES	2021	3 Years	Indexed	Wind, Solar
Google 24/7 California	Google	SVCE	-	92% (by 2027)	US - California	Same Grid	YES	2022	10 Years	Indexed	Solar PV, Wind, Storage, Geothermal
Microsoft 24/7 Virginia	Microsoft	AES	576 MW	90%	Global	Bidding Zone	Old/New Assets	2021	15 Years	-	Solar PV, Wind, Storage
Pure Statkraft PPA	Mercedes-Benz	Statkraft	-	100%	Germany	Same Grid (mainly)		2020	-		Solar PV, Wind, Hydro
AES/Microsoft California	Microsoft	AES	165 MW	100%	California, US			2022	20 Years		Solar PV, Storage

Remember: Deals done today have a Granular Accounting score already!

Today's Model - Buyer is the PPA Manager

FIGURE 2A: IN THE TRADITIONAL PPA MODEL, THE CLEAN ENERGY BUYER MUST MANAGE MULTIPLE ENERGY SUPPLY AGREEMENTS FOR MULTIPLE DEMAND FACILITIES, AND MANAGE MULTIPLE PPAS WITH DIFFERENT CFE GENERATORS

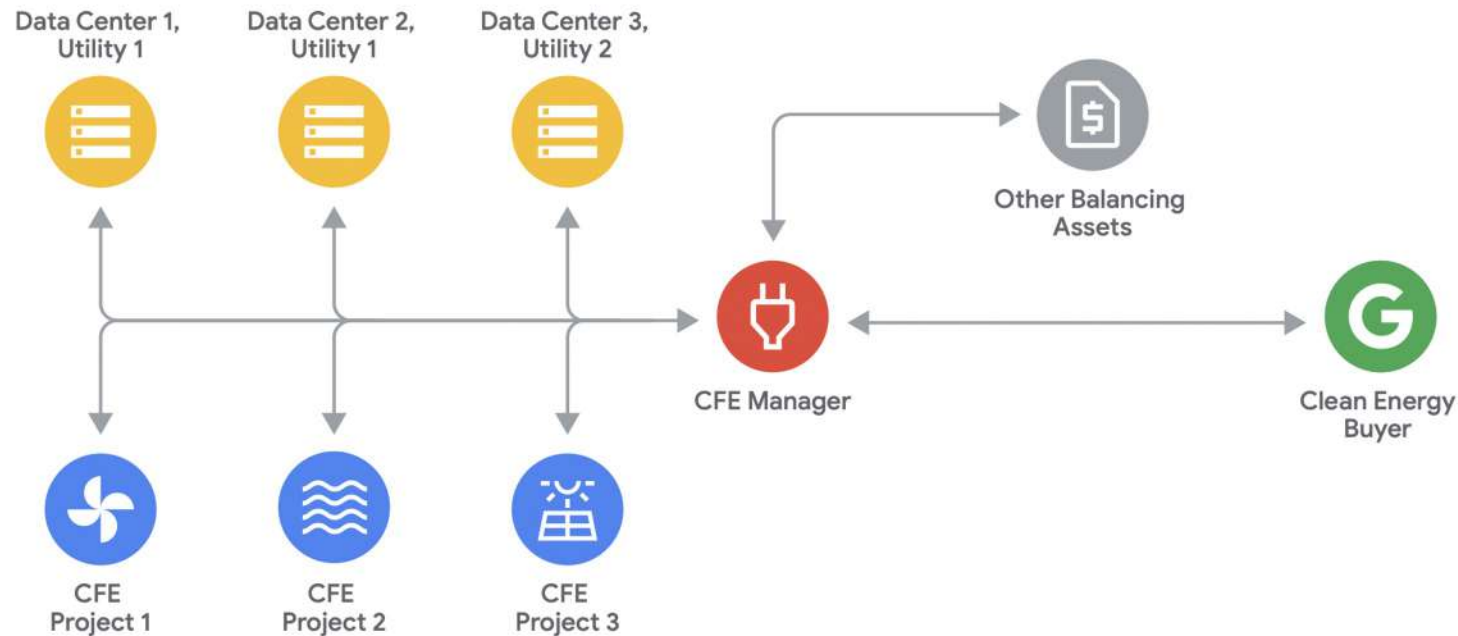


→ Buyer manages the portfolio bringing complexity.

→ Few buyers have expertise.

Tomorrow's Model? - Supplier Centric

FIGURE 2B: WITH THE CFE MANAGER MODEL, THE CFE MANAGER TAKES RESPONSIBILITY FOR RETAIL ENERGY SUPPLY TO THE DEMAND FACILITIES, AND CONTRACTS WITH A PORTFOLIO OF CFE GENERATORS TO ACHIEVE A SPECIFIED HOURLY CFE PERCENTAGE



PPAs	Supply Agreements	DC Sites	Effective Price	CFE %
↓0	↓1	3+	Known	Guaranteed

→ **Suppliers manage portfolios of asset to deliver supply with max CFE score**

- (Carbon-free energy hourly matching)

→ **Utilities can manage complexity**

EnergyTag Standard Aims for Harmonisation

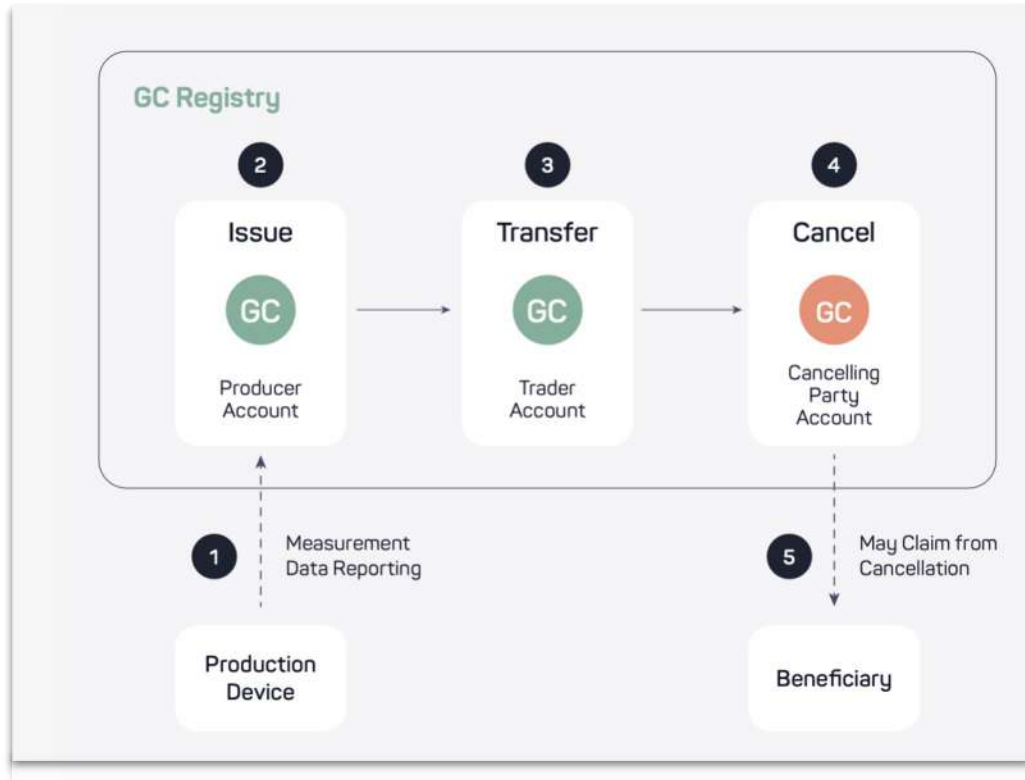


- Global Scope, Only GC Standard
- **Key criteria** for robust granular tracking
- Developed by **world's leading experts**,
 - incl. Phil Moody and Katrien Verwimp instrumental in EU GO system.
- **Based on existing EAC schemes**, in particular EU GO (EECS standard)
- **6+ audits** ongoing in EU, US, Asia.
- **V2** expected December 2023.

GCs → Evolution of or supplement to Existing System?

Configuration 1

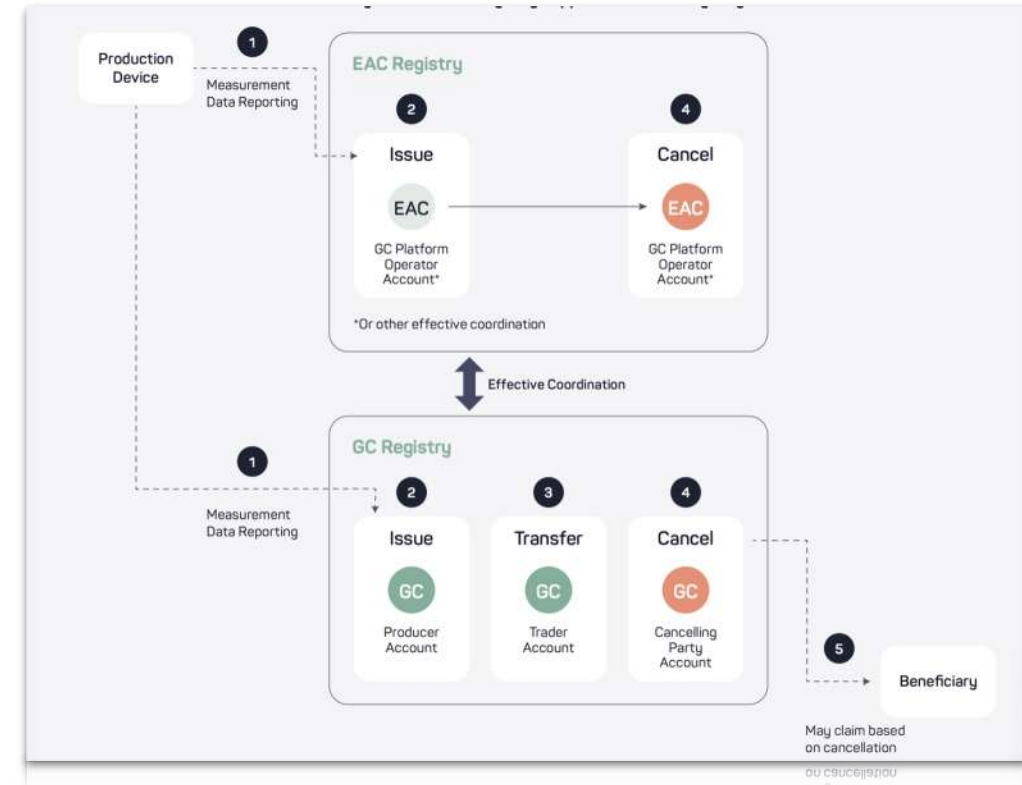
GC Schemes Evolves Out of EAC Scheme



- Framework for legacy registries to move to granularity.

Configuration 2

GC Scheme Supplements EAC Scheme



- Enable hourly matching in a robust, traceable way - TODAY.

Should we care about Granular Certificates now?

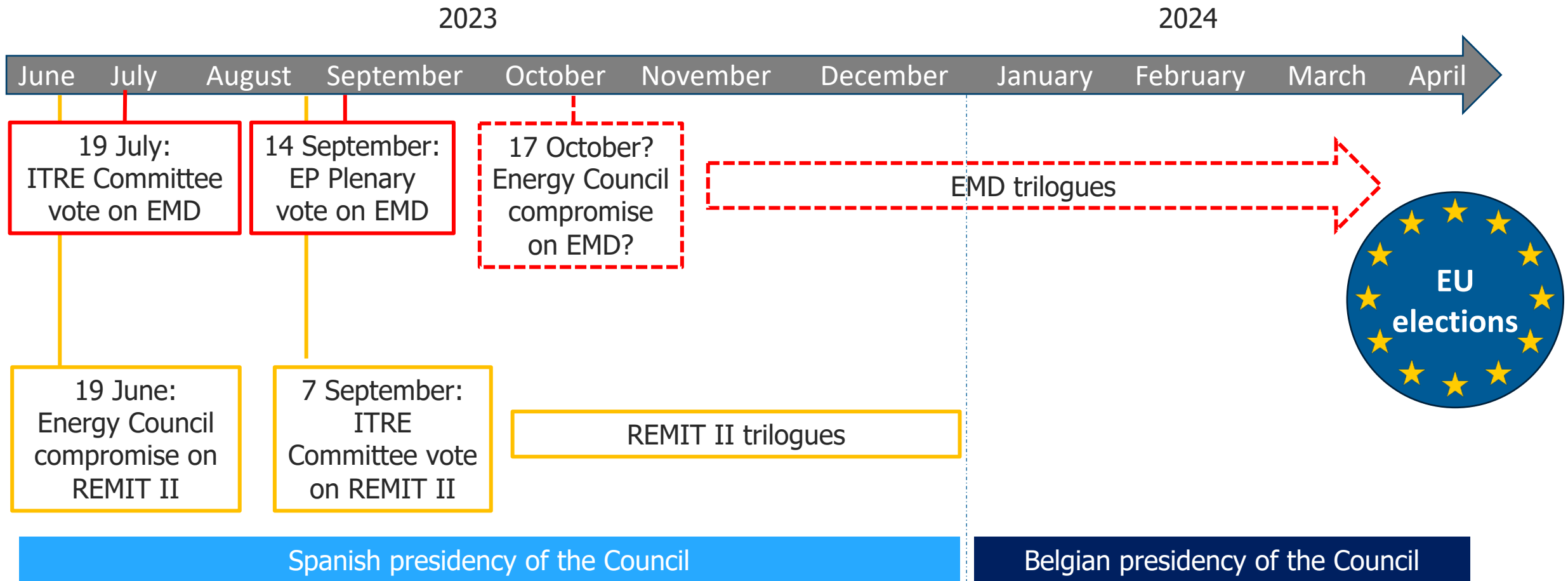
- Yes. If not, non-EAC alternatives will emerge.
- For example, a hydrogen electrolyser signing a PPA now must ensure contract is future-proof for hourly matching an Granular GOs.
- Hourly matching based on excel meter data rather than robust tracking presents many serious issues:
 - Potential for double counting
 - Poor traceability
 - Complexity error handling
- EnergyTag can help bridge the gap for consumers wanting to do hourly matching now, until robust Granular GOs are available across EU, which could take a while.

Questions ?

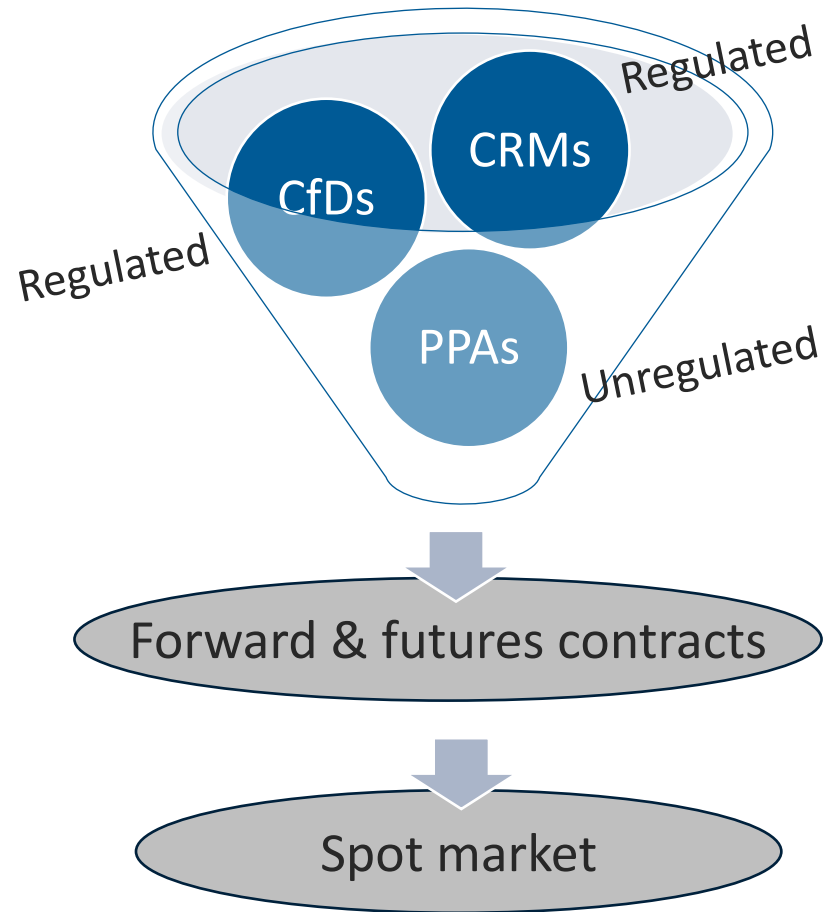
Role of the PPA in the new Electricity Market Design proposal

Jerome le Page, Chair of the Electricity Committee, EFET

2023/2024 – Timeline for EMD and REMIT reforms



PPAs in the future electricity market design



👉 Long-term hedging & investment

👉 Medium-term hedging

👉 Portfolio optimisation

Challenges & opportunities in relation to PPAs (EP proposal)

#1

PPA standardisation: ACER and NEMOs to develop a standard PPA for voluntary use



- **Question mark:** ACER and NEMOs have no experience with standardisation
- **Possible challenge:** Standardisation not fitting industry needs; voluntary use becomes de facto mandatory
- **Possible opportunity:** EFET could promote its standard?

Challenges & opportunities in relation to PPAs (EP proposal)

#2

PPA platform: EC and NEMOs to develop a platform for voluntary PPA trading



- **Question mark:** NEMOs have no role/experience outside spot trading so far
- **Possible challenges:** Emergence of multiple platforms; voluntary use becomes de facto mandatory
- **Possible opportunity:** pooling liquidity?

Challenges & opportunities in relation to PPAs (EP proposal)

#3



PPA database(s): ACER to set up a Union database to report on PPAs

- **Question mark:** what can be fed directly from REMIT and what more would need to be reported? Will this be a publicly accessible database?
- **Possible challenges:** Emergence of multiple national platforms; excessive reporting requirements; too easy identification of deals in case of public accessibility
- **Possible opportunity:** enhanced transparency?